PULS

Industrial Power-over-Ethernet Injectors and Power Supplies

4-channel or 8-channel | 30W per port | 1.000 Mbps

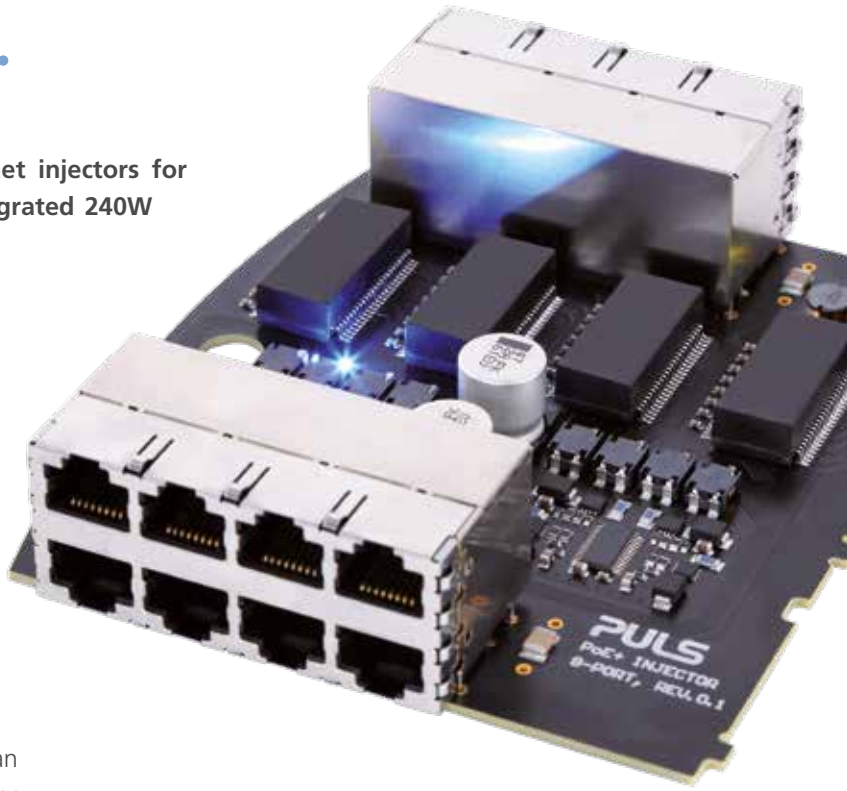
PoE Injector

PoE Power Supply

Flexible. Reliable. Fast.

Flexible. Reliable. Fast.

Efficient 4-channel and 8-channel Power-over-Ethernet injectors for a wide range of applications. Available with an integrated 240W power supply or as stand-alone device.



The 4- and 8-channel solutions are available with an integrated PULS high-end power supply or as standalone PoE injectors. Both devices feature a stable power of up to 30W per channel. This enables you to supply up to 8 PoE/PoE+ devices with only one injector.

The all-in-one device with an integrated AC/DC converter adds some extra benefits: It can be connected directly to the AC mains, permitting a simplified system structure. Previously, at least two devices were needed to achieve this result.

The underlying, trusted power supply CP10.481 provides an outstanding efficiency of 95.5%, which leads to even lower power losses. This results in significantly lower temperatures in your application, so you will benefit from cost savings for your cooling system.

In addition, lower temperatures lead to a higher reliability (MTBF 699,000h) and longer service life (120,000h) of the power supply.

Highlights

- **PoE+ 30W per port**
- **1 Gbit/s Ethernet**
- **DIN rail mounting**
- **Version with integrated high-end power supply**

Benefits at a glance

Power up to 8 devices

PULS PoE injectors are equipped with up to 8 ports. Each port delivers a power of 30W (25.5W at load) and is compliant to IEEE Standard 802.3at (also backwards compatible to IEEE 802.3af/15W per port). This enables PoE communication with a high number of devices using only one PoE injector.

Safety first

PULS always ensures a maximum level of security for its products, for hardware as well as software. For example, if one Ethernet channel of the PoE injector should fail, all other channels remain unaffected and fully functional. The devices are protected against digital attempts at manipulation – the integration of an ASIC in the switch design prevents intrusion.

Technical Data

PoE Power Supply (AC input)

Output	
PoE standard	PoE+ (IEEE 802.3at) PoE (IEEE 802.3af)
Output power	30W (25.5W on the load) per port
Output voltage	48V – 56V per port (adjustable)
Input (integrated power supply: CP10.481)	
AC input voltage nominal	100V – 240V
AC input voltage range	90V – 264V
Power factor PFC	0.98
Input inrush current	6A / 9A (120 / 230V)
DC input voltage, nominal	110V – 150V
DC input voltage range	88V – 187V
Efficiency (CP10.481)	95.5%
MTBF SN 29500, IEC 61709 (CP10.481)	699kh
Lifetime expectancy (CP10.481)	> 109kh
General data	
Data transfer rate	Gigabit Ethernet
Connection terminal type	Plug connector, RJ45 Ethernet
Dimensions WxHxD	77 x 131 x 117mm
Weight	900g
Operational temperature	-25°C to +70°C
Order Number	
POE.8AT-AC1	8 ports
POE.4AT-AC1	4 ports (coming soon)

PoE Injector (DC input)

Output	
PoE standard	PoE+ (IEEE 802.3at) PoE (IEEE 802.3af)
Output power	30W (25.5W on the load) per port
Output voltage	48V – 56V per port (adjustable)
Input	
DC input voltage range	48V – 56V
Input inrush current	5.5A
General data	
Data transfer rate	Gigabit Ethernet
Connection terminal type	Plug connector, RJ45 Ethernet
Dimensions WxHxD	39 x 128 x 117mm
Weight	360g
Operational temperature	-45°C to +85°C
Order Numbers	
POE.8AT-DC1	8 ports
POE.4AT-DC1	4 ports (coming soon)

Standards and approvals

CE

Save time and space

Standard DIN rail mounting allows an easy and quick installation of the PoE injector into customer applications. No complicated setup and integration into the Ethernet LAN is required. The small size of the all-in-one solution – with a width of only 77mm – saves space. You can also reduce the total number of devices in your system.

Perfect for industrial applications

Industrial applications are more challenging. The devices need to be able to handle varying grid quality, high temperatures and vibrations. With its new PoE injectors, PULS now offers robust, durable and efficient midspan solutions for anyone looking to power a larger number of PoE devices in an industrial environment.

Made for your application

Industrial automation

Building automation

Transportation infrastructure

Point-of-Sale (PoS)

Office environment

Medical and healthcare

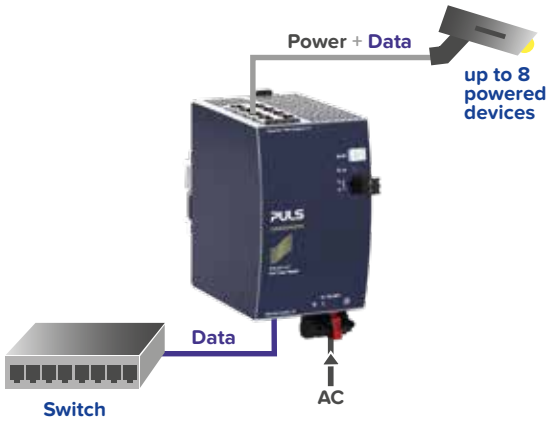
Options

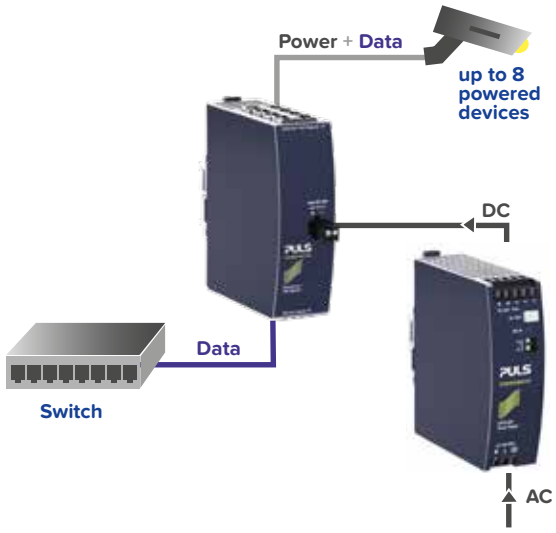
All-in-one solution

The version with a built-in PULS CP10.481 offers customers a high-quality power supply that impresses with its reliability and performance. This all-in-one solution reduces the system complexity and costs due to shorter installation times. In addition, only one part number needs to be managed.

PoE injector and external power supply

The stand-alone PoE injector is the perfect addition to existing PoE infrastructures or retrofit projects. The slim device is optimized for a flexible usage and works seamlessly with exisiting power supplies.





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FLY04-EN-02

Combine it with other PULS devices

DIN rail power supplies
use it to power the injector (e.g. CP10.481)

DC-UPS and buffer modules
to override short input voltage failures (e.g. UF20.481)

Redundancy modules
for high uptimes (e. g. YR40.482)

More Information

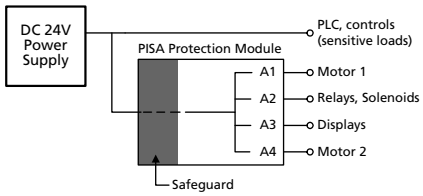
PROTECTION MODULE

- One Input and Four Current Controlled Outputs
- Ensures Sufficient Supply Voltage for Critical Loads even in the Event of an Fault
- Protects Small Cable Sizes against Overload
- Hassle-free Turn-on of Loads with Large Input Capacitors
- NEC Class 2 Compliant (1A and 2A Model)
- Wide Temperature Range between -25°C and +70°C
- On/Off Function of Outputs
- Compact Design, Width only 45mm
- Remote Monitoring and Control Functions
- 3 Year Warranty

GENERAL DESCRIPTION

This protection module fulfills two basic functions. First it distributes the current of a large power source to four lower current output channels and therefore allows for smaller wires to be used. The second function is to permit only so much current on the outputs that the input voltage of this unit (which corresponds to the output voltage of the power supply) does not fall below 21V.

This ensures a safe and an uninterrupted supply voltage for sensitive equipments, such as PLCs, controls or sensors, when they are connected directly to the same power supply as the PISA module. Less critical loads that are not affected to short voltage interruptions or that could even be the cause of a fault on the 24V power supply are connected to one of the four current controlled output channels of the PISA module.



SHORT-FORM DATA

Input voltage	DC 24V	
Input voltage range	18 - 30V	
Input current	typ. 43mA	At no load
Number of outputs	4	
Output currents	fixed between 1A and 12A	See order information
Input voltage protection levels	typ. 21.4V	
Temperature range	-25°C to +70°C -40°C to +85°C	Operational Storage
Type of current limitation	Active current limitation followed by a shutdown	
Dimensions	45x75x91mm *)	WxHxD

*) Add 13mm in depth for signal connector.

ORDER NUMBERS

		Output Ratings
Protection module	**PISA11.401**	1A, 1A, 1A, 1A
	PISA11.402	2A, 2A, 2A, 2A
	PISA11.403	3A, 3A, 3A, 3A
	PISA11.404	4A, 4A, 4A, 4A
	PISA11.406	6A, 6A, 6A, 6A
	PISA11.410	10A, 10A, 10A, 10A
	PISA11.203206	3A, 3A, 6A, 6A
	PISA11.206212	6A, 6A, 12A, 12A

Please note: An additional, NEC Class 2 optimized module (PISA11.CLASS2), can be found in a separate datasheet.

MARKINGS

c UL US LISTED IND. CONT. EQ. — UL 508

c UL US — UL 60950-1

UL 2367

IECEE CB SCHEME — IEC 60950-1

ATEX — II 3G EX nA nC IIC T4

CE — EMC, LVD

c SP US — Class I Div 2

GL — Marine

INDEX

TERMINOLOGY AND ABREVIATIONS

DC 24V	A figure displayed with the AC or DC before the value represents a nominal voltage with standard tolerances (usually ±15%) included. E.g.: DC 12V describes a 12V battery disregarding whether it is full (13.7V) or flat (10V)
24Vdc	A figure with the unit (Vdc) at the end is a momentary figure without any additional tolerances included.

1. INTENDED USE

This device is designed for installation in an enclosure and is intended for the general use such as in industrial control, office, communication, and instrumentation equipment.

Do not use this protection module in equipment, where malfunction may cause severe personal injury or threaten human life.

This device is designed for use in hazardous, non-hazardous, ordinary or unclassified locations.

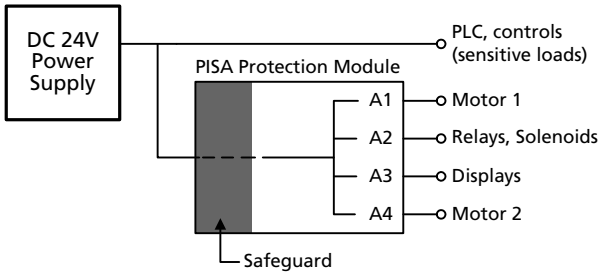
2. PRODUCT DESCRIPTION

This protection module fulfills two basic functions. First it distributes the current of a large power source to four lower current output channels and therefore allows for smaller wires to be used. The second function is to permit only so much current on the outputs that the input voltage of this unit (which corresponds to the output voltage of the power supply) does not fall below 21V. This ensures a reliable supply voltage for sensitive equipments, such as PLCs, controls or sensors, when they are connected directly to the same power supply as the PISA protection module.

The protection module has one 24V input and four output channels to which the current is distributed. Each output channel is equipped with a redundant over-current protection, which avoids that wires will be overloaded. All four output channels will shutdown simultaneously, if the current of one individual channel or the maximum allowed current for the protection module is exceeded.

A safeguard circuit in the input stage of the PISA module works like a valve. It permits only so much current that the input voltage does not drop below 21V. In case the input voltage would fall below this value (e.g. due to overloads, too small of a power supply or high inrush currents such as from starting a motor), all four output channels will be actively current limited and will shutdown after a certain period of time.

A typical wiring configuration is shown below. All sensitive loads are connected directly to the power supply. If needed, these load circuits can be protected with standard circuit breakers or fuses. Loads which are less sensitive to voltage dips or interruptions or which are the source of the voltage drop themselves are connected to the output of the PISA protection module.



3. INSTALLATION REQUIREMENTS

This protection module is suitable for DIN-rail mounting. Use DIN-Rails according to EN 60715 or EN 50022 with a height of 7.5 or 15mm.

The protection module can be used with any regulated 24Vdc power supply. If the power source can deliver more than 40A continuous, the PISA module shall be equipped with an external input fuse (e.g. 30/32A). The power capability and performance of the power supply can limit the output characteristics of the PISA module.

Make sure that the input voltage polarity is correct before applying the input voltage.

Do not connect batteries to the outputs of the PISA11 module.

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

The unit does not contain serviceable parts.

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

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

The standard mounting orientation is input terminals on the bottom and output terminals on the top. Do not use the unit in other mounting orientations.

Keep the following installation clearances:

- Top and bottom: min. 40mm on top, 20mm on the bottom
- Left and right: min. 0mm if the total output current of the PISA module is less than 15A
  min. 6.4mm if the total output current is equal or higher than 15A and the ambient temperature is between 45°C and 60°C.
  min. 6.4mm if the ambient temperature is above 60°C (except for PISA11.401, PISA11.402 and PISA11.403).

A high voltage drop between the power supply and the protection module might cause a malfunction. It is not recommended to use wires longer than 2x2m (for 2.5mm² or AWG14 wires) or 2x4m (for 4mm² or AWG12 wires) to avoid undesired undervoltage conditions on the input of the protection module.

At ambient temperatures above 50°C and output currents higher than 15A (sum of all four channels), do not use a wire size smaller than 2.5mm² (or AWG14) and use wiring scheme Fig. 3-2.

Use only regulated PULS power supplies to meet the conducted low frequency interference requirements when used in marine applications according to the GL regulations (section 20 of the GL regulations).

Fig. 3-1 **Standard wiring scheme**

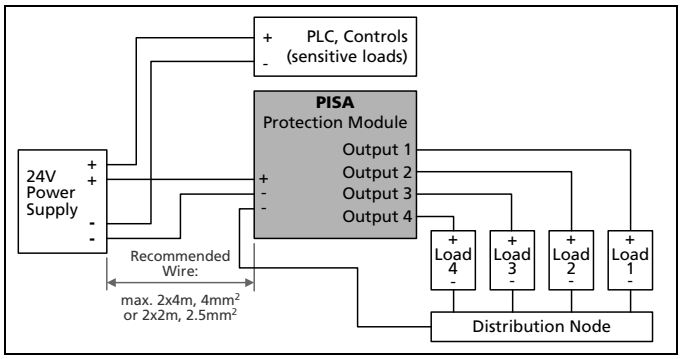
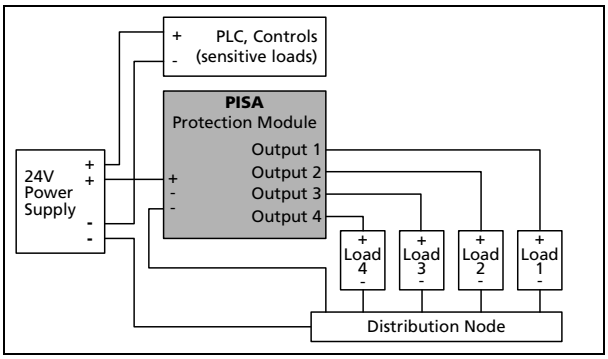


Fig. 3-2 **Wiring scheme for ambient temperatures above 50°C and output currents above 15A**



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

- Turn power off before working on the device. Protect against inadvertent re-powering.
- Make sure that the wiring is correct by following all local and national codes.
- Do not modify or repair the unit.
- Do not open the unit.
- 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.

Notes for use in hazardous location areas:

The units are suitable for use in Class I Division 2 Groups A, B, C, D locations.

The units are suitable for use in Group II Category 3 (Zone 2) environments and are evaluated according to EN 60079-0:2009 and EN 60079-15:2010.

WARNING EXPLOSION HAZARDS!

Substitution of components may impair suitability for this environment. Do not disconnect the unit or operate the reset button unless power has been switched off or the area is known to be non-hazardous. The signal-connector may not be used in hazardous location areas unless additional measures are met to avoid an unintended disconnection (e.g. an additional mechanical fixation). The connection must meet the requirements of the EN 60079-15:2010. A suitable enclosure must be provided for the end product which has a minimum protection of IP54 and fulfils the requirements of the EN 60079-15:2010.

4. INPUT

Input voltage	nom.	DC 24V	±25%
Input voltage range	-	18Vdc – 30Vdc	
	max.	30Vdc	Absolute maximum continuous input voltage with no damage to the PISA module
Turn-on voltage	typ.	21.4Vdc	Required input voltage for turning-on the outputs
Turn-on delay of outputs	typ.	270ms	Period between applying the input voltage and turning on the outputs. All outputs will be turned-on at the same time.
Input voltage protection level *)	min. max.	21.0Vdc 21.8Vdc	Below this voltage level, outputs will shutdown.
Stand-by input current	typ.	43mA	Stand-by current with no load current on the outputs

*) Voltage dips below this value can occur for maximal 200µs.

5. OUTPUTS

			PISA11.401	PISA11.402	PISA11.403	PISA11.404
Output current	output 1	nom.	1A	2A	3A	4A
	output 2	nom.	1A	2A	3A	4A
	output 3	nom.	1A	2A	3A	4A
	output 4	nom.	1A	2A	3A	4A
All 4 outputs together		nom.	4A	8A	12A	16A
NEC CLASS 2 compliance			yes	yes	no	no
Output current limitation *)		min.	9A	9A	16.6A	16.6A
		typ.	10.7A	10.7A	19.9A	19.9A
		max.	12.7A	12.7A	23.6A	23.6A
Voltage drop **)	per output	typ.	41mV	83mV	75mV	101mV
Output leakage current ***)		typ.	0.4mA	0.4mA	0.4mA	0.4mA

			PISA11.406	PISA11.410	PISA11.203206	PISA11.206212
Output current	output 1	nom.	6A	10A	3A	6A
	output 2	nom.	6A	10A	3A	6A
	output 3	nom.	6A	10A	6A	12A
	output 4	nom.	6A	10A	6A	12A
All 4 outputs together		nom.	20A	20A	18A	20A
NEC CLASS 2 compliance			no	no	no	no
Output current limitation*)		min.	20.5A	20.5A	20.5A	20.5A
		typ.	25A	25A	25A	25A
		max.	30A	30A	30A	30A
Voltage drop**)	output 1, 2	typ.	124mV	197mV	92mV	178mV
	output 3, 4	typ.	124mV	197mV	107mV	182mV
Output leakage current ***)		typ.	0.4mA	0.4mA	0.4mA	0.4mA

*) The current limitation value for the sum of all four output currents. This current can be drawn from each individual output regardless whether it is a 1A, 2A, 3A, 4A, 6A,10A or 12A output. According to the specified ampacity of the outputs, the current can flow for a shorter or longer period before the protection module shutdown all four outputs at the same time. Shutdown times can be found in chapter 6.

**) Voltage loss between input and output, when all output channels are loaded with 50% of its nominal current.

***) Output current when outputs have shut down.

6. CURRENT LIMITATION AND SHUTDOWN BEHAVIOR

The PISA11 protection module comprises one common limitation and switching element for all four outputs. In a protection event, all four outputs limit the current or shutdown at the same time.

The following reasons can cause a limitation of the output currents or a shutdown of the output channels:

1) The output current of one or more output channels was too high.
2) The sum of the output current of all four output channels was exceeded.
3) The outputs needed to be shutdown in order to maintain sufficient input voltage.

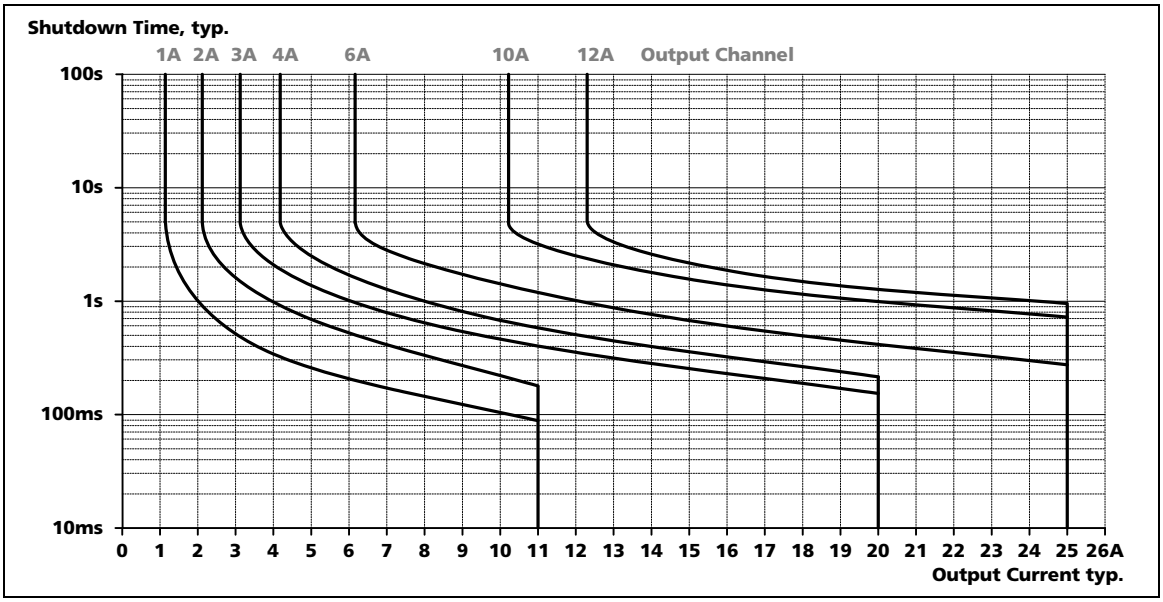
Shutdown times*) when exceeding the rated output current:

		PISA11.401 (4x1A)	PISA11.402 (4x2A)	PISA11.403 (4x3A)	PISA11.404 (4x4A)
At 2x the rated current	typ.	1s at 2A	1s at 4A	1s at 6A	1s at 8A
At short circuit	typ.	110ms	110ms	10ms	10ms

			PISA11.406 (4x6A)	PISA11.410 (4x10A)	PISA11.203206 (2x3A, 2x6A)	PISA11.206212 (2x6A, 2x12A)
At 2x rated current	output 1, 2	typ.	1s at 12A	1s at 20A	1s at 6A	1s at 12A
	output 3, 4	typ.	1s at 12A	1s at 20A	1s at 12A	1s at 24A
At short circuit	output 1, 2	typ.	8ms	8ms	8ms	8ms
	output 3, 4	typ.	8ms	8ms	8ms	8ms

*) The timer for shutdown starts immediately once the rated current levels are exceeded. All output channels will shutdown, if one channel is overloaded. See Fig. 6-1 for more values.
A shutdown of the outputs can also happen earlier, e.g. when the PISA module has to protect the supply voltage in case the power supply can not deliver enough current to support all loads without going into overload.

Fig. 6-1 **Shutdown characteristic for 1A, 2A, 3A, 4A, 6A and 10A output channels**

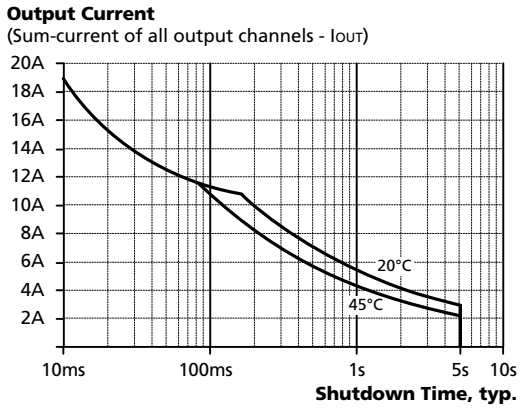


Shutdown behavior to avoid under-voltage situations on the supply voltage

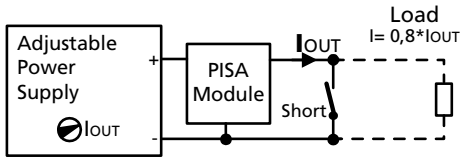
A further limitation of the output current activates when the supplying power source can not deliver enough current to support all loads without bringing the power source into overload followed by a voltage drop. In such an event, the voltage dependent current limitation of the input stage of the protection module is activated (safeguard circuit). This safeguard circuit acts like a valve only permitting so much current so that the supply voltage does not fall below 21V. The period of time for how long the protection circuit is able to actively limit the current depends on the difference between input and output voltage and the current which flows through the PISA protection module and is limited to a maximum of 5s. All four outputs will shutdown simultaneously.

Shutdown times for a short circuit condition across the outputs can be found in Fig. 6-2.

