POWER SUPPLY 3AC 24V 500W

- IP65/67 degree of protection
- 1000W$_{peak}$ 5s
- 3AC 380-480V wide-range input
- Up to 4 switchable outputs
- 95.6% full load and excellent partial load efficiencies
- DIN rail mounting possible, option “D”
- Output connected to PE (PELV)
- Version without connection to PE on request
- Large output capacitors
- Not potted
- Negligible low input inrush current surge
- Full power between -25°C and +55°C
- IO-Link
- 3 years warranty

GENERAL DESCRIPTION

The **FPT500** is an industrial grade power supply for the 3-phase mains system incorporated in a rugged wall-mount housing with a degree of protection IP65/67.

It provides two to four stabilized outputs that is galvanically separated from the input. The negative potential of the outputs is permanently connected to PE within the unit.

The most outstanding features of the FPT series are the compact size, the wide operational temperature range, the extremely low input inrush current and the very high efficiencies, which are achieved by various design technologies. Large sized output capacitors can absorb and store regenerative energy from breaking motors.

Various connector options support the different needs of individual applications. Please contact PULS for possible options. High immunity to transients and power surges as well as low electromagnetic emission and an international approval package makes usage in nearly every application possible.

SHORT-FORM DATA

Output voltage	DC 24V	Nominal
Adjustment range	24-28V	Factory setting 24.5V
Output power	Continuous:	Up to:
	600 / 500 / 350W	+45 / +55 / +70°C
	Short term up to 5s	
	1000 / 700W	+55 / +70°C
Number of outputs	Up to: 4	
Output currents	Settable per output; up to 12A	
Input voltage	3AC 380-480V	±15%
Power factor	0.94 / 0.95	At 3x400 / 480Vac
AC Inrush current	1.9 / 1.8A$_{peak}$	At 3x400 / 480Vac
Efficiency	95.8 / 95.6%	At 3x400 / 480Vac
Losses	20.8 / 23 W	At 3x400 / 480Vac
Hold-up time	24 / 24ms	At 3x400 / 480Vac
Temperature range	-25°C to +70°C	
	Derate linearly from +45°C to +70°C	
Size (wxhxd)	182x183x59mm	Without connectors
Weight	1200g / 3.4lb	

ORDER NUMBERS

Description: Power supply FPT500

Order Number	Input	Output
CE **FPT500.245-020-101***	M12-S	3x 7/8" 4pin
FPT500.245-018-103*	M12-S	2x 7/8" 4pin
CE **FPT500.245-036-104***	M12-S	3x M12-L
FPT500.245-034-105*	M12-S	2x M12-L
CE **FPT500.245-044-109***	M12-S	4x M12-T

Accessories: Chapter 21
Related Products Chapter 22

***For DIN rail mounting PSU: (Order Number)D**
e.g. FPT500.245-020-101D

CE Pending Planned for Q2/2021

MAIN APPROVALS

For details or a complete approval list, see chapter 21.

IECEE CB SCHEME
IEC 62368-1
IEC 61010-2-201

c UL us LISTED

CE

All parameters are specified at 24V, 20A, 400Vac, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.

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.
3AC 400V	A figure displayed with the AC or DC before the value represents a nominal voltage with tolerances (usually ±15%) included. E.g.: DC 12V describes a 12V battery disregarding whether it is full (13.7V) or flat (10V)
3x 400Vac	A figure with the unit (Vac) at the end is a momentary figure without any additional tolerances included.
50Hz vs. 60Hz	As long as not otherwise stated, 3AC 400V parameters are valid at 50Hz mains frequency.
may	A key word indicating flexibility of choice with no implied preference.
shall	A key word indicating a mandatory requirement.
should	A key word indicating flexibility of choice with a strongly preferred implementation.

All parameters are specified at 24V, 20A, 400Vac, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.

1. Intended Use

This device is designed for indoor use and is intended for commercial applications, such as in industrial control, process control, monitoring and measurement equipment.

Do not use this device in equipment where malfunction may cause severe personal injury or threaten human life. If this device is used in a manner outside of its specification, the protection provided by the device may be impaired.

2. Installation Instructions

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

- Turn power off before working on the device. Protect against inadvertent re-powering.
- Do not open, modify or repair the device.
- 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.
- Install the device on a large enough flat surface. Sharp edges on the back may cause injury.
- If damages or malfunctioning occur during installation or operation, immediately turn power off and send unit to the factory for inspection.
- The device is designed as “Class of Protection I” equipment according to IEC 61140. Do not use without a proper PE (Protective Earth) connection.

⚠ WARNING Risk of damages on the device

- Keep the following minimum installation clearances: 50mm on top, 50mm on the bottom, 10mm on the front and10 left and right side.
- The maximum surrounding air temperature is +70°C (+158°F). The operational temperature is the same as the ambient or surrounding air temperature and is defined 2cm below the device.
- The device is designed to operate in areas between 5% and 95% relative humidity.
- Clean only with a damp cloth.

Obey the following installation instructions:

This device may only be installed and put into operation by qualified personnel. This device does not contain serviceable parts. The tripping of an internal fuse is caused by an internal defect. Install the device onto a flat surface with the terminals on the bottom of the device. Other mounting orientations require a reduction in output power, chapter 23.6.

For wall mounting use 4 screws. Two on top and 2 on bottom mounting holes. Recommended screw size is M4 (UNC 8-32). The enclosure of the device provides a degree of protection of IP65/67 when installed with all mating connectors firmly connected. The device is designed for pollution degree 3 areas in controlled environments.

The negative potential of the outputs is permanently connected to PE within the unit. Do not connect the negative potential of any output to PE outside the unit.

For TN,TT mains systems with earthed neutral and IT star mains systems with insulation monitoring the device is designed for overvoltage category III zones up to 2000m (6560ft) and for overvoltage category II zones up to 5000m (16400ft).

For TN, TT, IT delta mains systems or IT star mains systems without insulation monitoring the device is intended for overvoltage category II zones up to 2000m (6560ft). The device is designed to be safe in case of a single phase loss and does not require an external protection. Functionality is limited see chapter 23.3.

The device is designed for altitudes up to 5000m (16400ft). Above 2000m (6560ft) a reduction in output current is required and the operation is limited according mains systems described above. The device is designed, tested and approved for branch circuits up to 20A (UL) and 32A (IEC) without additional protection device. If an external fuse is utilized, do not use circuit breakers smaller than 6A B- or C-characteristic to avoid a nuisance trip. A disconnecting means shall be provided for the input of the device. This must be suitably located and easily accessible. The disconnecting means must be marked as the such for the device.

All parameters are specified at 24V, 20A, 400Vac, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.

3. AC-Input

The device is suitable to be supplied from TN, TT or IT mains networks. For more details, please review chapter 2.

AC input voltage rated range	Nom.	3AC 380-480V	
AC input operating range		3x 323-552Vac	
Input frequency	Nom.	50–60Hz	±6%
Turn-on voltage	Typ.	3x 320Vac	Steady-state value, see Fig. 3-1
Shut-down voltage	Typ.	3x 300Vac	Steady-state value, see Fig. 3-1
Loss of one phase	will continue to operate without interruption if loaded below limits in figure see Fig. 23-1		
External input protection	See recommendations in chapter 2 .		

		3AC 400V	**3AC 480V**	
Input current	typ.	0.8A	0.66A	At 500W, symmetrical phase voltages, see Fig. 3-3 Power
Power factor	typ.	0.94	0.95	At 500W, see Fig. 3-4
Start-up delay	typ.	2s	2s	At 500W symmetrical phase voltages, see Fig. 3-2
Rise time	typ.	1ms	1ms	At 500W constant current load, 0mF load, see Fig. 3-2
Turn-on overshoot	Max.	500mV	500mV	See Fig. 3-2

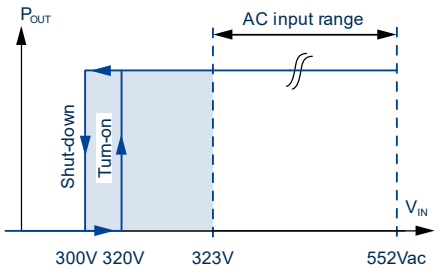


Fig. 3-1: Input voltage range

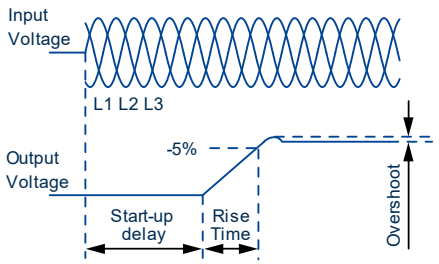


Fig. 3-2: Turn-on behavior, definitions

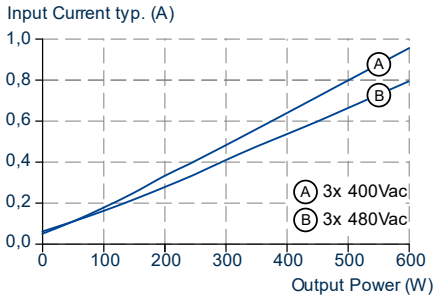


Fig. 3-3: Input current vs. output power at 24V output voltage

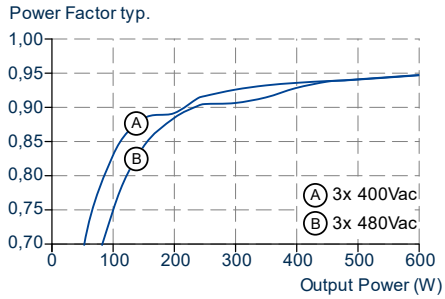


Fig. 3-4: Power factor vs. output power at 24V output voltage

All parameters are specified at 24V, 20A, 400Vac, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.

4. DC-Input

Do not operate this power supply with DC-input voltage.

5. Input Inrush Current

The power supply is equipped with an active inrush current limitation circuit, which limits the input inrush current after turn-on to an extremely low value. The inrush current is usually smaller than the steady state input current.

		3AC 400V	3AC 480V	
Inrush current *)	max.	$2.1A_{peak}$	$2A_{peak}$	Temperature independent
	typ.	$1.9A_{peak}$	$1.8A_{peak}$	Temperature independent

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

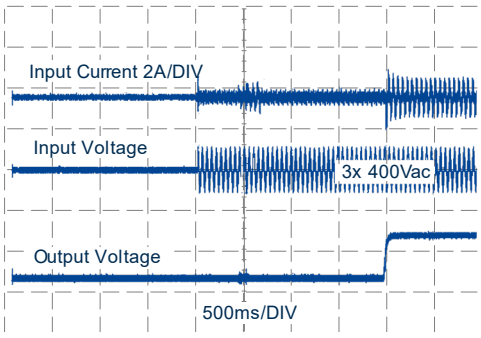


Fig. 5-1: Typical turn-on behavior at nominal load and 25°C ambient temperature

All parameters are specified at 24V, 20A, 400Vac, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.

6. Output

The outputs provide a (PELV/ES1) rated voltage, which is galvanically isolated from the input voltage. The negative potential of the outputs is permanently connected to PE within the unit. Do not connect any output to PE (Ground)

The device is designed to supply any kind of loads, including capacitive and inductive loads. If capacitors with a capacitance >20mF are connected to one output, this output might switch off after turning the unit or the output on or connecting the load.

All outputs are individually current limited. In case of an overload, the individual output switches off and needs to be reset manually with the reset button on the front of the device or with IO-Link. A cycling of the input power does not reset the output. The failure signals are stored until a reset is intentionally initiated.

For protection reasons a delay of at least 5 seconds is mandatory, before an output can be reset after it has switched off. Otherwise the green LED will be flickering after pushing the button. The unit will be shipped with all outputs turned on. The ON/OFF function has no safety feature included.

The sum of the configured output power of all outputs may exceed the total output power of available power. If this is the case, the output with the highest number will switch off first followed by the next output to ensure that the lower output number will supply continuous power and see no voltage dips.

