



POWER SUPPLY

- AC 100-240 V wide-range input
- Width only 48 mm
- With IO-Link communication interface
- Display for on-site condition monitoring and easy analysis of power errors
- Efficiency up to 95.5 %
- 20 % output power reserves (PowerBoost)
- Easy Fuse Breaking – 3 times nominal current for 12 ms
- Safe Hiccup^{PLUS} Overload Mode
- Full power between -25 °C and +60 °C
- Current sharing feature for parallel use
- 3 Year warranty

PRODUCT DESCRIPTION

The CP20.248-IOL is a high-quality power supply based on the popular CP20 series. With an integrated IO-Link interface and a condition display the device is giving access to real-time and recorded data informing about the condition of the power supply itself and the power line. This combination of interfaces allows automation scenarios and remote control, while at the same time supporting on site analysis and maintenance sequences at your cabinet. User-specified event signals are available via the IO-Link interface as well as “Remote ON/OFF” and a “Parallel Use” feature for load sharing between power supplies connected in parallel.

Like its series members, the CP20.248-IOL comes with advanced features like e.g. PowerBoost: Power reserves of 20 %, which may even be used continuously at temperatures up to +45 °C. Additionally it can deliver 3 times the nominal output current for 12 ms, which helps to trip fuses on faulty output branches.

The Dimension CP-Series are cost optimized power supplies without compromising quality, reliability and performance. The most outstanding features of this series are the high efficiency, electronic inrush current limitation, active PFC, wide operational temperature range and the extraordinary small size.

ORDER NUMBERS

Power Supply **CP20.248-IOL**

Accessory **ZM10.WALL** Wall/Panel mounting bracket

SHORT-FORM DATA

Output voltage	DC 24 V	Nominal
Adjustment range	24 – 28 V	Factory setting 24.1 V
AC 120–240 V mains, DC 150-300 V mains		
Output current	20.0 – 17.1 A	Up to +60 °C ambient
PowerBoost	24.0 – 20.6 A	Up to +45 °C ambient
Derating	linear 12.5 W/K	> +60 °C ambient
AC 100 V mains, DC 110-150 V mains		
Output current	17.5 – 15.0 A	Up to +60 °C ambient
PowerBoost	21.0 – 18.0 A	Up to +45 °C ambient
Derating	linear 10.5 W/K	> +60 °C ambient
Input voltage AC	AC 100-240 V	-15 %/+10 %
Mains frequency	50-60 Hz	±6 %
Input current AC	4.26 / 2.23 A	At 120 / 230 Vac
Power factor	0.99 / 0.98	At 120 / 230 Vac
Input voltage DC	DC 110-300 V	±20 %
Input current DC	4.64 / 1.66 A	At 110 / 300 Vdc
AC Inrush current	10.0 / 4.5 A _{peak}	At 120 / 230 Vac
Efficiency	94.1 / 95.5 %	At 120 / 230 Vac
Power losses	30.0 / 23.0 W	At 120 / 230 Vac
Hold-up time	32 / 32 ms	At 120 / 230Vac
Temperature range	-25 °C to +70 °C	
Size (WxHxD)	48x124x127 mm	Without DIN rail
Weight	835 g	

MAIN APPROVALS

For details and the complete approval list, see chapter 22.

All parameters are typical values specified 230 Vac, 50 Hz input voltage, 24 V, 20 A output load, +25 °C ambient and after a 5 minutes run-in time unless otherwise noted.

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No part of this document may be reproduced or utilized in any form without our prior permission in writing.

Packaging and packaging aids can and should always be recycled. The product itself may not be disposed of as domestic refuse.

Terminology and Abbreviations

PE and \oplus symbol	PE is the abbreviation for Protective Earth and has the same meaning as the symbol \oplus .
Earth, Ground	This document uses the term "earth" which is the same as the U.S. term "ground".
t.b.d.	To be defined, value or description will follow later.
AC 230 V	A figure displayed with the AC or DC before the value represents a nominal voltage with standard tolerances (usually $\pm 15\%$) included. E.g.: DC 12 V describes a 12 V battery disregarding whether it is full (13.7 V) or flat (10 V)
230 Vac	A figure with the unit (Vac) at the end is a momentary figure without any additional tolerances included.
50 Hz vs. 60 Hz	As long as not otherwise stated, AC 230 V parameters are valid at 50 Hz mains frequency.
may	A key word indicating flexibility of choice with no implied preference.
shall	A key word indicating a mandatory requirement.
should	A key word indicating flexibility of choice with a strongly preferred implementation.

All parameters are typical values specified 230 Vac, 50 Hz input voltage, 24 V, 20 A output load, +25 °C ambient and after a 5 minutes run-in time unless otherwise noted.

1. Intended Use

This device is designed for installation in an enclosure and is intended for commercial use, such as in industrial control, process control, monitoring and measurement equipment or the like.

Do not use this device in equipment, where malfunctioning may cause severe personal injury or threaten human life without additional appropriate safety devices, that are suited for the end-application.

If this device is used in a manner outside of its specification, the protection provided by the device may be impaired.

2. Installation Instructions

⚠ WARNING Risk of electrical shock, fire, personal injury or death

- Turn power off before working on the device. Protect against inadvertent re-powering.
- Do not modify or repair the unit.
- Do not open the unit as high voltages are present inside.
- Use caution to prevent any foreign objects from entering the housing.
- Do not use in wet locations or in areas where moisture or condensation can be expected.
- Do not touch during power-on, and immediately after power-off. Hot surfaces may cause burns.

Obey the following installation instructions:

This device may only be installed and put into operation by qualified personnel.

This device does not contain serviceable parts. The tripping of an internal fuse is caused by an internal defect.

If damage or malfunction should occur during installation or operation, immediately turn power off and send unit to the factory for inspection.

Install the device in an enclosure providing protection against electrical, mechanical and fire hazards.

Install the device onto a DIN rail according to EN 60715 with the input terminals on the bottom of the device.

Make sure that the wiring is correct by following all local and national codes. Use appropriate copper cables that are designed for a minimum operating temperature of +60 °C for ambient temperatures up to +45 °C, +75 °C for ambient temperatures up to +60 °C and +90 °C for ambient temperatures up to +70 °C. Ensure that all strands of a stranded wire enter the terminal connection. Use ferrules for wires on the input terminals. Unused screw terminals should be securely tightened.

The device is designed for pollution degree 2 areas in controlled environments. No condensation or frost is allowed. The enclosure of the device provides a degree of protection of IP20. The housing does not provide protection against spilled liquids.

The isolation of the device is designed to withstand impulse voltages of overvoltage category III according to IEC 60664-1.

The device is designed as "Class of Protection I" equipment according to IEC 61140. Do not use without a proper PE (Protective Earth) connection.

The device is suitable to be supplied from TN, TT or IT mains networks. The continuous voltage between the input terminals and the PE potential must not exceed 300 Vac.

The input can also be powered from a battery or a similar DC source. The continuous voltage between the supply voltage and the PE/ground potential must not exceed 375 Vdc.

A disconnecting means shall be provided for the input of the device.

The device is designed for convection cooling and does not require an external fan. Do not obstruct airflow and do not cover ventilation grid!

The device is designed for altitudes up to 5000 m. Above 2000 m a reduction in output current and over voltage category is required.

Keep the following minimum installation clearances:

Output power related to nominal	Installation clearance (mm)		
	top	bottom	side
< 50 %	40	20	0
≥ 50 %	40	20	5
≥ 90 %	40	20	15

The device is designed, tested and approved for branch circuits up to 32 A (IEC) and 30 A (UL) without additional protection device. If an external fuse is utilized, do not use circuit breakers smaller than 10A B- or C-Characteristic to avoid a nuisance tripping of the circuit breaker.

The maximum surrounding air temperature is +70 °C. The operational temperature is the same as the ambient or surrounding air temperature and is defined 2 cm below the device.

The device is designed to operate in areas between 5 % and 95 % relative humidity.

3. AC-Input

The device is suitable to be supplied from TN, TT or IT mains networks.

AC input voltage Range A	nom.	AC 120-240 V	-15 %/+10 %
AC input voltage Range B	nom.	AC 100-240 V	-15 %/+10 %
AC input range		85-264 Vac	
		264-300 Vac	Occasionally for maximal 500 ms
Allowed voltage L or N to earth	max.	300 Vac	Continuous, according to IEC 60664-1
Input frequency	nom.	50–60 Hz	±6 %
Turn-on voltage	typ.	82 Vac	Steady-state value, see Fig. 3-1
Shut-down voltage	typ.	72 Vac	Steady-state value, see Fig. 3-1
External input protection	See recommendations in chapter "Installation Instructions".		

		AC 100 V	AC 120 V	AC 230 V	
Input current	typ.	5.15 A	4.26 A	2.23 A	At 24 V, 20 A, see Fig. 3-3
Power factor	typ.	0.99	0.99	0.98	At 24 V, 20 A, see Fig. 3-4
Crest factor	typ.	1.65	1.63	1.63	At 24 V, 20 A, The crest factor is the mathematical ratio of the peak value to RMS value of the input current waveform.
Start-up delay	typ.	546 ms	503 ms	441 ms	See Fig. 3-2
Rise time	typ.	125 ms	116 ms	111 ms	At 24 V, 20 A const. current load, 0mF load capacitance, see Fig. 3-2
	typ.	129 ms	124 ms	122 ms	At 24 V, 20 A const. current load, 20 mF load capacitance, see Fig. 3-2
Turn-on overshoot	max.	200 mV	200 mV	200 mV	In single use mode, see Fig. 3-2

Fig. 3-1 Input voltage range

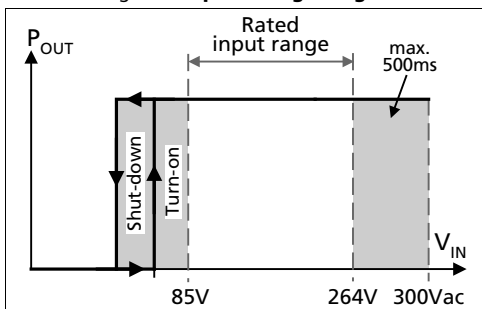


Fig. 3-3 Input current vs. output current at 24 V output voltage

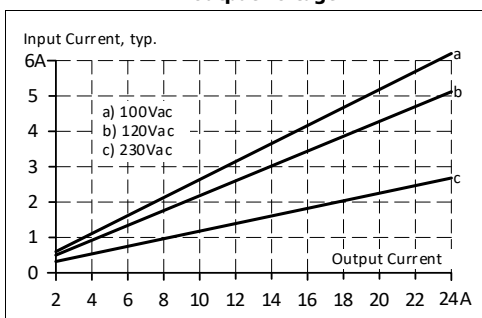


Fig. 3-2 Turn-on behavior, definitions

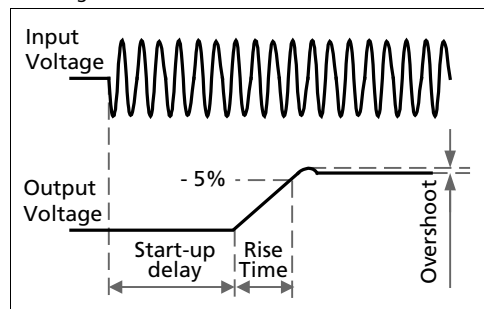
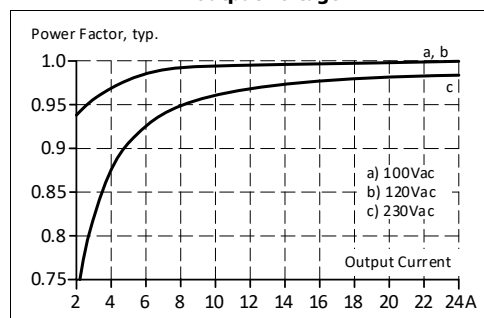


Fig. 3-4 Power factor vs. output current at 24 V output voltage



All parameters are typical values specified 230 Vac, 50 Hz input voltage, 24 V, 20 A output load, +25 °C ambient and after a 5 minutes run-in time unless otherwise noted.

