

# XtrapulsPac

## XtrapulsPac

### XtrapulsPac Installation Guide

en



**Digital drive  
for sinusoidal  
synchronous  
AC motors**

# XtrapulsPac

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**WARNING**

This is a general manual describing a series of servo drives having output capability suitable for driving AC brushless sinusoidal servo motors.

Please see also:

- **XtrapulsPac STO** for the Safe Torque Off function
- **XtrapulsPac User Guide** for the operation of the drive (commissioning, configuration, ...)
- **XtrapulsPac Templates** for the templates of target applications.

**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.



Any contact with electrical parts, even after power down, may involve physical damage. Wait for at least 5 minutes after power down before handling the drives (a residual voltage of several hundreds of volts may remain during a few minutes).

**ESD INFORMATION (ElectroStatic Discharge)**

INFRANOR drives are conceived 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 drives must be stored in their original package.
- When taken out of their package, 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 drive connectors and material with electrostatic potential (plastic film, polyester, carpet...).

**HANDLING**

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

**ELIMINATION**

In order to comply with the 2002/96/EC directive of the European Parliament and of the Council of 27 January 2003 on waste electrical and electronic equipment (WEEE), all INFRANOR devices have got a sticker symbolizing a crossed-out wheeled dustbin as shown in Appendix IV of the 2002/96/EC Directive.

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

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 - General |

## 1.1 – INTRODUCTION

**XtrapulsPac** all-digital drives with sinusoidal PWM control are servo drives that provide the control of brushless AC motors with a position sensor.

The standard control interface can be:

- CANopen,
- EtherCAT®<sup>1</sup>,
- analog,
- stepper motor emulation,
- logic I/Os.

But the XtrapulsPac range also offers more sophisticated functions such as:

- DS402 including position capture,
- Master/slave and camming,
- Positioner with motion sequencing.

All versions are delivered as standard with the integrated protection function **Safe Torque Off : STO SIL 2**.

With its very small dimensions, the XtrapulsPac is a single-axis stand-alone module that includes power supply and mains filters. It is available in 230 Vac single-phase and particularly suited to low power applications from 0,5 kW to 3 kW.

Series XtrapulsPac drives are fully configurable in order to fit various applications. Both drive versions of the XtrapulsPac range are described below.

The XtrapulsPac version with CANopen interface can be used in the following application types:

- Axes controlled by CANopen fieldbus according to the DS402 protocol,
- Stand-alone operation as a motion sequencer with control by means of logic I/Os,
- Traditional analog speed amplifier with +/- 10 V command and position output by A, B, Z encoder signal emulation,
- Stepper motor emulation with PULSE and DIR command signals.

The XtrapulsPac version with EtherCAT® interface can be used in the following application types:

- Axes controlled by EtherCAT® fieldbus according to the DS402 protocol,
- Stand-alone operation as a motion sequencer with control by means of logic I/Os.

The configuration and parametrization software tool Gem Drive Studio allows a quick configuration of the XtrapulsPac drives according to the target application (template).

## 1.2 – DESCRIPTION / COMPLIANCE WITH THE STANDARDS

### 1.2.1 – GENERAL DESCRIPTION

The XtrapulsPac amplifier directly controls the motor torque and speed from the information provided by a high resolution position sensor (**resolver** or **encoder**). The sinusoidal current commutation generated from the information of this high resolution position sensor ensures very smooth motor torque/force control.

The XtrapulsPac amplifier can be configured for the feedback of various position sensor types. The appropriate position sensor configuration is software selectable and saved in the amplifier.

- With a **resolver** sensor feedback, the motor absolute position value over one revolution is available and the servo motor can immediately be enabled after the amplifier power up.

<sup>1</sup> EtherCAT® is a registered trade mark and a patented technology of Company Beckhoff Automation GmbH, Germany.

- With an **incremental encoder only**, a motor phasing procedure (**Phasing**) must be executed at each amplifier power up before the motor enabling.
- With an **incremental encoder + Hall Effect Sensors (HES)** feedback, the motor phasing procedure is no more necessary and the servo motor can immediately be enabled after the amplifier power up.
- With an **absolute single-turn, multi-turn or linear encoder** using the **HIPERFACE®** communication protocol and fitted with incremental SinCos outputs, the servo-motor can also be immediately enabled after the drive powering.

Series XtrapulsPac amplifiers have their own DC/DC converter to provide the voltages required for the drive operation with a 24VDC +/- 15 % supply source which is generally available on machines. The auxiliary supply allows to keep the amplifier logic supplies after the power supply has been switched off. Thus, the position output can be kept without new initializations of the machine. A 24 VDC battery supply with specific wiring allows to keep the position even after switching off the auxiliary 24 VDC supply. This wiring can be used for getting an "absolute" servo drive operation.

The power supply is 230 VAC single-phase mains operated. A soft start system of the power supply limits the inrush current at power on.

The extremely small dimensions of the XtrapulsPac amplifier allow an optimum integration in 200 mm deep cabinets (connectors included).

All control parameters are programmable via a serial link (e.g. RS-232) and saved in a memory. The auto-tuning and auto-phasing functions allow a quick and easy commissioning of the drive.

Thanks to the **Gem Drive studio** software tool, which is PC compatible with the WINDOWS® operating system, all drive parameters can be displayed and easily modified.

**Gem Drive Studio** also allows the quick configuration of the XtrapulsPac drive according to the application type: as an **Analog drive, Stepper motor emulation, Positioner, etc.**

The **Digital Oscilloscope** of this software tool ensures an easy and quick commissioning of the drive.

The **Gem Drive Studio** software also allows parametrization and diagnostic in a multi-axis configuration.

## 1.2.2 - REFERENCE TO THE STANDARDS: CE

### Electromagnetic compatibility

According to the Directive 2004/108/EC, the actuators are complying with the Electromagnetic Compatibility standards regarding the power servos, referenced in the EN 61800-3 – Part 3 about "Electrical power servo systems with variable speed":

#### EMISSION

EN 61800-3:2004 – Part 3 : section 6, 4-2 (C3 category equipment – tables 17 and 18).

#### IMMUNITY

EN 61000.4-2-3-4.5-6

**Expected use: Second environment** including other areas than those directly supplied with electricity by a public low-voltage mains network.

**NOTE:** Industrial areas and technical rooms are examples of second environment.

**Category of the amplifier equipment: C3.**

#### Security:

73/23/EEC modified by the directive 93/68/EEC:  
EN 61800-5-1 :  
EN 60204-1  
UL508C :  
UL840  
EN 61800-5-2

Low voltage directive  
Electrical, Thermal and Energetic security requirements  
Electrical equipments of industry machines  
Power Conversion Equipment  
Isolation distances  
Safe Torque Off

### 1.2.3 – REFERENCE TO THE STANDARDS: UL

Series XtrapulsPac drives have been "cULus" listed according to UL508C and UL840 regarding the insulator. This product was evaluated to the Third Edition of UL508C, the UL Standard for Power Conversion Equipment, dated May 2002 for the UL Listing (USL).

The final user has to provide an isolated 24 V<sub>DC</sub> auxiliary supply, protected by a UL certified 4 A fuse. The power board is considered, within a limited voltage/current range, as complying with section 31.4 of UL508C. Therefore, spacings on the power board do not require any evaluation according to section 31.2 of UL508C and have been evaluated according to UL 840. According to the UL 840 requirements (2nd Edition, of May 20, 1993), spacings are limited at 2.5 mm, under the condition of an environment with pollution degree 2. Ground is connected to the drive housing by a screw, nuts and washers with diameter 3.

### 1.3 – OTHER DOCUMENTS

- XtrapulsPac User guide.
- CANopen Communication Protocol.
- EtherCAT® fieldbus interface.
- "Safe Torque Off STO" specification.

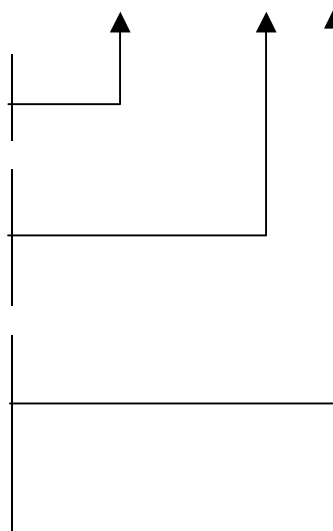
### 1.4 - IDENTIFICATION

The **XtrapulsPac** drive is available with a single-phase 230 Vac supply and three current ratings, with two communication interfaces: CANopen or EtherCAT®.

### 1.5 – ORDER CODE

- ak:** Analog and CANopen interfaces
- et:** EtherCAT® interface
- cc:** Max. current ratings:  
05 = 5 Arms  
11 = 11 Arms  
17 = 17 Arms
- xx:** Delivered with or without power connector
- 00:** Without connector set
- FC:** With **power + motor** connector set
- FL:** With **command** connector set
- FCL:** With **power + motor + command** connector set

#### Pac- xx - 230 / cc - xx



### 1.6 - CONNECTOR SET DESCRIPTION

#### Pac-FC

X8: female 5 pin connector for the auxiliary 24 V<sub>dc</sub> supply and wiring relay for the motor brake.  
X9: female 10 pin connector for the power supply : 230 Vac mains and motor.

## Chapter 2 - Specifications

### 2.1 - MAIN TECHNICAL DATA

#### 2.1.1 – XTRAPULSPAC-230/I

Mains operated power supply voltage	230 Vac +10% -15% single-phase 50 - 60 Hz
Galvanic isolated auxiliary supply voltage	24 Vdc +/-15% - 300 mA
Motor phase-to-phase output voltage	200 Varms
Integrated braking resistor	100 R / 35 W
External braking resistor (disconnection of the internal resistor - see chapter 4: Connections)	Minimum external resistor: 50 $\Omega$ / 200 W (dp 50/200)
Minimum phase-to-phase inductance	1 mH

#### OUTPUT CURRENT RATINGS

TYPE	Max. output current for 1 s (Arms) +/-5 % (230 Vac)	Rated output current (Arms) (230 Vac)	Joule losses (W)	Rated input current (Arms) (230 Vac, 60 Hz)	Certified max. protection line circuit fuses A60Q	Mains short-circuit power	UL C.TUV.US compliance
Pac- 230/5	5.65	2.5	30	2,5	20A	5 kA	In progress
Pac -230/11	11.3	5	55	5	20 A	5 kA	In progress
Pac -230/17	17	8	66	8	25 A	5 kA	In progress

Maximum room temperature: 40°C.

#### OPERATION POWER RESTRICTION IN SINGLE-PHASE



Continuous RMS power ensuring a capacitor lifetime of 20 000 hours:  
650 W for ratings 230/5 and 11  
1000 W for rating 230/17

