



XtrapulsGDPS

Power supply unit



Warning

This is a general manual describing a series of power supplies having output capability suitable for powering servo drives.

Instructions for storage, use after storage, commissioning as well as all technical details require the MANDATORY reading of the manual before getting the drives operational.

Maintenance procedures should be attempted only by highly skilled technicians having good knowledge of electronics and servo systems with variable speed (EN 60204-1 standard) and using proper test equipment.

The conformity with the standards and the "CE" approval is only valid if the items are installed according to the recommendations of the drive manuals. Connections are the user's responsibility if recommendations and drawings requirements are not met.



CAUTION

Any contact with electrical parts, even after power down, may involve physical damage.

Wait at least 10 minutes after power down before handling the devices (a residual voltage of several hundreds of volts may remain during a few minutes).



Caution: Hot surface, risk of burns (wait for cooling after power down).



ESD INFORMATION (ElectroStatic Discharge)

INFRANOR® drives are designed to be best protected against electrostatic discharges. However, some components are particularly sensitive and may be damaged if the drives are not properly stored and handled.

STORAGE

- The devices must be stored in their original packaging.
- When taken out of their packaging, they must be stored positioned on one of their flat metal surfaces and on a dissipating or electrostatically neutral support.
- Avoid any contact between the device connectors and material with electrostatic potential (plastic film, polyester, carpet ...).

HANDLING

- If no protection equipment is available (dissipating shoes or bracelets), the devices must be handled via their metal housing.
- Never get in contact with the connectors.

All electrical industrial automatism which lifetime is coming to its end are Waste Electronic and Electrical Equipment (WEEE) according to article R543-172 of the French Environmental Code.



WASTE DISPOSAL

This symbol indicates that INFRANOR devices shall be eliminated by selective disposal and not with household waste.



WEEE classification of the INFRANOR® products	Category 9: Monitoring and control instruments
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In accordance with the Decree nr. 2012-617 of May 2nd, 2012 which specifies the provisions related to the professional EEE manufacturers' obligations, INFRANOR France is a member of RECYLUM: eco-organization **ecosystem**® certified for the collection, treatment and recycling of WEEE.

In France, RECYLUM allows all professionals benefiting from a free collection and recycling solution, in observance of the regulation, the environment and health.



Information and sorting instructions regarding INFRANOR® products

	Type of waste	Waste category	Waste management
Packaging	Cardboard	Recyclable waste	Waste disposal centre / collection point of recyclable waste
Documents	Paper	Recyclable waste	Waste disposal centre / collection point of recyclable waste
Mechanics	Metal	Recyclable waste	Waste disposal centre / metal collection point
Heatsinks	Metal	Recyclable waste	Waste disposal centre / metal collection point
Electronical boards and components	WEEE (Waste Electronic and Electrical Equipment)	Dangerous industrial waste	France: http://www.ecosystem.eco/fr/sous-rubrique/solutions Abroad: Country-specific regulation

 Sorting instructions may vary according to regions / countries.

INFRANOR does not assume any responsibility for any physical or material damage due to improper handling or wrong descriptions of the ordered items.

Any intervention on the items, which is not specified in the manual, will immediately cancel the warranty.

INFRANOR reserves the right to change any information contained in this manual without notice.

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CHAPTER 1 -SPECIFICATIONS

1.1 -DESCRIPTION / COMPLIANCE WITH THE STANDARDS

1.1.1 -General description

The external XtrapulsGDPS-400/xx power supply unit is the multi-axis power supply intended for use with the XtrapulsPac and XtrapulsPacHP servo drives. For the various configurations, see XtrapulsPac and XtrapulsPacHP Installation manuals.

The XtrapulsGDPS -400/xx power supply unit operates within a wide voltage range between 230 and 480 V_{AC}. Consequently, the output power will depend on the input voltage. The specified power values are given for a maximum voltage of 480 V_{AC}.

1.1.2 -Reference to directives and standards



- 2014/35/EU: Low Voltage Directive
Harmonized standard applied: EN 61800-5-1:2007: Electrical, Thermal and Energetic security requirements - Part 5-1: Safety Requirements - Electrical, Thermal and Energy

Overvoltage category III, System Voltage = 300 V

- 2006/42/EC: Machinery directive
Harmonized standard applied: EN 61800-5-2:2007 & 2017: Adjustable speed electrical power drive systems - Part 5-2: Safety requirements - Functional
- 2014/30/EU: Electromagnetic Compatibility
Harmonized standard applied: EN 61800-3:2018: Adjustable speed electrical power drive systems - Part 3: EMC requirements and specific test methods
C3 category equipment - Expected use: Second environment including other areas than those directly supplied with electricity by a public low-voltage mains network.
- 2017/2102: Restriction of Hazardous Substances
- 2012/19/EU: Waste Electrical and Electronic Equipment