4. DC-Input

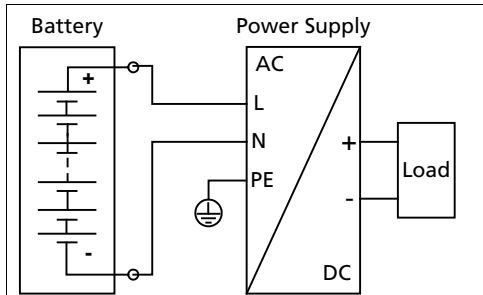
The device is suitable to be supplied from a DC input voltage. Use a battery or a similar DC source.

A supply from the intermediate DC-bus of a frequency converter is not recommended and can cause a malfunction or damage the unit.

Connect +pole to L, -pole to N and the PE terminal to an earth wire or to the machine ground.

DC input voltage Range A	nom.	DC 150-300 V	±20 %
DC input voltage Range B	nom.	DC 110-150 V	±20 %
DC input range		88-360 Vdc	
DC input current	typ.	4.64 A 1.66 A	At 110 Vdc, at 24 V, 20 A At 300 Vdc, at 24 V, 20 A
Allowed Voltage L/N to Earth	max.	375 Vdc	Continuous, according to IEC 62477-1
Turn-on voltage	typ.	80 Vdc	Steady state value
Shut-down voltage	typ.	70 Vdc	Steady state value

Fig. 4-1 **Wiring for DC Input**



5. Input Inrush Current

An active inrush limitation circuit limits the input inrush current after turn-on of the input voltage.

The charging current into EMI suppression capacitors is disregarded in the first microseconds after switch-on.

		AC 100 V	AC 120 V	AC 230 V	
Inrush current	max.	15 A _{peak}	12 A _{peak}	5.5 A _{peak}	Temperature independent
	typ.	12 A _{peak}	10 A _{peak}	4.5 A _{peak}	Temperature independent

All parameters are typical values specified 230 Vac, 50 Hz input voltage, 24 V, 20 A output load, +25 °C ambient and after a 5 minutes run-in time unless otherwise noted.

6. Output

The output provides a SELV/PELV rated voltage, which is galvanically isolated from the input voltage.

The output is electronically protected against no-load, overload and short circuit. In case of a protection event, audible noise may occur.

The output is designed to supply any kind of loads, including inductive and capacitive loads. If capacitors with a capacitance > 1 F are connected, the unit might charge the capacitor in an intermittent mode.

At heavy overloads (when output voltage falls below 13 V), the power supply delivers continuous output current for 2 s. After this, the output is switched off for approx. 18 s before a new start attempt is automatically performed. This cycle is repeated as long as the overload exists. If the overload has been cleared, the device will operate normally.

The device is equipped with a "Single Use/Parallel Use" feature, which can be selected via IO-Link. The "Parallel Use" mode regulates the output voltage in such a manner that the voltage at no load is approx. 4 % higher than at nominal load. This achieves a load sharing between power supplies when they are connected in parallel.

Output voltage	nom.	24 V	
Adjustment range	min.	24-28 V	Guaranteed value This is the maximum output voltage which can occur at the clockwise end position of the potentiometer due to tolerances. It is not a guaranteed value which can be achieved.
	max.	30 V	
Factory setting output voltage	typ.	24.1 V	±0.2 % in "single use" mode at full load, cold unit ±0.2 % in "parallel use" mode at 20 A, cold unit (results to 23.9 V ±0.2 % at 24 A and 25.1 V ±0.2 % at no load), see Fig. 6-2
	typ.	24.1 V	
Line regulation	max.	10 mV	Between 85 and 300 Vac input voltage change
Load regulation	max.	100 mV	Between 0 and 24 A in "single use" mode, static value
	typ.	1000 mV	Between 0 and 20 A in "parallel use" mode, static value
Ripple and noise voltage	typ.	60 mVpp	Bandwidth 20 Hz to 20 MHz, 50 Ohm
Output current Range A	nom.	20.0 A	At 24 V and up to +60 °C ambient temperature
	nom.	14.8 A	At 24 V and +70 °C ambient temperature
	nom.	17.1 A	At 28 V and up to +60 °C ambient temperature
	nom.	12.7 A	At 28 V and +70 °C ambient temperature
	Derate linearly between +60 °C to +70 °C, see chapter 19		
PowerBoost Range A ¹⁾	nom.	24.0 A	At 24 V and up to +45 °C ambient temperature, see Fig. 19-1
	nom.	20.6 A	At 28 V and up to +45 °C ambient temperature, see Fig. 19-1
PowerBoost decreases linearly to nominal power between +45 °C and +60 °C, see chapter 19			
Output current Range B	nom.	17.5 A	At 24 V and up to +60 °C ambient temperature
	nom.	13.1 A	At 24 V and +70 °C ambient temperature
	nom.	15.0 A	At 28 V and up to +60 °C ambient temperature
	nom.	11.3 A	At 28 V and +70 °C ambient temperature
Derate linearly between +60 °C to +70 °C, see chapter 19			
PowerBoost Range B ¹⁾	nom.	21.0 A	At 24 V and up to +45 °C ambient temperature, see Fig. 19-1
	nom.	18.0 A	At 28 V and up to +45 °C ambient temperature, see Fig. 19-1

All parameters are typical values specified 230 Vac, 50 Hz input voltage, 24 V, 20 A output load, +25 °C ambient and after a 5 minutes run-in time unless otherwise noted.

			PowerBoost decreases linearly to nominal power between +45 °C and +60 °C, see chapter 19
Fuse breaking current	typ.	60 A	Up to 12 ms once every five seconds, see Fig. 6-4. The fuse breaking current is an enhanced transient current which helps to trip fuses on faulty output branches. The output voltage stays above 20 V.
Overload behavior		Continuous current Intermittent current	For output voltage above 13 Vdc, see Fig. 6-1 For output voltage below 13 Vdc, see Fig. 6-1
Overload/ short-circuit current	max. typ.	29.8 A 29.0 A	Continuous current, see Fig. 6-1 Intermitted current peak value for typ. 2 s Load impedance 10 mOhm, see Fig. 6-3 Discharge current of output capacitors is not included.
	max.	9.8 A	Intermitted current average value (R.M.S.) Load impedance 10 mOhm, see Fig. 6-3
Output capacitance	typ.	8 500 µF	Included inside the power supply
Back-feeding loads	max.	35 V	The unit is resistant and does not show malfunctioning when a load feeds back voltage to the power supply. It does not matter whether the power supply is on or off. The absorbing energy can be calculated according to the built-in large sized output capacitor.

- 1) **PowerBoost**
This power/ current is continuously allowed up to an ambient temperature of +45 °C. Above +45 °C, do not use this power/ current longer than a duty cycle of 10 % and/ or not longer than 1 minute every 10 minutes.

Fig. 6-1 Output voltage vs. output current, typ.

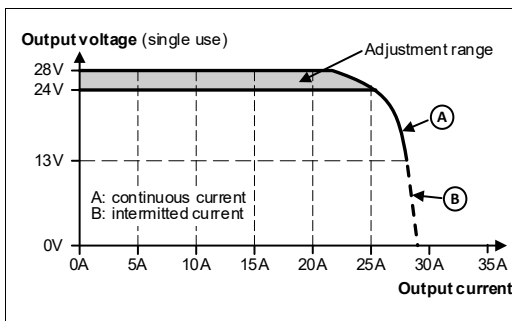


Fig. 6-2 Output voltage in "parallel use" mode, typ.

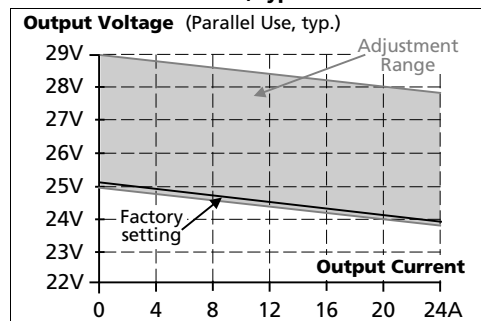


Fig. 6-3 Short-circuit on output, Hiccup^{PLUS} mode, typ.

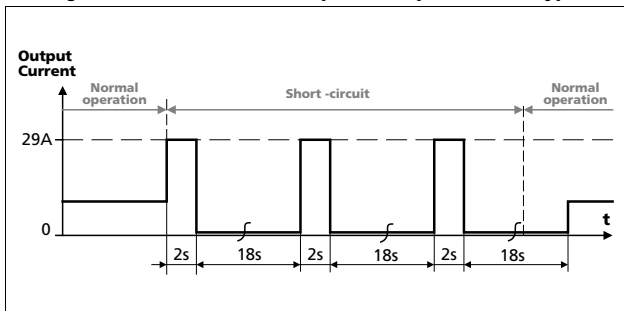
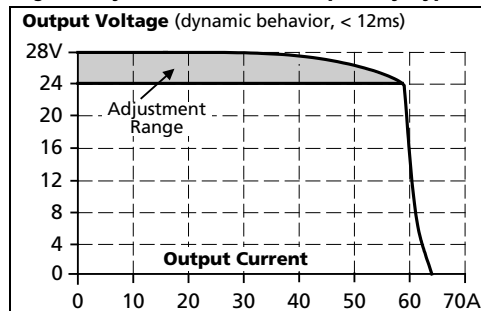


Fig. 6-4 Dynamic overcurrent capability, typ.



All parameters are typical values specified 230 Vac, 50 Hz input voltage, 24 V, 20 A output load, +25 °C ambient and after a 5 minutes run-in time unless otherwise noted.

7. Hold-up Time

The hold-up time is the time during which a power supply's output voltage remains within specification following the loss of input power. The hold-up time is output load dependent. At no load, the hold-up time can be up to several seconds. The green DC OK LED is also on during this time.