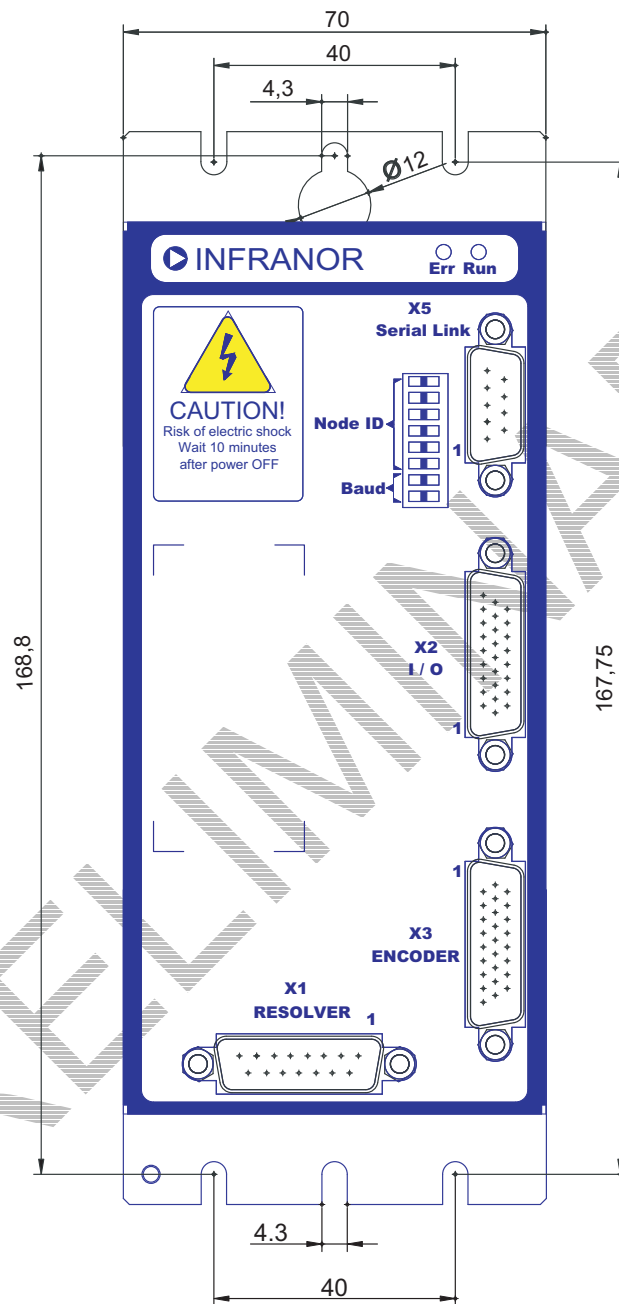
## 2.1.2 - TECHNICAL SPECIFICATIONS

Servo loops: current, speed, position	Digital
Mains filter on power supply	Integrated in the drive
Common mode filter on auxiliary supply	Integrated in the drive
Position sensor	Transmitter resolver Incremental encoder (TTL or SinCos signals) Incremental encoder + Hall Effect sensors Absolute Hiperface encoder
Power protections	See section 3.2.1 - LEDs
Switching frequency	8 kHz
Analog input 1	0 to $\pm 10$ V (resolution: 12 bits)
Analog input 2	0 to $\pm 10$ V (resolution: 12 bits)
Speed and position regulators	Sampling period = 0.5 ms Anti-wind-up system of the integrator Anti-resonance filter Adjustable digital gains
Speed loop bandwidth	Selectable cut-off frequency for 45° phase shift: 50 Hz, 75 Hz or 100 Hz
Current loop bandwidth	Cut-off frequency for 45° phase shift: 1000 Hz
Max. motor speed	Adjustable from 100 to 25 000 rpm
Encoder position output for CANopen version.  <b>No encoder output available on EtherCAT® version</b>	Quadrature signals A & B with Z marker pulse. RS 422 line transmitter Programmable resolution: 64 ppr to 16384 ppr (according to max. motor speed) Accuracy in arc minutes = $(8 + 5400/\text{resolution})$ <u>Note:</u> the total position accuracy must take into account the accuracy of the resolver used.
Resolver input	Excitation frequency: 8 kHz Transformation ratio: 0.3 to 0.5 (other values are factory set)
Encoder input	Software selectable Quadrature signals A & B + one Z marker pulse per rev. Line receiver RS-422 Max. frequency of encoder pulses: 1 MHz Resolution: 500 à 10 <sup>6</sup> ppr
Pulse & Direction input	Software re-configuration of 2 logic inputs for stepper motor emulation: Max. pulse frequency: 10 kHz Resolution: programmable.
Hall sensors input	Software selectable: HES 120° or 60° type Supply voltage provided by the user: 5 V or 12 V HES sequence error detection
7 opto-isolated and parameterizable logic inputs	5 software configurable logic inputs 2 inputs dedicated to the STO (Safe Torque Off) function
"Amp OK" output	"OptoMos" relay: output open if fault U <sub>max</sub> = 50 V, I <sub>max</sub> = 300 mA

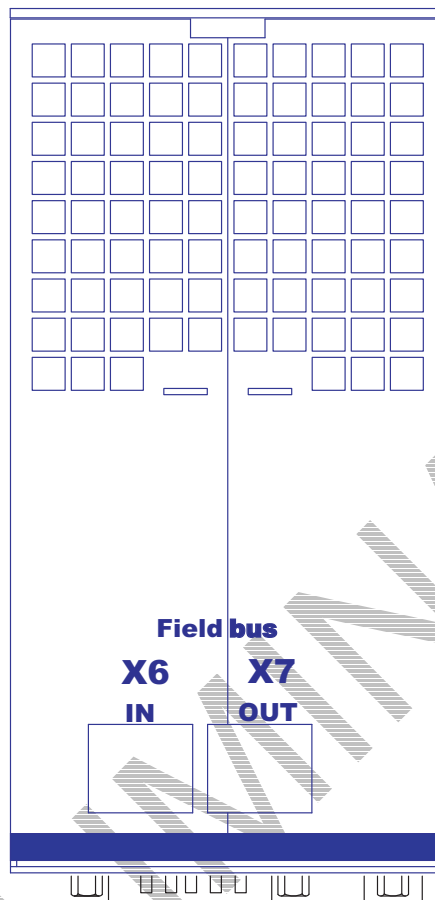
3 parameterizable logic outputs	Type PNP "high side" 24Vdc, max. 200 mA
Analog output	2.5 V +/-2.5 V, resolution: 8 bit, load: 10 mA Low-pass filter: 160 Hz, programmable output signal: all objects can be mapped.
Error display	Front panel LEDs + diagnostic via serial link or CAN bus
Motor and application parametrization	Serial link RS-232 or bus interface with CANopen communication protocol
CAN interface	CANopen Protocol ( DS301, DSP402)
EtherCAT® interface	See <b>EtherCAT® Fieldbus Interface</b> manual
Automatic functions	Drive adjustment to the motor (AUTO-PHASING) Adjustment of the servos (AUTO-TUNING)
Temperature:	Max. temperature: 50 °C
- storage: -20 °C to +70 °C - operation: +5 °C to +40 °C	From 40 °C, the rated currents must be reduced of 3 % per additional Celsius degree
Altitude	1000 m
Moisture	< 50 % at 40 °C and < 90 % at 20 °C: EN 60204-1 standard <b>Condensation prohibited (storage and operation)</b>
Cooling	Natural ventilation or forced air according to the current rating. Check for free ventilation and no obstruction of the upper or lower air admissions
Environment	Open chassis to be mounted in a housing protecting the amplifier from conducting dust and condensation (pollution degree 2 environment)
Mounting position	Vertical
Mounting location	Closed cabinet without any conducting and/or corroding agents, and according to the room temperature requirements. <b>Condensation prohibited</b>
Weight	Pac-230/5, 11 and 17: 1.5 kg.