Fig. 6-2 **Active current limitation – Period of time in current limiting mode until the outputs will shutdown**



Test Setup



Test Procedure:

1. Set the output current of the adjustable power supply to the test current value.
2. Set load current to 80% of the test current and wait for a thermally stable condition.
3. Short circuit the output of the PISA module and measure the time until the outputs shutdown.

No single output channel is allowed to be overloaded

The output current is the sum of all outputs.

7. CONNECTING CAPACITIVE LOADS TO THE OUTPUTS

Large input capacitors of drives, monitors or other similar loads can result in an unintended shutdown of the module when trying to turn-on such loads. This especially can occur after a reset or by turning on a load via the push button or the external signal input. The PISA protection module is designed to be exceptionally compatible with such types of loads. The module can turn-on as much capacitance as possible and comprises several different protection mechanisms to protect against an unintended shutdown or damage of the unit.

The permissible capacitor sizes which can be connected to the output of the PISA module depends on the load current itself as well as on the characteristic of the load.

The following tables show two typical cases (case A and case B) for the permissible capacitors, which can be connected on the outputs without shutdown of the protection module. The listed values are valid for the entire temperature range.

Case A: All outputs are loaded.

The minimum values are worst-case figures for the permissible capacitors which are defined with an additional constant current load and with the maximum permissible total current of the PISA protection module. See also the parameter list below the table.

The typical values are defined with an additional resistive load. See also the parameter list below the table.

Permissible Capacitors		**PISA11.401** (4x1A)	**PISA11.402** (4x2A)	**PISA11.403** (4x3A)	**PISA11.404** (4x4A)
Per channel	typ.	48mF	94mF	69mF	57mF
	min.	41mF	43mF	22mF	11mF
All four outputs together	typ.	135mF	124mF	69mF	57mF
	min.	94mF	43mF	22mF	11mF

Permissible Capacitors		**PISA11.406** (4x6A)	**PISA11.410** (4x10A)	**PISA11.203206** (2x3A, 2x6A)	**PISA11.206212** (2x6A, 2x12A)
For channel 1 & 2	typ.	42mF	33mF	43mF	34mF
	min.	9mF	8mF	11mF	8mF
For channel 3 & 4	typ.	42mF	33mF	48mF	33mF
	min.	9mF	8mF	12mF	8mF
All four outputs together	typ.	42mF	33mF	48mF	33mF
	min.	9mF	8mF	12mF	8mF

	Parameters for typical values	**Parameters for minimum values**
PISA11.401	0.5A resistive load per output	1A constant current load per output
PISA11.402	1A resistive load per output	2A constant current load per output
PISA11.403	1.5A resistive load per output	3A constant current load per output
PISA11.404	2A resistive load per output	4A constant current load per output
PISA11.406	3A resistive load per output	5A constant current load per output
PISA11.410	5A resistive load per output	5A constant current load per output
PISA11.203206	1.5A resistive load for outputs 1 & 2 3A resistive load for outputs 3 & 4	3A constant current load for outputs 1 & 2 6A constant current load for outputs 3 & 4
PISA11.206212	3A resistive load for outputs 1 & 2 6A resistive load for outputs 3 & 4	5A constant current load for outputs 1 & 2 5A constant current load for outputs 3 & 4

Case B: Only one output is loaded

The minimum values for the permissible capacitors are defined with an additional constant current load according to the parameter list below. During the tests, only one output is loaded and all others are not.

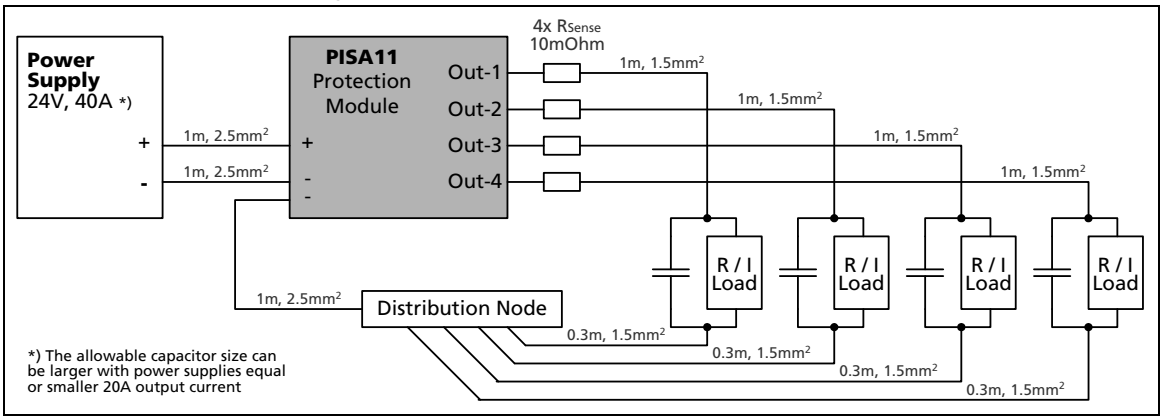
The typical values for the permissible capacitors are defined with an additional resistive load according to the parameter list below. During the tests, only one output is loaded and all others are not.

Permissible Capacitors		**PISA11.401** (4x1A)	**PISA11.402** (4x2A)	**PISA11.403** (4x3A)	**PISA11.404** (4x4A)
Per channel	typ.	49mF	92mF	80mF	71mF
	min.	41mF	73mF	49mF	45mF

Permissible Capacitors		**PISA11.406** (4x6A)	**PISA11.410** (4x10A)	**PISA11.203206** (2x3A, 2x6A)	**PISA11.206212** (2x6A, 2x12A)
For channel 1 & 2	typ.	58mF	44mF	56mF	59mF
	min.	38mF	24mF	38mF	36mF
For channel 3 & 4	typ.	58mF	44mF	50mF	42mF
	min.	38mF	24mF	31mF	20mF

	Parameters for typical values	**Parameters for minimum values**
PISA11.401	with additional 0.5A resistive load	with additional 1A constant current load
PISA11.402	with additional 1A resistive load	with additional 2A constant current load
PISA11.403	with additional 1.5A resistive load	with additional 3A constant current load
PISA11.404	with additional 2A resistive load	with additional 4A constant current load
PISA11.406	with additional 3A resistive load	with additional 6A constant current load
PISA11.410	with additional 5A resistive load	with additional 10A constant current load
PISA11.203206	3A: with additional 1.5A resistive load	with additional 3A constant current load
	6A: with additional 3A resistive load	with additional 6A constant current load
PISA11.206212	6A: with additional 3A resistive load	with additional 6A constant current load
	12A: with additional 6A resistive load	with additional 12A constant current load

Fig. 7-1 **Test setup for capacitive load measurements**



8. OUTPUT-OK RELAY CONTACT

This relay contact is closed when the input voltage is sufficient and the outputs are not shutdown.

Threshold voltage	typ.	21.4Vdc	Required voltage to power the relay and to close the relay contact. The outputs must also not be shutdown.
Contact ratings	max.	30Vdc, 1.0A	Resistive load
	max.	30Vac, 0.5A	Resistive load
	min.	1mA at 5Vdc	
Galvanic isolation	nom.	500Vac	Test voltage: Signal path to power path

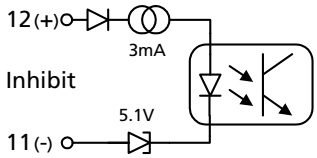
9. ON/OFF AND RESET SIGNAL INPUT

This signal input is galvanically isolated with an integrated optocoupler and works in the same manner as the reset and ON/OFF button. The ON/OFF function has no safety feature included.

In a failure mode (outputs have shutdown), the outputs can be turned on again by applying a voltage for more than 1 second.

In normal mode (outputs have not shutdown), a short (> 50ms) voltage pulse will turn all outputs ON or OFF.

The unit will be shipped (factory setting) with the outputs turned-on.

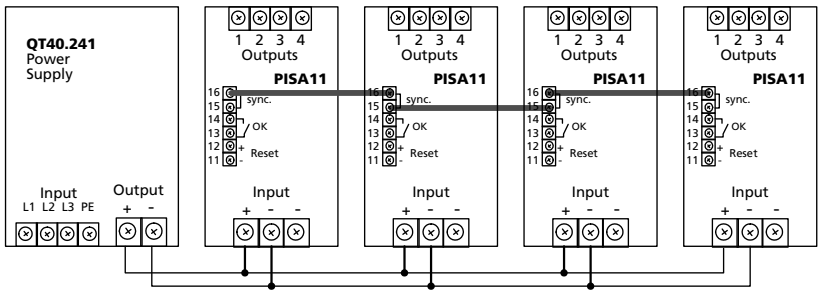


Signal voltage	max.	30Vdc	
Signal current	typ.	3mA	Active current limited
	max.	6mA	active current limited
Threshold voltage levels	min	6Vdc	Voltages above this level will trigger the inhibit or
	max.	10Vdc	reset.
Galvanic isolation	nom.	500Vac	Test voltage: signal path to power path

10. SYNCHRONIZATION OF MULTIPLE PISA MODULES

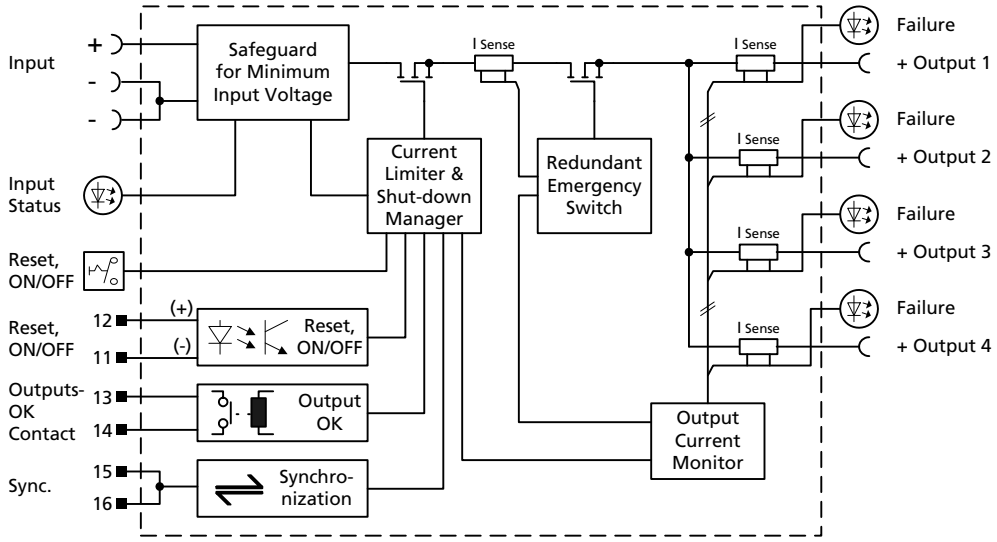
If multiple PISA modules are used on the same power supply, it is recommended to connect the sync. bus of all modules together. If one unit shuts down due to the protection function of the input voltage protection circuit (safeguard), all other modules will shutdown too. This avoids a false interpretation of which output channel caused the problem. If the sync. terminals are not linked, the module with the highest safeguard protection voltage level (caused by tolerances) would shutdown first regardless whether the failure was caused by this module or not.

Please note:
If the cause for the shutdown was an over-current of one individual channel only this module will shutdown and the other modules will stay on. In this case the sync. line has no impact on the other modules.



11. FUNCTIONAL DIAGRAM

Fig. 11-1 **Functional diagram**



12. BACK-FEEDING LOADS

Loads such as decelerating motors and inductors can feed voltage back to the PISA11 protection module. This feature is also called return voltage immunity or resistance against Back- E.M.F. (Electro Magnetic Force).

The protection module is resistant and does not show malfunctioning when a load feeds back voltage up to 30Vdc to the protection module. It does not matter whether the protection module is on or off.

The protection module has no capability to absorb energy. Internal diodes (integrated body diodes of the Mosfets) directs the voltage and energy to the power supply, which is connected on the input side of the protection module. The power supply defines the amount of energy which can be absorbed.

13. POWER LOSSES

		PISA11.401	PISA11.402	PISA11.403	PISA11.404
No-load losses	typ.	1.0W	1.0W	1.0W	1.0W
Losses at typical output loads*)	typ.	1.0W	1.3W	1.4W	1.8W

		PISA11.406	PISA11.410	PISA11.203206	PISA11.206212
No-load losses	typ.	1.0W	1.0W	1.0W	1.0W
Losses at typical output loads*)	typ.	2.4W	4.9W	1.9W	4.2W

*) Typical value when all output channels are loaded with 50% of its nominal current.

14. RELIABILITY

The PISA protection modules are extremely reliable and use only the highest quality materials. The number of critical components such as electrolytic capacitors have been reduced.

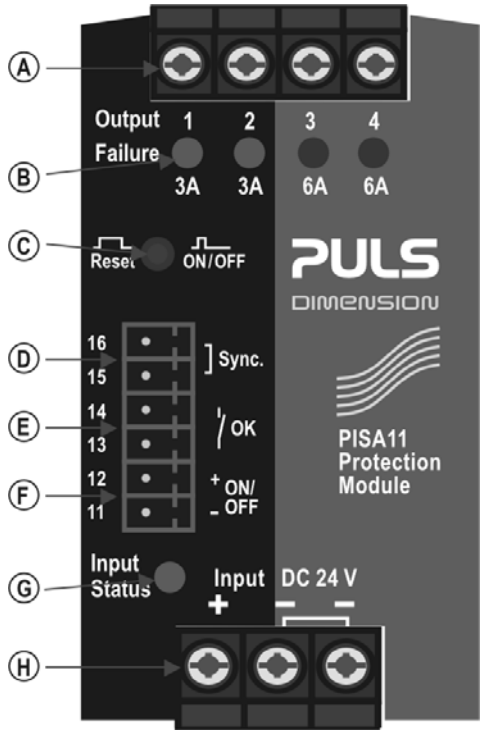
	PISA11.401	PISA11.402	PISA11.403	PISA11.404	
Applied load	4x0.5A	4x1A	4x1.5A	4x2A	
Lifetime expectancy *)	243 000h *)	233 000h *)	229 000h *)	216 000h *)	at 40°C
	686 000h *)	658 000h *)	649 000h *)	610 000h *)	at 25°C
MTBF **) SN 29500, IEC 61709	2 347 000h	2 323 000h	2 283 000h	2 114 000h	at 40°C
	4 039 000h	3 998 000h	3 930 000h	3 638 000h	at 25°C
MTBF **) MIL HDBK 217F, GB	790 000h	775 000h	762 000h	705 000h	at 40°C
	1 090 000h	1 066 000h	1 048 000h	970 000h	at 25°C

	PISA11.406	PISA11.410	PISA11.203206	PISA11.206212	
Applied load	4x3A	4x5A	2x1.5A + 2x3A	2x3A + 2x5A	
Lifetime expectancy *)	203 000h *)	155 000h *)	213 000h *)	171 000h *)	at 40°C
	573 000h *)	437 000h *)	604 000h *)	485 000h *)	at 25°C
MTBF **) SN 29500, IEC 61709	1 942 000h	1 296 000h	2 095 000h	1 373 000h	at 40°C
	3 377 000h	2 305 000h	3 605 000h	2 443 000h	at 25°C
MTBF **) MIL HDBK 217F, GB	583 000h	448 000h	699 000h	475 000h	at 40°C
	766 000h	589 000h	961 000h	624 000h	at 25°C

*) The Lifetime expectancy shown in the table indicates the minimum operating hours (service life) 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 life of up to 15 years (131 400h). Any number exceeding this value is a calculated theoretical lifetime which can be used to compare devices.

) **MTBF stands for **M**ean **T**ime **B**etween **F**ailure, 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 000h means that statistically one unit will fail every 100 hours if 10 000 units are installed in the field. However, it can not be determined if the failed unit has been running for 50 000h or only for 100h.

15. FRONT SIDE AND USER ELEMENTS



A **Output Terminals** (plus (+) pole connection points)

B **Red Failure LEDs**

The red LEDs are failure indicators. Any time a red LED is on or blinking, the outputs have been shutdown.

Three reasons why the outputs have been shutdown:

1) The output current of one or more individual output channels was too high. In this case, the affected output channel LED is blinking and all others are illuminated.
2) The sum of the output current of all four output channels was exceeded. In this case, all red LEDs are blinking.
3) The outputs needed to be shutdown in order to maintain sufficient input voltage. In this case, all red LEDs are on and the green LED (Input Status) is blinking.

The outputs can also be turned off by pushing the ON/OFF button on the front of the unit or by applying an external signal to the ON/OFF signal input. In this case, all red LEDs are on.

When LED 1 and 4 as well as the LEDs 2 and 3 are alternately blinking, an internal error has occurred. Try to reset the unit by pushing the reset button. If this does not help, ship the unit to the factory for inspection.

C **ON/OFF and Reset Button**

This is a pushbutton which can be used for two purposes:

1) In a failure mode (outputs have shutdown), the outputs can be turned on again by pushing and holding the reset button for more than 1 second.
2) In normal mode (outputs have not shutdown), a short (> 50ms) push will turn all outputs ON or OFF.

The unit will be shipped (factory setting) with the outputs turned-on. The ON/OFF function has no safety feature included.

D **Synchronization Bus** (connection by plug-connector on the front), See also chapter 10.

If multiple PISA modules are used on the same power supply, it is recommended to connect the sync. bus of all modules together. If one unit shuts down due to the protection function of the input voltage protection circuit, all other modules will shutdown too. This avoids a false interpretation of which output channel caused the problem. If the cause for the shutdown was an over-current of one individual channel only this module will shutdown and the other modules will stay on. In this case the sync. line has no impact on the other modules.

E **Output-OK Relay Contact** (connection by plug-connector on the front), See also chapter 8.

This relay contact is closed when the input voltage is sufficient and all outputs are not shutdown.

F **Inhibit / Reset Signal Input** (connection by plug-connector on the front), See also chapter 9.

This signal input is galvanically isolated with an integrated optocoupler and works in the same manner as the reset and ON/OFF button. The ON/OFF function has no safety feature included.

1) In a failure mode (outputs have shutdown), the outputs can be turned on again by applying a voltage for more than 1 second.
2) In normal mode (outputs have not shutdown), a short (> 50ms) voltage pulse will turn all outputs ON or OFF.

G **Green Input Status LED**

This LED indicates the status of the input. The green LED is illuminated if the input voltage is higher than 21Vdc. The green LED will blink when the input protection circuit (Safeguard) is activated in order to protect the supply voltage from dropping below 21V or when the outputs have already been shutdown due to a low input voltage.

H **Input Terminals**

Two minus (-) connection points for simpler load distribution or grounding (earthing) of the minus (-) pole.

Please note:

Outputs which have shutdown must be turned on manually by pushing the reset button or by an external reset signal (ON/OFF signal input). A cycling of the input power does not reset the unit. The failure signals are stored until a reset is intentionally initiated.

16. TERMINALS AND WIRING

All terminals are easy to access when mounted on the panel.

Input, outputs and signal terminals are separated from each other to help in error-free wiring.

	Input and Output	**Signals**
Type	screw terminals	plug connector
Solid wire	0.2-6mm²	0.2-1.5mm²
Stranded wire	0.2-4mm²	0.2-1.5mm²
AWG (American Wire Gauge)	24-10 AWG	24-16 AWG
Wire stripping length	7mm / 0.28inch	6mm / 0.24inch
Screwdriver	3.5mm slotted or Pozidrive No 2	2.5mm slotted
Recommended tightening torque	0.8Nm, 7lbs.in	0.35Nm, 3lbs.in

Instructions:

a) Use appropriate copper cables that are designed for minimum operating temperatures of:
   60°C for ambient up to 45°C and minimum
   75°C for ambient up to 60°C and minimum
   90°C for ambient up to 70°C.
b) Follow national installation codes and installation regulations!
c) Ensure that all strands of a stranded wire enter the terminal connection!
d) Screws of unused terminal compartments should be securely tightened.
e) Ferrules are allowed.

17. INPUT WIRE SIZES

A high voltage drop between the power supply and the protection module might cause a malfunction. It is not recommended to use wires longer than 2x2m (for 2.5mm² or AWG14 wires) or 2x4m (for 4mm² or AWG12 wires) to avoid undesired undervoltage conditions on the input of the protection module.

Use an appropriate wire size which matches to the ampacity of the power supply.

Do not use a wire size smaller than 2.5mm² (or AWG14), when the total output current is higher than 15A.

18. OUTPUT WIRE SIZES

One task of the PISA module is the distribution of the current from a large amperage power supply to four current monitored output channels. This permits wires with smaller cross-sections than would be needed for the ampacity of the power supply. Therefore, the PISA11 module is equipped with a redundant electronic current measurement and an additional emergency Mosfet to protect the wires. In case of an overload, all outputs will shutdown.

For the coordination between wire sizes and load currents, the relevant regulations must be observed. In most cases, these are VDE 0891, VDE 0100-523 and the IEC/EN 60204-1. This means that the following wire sizes shall be used in typical applications:

1A output:	≥0,14mm²	(approximately equals AWG26) – Please note that the minimum wire size for the terminal is 0.2mm² / AWG24.
2A output:	≥0,25mm²	(approximately equals AWG24)
3A output:	≥0,34mm²	(approximately equals AWG22)
4A output:	≥0,50mm²	(approximately equals AWG20)
6A output:	≥0,75mm²	(approximately equals AWG18)
10A output:	≥1,0mm²	(approximately equals AWG16)
12A output:	≥1,5mm²	(approximately equals AWG14)

19. EMC

This protection module is suitable for applications in industrial environment as well as in residential, commercial and light industry environment. A detailed EMC report is available on request.

EMC Immunity	Generic standards: EN 61000-6-1 and EN 61000-6-2				
			Outputs ON	Outputs OFF	
Electrostatic discharge	EN 61000-4-2	Contact discharge *) Air discharge	8kV 8kV	8kV 8kV	Criterion A Criterion A
Electromagnetic RF field	EN 61000-4-3	80MHz-2,7GHz	10V/m	10V/m	Criterion A
Fast transients (Burst)	EN 61000-4-4	Input lines output lines DC-OK, Inhibit	2kV 2kV 1kV	2kV 2kV 1kV	Criterion A Criterion A Criterion A
Surge voltage on input lines	EN 61000-4-5	+ → - +/- → DIN-Rail	500V 1kV	500V 1kV	Criterion A Criterion A
Surge voltage on output lines	EN 61000-4-5	+ → - +/- → DIN-Rail	500V 1kV	500V 1kV	Criterion A Criterion A
Surge voltage on signal lines	EN 61000-4-5	DC-OK → DIN-Rail	1kV	1kV	Criterion A
Conducted disturbance	EN 61000-4-6	0.15-80MHz	10V	10V	Criterion A

Criterion A: The PISA protection module shows normal operation behavior within the defined limits.
*)… on coupling plane

EMC Emissions	Generic standards: EN 61000-6-3, EN 61000-6-4	
Conducted emission input and output lines**)	IEC/ CISPR 16-1-2, IEC/ CISPR 16-2-1	limits for DC power ports according to EN 61000-6-3 fulfilled
Radiated emission	EN 55011, EN 55022	Class B

**) provided that the supplying power source fulfills these requirements too

20. ENVIRONMENT

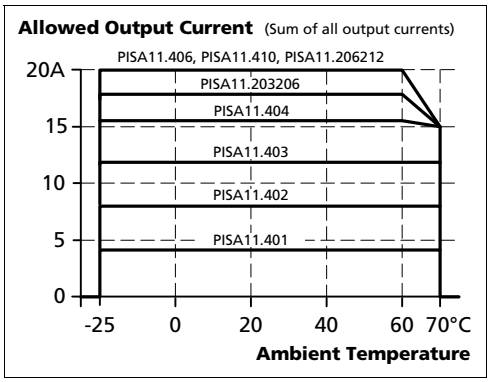
Operational temperature *)	-25°C to +70°C (-13°F to 158°F)	for PISA11.401, PISA11.402, PISA11.403 without de-rating
	-25°C to +60°C (-13°F to 140°F)	for PISA11.404, PISA11.406, PISA11.410, PISA11.203206, PISA11.206210 without de-rating
Output de-rating	+60°C to +70°C (140°F to 158°F)	De-rate linearly to 15A between 60°C and 70°C for PISA11.404, PISA11.406, PISA11.410, PISA11.203206, PISA11.206210, see also Fig. 20-1 De-rate the output current equally between the individual outputs.
Storage temperature	-40 to +85°C (-40°F to 185°F)	
Humidity **)	5 to 95% r.H.	IEC 60068-2-30
Vibration sinusoidal ***)	2-17.8Hz: ±1.6mm; 17.8-500Hz: 2g 2 hours / axis	IEC 60068-2-6
Shock ***)	30g 6ms, 20g 11ms 3 bumps / direction, 18 bumps in total	IEC 60068-2-27
Altitude	0 to 6000m (0 to 20 000ft)	
Over-voltage category	III	IEC 62103, EN 50178, altitudes up to 2000m
	II	for altitudes from 2000m to 6000m
Degree of pollution	2	IEC 62103, EN 50178, not conductive
LABS compatibility	The unit does not release any silicone or other LABS-critical substances and is suitable for use in paint shops.	

*) Operational temperature is the same as the ambient temperature and is defined as the air temperature 2cm below the unit.

**) Do not energize while condensation is present.

***) Tested in combination with DIN-Rails according to EN 60715 with a height of 15mm and a thickness of 1.3mm and standard mounting orientation.

Fig. 20-1 **Total module output current vs. ambient temperature**



21. PROTECTION FEATURES

Output over-current protection	Electronically limited	
Class of protection	III	IEC 61140
Degree of protection	IP 20	EN/IEC 60529
Penetration protection	> 2.5mm in diameter	E.g. screws, small parts
Over-temperature protection	Not included	
Reverse polarity protection; input voltage	Not included	Make sure that the input voltage polarity is correct before applying the input voltage.
Internal input fuse	Not included	

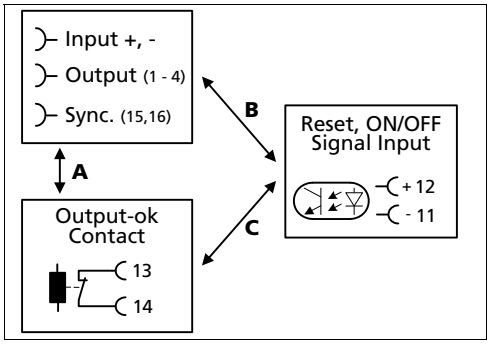
22. DIELECTRIC STRENGTH

The relay contact and the ON/OFF signal input are floating and have no ohmic connection to the input or output voltage. Type and factory tests are conducted by the manufacturer.

The creepage and clearance distances between relay contacts, the ON/OFF signal input and input/output voltage are 1.3mm.