Outputs start sequentially from 1 to 4 with an interval of 150ms.

Number of outputs		4	
Output voltage	Nom.	24V	Factory setting 24.5V
Adjustment range		24-28V	Adjustable in steps: 24V, 24.5V, 25V, 25.5V, 26V, 26.5V, 27V and 28V
Factory setting	Typ.	24.5V	±0.2%, at nominal load
Line regulation	Max.	10mV	Between 3x323 and 552Vac input voltage change
Load regulation	Typ.	100mV	Between 0 and 600W output load, static value
Ripple and noise voltage	Max.	100mVpp	Bandwidth 20Hz to 20MHz, 50Ohm

Output current

Order number	Outputs	Connector	Max. current	Picture
FPT500.245-020-101	3	7/8” 4pin	10A each output	Fig. 6-2
FPT500.245-018-103	4	7/8” 4pin	10A each output	Fig. 6-2
FPT500.245-036-104	3	M12-L	12A each output	Fig. 6-1
FPT500.245-034-105	4	M12-L	12A each output	Fig. 6-1
FPT500.245-044-109	4	M12-T	12A each output	Fig. 6-1
FPT500.245-053-113	2	7/8” 5pin	10A each output	Fig. 6-2

Total output power	Nom.	600W	Up to +45°C at ambient temperatures, for the sum of all outputs.
	Nom.	500W	At +55°C at ambient temperatures, for the sum of all outputs.
	Nom.	350W	At +70°C at ambient temperatures, for the sum of all outputs.
short term up to 5s	Nom.	1000W	Up to +55°C at ambient temperatures, for the sum of all outputs.
	Nom.	700W	At +70°C at ambient temperatures, for the sum of all outputs.
		Derate linearly between +45°C and +70°	
Overload behavior		Trip curve	See Fig. 6-1 and Fig. 6-2
Output capacitance	Typ.	12 500µF	Included inside the power supply, common for all four outputs
Parallel Use			Do not parallel units for higher output currents
Back-feeding loads	Max.	35V / 4J	The unit is resistant and does not show a malfunction when a load feeds back voltage to the power supply. It does not matter whether the power supply is on or off. For all four outputs in total

All parameters are specified at 24V, 20A, 400Vac, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.

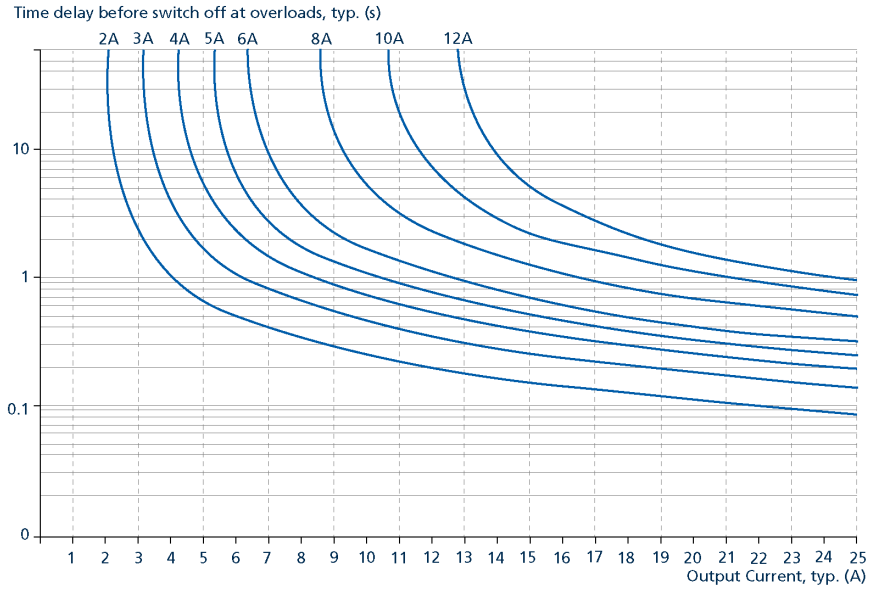


Fig. 6-1: Trip curve diagram for max 12A

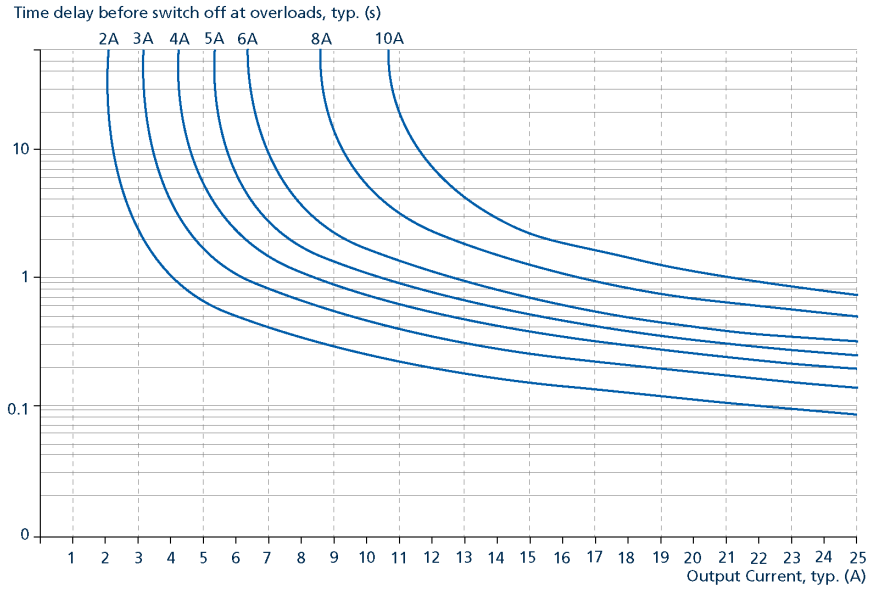


Fig. 6-2: Trip curve diagram for max 10A

All parameters are specified at 24V, 20A, 400Vac, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.

7. Hold-up Time

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

		3AC 400V	3AC 480V	
Hold-up Time	typ.	56ms	56ms	At 250W output load, see Fig. 7-1
	min.	47ms	47ms	At 250W output load, see Fig. 7-1
	typ.	24ms	24ms	At 500W output load, see Fig. 7-1
	min.	20ms	20ms	At 500W output load, see Fig. 7-1

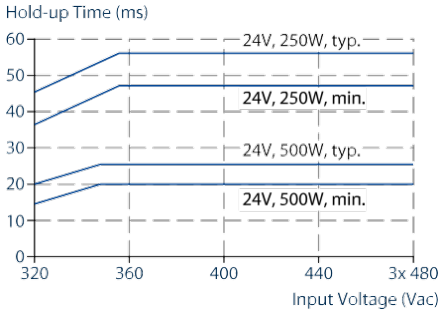


Fig. 7-1: Hold-up time vs. input voltage

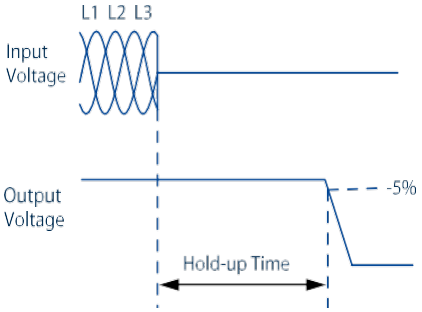


Fig. 7-2: Shut-down behavior, definitions

8. IO-Link Interface

This power supply is equipped with an IO-Link interface compliant to IO-Link protocol V1.1 (M12 male, A-coded) on the device bottom side and can be connected to any IO-Link masters compliant to V1.1 of IO-Link protocol. The Pin Assignment is shown in Fig. 8-1.

It is possible to operate the power supply without IO-Link communication. Due to a built-in EEPROM, the power supply can also be operated with values which have previously been updated via IO-Link also in case of no IO-Link master is connected or in case of defective IO-Link connection.

Via IO-Link the power supply can communicate current status, in-/output values and it is also possible to configure the output voltage, set current limit per output as well as to remotely shut-down the power supply.

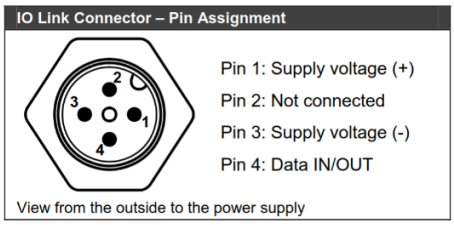


Fig. 8-1: IO-Link Interface Pin Assignment

In order to operate the IO-Link interface it is required to install/upload the IODD-File (IO-Link Device Description) into the connected IO-Link master in the first step. The most recent IODD File can be found on the PULS website (www.pulspower.com) in the product download section of the product page. The device can be accessed via IO-Link also, if the power supply is not connected to AC-mains and switched off

IO-Link Version	V1.1 masters with V1.1	To get full performance, it is recommended to use IO-Link
Baud-Rate	COM3 (230.4 kBaud)	
Cycle Time	2ms	Cycle time refers to the Process Data communication speed
SIO-Mode	yes	
Process Data Length	23 bytes	

All data types used are listed and described in the chapter 24.

All parameters are specified at 24V, 20A, 400Vac, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.

9. Efficiency And Power Losses

		3AC 400V	3AC 480V	
Efficiency	typ.	95.8%	95.6%	At 24V, 500W
Average efficiency	typ.	94.2%	94%	25% at 120W, 25% at 250W, 25% at 370W, 25% at 500W
Power losses	typ.	2.5W	2.5W	At 24V, 0W (no load)
	typ.	12W	13W	At 24V, 250W (half load)
	typ.	22W	23W	At 24V, 500W (full load)

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

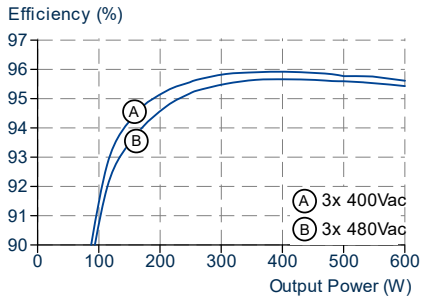


Fig. 9-1: Efficiency vs. output power at 24V, typ.

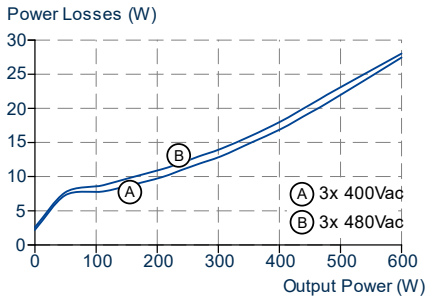


Fig. 9-2: Losses vs. output power at 24V, typ.

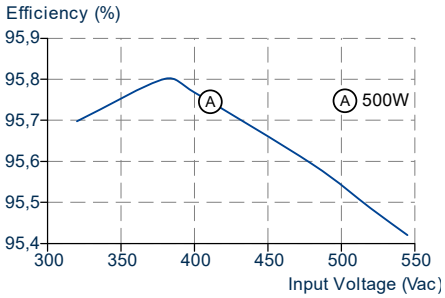


Fig. 9-3: Efficiency vs. input voltage at 24V, 500W, typ.

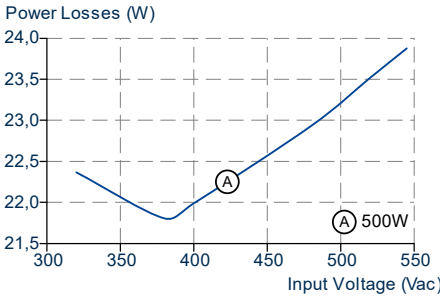


Fig. 9-4: Losses vs. input voltage at 24V, 500W, typ.

All parameters are specified at 24V, 20A, 400Vac, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.

10. Lifetime Expectancy

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.

	3AC 400V	3AC 480V	
Calculated lifetime expectancy	43 000h	37 000h	At 24V, 500W and 40°C
	177 000h	168 000h	At 24V, 250W and 40°C
	135 000h	119 000h	At 24V, 500W and 25°C
	466 000h	476 000h	At 24V, 250W and 25°C

11. MTBF

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.