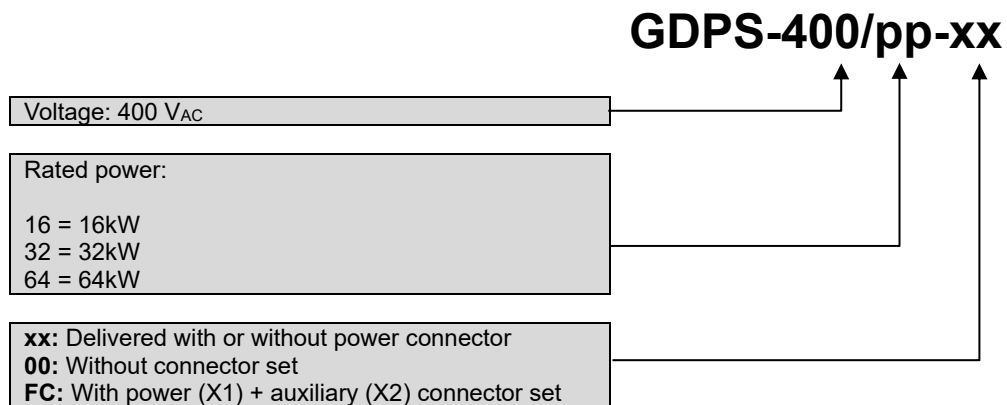
- UL 61800-5-1: Adjustable Speed Electrical Power Drive Systems - Safety Requirements - Electrical, Thermal and Energy
- CSA C22.2 N°274-17: Adjustable speed drives.



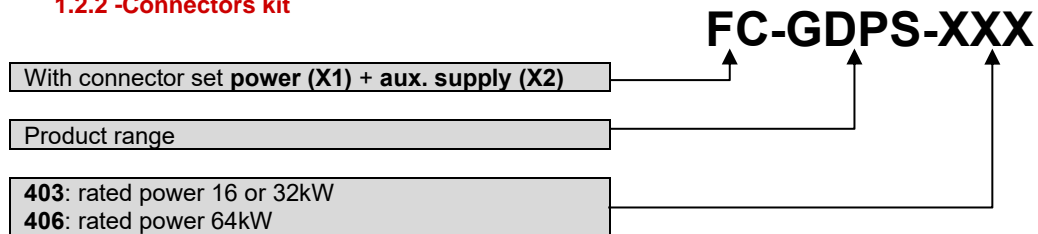
- Electrical Equipment (Safety) Regulations 2016
Harmonized standard applied: EN 61800-5-1:2007
- Supply of Machinery (Safety) Regulations 2008
Harmonized standard applied: EN 61800-5-2:2007 & 2017
- Electromagnetic Compatibility Regulations 2016
Harmonized standard applied: EN 61800-3:2018
- The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012

1.2 -ORDERING CODE

1.2.1 -XtrapulsGDPS power supply unit



1.2.2 -Connectors kit



1.2.3 -Braking resistors

The choice of the braking resistor should be the result of the method described in [Chapter 1.5.3: Braking system](#). However, the following references are recommended in most applications:

- dp-7.5/560 to be connected to an XtrapulsGDPS 400/64
- dp-16.5/560 to be connected to an XtrapulsGDPS 400/32
- dp-33/280 to be connected to an XtrapulsGDPS 400/16.

In any case, the connection of a braking resistor is required.