The following dielectric strength tests were conducted:

Fig. 22-1 **Dielectric strength**



		A	B	C
Type test	60s	500Vac	500Vac	50Vac
Factory test	5s	500Vac	500Vac	-
Field test	5s	500Vac	500Vac	50Vac
Cut-off current setting		> 1mA	> 1mA	> 1mA

Type and factory 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 (2s up and 2s down). Connect all input and output terminals together as well as all signal poles before conducting the tests. When testing, set the cut-off current settings to the value in the table above.

23. APPROVALS

EC Declaration of Conformity	CE	The CE mark indicates conformance with the: - EMC directive 2004/108/EC, - Low-voltage directive (LVD) 2006/95/EC, - RoHS directive 2011/65/EU and the - ATEX directive 94/9/EC
IEC 60950-1 2nd Edition	IECEE CB SCHEME	CB Scheme, Safety of Information Technology Equipment
UL 508	c UL US LISTED IND. CONT. EQ.	Listed for the use as Industrial Control Equipment; U.S.A. (UL 508) and Canada (C22.2 No. 107-1-01); E-File: E198865
UL 60950-1 2nd Edition	c UL US	Recognized for the use as Information Technology Equipment, Level 5; U.S.A. (UL 60950-1) and Canada (C22.2 No. 60950); E-File: E137006
NEC Class 2, only PISA11.401, PISA11.402	NEC CLASS 2	Recognized as Limited Power Source (LPS) according to UL 60950-1. Also meet the requirements of NEC CLASS 2 according to UL1310.
UL 2367		Special-purpose Solid-State Overcurrent Protector Component Recognition; UL Category QVRQ2 E-File: E342020
ANSI / ISA 12.12.01-2007 (Class I Div 2)	C US	LISTED for use in Hazardous Location Class I Div 2 T4 Groups A,B,C,D systems; NRTL/C (Canada and U.S.)
EN 60079-15 ATEX	Ex II 3G EX nA nC IIC T4 Gc	Approval for use in hazardous locations Zone 2 Category 3G. Number of ATEX certificate: EPS 11 ATEX 1 327 X Evaluated according to EN 60079-0 and EN 60079-15
Marine	GL	GL (Germanischer Lloyd) classified Environmental category: C, EMC2 Marine and Offshore applications
GOST R		Certificate of Conformity for Russia and other GUS countries

24. READ-OUT OF THE SOFTWARE REVISION LEVEL

PISA utilizes a microcontroller with a dedicated firmware to control the whole unit. The revision level of the used firmware can be determined as follows:

Press and hold the reset button before applying the input voltage. The pattern of the four red LEDs shows the firmware revision level.

Revision level	LED 1	LED 2	LED 3	LED 4
A	OFF	OFF	OFF	ON
B	OFF	OFF	ON	OFF
C	OFF	OFF	ON	ON
D	OFF	ON	OFF	OFF
E	OFF	ON	OFF	ON
F	OFF	ON	ON	OFF
G	OFF	ON	ON	ON
H	ON	OFF	OFF	OFF
I	ON	OFF	OFF	ON
J	ON	OFF	ON	OFF
K	ON	OFF	ON	ON
L	ON	ON	OFF	OFF
M	ON	ON	OFF	ON
N	ON	ON	ON	OFF
O	ON	ON	ON	ON

25. PHYSICAL DIMENSIONS AND WEIGHT

Weight	120g / 0.26lb
DIN-Rail	Use 35mm DIN-rail according to EN 60715 or EN 50022 with a height of 7.5 or 15mm. The DIN-rail height must be added to the unit depth to calculate the total required installation depth.
Installation clearances	See chapter 3

Fig. 25-1 **Front view**

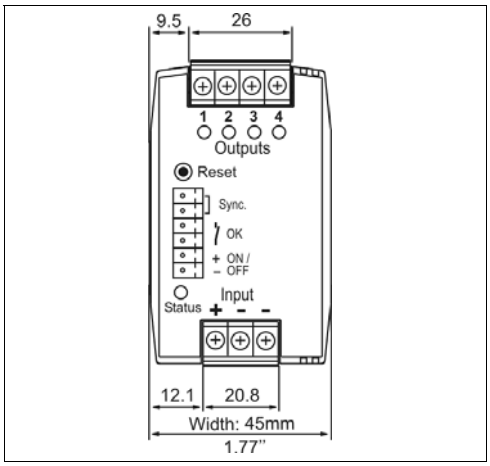
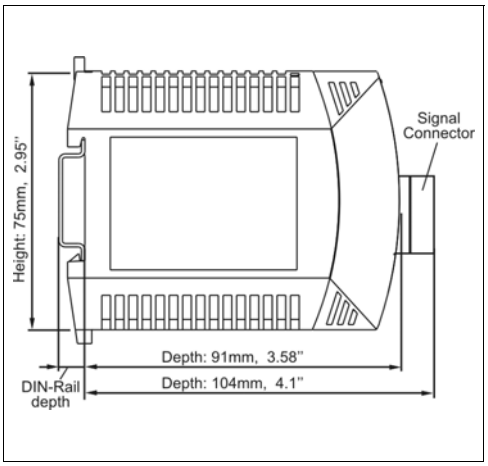


Fig. 25-2 **Side view**

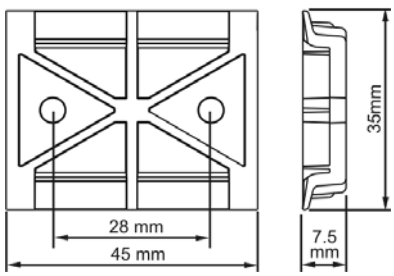


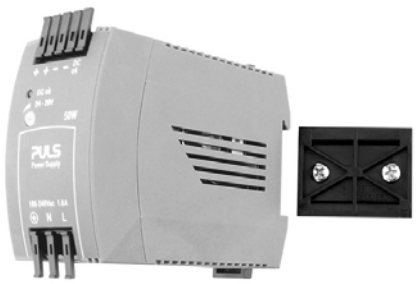
26. ACCESSORY

26.1. ZM3.WALL WALL MOUNTING BRACKET

(bulk-package with 25 pcs.)

DIN-Rail bracket for wall or panel mount:



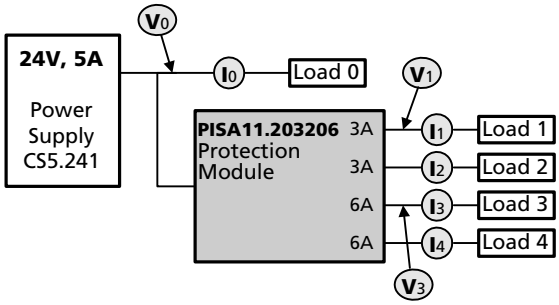


Note: The picture is for representation only.

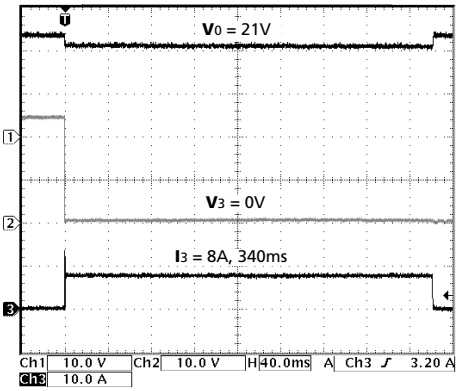
Hole diameter: 4.2mm

27. VARIOUS MEASUREMENT RESULTS

Test setup for the following measurements:



a) Short-circuit across a 6A output of a PISA11.203206 protection module

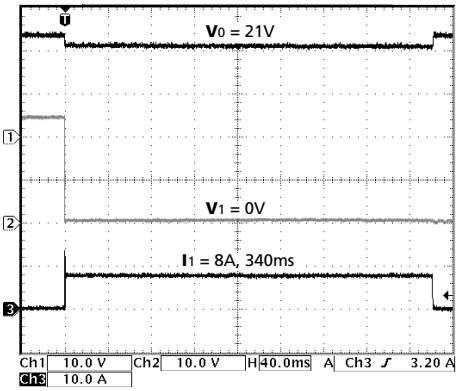


Parameters:
Power supply: 5A (CS5.241)
I0 = 0A
I3 = Short-circuit
I1, I2, I4 = 0A

8A is flowing, which is the current level that can be drawn from the CS5.241 power supply without the supply voltage falling below 21V. The electronic circuit in the PISA protection module can actively limit this current for 340ms. After this time period, the outputs shutdown in order to protect the MOSFET in the PISA module.

Refer also to Fig. 6-2 of this datasheet.

b) Short-circuit across a 3A output of a PISA11.203206 protection module



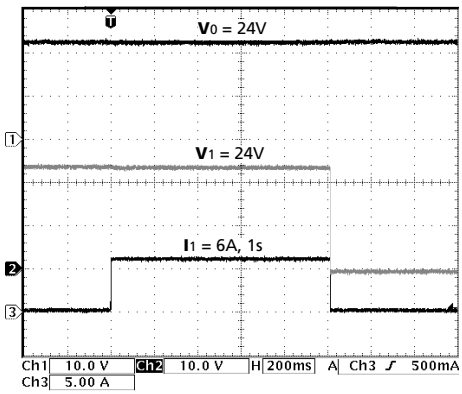
Parameters:
Power supply: 5A (CS5.241)
I0 = 0A
I1 = Short circuit
I2, I3, I4 = 0A

Similar situation as above (short circuit across the 6A output).

The same 8A is flowing, which is the current level that can be drawn from the CS5.241 power supply without the supply voltage falling below 21V. The electronic circuit in the PISA protection module can actively limit this current for 340ms. After this time period, the outputs shutdown in order to protect the MOSFET in the PISA module.

Refer also to Fig. 6-2 of this datasheet.

c) 6A Overload (4 Ohm resistive load) **of the 3A output of a PISA11.203206 protection module**

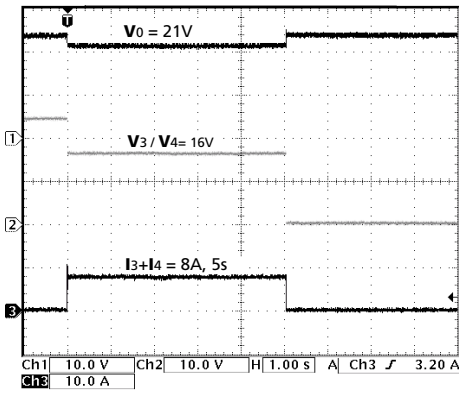


Parameters:
Power supply: 5A (CS5.241)
I0= 0A
I1 = 6A (4Ohm)
I2, I3, I4 = 0A

6A is flowing on output 1, which can be drawn from the CS5.241 power supply with full output voltage. The electronic circuit in the PISA protection module allows this current for 1s. After this time period, the outputs shutdown in order to protect wires and loads.

Refer also to Fig. 6-1 of this datasheet.

d) Both 6A outputs of a PISA11.203206 module loaded with 6A (4 Ohm resistive load)

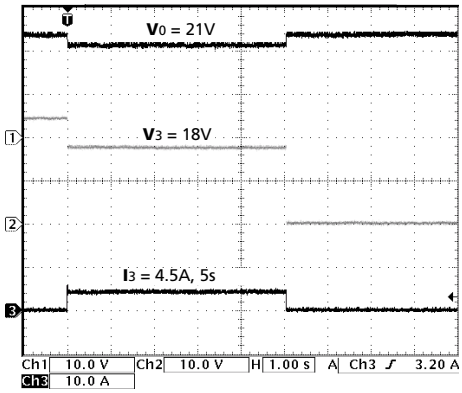


Parameters:
Power supply: 5A (CS5.241)
I0, I1, I2 = 0A
I3, I4 = 6A (4Ohm)

The power supply can not deliver the required current and switches into current limiting mode. The PISA module only permits so much current on the outputs so that the input voltage does not drop below 21V. With these conditions, there is only 16V (8A * 2Ohms) on the outputs of the protection module.

The electronic circuit in the PISA protection module actively limits this current for 5s (fixed time setting) before the outputs shutdown. Please note that the time can be shorter if the internal MOSFET needs to be protected.

e) The power supply is directly loaded with 4A (6 Ohm resistive load) **and one 6A output of a PISA11.203206 module is loaded with 6A** (4 Ohm resistive load)



Parameters:
Power supply: 5A (CS5.241)
I0 = 4A (6 Ohm)
I3 = 6A (4 Ohm)
I1, I2, I4 = 0A

The power supply can not deliver the required current and switches into current limiting mode. The PISA module only permits so much current on the outputs so that the input voltage does not drop below 21V. With these conditions, there is only 18V on the outputs of the protection module.

The electronic circuit in the PISA protection module limits this current actively and shutdown after 5s.

Refer also to Fig. 6-2 of this datasheet.

UC10.241, UC10.242

24V, 15A, CAPACITOR-BASED DC-UPS

CAPACITOR-BASED DC-UPSS

- Built-in Capacitors as Energy Source (EDLC Electrochemical Double Layer Capacitors)
- Wide Temperature Range from -40°C to +60°C
- Typically >10 Years Operational Lifetime Expectancy
- Regulated Output Voltage in Buffer Mode
- No Ventilated Cabinets Required (No Generation of Hydrogen as VRLA batteries do)
- Active Balancing for Longest Life and Buffer Times
- Short Charging Time, Unit is Rapidly Back in Ready Mode
- Output is Decoupled from the Input to Separate Load Circuits into Buffered and Non-buffered Sections
- Supports PC-Mode Function
- 3 Year Warranty

GENERAL DESCRIPTION

The DIMENSION UC-Series are DC-UPSs utilizing Electrochemical Double Layer Capacitors (EDLC), commonly known as Ultracapacitors or Supercapacitors, which are installed inside the DC-UPS. They can bridge power failures or voltage fluctuations and supply voltage to the DC 24V bus for a certain period, which allows for a safe shut-down of the system. Expensive downtimes, long restart cycles and loss of data can be avoided.

In times when the power supply provides sufficient voltages, the DC-UPS stores energy in the capacitors. In case of a mains voltage fault, this energy is released to the DC bus in a regulated process.

The DC-UPSs are maintenance-free and have a similar lifetime expectancy as power supplies. No regular replacement of the capacitors is necessary as is required for battery based DC-UPS systems. The wide temperature range from -40°C to +60°C makes the unit suitable for many applications.

The DC-UPSs come in two versions which differ in the size of the installed capacitors.

SHORT-FORM DATA

Nominal voltage	DC 24V	
Output current	15A	continuous
Buffer voltage	22.0 - 22.65V	fixed, 15A – 0A
Input current	typ. 1.1A	during charging, output current not included
Capacitor size	6kWs 12kWs	UC10.241 UC10.242
Charging time	16 minutes 32 minutes	UC10.241 UC10.242
Buffer time	16.5s at 10A 33s at 10A	UC10.241 UC10.242
Power losses	4.6W	in normal mode at 10A output current
Temperature range	-40°C to +60°C	operational
Dimensions W x H x D	126x124x117mm 198x124x117mm	UC10.241 UC10.242
Weight	1150g / 2.54lb 1720g / 3.79lb	UC10.241 UC10.242

ORDER NUMBERS

DC-UPS	**UC10.241**	6kWs energy storage
	UC10.242	12kWs energy storage
Accessory	ZM2.WALL	Panel/ wall-mount bracket

MARKINGS

c UL US LISTED IND. CONT. EQ.
UL 508

c US
UL 60950-1

CE
EMC, RoHS

IECEx Ex ATEX
II 3G Ex nA nC II T4 Gc

c SP US
Class I Div 2

May 2016 / Rev. 2.2 DS-UC10.241-EN
All parameters are specified at 24V, 10A output current, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.

INDEX

TERMINOLOGY AND ABREVIATIONS

Normal mode	Describes a condition where the capacitor is charged, the input voltage is in range and the output is loaded within the allowed limits.
Buffer mode	Describes a condition where the input voltage is below the transfer threshold level, the unit is running on capacitor (buffering) and the output is loaded within the allowed limits.
Charging mode	Describes a condition where the capacitor is being charged, the input voltage is in range and the output is loaded within the allowed limits.
Inhibit mode	Describes a condition where buffering is disabled on purpose (e.g. for service actions)
T.b.d.	To be defined, value or description will follow later.
AC 24V	A figure displayed with the AC or DC before the value represents a nominal voltage with standard tolerances included. E.g.: DC 12V describes a 12V battery disregarding whether it is full (13.7V) or flat (10V)
24Vac	A figure with the unit (Vac) at the end is a momentary figure without any additional tolerances included.
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.

1. Intended Use

This device is designed for installation in an enclosure. Use an appropriate enclosure which protects against mechanical, electrical and fire hazards.

This device is intended for professional use in areas such as in industrial control, office, communication, and instrumentation equipment.

Do not use this device in equipment or systems where malfunction may cause severe personal injury or threaten human life.

2. Installation Notes

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

The input must be powered from a SELV or PELV power source.

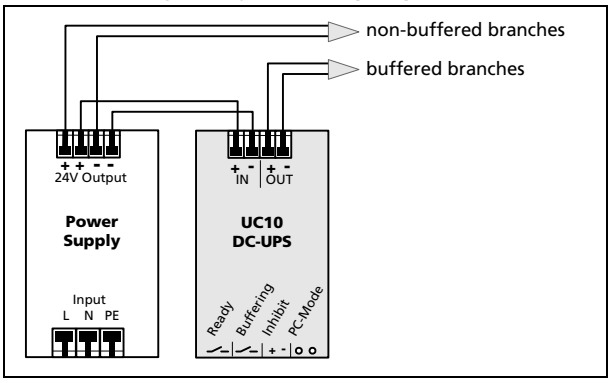
This device does not contain serviceable parts. The tripping of an internal fuse is caused by an internal defect. If damage or malfunction should occur during installation or operation, immediately turn power off and send unit to the factory for inspection.

Mount the unit on a DIN-rail so that the power terminals are located on the top of the unit.

This device is designed for convection cooling and does not require an external fan. Do not obstruct airflow and do not cover ventilation grid (e.g. cable conduits) by more than 15%!

Keep the following installation clearances: 40mm on top, 20mm on the bottom, 5mm on the left and right sides are recommended when the device is loaded permanently with more than 50% of the rated power. Increase this clearance to 15mm in case the adjacent device is a heat source (e.g. a power supply).

Fig. 2-1 **Typical wiring diagram**



The EDLC (storage capacitors) contain Acetonitrile and Tetraethylammonium-tetrafluoroborate. These components are declared as non-dangerous goods in regards to shipment. A safety datasheet can be provided when required.

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

- Turn power off before working on the device. Protect against inadvertent re-powering.
- Make sure that the wiring is correct by following all local and national codes.
- Do not modify or repair the unit.
- Do not open the unit as hazardous energy may be present inside.
  Info for service personnel: Before opening the unit, wait at least 45 minutes after disconnecting the unit from input power so that the remaining capacitor charge has completely been discharged.
- 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.

Notes for use in hazardous location areas:

The DC-UPS is suitable for use in Class I Division 2 Groups A, B, C, D locations and for use in Group II Category 3 (Zone 2) environments and are evaluated according to EN 60079-0 and EN 60079-15.

WARNING EXPLOSION HAZARDS!

Substitution of components may impair suitability for this environment. Do not disconnect the unit or change unit settings unless power has been switched off or the area is known to be non-hazardous.

A suitable enclosure must be provided for the end product which has a minimum protection of IP54 and fulfils the requirements of the EN 60079-15.

3. INPUT

Input voltage	nom.	DC 24V $^{-20\%/+25\%}$	
Input voltage ranges	typ. max.	22.5 to 30Vdc 30 to 35Vdc	continuous operation temporarily allowed, no damage to the unit Between 30 and 35Vdc buffering is not possible, the unit indicates "Check Input Voltage" with the red LED on the front
Transfer threshold voltage	 typ. typ. max.	22.45V $^{\pm 1\%}$ 22.55V 22.60V 22.88V	at no load at 10A buffer current at 15A buffer current at 15A buffer current The transfer threshold voltage describes the input voltage, where the unit switches into buffer mode and delivers output voltage from the capacitors if the input was above the turn-on level before and all other buffer conditions are fulfilled.
Turn-on voltage	typ. max.	22.8Vdc 23.0V	The output does not switch on if the input voltage is below this level.
Allowed voltage between input and earth (chassis)	max.	60Vdc or 42.4Vac	continuous, IEC 62103
Current consumption	typ. typ. max.	0.09A 1.1A 1.3A	capacitors charged, output current not included during charging, output current not included
Input current	max.	17A	during charging an full output current
Return current	typ. max.	-9mA -11mA	Leakage current to input in buffer mode
Suitable power sources on input		no limitation in the maximum power supply current	

Fig. 3-1 **Input voltage range**

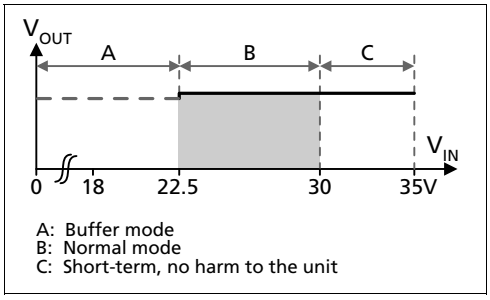
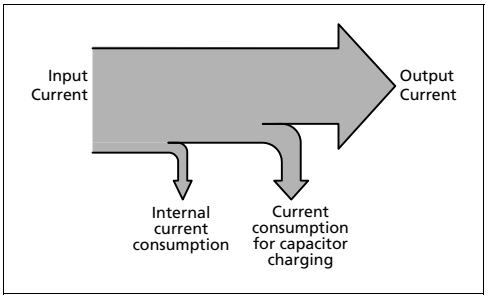


Fig. 3-2 **Current budget**



4. OUTPUT

The output section of the DC-UPS is fully controlled and is equipped with an electronic current limitation. A current overloading of the DC-UPS cannot happen, independent of which sizes of power supplies are used on the input of the DC-UPS.

The current limitation works in a switching mode which reduces the power losses and heat generation to a minimum.

Output in normal mode:

In normal mode (and also in charging mode), the output voltage is slightly lower as the input voltage. The output voltage follows the input voltage reduced by the input to output voltage drop.

Input to output voltage drop	max.	0.3V 0.45V	at 10A output current at 15A output current, see Fig. 4-1
Ripple & noise voltage	max.	30mVpp	at 20Hz to 20MHz, 50Ohm measurement. This figure indicates the ripple & noise voltage which is produced by the DC-UPS. It can be higher if the supplying source has a higher ripple and noise voltage.
Output current	nom.	15A	continuously allowed for the entire voltage range
Output power	nom.	360W	at 24V
Overload behavior		continuous current	see Fig. 4-2
Current limitation	typ. min.	16A 15A	see Fig. 4-2
Short-circuit current	min.	17.9A	load impedance 100mOhm, see Fig. 4-2
	max.	21.0A	load impedance 100mOhm, see Fig. 4-2
Output capacitance	typ.	1 500µF	included inside the DC-UPS
Capacitive and inductive loads		No limitation	

Output in buffer mode:

The output voltage is fully regulated in buffer mode.

The unit switches into buffer mode, when the input voltage falls below the transfer threshold input voltage level, The buffer voltage is slightly lower than this threshold input voltage. The unit switches back to normal mode, as soon as the input voltage exceeds the transfer threshold voltage, which is specified in the input section.

Output voltage	typ.	22.45V ±1% 22.25V ±1% 22.12V ±1%	at no load at 10A buffer current at 15A buffer current
Ripple & noise voltage	max.	30mVpp	at 20Hz to 20MHz, 50Ohm measurement
Output current	nom.	15A	continuously allowed
Output power	nom.	360W	at 24V
Overload behavior		continuous current	see Fig. 4-2
Current limitation	typ. min.	16A 15A	see Fig. 4-2
Short-circuit current	min.	17.9A	load impedance 70mOhm, see Fig. 4-2
	max.	21.0A	load impedance 50mOhm, see Fig. 4-2
Capacitive and inductive loads		No limitation	

Fig. 4-1 **Input to output voltage drop in normal mode, typ.**

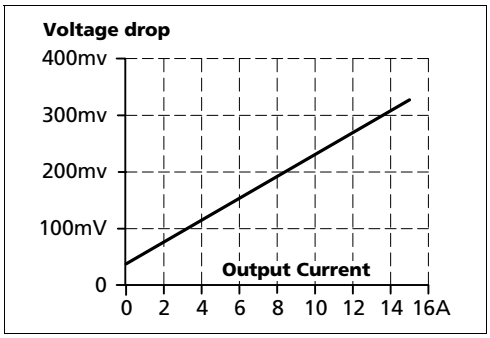


Fig. 4-2 **Output characteristic and overload behavior in normal and buffer mode, typ.**

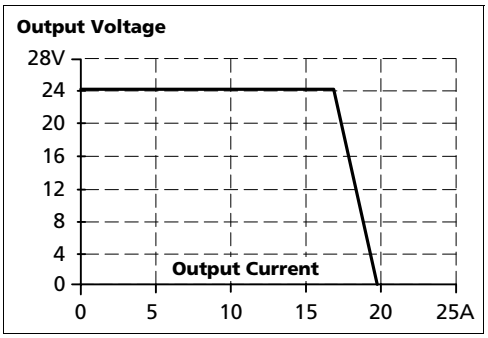


Fig. 4-3 **Transition from buffer mode to normal mode and vice versa, definitions**

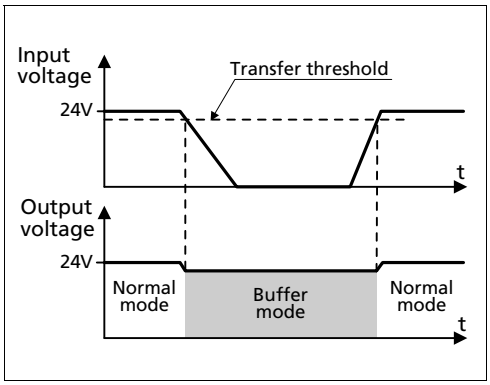
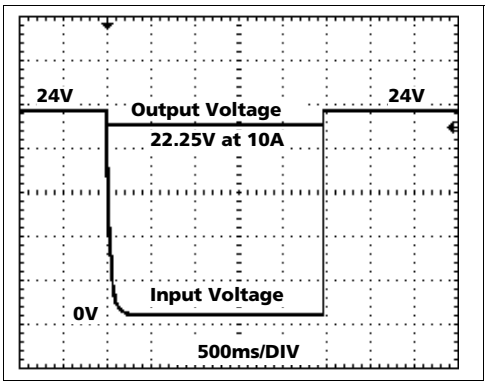


Fig. 4-4 **Transfer behavior, typ.**



5. CHARGING

During charging, the DC-UPS consumes additional current from the input. See chapter "Input".
When charging is completed, the "Ready LED" stops flashing and is on solid and the "Ready relay contact" closes.