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.

For these types of units the MTTF (**M**ean **T**ime **T**o **F**ailure) value is the same value as the MTBF value.

	3AC 400V	3AC 480V	
MTBF SN 29500, IEC 61709	253 000h	233 000h	At 24V, 500W and 40°C
	461 000h	427 000h	At 24V, 500W and 25°C
MTBF MIL HDBK 217F	98 000h	93 000h	At 24V, 500W and 40°C; Ground Benign GB40
	144 000h	138 000h	At 24V, 500W and 25°C; Ground Benign GB25
	25 000h	24 000h	At 24V, 500W and 40°C; Ground Fixed GF40
	33 000h	32 000h	At 24V, 500W and 25°C; Ground Fixed GF25

All parameters are specified at 24V, 20A, 400Vac, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.

12. Functional Diagram

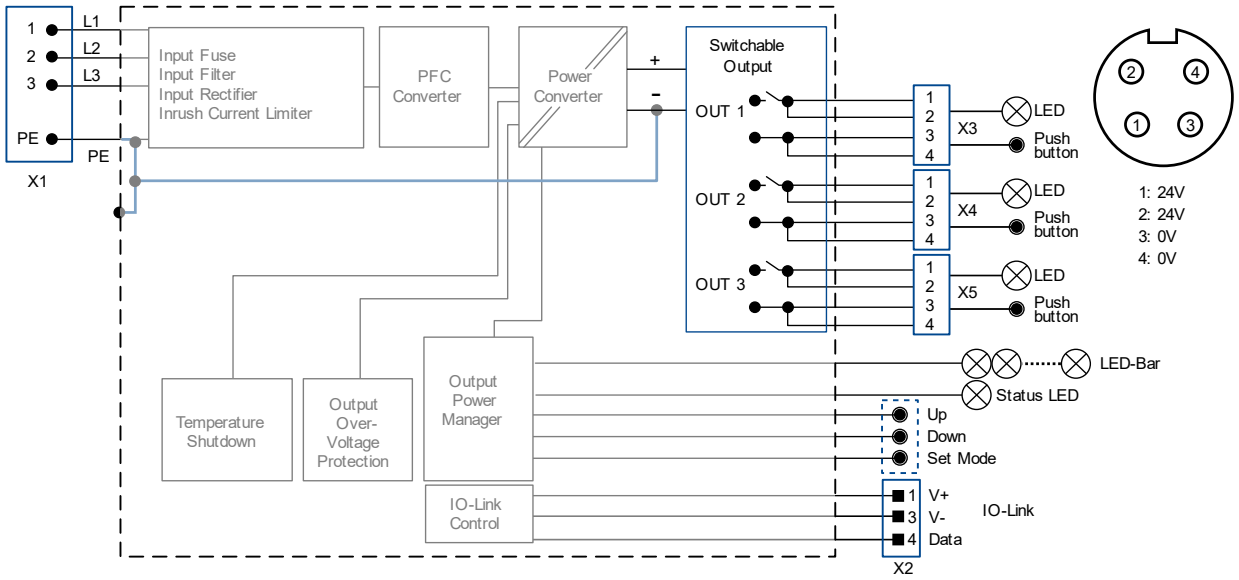


Fig. 12-1: Functional Diagram FPT500.245-020-101

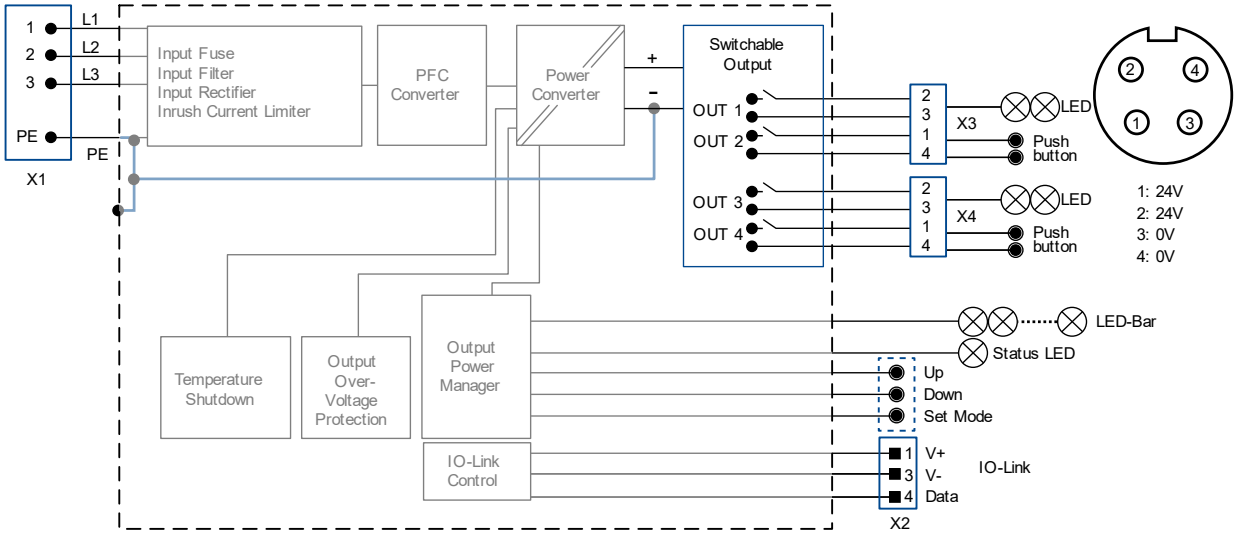


Fig. 12-2: Functional Diagram FPT500.245-018-103

All parameters are specified at 24V, 20A, 400Vac, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.

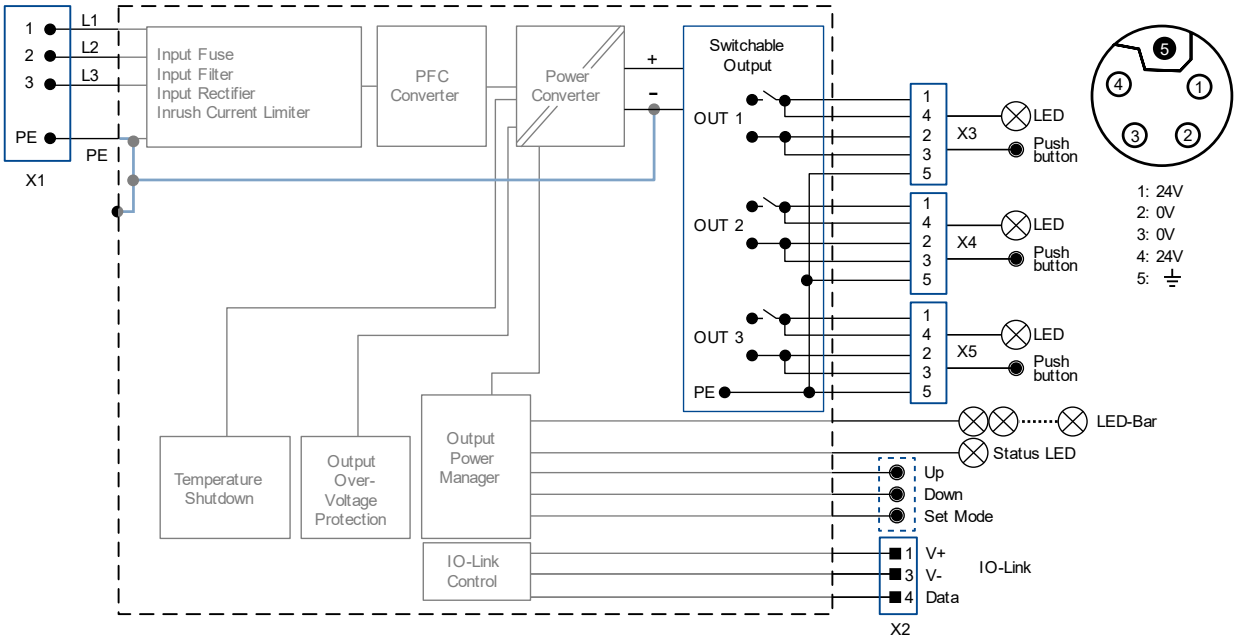


Fig. 12-3: Functional Diagram FPT500.245-036-104

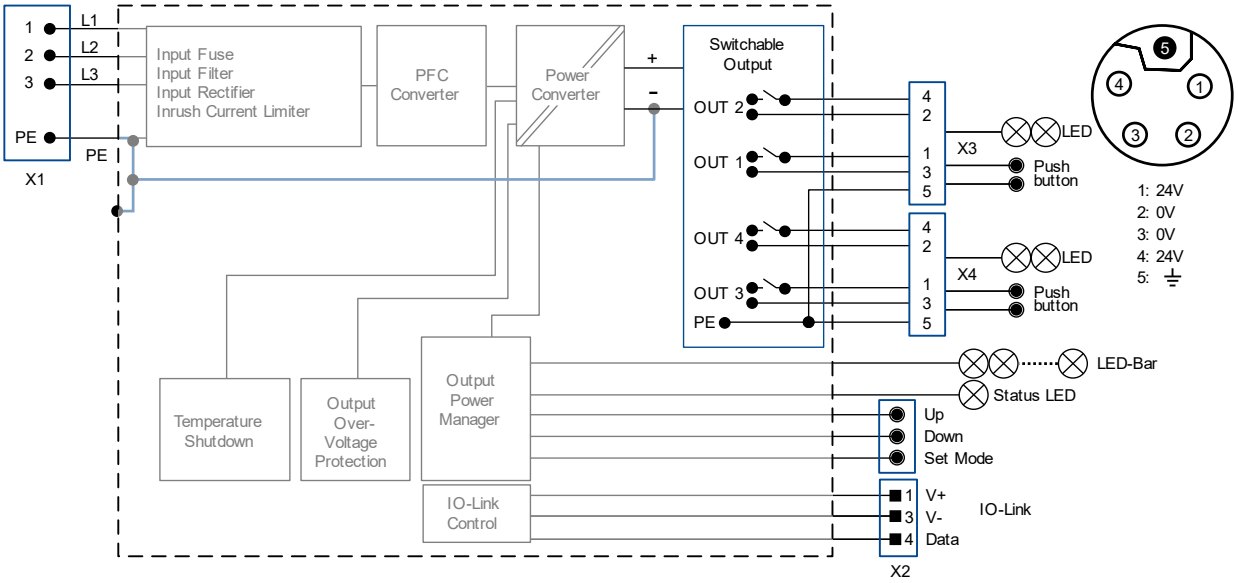


Fig. 12-4: Functional Diagram FPT500.245-034-105

All parameters are specified at 24V, 20A, 400Vac, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.