1.3 -MAIN TECHNICAL DATA

		Operating voltage 400 V _{AC}	Operating voltage 230 V _{AC}
Mains operating voltage		400 - 480 V _{AC} *	230 V _{AC}
Mains specifications		Three-phase, 50 to 60 Hz, Grounded neutral system with balanced phase-to-ground voltage.	
Voltage unbalance		Max. 3 % of the mains voltage fundamental	
Mains filter		Integrated	
Peak output power	GDPS 16 kW GDPS 32 kW GDPS 64 kW	45 kW 90 kW 180 kW (IEC) / 154 kW (UL)	25 kW 45 kW 90 kW
Rated output power	GDPS 16 kW GDPS 32 kW GDPS 64 kW	16 kW 32 kW 64 kW (IEC) / 55 kW (UL)	8 kW 16 kW 32 kW
Static output DC voltage		$V_{DC} = \sqrt{2} \times V_{AC}$	$V_{DC} = \sqrt{2} \times V_{AC}$
Dynamic output DC voltage according to the mains voltage / regenerative phase		480 - 800 V _{DC}	275 - 400 V _{DC}
Triggering threshold of the braking system		790 V ± 5 %	390 V ± 5 %
Minimum braking resistor value	GDPS 16 kW GDPS 32 kW GDPS 64 kW	33 Ω 16.5 Ω 7.5 Ω	16.5 Ω 7.5 Ω 3.75 Ω
Peak power of the braking system	GDPS 16 kW GDPS 32 kW GDPS 64 kW	20 kW 40 kW 80 kW	10 kW 20 kW 40 kW
Maximum continuous power of the braking system (I ² t limited)	GDPS 16 kW GDPS 32 kW GDPS 64 kW	4 kW 8 kW 16 kW	2 kW 4 kW 8 kW
Undervoltage threshold		200 V ± 5 %*	100 V ± 5 %
Overvoltage threshold		950 V ± 5 %	450 V ± 5 %
Maximum surrounding air temperature		- operation: -25°C to +50°C (from 40°C, the rated power must be reduced by 3 % per additional °C) - storage: -25°C to +70°C.	
UL Listed		Yes	
Weight	GDPS 16 / 32 kW GDPS 64 kW	2.35 kg 3.45 kg	

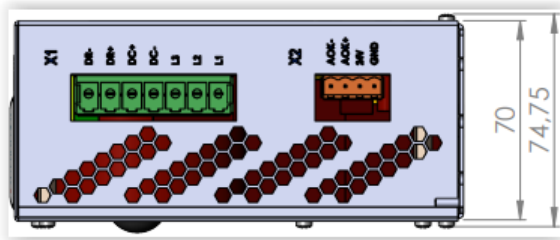
* For special applications, the input voltage range can be extended to 230 Vac - 480 Vac (see chapter 2.4 for reducing the undervoltage threshold to 100 Vdc).