		UC10.241	UC10.242	
Charging time initial charging*)	typ.	16 minutes	32 minutes	when capacitor is completely discharged
Charging time recharging**)	typ.	1 minute 50s	1 minute 50s	after discharging with 10A for 10s
	typ.	3 minutes 50s	7 minutes 40s	after discharging with 10A until buffering stops
	typ.	4 minutes 40s	9 minutes 40s	after discharging with 5A until buffering stops
	typ.	5 minutes 40s	11 minutes 15s	after discharging with 1A until buffering stops
Allowed number of charging/ discharging cycles		no limitation	no limitation	

*) Initial charging means that no input voltage was applied for several hours or longer and the capacitor is completely discharged by the internal electronics.

**) Recharging means that the electronics inside the DC-UPS has not completely discharged the capacitor. The values in the table apply when the input voltage is applied immediately after buffering has stopped.

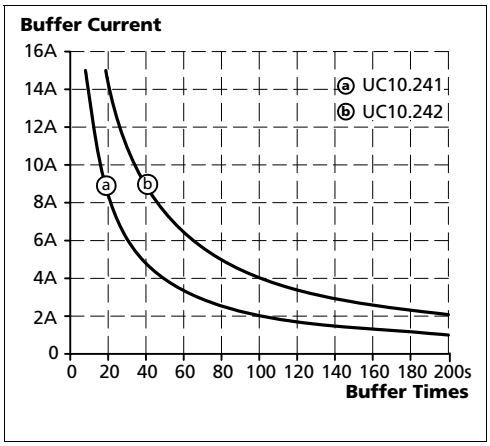
Note:
At the end of the charging process the active balancing circuit reduces the charging current periodically, which can be seen as current oscillations on the input current.

6. BUFFER TIME

The following times are typical values for a new product and the aging effect during operation is not included. More information about the reduction of the buffer time over the life of the product can be found in the chapter 11 "Lifetime Expectancy and MTBF".

		UC10.241	UC10.242	
Buffer Time	typ.	1650s	3300s	at 0A buffer current
	typ.	340s	680s	at 0.5A buffer current
	typ.	200s	400s	at 1A buffer current
	typ.	68s	136s	at 3A buffer current
	typ.	39s	78s	at 5A buffer current
	typ.	26s	53s	at 7A buffer current
	typ.	16.5s	33s	at 10A buffer current
	typ.	9s	18s	at 15A buffer current

Fig. 6-1 **Buffer time vs. buffer current, typ.**



7. Ready and Buffering Relay Contact

The DC-UPSs are equipped with two independent relay contacts for remote monitoring and controlling of the unit.

Ready contact

Contact is closed when capacitor is completely charged, input voltage is sufficient and inhibit signal is not active.

Contact ratings	max.	60Vdc 0.3A, 30Vdc 1A, 30Vac 0.5A	resistive load
	min.	1mA at 5Vdc	min. permissible load
Isolation voltage	500Vac, signal port to power port		

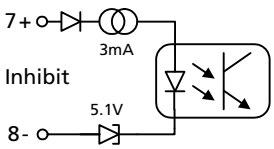
Buffering contact

Contact is closed when unit is buffering.

Contact ratings	max.	60Vdc 0.3A, 30Vdc 1A, 30Vac 0.5A	resistive load
	min.	1mA at 5Vdc	min. permissible load
Isolation voltage	500Vac, signal port to power port		

8. Inhibit Input

The inhibit input disables buffering. In normal mode, a static signal is required. In buffer mode, a pulse with a minimum length of 250ms is required to stop buffering. The inhibit is stored and can be reset by cycling the input voltage. See also section 23.7 for application notes.



Signal voltage	max.	35Vdc
Signal current	max.	6mA, current limited
Inhibit threshold	min.	6Vdc, buffering is disabled above this threshold level
	max.	10Vdc
Isolation voltage	500Vac, signal port to power port	

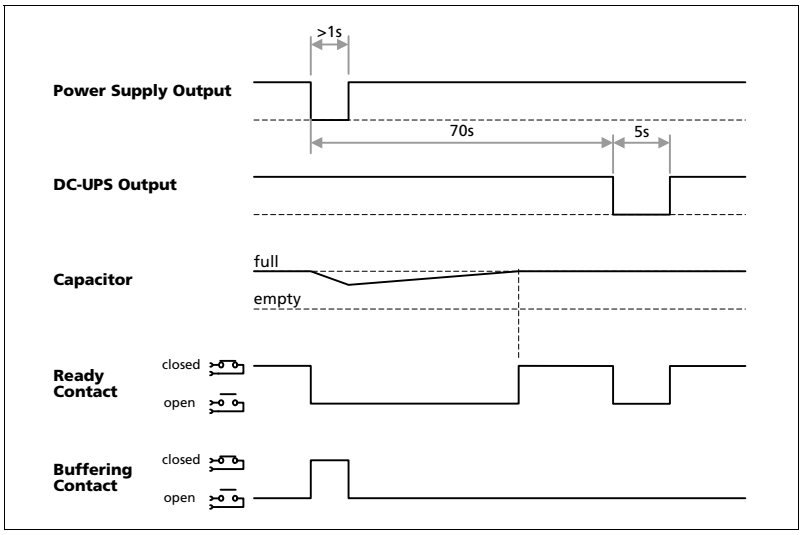
9. PC-MODE

The PC-mode always turns the output off for at least 5s after a buffer event lasting longer than 1s, independent of whether the 24V may have recovered during this time. This function ensures that the PC gets a restart signal. To enable a safe shut-down of the system, the forced turn off of the output is delayed with a constant time of 70s.

To activate the PC-mode, connect the two pins marked with "PC-mode" together on the signal connector together.

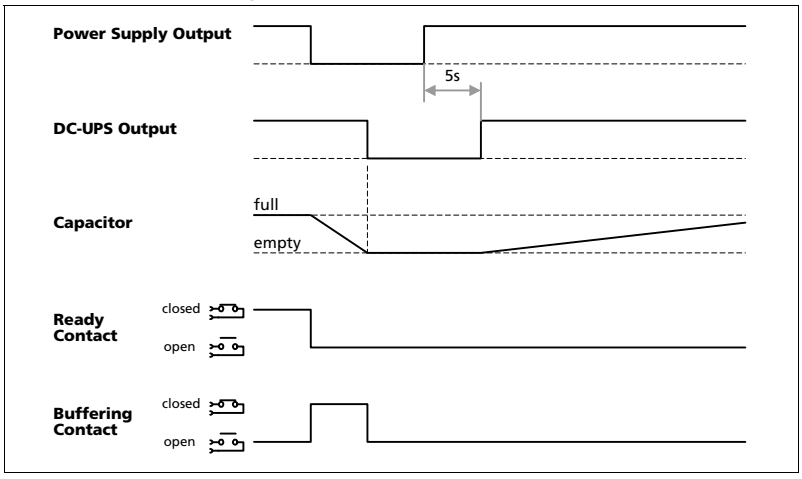
If the reset is to be controlled by the PC and not the DC-UPS, a wiring option called "external controlled delayed shut-down" is available. See section 23.8 for details.

Fig. 9-1 **PC-Mode - Buffer event ends before buffer capacitors are discharged and buffer event is shorter than 70s**



Example A:
The buffer event is longer than 1s and ends before the buffer capacitors are fully discharged.
After 70s of the beginning of the buffer event, the output of the DC-UPS will be switched off for 5s.

Fig. 9-2 **PC-Mode - Buffer event discharges the buffer capacitors before the input recovers**



Example B:
The buffer event lasts longer than the buffer capacitors can supply the output.
The buffer capacitors are fully discharged before the input voltage recovers.
The DC-UPS output will turn-on earliest 5s after the power supply output voltage has recovered.

10. Efficiency and Power Losses

Efficiency	typ.	97.8%	Normal mode, 10A output current, capacitor fully charged
	typ.	97.8%	Normal mode, 15A output current, capacitor fully charged
Power losses	typ.	2.9W	Normal mode, 0A output current, capacitor fully charged
	typ.	4.6W	Normal mode, 10A output current, capacitor fully charged
	typ.	7.7W	Normal mode, 15A output current, capacitor fully charged
	typ.	5.0W	During charging, 0A output current

Fig. 10-1 **Efficiency vs. output current in normal mode, typ.**

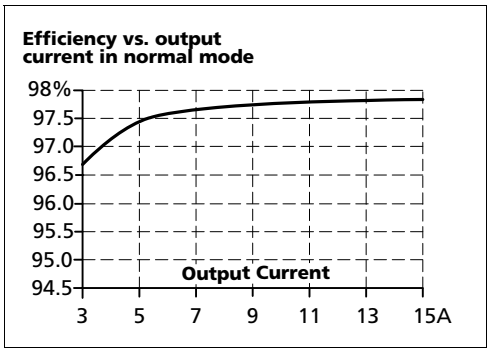
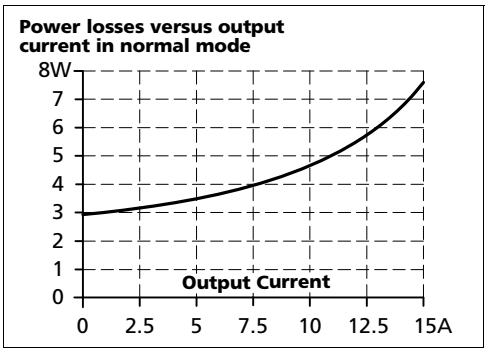


Fig. 10-2 **Power losses vs. output current in normal mode, typ.**



11. LIFETIME EXPECTANCY AND MTBF

The lifetime expectancy of the DC-UPS is predominantly affected by the storage capacitors. The biggest influence in lifetime is a combination of operating voltage and operating temperature of these capacitors. To gain longest lifetimes, PULS does not utilize the full allowed working voltage for these capacitors and therefore accepts a slightly shorter buffer time.

The EDLC's do not experience a true end-of-life, rather the capacitance continually degrades over the life of the DC-UPS. The typical degradation behavior resembles that of an exponential decay in the first couple of 1000 hours followed by a linear degradation. The majority of the capacitance reduction occurs during the initial use of the DC-UPS and this change in performance then levels off over time. When working with the specified lifetime numbers, the remaining capacity must always be taken into account. The buffer time correlates linearly to the capacity.

The ultracapacitors have an almost unlimited shelf life (unlike batteries) when stored uncharged at 25°C.

The number of charge/ discharge cycles does not have an impact on the lifetime as long as the number of cycles does not exceed 100 000. This should not be the case for a typical backup operation.

Lifetime	**UC10.241**		**UC10.242**		
Remaining capacity	**85%**	**75%**	**85%**	**75%**	
Lifetime expectancy *)	186 000h	324 000h	186 000h	324 000h	at 24V, 10A, 25°C
	155 000h	270 000h	155 000h	270 000h	at 24V, 15A, 25°C
	66 000h	115 000h	66 000h	115 000h	at 24V, 10A, 40°C
	55 000h	96 000h	55 000h	96 000h	at 24V, 15A, 40°C
	23 000h	40 000h	23 000h	40 000h	at 24V, 10A, 55°C
	19 000h	34 000h	19 000h	34 000h	at 24V, 15A, 55°C

MTBF	**UC10.241**	**UC10.242**	
MTBF **) SN 29500, IEC 61709	1 519 000h	1 515 000h	at 24V, 10A, 25°C
	1 443 000h	1 439 000h	at 24V, 15A, 25°C
	899 000h	895 000h	at 24V, 10A, 40°C
	854 000h	850 000h	at 24V, 15A, 40°C
MTBF **) MIL HDBK 217F	525 000h	524 000h	at 24V, 10A, 25°C; Ground Benign GB25
	498 000h	497 000h	at 24V, 15A, 25°C; Ground Benign GB25
	385 000h	384 000h	at 24V, 10A, 40°C; Ground Benign GB40
	365 000h	364 000h	at 24V, 15A, 40°C; Ground Benign GB40
	125 000h	125 000h	at 24V, 10A, 25°C; Ground Fixed GF25
	118 000h	118 000h	at 24V, 15A, 25°C; Ground Fixed GF25
	95 000h	95 000h	at 24V, 10A, 40°C; Ground Fixed GF40
	90 000h	90 000h	at 24V, 10A, 40°C; Ground Fixed GF40

*) The **Lifetime expectancy** shown in the table indicates the minimum operating hours (service life) and is determined by the lifetime expectancy of the built-in electrolytic capacitors and storage capacitors (ultracapacitors). Lifetime expectancy is specified in operational hours and is calculated according to the capacitor's manufacturer specification.

) **MTBF stands for **M**ean **T**ime **B**etween **F**ailure, 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 000h means that statistically one unit will fail every 100 hours if 10 000 units are installed in the field. However, it can not be determined if the failed unit has been running for 50 000h or only for 100h.

Fig. 11-1 Lifetime expectancy vs. ambient temp. at 10A output current

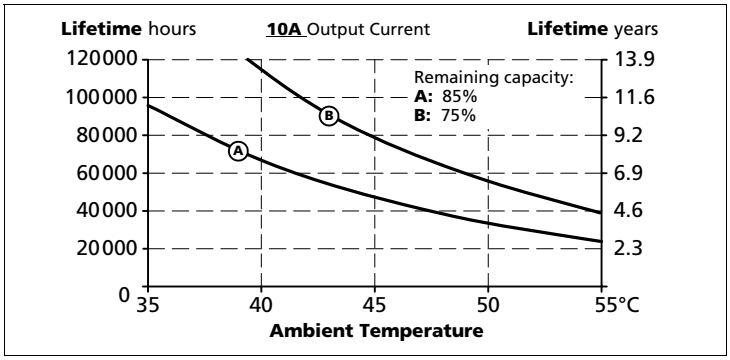
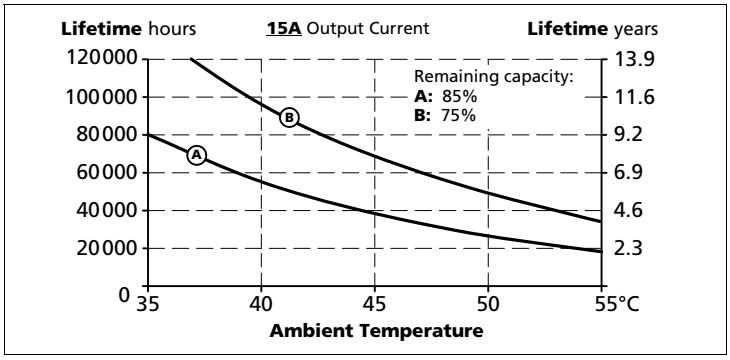
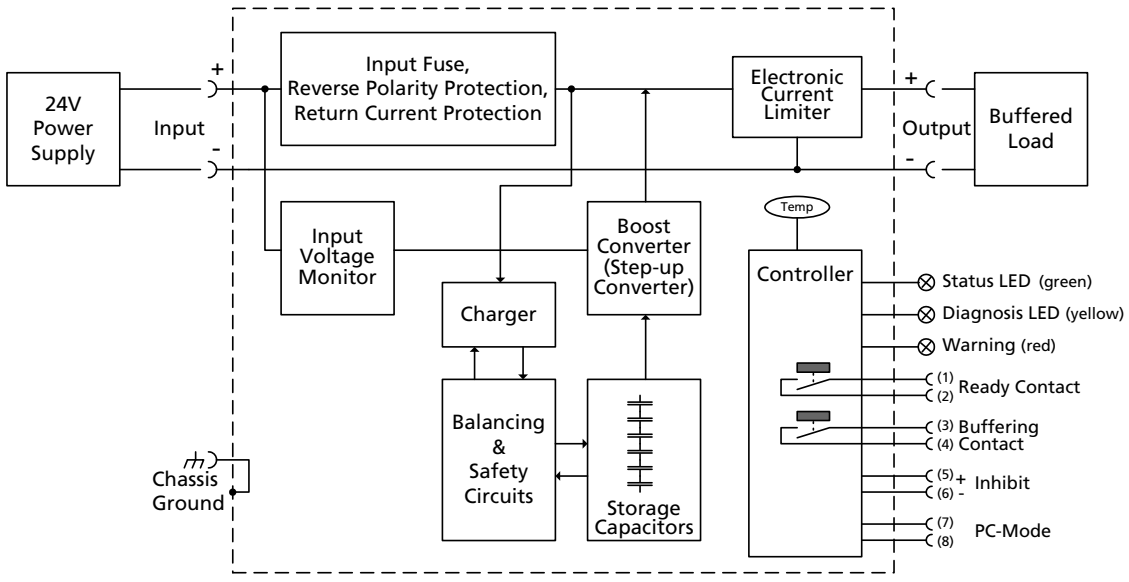


Fig. 11-2 Lifetime expectancy vs. ambient temp. at 15A output current



12. FUNCTIONAL DIAGRAM

Fig. 12-1 **Functional diagram**



13. TERMINALS AND WIRING

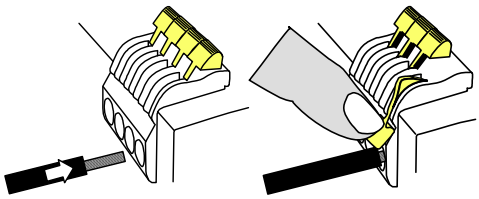
The terminals are IP20 finger safe constructed and suitable for field and factory wiring.

	Input and output	**Signals**
Type	bi-stable quick-connect spring-clamp terminals	pluggable spring-clap terminals
Solid wire	max. 6mm²	max. 1.5mm²
Stranded wire	max. 4mm²	max. 1.5mm²
American Wire Gauge	AWG 20-10	AWG 24-14
Max. wire diameter	2.8mm (including ferrules)	1.5mm (including ferrules)
Wire stripping length	10mm / 0.4inch	8mm / 0.3inch
Screwdriver	-	2.5mm slotted

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 and
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) Unused terminal compartments should be securely tightened or closed.
e) Ferrules are allowed.

Fig. 13-1 **Connecting a wire**

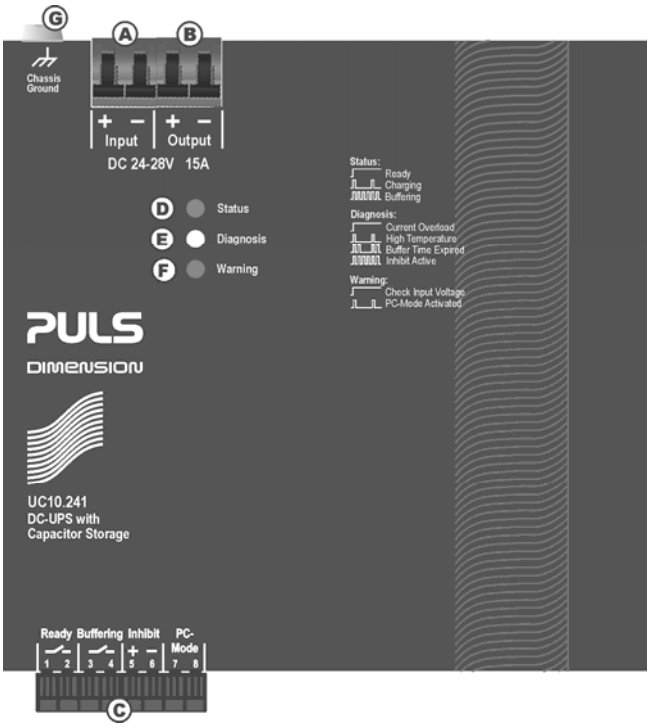


1. Insert the wire **2.** Close the lever

To disconnect wire:
reverse the procedure

14. Front Side and User Elements

Fig. 14-1 **Front side** (UC10.241)



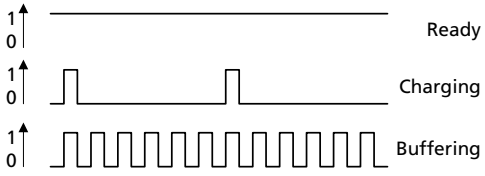
A **Input Terminals** (quick-connect spring-clamp terminal)

B **Output Terminals** (quick-connect spring-clamp terminal)
The minus-pole has the same reference as the minus-pole of the input terminals

C **Signal Connector** (plug connector)
- Ready: contact is closed when status LED indicates ready
- Buffering: contact is closed during buffering
- Inhibit: a voltage applied on this input signal disables buffering (e.g. during service)
- PC-Mode: To activate the PC-mode connect the two pins of the signal connector together; see also section 9.

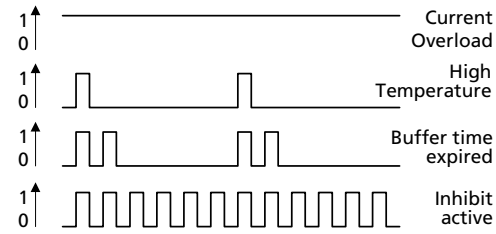
D **Status LED** (green)
- Ready: capacitors are fully charged, no failures detected
- Charging: capacitors are being charged
- Buffering: capacitors are being discharged

Flashing pattern for the green status LED:



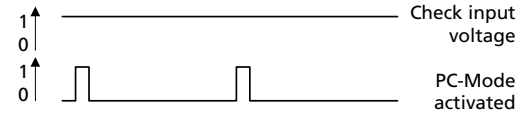
E **Diagnosis LED** (yellow)
Helps troubleshooting and indicates the following:
- Current Overload: output voltage below 20Vdc due to a too high output current, ready contact is open
- High Temperature: signal for too high capacitor temperature (>65°C), charging and buffering is still possible, ready contact is open
- Buffer Time Expired: buffering stopped due to discharged capacitors
- Inhibit Active: buffering is blocked by the inhibit signal

Flashing pattern for the yellow diagnosis LED:



F **"Warning" LED** (red)
- Check Input Voltage:
  Indicates a too low or too high input voltage. The input voltage must be between 23Vdc and 30Vdc to turn-on the output and to start charging of the capacitors.
- PC-Mode Activated
  Indicates, that the PC-Mode (see also section 9) is activated.

Flashing pattern for the red warning LED:



G **Chassis Ground** (screw)
Use a M4 ring-type terminal to connect the housing to ground, when required

15. EMC

The DC-UPS is suitable for applications in industrial environment as well as in residential, commercial and light industry environment without any restrictions.

EMC Immunity	According generic standards: EN 61000-6-1 and EN 61000-6-2			
Electrostatic discharge	EN 61000-4-2	contact discharge *) air discharge *)	8kV 15kV	Criterion A Criterion A
Electromagnetic RF field	EN 61000-4-3	80MHz-2.7GHz	10V/m	Criterion A
Fast transients (Burst)	EN 61000-4-4	input lines output lines signals **)	2kV 2kV 2kV	Criterion A Criterion A Criterion A
Surge voltage on input	EN 61000-4-5	+ → - + / - → chassis ground	500V 1kV	Criterion A Criterion A
Surge voltage on output	EN 61000-4-5	+ → - + / - → chassis ground	500V 1kV	Criterion A Criterion A
Surge voltage on inhibit input, ready- and buffering contacts and PC-mode selector	EN 61000-4-5	signals → chassis ground	1kV	Criterion A
Conducted disturbance	EN 61000-4-6	0.15-80MHz	10V	Criterion A

*) Chassis ground connection earthed (grounded)
**) Tested with coupling clamp

Criterions:
A: DC-UPS shows normal operation behavior within the defined limits.

EMC Emission	According generic standards: EN 61000-6-3 and EN 61000-6-4		
Conducted emission	IEC/CISPR 16-1-2, IEC/CISPR 16-2-1	input lines	limits for DC power ports acc. EN 61000-6-3 fulfilled
	IEC/CISPR 16-1-2, IEC/CISPR 16-2-1	output lines	limits for DC power ports acc. EN 61000-6-3 fulfilled
Radiated emission	EN 55011, EN 55022		Class B

This 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.

Switching Frequencies	The unit has two converters with two different switching frequencies and one switch-mode current limiter included.	
Switching frequency 1	100kHz	Boost Converter (active only in buffer mode)
Switching frequency 2	78kHz	Electronic output current limitation
Switching frequency 3	19.5kHz	Charger

16. ENVIRONMENT

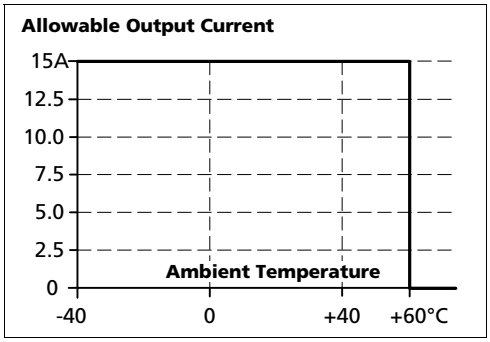
Operational temperature *)	-40°C to +60°C (-40°F to 140°F)	
Storage temperature	-40 to +70°C (-40°F to 158°F)	for storage and transportation
Humidity **)	5 to 95% r.H.	IEC 60068-2-30
Vibration sinusoidal	2-17.8Hz: ±1.6mm; 17.8-500Hz: 2g ***) 2 hours / axis	IEC 60068-2-6
Shock	30g 6ms, 20g 11ms ***) 3 bumps / direction, 18 bumps in total	IEC 60068-2-27
Altitude	0 to 6000m (0 to 20 000ft)	Approvals apply only up to 2000m
Over-voltage category	II	IEC 62103, EN 50178, EN 60950, UL 840
Degree of pollution	2	IEC 62103, EN 50178, not conductive
LABS compatibility	The unit does not release any silicone or other LABS-critical substances and is suitable for use in paint shops.	

*) Operational temperature is the same as the ambient or surrounding temperature and is defined as the air temperature 2cm below the unit.

**) Do not energize while condensation is present

***) Higher levels allowed when using the wall mounting bracket ZM2.WALL

Fig. 16-1 **Output current vs. ambient temp.**



17. PROTECTION FEATURES

Output protection	Electronically protected against overload, no-load and short-circuits *)	
Output over-voltage protection in buffer mode	typ. 32Vdc max. 35Vdc	In case of an internal DC-UPS defect, a redundant circuit limits the maximum output voltage. The output shuts down and automatically attempts to restart.
Degree of protection	IP 20	EN/IEC 60529 For use in a controlled environment according to CSA 22.2 No 107.1-01.
Penetration protection	> 3.5mm	e.g. screws, small parts
Over-temperature protection	included	Output shuts down with automatic restart
Input over-voltage protection	-	Max. 35Vdc, no harm or defect of the unit
Internal input fuse	included	Non user replaceable The tripping of this fuse is caused by an internal defect. In such cases, send unit to the factory for inspection.
Internal capacitor fuse	included	Non user replaceable The tripping of this fuse is caused by an internal defect. In such cases, send unit to the factory for inspection.
Overcharging of capacitors	included	The capacitors are permanently monitored. In case of a too high charging voltage, the charger will be switched off with redundant protection measures.
Balancing of capacitors	included	An active balancing circuit ensures uniform capacitor voltages. If necessary, the charging current will be reduced to a safe value.
Failing of one or more capacitor in the capacitor-string	included	Ready contact open, moving light pattern on the three LEDs
Temperature of capacitors	included	Indicated by the diagnosis LED, ready contact open
Internal errors (broken wires, …)	included	Charging is stopped, ready contact open, moving light pattern on the three LEDs

*) In case of a protection event, audible noise may occur.