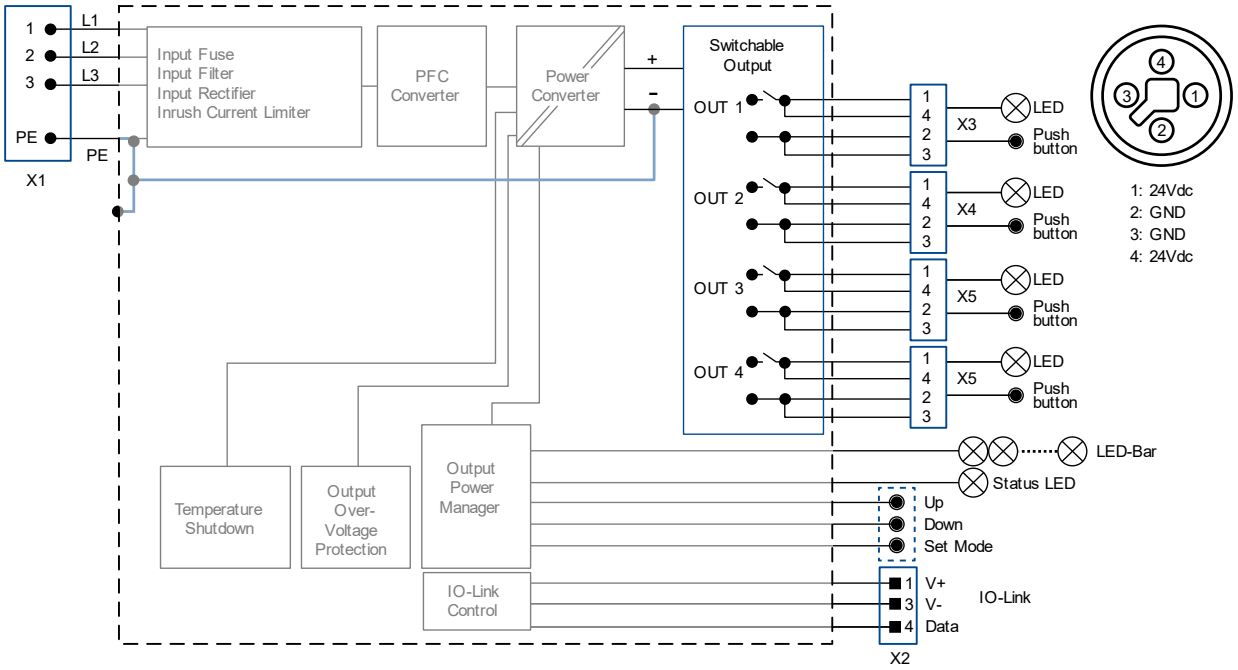
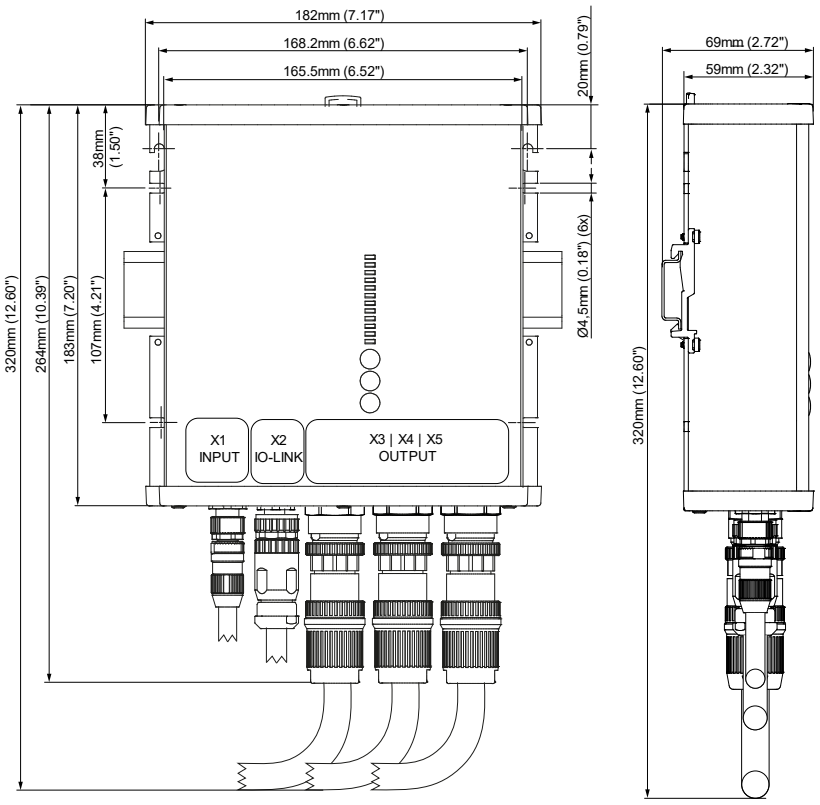


Fig. 12-5: Functional Diagram FPT500.245-044-109

All parameters are specified at 24V, 20A, 400Vac, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.

13. Dimensions And Connector Variants

FPT500.245-020-101

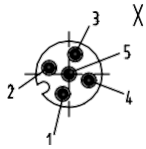


Width	182mm / 7.17''
Height	183mm / 7.2''
Depth	59mm / 2.32''
Weight	1200g / 2.7lb
Housing material	
Body:	Aluminium alloy
Covers:	Hi-grade polycarbonate
Installation clearances	See chapter 2

Mating Input (X1):

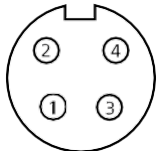
M12 S coded	M12-S 4pin screw (female) 2.5mm² / 6-8mm	Harting order code 6102201020400	PULS order code ZCF.m12s4p
Pin assignment	Pin 1	L1	
	Pin 2	L2	
	Pin 3	L3	
	Pin with the PE symbol	PE connection	

Mating IO-Link (X2):



M12 A coded	M12-A 5pin cut clamp (female) 0.34-0.5mm² / 6-8mm	Harting order code 21032722505	PULS order code ZCF.m12a5p
Pin assignment	Pin 1	Supply voltage +	
	Pin 2 and Pin 5	Not connected	
	Pin 3	Supply voltage -	
	Pin 4	Data IN/OUT	

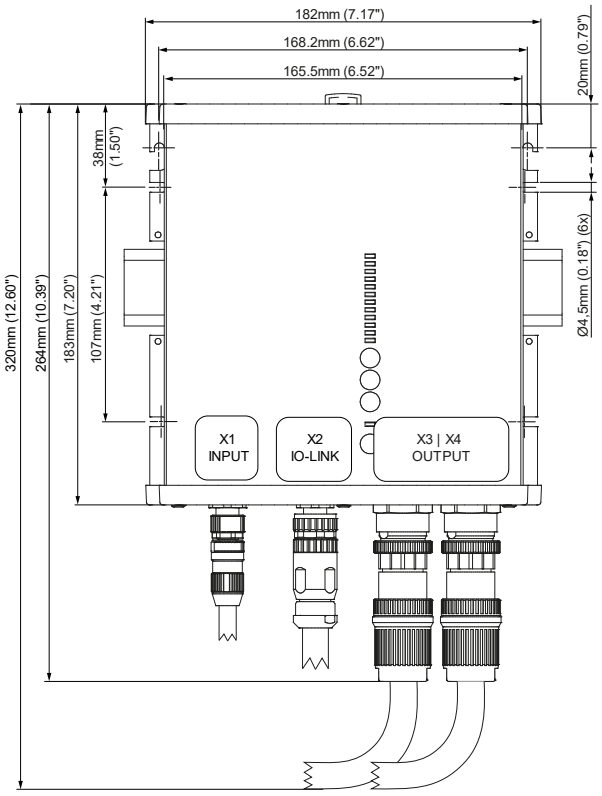
Mating Output (X3, X4 and X5):

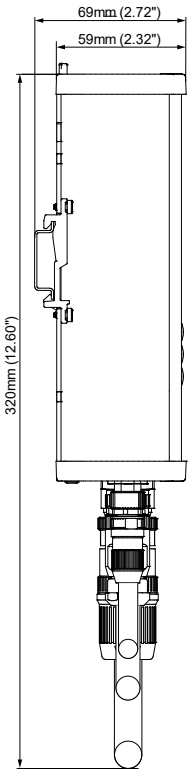


Harting 7/8”	7/8” 4pin screw (male) 1.5mm² / 6-8mm²	Harting order code 6102201021100	PULS order code ZCM.78inch4p
Pin assignment	Pin 1	Output 1 | 2 | 3 : (+) pole	
	Pin 2	Output 1 | 2 | 3 : (+) pole	
	Pin 3	Output 1 | 2 | 3 : (–) pole	
	Pin 4	Output 1 | 2 | 3 : (–) pole	

All parameters are specified at 24V, 20A, 400Vac, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.

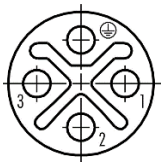
FPT500.245-018-103





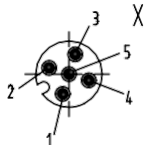
Width	182mm / 7.17"
Height	183mm / 7.2"
Depth	59mm / 2.32"
Weight	1200g / 2.7lb
Housing material	
Body:	Aluminium alloy
Covers:	Hi-grade polycarbonate
Installation clearances	See chapter 2

Mating Input (X1):



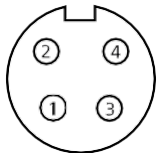
M12 S coded	M12-S 4pin screw (female) 2.5mm² / 6-8mm	Harting order code 6102201020400	PULS order code CF.m12s4p
Pin assignment	Pin 1	L1	
	Pin 2	L2	
	Pin 3	L3	
	Pin with the PE symbol	PE connection	

Mating IO-Link (X2):



M12 A coded	M12-A 5pin cut clamp (female) 0.34-0.5mm² / 6-8mm	Harting order code 21032722505	PULS order code ZCF.m12a5p
Pin assignment	Pin 1	Supply voltage +	
	Pin 2 and Pin 5	Not connected	
	Pin 3	Supply voltage -	
	Pin 4	Data IN/OUT	

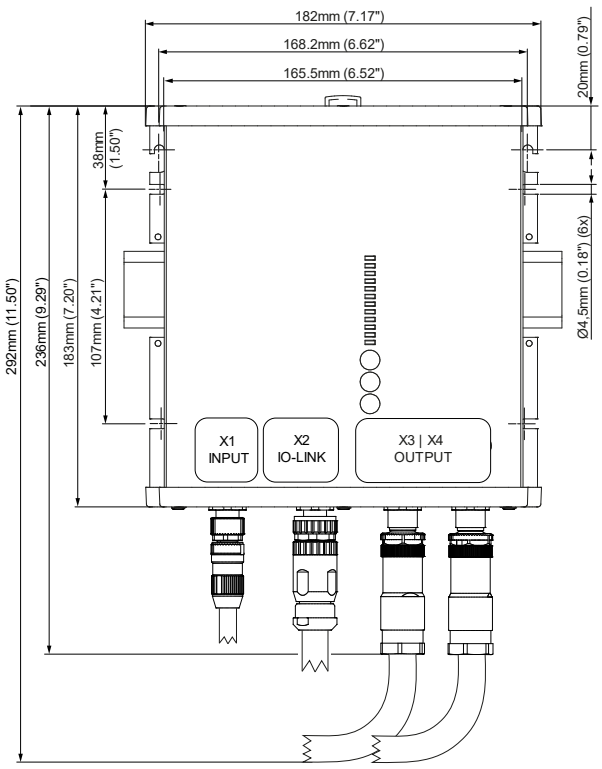
Mating Output (X3 and X4):

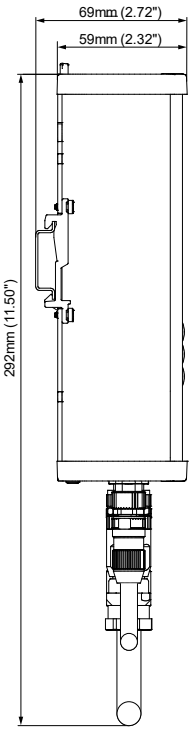


Harting 7/8"	7/8" 4pin screw (male) 1.5mm² / 6-8mm²	Harting order code 6102201021100	PULS order code ZCM.78inch4p
Pin assignment	Pin 1	Output 2 | 4: (+) pole	
	Pin 2	Output 1 | 3: (+) pole	
	Pin 3	Output 1 | 3: (–) pole	
	Pin 4	Output 2 | 4: (–) pole	

All parameters are specified at 24V, 20A, 400Vac, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.