## 2.2 - DIMENSIONS

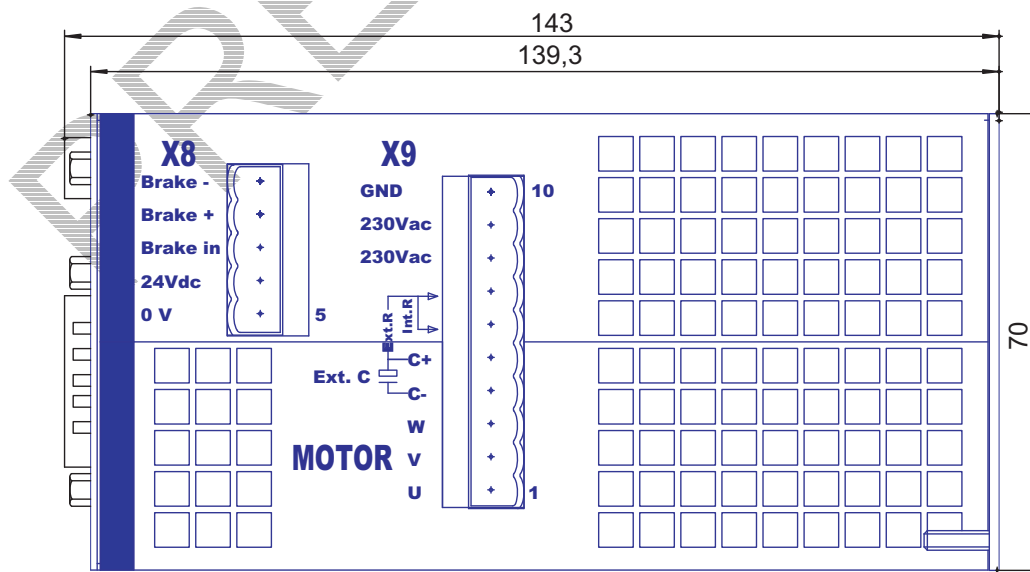
### FRONT PANEL



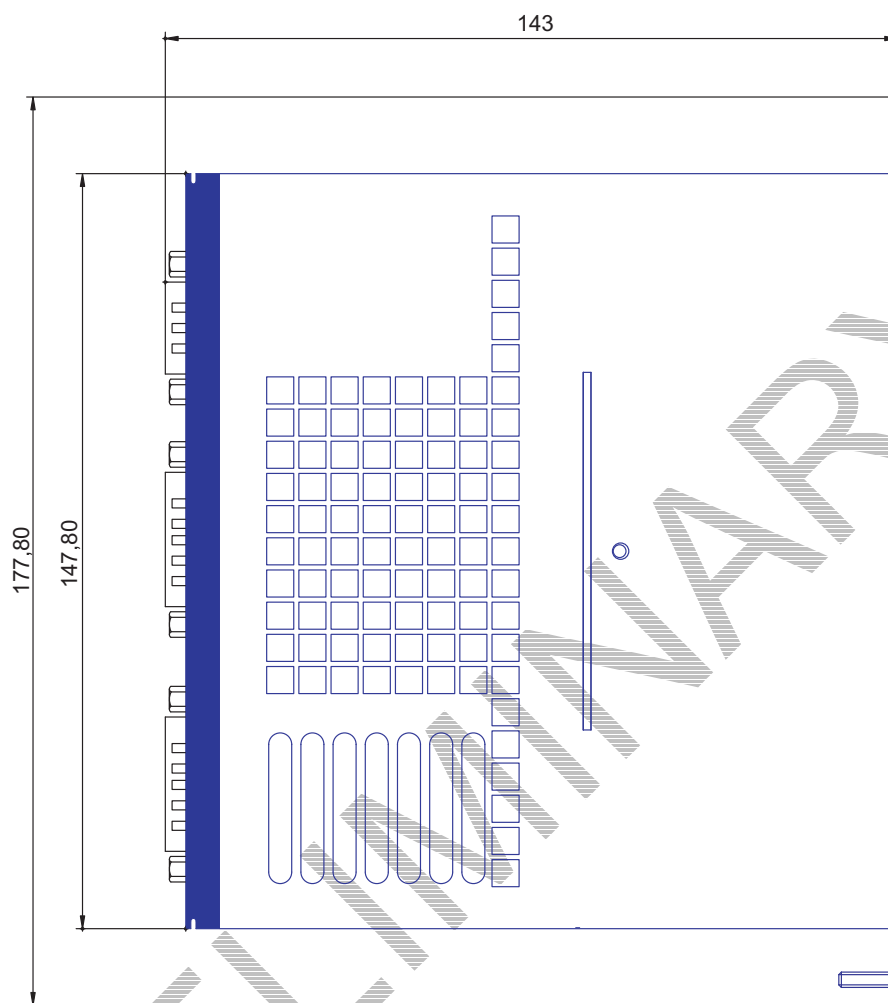
### UPPER VIEW



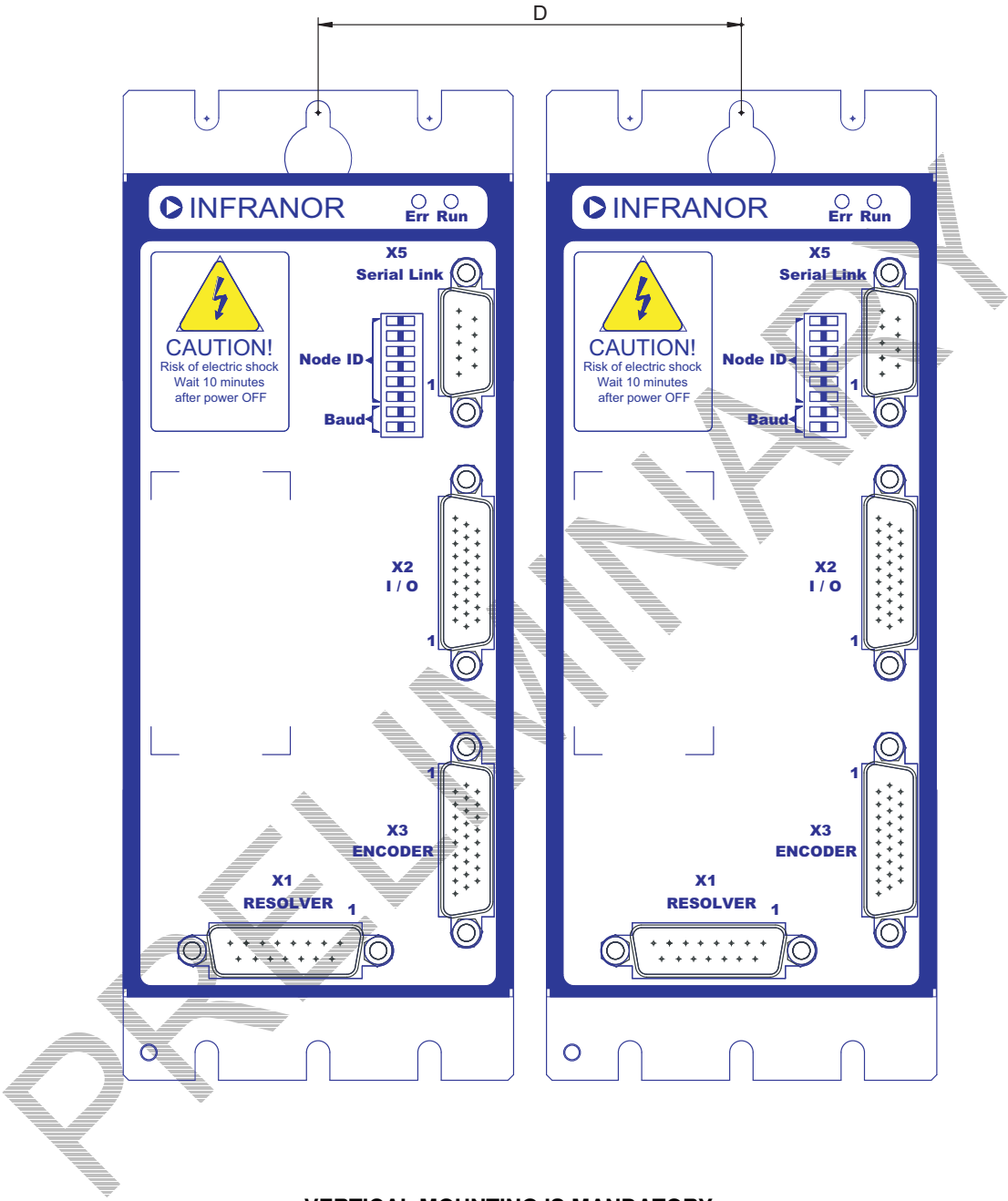
### BOTTOM VIEW



**SIDE VIEW**



2.3 – FASTENINGS



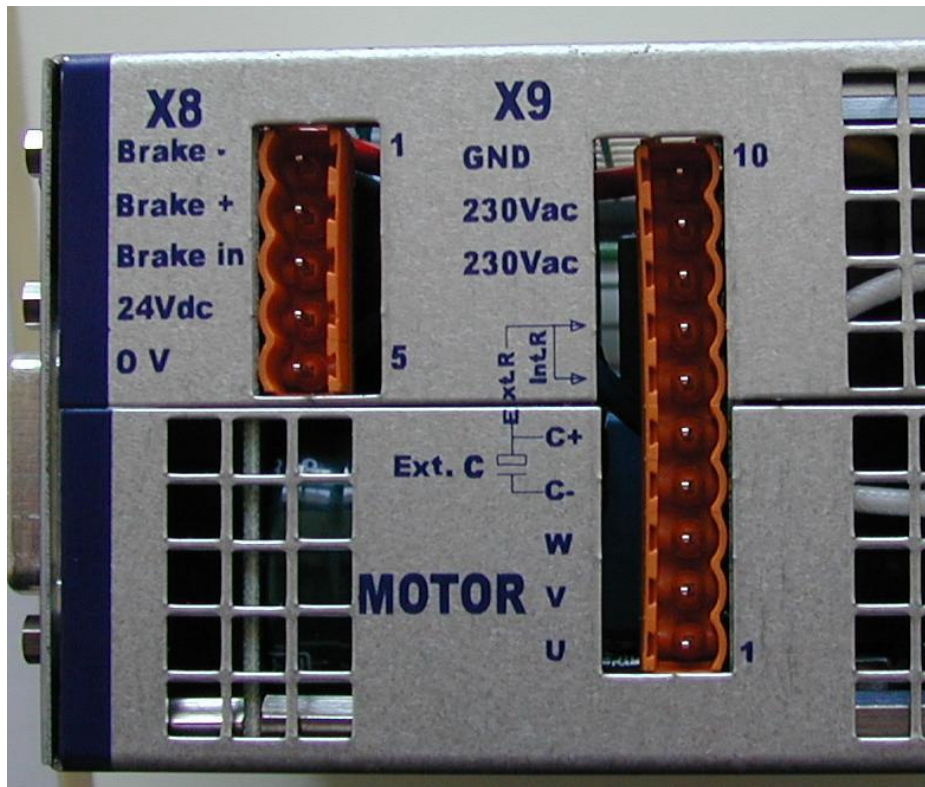
VERTICAL MOUNTING IS MANDATORY

	XtrapulsPacxx-230/5 and 11	XtrapulsPacxx-230/17
D		≥ 76

## Chapter 3 – Inputs - Outputs


### 3.1 – CONNECTOR LOCATION






## 3.2 - DISPLAY

### 3.2.1 – LEDS

RUN (green) 

ERROR (red) 

**RUN:** status of the CANopen or EtherCAT® communication bus connection (according to drive version)..

**ERROR:** faults grouped on the 'ERROR' LED: these errors are coded and can be displayed by means of the parametrization software tool via the serial link RS232 or the CANopen bus.

**ERROR** LED unlit if no fault.

**ERROR** LED flashing: 'UNDERVOLTAGE' error: no power supply voltage.

**ERROR** LED continuously lit: fault.

The **ERROR** LED groups the following faults:

- Power supply overvoltage.
- 24 Vdc logic supply < 17.5 Vdc.
- Motor phase / GND short-circuit.
- Braking system short-circuited or overheated, or braking resistor in open circuit.
- Motor phase / motor phase short-circuit, power stage overtemperature, defective IGBT module.
- Triggering of the  $I^2t$  protection.
- Counting error.
- Position following error
- EEPROM error.
- Procedure execution error (busy).
- Current offset error.
- Drive rating overcurrent.
- Motor temperature error.
- Resolver or encoder cable interruption.

- Hall sensors or absolute encoder error.

### Notes

Any of these errors (except for the "Undervolt." error) involves:

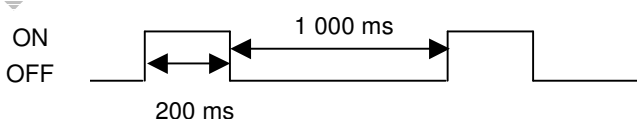
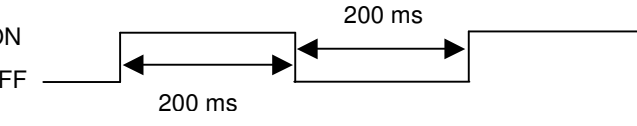
- The continuous lighting of the red **ERROR** LED,
- The amplifier disabling,
- The motor brake control if one of the logic outputs is configured as brake output,
- The opening of the **AOK** relay contact. This relay must be wired as described in [Chapter 5, section 3](#), in order to switch-off the power supply and keep a zero type standstill.

The 'UNDERVOLTAGE' error (flashing **ERROR** LED) involves:

- The amplifier disabling,
- The motor brake control.

### 3.2.2 –XTRAPULSPAC-K VERSION: CANOPEN COMMUNICATION BUS

**RUN:** The CANopen RUN LED indicates the status of the NMT state machine (see DS-301 – 9.52 NMT state machine):

CAN RUN LED	STATUS	
FLASHING	STOP	
BLINKING	PRE-OPERATIONAL	
ON	OPERATIONAL	

See "DR-303-3 Indicator specification" for more information.

### 3.2.3 –XTRAPULSPAC-ET VERSION: ETHERCAT® COMMUNICATION BUS

See "*EtherCAT® Fieldbus interface*" manual.

## 3.3- AMPLIFIER ADDRESSING: SELECTION OF THE TRANSMISSION SPEED

### 3.3.1 – PAC-K VERSION: CANOPEN COMMUNICATION BUS

Each amplifier of the network must be configured with one single address.

A DIP8 switch accessible by the operator allows to configure the amplifier address as well as the communication speed of the **CANopen** bus.

- Addressing (6 selection bits):

Status of the cursors						Address
6	5	4	3	2	1	
OFF	OFF	OFF	OFF	OFF	OFF	0
OFF	OFF	OFF	OFF	OFF	ON	1
OFF	OFF	OFF	OFF	ON	OFF	2
...	...	...	...	...	...	...
ON	ON	ON	ON	ON	ON	63

- Communication speed (2 selection bits):

Status of the cursors		Speed
8	7	
OFF	OFF	1 Mbits
OFF	ON	500 Kbits
ON	OFF	250 Kbits
ON	ON	125 Kbits

**Note:**

- The "00" address configures the drive in **Local** mode.
- An address different from 00 configures the drive in **Remote** mode (use of the **CANopen** bus).

**3.4 – PAC-et VERSION: EtherCAT® COMMUNICATION BUS**

See manual "EtherCAT® fieldbus interface".

**3.5 – RESOLVER CONNECTOR: X1**

SUB D 15 PIN FEMALE CONNECTOR (same as XtrapulsGem and XtrapulsCD1 series)

PIN	FUNCTION	I/O	DESCRIPTION
1	Shield connection	I	If no "360°" connection on the connector
12	TC (thermal sensor)	I	
13	TC (thermal sensor)	I	
2	S3 (cosine +)	I	Resolver signal
10	S1 (cosine -)	I	Resolver signal
11	S2 (sine +)	I	Resolver signal
3	S4 (sine -)	I	Resolver signal
5	R1 (reference +)	I	Resolver signal
4	R2 (reference -)	I	Resolver signal
7	5 V	O	
8	GND	O	
9	Reserved	O	
14	I2C-SCL	I	Bus I2C
15	I2C-SDA	I	Bus I2C

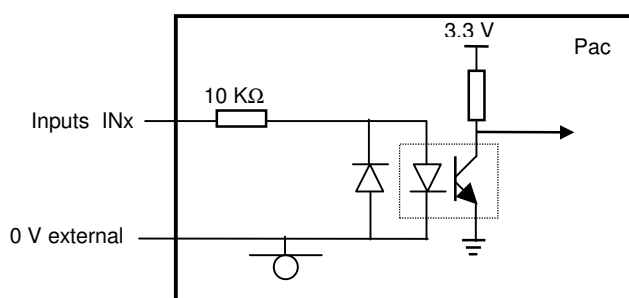
For the connection of other resolver types, see [chapter 5, section 2](#).

### 3.6 - INPUTS-OUTPUTS CONNECTOR: X2

#### SUB D 26 PIN FEMALE HD CONNECTOR

PIN	FUNCTION	I/O	DESCRIPTION
1	ANA1+	I	Analog input n°1
10	ANA1-	I	Differential input +/-10 V Input impedance: 20 kOhms
2	GND		Non differential analog input n°2
11	ANA2	I	Direct input +/-10 V / GND reference
4	AOK-	O	OptoMos relay: high output impedance if fault U <sub>max</sub> = 50 V , I <sub>max</sub> = 300 mA Polarity must be observed: AOK+ = positive potential AOK- = negative potential
14	AOK+	O	
13	GND		External supply for Hall sensor different from encoder +5 V.
3	External supply: max. 24 Vdc / max.300 mA	I	
5	OUT1	O	Non optocoupled DRIVER PNP "high side" logic outputs 24 V / 300 mA
15	OUT2	O	
6	OUT3	O	
16	Differential encoder output Marker Z-	O	Differential encoder outputs available on the XtrapulsPac-k version only. 5 V / 60 mA via channels A, B, Z
7	Differential encoder output Marker Z+	O	
17	Differential encoder output channel B-	O	
8	Differential encoder output channel B+	O	
18	Differential encoder output channel A-	O	
9	Differential encoder output channel A+	O	All logic inputs are optocoupled EGND = optocoupled inputs reference Vin voltage = 18 V < Vin < 30 V Input impedance Z <sub>in</sub> = 10 KOhms Tin input filtre = 20 µs  <b>NOTE: IN5 and IN3 inputs can be used as PULSE and DIRECTION logic inputs (stepper motor emulation). The configuration of the Pulse / Direction inputs is software selectable and saved in the amplifier EEPROM</b>
19	STO2/	I	
20	EGND		
21	STO1/	I	
22	IN5 / PULSE (stepper motor emulation)	I	
23	IN4	I	
24	IN3 / DIR (stepper motor emulation)	I	
25	IN2	I	
26	IN1	I	
12	ANA-OUT	O	Analog output 2.5 V +/- 2 V - 8 bits. software configurable analog output

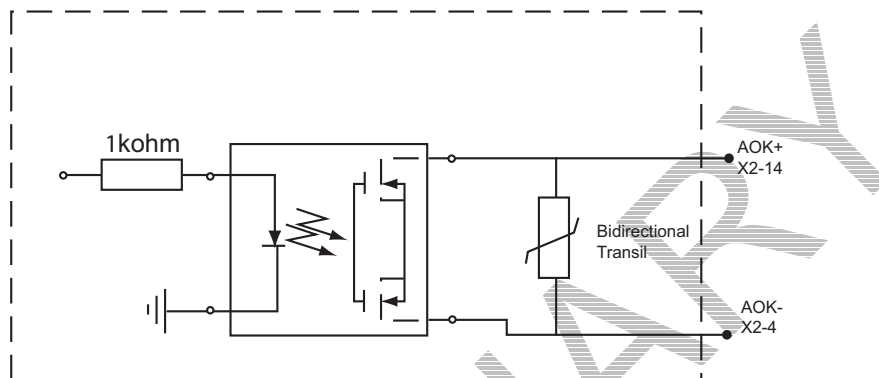
### 3.7 – SPECIFICATION OF THE LOGIC INPUTS



These optocoupled inputs are working in positive logic.  
The input voltage corresponding to level 1 must be between 18 V and 30 V.