18. SAFETY FEATURES

Output voltage	SELV	IEC/EN 60950-1, The input must be powered from a SELV power source.
	PELV	IEC/EN 60204-1, EN 50178, IEC 62103, IEC 60364-4-41, The input must be powered from a PELV power source.
Class of protection	III	PE (Protective Earth) connection not required
Isolation resistance	> 5MOhm > 800kOhm > 5MOhm	Power port to signal port Power port to housing Signal port to housing
Dielectric strength	500Vac 500Vac	Power port to signal port Power port / signal port to housing
Touch current (leakage current)	The leakage current which is produced by the DC-UPS itself depends on the input voltage ripple and need to be investigated in the final application. For a smooth DC input voltage, the produced leakage current is less than 100µA.	

19. APPROVALS

EC Declaration of Conformity	CE	The CE mark indicates conformance with the - EMC directive and the - RoHS directive.
IEC 60950-1 2nd Edition	IECEE CB SCHEME	CB Scheme, Information Technology Equipment Applicable for altitudes up to 2000m.
UL 508	c UL US LISTED IND. CONT. EQ.	Listed for use as Industrial Control Equipment; U.S.A. (UL 508) and Canada (C22.2 No. 107-1-01); E-File: E198865
UL 60950-1 2nd Edition	c UL US	Recognized for use as Information Technology Equipment, Level 5; U.S.A. (UL 60950-1) and Canada (C22.2 No. 60950-1); E-File: E137006 Applicable for altitudes up to 2000m.
ANSI / ISA 12.12.01-2007 Class I Div 2	C SP US	Recognized for use in Hazardous Location Class I Div 2 T4 Groups A,B,C,D systems; U.S.A. (ANSI / ISA 12.12.01-2007) and Canada (C22.2 No. 213-M1987)
EN 60079-0, EN 60079-15 ATEX	Ex II 3G Ex nA nC II T4 Gc	Approval for use in hazardous locations Zone 2 Category 3G. Number of ATEX certificate: EPS 15 ATEX 1 025 X The power supply must be built-in in an IP54 enclosure.
IEC 60079-0, IEC 60079-15	IECEx	Suitable for use in Class 1 Zone 2 Groups IIa, IIb and IIc locations. Number of IECEx certificate: IECEx EPS 15.0049X
EAC TR Registration (only for CP10.241)	EAC	Registration for the Eurasian Customs Union market (Russia, Kazakhstan, Belarus)

20. ROHS, REACH AND OTHER FULFILLED STANDARDS

RoHS Directive	RoHS ✓	Directive 2011/65/EU of the European Parliament and the Council of June 8th, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.
REACH Directive	REACH ✓	Directive 1907/2006/EU of the European Parliament and the Council of June 1st, 2007 regarding the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)

21. PHYSICAL DIMENSIONS AND WEIGHT

Weight	UC10.241: 1150g / 2.54lb UC10.242: 1720g / 3.79lb
DIN-Rail	Use 35mm DIN-rails according to EN 60715 or EN 50022 with a height of 7.5 or 15mm. The DIN-rail height must be added to the unit depth (127mm) to calculate the total required installation depth.
Installation Clearances	See chapter 2.

Fig. 21-1 **Front view UC10.241**

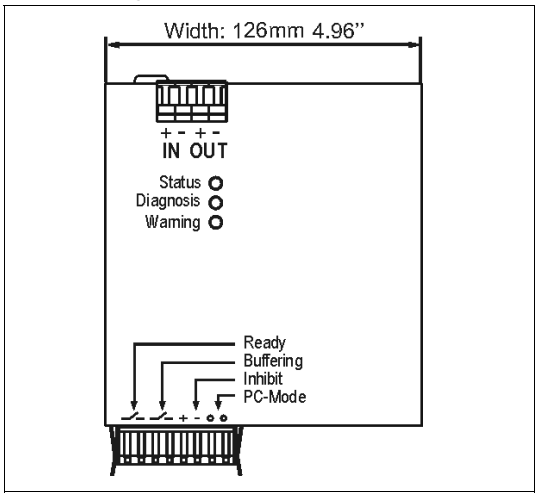


Fig. 21-2 **Front view UC10.242**

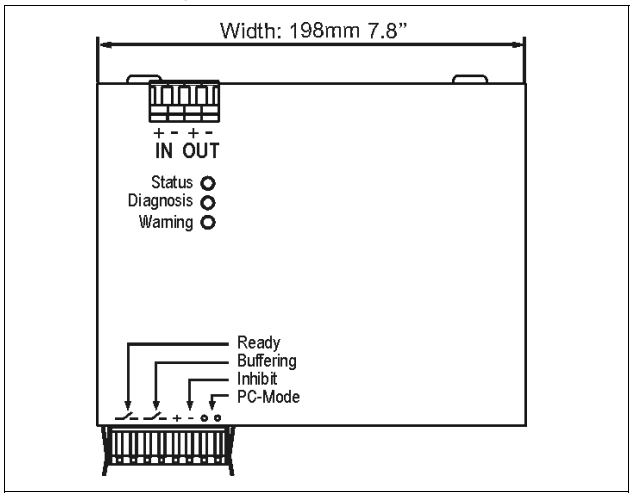
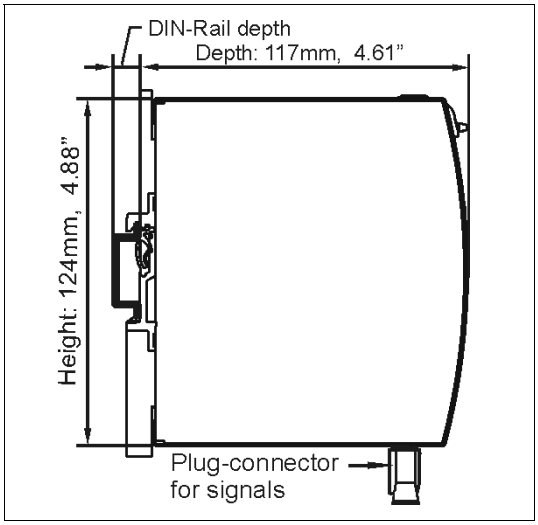


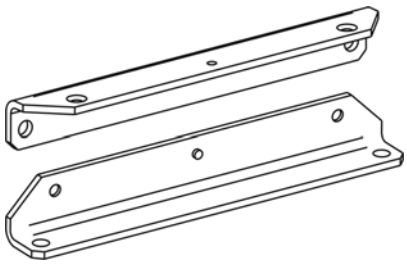
Fig. 21-3 **Side view**

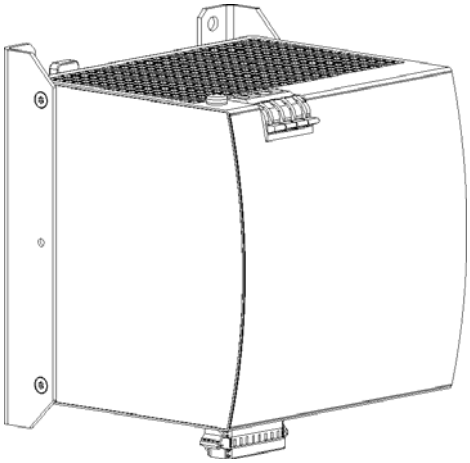


22. ACCESSORIES

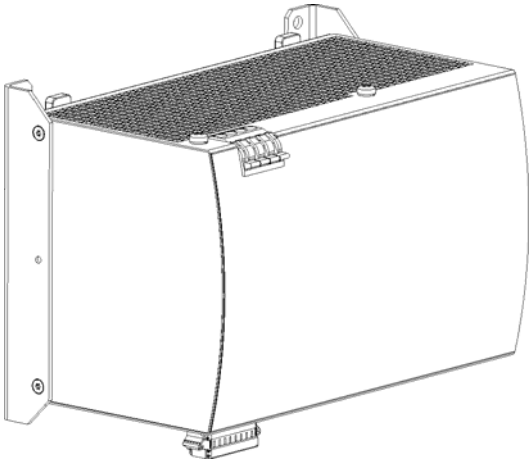
22.1. ZM2.WALL – WALL-MOUNTING BRACKET

This bracket is used to mount the DC-UPS
onto a flat surface without utilizing a DIN-Rail.





UC10.241



UC10.242

23. Application Notes

23.1. External Input Protection

The DC-UPS is tested and approved for branch circuits up to 50A. An external protection is only required, if the supplying branch has an ampacity greater than this. 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 20A B- or C-Characteristic breaker should be used.

Check also local codes and local requirements. In some countries local regulations might apply.

23.2. Output Circuit Breakers

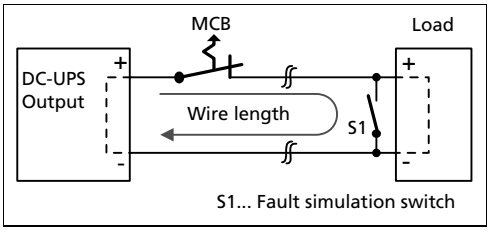
The output of the DC-UPS is equipped with an electronic current limitation. An overload or short-circuit on the output is electronically protected and cannot cause any harms, independent of which sizes of power supplies are used on the input of the DC-UPS.

However, some applications require branch circuit or branch circuit conductor protection. Therefore standard miniature circuit breakers (MCB's or UL 1077 circuit breakers) are commonly used on 24V 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 24V 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 high peak currents to open the circuit breaker in the required time. Furthermore, the impedance of the faulty branch must be sufficiently small in order for the current to actually flow. The following table has typical test results showing which C-Characteristic MCBs magnetically trip depending on the wire cross section and wire length.

Fig. 23-1 **Test circuit**



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

	0.75mm²	**1.0mm²**	**1.5mm²**	**2.5mm²**
C-2A	20m	25m	39m	58m
C-3A	12m	14m	24m	39m
C-4A	3m	3m	4m	4m

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

23.3. Parallel Use to Increase Output Current

Do not use the DC-UPS in parallel to increase the output power.

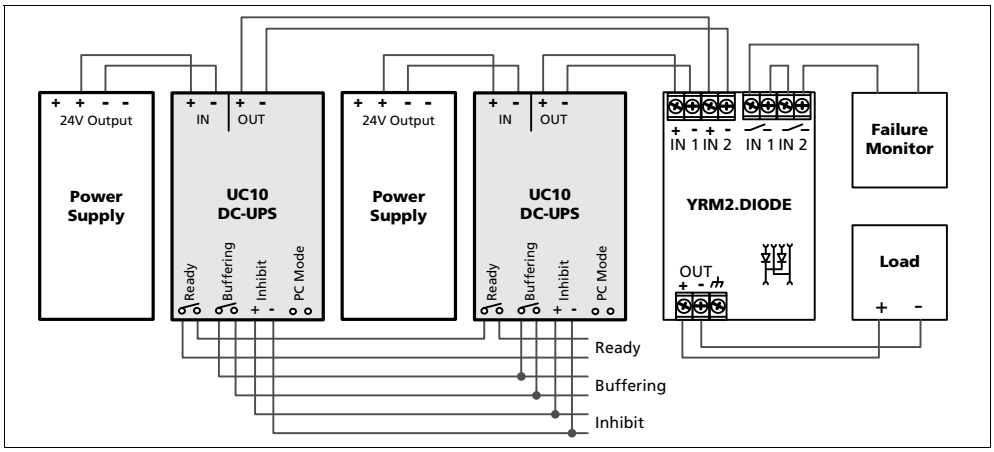
23.4. Parallel Use for Redundancy

Two DC-UPSs can be paralleled to build a 1+1 redundant system to gain higher system reliability.

Recommendations for building redundant power systems:

a) Use separate input fuses for each power supply.
b) Set the power supply into "Parallel use" mode if available.
c) Use a redundancy module to decouple the two power sources.
d) Monitor the individual sources. Therefore, use the alarm contacts of the YRM2.DIODE redundancy module. (The YRM2.DIODE is suitable for a 10A redundant system)
e) It is desirable to set the output voltages of all power supplies to the same value (± 100mV) or leave it at the factory setting.

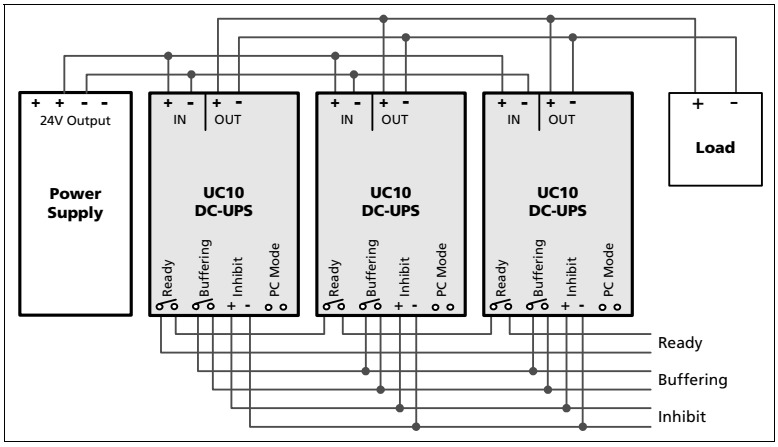
Fig. 23-2 **Wiring example for a fully redundant system, redundant power supplies and redundant DC-UPSs**



23.5. Parallel Use for Longer Buffer Times

DC-UPSs can be paralleled to extend the buffer time.

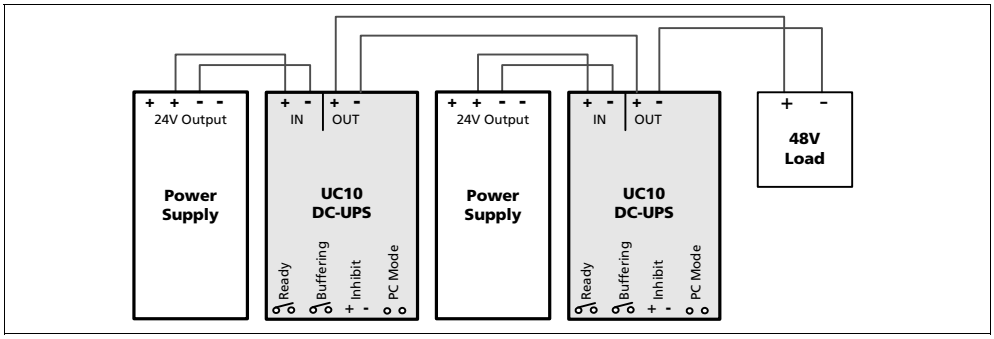
Fig. 23-3 **Wiring example for parallel use for longer buffer times**



23.6. SERIES USE FOR 48V APPLICATIONS

A series connection for 48V applications is allowed when utilizing two individual power supplies and two DC-UPSs.

Fig. 23-4 **Wiring example for 48V serial use**

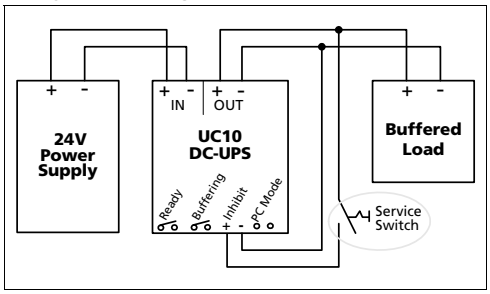


23.7. USING THE INHIBIT-INPUT

The inhibit-input disables buffering. In normal mode, a static signal is required. In buffer mode, a pulse with a minimum length of 250ms is required to stop buffering. The inhibit signal is stored and can be reset by cycling the input voltage.

For service purposes, the inhibit input can also be used to connect a service switch. Therefore, the inhibit signal can be supplied from the output of the DC-UPS.

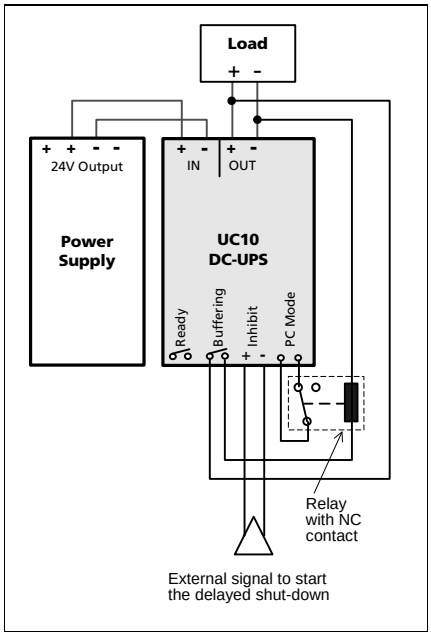
Fig. 23-5 **Wiring example for inhibit input**

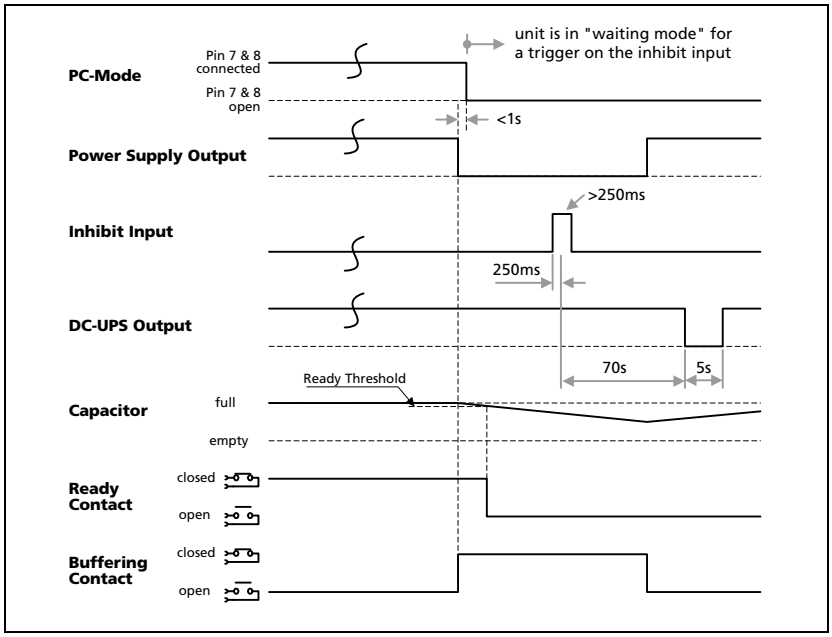


23.8. External Controlled Delayed Shut-down

If the reset is supposed to be controlled by the PC or another external trigger and not the DC-UPS, the following wiring option is possible but requires an external relay:

Fig. 23-6 **Wiring scheme for an external controlled reset after a buffer event**





Activation of the "external control mode":

The PC-Mode pins need to be connected together during a normal mode operation. This connection must be opened within the first second of a buffer event to set the DC-UPS into the "external control mode". In this mode, a signal on the inhibit input will not immediately execute a shut-down of the DC-UPS's output but will be delayed by 70s. The output of the DC-UPS will always be switched off for at least 5s.

23.9. WHAT DO KJ AND KWS MEAN?

The units kJ (kilo Joule) or kWs (kilo Watt seconds) is used for specifying the installed storage capacitor size.

1 kJ = 1 kWs = 1000Ws

The stored energy of a capacitor can be calculated with the following formula:

$$Energy(Ws) = \frac{C * U^2}{2}$$

For example: A 350F (Farad) capacitor which is charged to 2.5V has the following energy

$$E = \frac{350F * 2.5V^2}{2} = 1093Ws = 1.09kWs$$

During discharging of the capacitor, the voltage decreases with the amount of discharge. A boost converter is needed to generate a stable output voltage. The boost converter needs a minimum input voltage (cut-off voltage), which reduces the amount of energy. The cut-off voltage usually depends on the load current, the lower the load current, the lower the cut-off voltage.

Considering this voltage range, the energy can be calculated with the following formula (full charge voltage= U1= 2.5V, cut-off voltage= U2= 1V):

$$E = \frac{C * (U1^2 - U2^2)}{2} = \frac{350 * (2.5^2 - 1^2)}{2} = 919Ws = 0.92kWs$$

The energy which can be used for the 24V loads is further reduced by the efficiency of the boost converter.

The UC10.241 has a rated capacitor size of 6kWs and the UC10.242 12kWs. This is the energy which can be used for 24V load at low load currents.

Calculation of the needed energy:

Example: A power of 45W is needed for 2 minutes:

$E = P * t = 45W * 120s = 5400Ws = 5.4kWs$ Always check with the buffer time curve (see Fig. 6-1) if the load can be powered for the required period of time!

23.10. TROUBLESHOOTING

The following guidelines provide instructions for fixing the most common failures and problems. Always start with the most likely and easiest to check condition. Some of the suggestions may require special safety precautions. See notes in section 2 first.

Symptom:	**Action:**
"Check input voltage" LED is on	- Check input voltage (must be between 22.8V and 30V)
DC-UPS did not buffer	- Inhibit input was set. - Capacitor did not have enough time to be charged.
DC-UPS stopped buffering	- Capacitor was discharged. - Capacitor did not have enough time to be charged. - Inhibit was activated - PC-mode was activated
Output has shut down in normal mode	- Over-temperature protection might have triggered. Let the DC-UPS cool down. - PC-mode was activated (if not longer than 5s)
DC-UPS constantly switches between normal mode and buffer mode	The supplying source on the input is too small and can not deliver sufficient current. Use a larger power supply or reduce the output load

PULS

DIMENSION **Y-Series**

YR40.241

12-28V, 40A, DUAL REDUNDANCY MODULE

MOSFET REDUNDANCY MODULE

- For N+1 and 1+1 Redundant Systems
- Dual Input with Single Output
- Suitable for all Power Supplies
- Only 72mV Voltage Drop at 20A Output Current
- Only 2.15W Loss at 20A and 6.3W at 40A Output Current
- 160% (65A) Peak Load Capability
- Reverse Input Polarity Protection
- Full Power Between -40°C and +70°C
- Width only 36mm
- Rugged Metal Housing
- Easy Wiring:
  Distribution Terminal for Negative Pole Included
- 3 Year Warranty

GENERAL DESCRIPTION

The YR40.241 is a redundancy module, which can be used to build 1+1 and N+1 redundant systems. It is equipped with two input channels, which can be connected to power supplies with up to 20A output current and one output, which can carry nominal currents up to 40A. The module is suitable for power supplies with constant current overload behavior as well as any kind of "Hiccup" overload behavior. In addition to the YR40.241, the YR40.242 is also available which is cost-optimized and suitable for all DIMENSION power supplies except the QT20 and QTD20 series.

The novelty of this redundancy module is the utilization of mosfets instead of diodes for the decoupling of the two input channels. This reduces the heat generation and the voltage drop between input and output. The redundancy module does not require an additional auxiliary voltage and is self-sufficient even in case of a short circuit across the output.

Due to the low power losses, the unit is very slender and only requires 36mm width on the DIN-rail. Large connection terminals allow for a safe and fast installation with a large international approval package. This unit is suitable for nearly every application.

SHORT-FORM DATA

Input voltage	DC 12-28V	±30%
Input voltage range	8.4-36.4Vdc	
Input current	2x 0-20A	continuous
	2x 20-32.5A	for 5 seconds
Output current	0-40A	continuous
	40-65A	for 5 seconds
	65A	at cont. overload or short circuit
Input to output voltage drop	typ. 72mV	input: 2x10A
	typ. 112mV	input: 1x20A
	typ. 140mV	input: 2x20A
Power losses	typ. 700mW	at no load
	typ. 2.15W	input: 2x10A
	typ. 2.65W	input: 1x20A
	typ. 6.3W	input: 2x20A
Temperature range	-40°C to +70°C	operational, no de-rating req.
Dimensions	36x124x127mm*)	WxHxD

*) plus 4mm in depth for the screw terminal

ORDER NUMBERS

Redundancy Module	**YR40.241**	12-28V Standard unit
Accessory	ZM2.WALL	Wall/ panel mount bracket
	ZM11.SIDE	Side mount bracket

MARKINGS

c UL US LISTED IND. CONT. EQ. UL 508

c US UL 60950-1

c SP US Class I Div 2

IECEx ATEX II 3G Ex nA IIC T4 Gc

GL Marine

CE EMC, LVD

INDEX

TERMINOLOGY AND ABREVIATIONS

PE and ⏚ symbol PE is the abbreviation for **P**rotective **E**arth and has the same meaning as the symbol ⏚.

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.

DC 24V A figure displayed with the AC or DC before the value represents a nominal voltage with standard tolerances (usually ±15%) included.
E.g.: DC 12V describes a 12V battery disregarding whether it is full (13.7V) or flat (10V)

24Vdc A figure with the unit (Vdc) at the end is a momentary figure without any additional tolerances included.

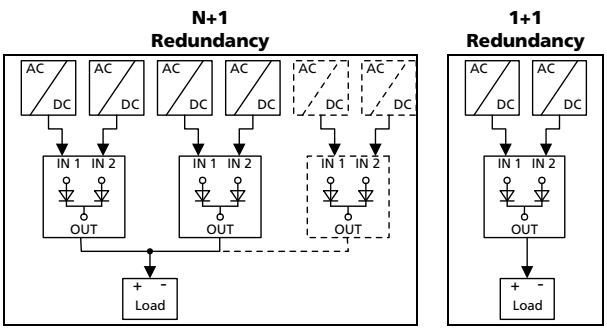
may A key word indicating flexibility of choice with no implied preference

shall A key word indicating a mandatory requirement

should A key word indicating flexibility of choice with a strongly preferred implementation

1+1 Redundancy Use of two identical power supplies in parallel to provide continued operation following most failures in a single power supply. The two power supply outputs should be isolated from each other by utilizing diodes or other switching arrangements. E.g. two 10A power supplies are needed to achieve a 10A redundant system.

N+1 Redundancy Use of three or more identical power supplies in parallel to provide continued operation following most failures in a single power supply. All power supply outputs should be isolated from each other by utilizing diodes or other switching arrangements.
E.g.: To achieve a 40A redundant system, five 10A power supplies are needed in a N+1 redundant system.



1. INTENDED USE

This redundancy module is designed for installation in an enclosure and is intended for the general use such as in industrial control, office, communication, and instrumentation equipment.

This redundancy module can be used with any type of power supply as long as the maximum ratings are not exceeded. It is suitable for power supplies with constant current overload behavior as well as any kind of "Hiccup" overload behavior.

Do not use this redundancy module in equipment, where malfunction may cause severe personal injury or threaten human life.

This device is designed for use in hazardous, non-hazardous, ordinary or unclassified locations.

2. INSTALLATION REQUIREMENTS

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

This device does not contain serviceable parts.