1.4 -MECHANICAL DIMENSIONS

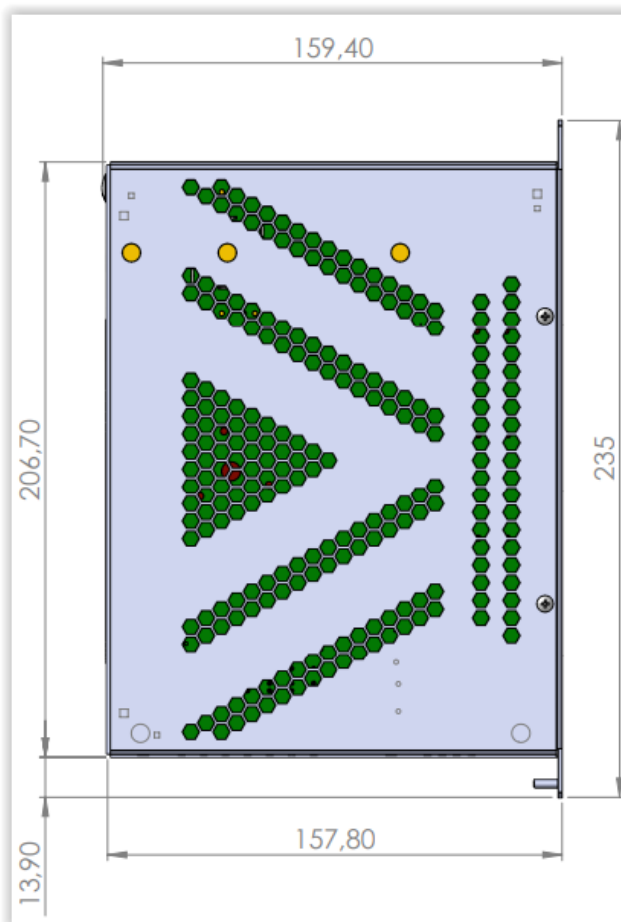

Warning
 VERTICAL MOUNTING IS MANDATORY

1.4.1 -XtrapulsGDPS 16 / 32 kW

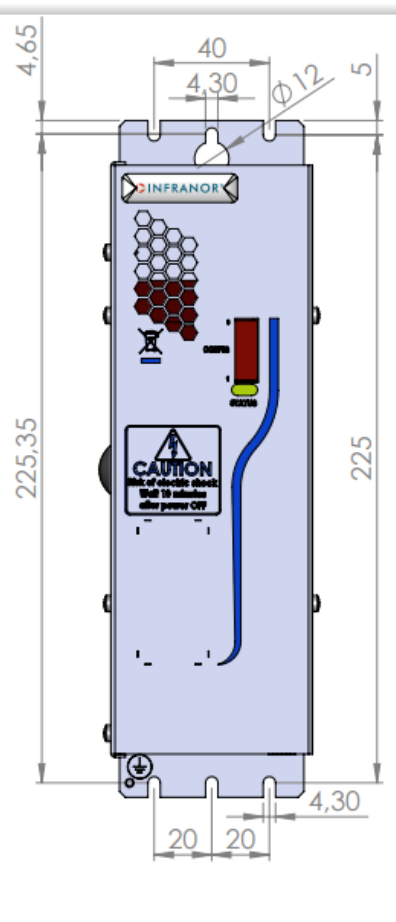
BOTTOM VIEW



SIDE VIEW

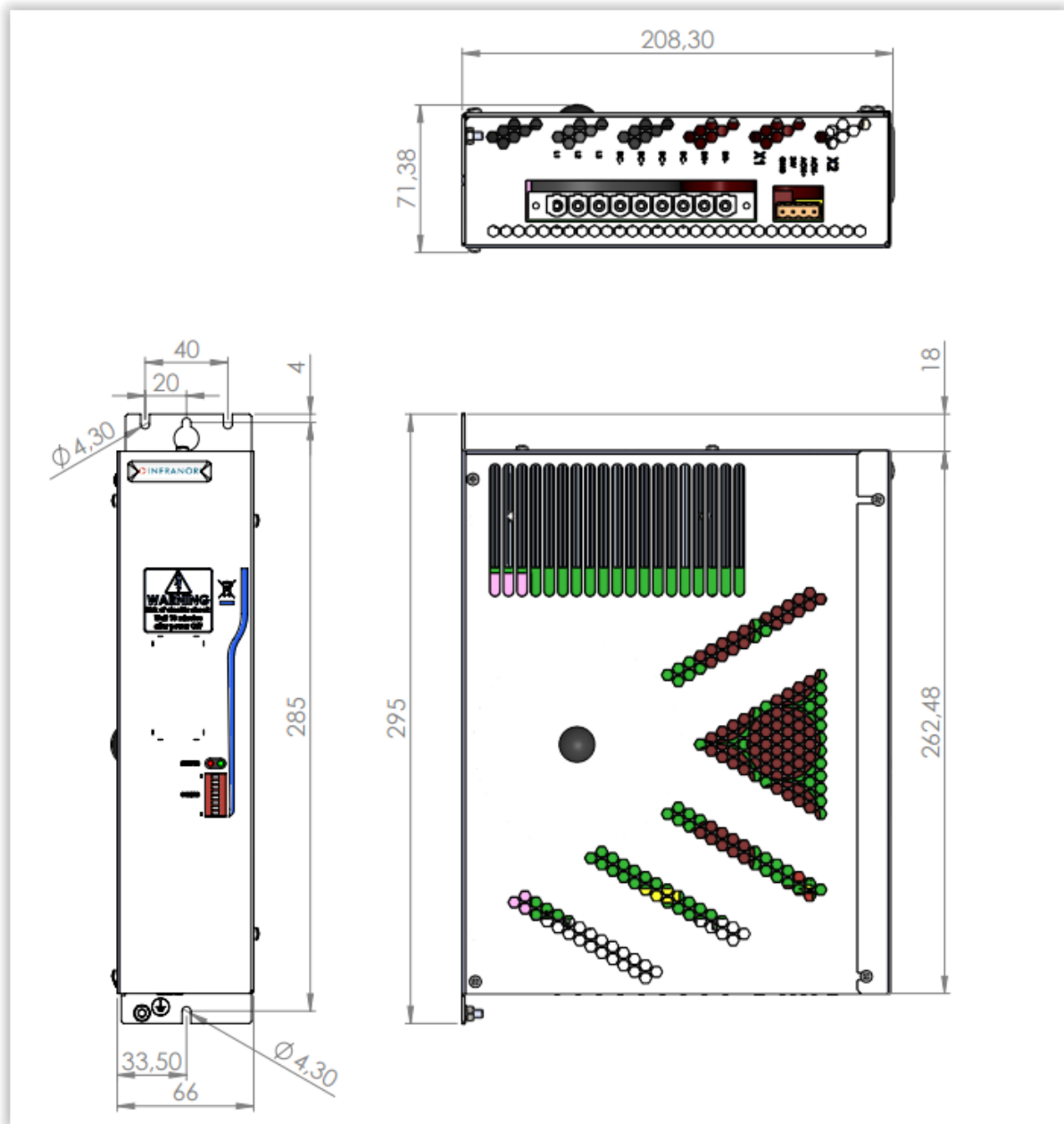


FRONT VIEW



Dimensions are given in mm.