FPT500.245-036-104



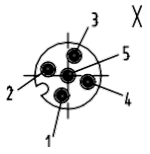


Width	182mm / 7.17"
Height	183mm / 7.2"
Depth	59mm / 2.32"
Weight	1200g / 2.7lb
Housing material	
Body:	Aluminium alloy
Covers:	Hi-grade polycarbonate
Installation clearances	See chapter 2

Mating Input (X1):

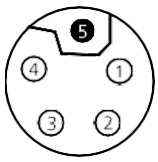
M12 S coded	M12-S 4pin screw (female) 2.5mm² / 6-8mm	Harting order code 6102201020400	PULS order code ZCF.m12s4p
Pin assignment	Pin 1	L1	
	Pin 2	L2	
	Pin 3	L3	
	Pin with the PE symbol	PE connection	

Mating IO-Link (X2):



M12 A coded	M12-A 5pin cut clamp (female) 0.34-0.5mm² / 6-8mm	Harting order code 21032722505	PULS order code ZCF.m12a5p
Pin assignment	Pin 1	Supply voltage +	
	Pin 2 and Pin 5	Not connected	
	Pin 3	Supply voltage -	
	Pin 4	Data IN/OUT	

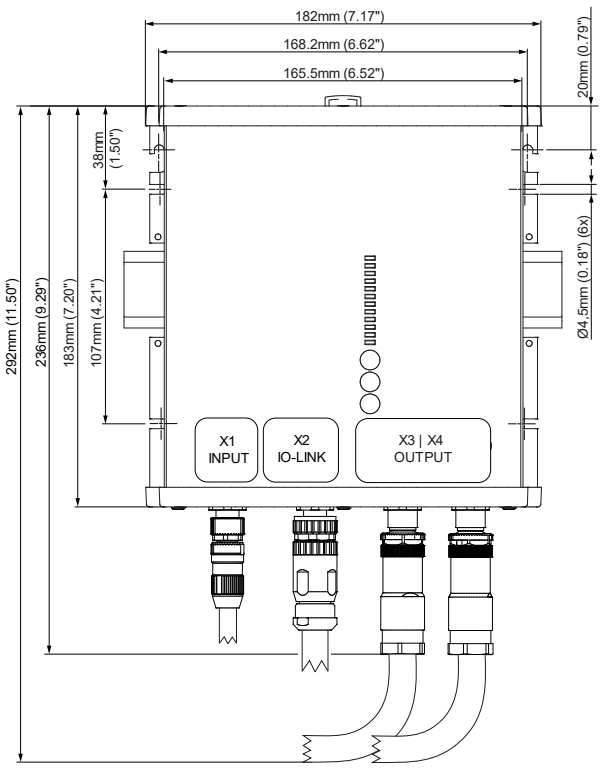
Mating Output (X3, X4 and X5):

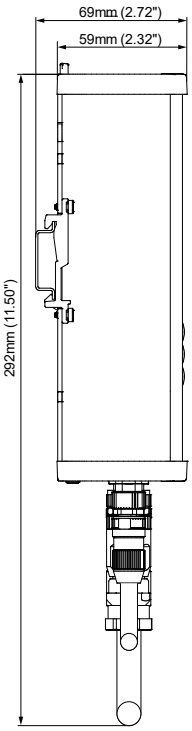


M12 L coded	M12-L 5pin cut clamp (male) 0.75-1.5mm² / 5.8-13.5mm	Harting order code 21032961505	PULS order code ZCM.m12l5p
Pin assignment	Pin 1	Output 1 | 2 | 3: (+) pole	
	Pin 2	Output 1 | 2 | 3: (–) pole	
	Pin 3	Output 1 | 2 | 3: (–) pole	
	Pin 4	Output 1 | 2 | 3: (+) pole	
	Pin 5	PE	

All parameters are specified at 24V, 20A, 400Vac, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.

FPT500.245-034-105



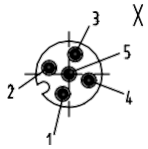


Width	182mm / 7.17"
Height	183mm / 7.2"
Depth	59mm / 2.32"
Weight	1200g / 2.7lb
Housing material	
Body:	Aluminium alloy
Covers:	Hi-grade polycarbonate
Installation clearances	See chapter 2

Mating Input (X1):

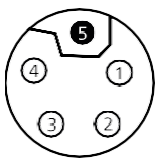
M12 S coded	M12-S 4pin screw (female) 2.5mm² / 6-8mm	Harting order code 6102201020400	PULS order code ZCF.m12s4p
Pin assignment	Pin 1	L1	
	Pin 2	L2	
	Pin 3	L3	
	Pin with the PE symbol	PE connection	

Mating IO-Link (X2):



M12 A coded	M12-A 5pin cut clamp (female) 0.34-0.5mm² / 6-8mm	Harting order code 21032722505	PULS order code ZCF.m12a5p
Pin assignment	Pin 1	Supply voltage +	
	Pin 2 and Pin 5	Not connected	
	Pin 3	Supply voltage -	
	Pin 4	Data IN/OUT	

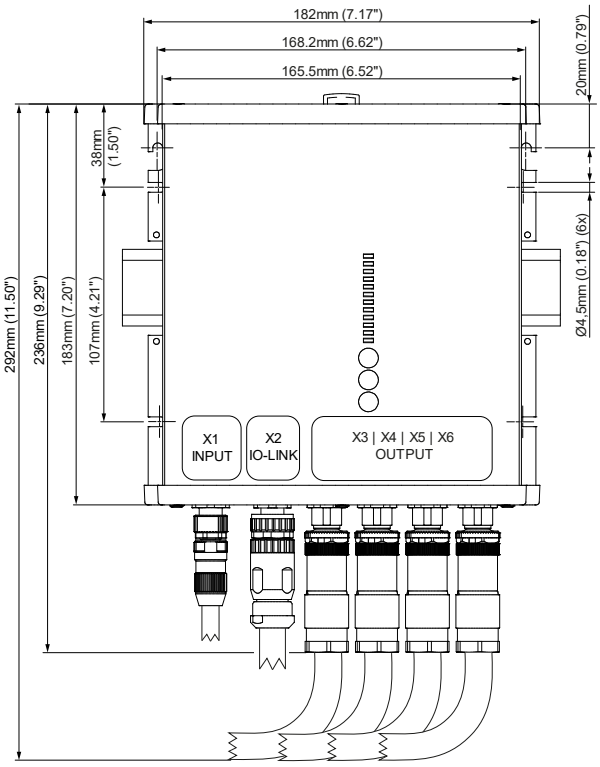
Mating Output (X3 and X4):

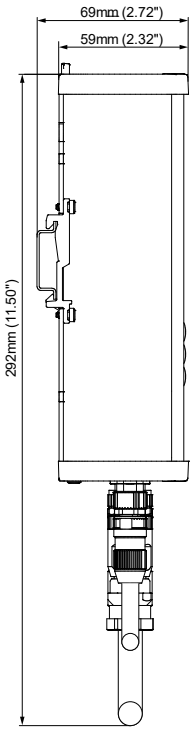


M12 L coded	M12-L 5pin cut clamp (male) 0.75-1.5mm² / 5.8-13.5mm	Harting order code 21032961505	PULS order code ZCM.m12l5p
Pin assignment	Pin 1	Output 1 | 3 : (+) pole	
	Pin 2	Output 2 | 4 : (–) pole	
	Pin 3	Output 1 | 3 : (–) pole	
	Pin 4	Output 2 | 4 : (+) pole	
	Pin 5	PE	

All parameters are specified at 24V, 20A, 400Vac, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.

FPT500.245-044-109



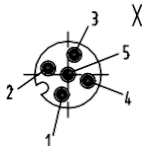


Width	182mm / 7.17''
Height	183mm / 7.2''
Depth	59mm / 2.32''
Weight	1200g / 2.7lb
Housing material	
Body:	Aluminium alloy
Covers:	Hi-grade polycarbonate
Installation clearances	See chapter 2

Mating Input (X1):

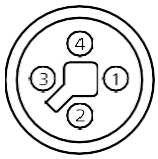
M12 S coded	M12-S 4pin screw (female) 2.5mm² / 6-8mm	Harting order code 6102201020400	PULS order code ZCF.m12s4p
Pin assignment	Pin 1	L1	
	Pin 2	L2	
	Pin 3	L3	
	Pin with the PE symbol	PE connection	

Mating IO-Link (X2):



M12 A coded	M12-A 5pin cut clamp (female) 0.34-0.5mm² / 6-8mm	Harting order code 21032722505	PULS order code ZCF.m12a5p
Pin assignment	Pin 1	Supply voltage +	
	Pin 2 and Pin 5	Not connected	
	Pin 3	Supply voltage -	
	Pin 4	Data IN/OUT	

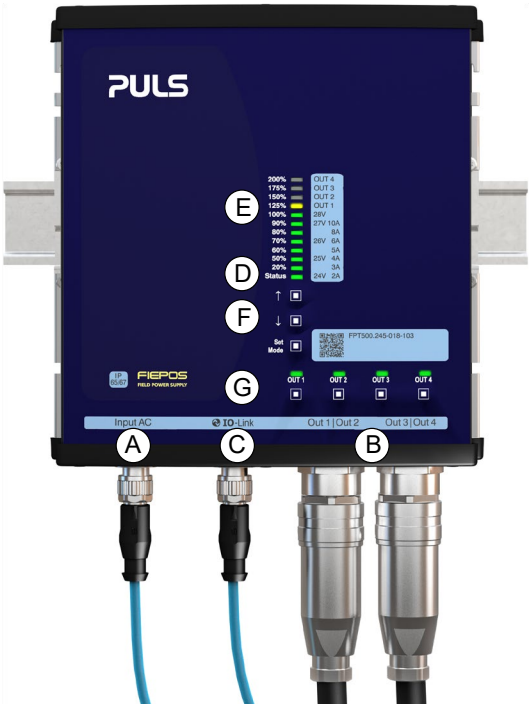
Mating Output (X3, X4, X5 and X6):



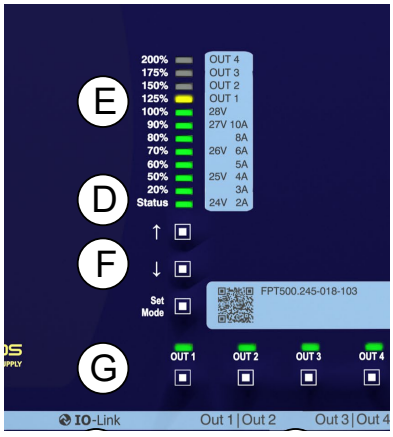
M12 T coded	M12-T (male) screw 1,5mm² / 8-10mm	Harting order code 6102201021000	PULS order code ZCM.m12t4p
Pin assignment	Pin 1	Output 1 | 2 | 3 | 4: (+) pole	
	Pin 2	Output 1 | 2 | 3 | 4: (–) pole	
	Pin 3	Output 1 | 2 | 3 | 4: (–) pole	
	Pin 4	Output 1 | 2 | 3 | 4: (+) pole	

All parameters are specified at 24V, 20A, 400Vac, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.

14. User Interface



A. Input Connector
B. Output Connectors
C. IO Link Connector
D. Status LED
E. LED Bar
F. Set Mode and Up and Down Button
G. Output LEDs | Reset & ON/OFF Buttons



LED Bar Overview

The user menu consists of the LED bar display and 3 push buttons for monitoring and configuration.

After the start-up of the PSU , the menu is in the output power monitoring mode by default.

Output Power Monitoring

The LED bar shows the actual output power in percentage of 500W. At 200W, the green LEDs up to and including 40% would be illuminated. The LEDs illuminate orange if the delivered power exceeds 500W.

By default, the PSU displays the total output power after startup.

Status LED

The Status LED is used to signal operating conditions.

STATUS LED lights shows solid Green if the

DC voltage is above 22V and all outputs are operating according to their settings.

STATUS LED is off if the

DC voltage is below 22V or power supply is not powered.

STATUS LED shows solid Red if the

AC input drops below the specified levels.

STATUS LED flashes Orange slowly if the

output is OFF during the 18s HiccupPlus mode.

STATUS LED flashes Red slowly if

the unit has turned off due to overtemperature. As soon as the temperature reaches normal operating range the output turns on again and the STATUS LED changes to solid Green.

All parameters are specified at 24V, 20A, 400Vac, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.