### 3.8 - SPECIFICATION OF THE LOGIC OUTPUT "AOK+/-" (POLARIZED OPTO-RELAY OUTPUTS)

The use of the AOK output on an opto relay is mandatory in order to allow the power supply connection (see section 4.1 – Connection diagram).

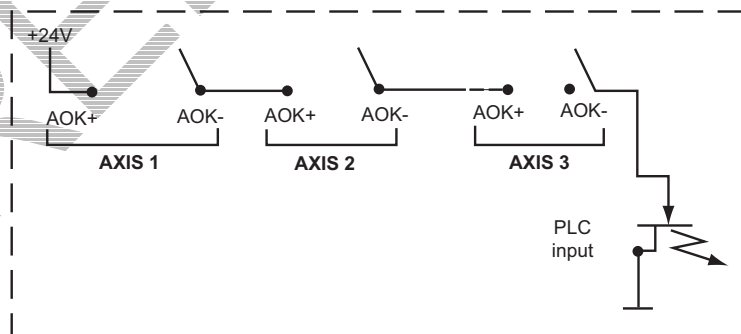


Opto relay polarized contact, closed if amplifier OK, open if fault: the AOK+ positive potential polarity must be observed with regard to AOK-.

$P_{max} = 10 \text{ W}$  with  $U_{max} = 50 \text{ V}$  –  $I_{max} = 300 \text{ mA}$ .

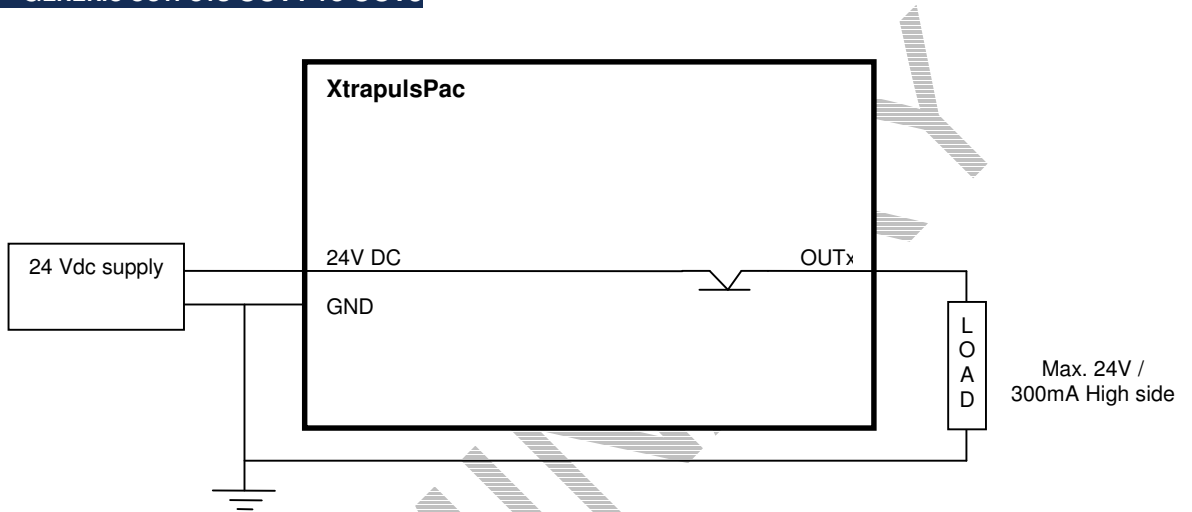


The AOK output is not made by means of a dry contact. Polarity must be observed when connecting the load. The serial connection of several AOK signals must also observe this polarity (see wiring diagram below).

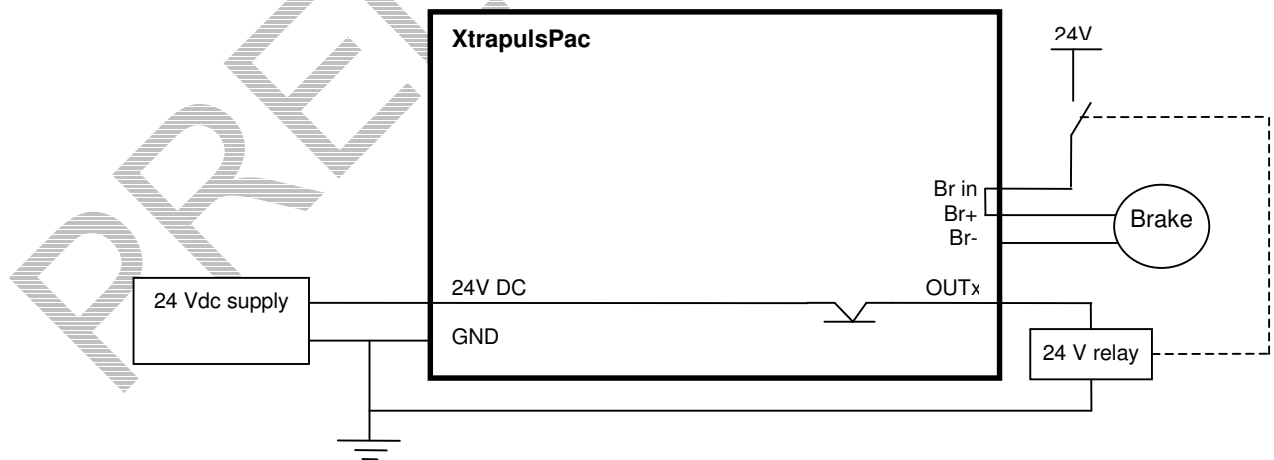


### 3.9 – SPECIFICATION OF THE LOGIC OUTPUTS

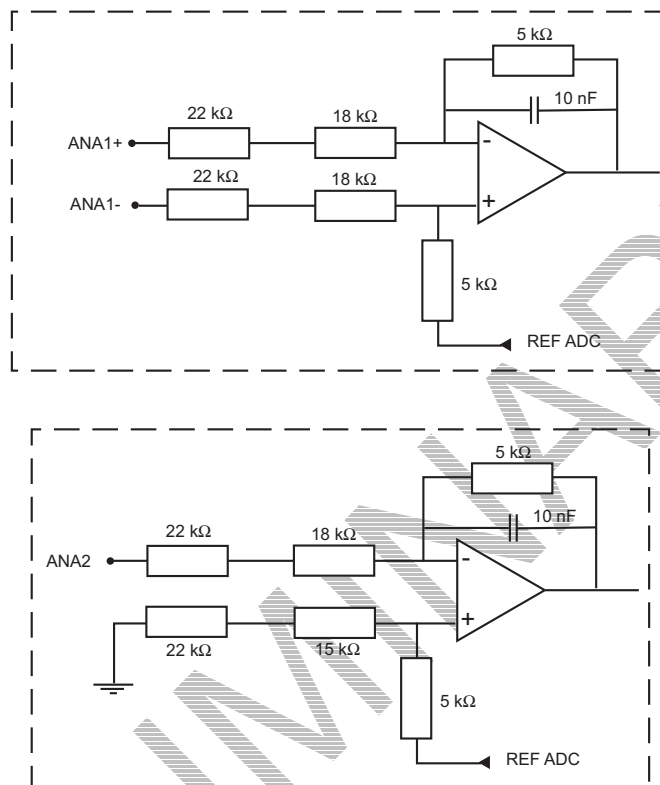
#### 3.9.1 – GENERIC OUTPUTS OUT1 TO OUT3



#### 3.9.2 – WIRING DIAGRAM OF AN OUT1 TO OUT3 LOGIC OUTPUT, SOFTWARE CONFIGURED AS A MOTOR BRAKE OUTPUT



### 3.10 - SPECIFICATION OF THE ANALOG INPUTS ANA1+/- AND ANA2

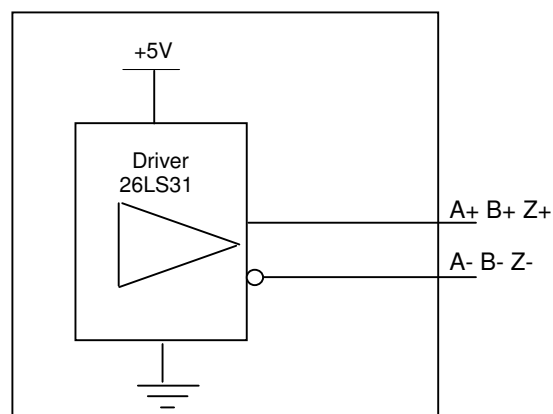


### 3.11 - X2 CONNECTOR FOR ENCODER OUTPUT

The appropriate pin functions of the X2 connector are described below.

PIN	FUNCTION	REMARKS
16	Differential encoder output marker Z-	Differential encoder outputs. Available on version XtrapulsPac-k only 5 V / 60 mA via channels A, B, Z
7	Differential encoder output marker Z+	
17	Differential encoder output channel B-	
8	Differential encoder output channel B+	
18	Differential encoder output channel A-	
9	Differential encoder output channel A+	Amplifier 0 V reference
3	GND	
Others	Reserved	

#### SPECIFICATION OF THE ENCODER OUTPUT SIGNALS



### 3.12 – ENCODER CONNECTORS: X3

#### 3.12.1 – X3 CONNECTOR FOR INCREMENTAL TTL & HES ENCODER INPUT (SUB D HD 26 PINS FEMALE)

The “Incremental TTL & HES encoder” configuration is software selectable and saved in the amplifier EEPROM.

PIN	FUNCTION	REMARKS
22	Z/ marker pulse	Differential input of the encoder marker pulse Z/
21	Z marker pulse	Differential input of the encoder marker pulse Z
3	Channel A/	Differential input of the encoder channel A/
12	Channel A	Differential input of the encoder channel A
4	Channel B/	Differential input of the encoder channel B/
13	Channel B	Differential input of the encoder channel B
7	+5 V	Encoder supply voltage (max. current = 300 mA)
16	GND	Encoder supply GND +5V
6	HALL U	Hall sensor input signal phase U
15	HALL V	Hall sensor input signal phase V
23	HALL W	Hall sensor input signal phase W
24	External supply	Hall sensor supply voltage $\neq$ 5 Vdc. Supply wired on X2 connector
16	GND	Hall sensors supply GND
14	TC+	Motor thermal sensor input
5	TC-	Motor thermal sensor input
Others	Reserved	

#### 3.12.2 - X3 CONNECTOR FOR INCREMENTAL SIN/Cos & HES ENCODER INPUT (SUBD HD 26 PINS FEMALE)

The “Incremental SinCos & HES encoder” configuration is software selectable and saved in the amplifier EEPROM

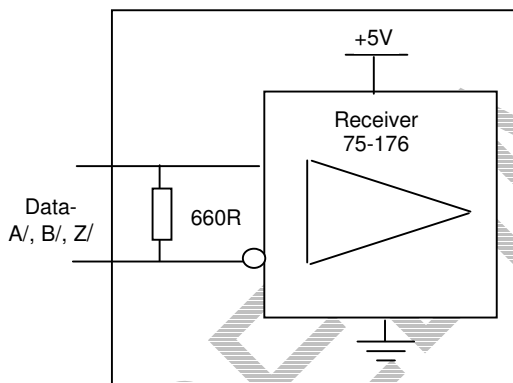
PIN	FUNCTION	REMARKS
25	Mark- channel	Differential input for the reference pulse of the Sin/Cos encoder channel Mark-
26	Mark+ channel	Differential input for the reference pulse of the Sin/Cos encoder channel Mark+
17	Sin- channel	Differential input for Sin- channel of the Sin/Cos encoder
18	Sin+ channel	Differential input for Sin+ channel of the Sin/Cos encoder
8	Cos- channel	Differential input for Cos- channel of the Sin/Cos encoder
9	Cos+ channel	Differential input for Cos+ channel of the Sin/Cos encoder
7	+5 V	Encoder supply voltage (max. current = 300 mA)
16	GND	Encoder supply GND
6	HALL U	Hall sensors input signal phase U
15	HALL V	Hall sensors input signal phase V
23	HALL W	Hall sensors input signal phase W
24	External supply	Hall sensor supply voltage $\neq$ 5 Vdc. Supply wired on X2 connector
16	GND	Hall sensors supply GND
14	TC+	Motor thermal sensor input
5	TC-	Motor thermal sensor input
Others	Reserved	