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

Mount the unit on a DIN-rail so that the input terminals are located on the top and the output terminals on the bottom of the unit. For other mounting orientations see de-rating requirements of chapter 17.6 in this document.

This device is designed for convection cooling and does not require an external fan. Do not obstruct airflow and do not cover the ventilation grid (e.g. cable conduits) by more than 30%!

Keep the following installation clearances:
40mm on top,
20mm on the bottom,
5mm on the left and right sides are recommended when the device is loaded permanently with more than 50% of the rated output current. Increase the side clearance to 15mm in case the adjacent device is a heat source (e.g. another power supply). See also chapter 17.3 for further information in combination with power supplies from the PULS DIMENSION series.

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

- Turn power off before working on the device. Protect against inadvertent re-powering.
- Make sure that the wiring is correct by following all local and national codes.
- Do not open, modify or repair the unit.
- 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.

Notes for use in hazardous location areas:

The redundancy module is suitable for use in Class I Division 2 Groups A, B, C, D locations and for use in Group II Category 3 (Zone 2) environments and is evaluated according to EN 60079-0:2009 and EN 60079-15:2010.

WARNING EXPLOSION HAZARDS!

Substitution of components may impair suitability for this environment. Do not disconnect the unit unless power has been switched off or the area is known to be non-hazardous.

A suitable enclosure must be provided for the end product which has a minimum protection of IP54 and fulfils the requirements of the EN 60079-15:2010.

3. INPUT AND OUTPUT CHARACTERISTICS

Number of inputs	-	2	
Number of outputs	-	1	
Input voltage	nom.	DC 12-28V ±30%	The input circuitry must meet the SELV requirements stipulated by IEC/EN/UL 60950-1.
Input voltage range	-	8.4-36.4Vdc	
Voltage drop, input to output	typ.	140mV	at 2x20A, see Fig. 3-1
	typ.	72mV	at 2x10A, see Fig. 3-1
	typ.	112mV	at 1x20A, see Fig. 3-2
Input current	nom.	2x 0-20A	continuous
	nom.	2x 20-32.5A	for 5 seconds
	max	2x 32.5A	at continuous overload or short circuit
Peak input current	max.	1000A	for max. 1ms per input
Output current	nom.	40A	continuous
	nom.	40-65A	for 5 seconds
	max.	65A	at continuous overload or short circuit
Reverse current	max.	1mA	at 24V, per input, -40°C to +70°C
Reverse voltage	max.	40Vdc	voltage applied to the output, continuously allowed
Output capacitance	typ.	320µF	

Note: Ensure that the continuous output current does not exceed 65A. Check the short-circuit current of the power sources and if the power source can deliver more than 65A together, use an appropriate fuse on the output.

Fig. 3-1 **Input to output voltage drop when both inputs draw current**
(typical 1+1 redundant case, when the output voltages of the two units are equal)

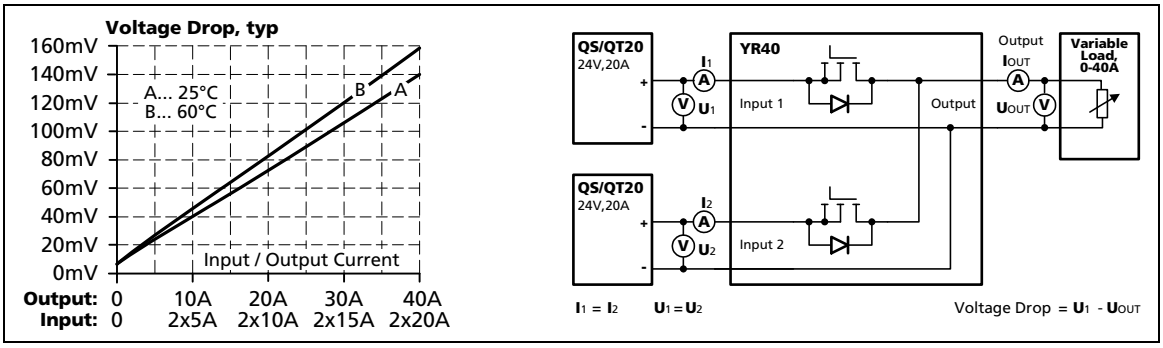
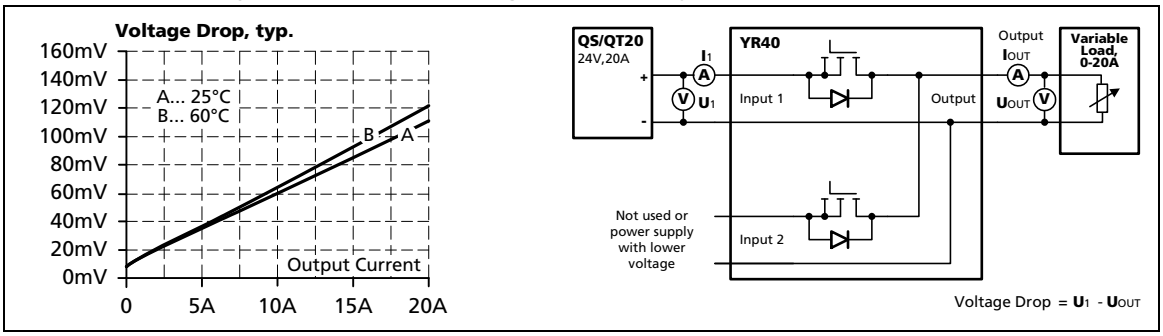


Fig. 3-2 **Input to output voltage drop when only one input draws current**



4. POWER LOSSES

		DC 24V	
Power losses	typ.	2.15W	input: 2x10A
	typ.	6.3W	input: 2x20A
	typ.	2.6W	input: 1x20A, (only one input is connected to input voltage)
Standby power losses	typ.	0.35W	at no output current, (only one input is connected to input voltage)
	typ.	0.7W	at no output current, (both inputs are connected to input voltages)

Fig. 4-1 **Power losses when both inputs draw equal current**

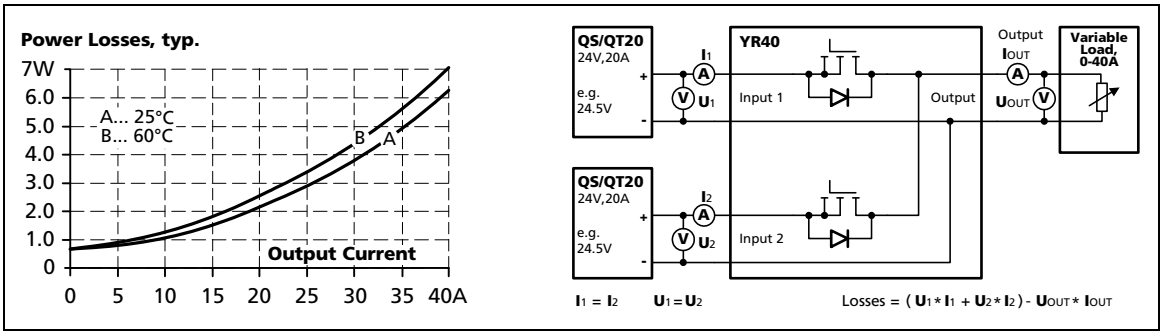
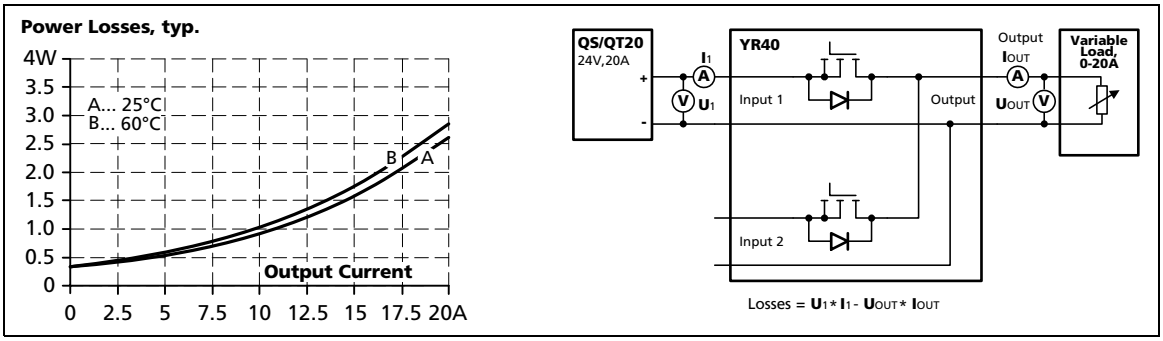


Fig. 4-2 **Power losses when only one input is used**



Note: As soon as voltage is applied on input 2, an additional 0.35W will be consumed. It is not relevant, whether this channel contributes to the output current or not.

5. LIFETIME EXPECTANCY AND MTBF

The redundancy module has two input channels which are completely independent from each other. Each control circuit, auxiliary voltage source, or other circuitry in the module are designed separately for each input. The dual input redundancy module can be considered as two single redundancy modules combined together in one housing. The only common point is the circuit trace that ties the two separate circuits together at the output.

The MTBF figures below are for the entire dual input module. If the MTBF number of only one path is needed, simply double the value from the table.

Input / output current conditions	**Input: 2x10A Output: 20A**	**Input: 2x20A Output: 40A**	
Lifetime expectancy*)	649 000h *)	246 000h *)	at 24V and 40°C
	1 835 000h *)	696 000h *)	at 24V and 25°C
MTBF**) SN 29500, IEC 61709	3 386 000h	2 706 000h	at 24V 40°C
	5 667 000h	4 686 000h	at 24V 25°C
MTBF**) MIL HDBK 217F	116 000h	97 000h	Ground Fixed GF40 (24V and 40°C)
	155 000h	128 000h	Ground Fixed GF25 (24V and 25°C)
	612 000h	522 000h	Ground Benign GB40 (24V and 40°C)
	813 000h	687 000h	Ground Benign GB25 (24V and 25°C)

*) The **Lifetime expectancy** shown in the table indicates the minimum operating hours (service life) 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 life of up to 15 years (131 400h). Any number exceeding this value is a calculated theoretical lifetime which can be used to compare devices.

) **MTBF stands for **M**ean **T**ime **B**etween **F**ailure, 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 000h means that statistically one unit will fail every 100 hours if 10 000 units are installed in the field. However, it can not be determined if the failed unit has been running for 50 000h or only for 100h.

6. TERMINALS AND WIRING

	Input	Output
Type	Screw termination IP20 Finger safe construction. Suitable for field installation.	Screw termination IP20 Finger safe construction. Suitable for field installation.
Solid wire	0.5-6mm^2	0.5-16mm^2
Stranded wire	0.5-4mm^2	0.5-10mm^2
American Wire Gauge	20-10 AWG	22-8 AWG
Max. wire diameter	2.8mm (including ferrule)	5.2mm (including ferrule)
Wire stripping length	7mm / 0.275inch	12mm / 0.5inch
Screwdriver	3.5mm slotted or Pozidrive No 2	3.5mm slotted or Pozidrive No 2
Recommended tightening torque	0.8Nm, 7lb.in	1.2Nm, 10.6lb.in

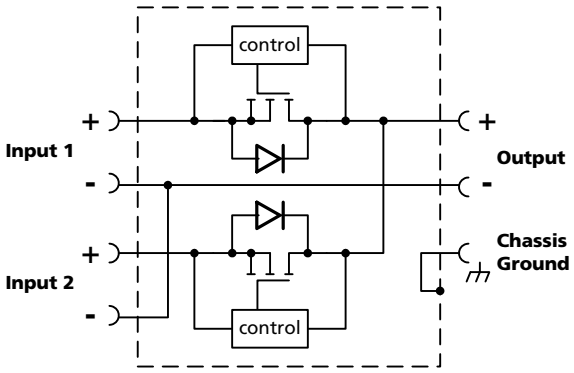
To connect the chassis to ground, use a ring-type terminal (ring cable lug) which is suitable for a M4 screw and connect it to the chassis ground terminal on top of the unit.

Instructions:

a) The external circuitry of all terminals must meet the safety requirements stipulated by IEC/EN/UL 60950-1: SELV.
b) 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 and
   90°C for ambient up to 70°C minimum.
c) Follow national installation codes and installation regulations!
d) Ensure that all strands of a stranded wire enter the terminal connection!
e) Screws of unused terminal compartments should be securely tightened.
f) Ferrules are allowed.
g) Do not connect or disconnect the wires from the terminals below -25°C (-13°F).

7. FUNCTIONAL DIAGRAM

Fig. 7-1 **Functional diagram**



8. FRONT SIDE AND USER ELEMENTS

Fig. 8-1 **Front side**

A **Output Terminals** (screw terminals)

B **Chassis Ground Terminals**
To be connected on the top side of the housing with a ring-type terminal (ring cable lug) which is suitable for a M4 screw.
Connection of the chassis is optional and not required since the unit fulfils the requirements according to protection class III.

C **Input Terminals for Input 1** (screw terminals)

D **Input Terminals for Input 2** (screw terminals)

9. EMC

The redundancy module is suitable for applications in industrial environment as well as in residential, commercial and light industry environment without any restrictions. A detailed EMC report is available on request.

EMC Immunity	According generic standards: EN 61000-6-1 and EN 61000-6-2			
Electrostatic discharge	EN 61000-4-2	Contact discharge Air discharge	8kV 15kV	Criterion A Criterion A
Electromagnetic RF field	EN 61000-4-3	80MHz-2.7GHz	20V/m	Criterion A
Fast transients (Burst)	EN 61000-4-4	Input lines Output lines	2kV 2kV	Criterion A Criterion A
Surge voltage on input lines	EN 61000-4-5	+ → - +/- → Chassis ground	500V 1kV	Criterion A Criterion A
Surge voltage on output lines	EN 61000-4-5	+ → - +/- → Chassis ground	500V 1kV	Criterion A Criterion A
Conducted disturbance	EN 61000-4-6	0.15-80MHz	20V	Criterion A
Power-frequency magnetic field *)	EN 61000-4-8	50Hz	30A/m	Criterion A

Criterions:

A: Redundancy module shows normal operation behavior within the defined limits.

Notes:

***)** A test is not applicable according to EN 61000-6-2, since the device does not contain components susceptible to magnetic fields, e.g. hall elements, electrodynamic microphones, etc.

EMC Emission	According generic standards: EN 61000-6-3 and EN 61000-6-4	
Conducted emission	IEC/CISPR 16-1-2, IEC/CISPR 16-2-1	limits for DC power ports according EN 61000-6-3 fulfilled *)
Radiated emission	EN 55011, EN 55022	Class B

This 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.

*) For information only, not mandatory for EN 61000-6-3. Provided, that power sources connected on the inputs fulfill the requirements too.

Switching frequency	The internal auxiliary supply is generated with a boost converter. The switching frequency is typ. 16kHz.

10. ENVIRONMENT

Operational temperature *)	-40°C to +70°C (-40°F to 158°F)	
Storage temperature	-40 to +85°C (-40°F to 185°F)	for storage and transportation
Humidity **)	5 to 95% r.H.	IEC 60068-2-30
Vibration sinusoidal ***)	2-17.8Hz: ±1.6mm; 17.8-500Hz: 2g 2 hours / axis	IEC 60068-2-6
Shock ***)	30g 6ms, 20g 11ms 3 bumps / direction, 18 bumps in total	IEC 60068-2-27
Altitude	0 to 2000m (0 to 6 560ft)	without any restrictions
	2000 to 6000m (6 560 to 20 000ft)	reduce output power or ambient temperature, see Fig. 10-2
Altitude de-rating	2.5A/1000m or 5°C/1000m	> 2000m (6500ft), see Fig. 10-2
Over-voltage category	not applicable	The concept of the overvoltage category is used for equipment energized directly from the low voltage mains (IEC 60664-1 §4.3.3.2.1).
Degree of pollution	2	IEC 62103, EN 50178, not conductive
LABS compatibility	The unit does not release any silicone or other LABS-critical substances and is suitable for use in paint shops.	

*) Operational temperature is the same as the ambient temperature and is defined as the air temperature 2cm below the unit.
**) Do not energize while condensation is present
***) Tested in combination with DIN-Rails according to EN 60715 with a height of 15mm and a thickness of 1.3mm and standard mounting orientation.

Fig. 10-1 **Output current vs. ambient temp.**

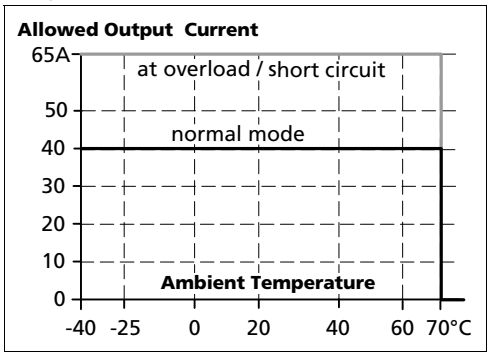
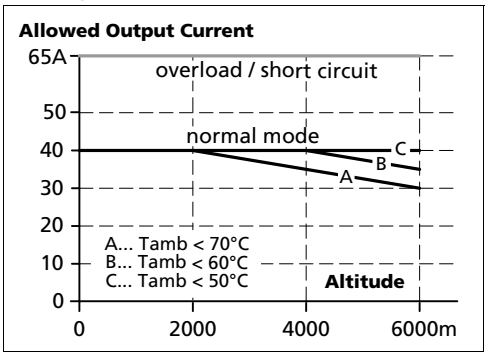


Fig. 10-2 **Output current vs. altitude**



11. PROTECTION FEATURES

Output over-current protection	not included	
Reverse input polarity protection	included	unit does not start when input voltage is reversed
Degree of protection	IP 20	EN/IEC 60529
Penetration protection	> 3.6mm	e.g. screws, small parts
Over-temperature protection	not included	
Input transient protection	not included	
Output transient protection	included	see EMC section
Internal input fuse	not included	

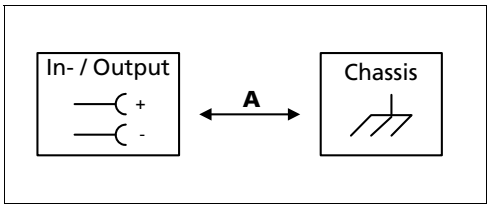
12. SAFETY FEATURES

Input / output separation	no galvanic separation	Mosfet between input and output
Class of protection	III	PE (Protective Earth) or chassis connection not required
PE resistance	< 0.1Ohm	between housing and chassis-ground terminal

13. DIELECTRIC STRENGTH

The input and output voltages have the same reference, are floating and have no ohmic connection to ground.
Type and factory 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 (2s up and 2s down). Connect input/output terminals together before conducting the test.
When testing, set the cut-off current settings to the value in the table below.

Fig. 13-1 **Dielectric strength**



		A
Type test	60s	500Vac
Factory test	5s	500Vac
Field test	5s	500Vac
Cut-off current setting		> 2mA

14. APPROVALS

EC Declaration of Conformity	CE	The CE mark indicates conformance with the - EMC directive 2004/108/EC, - Low-voltage directive (LVD) 2006/95/EC and - RoHS directive 2011/65/EU.
EC Declaration of Conformity ATEX	CE	The CE mark indicates conformance with the - ATEX directive 94/9/EC (Equipment and protection systems intended for use in potentially explosive atmospheres)
IEC 60950-1	IECEE CB SCHEME	CB Scheme, Information Technology Equipment
UL 508	c UL US LISTED IND. CONT. EQ.	Listed for use as Industrial Control Equipment; U.S.A. (UL 508) and Canada (C22.2 No. 107-1-01); E-File: E198865
UL 60950-1	c UL us	Recognized for use as Information Technology Equipment, Level 5; U.S.A. (UL 60950-1) and Canada (C22.2 No. 60950); E-File: E137006
HazLoc (Class 1 Div 2) ANSI / ISA 12.12.01-2007	C SP US	LISTED for use in Hazardous Location Class I Div 2 T4 Groups A,B,C,D systems; U.S.A. (ANSI / ISA 12.12.01-2007) and Canada (C22.2 No. 213-M1987)
ATEX EN 60079-0, EN 60079-15	Ex II 3G Ex nA IIC T4 Gc	Suitable for use in Category 3 Zone 2 locations. Number of ATEX certificate: EPS 11 ATEX 1 312 X The redundancy module must be built-in in an IP54 enclosure.
IECEx IEC 60079-0, IEC 60079-15	IECEx Ex nA IIC T4 Gc	Suitable for use in Category 3 Zone 2 locations. Number of IECEx certificate: IECEx EPS 12.0032X
Marine	GL ABS	GL (Germanischer Lloyd) classified and ABS (American Bureau for Shipping) PDA Environmental category: C, EMC1 Marine and offshore applications
GOST R		Certificate of Conformity for Russia and other GUS countries

15. PHYSICAL DIMENSIONS AND WEIGHT

Weight	340g / 0.75lb
DIN-Rail	Use 35mm DIN-rails according to EN 60715 or EN 50022 with a height of 7.5 or 15mm. The DIN-rail height must be added to the unit depth (127mm) to calculate the total required installation depth.
Installation clearances	See chapter 2

Fig. 15-1 **Front view**

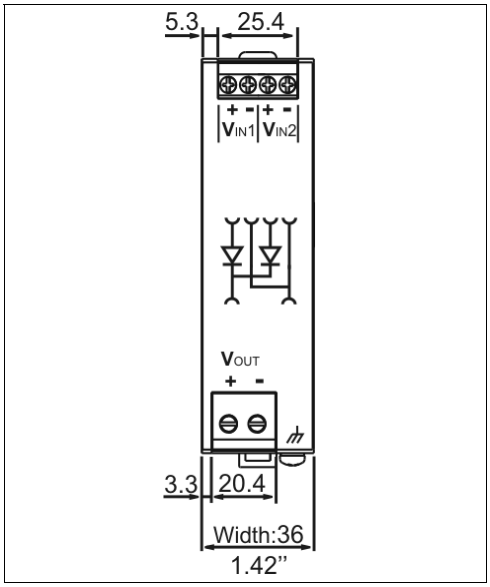
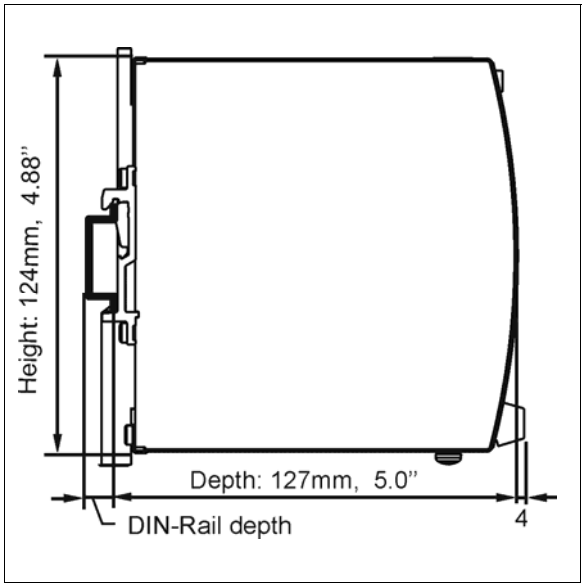


Fig. 15-2 **Side view**



16. ACCESSORIES

ZM2.WALL Wall mounting bracket

This standard bracket is used to mount the YR40.241 redundancy module onto a flat surface without utilizing a DIN-Rail.

Fig. 16-1 **ZM2.WALL Wall mounting bracket**

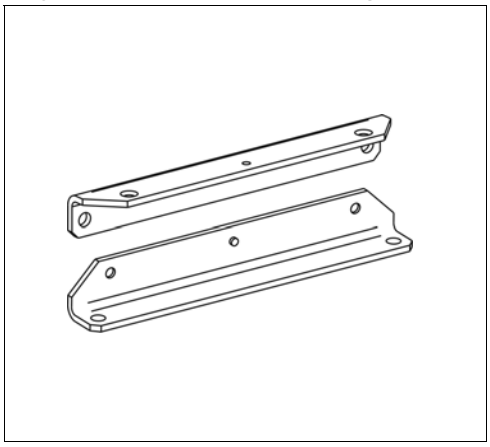
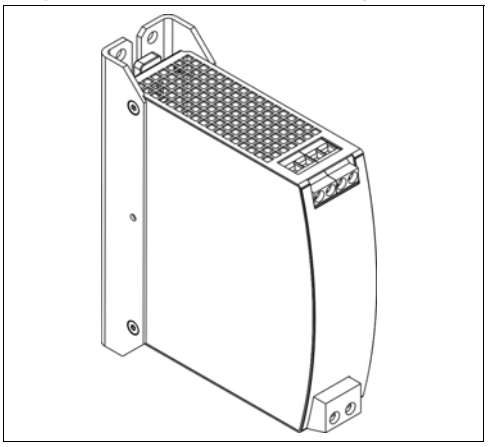


Fig. 16-2 **Assembled wall mounting bracket**



ZM11.SIDE Side mounting bracket

This bracket is used to mount the YR40.241 redundancy module sideways with or without utilizing a DIN-Rail.

The two aluminum brackets and the black plastic slider of the unit have to be detached, so that the steel brackets can be mounted.

For sideway DIN-rail mounting, the removed aluminum brackets and the black plastic slider need to be mounted on the steel bracket.

Fig. 16-3
ZM11.SIDE Side mounting bracket

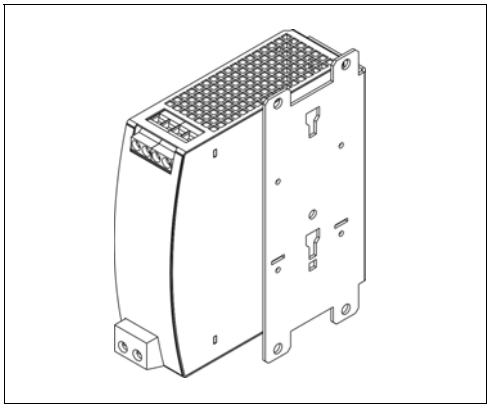
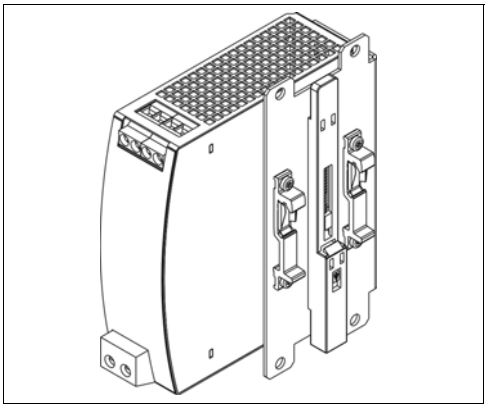


Fig. 16-4
Side mounting with DIN-rail brackets



17. APPLICATION NOTES

17.1. RECOMMENDATIONS FOR REDUNDANCY

Recommendations for the configuration of redundant power systems:

- Use separate input fuses for each power supply.
- Use three-phase power supplies to gain functional safety if one phase fails.
- When single-phase power supplies are utilized connect them to different phases or mains circuits if possible.
- Set the power supply in "Parallel-Use" mode if this feature is available
- It is desirable to set the output voltages of all power supplies to the same value.