Setting Functions

Output Voltage Setting

- Press SET MODE for 3s. All LEDs turn on.
- Voltage Mode and a green LED indicates the current setting. (e.g. the LED next to 20% represents a value of 24.5V)
- Voltage settings are marked on the right hand side of the LED bar.
- Push the UP or DOWN button to increase or decrease the set point.
- New set point is applied immediately.
- After 20s without any activity, the LED bar will return to output power monitoring mode.

Monitor channel output current

- In power monitoring mode, press UP or DOWN button to change to channel output current monitoring mode.
- The 7 current scaling LEDs are green (2A to maximum current – depending on the variant)
- One of the upper 4 orange LEDs is steady on and indicating the actual displayed channel.
- Press UP or DOWN button to scroll between the available channels. After the highest or lowest channel number is reached, the output power monitor is entered again.
- If all 4 orange channel indication LEDs are off, the monitoring menu is back in the total output power monitoring mode.

Button lock feature

- Press UP and DOWN buttons simultaneously for 3s. All LEDs will flash for 5s to indicate that button lock status has changed.
- The display will return to output power monitoring mode.
- If SETMODE button is pushed for 3s and the button lock is activated, all LEDs will flicker for 5s to indicate that the buttons are locked
- To Deactivate the button lock feature, press the UP and DOWN buttons simultaneously for 3s. All LEDs will flash for Ss to indicate that button lock status has changed.

Set channel trip current

- In any monitoring mode, press SET / MODE button for 3s.
  - ➢ All LEDs are lit for 1s to indicate the change to voltage set mode
- After that, one green LED shows the actual set point, e.g. LED for 20% indicates 3A
- All orange LEDs are off in this mode.
- Current steps are printed on the right hand side of the LED bar display.
- Press the UP button to increase set point by one step.
- Press the Down button to decrease set point by one step.
- New set point is stored immediately.
- To exit the configuration menu, wait for 15s without pressing any button – PSU will change to total output power monitoring mode automatically.

Reset and ON/OFF Push Buttons

- In a failure mode (output has switched off), the output can be turned on again by pushing and holding the reset button for more than 1 second.
- In normal mode (output has not switched off), a 1 second push will turn the output ON or OFF. For protection reasons a delay of at least 5 seconds is mandatory, before an output can be reset after it has switched off.

All parameters are specified at 24V, 20A, 400Vac, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.

Channel LED Signaling Overview

Below is an overview of the output LED signaling.

LED is off if the

Output is switched off, by button or PSU is not energized.

Channel LED is solid Green if the

Output is switched on, current is below warning threshold (fix 80% of trip setting for units without external interface).

Channel LED flashes Green at a slow rate, 250ms ON / 250ms OFF

Current/Power Budget trip Reason:

- Sum of output currents was above PSU current rating, low priority Outputs get disconnected first.

Channel LED flashes Green at a fast rate, 125ms ON / 125ms OFF, if the

Button is pressed, but unit does not turn Output ON or OFF.

Reasons:

- Button is locked by “external interface” or “button lock feature”.
- Interval between Charge Up/ Turn on cycles <5s (MOSFET protection).
- Temperature of MOSFET is >90°C.

PSU output voltage not available.

Channel LED is solid Orange if the

Output is switched on, but current is above overcurrent warning threshold (fix 80% of trip setting for units without external interface)

Channel LED flashes Orange at a slow rate, 500ms ON / 500ms OFF, if the

Output is tripped due to overload, or charging a large capacitance.

- Output overcurrent according to trip setting and curves. After pushing of a button, channel tries to turn on

Channel LED flashes Orange at a medium rate, 250ms ON / 250ms OFF, if the

Installation is Fault, Output Turned OFF. After pushing a button, channel goes to steady OFF.

Condition:

- PSU with NEC outputs: Difference between positive and negative current of the output has been >1A for 6-6.5s
- PSU without NEC outputs: Connector negative wire overcurrent according to negative trip curve, or Output was contributing to negative overcurrent of another output.

Channel LED flashes Orange at a fast rate, 125ms ON / 125ms OFF, if the

Output is tripped due to short-circuit. The channel's output current exceeded a value of approx. 48A. The reason may be one of the following:

- electrical short
- loads beyond specification
- plugging-in a large capacitance during operation

Channel LED flashes Orange/Green at a slow rate, 250ms orange / 250ms green, if the

MOSFET overtemperature limit is reached (125°C). After pushing a button, channel is turned OFF. After cooling down to 90°C, the output turns on automatically.

Channel LED is solid Red if the

Fatal Hardware Fault, MOSFET damaged (short circuit), PSU will be turned off

Condition:

- Positive current of the output (not in on-state) >2A for >0.5s

Channel LED flashes Red at a slow rate, 500ms ON / 500ms OFF, if the

Measurement Circuit Hardware is Fault

Condition:

- Difference between positive and negative current of the output >1A for 6-6.5s and difference between sum of positive currents and sum of negative currents >1A

  (**NOTE:** Applies only to PSU with NEC outputs)
- Temperature sensor measurement out of range (-45°C or +160°C) for 5s

15. EMC

The EMC behavior of the device is designed for applications in industrial environment as well as in residential, commercial and light industry environments.

The device is investigated according to EN 61000-6-1, EN 61000-6-2, EN 61000-6-3, EN 61000-6-4, EN 61000-3-2 and EN 61000-3-3.

EMC immunity

Electrostatic discharge	EN 61000-4-2	Contact discharge	8kV*	Criterion A
Air discharge		Air discharge	15kV*	Criterion A
Electromagnetic RF field	EN 61000-4-3	80MHz - 2.7GHz	15V/m*	Criterion A
		2.7GHz - 6GHz	10V/m	Criterion A
Magnetic field	EN 61000-4-8	50Hz/60Hz	30A/m	Criterion A
Fast transients (Burst)	EN 61000-4-4	AC Input lines	4kV	Criterion A
		DC Output lines	4kV	Criterion A
		IO-Link	2kV*	Criterion A
Surge voltage on AC input	EN 61000-4-5	Lx to Ly	2kV	Criterion A
		L to -PE	4kV	Criterion A
Surge voltage on DC output	EN 61000-4-5	+ to -	1kV	Criterion A
		+/- to PE	1kV	Criterion A
Surge voltage on IO-Link	EN 61000-4-5	IO-Link to PE	1kV*	Criterion A
Conducted immunity	EN 61000-4-6	0.15 - 80MHz	20V*	Criterion A
Voltage dips	EN 61000-4-11	0V	1 cycle	Criterion A
		40% of V_{nom}	200ms	Criterion A
		70% of V_{nom}	500ms	Criterion A
Voltage interruptions	EN 61000-4-11	0V	5000ms	Criterion C
Powerful transients	VDE 0160	Over entire load range	1550V, 1.3ms	Criterion A

Performance criterions:

A: The device shows normal operation behavior within the defined limits.

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

* For IO Link certification immunity test levels according EN 61326-1:2013-01 have been tested

EMC Emission

Conducted emission AC input lines Conducted emission DC output lines Conducted emission IO-Link	EN 55032 , FCC Part 15	Class B
Radiated emission	EN 55032 / EN 55011 FCC Part 15	Class B
Harmonics	EN 61000-3-2	Pass for Class A equipment
Voltage fluctuations, flicker	EN 61000-3-3	Pass tested with constant current loads, non pulsing

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

PFC converter	20kHz to 135kHz	Input voltage and output load dependent
Main converter	60kHz to 140kHz	Output load dependent
Auxiliary converter	54kHz to 66kHz	Output load dependent
Microcontroller clocks	48Mhz and 32MHz	Fixed frequency

All parameters are specified at 24V, 20A, 400Vac, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.

16. Environment

Operational temperature	-25°C to +70°C (-13°F to 158°F)	Operational temperature is the same as the ambient or surrounding temperature and is defined as the air temperature 2cm below the unit.
Storage temperature	-40°C to +85°C (-40°F to 185°F)	For storage and transportation
Output derating	10W/°C 33W/1000m or 5°C/1000m	Between +45°C and +70°C (113°F to 140°F) For altitudes >2000m (6560ft), see Fig. 16-2: Output power vs. ambient temp.: Output power vs. ambient temp.
	The derating is not hardware controlled. The user has to take care to stay below the derated current limits in order not to overload the unit.	
Humidity	5 to 95% r.h.	According to IEC 60068-2-30
Atmospheric pressure	54-110kPa	see Fig. 16-2: Output power vs. ambient temp. for details
Altitude	Up to 5000m (16 400ft)	see Fig. 16-2: Output power vs. ambient temp. for details
Over-voltage category	III	According to IEC 60664-1 For TN, TT mains systems with earthed neutral and IT star mains systems with insulation monitoring for altitudes up to 2000m
	II	According to IEC 60664-1 For TN, TT mains systems with earthed neutral and IT star mains systems with insulation monitoring for altitudes between 2000m and 5000m According to IEC 60664-1 For TN, TT, IT Delta mains systems or IT star mains systems without insulation monitoring for altitudes up to 2000m
Degree of pollution	3	According to IEC 62477-1, not conductive
Vibration sinusoidal	2-17.8Hz: ±1.6mm; 17.8-500Hz: 2g 2 hours / axis	According to IEC 60068-2-6
Shock	30g 6ms, 20g 11ms 3 bumps / direction, 18 bumps in total	According to IEC 60068-2-27
	Shock and vibration is tested in combination with DIN-Rails according to EN 60715 with a height of 15mm and a thickness of 1.3mm and standard orientation.	
LABS compatibility	Yes	
Audible noise	Some audible noise may be emitted from the power supply during no load, overload or short circuit.	

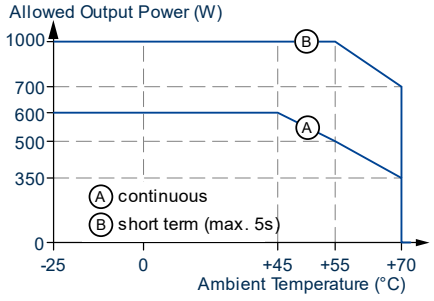


Fig. 16-1: Output power vs. ambient temp.

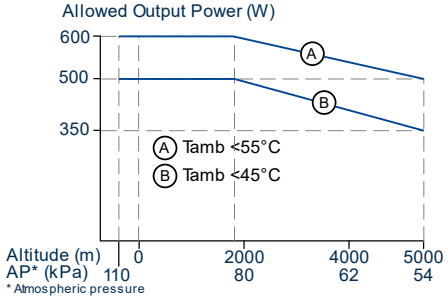


Fig. 16-2: Output power vs. altitude.

All parameters are specified at 24V, 20A, 400Vac, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.

17. Safety And Protection Features

Isolation resistance	min.	500MOhm	At delivered condition between input and output, measured with 500Vdc
	min.	500MOhm	At delivered condition between input and PE, measured with 500Vdc
PE resistance	max.	0.1Ohm	Resistance between PE terminal and the housing
Input/Output separation		PELV	IEC/EN/UL 61010-2-201, IEC/EN 62368-1, IEC/EN 60950-1
Output over-voltage protection	typ.	31.8Vdc	
	max.	32.5Vdc	
		In case of an internal defect, a redundant circuit limits the maximum output voltage. The output shuts down and automatically attempts to restart	
Class of protection			According to IEC 61140 A PE (Protective Earth) connection is required
Ingress protection		IP 65/67	According to EN/IEC 60529
Over-temperature protection		Included	Output shut down with automatic restart. Temperature sensors are installed on critical components inside the unit and turns the unit off in safety critical situations, which can happen e.g. when ambient temperature is too high, ventilation is obstructed or the de-rating requirements are not followed. There is no correlation between the operating temperature and turn-off temperature since this is dependent on input voltage, load and installation methods.
Input transient protection		MOV (Metal Oxide Varistor)	For protection values, see chapter 23, EMC.
Internal input fuse		Included	Not user replaceable slow-blow high-breaking capacity fuse
Touch current (leakage current)	max.	0.45 / 1.5 mA	At 3x 480Vac, 60Hz, TN-,TT-mains / IT-mains Lower currents at lower voltages and frequencies.