### 3.12.3 - X3 CONNECTOR FOR "ABSOLUTE HIPERFACE ENCODER" INPUT (SUB D HD 26 PINS FEMALE)

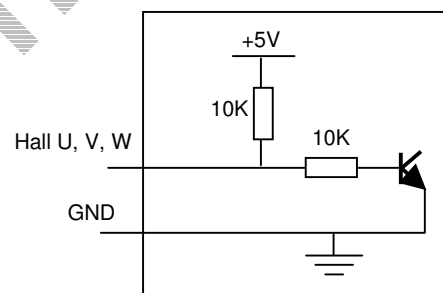
The Hiperface absolute encoder configuration is software selectable and saved in the amplifier EEPROM

PIN	FUNCTION	REMARKS
3	Data-	Differential input of the Hiperface encoder Data- channel
12	Data+	Differential input of the Hiperface encoder Data+ channel
17	Sin- channel	Differential input of the Hiperface encoder Sin- channel
18	Sin+ channel	Differential input of the Hiperface encoder Sin+ channel
8	Cos- channel	Differential input of the Hiperface encoder Cos- channel
9	Cos+ channel	Differential input of the Hiperface encoder Cos+ channel
24	External +12V supply	Hiperface encoder supply voltage Supply wired on X2 connector
16	GND	Supply GND
14	TC+	Motor thermal sensor input
5	TC-	Motor thermal sensor input
Others	Reserved	

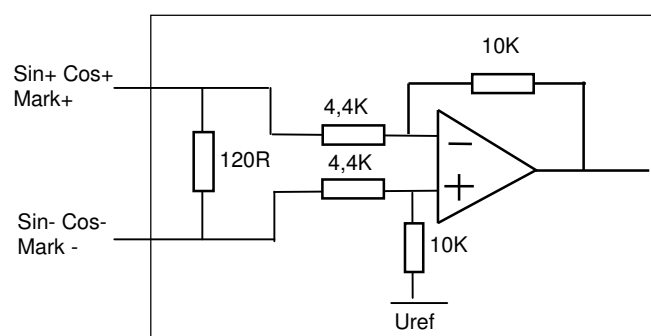
#### SPECIFICATION OF THE INCREMENTAL TTL ENCODER INPUT LINES



#### SPECIFICATION OF THE HALL SENSOR INPUT LINES



#### SPECIFICATION OF THE SIN/COS AND HIPERFACE ENCODER SIGNALS



### 3.13 – FIELDBUS CONNECTORS

Standard connectors RJ45.

### 3.14 – CAN BUS CONNECTORS: X6 AND X7

PIN	SIGNAL	DESCRIPTION
2	CAN-L	Ligne CAN-L (dominant low)
3	CAN-GND	CAN Ground
1	CAN-H	Ligne CAN-H (dominant high)
6-7-8	GND	
Others		Reserved

### 3.15 - "EtherCAT® IN" BUS CONNECTOR: X6

PIN	SIGNAL	DESCRIPTION
1	Tx Data+	Differential signals
2	Tx Data-	
3	Rx Data+	Differential signals
6	Rx Data-	
Others		Reserved

### 3.16 - "EtherCAT® OUT" BUS CONNECTOR: X7

PIN	SIGNAL	DESCRIPTION
1	Tx Data+	Differential signals
2	Tx Data-	
3	Rx Data+	Differential signals
6	Rx Data-	
Others		Reserved

For more information, see **EtherCAT® fieldbus Interface** manual.

### SERIAL LINK RS-232 CONNECTOR: X5

#### 3.17.1- XTRAPULSPAC VERSION WITH CANOPEN BUS

SUB D 9 pin male connector (same as XtrapulsCD1 and XtrapulsGem series)

PIN	FUNCTION	REMARKS
5	GND	GND (shield connection if no 360° connection on the connector). 360° shield is strongly recommended.
3	TXD	Transmit data RS-232
2	RXD	Receive data RS-232

#### 3.17.2 – XTRAPULSPAC VERSION WITH ETHERCAT® BUS

SUB D 9 pin male connector

PIN	FUNCTION	REMARKS
5	GND	GND (shield connection if no 360° connection on the connector). 360° shield is strongly recommended.
3	TXD	Transmit data RS-232
2	RXD	Receive data RS-232
1	CAN-H	Ligne CAN-H (dominant high)
9	CAN-L	Ligne CAN-L (dominant low)
Others		Reserved

In the EtherCAT® version, the X6 and X7 CONNECTORS (type RJ45) are used for the EtherCAT® bus connection.

The connection of the first axis to the **Gem Drive Studio** software tool via the serial link can be made as a multi-axis connection via the CAN bus (X5 connector).

### 3.18 – 24 Vdc AUXILIARY SUPPLY CONNECTOR AND WIRING RELAY OF THE MOTOR BRAKE: X8

5 pin male connector with 5.08 mm pitch.

Fastening torque of the connector screws: 0.5 Nm.

The female 5 pin connector to be screwed is delivered with the amplifier or to be ordered separately according to the order code = Pac-xx-230/cc-xx (see section 1.5):

INFRANOR reference: E425.3.

Weidmuller reference: 152676.

PIN	SIGNAL	I/O	FUNCTION	DESCRIPTION
1	Brake-(GND)	O	Motor brake supply reference	Grounded potential reference (GND reference)
2	Brake+	O	Motor brake supply 48 Vdc max / I <sub>max</sub> = 1.5 A	Pins 2 and 3 internally connected on X8 for an easier wiring relay
3	Brake In	I	Signal connection for the motor brake supply wiring relay 48 Vdc max. / 1.5 A max.	See diagram of section 5.3.2. The brake supply may be different from the amplifier 24 Vdc but must have the same GND potential reference. Max. brake supply value: 48 Vdc
4	24 V	I	Mains isolated 24 Vdc auxiliary supply	24 Vdc supply: +/- 10% Consumption: 0.320 A
5	0V = GND	I	0 V input referenced to the GND potential on the amplifier housing	UL: protection by means of 4 A UL fuse

### 3.19 – POWER CONNECTOR: X9

10 pin male connector with 5.08 mm pitch.

Fastening torque of the connector screws: 0.5 Nm.

The female 10 pin connector to be screwed is delivered with the amplifier or to order separately according to the order code = Pac-xx-230/cc-xx (see section 1.5):

INFRANOR reference: E427.11

Weidmuller reference: 152956

PIN	SIGNAL	I/O	FUNCTION	DESCRIPTION
5-7		O	Connection of an external braking resistor if the energy dissipation of the resistor is higher than 35 W. R <sub>min</sub> = 50 Ω P <sub>max</sub> = 200 W	Remove the 6-7 connection of X9 and connect the external resistor between pins 5 and 7 of X9. The external braking resistors must be separately controlled. Minimum resistance = 50 Ω type dp 50/200 (50Ω / 200W)
4	C-	I/O	C- connection of an external capacitor box	For applications which operation power is continuous and higher than 650 W for current ratings 5 and 11 A, and higher than 1000 W for current rating 17 A, an additional and external capacitor box is required in order to get a capacitors lifetime longer than 20 000 hours.
5	C+	I/O	C+ connection of an external capacitor box	
6-7	Rin	O	Connection of the internal 100 Ω/35 W braking resistor	Wiring bridge between pins 6 and 7 for the connection of the internal amplifier resistor.
8-9	230 Vac	I	230 Vac single-phase mains input supply	230 Vac single-phase +10% -15% Integrated mains filtre.
10	GND		GND reference potential of the 230 Vac supply cable.	Reference potential of the amplifier housing. 230 Vac mains GND connection.
3	W	O	Motor phase W	Motor cable connection with grounding by means of a screw with nut on the bottom plate, and shield connection by means of a grounded collar on the cabinet reference plate.
2	V	O	Motor phase V	
1	U	O	Motor phase U	

**IMPORTANT**

Motor and brake cables must be shielded.

The 360° shield connection must be ensured by collars and connected to the ground reference potential.

The GND wire of the motor cable **MUST** be connected to the ground screw marked with the ground symbol on the housing bottom plate.

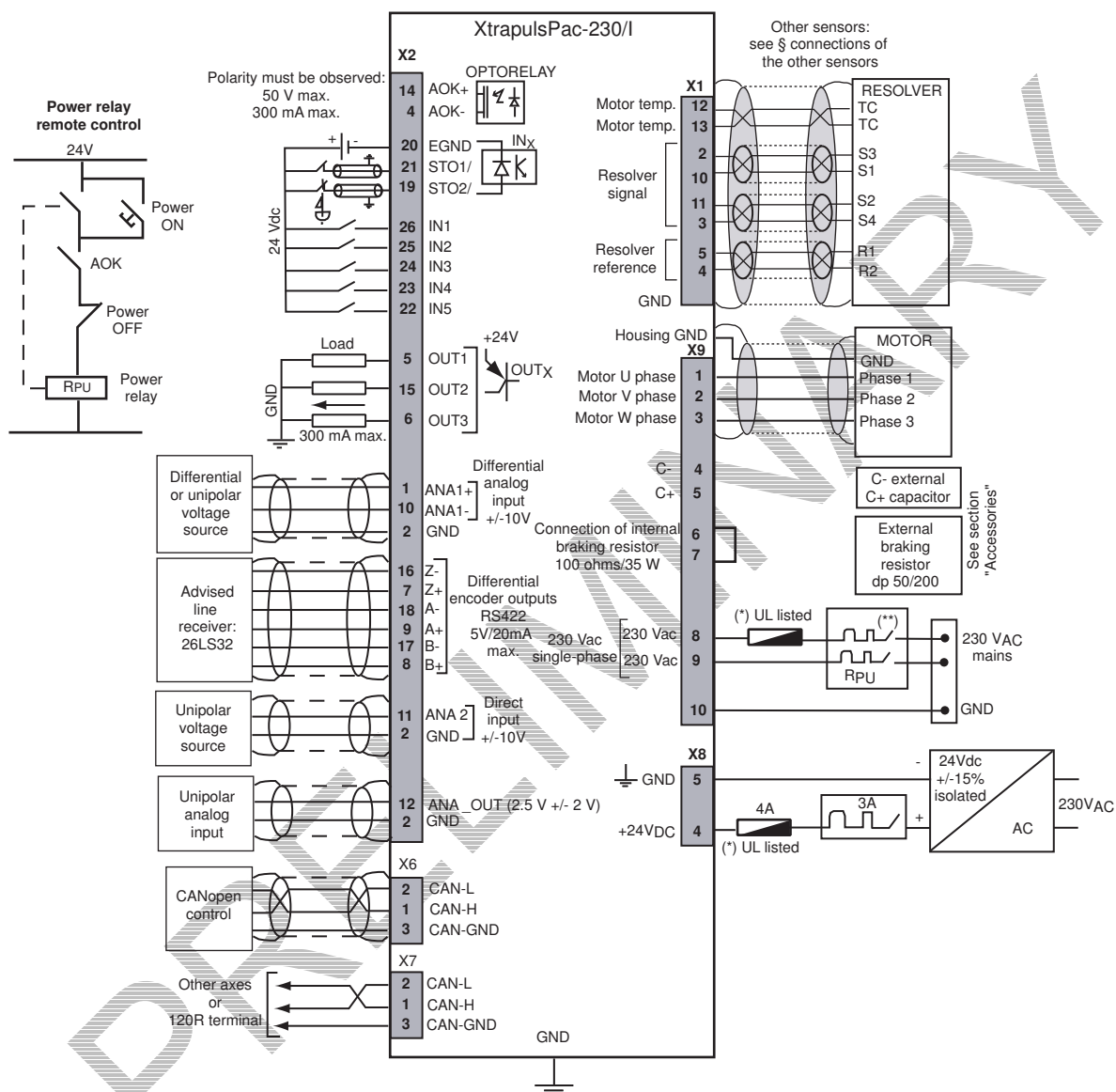
The ground reference must also be connected to this screw by a metal braid or by a green-yellow large section wire.