1.4.2 -XtrapulsGDPS 64 kW



1.5 -SIZING OF THE POWER SUPPLY

1.5.1 -Continuous power

For a reliable and safe operation of the installation, the continuous average power needs to be evaluated for all axes.

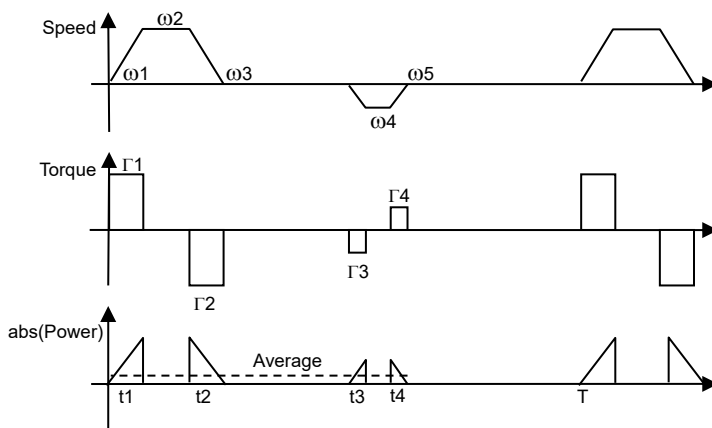
Various ways to proceed for evaluating the continuous power of a machine are listed below:

Accurate method:

The power can be calculated by the absolute value average of the mechanical power for each axis.

$$P_{averageGDPS} = \sum_1^N < Abs(P_{mechanicalaxis.n}) >$$

Example for one axis:



$$E_{GDPS} = \frac{1}{2} \cdot \Gamma_1 \cdot (\omega_2 + \omega_1) \cdot t_1 + \frac{1}{2} \cdot \Gamma_2 \cdot (\omega_3 + \omega_2) \cdot t_2 + \frac{1}{2} \cdot \Gamma_3 \cdot (\omega_4 + \omega_3) \cdot t_3 + \frac{1}{2} \cdot \Gamma_4 \cdot (\omega_5 + \omega_4) \cdot t_4$$

$$P_{averageGDPS} = \frac{E_{GDPS}}{T}$$

With: Γ : Torque value in Nm (positive when the speed increases)
 ω : Speed value in rad/s
 t : Duration of the deceleration or acceleration phase
 T : Period of the whole cycle

Simplified method 1:

If the continuous average power cannot be evaluated by the "accurate method", it may be convenient to use the power of the application motors.

The electrical power can be evaluated by the mechanical power divided by the electromechanical efficiency.

If motors have been correctly sized, the average power can be evaluated by means of the following formula:

$$P_{averageGDPS} = \sum_1^N \frac{P_{rated.motor.n}}{\eta_N} \quad \text{With } \eta \approx 0.9$$

Simplified method 2:

If the continuous average power cannot be evaluated by the "accurate method", it may be convenient to define a service ratio (K_S) for each drive.

In this case, the average power can be evaluated by means of following formula:

$$P_{averageGDPS} = \sum_1^N K_S \times P_{rated.axis.n} \quad \text{With: } K_S \geq 0.4$$

$$P_{rated.axis.n} = \sqrt{3} \times U \times I_{rated.axis.n}$$

1.5.2 -Peak power

The sum of the electrical power of all axes must not exceed the power ability of the XtrapulsGDPS supply unit at any moment.

The maximum power of a servo-axis is generally reached at the end of the acceleration phase.

1.5.3 -Braking system

The braking I^2t function defines the conduction time of the braking transistor over 1 second horizon time.

Two different quantities are necessary to completely define an application:

- The peak power:
 - o It defines the deceleration energy,
 - o It is limited by the braking transistor current.
- The average power:
 - o It defines the heat dissipation.

Method for the design of the braking system:

1. Estimation of the regenerative power

The regenerative power must be calculated for each deceleration phase of each motor.

$$P_{LOAD} = \frac{J_{TOTAL} \cdot (n_1^2 - n_2^2)}{180 \cdot t_{DEC}} - \frac{T_{LOAD} \cdot (n_1 + n_2)}{19}$$

$$P_{MOTOR} = P_{LOAD} \cdot \eta_{COUPLING}$$

$$P_{JOULE} = \frac{3}{2} R_{MOTOR} \cdot I_{MOTOR}^2$$

$$P_{ELEC} = P_{MOTOR} - P_{JOULE}$$

With : P_{LOAD} : Power regenerated by the load during the deceleration phase in W