		AC 100 V	AC 120 V	AC 230 V	
Hold-up Time	typ.	65 ms	65 ms	65 ms	At 24 V, 10 A, see Fig. 7-1
	min.	54 ms	54 ms	54 ms	At 24 V, 10 A, see Fig. 7-1
	typ.	32 ms	32 ms	32 ms	At 24 V, 20 A, see Fig. 7-1
	min.	24 ms	24 ms	24 ms	At 24 V, 20 A, see Fig. 7-1

Fig. 7-1 **Hold-up time vs. input voltage**

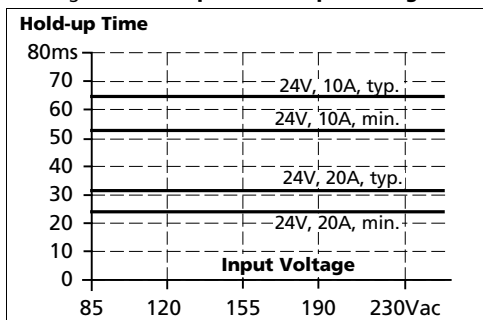
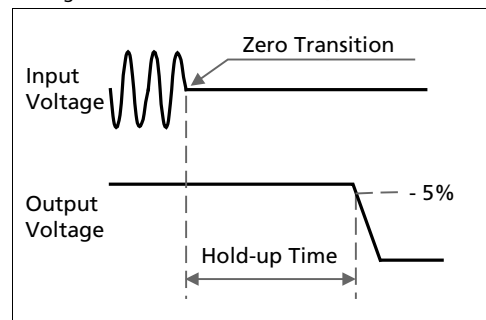


Fig. 7-2 **Shut-down behavior, definitions**



8. DC OK Function

This feature monitors the output voltage on the output terminals of a running power supply. The DC OK Function can be monitored via the IO-Link-Interface. It corresponds with the DC OK LED. The value of the setpoint can be adjusted via the IO-Link interface.

DC OK	As soon as the output voltage reaches the setpoint (default 22 V)
DC NOK	As soon as the output Voltage dips below a value, which is typically 0.5 V lower than the setpoint value (Hysteresis)
Hysteresis	Typically 0.5 V

All parameters are typical values specified 230 Vac, 50 Hz input voltage, 24 V, 20 A output load, +25 °C ambient and after a 5 minutes run-in time unless otherwise noted.

9. Remote ON / OFF Function

This feature enables to switch off the output voltage via the IO-Link interface.

Note: The remote ON / OFF function has no safety feature included.

10. IO-Link Interface

The IO-Link interface used in this power supply complies with the IO-Link protocol V1.1 and can be connected to any IO-Link master that is compatible with V1.1 of the IO-Link protocol. This enables a transparent data flow to the sensors and actuators and therefore a more transparent and easier way of monitoring the current status of the power supply.

If no IO-Link connectivity is available, the power supply continues to operate without interruption. Thanks to a built-in EEPROM, previously stored data is retrieved from its memory.

To operate the IO-Link interface it is necessary to install/upload the IODD-File (IO-Link Device Description) to the connected IO-Link master. The most recent IODD file can be found on IODDfinder (<https://ioddfinder.io-link.com>) and on the PULS website (www.pulspower.com) in the download section of the individual product page. The device can also be accessed via IO-Link, if the power supply is not connected to AC-mains and in a switched off mode.

IO-Link version	V1.1	
Bit rate	COM3 (230.4 kBaud)	
Minimum cycle time	2.0 ms	Cycle time refers to the reloading speed of certain process data
SIO-Mode support	no	Class A
Process data length	6 bytes	

All parameters are typical values specified 230 Vac, 50 Hz input voltage, 24 V, 20 A output load, +25 °C ambient and after a 5 minutes run-in time unless otherwise noted.

Three different types of data are exchanged via the IO-Link interface (for detailed information please refer to the "IO-Link interface description"):

Process data

Process data is cyclically sent to the IO-Link master. CP20.248-IOL provides output current (A) and output voltage (V) as process data. The data length is 6 bytes, showing actual current between 0 – 65 A in the first two bytes. The next two bytes shows the actual voltage between 0 – 35 V. The last two bytes shows different warning and error flags. If these bytes are 0, no warning or error is active. This process data is transmitted every 2 ms automatically. The accuracy is 100 mA for output current and 100 mV for output voltage.

Parameter values

Parameter values are exchanged acyclically and at the request of the IO-Link master. Depending on the access rights device data can be written to the device, read from the device or both.

Parameter values are generated every 52 ms and stored in the IO-Link registers. A timer is used to supervise the time interval. If the time interval between two received bytes is longer than 100 ms or any error occurs (e.g. checksum error), the previously received data will be discarded and the IO-Link read access returns the error 0x8082 "Application not ready".

Events

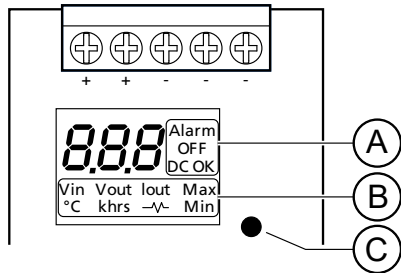
Events report the status of the power supply. Typical events are warnings and errors in non-ideal and abnormal situations (e.g. temperature too high, input voltage too low, etc.). These events are triggered by certain situations and will result in an automated notification to the IO-Link master.

- Actual RMS input voltage
- Min. RMS input voltage
- Input undervoltage event counter
- Max. RMS input voltage
- Actual PEAK input voltage
- Max. PEAK input voltage
- Input overvoltage event counter
- Actual device temperature
- Min. device temperature
- Max. device temperature
- Overtemperature warning threshold
- Actual output current
- Max. output current
- Overcurrent warning threshold
- Actual output voltage
- Max. output voltage
- Output overvoltage warning threshold
- DC not OK threshold (Output undervoltage warning threshold)
- Operating time
- Turn-on counter
- Parallel mode
- Switch off output voltage
- Actual IO-Link voltage

All parameters are typical values specified 230 Vac, 50 Hz input voltage, 24 V, 20 A output load, +25 °C ambient and after a 5 minutes run-in time unless otherwise noted.

11. Power Supply Condition Display

Fig. 11-1 Power Supply Condition Display



The device has an integrated Power Supply Condition Display (PSCD). It shows all the different power supply condition values on the front of the PSU for condition monitoring and easy analysis of power errors. When switched on, all LED segments of the PSCD light up for 2 seconds to indicate the full functionality of the display. At the next turn-on procedure, the PSCD shows the menu of the last turn-off sequence.

- A) **Status Indicator:** (see Fig. 9-1) consists of three LEDs, showing the basic operation status of the PSU:
- Alarm = an error has occurred (see **Troubleshooting**)
 - OFF = input voltage is switched off via the shut-down-input
 - DC OK = see chapter 8
- B) **Denomination Fields:** display units of the condition values
- C) **Display Push-Button:** only means to navigate through the PSCD

Functionalities of the PSCD

The PSCD has two operating modes:

The Real-Time Data Mode provides the concurrent condition values of the PSU on Page 1.

The Recorded Data Mode continuously records min./max. condition values for analysis and monitoring purposes on Page 2.



To start a new cycle of analysis the recorded data can be reset to the concurrent condition values (see **To reset recorded data**). For a more in-depth analysis, PEAK values of input voltage parameters can also be displayed and recorded (see **Display R.M.S./PEAK values**).

The detailed list of condition values can be found in the denomination fields (see Fig. 11-2):

Real-Time Data Mode: displayed on Page 1

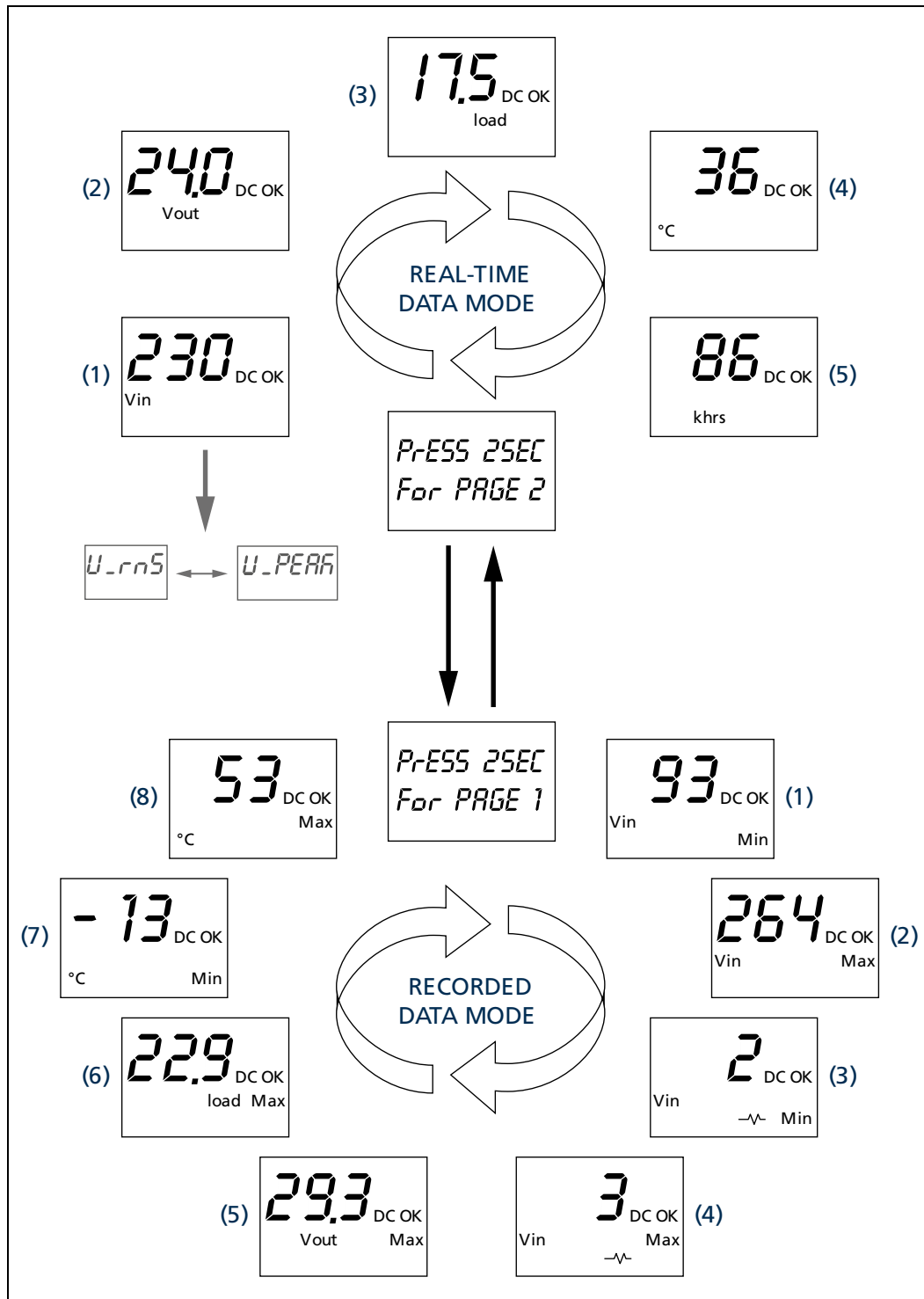
- 1) Vin: Input voltage as R.M.S./PEAK value [V]
- 2) Vout: Output voltage [V]
- 3) Iout: Output current [A]
- 4) °C: Internal temperature [°C]
- 5) khrs: Total operating hours [khrs]

Recorded Data Mode: displayed on Page 2

- (1) Vin Min: Min. input voltage as R.M.S./PEAK value [V]
- (2) Vin Max: Max. input voltage as R.M.S./PEAK value [V]
- (3)  Min: Number of **undershoot** transient events on input voltage [Number of events]
- (4)  Max: Number of **overvoltage** transient events on input voltage [Number of events]
- (5) Vout Max: Max. output voltage [V]
- (6) Iout Max: Max. output current [A]
- (7) °C Min: Min. internal temperature [°C]
- (8) °C Max: Max. internal temperature [°C]

All parameters are typical values specified 230 Vac, 50 Hz input voltage, 24 V, 20 A output load, +25 °C ambient and after a 5 minutes run-in time unless otherwise noted.