An increase of the amplifier rated power requires the mounting of an external capacitor box between outputs C+ and C-.

## Chapter 4 - Connections

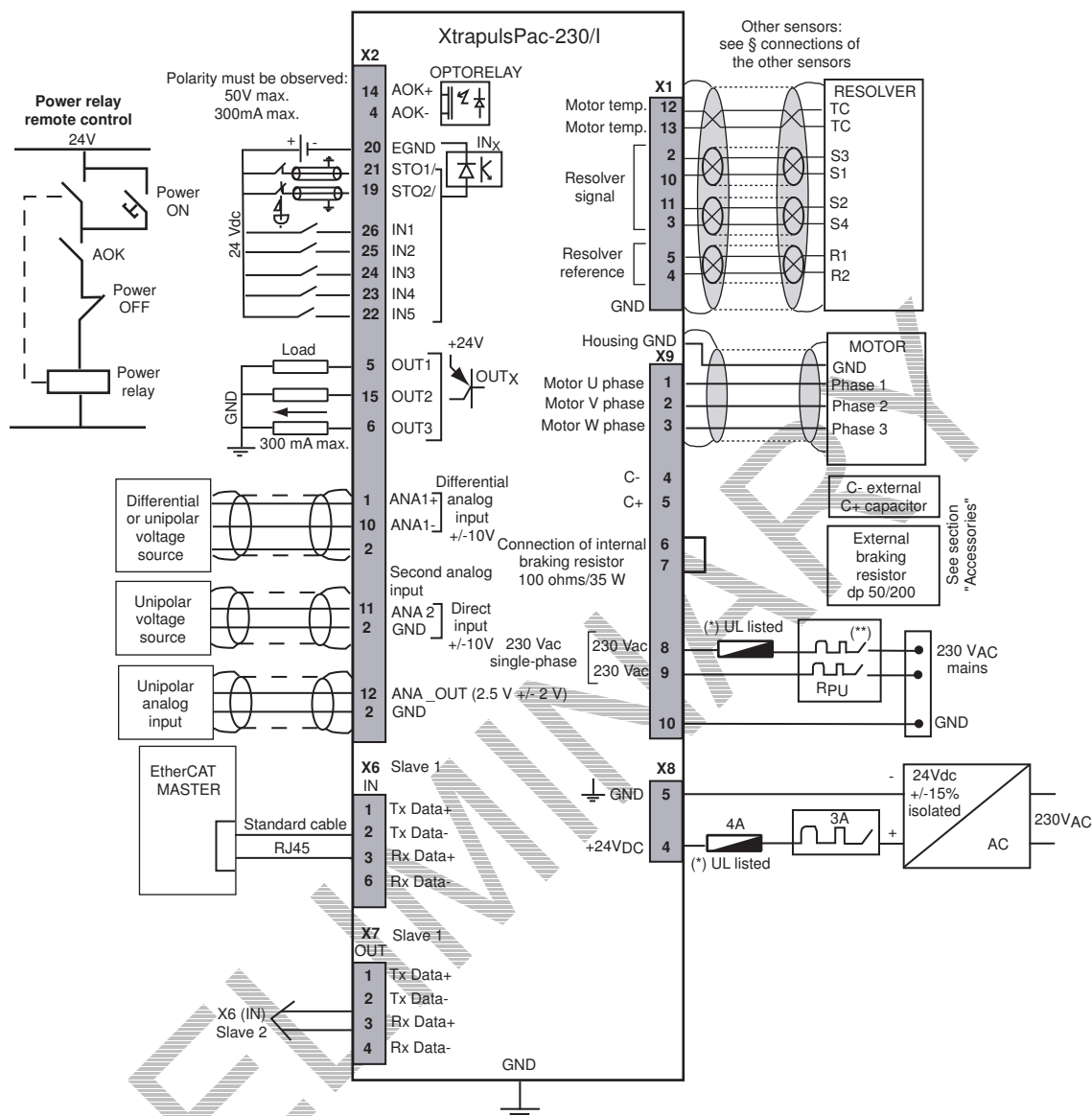
### 4.1 – CONNECTION DIAGRAMS

#### 4.1.1 – CANOPEN VERSION



**Note:** The 24 V and power supply protection on source side must be made by the user.

#### 4.1.2 - ETHERCAT® VERSION



(\*) See fuses table for the UL conformity.

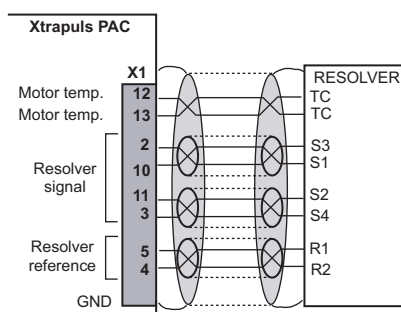
(\*\*) Curve D circuit-breaker  
 $I_{1s} = 10 \times I_n$   
 $I_n = 10 \text{ A}$

Use only copper conductors for the wiring terminations.  
The torque values of the wiring terminations must comply with the certified bloc terminal.

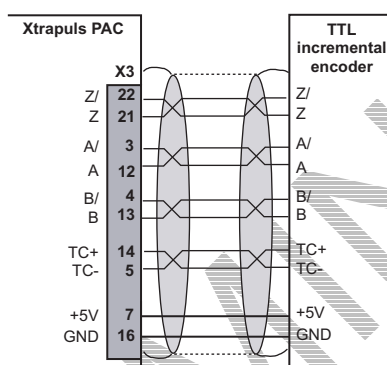
**Note:** The 24 V and power supply protection, on source side, must be made by the user.

## 4.2 – CONNECTION TO VARIOUS SENSOR TYPES

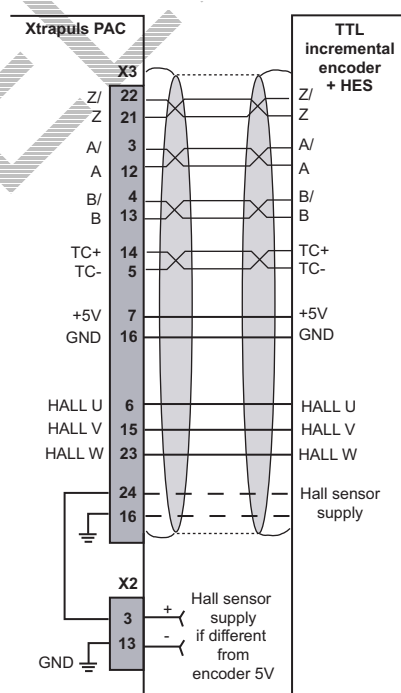
### 4.2.1 - CONNECTION TO A RESOLVER: X1 - SUB D 15 PIN FEMALE CONNECTOR



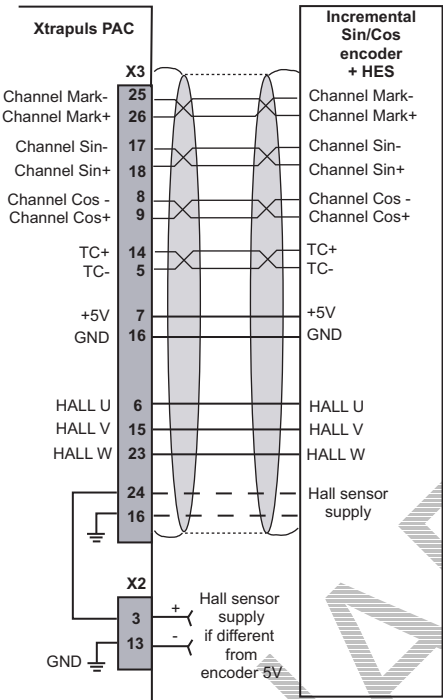
### 4.2.2 - CONNECTION TO AN INCREMENTAL TTL ENCODER: X3 - 26 PIN FEMALE HD CONNECTOR



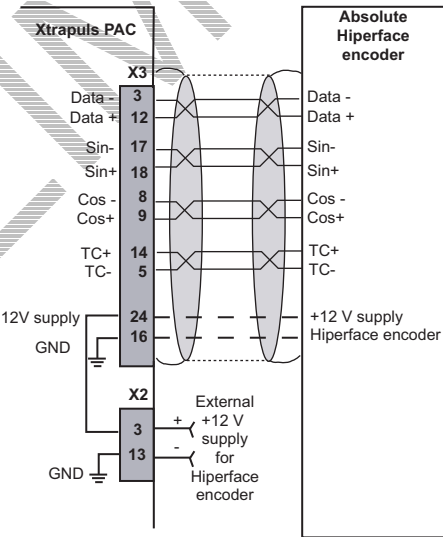
### 4.2.3 - CONNECTION TO AN INCREMENTAL TTL ENCODER WITH HALL SENSOR: X3 – 26 PIN FEMALE HD CONNECTOR



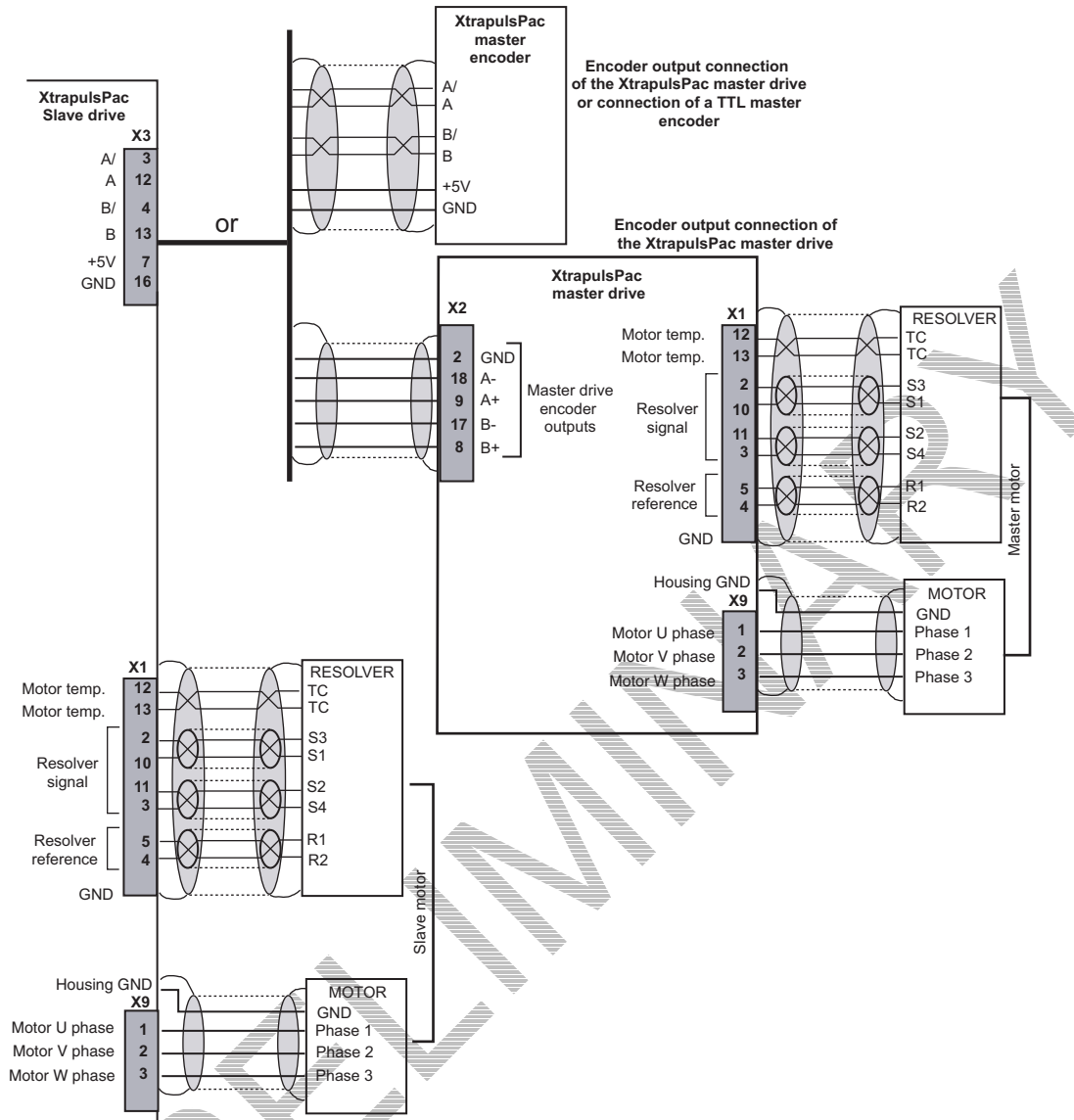
4.2.4 - CONNECTION TO AN INCREMENTAL SIN/COS ENCODER WITH HALL SENSOR: X3- 26 PIN FEMALE HD CONNECTOR



4.2.5 – CONNECTION TO AN ABSOLUTE HIPERFACE ENCODER: X3 – 26 PIN FEMALE HD CONNECTOR



#### 4.2.6 – CONFIGURATION OF THE XTRAPULSPAC AMPLIFIER WITH "SOFTWARE GEARING" FUNCTION



In master/slave "software gearing" applications, the amplifier controls the slave motor shaft position with regard to the input command sent by the master axis.