J_{TOTAL} : Motor + load inertia of the axis reflected to the motor shaft in $kg \cdot m^2$

n_1 : Rotation speed at the beginning of the deceleration phase in RPM

n_2 : Rotation speed at the end of the deceleration phase in RPM

t_{DEC} : Deceleration time in s

T_{LOAD} : Torque applied by the load on the motor shaft at the beginning of the deceleration phase in Nm

P_{MOTOR} : Power regenerated on the motor shaft in W

$\eta_{COUPLING}$: Efficiency of the mechanical coupling (gearbox). If no gearbox is used $\eta_{COUPLING} \approx 1$

P_{JOULE} : Losses in the motor windings in W

R_{MOTOR} : Winding resistance measured between two phases of the motor in Ω

I_{MOTOR} : Average current in one phase of the motor during the deceleration phase in A

P_{ELEC} : Average power managed by the drive during the deceleration phase in W

2. Choice of the ohmic value

$$R_{MIN} \leq R_{BRAKING} < \frac{U_{BRAKING}^2}{2 \cdot \hat{P}_{ELEC}}$$

With: R_{MIN} : Minimum braking resistor value in Ohm according to section "Main technical data".

$U_{BRAKING}$: Triggering threshold of the braking system in V.

$R_{BRAKING}$: Braking resistor in Ω .

\hat{P}_{ELEC} : Maximum of all P_{ELEC} calculated for all motors and for all deceleration phases in W.

3. Average power

The required average power must be calculated to correctly choose the size of the braking resistor and to take into account the heat dissipation effect into the near environment.

$$P_{AVERAGE} = \frac{\sum_{n,p} P_{ELEC}(n, p) \times T_{DEC}(n, p)}{T_{CYCLE}}$$

With: P_{ELEC} : Power managed by the drive axis n during the deceleration phase in W.

4. Braking I²t setup

$$P_{I^2t} = \frac{t_{ON}}{1000} \cdot \frac{U_{BRAKING}^2}{R_{BRAKING}}$$

With: P_{I^2t} : Maximum average power allowed by the braking I²t function in W

t_{ON} : Conduction time allowed by the braking I²t function in ms

$U_{BRAKING}$: Triggering threshold of the braking system in V

$R_{BRAKING}$: Braking resistor in Ω

5. Connection of the braking resistor



Warning

The braking resistor **MUST** be mounted out of range of heat sensitive and inflammable elements (plastic, cable sleeves, etc.).

In order to avoid any EMC or electrical problem, some rules must be observed:

- heat must be evacuated,
- shielded cable or at least twisted wires must be used,
- wires must bear high voltage and high temperature (recommended type: UL1015, AWG 14)
- wires must be as short as possible (max. 1 m).

CHAPTER 2 -INPUTS-OUTPUTS

2.1 -X1 CONNECTOR: POWER - XTRAPULSGDPS 16 / 32 KW

Manufacturer: Phoenix Contact
 Type: PC 5/ 7-STCL1-7.62
 Reference: 1778117
 Tightening torque: 0.7 to 0.8 Nm

PIN	SIGNAL	I/O	FUNCTION	DESCRIPTION
1	L1	I	Mains input supply	Integrated EMI filter. Grounding by means of a screw with nut on the bottom plate.
2	L2	I		
3	L3	I		
4	DC-	I/O	DC bus negative voltage output	Output to power drives. Recommended wire section: - AWG 10 /105°C for GDPS 32 kW - AWG 12 / 105°C for GDPS 16 kW Maximum length: 200 mm
5	DC+	I/O	DC bus positive voltage output	
6	DR+	O	Braking resistor connection	Recommended wire section: AWG14. Braking resistor is required.
7	DR-	O		



Warning

The DC+/DC- polarity between the multi-axis power supply unit and the drives MUST be observed.

2.2 -CONNECTOR: POWER - GDPS 64 KW

Manufacturer: Phoenix Contact
 Type: SPC 16/ 9-STF-10,16 (Push-in spring)
 Reference: 1711446

PIN	SIGNAL	I/O	FUNCTION	DESCRIPTION
1	L1	I	Mains input supply	Integrated EMI filter. Grounding by means of a screw with nut on the bottom plate.
2	L2	I		
3	L3	I		
4	DC-	I/O	DC bus negative voltage output	Output to power drives. Recommended wire section: - AWG 06 / 105°C *) Maximum length: 200 mm
5	DC+	I/O	DC bus positive voltage output	
6	DC-	I/O	DC bus negative voltage output	Recommended wire section: AWG 12. Braking resistor is required.
7	DC-	I/O	DC bus negative voltage output	
8	DR+	O	Braking resistor connection	
9	DR-	O		

*) According to the actual power, the total cross section can be distributed on all four DC bus outputs



Warning

The DC+/DC- polarity between the multi-axis power supply unit and the drives MUST be observed.