Fig. 11-2 Condition values displayed on the PSCD



All parameters are typical values specified 230 Vac, 50 Hz input voltage, 24 V, 20 A output load, +25 °C ambient and after a 5 minutes run-in time unless otherwise noted.

Navigate through Real-Time Data Mode/Recorded Data Mode

- ⇒ Press the Display Push-Button less than 1 second to browse through the different condition values

Access Real-Time Data Mode/Recorded Data Mode

To switch between Page 1 between Page 2:

- ⇒ Press the Display Push-Button and browse until display shows "Press 2 sec for page 1" or "Press 2 sec for page 2"
- ⇒ Press the Display Push-Button for 2 seconds
 - ✓ Display will switch to the other page
 - ✓ Page 1 shows Real-Time Data
 - ✓ Page 2 shows Recorded Data

To reset recorded data:

- ⇒ Access Page2: Recorded Data
- ⇒ Press the Display Push-Button to select the data that needs to be reset
- ⇒ Press the Display Push-Button for more than 2 seconds to activate reset
 - ✓ Reset initiated when the display flashes
- ⇒ Continue to press the Display Push-Button until flashing stops
 - ✓ The value is reset to the current value
 - ✗ If the Display Push-Button is released before flashing ends, the value is not reset

Note: Min. and Max. values will be updated and recorded continuously until reset by the user

Fig. 11-3 Reset recorded data



Display R.M.S./PEAK input voltage parameters values:

- ⇒ To display PEAK input voltage values:
 - in Real-Time Mode, browse to V_{in} and press the Display Push-Button for more than 6 seconds
 - ✓ PEAK values initiated when:
 - ✓ Display shows "U_{PEAK}"
 - ✓ V_{in} starts flashing
- ⇒ To display the PEAK input voltage recorded data
 - browse until display shows "Press 2 sec for page 2"
- ⇒ To return to the R.M.S. standard values:
 - browse to V_{in} and press the Display Push-Button for more than 6 seconds
 - ✓ R.M.S. values initiated when:
 - ✓ Display shows "U_{RMS}"
 - ✓ V_{in} stops flashing

All parameters are typical values specified 230 Vac, 50 Hz input voltage, 24 V, 20 A output load, +25 °C ambient and after a 5 minutes run-in time unless otherwise noted.

12. Efficiency and Power Losses

		AC 100 V	AC 120 V	AC 230 V	
Efficiency	typ.	93.6 %	94.1 %	95.5 %	At 24 V, 20 A
	typ.	93.3 %	94.0 %	95.4 %	At 24 V, 24 A (PowerBoost)
Average efficiency	typ.	93.5 %	94.1 %	95.5 %	25 % at 5 A, 25 % at 10 A, 25 % at 15 A, 25 % at 20 A
Power losses	typ.	1.0 W	1.0 W	1.5 W	in "Remote OFF" mode
	typ.	2.7 W	2.4 W	2.3 W	At 24 V, 0 A
	typ.	17.5 W	14.6 W	13.0 W	At 24 V, 10 A
	typ.	33.9 W	30.0 W	23.0 W	At 24 V, 20 A
	typ.	41.5 W	37.7 W	28.1 W	At 24 V, 24 A (PowerBoost)

The average efficiency is an assumption for a typical application where the power supply is loaded with 25 % of the nominal load for 25 % of the time, 50 % of the nominal load for another 25 % of the time, 75 % of the nominal load for another 25 % of the time and with 100 % of the nominal load for the rest of the time.

Fig. 12-1 **Efficiency vs. output current at 24 V, typ.**

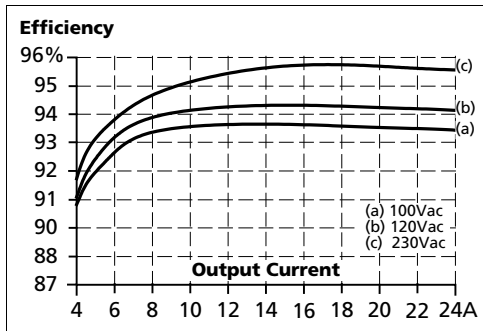


Fig. 12-2 **Losses vs. output current at 24 V, typ.**

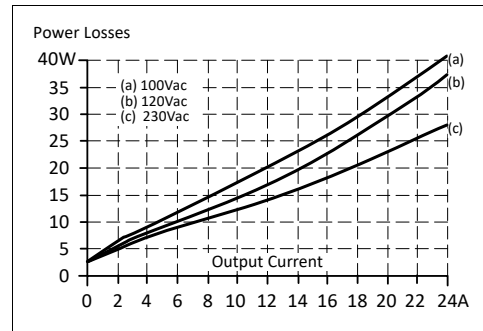


Fig. 12-3 **Efficiency vs. input voltage at 24 V, 20 A, typ.**

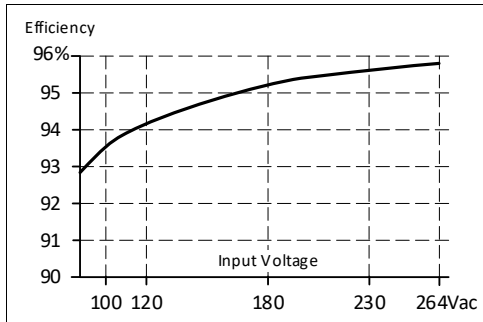
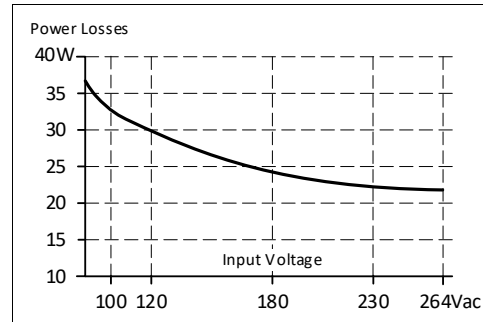


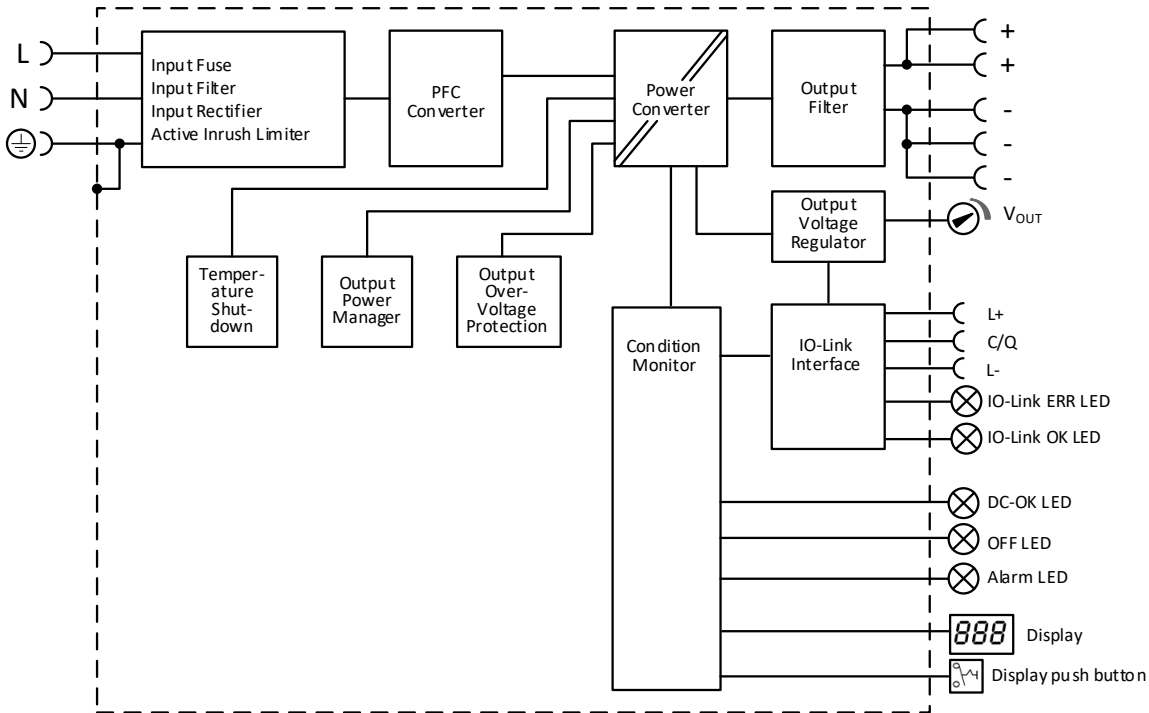
Fig. 12-4 **Losses vs. input voltage at 24 V, 20 A, typ.**



All parameters are typical values specified 230 Vac, 50 Hz input voltage, 24 V, 20 A output load, +25 °C ambient and after a 5 minutes run-in time unless otherwise noted.

13. Functional Diagram

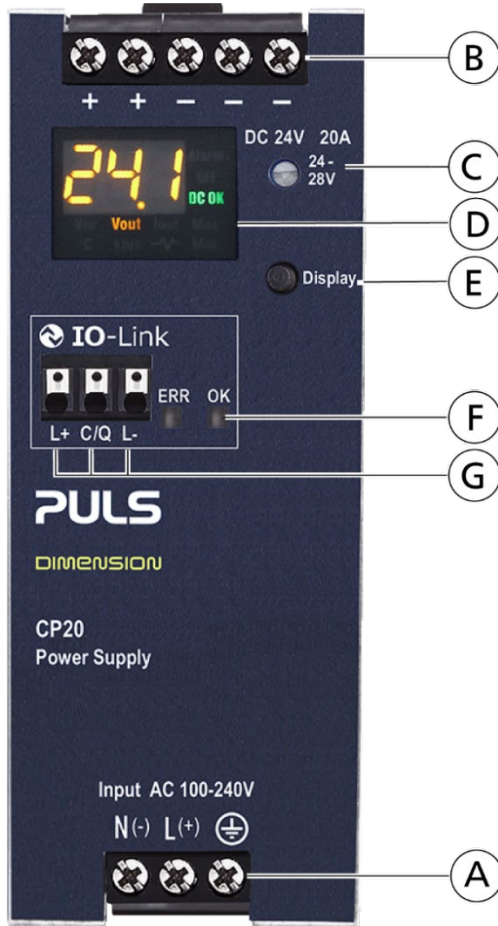
Fig. 13-1 Functional diagram



All parameters are typical values specified 230 Vac, 50 Hz input voltage, 24 V, 20 A output load, +25 °C ambient and after a 5 minutes run-in time unless otherwise noted.