The position input command issued from the master axis can be interfaced either:

- with a master encoder
- or with the encoder output of an XtrapulsPac master amplifier.

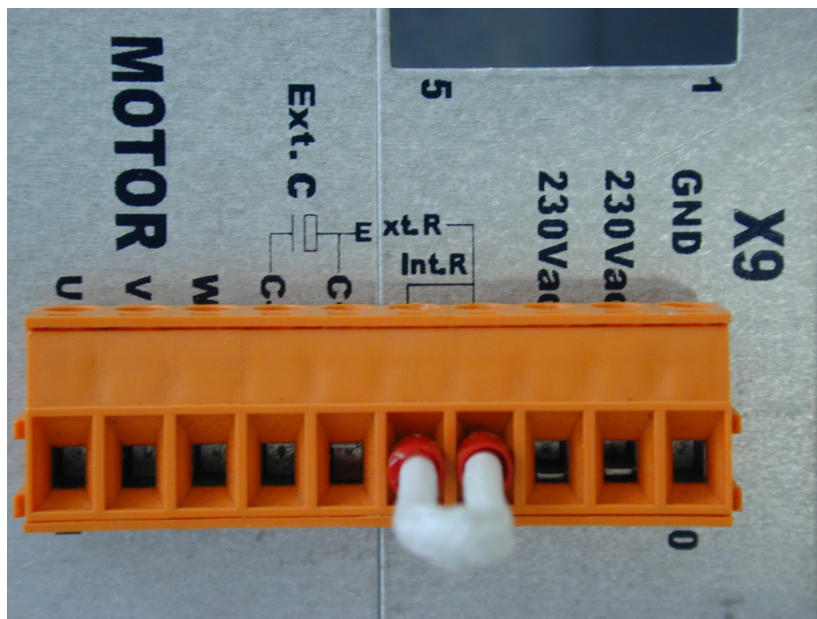
#### 4.3 – ACCESSORIES AND CONNECTIONS

##### ENERGY RECUPERATION VIA A BRAKING RESISTOR

All XtrapulsPac amplifiers are equipped with the power feedback system. When the motor is decelerating with high inertia and high speed, the mechanical braking energy is reflected to the amplifier. This energy is dissipated inside a resistor called "braking resistor".

In order to avoid too important a heat dissipation inside the amplifier, the power dissipated by the internal resistor must not exceed 35 W. If the internal resistor power is too low, a braking resistor is mounted outside. This resistor **MUST** be mounted out of range of heat sensitive and inflammable elements (plastic, cable sleeves, etc.).

An electronic control of the dissipated power avoids the overload of the braking resistor. So, if the energy reflected to the amplifiers is too high, the DC bus voltage will rise up to the release of the "**Overvoltage**" fault.

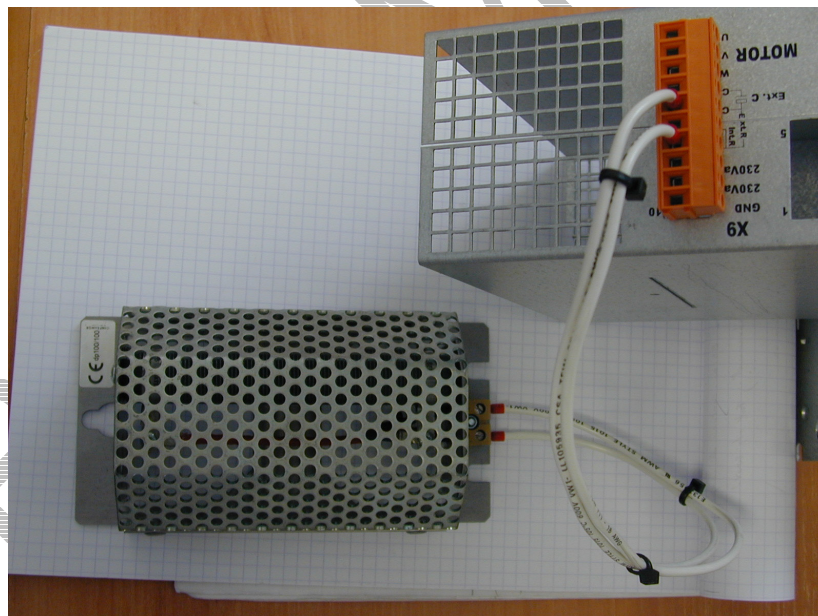
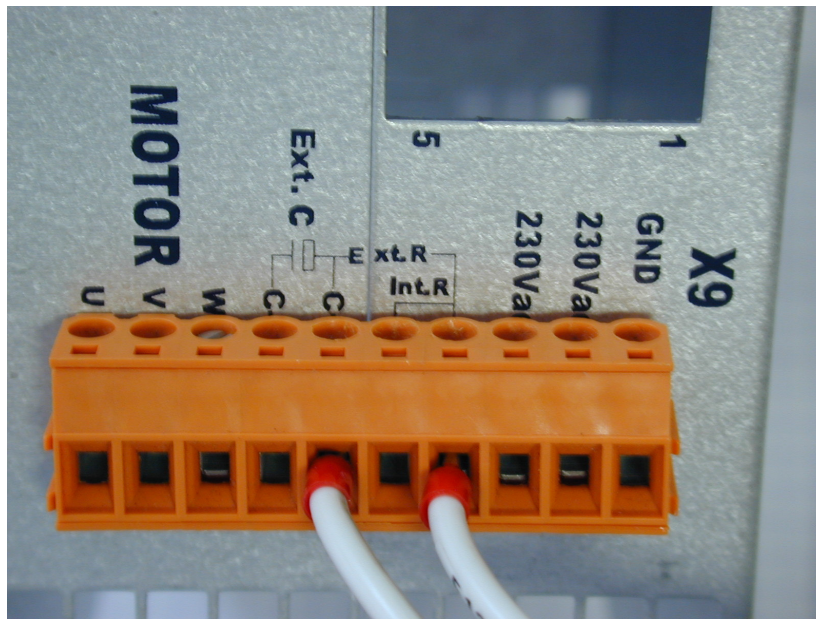
**4.3.1 – CONNECTION OF THE INTERNAL BRAKING RESISTOR OF THE XTRAPULSPAC DRIVE**

The XtrapulsPac drive is equipped with an internal  $100\ \Omega$  / 35 W braking resistor. Its connection is made by means of a wiring bridge between pins 6 and 7 of the X9 connector. If the required rated power of the braking resistor is higher than 35 W or if the pulse power is higher than 1500 W, a larger external dp 50/200 power resistor must be mounted.

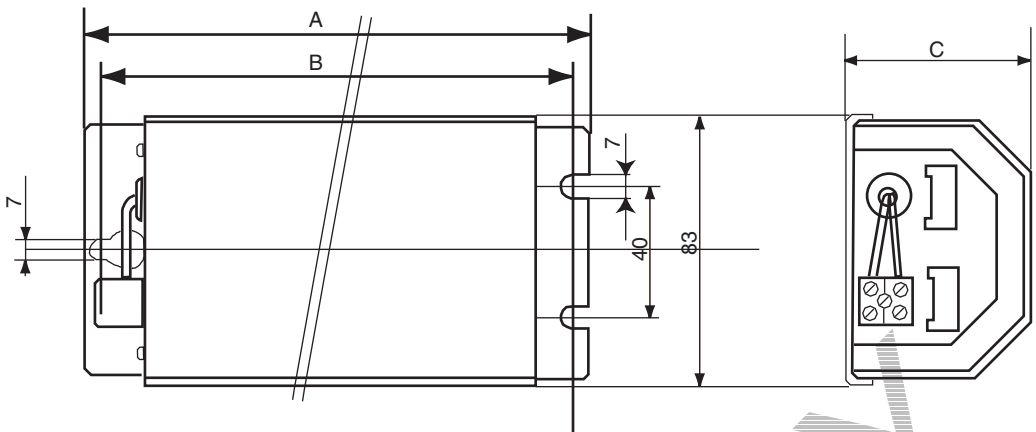
**The connection of an external braking resistor requires the removal of the wiring bridge between pins 6 and 7 of X9.**

### 4.3.2 – CONNECTION OF AN EXTERNAL DP 50/200 BRAKING RESISTOR

#### 4.3.2.1 – Connection of the external braking resistor



4.3.2.2 – Dimensions of the external braking resistor: dp 100/100, dp 200/100, dp 50/200



DIMENSIONS	dp 100/100, dp 200/100 and dp 50/200
A	157 mm
B	145 mm
C	52 mm

Electrical specification of the dp 50/200 braking resistor:

Resistance value: 50 ohms  
Rated power: 200 W  
Pulse power: 3000 W

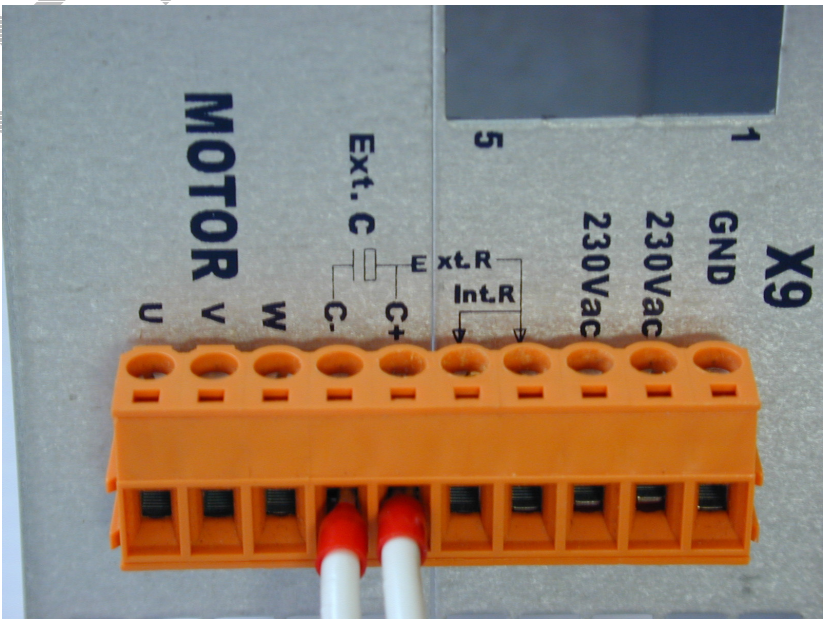
**Note:** 50 Ohm is the minimum resistance value beared by the XtrapulsPac amplifier.

If the reflected energy of the application requires an ohmic braking resistor value lower than 50  $\Omega$ , a capacitor box must then be mounted outside.

In the same way, if the continuous rated motor power of the application is higher than the specified power, a capacitor box must also be mounted outside.

– CONNECTION OF AN EXTERNAL CAPACITOR BOX

For applications which operation power is continuous and higher than 650 W for current ratings 5 and 11 A, and higher than 1000 W for current rating 17 A, an additional and external capacitor box is required in order to get a capacitors lifetime longer than 20 000 hours.