2.3 -X2 CONNECTOR: AUXILIARY POWER SUPPLY AND AOK

Manufacturer: Weidmüller
 Type: BLZP 5.08 / 04 / 180
 Reference: 194360
 Tightening torque: 0.4 to 0.5 Nm

PIN	SIGNAL	I/O	FUNCTION	DESCRIPTION
1	0V = GND	I	Mains isolated 24 Vdc auxiliary supply 0 V input referenced to the GND potential of the amplifier housing	24 Vdc supply: +/- 10% Consumption: 0.320 A
2	24 V	I		
3	AOK+	O	Shut down the mains in case of power component failure	OptoMos relay: high output impedance if fault U _{max} = 50 V , I _{max} = 300 mA Polarity must be observed: AOK+ = positive potential AOK- = negative potential
4	AOK-	O		



Warning

Providing the +24 V auxiliary power supply is MANDATORY.

Powering the GDPS module with the mains but without the auxiliary power supply will destroy it.

2.4 -LEDS

The XtrapulsGDPS unit cannot be reset.

If a fault has been detected, the user has to identify the origin of the problem.

Once the origin of the problem solved, the auxiliary power supply of the XtrapulsGDPS unit has to be switched off/on.

LEDs available on the front panel are used to display the XtrapulsGDPS unit status:

RED LED	GREEN LED	AOK	DESCRIPTION
X	○	OPEN	+24 V _{DC} auxiliary power supply is off
X	— —		Power supply is off: undervoltage fault
X	●		Power supply is on
○	X	CLOSE	No fault detected
- -	X	OPEN	Overvoltage fault
-- --	X	OPEN	Braking transistor fault
--- ---	X	OPEN	Temperature fault (XtrapulsGDPS 400/64 kW only)
●	X	OPEN	Configuration fault

Legend:

X	No influence on the status described
○	LED is off
●	LED is on
— —	regular blink
- -	one flash
-- --	two flashes
--- ---	three flashes

2.5 -MINI-SWITCH SW1

The mini-switch available on the front panel is used to configure the operation mode of the XtrapulsGDPS unit:

MINI-SWITCH								DESCRIPTION
1	2	3	4	5	6	7	8	
0	0	0	0	X	X	X	X	Operating voltage = 400 V _{AC} (default configuration)
1	1	0	0	X	X	X	X	Operating voltage = 400 V _{AC} with undervoltage threshold reduced to 100 V _{DC}
1	1	1	1	X	X	X	X	Operating voltage = 230 V _{AC}
X	X	X	X	0	0	0	0	Braking I ² t = 200 ms (default configuration)
X	X	X	X	1	1	1	1	Braking I ² t = 100 ms

The configuration of the XtrapulsGDPS unit is read only at power up.

If the configuration has to be changed, proceed as described below:

1. Switch off all power supplies (mains and auxiliary power supplies)
2. Change the mini-switch code
3. Switch on the auxiliary power supply
4. Verify that no configuration fault is detected.



IMPORTANT

When the operating voltage is 230 V, make sure that it is correctly set up in the XtrapulsGDPS power supply unit **AND** in the drive.