14. Front Side and User Elements

Fig. 14-1 Front side



A Input Terminals

- L Phase (Line) input
- N Neutral conductor input
- ⊕ PE (Protective Earth) input

B Output Terminals

Three terminals for the negative and two terminals for the positive pole. Identical poles are internally connected.

- + Positive output
- Negative (return) output

C Output Voltage Potentiometer

For adjustment of output voltage.
Factory setting: 24.1 V

D Power Supply Condition Display

See Fig. 14-2

E Display Push-Button

This Push-Button can be used to navigate through the display menus and to select either the "Real-time Mode" or the "Recorded Data Mode".

F IO-Link Communication LEDs

ERR:

Red LED ON:

- IO-Link event is present (additionally green LED on / flashing)
- IO-Link voltage too low (additionally green LED off)

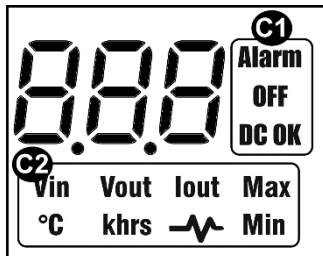
OK:

Green LED ON:

- IO-Link powered, no communication to IO-Link Master
- Green LED Flashing:
- IO-Link communication up and running

G IO-Link Terminals

Fig. 14-2 Power Supply Condition Display




C1 Status Indicator: Alarm, OFF, DC OK

Alarm: The red Alarm LED reports overtemperature, output overload, output overvoltage is integrated in the power supply condition display.

OFF: The yellow OFF LED reports that the output has been switched off due to the remote ON/OFF signal and is integrated in the power supply condition display.

DC OK: The green DC OK LED reports an output above 22V of a running device

C2 Denomination Fields: Vin, Vout, Iout, °C, Transients and khrs

The symbol  stands for transient events

See chapter "Power Supply Condition Display" for details.

All parameters are typical values specified 230 Vac, 50 Hz input voltage, 24 V, 20 A output load, +25 °C ambient and after a 5 minutes run-in time unless otherwise noted.

15. Terminals and Wiring

The terminals are IP20 Finger safe constructed and suitable for field- and factory wiring.

	Input	Output	IO-Link Terminals
Type	Screw terminal	Screw terminal	Push-in terminal
Solid wire	max. 6 mm ²	max. 6 mm ²	max. 1.5 mm ²
Stranded wire	max. 4 mm ²	max. 4 mm ²	max. 1.5 mm ²
American Wire Gauge	AWG 20-10	AWG 20-10	AWG 24-16
Max. wire diameter (including ferrules)	2.8 mm	2.8 mm	1.6 mm
Recommended tightening torque	max. 1 Nm	max. 1 Nm	-
Wire stripping length	7 mm	7 mm	8 mm
Screwdriver	3.5 mm slotted or cross-head No 2	3.5 mm slotted or cross-head No 2	3 mm slotted to open the spring

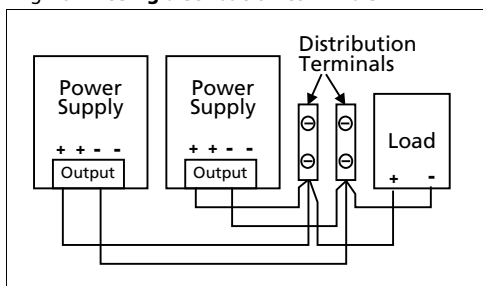
Instructions:

- a) Use appropriate copper cables that are designed for minimum operating temperatures of:
 - +60°C for ambient up to +45°C and
 - +75°C for ambient up to +60°C minimum
 - +90°C for ambient up to +70°C minimum.
- b) Follow national installation codes and installation regulations!
- c) Ensure that all strands of a stranded wire enter the terminal connection!
- d) Do not use the unit without PE connection.
- e) Unused terminal compartments should be securely tightened.
- f) Ferrules are allowed.

Daisy chaining:

Daisy chaining (jumping from one power supply output to the next) is not allowed. Use a separate distribution terminal block as shown in Fig. 15-1.

Fig. 15-1 Using distribution terminals



All parameters are typical values specified 230 Vac, 50 Hz input voltage, 24 V, 20 A output load, +25 °C ambient and after a 5 minutes run-in time unless otherwise noted.

16. Lifetime Expectancy

The Lifetime expectancy shown in the table indicates the minimum operating hours (service lifetime) and is determined by the lifetime expectancy of the built-in electrolytic capacitors. Lifetime expectancy is specified in operational hours and is calculated according to the capacitor's manufacturer specification. The manufacturer of the electrolytic capacitors only guarantees a maximum lifetime of up to 15 years (131 400 h). Any number exceeding this value is a calculated theoretical lifetime which can be used to compare devices.

	AC 100 V	AC 120 V	AC 230 V	
Lifetime expectancy	159 000 h	185 000 h	223 000 h	At 24 V, 10 A and +40 °C
	450 000 h	523 000 h	630 000 h	At 24 V, 10 A and +25 °C
	48 000 h	63 000 h	121 000 h	At 24 V, 20 A and +40 °C
	137 000 h	179 000 h	422 000 h	At 24 V, 20 A and +25 °C
	23 000 h	38 000 h	73 000 h	At 24 V, 24 A and +40 °C
	69 000 h	108 000 h	207 000 h	At 24 V, 24 A and +25 °C

17. MTBF

MTBF stands for **Mean Time Between Failures**, which is calculated according to statistical device failures, and indicates reliability of a device. It is the statistical representation of the likelihood of a unit to fail and does not necessarily represent the life of a product.

The MTBF figure is a statistical representation of the likelihood of a device to fail. A MTBF figure of e.g. 1 000 000 h means that statistically one unit will fail every 100 h if 10 000 units are installed in the field. However, it cannot be determined if the failed unit has been running for 50 000 h or only for 100 h.

For these types of units the MTTF (**Mean Time To Failure**) value is the same value as the MTBF value.

	AC 100 V	AC 120 V	AC 230 V	
MTBF SN 29500, IEC 61709	287 000 h	302 000 h	401 000 h	At 24 V, 20 A and +40 °C
	544 000 h	573 000 h	730 000 h	At 24 V, 20 A and +25 °C
MTBF MIL HDBK 217F	168 000 h	172 000 h	201 000 h	At 24 V, 20 A and +40 °C; Ground Benign GB40
	235 000 h	241 000 h	287 000 h	At 24 V, 20 A and +25 °C; Ground Benign GB25
	37 000 h	39 000 h	41 000 h	At 24 V, 20 A and +40 °C; Ground Fixed GF40
	49 000 h	50 000 h	63 000 h	At 24 V, 20 A and +25 °C; Ground Fixed GF25

All parameters are typical values specified 230 Vac, 50 Hz input voltage, 24 V, 20 A output load, +25 °C ambient and after a 5 minutes run-in time unless otherwise noted.

18. EMC

The EMC behavior of the device is designed for applications in industrial environments as well as in professional equipment in commercial and light-industrial locations.

The device complies with EN IEC 61000-6-1, EN IEC 61000-6-2, EN IEC 61000-6-8, EN IEC 61000-6-4, EN IEC 61000-3-2 and EN 61000-3-3.

The device complies with FCC Part 15 rules. Operation is subjected to following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

EMC Immunity	Power lines and housing			
Electrostatic discharge	EN 61000-4-2	Contact discharge	8 kV	Criterion A
		Air discharge	15 kV	Criterion A
Electromagnetic RF field	EN 61000-4-3	80 MHz-2.7 GHz	10 V/m	Criterion A
		2.7-6 GHz	10 V/m	Criterion A
Fast transients (Burst)	EN 61000-4-4	Input lines	4 kV	Criterion A
		Output lines	2 kV	Criterion A
Surge voltage on input	EN 61000-4-5	L → N	2 kV	Criterion A
		N → PE	4 kV	Criterion A
		L → PE	4 kV	Criterion A
Surge voltage on output	EN 61000-4-5	+ → -	500 V	Criterion A
		+ → PE	1 kV	Criterion A
		- → PE	1 kV	Criterion A
Conducted disturbance	EN 61000-4-6	0.15-80 MHz	10 V	Criterion A
Mains voltage dips	EN 61000-4-11	0 % of 100 Vac	0 Vac, 20 ms	Criterion A
		40 % of 100 Vac	40 Vac, 200 ms	Criterion C
		70 % of 100 Vac	70 Vac, 500 ms	Criterion A
		0 % of 120 Vac	0 Vac, 20 ms	Criterion A
		40 % of 120 Vac	48 Vac, 200 ms	Criterion C
		70 % of 120 Vac	84 Vac, 500 ms	Criterion A
		0 % of 200 Vac	0 Vac, 20 ms	Criterion A
		40 % of 200 Vac	80 Vac, 200 ms	Criterion A
70 % of 200 Vac	140 Vac, 500 ms	Criterion A		
Voltage interruptions	EN 61000-4-11	0 V	5000 ms	Criterion C
Powerful transients	VDE 0160	Over entire load range	750 V, 0.3 ms	Criterion A

EMC Immunity	Signal and communication lines			
Fast transients (Burst)	EN 61000-4-4	Signals with coupling clamp	2 kV	Criterion B
Surge voltage	EN 61000-4-5	IO-Link lines → PE	1 kV	Criterion B
Conducted disturbance	EN 61000-4-6	IO-Link lines	10 V	Criterion A

Performance criterions:

A: Device shows normal operation behavior within the defined limits.

B: Device shows normal operation behavior within the defined limits. During burst or surge events small reduction of IO-Link transmission rate is possible.

C: Temporary loss of function is possible. The device may shut-down and restarts by itself. No damage or hazards for the device will occur.

All parameters are typical values specified 230 Vac, 50 Hz input voltage, 24 V, 20 A output load, +25 °C ambient and after a 5 minutes run-in time unless otherwise noted.

EMC Emission

Conducted emission input lines	EN 55011, EN 55032, FCC Part 15, CISPR 11, CISPR 32	Class B
Conducted emission output lines	IEC/CISPR 16-1-2, IEC/CISPR 16-2-1	EN IEC 61000-6-8 Limits for DC power ports fulfilled
Conducted emission IO-Link lines	EN 55032, CISPR 32	EN IEC 61000-6-8 Limits for wired ports fulfilled
Radiated emission	EN 55011, EN 55032, CISPR 11, CISPR 32	Class A
Harmonic input current	EN IEC 61000-3-2 - Class A equipment EN IEC 61000-3-2 - Class C equipment	Fulfilled Fulfilled in the load range from 8 to 24 A
Voltage fluctuations, flicker	EN 61000-3-3	Fulfilled, tested with non-pulsing constant current loads.

Switching Frequencies

PFC converter	100 kHz	Fixed frequency
Main converter	80 kHz to 140 kHz	Output load dependent
Auxiliary converter	60 kHz	Fixed frequency
Microcontroller	24 MHz, 29.4912 MHz, 48 MHz	The device utilizes in total 3 microcontrollers

All parameters are typical values specified 230 Vac, 50 Hz input voltage, 24 V, 20 A output load, +25 °C ambient and after a 5 minutes run-in time unless otherwise noted.