17.2. INDUCTIVE AND CAPACITIVE LOADS

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

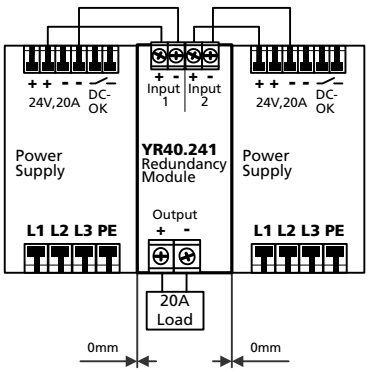
17.3. SIDEWARDS INSTALLATION CLEARANCES

The minimum clearance recommendations are defined in chapter 2.

Normally, the following installation clearance are recommended: 40mm on top, 20mm on the bottom, 5mm on the left and right sides when the device is loaded permanently with more than 50% of the rated power. Increase this clearance to 15mm in case the adjacent device is a heat source (e.g. another power supply).

The clearance between the power supplies and the redundancy module can be reduced to zero under the following conditions:

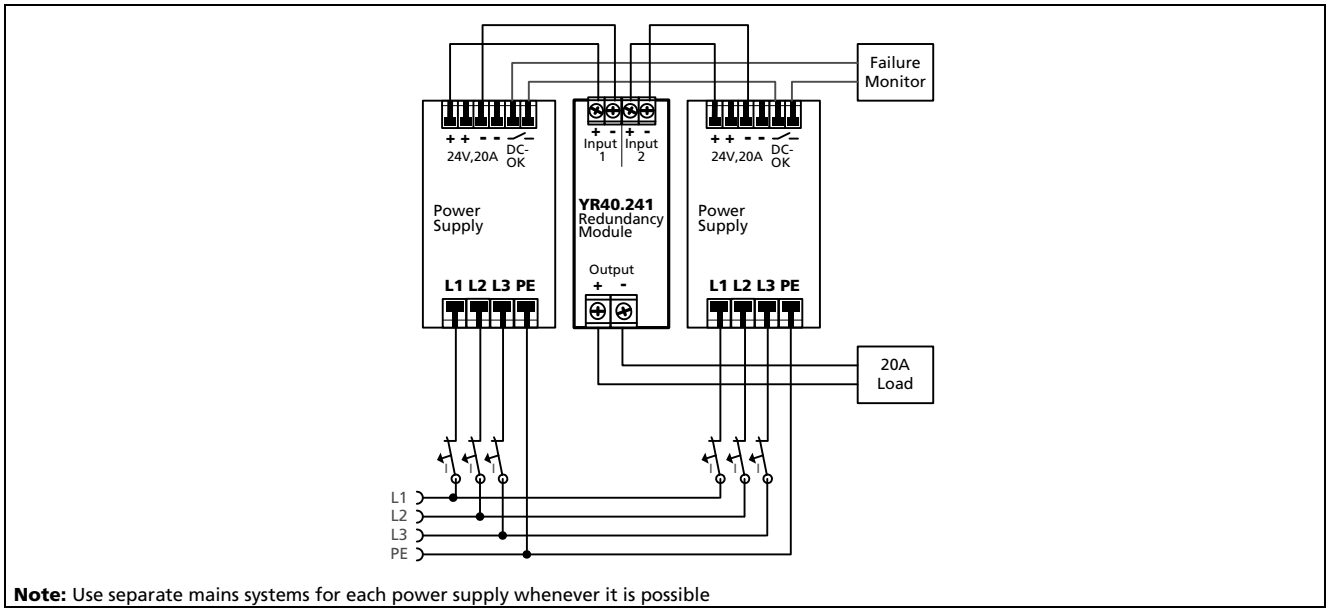
- 1+1 redundancy application with maximum 20A output current.
- The power supplies are from the PULS DIMENSION series.
- The redundancy module is placed between the two power supplies.
- The output voltage is set to the same level on both power supplies.



17.4. 1+1 REDUNDANCY UP TO 20A

1+1 Redundancy up to 20A requires two 20A power supplies and one YR40.241 redundancy module.

Fig. 17-1 **Wiring diagram, 1+1 Redundancy, 20A output current**

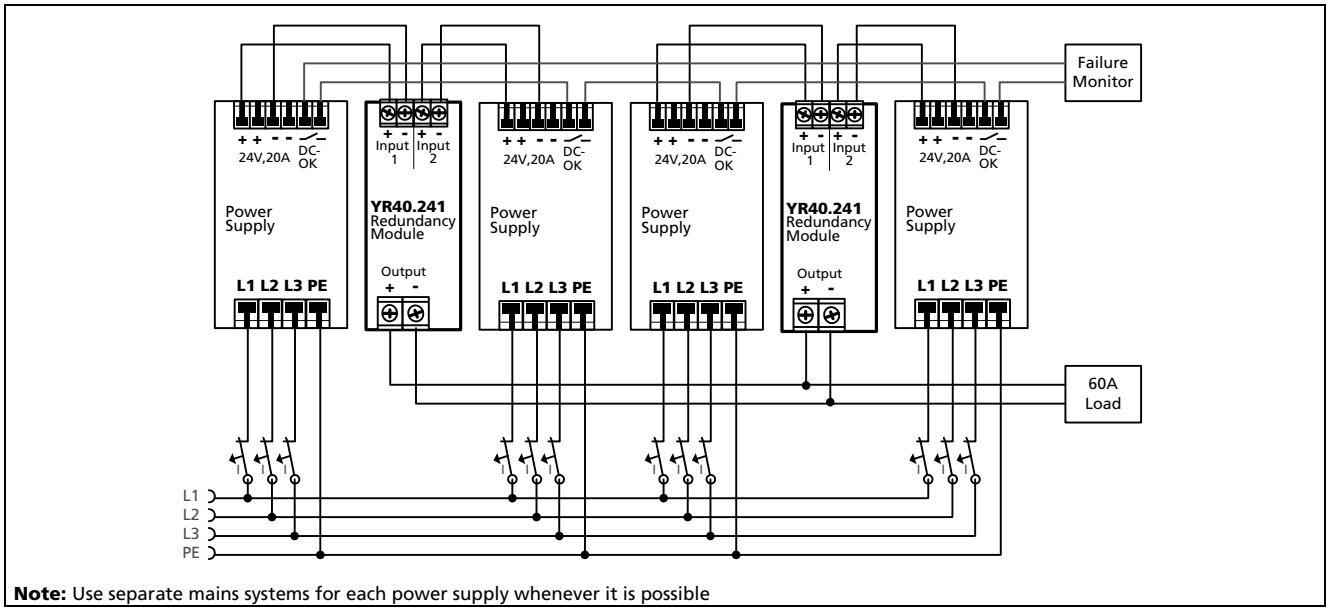


Note: Use separate mains systems for each power supply whenever it is possible

17.5. N+1 REDUNDANCY, EXAMPLE WITH 60A

N+1 Redundancy up to 60A requires four 20A power supplies and two YR40.241 redundancy modules.

Fig. 17-2 **Wiring diagram, n+1 Redundancy, 60A output current**



Note: Use separate mains systems for each power supply whenever it is possible

17.6. 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 maximum 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. 17-3
Mounting Orientation A
(Standard orientation)

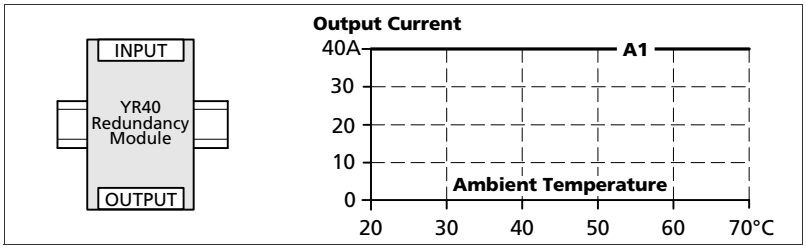


Fig. 17-4
Mounting Orientation B
(Upside down)

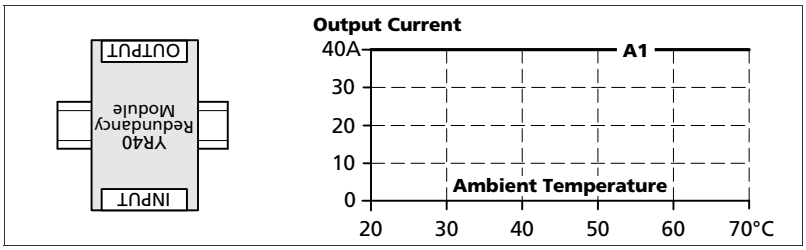


Fig. 17-5
Mounting Orientation C
(Table-top mounting)

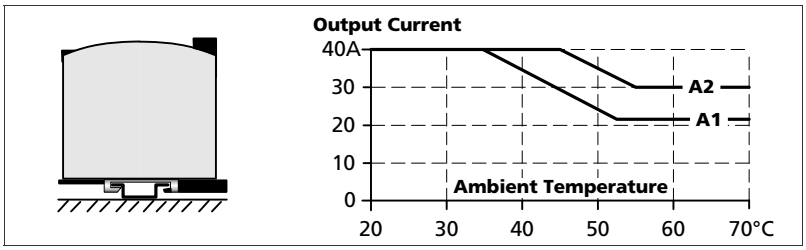


Fig. 17-6
Mounting Orientation D
(Horizontal cw)

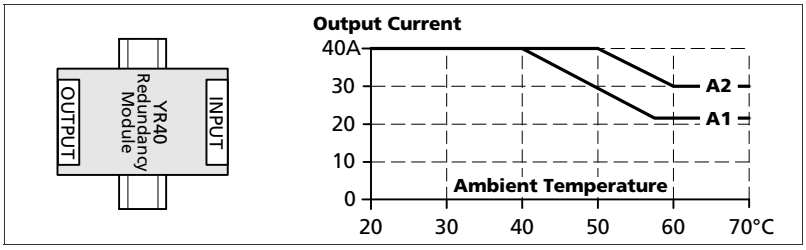
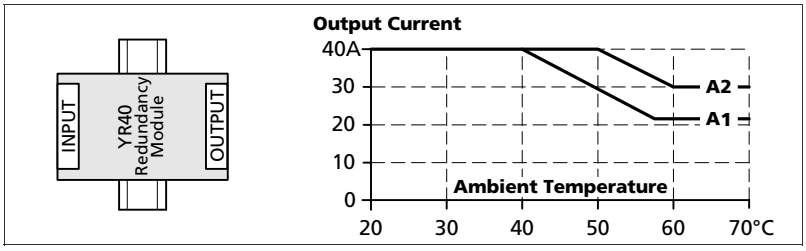


Fig. 17-7
Mounting Orientation E
(Horizontal ccw)



PULS

DIMENSION **Y-Series**

YR40.242

12-28V, 40A, DUAL REDUNDANCY MODULE

MOSFET REDUNDANCY MODULE

- For N+1 and 1+1 Redundant Systems
- Dual Input with Single Output
- Suitable for all DIMENSION Power Supplies Except QT20 and QTD20 Series
- Only 72mV Voltage Drop at 20A Output Current
- Only 1.7W Loss at 20A and 5.9W at 40A Output Current
- 160% (65A) Peak Load Capability
- Reverse Input Polarity Protection
- Full Power Between -40°C and +60°C
- Width only 36mm
- Rugged Metal Housing
- Easy Wiring: Distribution Terminal for Negative Pole Included
- 3 Year Warranty

GENERAL DESCRIPTION

The YR40.242 is a redundancy module, which can be used to build 1+1 and N+1 redundant systems. It is equipped with two input channels, which can be connected to power supplies with up to 20A output current and one output, which can carry nominal currents up to 40A. In addition to the YR40.242, the YR40.241 is also available. This unit has an additional circuit included, which generates a supply voltage for the internal mosfets even when the output of the unit is in a short circuit condition. This makes the unit suitable for any power supplies.

The novelty of this redundancy module is the utilization of mosfets instead of diodes for the decoupling of the two input channels. This reduces the heat generation and the voltage drop between input and output. The redundancy module does not require an additional auxiliary voltage.

Due to the low power losses, the unit is very slender and only requires 36mm width on the DIN-rail. Large connection terminals allow for a safe and fast installation. The large international approval package makes this unit suitable for nearly every application.

SHORT-FORM DATA

Input voltage	DC 12-28V	±30%
Input voltage range	8.4-36.4Vdc	
Input current	2x 0-20A	continuous
	2x 20-32.5A	for 5 seconds
Output current	0-40A	continuous
	40-65A	for 5 seconds
	max. 26A	in overload*) or short circuit mode
Input to output voltage drop	typ. 72mV	input: 2x10A
	typ. 112mV	input: 1x20A
	typ. 140mV	input: 2x20A
Power losses	typ. 230mW	at no load
	typ. 1.7W	input: 2x10A
	typ. 2.4W	input: 1x20A
	typ. 5.9W	input: 2x20A
Temperature range	-40°C to +70°C	operational
Derating	1A/°C (output)	+60 to +70°C
Dimensions **)	36x124x127mm	WxHxD
Weight	280g, 0.62lb	

*) Currents at voltages below 6V
**) Plus 4mm in depth for the screw terminal

ORDER NUMBERS

Redundancy Module	**YR40.242**	12-28V Standard unit
Accessory	ZM2.WALL	Wall/ panel mount bracket
	ZM11.SIDE	Side mount bracket

MARKINGS

c UL US LISTED IND. CONT. EO. UL 508

c US UL 60950-1

c SP US Class I Div 2

IECEx Ex ATEX II 3G Ex nA IIC T4 Gc

GL Marine

CE EMC, LVD

INDEX

TERMINOLOGY AND ABREVIATIONS

PE and ⏚ symbol PE is the abbreviation for **P**rotective **E**arth and has the same meaning as the symbol ⏚.

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.

DC 24V A figure displayed with the AC or DC before the value represents a nominal voltage with standard tolerances (usually ±15%) included.
E.g.: DC 12V describes a 12V battery disregarding whether it is full (13.7V) or flat (10V)

24Vdc A figure with the unit (Vdc) at the end is a momentary figure without any additional tolerances included.

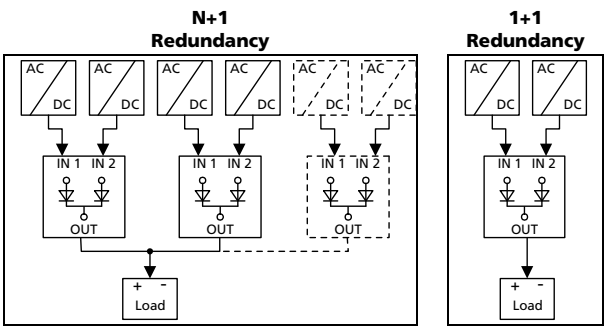
may A key word indicating flexibility of choice with no implied preference

shall A key word indicating a mandatory requirement

should A key word indicating flexibility of choice with a strongly preferred implementation

1+1 Redundancy Use of two identical power supplies in parallel to provide continued operation following most failures in a single power supply. The two power supply outputs should be isolated from each other by utilizing diodes or other switching arrangements. E.g. two 10A power supplies are needed to achieve a 10A redundant system.

N+1 Redundancy Use of three or more identical power supplies in parallel to provide continued operation following most failures in a single power supply. All power supply outputs should be isolated from each other by utilizing diodes or other switching arrangements.
E.g.: To achieve a 40A redundant system, five 10A power supplies are needed in a N+1 redundant system.



1. INTENDED USE

This redundancy module is designed for installation in an enclosure and is intended for the general use such as in industrial control, office, communication, and instrumentation equipment.

This redundancy module can be used with any DIMENSION power supplies except the QT20 series and the QTD20 series.

Do not use this redundancy module in equipment, where malfunction may cause severe personal injury or threaten human life.

This device is designed for use in hazardous, non-hazardous, ordinary or unclassified locations.

2. INSTALLATION REQUIREMENTS

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

This device does not contain serviceable parts.

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

Mount the unit on a DIN-rail so that the input terminals are located on the bottom and the output terminals on the top of the unit. For other mounting orientations see de-rating requirements of chapter 17.6 in this document.

This device is designed for convection cooling and does not require an external fan. Do not obstruct airflow and do not cover the ventilation grid (e.g. cable conduits) by more than 30%!

Keep the following installation clearances:
40mm on top,
20mm on the bottom,
5mm on the left and right sides are recommended when the device is loaded permanently with more than 50% of the rated output current. Increase the side clearance to 15mm in case the adjacent device is a heat source (e.g. another power supply). See chapter 17.3 for other allowed clearances when used with the PULS DIMENSION series in a 1+1 redundant configuration.

Use only power supplies with a negligible output ripple voltage in the low frequency range between 50Hz and 10kHz when used in marine applications according to the GL regulations.

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

- Turn power off before working on the device. Protect against inadvertent re-powering.
- Make sure that the wiring is correct by following all local and national codes.
- Do not open, modify or repair the unit.
- 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.

Notes for use in hazardous location areas:

The redundancy module is suitable for use in Class I Division 2 Groups A, B, C, D locations and for use in Group II Category 3 (Zone 2) environments and is evaluated according to EN 60079-0:2009 and EN 60079-15:2010.

WARNING EXPLOSION HAZARDS!

Substitution of components may impair suitability for this environment. Do not disconnect the unit unless power has been switched off or the area is known to be non-hazardous.

A suitable enclosure must be provided for the end product which has a minimum protection of IP54 and fulfils the requirements of the EN 60079-15:2010.

3. INPUT AND OUTPUT CHARACTERISTICS

Number of inputs	-	2	
Suitable power supplies		QS20, CPS20, …	Use only power supplies which are featured with the Hiccup^{PLUS} overload behavior
Number of outputs	-	1	
Input voltage	nom.	DC 12-28V ±30%	The input circuitry must meet the SELV requirements stipulated by IEC/EN/UL 60950-1.
Input voltage range	-	8.4-36.4Vdc	
Voltage drop, input to output	typ.	140mV	at 2x20A, see Fig. 3-1
	typ.	72mV	at 2x10A, see Fig. 3-1
	typ.	112mV	at 1x20A, see Fig. 3-2
Input current	nom.	2x 0-20A	continuous
	nom.	2x 20-32.5A	for 5 seconds
	max	2x 13A	in overload (voltage < 6V) or short circuit mode
Peak input current	max.	1000A	for max. 1ms per input
Output current	nom.	40A	continuous
	nom.	40-65A	for 5 seconds
	max.	26A	in overload (voltage < 6V) or short circuit mode
Reverse current	max.	1mA	at 24V, per input, -40°C to +70°C
Reverse voltage	max.	40Vdc	voltage applied to the output, continuously allowed
Output capacitance	typ.	320µF	

Fig. 3-1 **Input to output voltage drop when both inputs draw current**
(typical 1+1 redundant case, when the output voltages of the two units are equal)

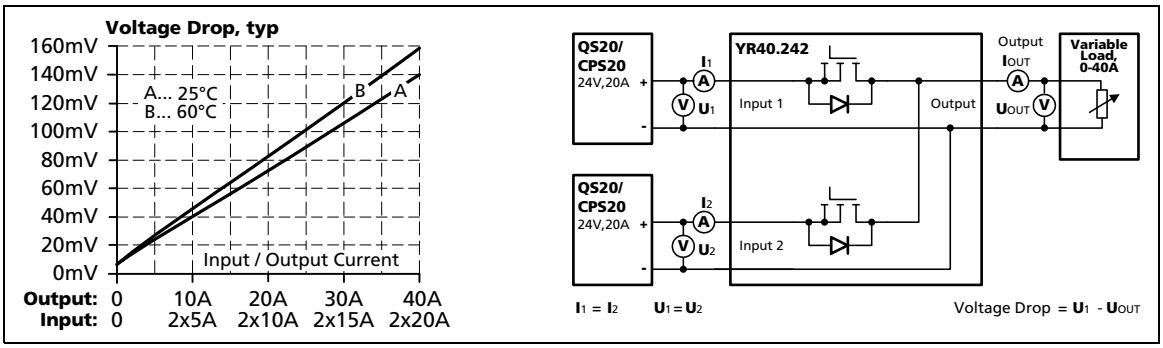
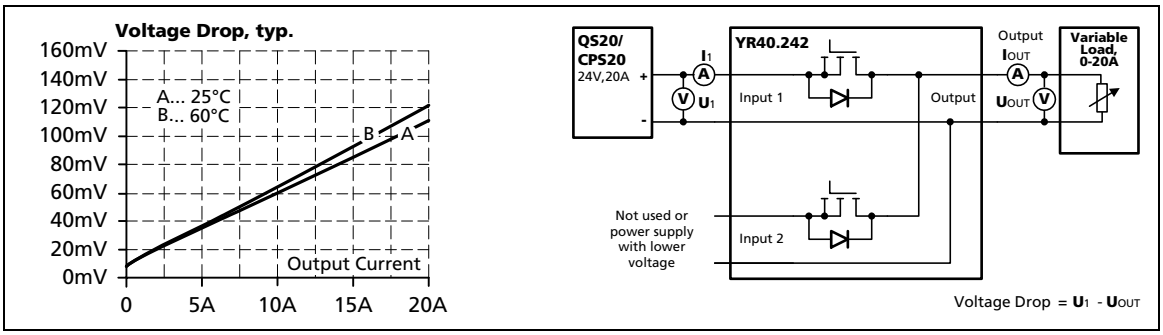


Fig. 3-2 **Input to output voltage drop when only one input draws current**



4. POWER LOSSES

		DC 12V	DC 24V	
Power losses	typ.	1.6W	1.7W	input: 2x10A
	typ.	5.8W	5.9W	input: 2x20A
	typ.	2.3W	2.4W	input: 1x20A, (only one input is connected to input voltage)
Standby power losses	typ.	0.07W	0.15W	at no output current, (only one input is connected to input voltage)
	typ.	0.12W	0.23W	at no output current, (both inputs are connected to input voltages)

Fig. 4-1 **Power losses when both inputs draw equal current**

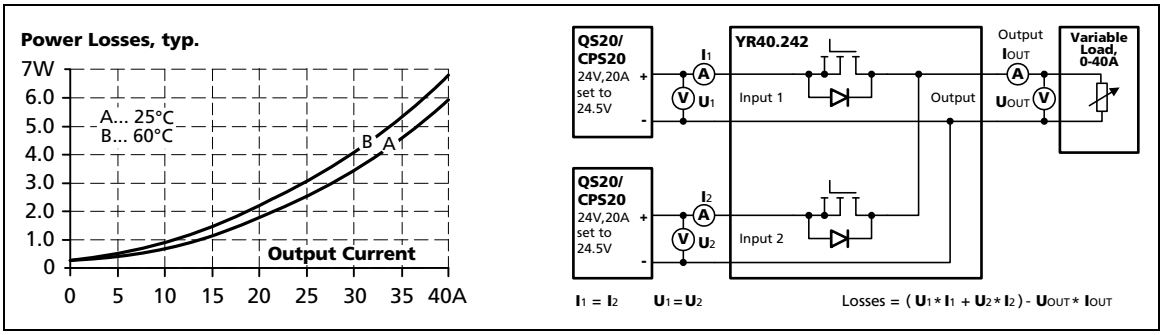
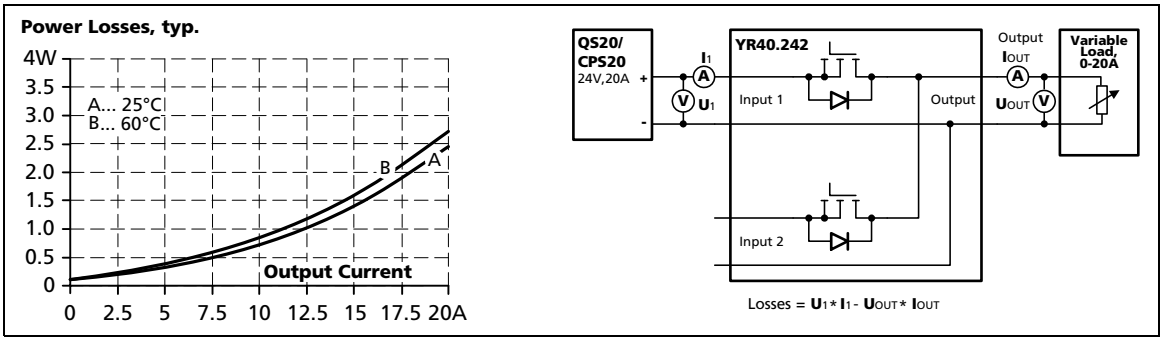


Fig. 4-2 **Power losses when only one input is used**



5. LIFETIME EXPECTANCY AND MTBF

The redundancy module has two input channels which are completely independent from each other. Each control circuit, auxiliary voltage source, or other circuitry in the module are designed separately for each input. The dual input redundancy module can be considered as two single redundancy modules combined together in one housing. The only common point is the circuit trace that ties the two separate circuits together at the output.

The MTBF figures below are for the entire dual input module. If the MTBF number of only one path is needed, simply double the value from the table.

Input / output current conditions	**Input: 2x10A Output: 20A**	**Input: 2x20A Output: 40A**	
Lifetime expectancy*)	672 000h *)	255 000h *)	at 24V and 40°C
	1 900 000h *)	720 000h *)	at 24V and 25°C
MTBF**) SN 29500, IEC 61709	7 234 000h	4 533 000h	at 24V 40°C
	12 445 000h	8 218 000h	at 24V 25°C
MTBF**) MIL HDBK 217F	325 000h	294 000h	Ground Fixed GF40 (24V and 40°C)
	438 000h	392 000h	Ground Fixed GF25 (24V and 25°C)
	1 588 000h	1 457 000h	Ground Benign GB40 (24V and 40°C)
	2 159 000h	1 964 000h	Ground Benign GB25 (24V and 25°C)

*) The **Lifetime expectancy** shown in the table indicates the minimum operating hours (service life) 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 life of up to 15 years (131 400h). Any number exceeding this value is a calculated theoretical lifetime which can be used to compare devices.

) **MTBF stands for **M**ean **T**ime **B**etween **F**ailure, 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 000h means that statistically one unit will fail every 100 hours if 10 000 units are installed in the field. However, it can not be determined if the failed unit has been running for 50 000h or only for 100h.