All parameters are specified at 24V, 20A, 400Vac, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.

18. Dielectric Strength

The negative terminal of the outputs is permanently connected to PE within the unit. The output is insulated from the input by a double or reinforced insulation.

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

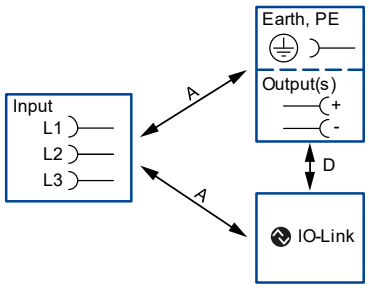


Fig. 18-1: Dielectric strength

		A	D
Type test	60s	2830Vac	500Vac
Routine test	5s	2550Vac	500Vac
Field test	5s	2000Vac	500Vac
Cut-off current setting for field test		>10mA	>10mA

All parameters are specified at 24V, 20A, 400Vac, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.

19. Approvals And Fulfilled Standards

IEC 62368-1	IECEE CB SCHEME	CB Scheme Certificate IEC 62368-1 - Audio/video, information and communication technology equipment - Safety requirements Output safety level: ES1
IEC 61010	IECEE CB SCHEME	CB Scheme Certificate IEC 61010-2-201 - Electrical Equipment for Measurement, Control and Laboratory Use - Particular requirements for control equipment
IEC 60950-1		Manufacturers Declaration IEC 60950-1 - General safety requirements for Information Technology Equipment (ITE)
UL 61010	c UL US LISTED	UL Certificate Listed equipment for category NMTR - UL 61010-2-201 - Electrical equipment for measurement, control and laboratory use - Particular requirements for control equipment Applicable for US and Canada E-File: E198865
Semi F47	SEMI F47	Test Report Voltage Sag Immunity for Semiconductor Processing Equipment Tested for 400VAC L-L mains voltages, nominal output voltage and nominal output load
VDMA 24364	LABS VDMA 24364-C1-L/W	Paint Wetting Impairment Substances Test (or LABS-Test) Tested for Zone 2 and test class C1 according to VDMA 24364-C1-L/W for solvents and water-based paints

20. Regulatory Compliance

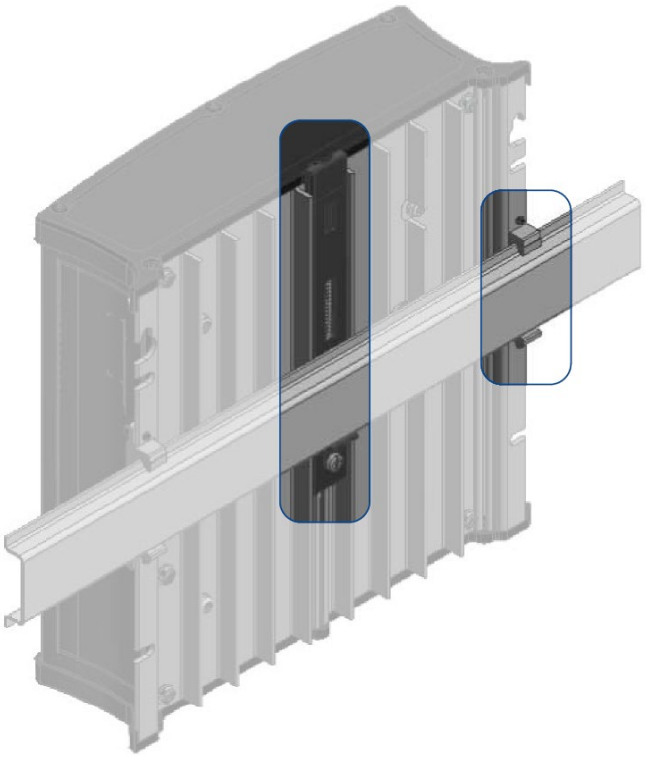
EU Declaration of Conformity	CE	Trade conformity assessment for Europe The CE mark indicates conformance with the European - EMC directive - Low-voltage directive (LVD) - RoHS directive
WEEE Directive		Manufacturer's Statement EU-Regulation on Waste Electrical and Electronic Equipment Registered in Germany as business to business (B2B) products.
REACH Directive	REACH	Manufacturer's Statement EU-Regulation regarding the Registration, Evaluation, Authorization and Restriction of Chemicals
RoHS-China	25	Manufacturer's Statement Administrative Measures for the Restriction of the Use of Hazardous Substances in Electrical and Electronic Products 25 years
IEC/EN 61558-2-16 (Annex BB)	Safety Isolating Transformer	Safety Isolating Transformers corresponding to Part 2-6 of the IEC/EN 61558

All parameters are specified at 24V, 20A, 400Vac, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.

21. Accessories

21.1. DIN RAIL Mounting KIT: ZM.FP-DIN2

In addition to screw mounting FIEPOS has the option to be simply attached to a DIN rail.



- DIN-Rail not included
- DIN-Fixture pre-assembled

21.2. Connectors

FIEPOS features a large number of different connectors. Mating connectors can be ordered at PULS from stock in order to be able to supply customers quickly in the design-in phase.

For a higher number of pieces or other options use www.harting.com.

Connector Name	Order number	Connector Description
Harting HanQ4/2	ZCF.hanq42	Q4/2 Set AS female 2.5-6mm² 7-13mm
Harting HanQ4/2	ZCF.hanq42-1	Q4/2 Set AS female 2.5-6mm² 14-17mm
Harting HanQ2/0	ZCM.hanq20	Q2/0 Set screw male 2.5-6mm² 6-12mm
Harting HanQ4/0	ZCM.hanq40	Q4/0 Set 1m cable 2,5mm2 IP67
Harting HanQ5/0	ZCF.hanq50	Q5/0 Set QuickLock female 0.5-2.5mm² 6-12mm
Harting M12-A	ZCF.m12a5p	M12-A 5pin cut clamp female 0.34-0.5mm² / 6-8mm
Harting M12-A	ZCM.m12a5p	M12-A 5pin cut clamp male 0.34-0.5mm² / 6-8mm
Harting M12-S	ZCF.m12s4p	M12-S 4pin screw female 2.5mm² / 6-8mm
Harting M12-L	ZCM.m12l5p	M12-L 5pin cut clamp male 0.75-1.5mm² / 5.8-13.5mm
Harting M12-T	ZCM.m12t4p	M12-T 4pin screw male 1.5mm² / 8-10mm
Harting 7/8”	ZCM.78inch4p	7/8” 4pin screw male 1.5mm² / 6-8mm
Harting 7/8”	ZCF.78inch3p	7/8” 3pin screw female 1.5mm² / 6-8mm
Harting 7/8”	ZCF.78inch5p	7/8” 5pin screw female 0.75-1.5mm² / 6.8-12.5mm

All parameters are specified at 24V, 20A, 400Vac, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.

22. Related Products

The FIEPOS product family includes various devices with different technical parameters and features. The following page provides a general overview of the available solutions. Please also get in touch with your PULS contact person, for more detailed application advice and technical information.

FPT500.245-006-107:

Power Supply with one **current-limited high-power channel** (20A) and second **fused low-power channel** (2–12A)

SHORT-FORM DATA

Output voltage	DC 24V	Nominal
Adjustment range	24-28Vdc	Factory setting 24.5V
Output power	Continuous:	
	600W	Up to +45°C ambient
	500W	At +55°C ambient
	350W	At +70°C ambient
	Short-term, up to 5s:	
	1000W	Below +55°C ambient
	700W	At +70°C ambient
	Derate linearly between +45°C to +70°C	
Number of outputs	2	
Output 1 current	Settable per output; up to 20A	
Output 2 current	Settable per output; up to 12A	

FPT500.241-002-107:

Power Supply with **Built-in Decoupling MOSFET** for parallel and redundant applications.

SHORT-FORM DATA

Output voltage	DC 24V	Nominal
Adjustment range	24-28Vdc	Factory setting 24.5V
Output power	Continuous:	
	600W	Up to +45°C ambient
	500W	At +55°C ambient
	350W	At +70°C ambient
	Short-term, up to 5s:	
	1000W	Below +55°C ambient
	700W	At +70°C ambient
	Derate linearly between +45°C to +70°C	
Built-in Decoupling MOSFET for 1+1 and n+1 Redundancy		

All parameters are specified at 24V, 20A, 400Vac, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.

23. Application Notes

23.1. Repetitive Pulse Loading

Typically, a load current is not constant and varies over time. This power supply is designed to support loads with a higher short-term power demand (BonusPower®). The short-term duration is hardware controlled by an output power manager and is available on a repeated basis. If the average load is higher than the sum of all output power, the output voltage will dip.

To avoid this, the following rules must be followed:

a) The power demand of the pulse must be below 200% of the nominal output power.

b) The duration of the pulse power must be shorter than the allowed BonusPower® time. (see output section 6)

c) The average power should be lower than the nominal output power.

The R.M.S. output current must be below the specified continuous output current. If the R.M.S. current is higher, the unit may respond with a thermal shut-down after a period of time.

23.2. External Input Protection

The device is designed, tested and approved for branch circuits up to 20A (UL) and 32A (IEC) without additional protection device. If an external fuse is utilized, do not use circuit breakers smaller than 6A B- or C-Characteristic to avoid a nuisance trip.

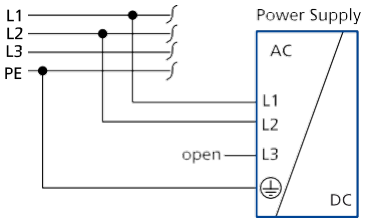
23.3. Two Phases Operation

No external protection devices are required to protect against a phase-loss.

Continuous two phase operation is not recommended for this power class since the supplying 3-phase network could become unbalanced. However, if one phase fails, the unit may continue to operate if the load is below the power limit shown in Fig. 24-1.

Exceeding of these limits for an extended period may result in a thermal shut-down of the unit.

During power-on, some start-up attempts can occur until a permanent output power is available. EMC performance, hold-up time, losses, and output ripple differ from a three phase operation. Such use is not included in the approval according to UL61010 and IEC62368.



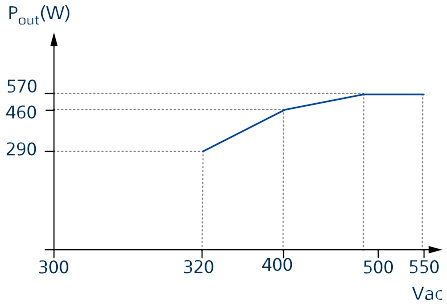


Fig. 23-1: Two phase power capability

23.4. Inductive and Capacitive Loads

The unit is designed to supply any kind of loads, including capacitive and inductive loads. If extreme large capacitors, such as EDLCs (electric double layer capacitors or “UltraCaps”) with a capacitance larger than 20mF are connected to the output, the unit might charge the capacitor or the output might trip, chapter 6.

All parameters are specified at 24V, 20A, 400Vac, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.

23.5. Back Feeding Loads

Loads such as decelerating motors and inductors can feed voltage back to the power supply. This feature is also called return voltage immunity or resistance against Back- E.M.F. (**E**lectro **M**agnetic **F**orce).

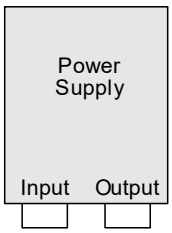
This power supply is resistant and does not show malfunctioning when a load feeds back voltage to the power supply. It does not matter whether the power supply is on or off.