19. Environment

Operational temperature	-25 °C to +70 °C	The operational temperature is the ambient or surrounding temperature and is defined as the air temperature 2 cm below the device.
Storage temperature	-40 °C to +85 °C	For storage and transportation
Output derating	12.5 W/ K 32 W/1000 m or 5 K/1000 m 10.5 W/K 28 W/1000 m or 5 K/1000 m	Between +60 °C and +70 °C For altitudes > 2000 m, see Fig. 19-2 Between +60 °C and +70 °C at AC 100 V For altitudes > 2000 m, see Fig. 19-2 The derating is not hardware controlled. The user has to take care by himself to stay below the derated current limits in order not to overload the unit.
Humidity	5 to 95 % r.h.	According to IEC 60068-2-30
Atmospheric pressure	110-54 kPa	See Fig. 19-2 for details
Altitude	Up to 5000 m	See Fig. 19-2 for details
Overtoltage category	II	According to IEC 60664-1, for altitudes up to 5000 m
Impulse withstand voltage	4 kV (according to overvoltage category III)	Input to PE According to IEC 60664-1, for altitudes up to 2000 m
Degree of pollution	2	According to IEC 60664-1, not conductive
Vibration sinusoidal	2-17.8 Hz: ±1.6 mm 17.8-500 Hz: 2 g 2 hours / axis	According to IEC 60068-2-6
Shock	30 g 6 ms, 20 g 11 ms 3 bumps / direction 18 bumps in total	According to IEC 60068-2-27
Shock and vibration is tested in combination with DIN rails according to EN 60715 with a height of 15 mm and a thickness of 1.3 mm and standard orientation.		

Fig. 19-1 **Output power vs. ambient temp.**

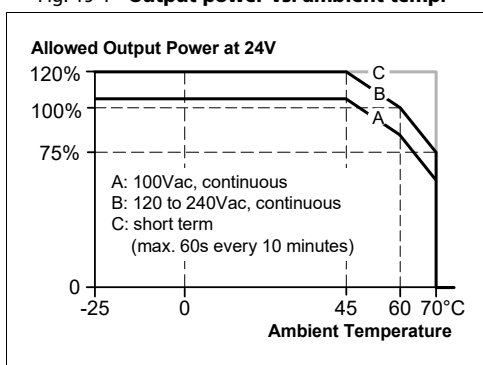
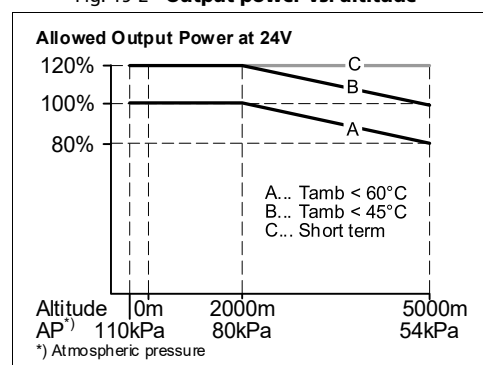


Fig. 19-2 **Output power vs. altitude**



All parameters are typical values specified 230 Vac, 50 Hz input voltage, 24 V, 20 A output load, +25 °C ambient and after a 5 minutes run-in time unless otherwise noted.

20. Safety and Protection Features

Insulation resistance	min.	500 MOhm	At delivered condition between input and output, measured with 500 Vdc
	min.	500 MOhm	At delivered condition between input and PE, measured with 500 Vdc
	min.	500 MOhm	At delivered condition between output and PE, measured with 500 Vdc
	min.	500 MOhm	At delivered condition between output and DC OK or Alarm contacts, measured with 500 Vdc
PE resistance	max.	0.1 Ohm	Resistance between PE terminal and the housing in the area of the DIN rail mounting bracket.
Output over-voltage protection	min.	30.5 Vdc	In case of an internal defect, a redundant circuit limits the maximum output voltage to 32 V. The output switches off and performs three restart attempts. If the failure continues, the output shuts down. Cycle input power to reset.
	max.	32 Vdc	
Class of protection		I	According to IEC 61140 A PE (Protective Earth) connection is required
Degree of protection		IP20	According to EN/IEC 60529
Over-temperature protection		Included	Output shuts down with automatic restart. Temperature sensors are installed on critical components inside the unit and turn the unit off in safety critical situations, which can happen e.g. when ambient temperature is too high, ventilation is obstructed or the derating requirements are not followed. There is no correlation between the operating temperature and turn-off temperature since this is dependent on input voltage, load and installation methods.
Input transient protection		MOV (Metal Oxide Varistor)	For protection values see chapter "EMC".
Internal input fuse		Included	Not user replaceable slow-blow high-breaking capacity fuse
Touch current (leakage current)	typ.	0.12 mA / 0.31 mA	At 100 Vac, 50 Hz, TN-,TT-mains / IT-mains
	typ.	0.18 mA / 0.45 mA	At 120 Vac, 60 Hz, TN-,TT-mains / IT-mains
	typ.	0.30 mA / 0.76 mA	At 230 Vac, 50 Hz, TN-,TT-mains / IT-mains
	max.	0.16 mA / 0.38 mA	At 110 Vac, 50 Hz, TN-,TT-mains / IT-mains
	max.	0.23 mA / 0.55 mA	At 132 Vac, 60 Hz, TN-,TT-mains / IT-mains
	max.	0.39 mA / 0.94 mA	At 264 Vac, 50 Hz, TN-,TT-mains / IT-mains

All parameters are typical values specified 230 Vac, 50 Hz input voltage, 24 V, 20 A output load, +25 °C ambient and after a 5 minutes run-in time unless otherwise noted.

21. Dielectric Strength

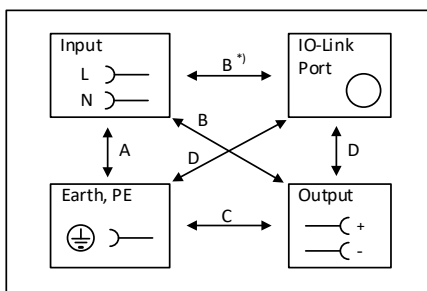
The output voltage is floating and has no ohmic connection to the ground.

The output is insulated to the input by a double or reinforced insulation.

Type and routine tests are conducted by the manufacturer. Field tests may be conducted in the field using the appropriate test equipment which applies the voltage with a slow ramp (2 s up and 2 s down). Connect all input-terminals together as well as all output poles before conducting the test. When testing, set the cut-off current settings to the value in the table below.

We recommend that that pole where the actuators in a control system are connected shall be grounded via protective earth. This helps to avoid situations in which a load starts unexpectedly or cannot be switched off when unnoticed earth faults occur.

Fig. 21-1 Dielectric strength



		A	B	C	D
Type test	60 s	2500 Vac	3000 Vac	1000 Vac	500 Vac
Routine test	5 s	2500 Vac	2500 Vac	500 Vac	500 Vac
Field test	5 s	2000 Vac	2000 Vac	500 Vac	500 Vac
Cut-off current setting for field test		> 10 mA	> 10 mA	> 20 mA	> 10 mA

B^{*)}

When testing input to IO-Link-Terminals ensure that the maximal voltage between IO-Link-Terminals and the output is not exceeded (column D). We recommend connecting IO-Link-Terminals and the output terminals together when performing the test.

All parameters are typical values specified 230 Vac, 50 Hz input voltage, 24 V, 20 A output load, +25 °C ambient and after a 5 minutes run-in time unless otherwise noted.

22. Approved, Fulfilled or Tested Standards

SEMI F47

SEMI F47

Test Report
Voltage Sag Immunity for Semiconductor Processing Equipment
Tested for AC 208V L-L or L-N mains voltages, nominal output voltage and nominal output load

23. Regulatory Product Compliance

EU Declaration of Conformity



EU Declaration of Conformity
Trade conformity assessment for Europe
The CE mark indicates conformance with the European
- RoHS directive,
- EMC directive and the
- Low-voltage directive (LVD)

REACH Regulation (EU)



Manufacturer's Statement
EU regulation regarding the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) fulfilled.

WEEE Regulation



Manufacturer's Declaration
EU Regulation on Waste Electrical and Electronic Equipment
Registered as business to business (B2B) products.
EU Regulation 2012/19/EU

RoHS (China RoHS 2)



Manufacturer's Statement
Administrative Measures for the Restriction of the Use of Hazardous Substances in Electrical and Electronic Products
25 years

All parameters are typical values specified 230 Vac, 50 Hz input voltage, 24 V, 20 A output load, +25 °C ambient and after a 5 minutes run-in time unless otherwise noted.

24. Physical Dimensions and Weight

Width	48 mm
Height	124 mm
Depth	127 mm The DIN rail depth must be added to the unit depth to calculate the total required installation depth.
Weight	835 g
DIN rail	Use 35 mm DIN rails according to EN 60715 or EN 50022 with a height of 7.5 or 15 mm.
Housing material	Body: aluminium alloy Cover: zinc-plated steel
Installation clearances	See chapter 2

Fig. 24-1 **Front view**

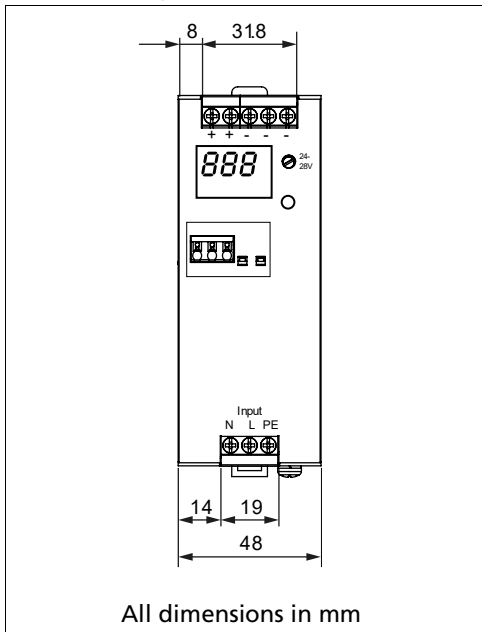
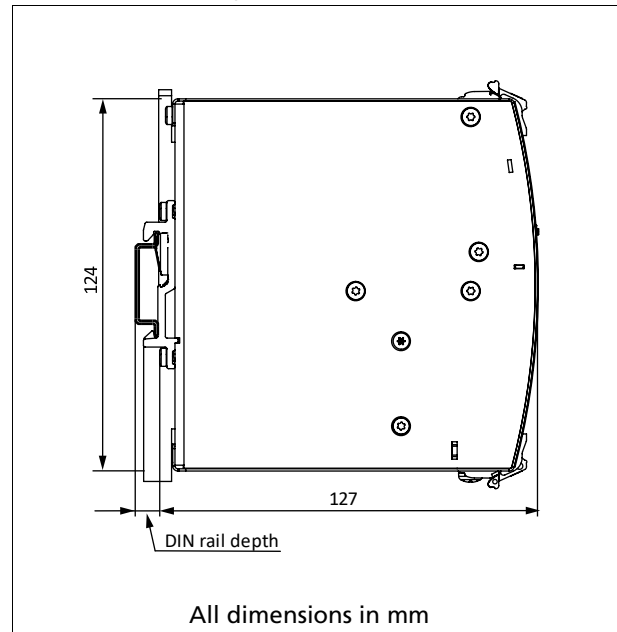


Fig. 24-2 **Side view**



All parameters are typical values specified 230 Vac, 50 Hz input voltage, 24 V, 20 A output load, +25 °C ambient and after a 5 minutes run-in time unless otherwise noted.