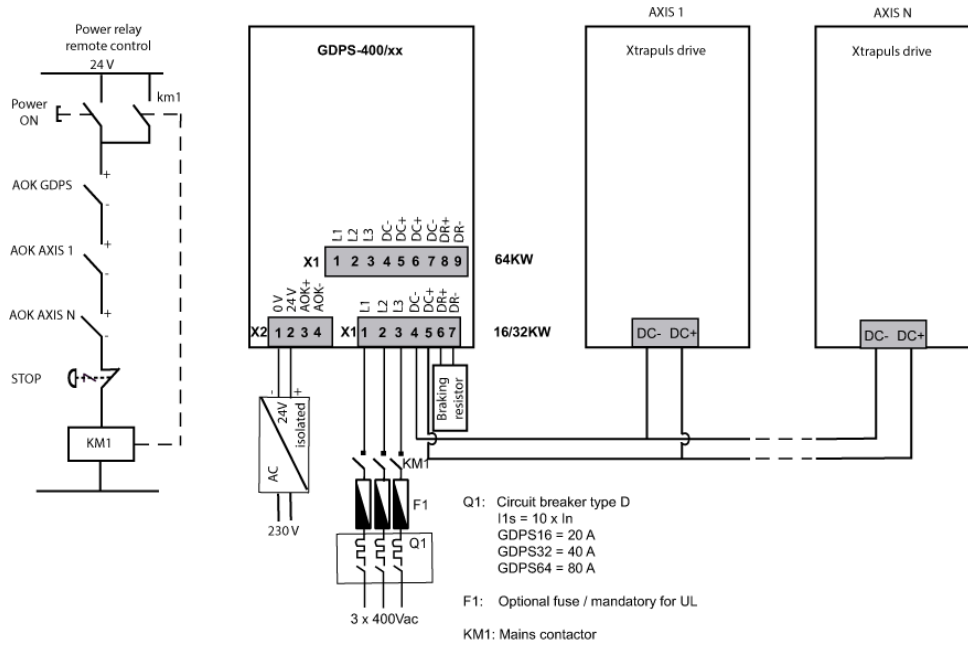


RISK OF ELECTRIC SHOCK

The XtrapulsGDPS unit is IP20 classified. Since the mini-switch configuration requires a little screwdriver, the SW1 mini-switch must always be handled with power off.

CHAPTER 3 -CONNECTION

3.1 -CONNECTION DIAGRAM



Warning

Polarity DC+ and DC- between drives and the XtrapulsGDPS power supply unit must be observed. Otherwise, drives will be immediately destroyed.

AOK input must be wired in order to reduce the risk of fire.

3.2 -UL FUSE RATING

In order to be UL compliant, the protection of the XtrapulsGDPS-400/xx multi-axis power supply unit must be achieved by a class J fuse. Suitable for use on a circuit of delivering not more 5000Arms symmetrical amperes at a voltage of 480V.

XtrapulsGDPS	400/16	400/32	400/64
Recommended ratings	A4J20 AJT20 (preferred)	A4J40 AJT40 (preferred)	A4J60 AJT60 (preferred)

CHAPTER 4 -TROUBLESHOOTING



Warning

The opening of the branch-circuit protective device may be an indication that a fault has been interrupted. To reduce the risk of fire or electric shock, current-carrying parts and other components of the controller should be examined.

4.1 -UNDERVOLTAGE FAULT

When switching on the auxiliary 24 V_{DC} supply, the XtrapulsGDPS unit always displays the undervoltage fault. The undervoltage fault will go out when switching on the power voltage, after a few seconds time delay that corresponds to the soft start of the power capacitors.

The soft start system will be activated again when the voltage will drop below the undervoltage threshold.

If the fault display remains after switching on the power supply:

- Check that the power supply is actually on and for the actual voltage value. The DC bus voltage value can be measured by means of the digitizing oscilloscope.

4.2 -OVERVOLTAGE FAULT

The overvoltage fault protects the drive against high voltage values on the DC bus.

This fault may have different origins:

- Check that the braking resistor is not open.
- Check that the operating voltage is correctly set up according to the mains voltage (SW1 configuration).
- When the braking I²t protection becomes active, it prevents the braking resistor from switching. Check that the braking ability is sufficient for the application. In this case, a lower ohmic value may solve the problem.

4.3 -BRAKING TRANSISTOR FAULT

The braking transistor fault is used to protect the XtrapulsGDPS unit and the braking resistor against a short-circuited transistor.

This fault may have two different origins:

- If no braking resistor is connected, the fault will be displayed. Check that a braking resistor is connected and not opened.
- Otherwise, the braking transistor has been destroyed. In this case, the XtrapulsGDPS unit must be repaired.

4.4 -TEMPERATURE FAULT

The temperature fault protects the XtrapulsGDPS 400/64 kW power supply unit against damages on the rectifier power module.

This fault may have different origins:

- Check that the application power does not exceed the XtrapulsGDPS rated power.
- Check that the room temperature does not exceed the maximum surrounding air temperature specified in section 1.3: MAIN TECHNICAL DATA.

4.5 -CONFIGURATION FAULT

The configuration fault is used to prevent a wrong configuration by means of the SW1 mini-switch.

Check the SW1 mini-switch code in the table.

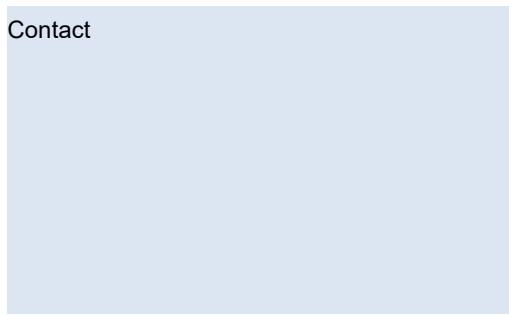


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