6. TERMINALS AND WIRING

	Input	Output
Type	Screw termination IP20 Finger safe construction. Suitable for field installation.	Screw termination IP20 Finger safe construction. Suitable for field installation.
Solid wire	0.5-6mm^2	0.5-16mm^2
Stranded wire	0.5-4mm^2	0.5-10mm^2
American Wire Gauge	20-10 AWG	22-8 AWG
Max. wire diameter	2.8mm (including ferrule)	5.2mm (including ferrule)
Wire stripping length	7mm / 0.275inch	12mm / 0.5inch
Screwdriver	3.5mm slotted or Pozidrive No 2	3.5mm slotted or Pozidrive No 2
Recommended tightening torque	0.8Nm, 7lb.in	1.2Nm, 10.6lb.in

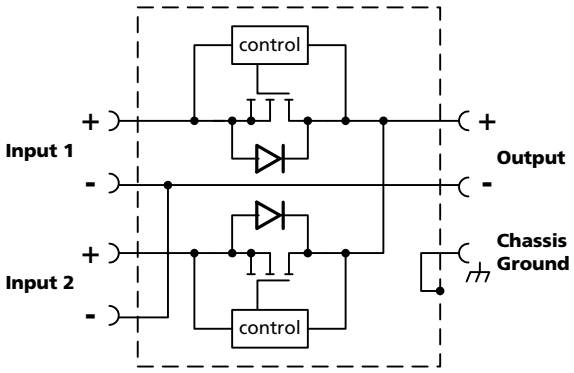
To connect the chassis to ground, use a ring-type terminal (ring cable lug) which is suitable for a M4 screw and connect it to the chassis ground terminal on top of the unit.

Instructions:

a) The external circuitry of all terminals must meet the safety requirements stipulated by IEC/EN/UL 60950-1: SELV.
b) 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 and
   90°C for ambient up to 70°C minimum.
c) Follow national installation codes and installation regulations!
d) Ensure that all strands of a stranded wire enter the terminal connection!
e) Screws of unused terminal compartments should be securely tightened.
f) Ferrules are allowed.
g) Do not connect or disconnect the wires from the terminals below -25°C (-13°F).

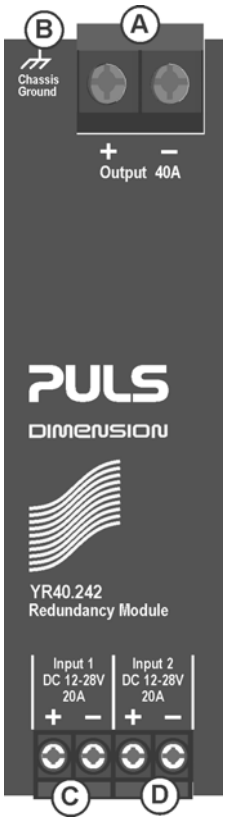
7. FUNCTIONAL DIAGRAM

Fig. 7-1 **Functional diagram**



8. FRONT SIDE AND USER ELEMENTS

Fig. 8-1 **Front side**



A **Output Terminals** (screw terminals)

B **Chassis Ground Terminals**
To be connected on the top side of the housing with a ring-type terminal (ring cable lug) which is suitable for a M4 screw.
Connection of the chassis is optional and not required since the unit fulfils the requirements according to protection class III.

C **Input Terminals for Input 1** (screw terminals)

D **Input Terminals for Input 2** (screw terminals)

9. EMC

The redundancy module is suitable for applications in industrial environment as well as in residential, commercial and light industry environment without any restrictions. A detailed EMC report is available on request.

EMC Immunity	According generic standards: EN 61000-6-1 and EN 61000-6-2			
Electrostatic discharge	EN 61000-4-2	Contact discharge Air discharge	8kV 15kV	Criterion A Criterion A
Electromagnetic RF field	EN 61000-4-3	80MHz-2.7GHz	20V/m	Criterion A
Fast transients (Burst)	EN 61000-4-4	Input lines Output lines	2kV 2kV	Criterion A Criterion A
Surge voltage on input lines	EN 61000-4-5	+ → - +/- → Chassis ground	500V 1kV	Criterion A Criterion A
Surge voltage on output lines	EN 61000-4-5	+ → - +/- → Chassis ground	500V 1kV	Criterion A Criterion A
Conducted disturbance	EN 61000-4-6	0.15-80MHz	20V	Criterion A
Power-frequency magnetic field *)	EN 61000-4-8	50Hz	30A/m	Criterion A

Criterions:

A: Redundancy module shows normal operation behavior within the defined limits.

Notes:

***)** A test is not applicable according to EN 61000-6-2, since the device does not contain components susceptible to magnetic fields, e.g. hall elements, electrodynamic microphones, etc.

EMC Emission	According generic standards: EN 61000-6-3 and EN 61000-6-4	
Conducted emission	IEC/CISPR 16-1-2, IEC/CISPR 16-2-1	limits for DC power ports according EN 61000-6-3 fulfilled *)
Radiated emission	EN 55011, EN 55022	Class B

This 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.

*) For information only, not mandatory for EN 61000-6-3. Provided, that power sources connected on the inputs fulfill the requirements too.

Switching frequency	The internal auxiliary supply is generated with a boost converter. The switching frequency varies from 140kHz to 500kHz depending on the input voltage.

10. ENVIRONMENT

Operational temperature *)	-40°C to +70°C (-40°F to 158°F)	
Storage temperature	-40 to +85°C (-40°F to 185°F)	for storage and transportation
Output de-rating	1A / °C	60-70°C (140°F to 158°F)
Humidity **)	5 to 95% r.H.	IEC 60068-2-30
Vibration sinusoidal***)	2-17.8Hz: ±1.6mm; 17.8-500Hz: 2g 2 hours / axis	IEC 60068-2-6
Shock***)	30g 6ms, 20g 11ms 3 bumps / direction, 18 bumps in total	IEC 60068-2-27
Altitude	0 to 2000m (0 to 6 560ft)	without any restrictions
	2000 to 6000m (6 560 to 20 000ft)	reduce output power or ambient temperature, see Fig. 10-2
Altitude de-rating	2.5A/1000m or 5°C/1000m	> 2000m (6500ft), see Fig. 10-2
Over-voltage category	not applicable	The concept of the overvoltage category is used for equipment energized directly from the low voltage mains (IEC 60664-1 §4.3.3.2.1).
Degree of pollution	2	IEC 62103, EN 50178, not conductive
LABS compatibility	The unit does not release any silicone or other LABS-critical substances and is suitable for use in paint shops.	

*) Operational temperature is the same as the ambient temperature and is defined as the air temperature 2cm below the unit.
**) Do not energize while condensation is present
***) Tested in combination with DIN-Rails according to EN 60715 with a height of 15mm and a thickness of 1.3mm and standard mounting orientation.

Fig. 10-1 **Output current vs. ambient temp.**

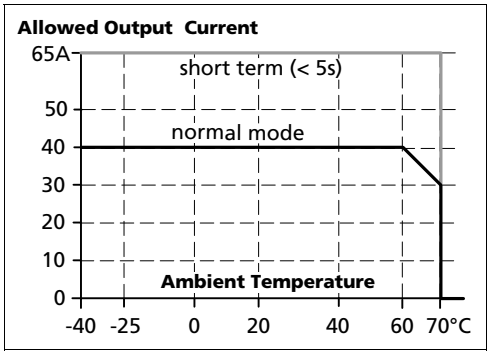
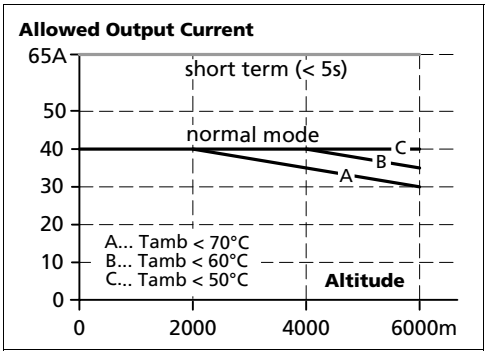


Fig. 10-2 **Output current vs. altitude**



11. PROTECTION FEATURES

Output over-current protection	not included	
Reverse input polarity protection	included	unit does not start when input voltage is reversed
Degree of protection	IP 20	EN/IEC 60529
Penetration protection	> 3.6mm	e.g. screws, small parts
Over-temperature protection	not included	
Input transient protection	not included	
Output transient protection	included	see EMC section
Internal input fuse	not included	

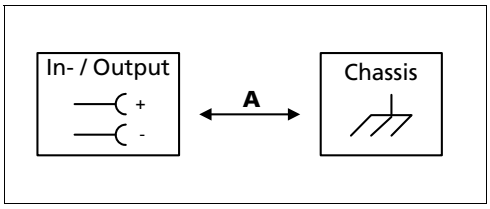
12. SAFETY FEATURES

Input / output separation	no galvanic separation	Mosfet between input and output
Class of protection	III	PE (Protective Earth) or chassis connection not required
PE resistance	< 0.1Ohm	between housing and chassis-ground terminal

13. DIELECTRIC STRENGTH

The input and output voltages have the same reference, are floating and have no ohmic connection to ground.
Type and factory 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 (2s up and 2s down). Connect input/output terminals together before conducting the test.
When testing, set the cut-off current settings to the value in the table below.

Fig. 13-1 **Dielectric strength**



		A
Type test	60s	500Vac
Factory test	5s	500Vac
Field test	5s	500Vac
Cut-off current setting		> 2mA

14. APPROVALS

EC Declaration of Conformity	CE	The CE mark indicates conformance with the - EMC directive 2004/108/EC, - Low-voltage directive (LVD) 2006/95/EC and - RoHS directive 2011/65/EU.
EC Declaration of Conformity ATEX	CE	The CE mark indicates conformance with the - ATEX directive 94/9/EC (Equipment and protection systems intended for use in potentially explosive atmospheres)
IEC 60950-1	IECEE CB SCHEME	CB Scheme, Information Technology Equipment
UL 508	c UL US LISTED IND. CONT. EQ.	Listed for use as Industrial Control Equipment; U.S.A. (UL 508) and Canada (C22.2 No. 107-1-01); E-File: E198865
UL 60950-1	c UL us	Recognized for use as Information Technology Equipment, Level 5; U.S.A. (UL 60950-1) and Canada (C22.2 No. 60950); E-File: E137006
HazLoc (Class 1 Div 2) ANSI / ISA 12.12.01-2007	C SP US	LISTED for use in Hazardous Location Class I Div 2 T4 Groups A,B,C,D systems; U.S.A. (ANSI / ISA 12.12.01-2007) and Canada (C22.2 No. 213-M1987)
ATEX EN 60079-0, EN 60079-15	Ex II 3G Ex nA IIC T4 Gc	Suitable for use in Category 3 Zone 2 locations. Number of ATEX certificate: EPS 11 ATEX 1 312 X The redundancy module must be built-in in an IP54 enclosure.
IECEx IEC 60079-0, IEC 60079-15	IECEx Ex nA IIC T4 Gc	Suitable for use in Category 3 Zone 2 locations. Number of IECEx certificate: IECEx EPS 12.0032X
Marine	GL	GL (Germanischer Lloyd) classified Environmental category: C, EMC1 Marine and offshore applications
GOST R		Certificate of Conformity for Russia and other GUS countries

15. PHYSICAL DIMENSIONS AND WEIGHT

Weight	280g / 0.62lb
DIN-Rail	Use 35mm DIN-rails according to EN 60715 or EN 50022 with a height of 7.5 or 15mm. The DIN-rail height must be added to the unit depth (127mm) to calculate the total required installation depth.
Installation clearances	See chapter 2

Fig. 15-1 **Front view**

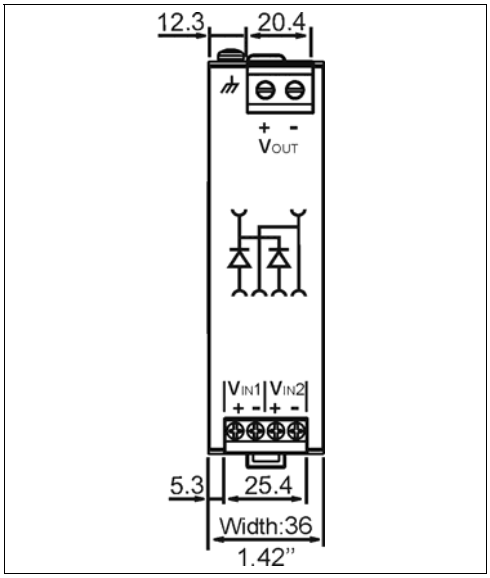
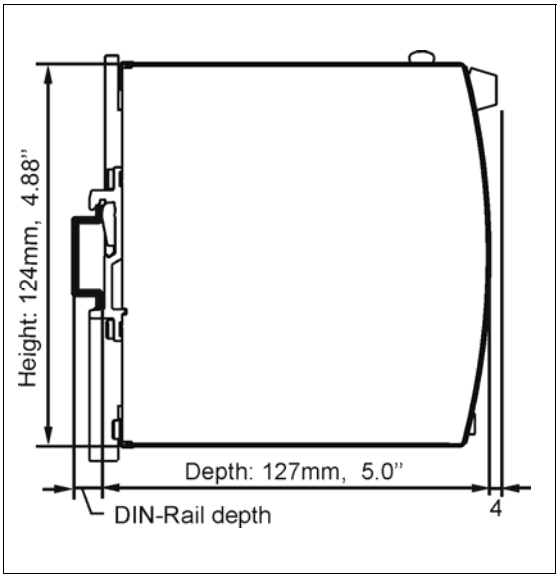


Fig. 15-2 **Side view**



16. ACCESSORIES

ZM2.WALL Wall mounting bracket

This standard bracket is used to mount the YR40.242 redundancy module onto a flat surface without utilizing a DIN-Rail.

Fig. 16-1 **ZM2.WALL Wall mounting bracket**

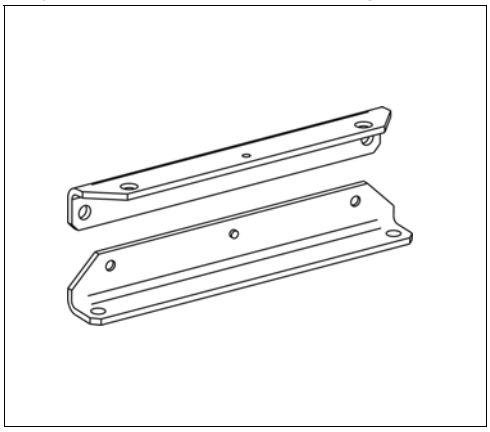
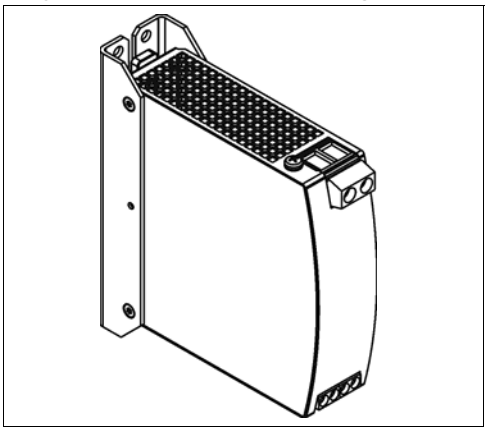


Fig. 16-2 **Assembled wall mounting bracket**



ZM11.SIDE Side mounting bracket

This bracket is used to mount the YR40.242 redundancy module sideways with or without utilizing a DIN-Rail.

The two aluminum brackets and the black plastic slider of the unit have to be detached, so that the steel brackets can be mounted.

For sideway DIN-rail mounting, the removed aluminum brackets and the black plastic slider need to be mounted on the steel bracket.

Fig. 16-3
ZM11.SIDE Side mounting bracket

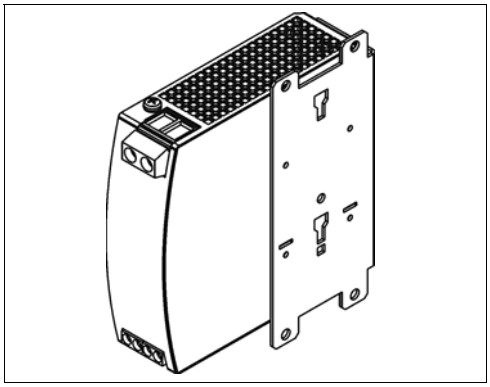
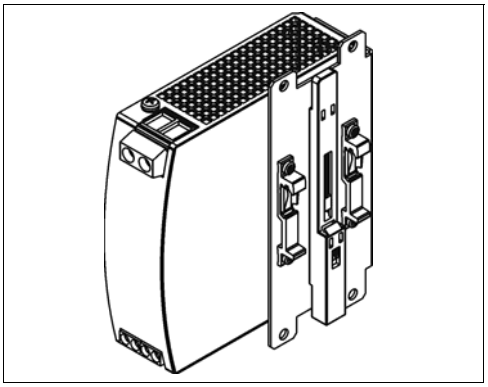


Fig. 16-4
Side mounting with DIN-rail brackets



17. APPLICATION NOTES

17.1. RECOMMENDATIONS FOR REDUNDANCY

Recommendations for the configuration of redundant power systems:

- Use separate input fuses for each power supply.
- Use three-phase power supplies to gain functional safety if one phase fails.
- When single-phase power supplies are utilized connect them to different phases or mains circuits if possible.
- Set the power supply in "Parallel-Use" mode if this feature is available
- It is desirable to set the output voltages of all power supplies to the same value.

17.2. INDUCTIVE AND CAPACITIVE LOADS

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

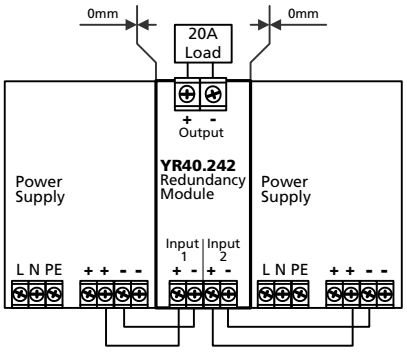
17.3. SIDEWARDS INSTALLATION CLEARANCES

The minimum clearance recommendations are defined in chapter 2.

Normally, the following installation clearance are recommended: 40mm on top, 20mm on the bottom, 5mm on the left and right sides when the device is loaded permanently with more than 50% of the rated power. Increase this clearance to 15mm in case the adjacent device is a heat source (e.g. another power supply).

The clearance between the power supplies and the redundancy module can be reduced to zero under the following conditions:

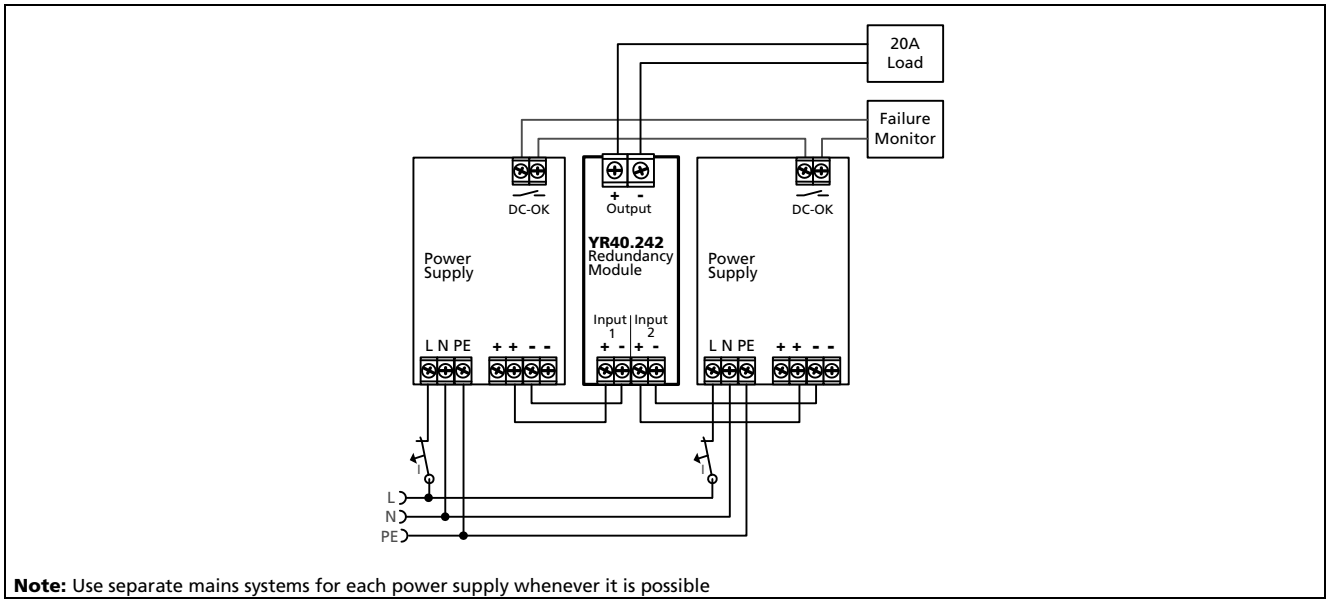
- 1+1 redundancy application with maximum 20A output current.
- The power supplies are from the PULS DIMENSION series.
- The redundancy module is placed between the two power supplies.
- The output voltage is set to the same level on both power supplies.



17.4. 1+1 REDUNDANCY UP TO 20A

1+1 Redundancy up to 20A requires two 20A power supplies and one YR40.242 redundancy module.

Fig. 17-1 **Wiring diagram, 1+1 Redundancy, 20A output current**

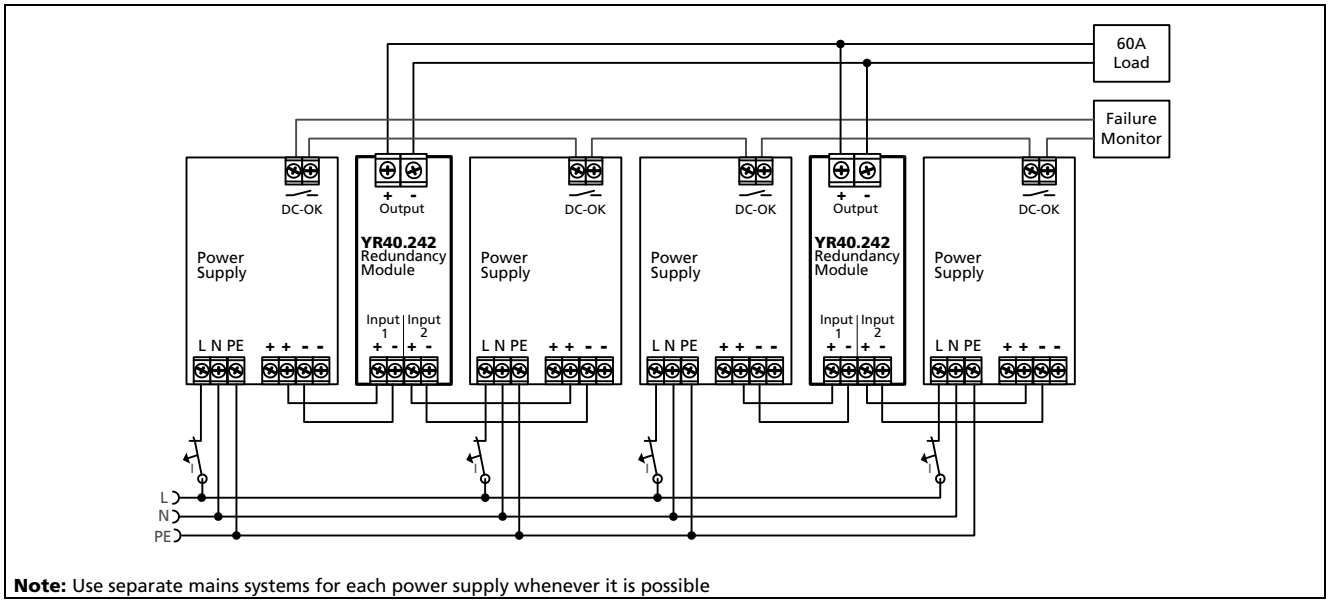


Note: Use separate mains systems for each power supply whenever it is possible

17.5. N+1 REDUNDANCY, EXAMPLE WITH 60A

N+1 Redundancy up to 60A requires four 20A power supplies and two YR40.242 redundancy modules.

Fig. 17-2 **Wiring diagram, n+1 Redundancy, 60A output current**



Note: Use separate mains systems for each power supply whenever it is possible

17.6. 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 maximum 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. 17-3
Mounting Orientation A
(Standard orientation)

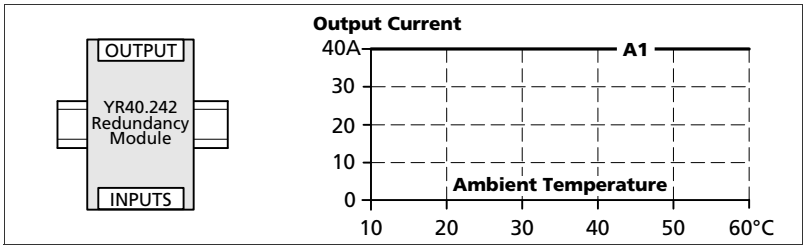


Fig. 17-4
Mounting Orientation B
(Upside down)

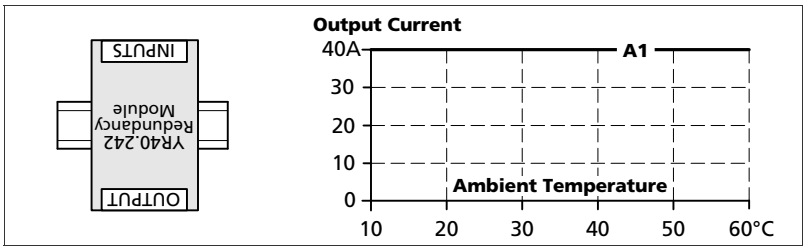


Fig. 17-5
Mounting Orientation C
(Table-top mounting)

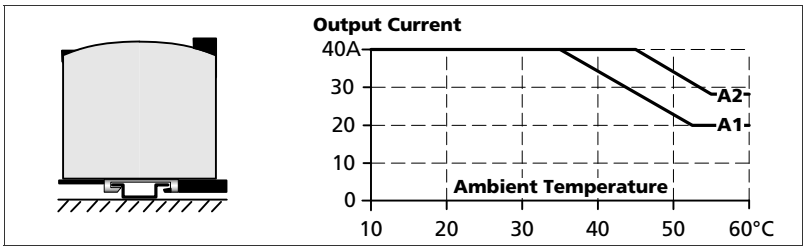


Fig. 17-6
Mounting Orientation D
(Horizontal cw)

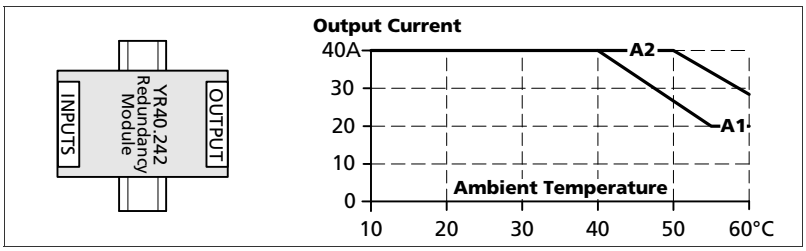


Fig. 17-7
Mounting Orientation E
(Horizontal ccw)