25. Accessories

25.1.ZM10.WALL – Wall/Panel Mounting Bracket

This bracket is used to mount the devices on a wall/panel without utilizing the DIN rail. The bracket can be mounted without detaching the DIN rail brackets from the power supply. Product for illustration purposes only.

Fig. 25-1 **Isometric view**

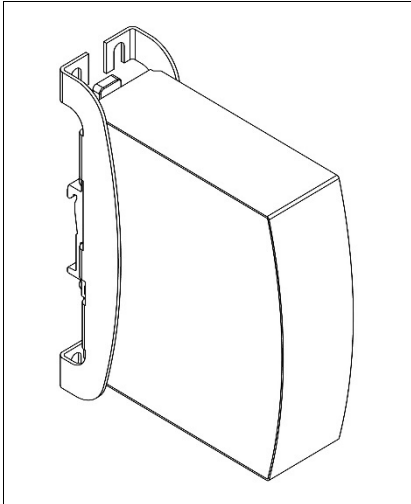


Fig. 25-2 **Isometric view**

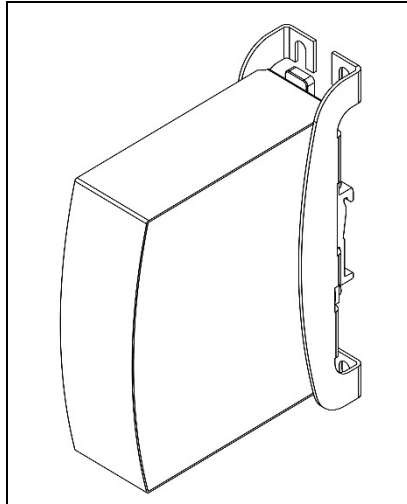


Fig. 25-3 **Isometric view**

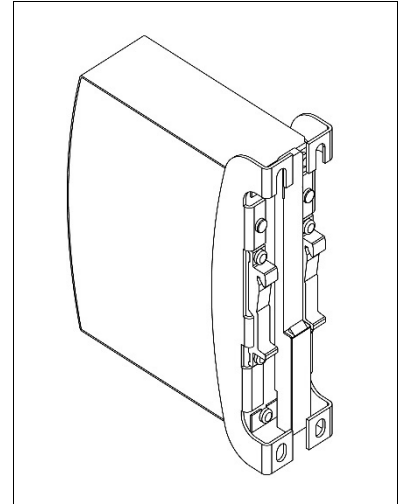


Fig. 25-4 **Wall/panel mounting, front view**

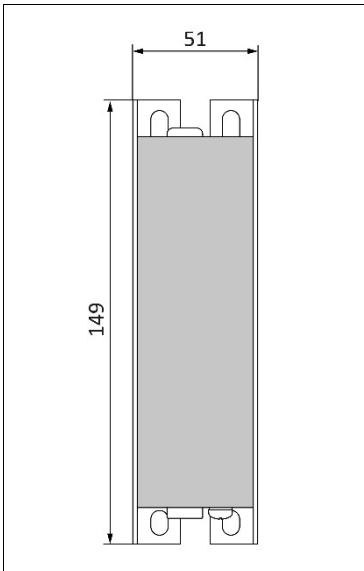


Fig. 25-5 **Hole pattern for wall mounting**

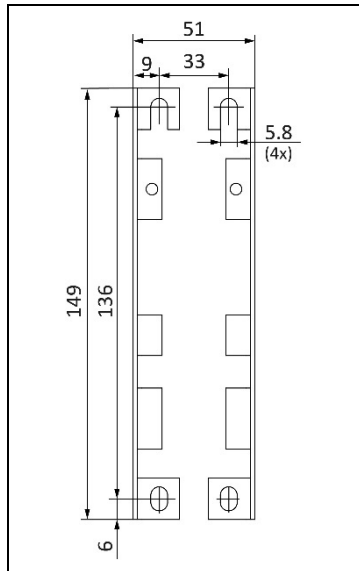
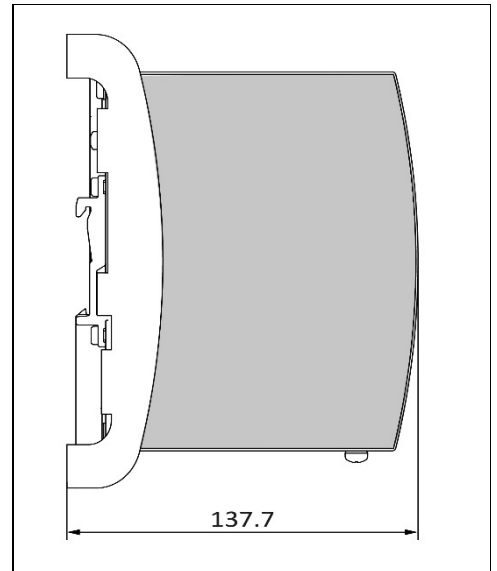


Fig. 25-6 **Wall/panel mounting, side view**



All parameters are typical values specified 230 Vac, 50 Hz input voltage, 24 V, 20 A output load, +25 °C ambient and after a 5 minutes run-in time unless otherwise noted.

25.2. UF20.241 Buffer Module



UF20.241 buffer module is a supplementary device for DC 24 V power supplies. It delivers power to bridge typical mains failures or extends the hold-up time after the AC power is turned off.

When the power supply provides a sufficient voltage, the buffer module stores energy in the integrated electrolytic capacitors. When the mains voltage is lost, the stored energy is released to the DC-bus in a regulated process.

The buffer module can be added in parallel to the load circuit at any given point and does not require any control wiring.

One buffer module can deliver 20 A additional current and can be added in parallel to increase the output ampacity or the hold-up time.

25.3. YR40.241 - Redundancy Module



The YR40.241 is a dual redundancy module, which can be used to build 1+1 or N+1 redundant system.

The device is equipped with two 20 A nominal input channels, which are individually decoupled by utilizing MOSFET technology. The output can be loaded with a nominal 40 A continuous current.

Using MOSFETs instead of diodes reduces heat generation, losses and voltage drop between input and output. Due to these advantages, the unit is very narrow and only requires 36 mm width on the DIN rail.

The device does not require an additional auxiliary voltage and is self-powered even in case of a short circuit across the output.

A feature of this redundancy module is a special circuit, which keeps the losses and temperature low, even at overload and short circuit conditions up to 65 A continuous current.

See chapter "Parallel Use for Redundancy" for wiring information.

25.4. YR40.242 - Redundancy Module



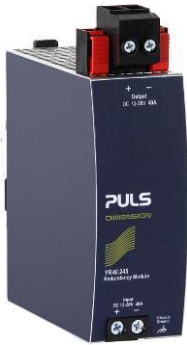
Using MOSFETs instead of diodes reduces heat generation, losses and voltage drop between input and output. Due to these advantages, the unit is very narrow and only requires 36 mm width on the DIN rail.

The device does not require an additional auxiliary voltage and is self-powered even in case of a short circuit across the output. It requires suitable power supplies on the input, where the sum of the continuous short circuit current stays below 26 A. This is typically achieved when the power supplies are featured with an intermittent overload behavior (Hiccup Mode).

See chapter "Parallel Use for Redundancy" for wiring information.

All parameters are typical values specified 230 Vac, 50 Hz input voltage, 24 V, 20 A output load, +25 °C ambient and after a 5 minutes run-in time unless otherwise noted.

25.5. YR40.245 - Redundancy Modules



The YR40.245 is a 40 A single channel redundancy module, which is equipped with a plug connector on the output. The plug connector allows replacing the power supply or the redundancy module while the system is running. The plug connector prevents the output wires from touching and creating a short on the load circuit.

The input of the device is decoupled by utilizing MOSFET technology.

Using MOSFETs instead of diodes reduces heat generation, losses and voltage drop between input and output. Due to these advantages, the unit is very narrow and only requires 46 mm width on the DIN rail.

The device does not require an additional auxiliary voltage and is self-powered even in case of a short circuit across the output. It requires a suitable power supply on the input, where the continuous short circuit current stays below 22 A. This is typically achieved when the power supply is featured with an intermittent overload behavior (Hiccup Mode).

See chapter "Parallel Use for Redundancy" for wiring information.

All parameters are typical values specified 230 Vac, 50 Hz input voltage, 24 V, 20 A output load, +25 °C ambient and after a 5 minutes run-in time unless otherwise noted.

26. Application Notes

26.1. Peak Current Capability

The unit can deliver peak currents (up to several milliseconds) which are higher than the specified short term currents. This helps to start current demanding loads. Solenoids, contactors and pneumatic modules often have a steady state coil and a pick-up coil. The inrush current demand of the pick-up coil is several times higher than the steady-state current and usually exceeds the nominal output current. The same situation applies when starting a capacitive load. The peak current capability also ensures the safe operation of subsequent circuit breakers of load circuits. The load branches are often individually protected with circuit breakers or fuses. In case of a short or an overload in one branch circuit, the fuse or circuit breaker need a certain amount of over-current to open in a timely manner. This avoids voltage loss in adjacent circuits.

The extra current (peak current) is supplied by the power converter and the built-in large sized output capacitors of the power supply. The capacitors get discharged during such an event, which causes a voltage dip on the output. The following three examples show typical voltage dips for resistive loads:

Fig. 26-1 **40 A_{peak} current for 50 ms, typ.**
(2x the nominal current)

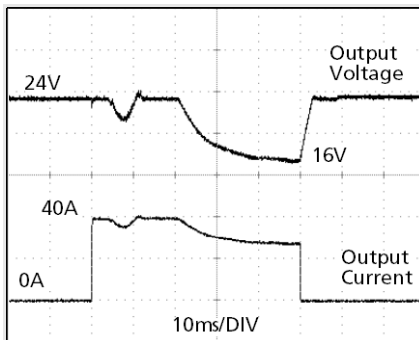


Fig. 26-2 **100 A_{peak} current for 5 ms, typ.**
(5x the nominal current)

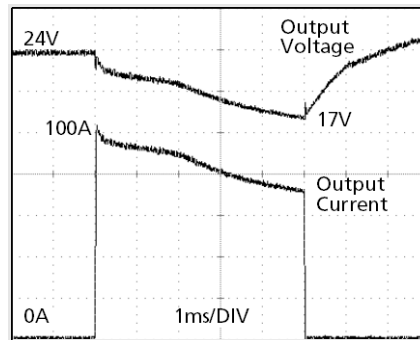
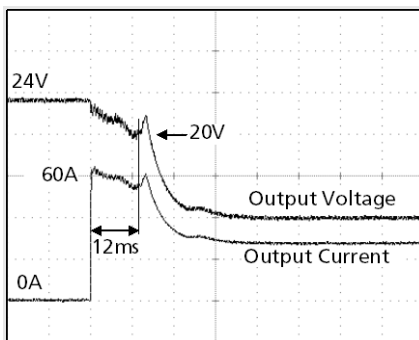


Fig. 26-3 **60 A_{peak} current for 12 ms, typ.**
(3x the nominal current)



Peak current voltage dips	typ.	from 24 V to 16 V	at 40 A for 50 ms, resistive load
	typ.	from 24 V to 21 V	at 100 A for 2 ms, resistive load
	typ.	from 24 V to 17 V	at 100 A for 5 ms, resistive load

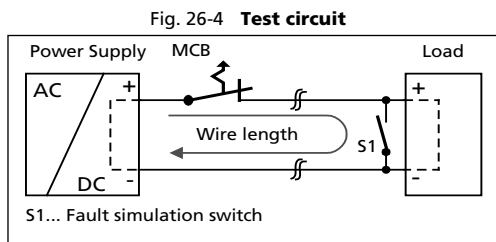
All parameters are typical values specified 230 Vac, 50 Hz input voltage, 24 V, 20 A output load, +25 °C ambient and after a 5 minutes run-in time unless otherwise noted.