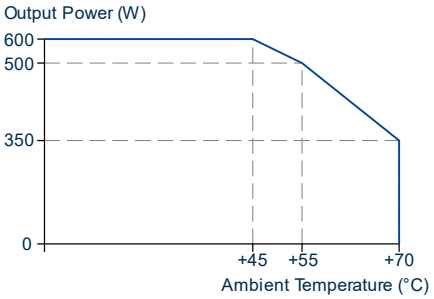
23.6. Mounting Orientations

The device can be mounted in various mounting orientations. The listed lifetime and MTBF values from this datasheet apply only for the standard mounting orientation. The following curves give an indication for allowed output power in different mounting orientations for altitudes up to 2000m (6560ft).

A

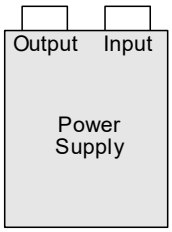
Standard Orientation

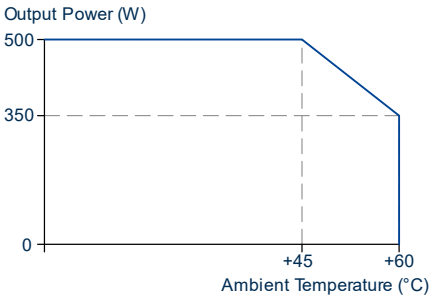




B

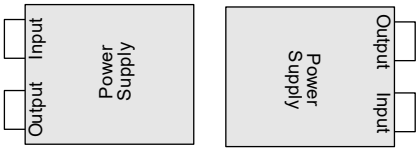
Upside down





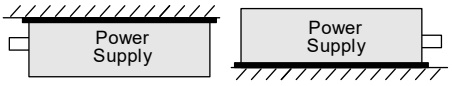
C

Horizontal cw and ccw



D

Over-head and Table-top mounting



All parameters are specified at 24V, 20A, 400Vac, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.

24. IO-Link Data Typs And Description

24.1. Cyclic Data

The first dataset is called process data and refers to data that is periodically sent to the IO-Link master. The length is 2Byte and the data is updated and communicated every 2ms. All other data in the power supply itself is generated every 50ms and stored in the IO-Link registers. The higher cycle frequency enables operation with IO-Link masters and attached PLCs without configuration.

Process	Unit	Subindex	Bit offset	Description
Actual Output total Current	A	1	104	
Actual Output Voltage	V	2	88	Actual Output Voltage
E-Fuse Current CH1	A	3	72	Actual Output Current
E-Fuse Current CH2	A	4	56	Actual Output Current
E-Fuse Current CH3	A	5	40	Actual Output Current
E-Fuse Current CH4	A	6	24	Actual Output Current
E-Fuse channel states		10	16-19	Actual state of E-Fuse outputs (on/off)
E-Fuse overload trip states		14	8-11	Overload trip state of E-Fuse outputs (ok/tripped)
E-Fuse short circuit states		18	0-3	Short circuit trip state of E-Fuse outputs (ok/tripped)

24.2. Acyclic data

The parameter values can be accessed to read out additional data (e.g. current output voltage, temperatures etc.), but in addition some of these values can also be written by the user to configure the power supply (e.g. output voltage and remote on/off).

Parameter	Unit	Pre Setting	Parameter Index	Sub-index	Read [R] Write [W]	Description
Output Voltage Setpoint	V	24.5V	105	0	R/W	Output Voltage Setpoint
Standby	bool	0	101	0	R/W	
Configuration Setting	uint8	2	103	0	R/W	0…human-machine interface only 1…IO-Link only 2…both 3…none (button lock)
E-Fuse Channel on/off	set of bool	on	106	0	R/W	
E-Fuse trip value CH1	A	max	108	0	R/W	
E-Fuse trip value CH2	A	max	108	1	R/W	
E-Fuse trip value CH3	A	max	108	2	R/W	
E-Fuse trip value CH4	A	max	108	3	R/W	
E-Fuse Pre-alarm level CH1	%	80.34	109	0	R/W	
E-Fuse Pre-alarm level CH2	%	80.34	109	1	R/W	
E-Fuse Pre-alarm level CH3	%	80.34	109	2	R/W	
E-Fuse Pre-alarm level CH4	%	80.34	109	3	R/W	
PSU total output current Pre-alarm level	A	20A	104	0	R/W	
EEPROM Status		-	64	0	R	0 ok 1 recoverable error detected 2 unrecoverable error
PSU events	set of bool	-	65	0 (1) (2) (3) (4) (5) (6)	R	Parameter must be accessed via subindex 0. bit 0: DC-OK bit 1: DC-Warning bit 2: Bonus Power bit 3: Over Temperature CAP bit 4: Over Temperature PSU bit 5: Over load

All parameters are specified at 24V, 20A, 400Vac, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.

Parameter	Unit	Pre Setting	Parameter Index	Sub-index	Read [R] Write [W]	Description
				(7)		bit 6: High voltage input
				(8)		bit 7: Low voltage input
				(9)		bit 8: Power supply down
				(10)		bit 9: Predictive maintenance power supply
				(11)		bit 10: 2 phase operation
				(13)		bit 12: PSU settings changed via HMI
				(14)		bit 13: PSU hardware failure
Temperature secondary inside	°C	-	69	0	R	Temperature secondary inside PSU
Max. temperature secondary inside	°C	-	70	0	R	Maximum temperature secondary inside PSU
Temperature primary inside	°C	-	71	0	R	Temperature primary inside
Max. temperature primary inside	°C	-	72	0	R	Maximum temperature primary inside
AC Input Voltage RMS	V	-	78	0	R	Actual Input Voltage RMS (phase-phase)
Actual output voltage	V	-	79	0	R	Actual average output voltage
Actual output current	A	-	81	0	R	Actual average output current
E-Fuse current CH1	A	-	84	0	R	Actual average E-Fuse current CH1
E-Fuse current CH2	A	-	84	1	R	Actual average E-Fuse current CH2
E-Fuse current CH3	A	-	84	2	R	Actual average E-Fuse current CH3
E-Fuse current CH4	A	-	84	3	R	Actual average E-Fuse current CH4
E-Fuse output status	set of bool	-	85	0	R	bit 0: Ch1 bit 1: Ch2 bit 2: Ch3 bit 3: Ch4 0…off, 1…on
E-Fuse trip status CH1	4bit enum	-	86	0	R	0 = No trip 1 = Over-load trip 2 = Short circuit trip 3 = Temperature trip 4 = Power budget trip 5 = Installation failure trip 6 = Sensor fault trip 7 = Fatal fault trip
E-Fuse trip status CH2	4bit enum	-	86	1	R	0 = No trip 1 = Over-load trip 2 = Short circuit trip 3 = Temperature trip 4 = Power budget trip 5 = Installation failure trip 6 = Sensor fault trip 7 = Fatal fault trip
E-Fuse trip status CH3	4bit enum	-	86	2	R	0 = No trip 1 = Over-load trip 2 = Short circuit trip 3 = Temperature trip 4 = Power budget trip 5 = Installation failure trip 6 = Sensor fault trip 7 = Fatal fault trip
E-Fuse trip status CH4	4bit enum	-	86	3	R	0 = No trip 1 = Over-load trip 2 = Short circuit trip 3 = Temperature trip 4 = Power budget trip 5 = Installation failure trip

All parameters are specified at 24V, 20A, 400Vac, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.

Parameter	Unit	Pre Setting	Parameter Index	Sub-index	Read [R] Write [W]	Description
						6 = Sensor fault trip 7 = Fatal fault trip
Stress level	uint8		66	0	R	current load 0 = “<5%” 1 = “>5%” 2 = “>25%” 3 = “>50%” 4 = “>75%”
Remaining Endurance LED coded	uint8		67	0	R	0= “<10%” 1 = “>10%” 2 = “>25%” 3 = “>50%” 4 = “>75%”
Remaining Endurance	uint8		68	0	R	Remaining Endurance in percent Value range 10 to 99 %
Counter						
E-Fuse Number of Startups CH1	uint32	0	87	0	R	Number of Startups Channel 1
E-Fuse Number of Startups CH2	uint32	0	87	1	R	Number of Startups Channel 2
E-Fuse Number of Startups CH3	uint32	0	87	2	R	Number of Startups Channel 3
E-Fuse Number of Startups CH4	uint32	0	87	3	R	Number of Startups Channel 4
E-Fuse Number of Overcurrents CH1	uint16	0	88	0	R	Number of Overcurrents Channel 1
E-Fuse Number of Overcurrents CH2	uint16	0	88	1	R	Number of Overcurrents Channel 2
E-Fuse Number of Overcurrents CH3	uint16	0	88	2	R	Number of Overcurrents Channel 3
E-Fuse Number of Overcurrents CH4	uint16	0	88	3	R	Number of Overcurrents Channel 4
Operating hours. hours minutes	uint32 uint8		73	0	R	Operating hours Operating minutes
Transient VDE-0160 Counter overall			74	0	R	Transient Counter overall
Transient VDE-0160 Counter last 2 minutes			75	0	R	Transient Counter last 2 minutes
Turn-on Counter			82	0	R	Turn-on Counter of the PSU
Uptime since last turn-on. hours minutes	uint32 uint8		83	0	R	Uptime since last turn-on - hours Uptime since last turn-on - minutes
Device Status						
Device Status			36		R	0 = Device is operating properly 1 = Maintenance-Required 2 = Out-of-Specification 3 = Functional-Check 4 = Failure
Detailed Device Status Item [1] Item [2] Item [3] Item [4] Item [5]			37		R	Shows up to 5 pending events 3 octets per subindex: Octet 1: EventQualifier Octet 2,3: EventCode

All parameters are specified at 24V, 20A, 400Vac, 25°C ambient and after a 5 minutes run-in time unless otherwise noted.

24.3. Events

This information is triggered by certain situations and will result in an event notification to the IO-Link master. Typical events are notification in case of ideal (e.g. DC-OK) and non-ideal situations (e.g. ambient temperature too hot, high input voltage etc.).

Events	Event-code	Event-type	Description
Parameter error – Check data sheet and values	0x6320	Error	
Device temperature over-run – Clear source of heat	0x4210	Warning	
Events. DC-Warning	0x1800	Warning	Output voltage dips more than 10% below adjusted output voltage
Events. Bonus Power	0x1801	Notification	Output current is 5% more than maximum for more than 3s
Events. Over Load	0x1802	Warning	Load higher than allowed
Events. High Voltage Input	0x1803	Warning	Input to high
Events. Low Voltage Input	0x1804	Warning	Input to low
Events. Power Supply down	0x1805	Warning	No link from IO-Link Transceiver to Power Supply
Events. Predictive Maintenance Power Supply	0x1806	Warning	The estimated remaining lifetime has reached 10%. Performance of PSU might be limited due to aging effects of components.
Events. Two phase AC supply	0x1807	Warning	One leg of the 3-phase system is missing
Events. PSU setting changed via HMI	0x1809	Notification	A PSU setting was changed via man-machine interface.
Events. PSU hardware failure	0x1825	Warning	Critical PSU hardware failure detected. PSU shut down.
Events. PSU output current pre-alarm	0x1830	Warning	Total PSU output current exceeds pre-alarm limit
Events. E-Fuse CH1 Tripped	0x1840	Warning	E-Fuse Ch1 tripped due to overcurrent
Events. E-Fuse CH2 Tripped	0x1841	Warning	E-Fuse Ch2 tripped due to overcurrent
Events. E-Fuse CH3 Tripped	0x1842	Warning	E-Fuse Ch3 tripped due to overcurrent
Events. E-Fuse CH4 Tripped	0x1843	Warning	E-Fuse Ch4 tripped due to overcurrent
Events. Output current pre-alarm CH1	0x1850	Notification	Output current on E-Fuse Ch1 exceeds pre-alarm limit
Events. Output current pre-alarm CH2	0x1851	Notification	Output current on E-Fuse Ch2 exceeds pre-alarm limit
Events. Output current pre-alarm CH3	0x1852	Notification	Output current on E-Fuse Ch3 exceeds pre-alarm limit
Events. Output current pre-alarm CH4	0x1853	Notification	Output current on E-Fuse Ch4 exceeds pre-alarm limit