26.2. Output Circuit Breakers

Standard miniature circuit breakers (MCB's or UL 1077 circuit breakers) are commonly used for AC-supply systems and may also be used on 24 V 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 24 V branches which are supplied by the same source, a fast (magnetic) tripping of the MCB is desired. A quick shutdown within 10 ms 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 chapter and wire length.



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

	0.75 mm ²	1.0 mm ²	1.5 mm ²	2.5 mm ²
C-2A	31 m	37 m	63 m	98 m
C-3A	28 m	34 m	51 m	78 m
C-4A	18 m	25 m	38 m	58 m
C-6A	9 m	11 m	18 m	26 m
C-8A	6 m	7 m	12 m	14 m
C-10A	4 m	6 m	11 m	13 m
C-13A	2 m	2 m	4 m	7 m
B-6A	23 m	28 m	46 m	66 m
B-10A	11 m	14 m	19 m	32 m
B-13A	7 m	11 m	16 m	29 m
B-16A	5 m	6 m	8 m	15 m
B-20A	1 m	1 m	2 m	4 m
B-25A				1 m

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

26.3. Charging of Batteries

The power supply can be used to charge lead-acid or maintenance-free batteries. Two 12 V SLA or VRLA batteries are needed in series connection.

Instructions for charging batteries:

- a) Use only matched batteries when putting 12 V types in series.
- b) Ensure that the ambient temperature of the power supply stays below +40 °C..
- c) Use a 30 A or 32 A circuit breaker or a 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) The return current to the power supply is typically 3.5 mA. This return current can discharge the battery when the power supply is switched off except in case a blocking diode is utilized.
- f) Set the device into "Parallel Use" mode and adjust the output voltage, measured at no load and at the battery end of the cable, very precisely to the end-of-charge voltage of 27.8 V at +10 °C, 27.5 V at +20 °C, 27.15 V at +30 °C and 26.8 V at +40 °C ambient temperature.

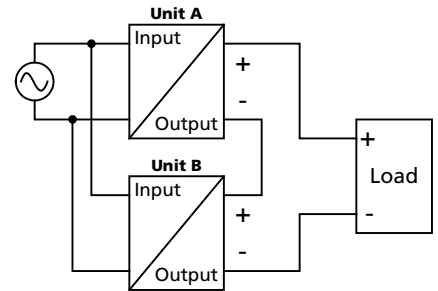
26.4. Series Operation

Devices 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 150 Vdc. Voltages with a potential above 60 Vdc must be installed with a protection against touching.

Avoid return voltage (e.g. from a decelerating motor or battery) which is applied to the output terminals.

Keep an installation clearance of 15 mm (left / right) between two power supplies and avoid installing the power supplies on top of each other. Do not use power supplies in series in mounting orientations other than the standard mounting orientation.

Pay attention that leakage current, EMI, inrush current, harmonics will increase when using multiple devices.



26.5. Parallel Use to Increase Output Power

Devices can be paralleled to increase the output power. The output voltage of all power supplies shall be adjusted to the same value (± 100 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, set the unit to "Parallel Use" mode via IO-Link interface, 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. 4 % higher than at nominal load.

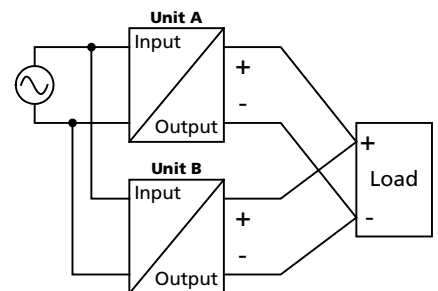
The ambient temperature is not allowed to exceed +60 °C.

If more than three units are connected in parallel, a fuse or circuit breaker with a rating of 30 A or 32 A is required on each output. Alternatively, a diode or redundancy module can also be utilized.

Energize all units at the same time. It also might be necessary to cycle the input power (turn-off for at least five seconds), if the output was in overload or short circuits and the required output current is higher than the current of one unit.

Keep an installation clearance of 15 mm (left / right) between two devices and avoid installing devices on top of each other. Do not use devices in parallel in mounting orientations other than the standard mounting orientation or in any other condition where a reduction of the output current is required (e.g. altitude).

Pay attention that leakage current, EMI, inrush current will increase when using multiple devices.



All parameters are typical values specified 230 Vac, 50 Hz input voltage, 24 V, 20 A output load, +25 °C ambient and after a 5 minutes run-in time unless otherwise noted.

26.6.Parallel Use for Redundancy

1+1 Redundancy:

Devices 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 device fails. The simplest way is to put two devices in parallel. This is called a 1+1 redundancy. In case one device fails, the other one is automatically able to support the load current without any interruption. It is essential to use a redundancy module to decouple devices from each other. This prevents that the defective unit becomes a load for the other device and the output voltage cannot be maintained any more.

1+1 redundancy allows ambient temperatures up to +70 °C.

Pay attention that leakage current, EMI, inrush current, harmonics will increase when using multiple devices.

Recommendations for building redundant power systems:

- Use separate input fuses for each device.
- Use separate mains systems for each device whenever it is possible.
- Monitor the individual devices. Therefore, use the DC OK signal of the device.
- It is desirable to set the output voltages of all devices to the same value (± 100 mV) or leave it at the factory setting.
- Set the devices into "Parallel Use" mode via IO-Link interface.

N+1 Redundancy:

Redundant systems for a higher power demand are usually built in a N+1 method. E.g. four devices, each rated for 20 A are paralleled to build a 60 A redundant system.

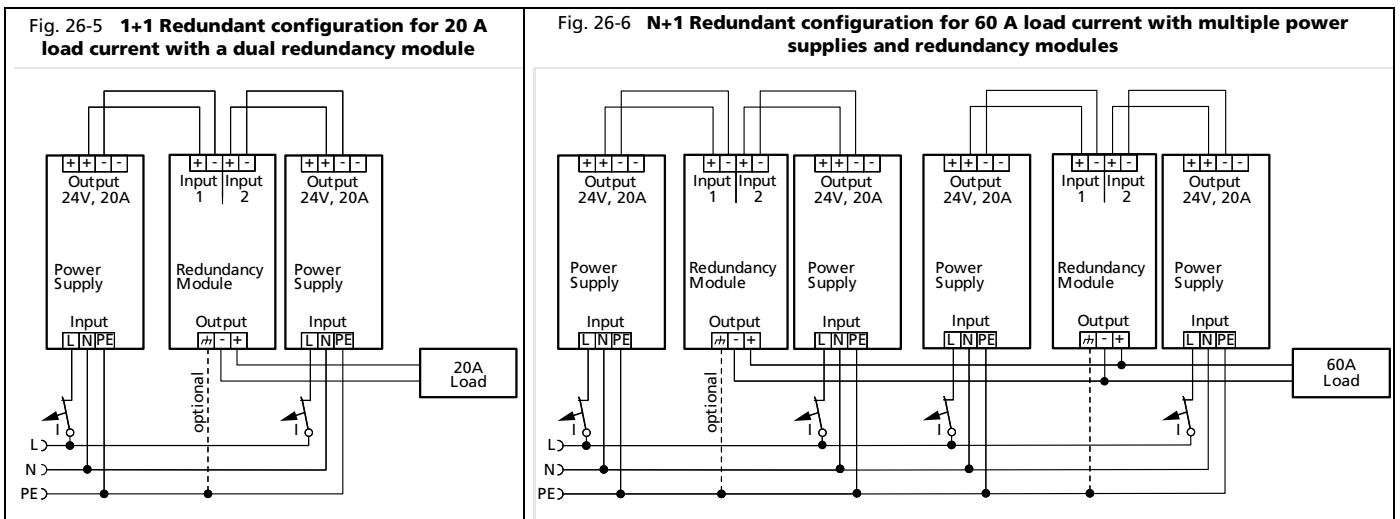
Pay attention that leakage current, EMI, inrush current, harmonics will increase when using multiple power supplies.

Keep an installation clearance of 15 mm (left / right) between two power supplies and avoid installing the power supplies on top of each other.

Do not use devices in parallel in mounting orientations other than the standard mounting orientation or in any other condition, where a derating of the output current is required.

For N+1 redundancy the ambient temperature is not allowed to exceed +60 °C.

Wiring examples for 1+1 and N+1 redundancy:

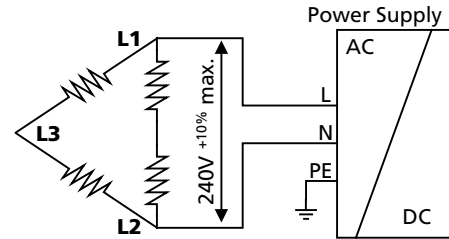


All parameters are typical values specified 230 Vac, 50 Hz input voltage, 24 V, 20 A output load, +25 °C ambient and after a 5 minutes run-in time unless otherwise noted.

26.7. Operation on Two Phases

The power supply can also be used on two-phases of a three-phase-system. Such a phase-to-phase connection is allowed as long as the supplying voltage is below 240 V^{+10%}.

Ensure that the wire, which is connected to the N-terminal, is appropriately fused.

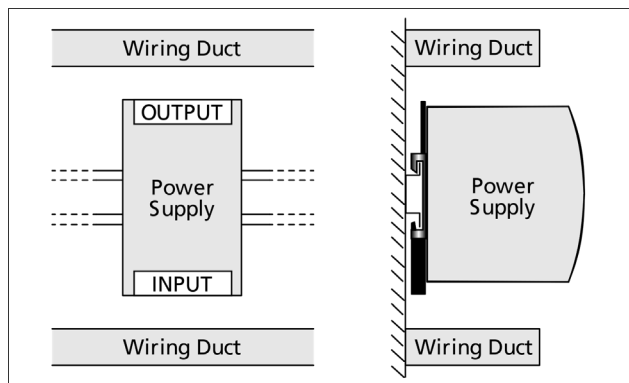


26.8. Mounting Orientation

Install the device onto a DIN rail with the input terminals on the bottom of the device.

The test environment is set up installing wiring ducts (depth: 80 mm) with clearances seen in chapter 2.

Fig. 26-7
Mounting Orientation A
(Standard orientation)



All parameters are typical values specified 230 Vac, 50 Hz input voltage, 24 V, 20 A output load, +25 °C ambient and after a 5 minutes run-in time unless otherwise noted.