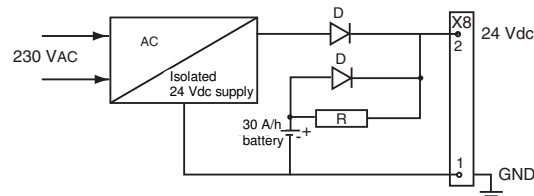


**Important:** The connection polarity of the capacitor box must be observed.

Features of the external capacitor box:

- Maximum cable length between the XtrapulsPac drive and the external capacitor box: 25 cm.
- Maximum capacity of the external box: 660  $\mu$ F
- Rated voltage of the external box: 400V.
- 

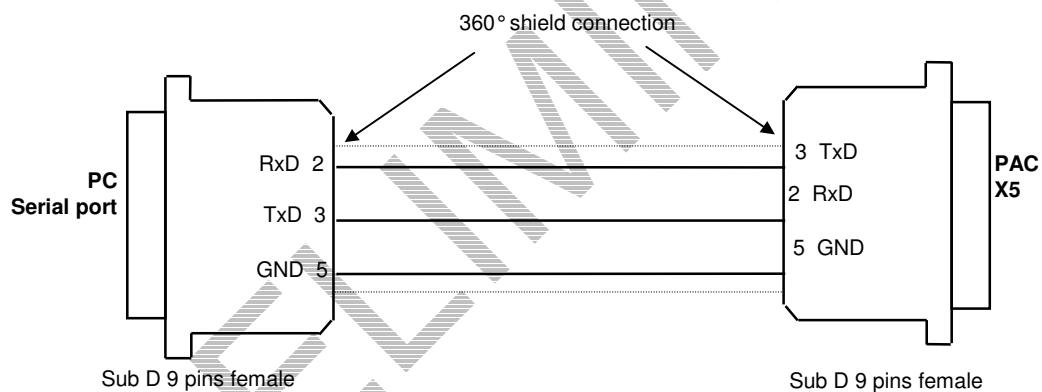
#### 4.3.4 – CONNECTION OF A BACKUP BATTERY



The XtrapulsPac drive consumption is 320 mA with 24 Vdc. So, a 24 V / 30 A/h battery can keep the amplifier powered during e.g. a long 3 days week-end. This backup method is very interesting for saving the machine initialization as well as the axis position even when moving with the mains switched off.

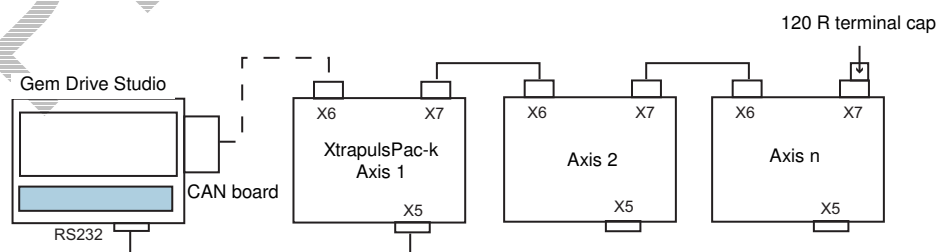
### 4.4 – CONNECTION TO THE "GEM DRIVE STUDIO" SOFTWARE TOOL

#### 4.4.1 – CONNECTION OF THE SERIAL LINK ON THE X5 CONNECTOR



#### 4.4.2 – MULTIAXIS CONNECTION OF THE SERIAL LINK

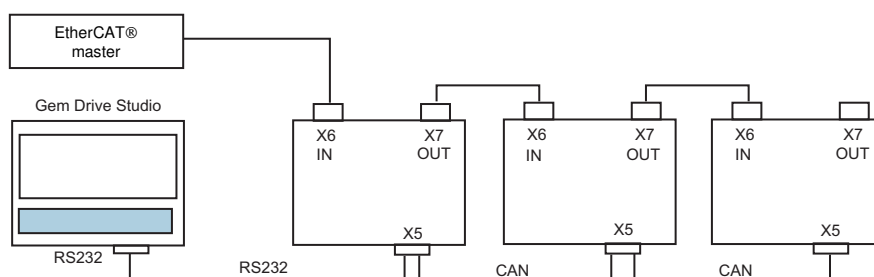
##### 4.4.2.1 - XtrapulsPac drive in CANopen configuration



The parametrization of all axis is made by one single connection to the first axis via the serial link RS232. The other axis are parametrized via the CAN bus.

If the PC is equipped with a CAN board, the parametrization can be directly made via the CAN bus on the first axis (the serial link RS232 is then no more necessary).

#### 4.4.2.2 - XtrapulsPac drive in EtherCAT® configuration



In the EtherCAT® configuration, the RS232 and CAN communication is made via the SUB D 9 pins connector X5. The multiaxis parametrization is then made according to the diagram above.

### 4.5 – WIRING INSTRUCTIONS

(according to the EN61000.4-2-3-4-5 and EN55011 standards – see pictures of the shield connections in chapter section 4.5.2).

#### 4.5.1 – GROUND WIRINGS AND GROUNDING



##### CAUTION !

**Each potential conducting element** must be **shielded**. Several potential conductors **in the same sleeve** must be **twisted and shielded**.

A shield has no effect if it is not connected:

- to a reference potential,
- by a connection as short as possible (a few centimeters only; 10 centimeters is prohibited),
- by a 360° shield connection. This means that the whole shield sleeve circumference must be connected to the reference conductor via a metal collar.

The connectors used for the compliance with the EN61000.4 standard must be made of metal or metallized and must allow the 360° shield connections.

Reference potential loops (especially with the ground) are recommended **only** if these loops have a very low impedance ( $< 0,1 \Omega$ ). Any shield that is used as a conductor can be connected at both ends under the condition to be connected over 360° at both ends by means of metal links in order to ensure the shield continuity.

**The reference potential must be the ground:** 10 mm<sup>2</sup> section or ground braid to the reference potential.

Cables with low potential should **never** run in the proximity of power lines.

If there is a potential reference, e.g. a chassis or cabinet with a low impedance between its different elements, it should be used for connections to this potential which shall be grounded itself.

#### LEAKAGE CURRENT TO THE GROUND

This product may generate a leakage current in the protection conductor. If a protection device with differential residual current is used for the protection in case of direct or indirect contact, **only a protection device of type B** is allowed on supply source.

#### RECOMMENDATIONS FOR THE GROUNDING OF THE PROTECTION CONDUCTOR

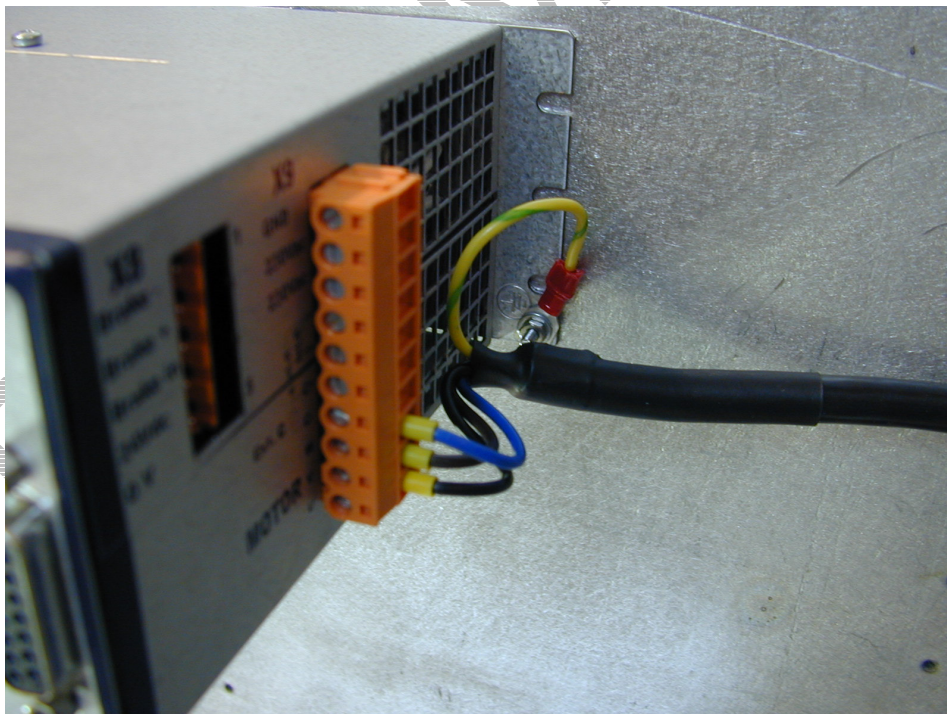
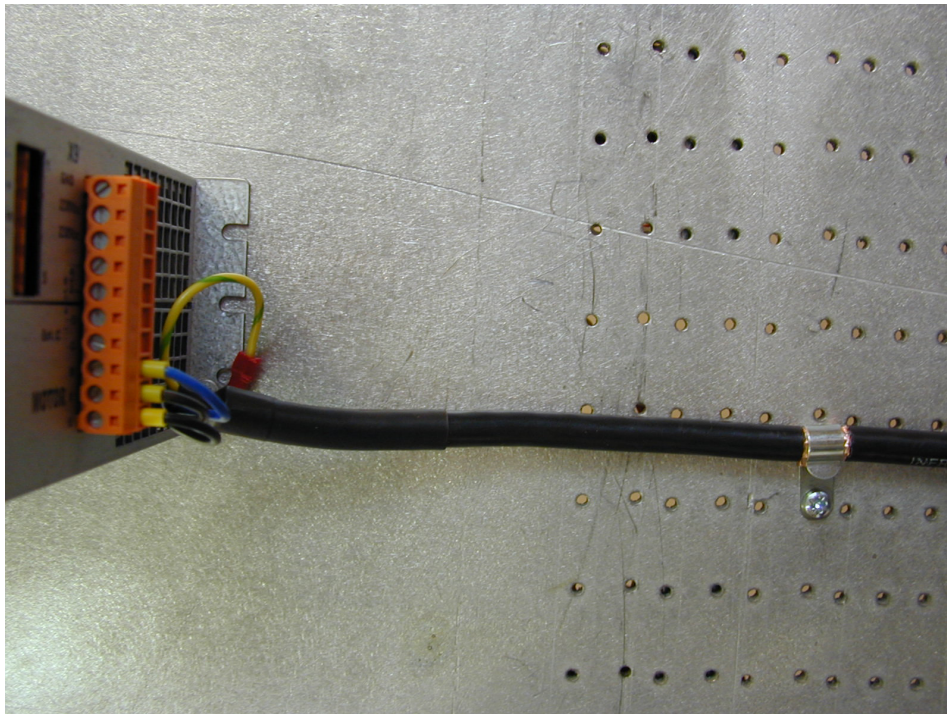
The "Electronic Power Unit" equipment which includes the control, the drive, the motor and the sensors, generates a leakage current to the ground higher than 10 mA continuous: the protection conductor section must be **at least 10 mm<sup>2</sup>** (Cu) or 16 mm<sup>2</sup> (Al).



#### 4.5.2 – SHIELD CONNECTION ON THE CONNECTORS

##### **RULE**

The shield should never be interrupted or corrupted over the whole cable length.



##### **NOTE**

When the 360° shield connection is made by means of a collar, it is not necessary to connect an additional cable on the appropriate pin of the SUB-D connector.

#### 4.5.3 – MOTOR, RESOLVER AND ENCODER CABLES

Motors, resolvers and encoders are grounded via their housing.

Cable inputs must be made by means of metal connectors with collars allowing the 360° shield connection.

The resolver cable must be pair twisted and shielded (sin, cos, ref.). Motor cables MUST also be shielded and connected over 360° at both ends, as shown on the shield connection pictures of section 4.5.2.

The encoder inputs A, B, C, D, Z and R require pair twisted and shielded cables. The shield must have a 360° connection via metallic collars at both ends. If the shield is connected by means of a pig tail wire, it must be connected at one end to the GND pin of the connector on amplifier side with a connection as short as possible.

Check that the voltage drop in the power supply lines of the encoder cable is complying with the technical specifications of the encoder. The voltage drop value for a given cable is calculated as follows:

$$\Delta U[V] = 40 \cdot 10^{-6} \cdot \frac{L_c[m] \cdot I[mA]}{S[mm^2]}$$

with       $\Delta U$ : voltage drop in volts  
              $L_c$ : cable length in meters  
              $I$ : encoder current in milliamps (see technical specifications)  
              $S$ : section in square millimeters

Due to this voltage drop:

- an encoder with a wide power supply voltage range should be selected,
- if the encoder has got power supply SENSE feedback lines, they can be connected to the power supply lines in order to reduce the voltage drop by the half (the SENSE feedback signal is not used in this drive),
- if none of both solutions above can be used, the user has to supply the encoder by means of an external supply.

#### Example

The application requires a linear Heidenhain encoder, supplied with 5 V  $\pm$  5 % / 300 mA and 25 m cable length. Supply voltage: 5 V  $\pm$  5 %  $\Rightarrow \Delta U_{\max} = 0.25$  V  $\Rightarrow$  Minimum section: S = 1.2 mm<sup>2</sup>.

Such a cross section is difficult to obtain, so the user can:

- either connect the SENSE feedback signal lines to the power supply lines, so the required wire section will be the half (0.6 mm<sup>2</sup>),
- or use the same encoder type but in a version which allows a power supply voltage from 3.6 to 5.25 V / 300mA. Minimum power voltage 3.6 V  $\Rightarrow \Delta U_{\max} = 1.4$  V  $\Rightarrow$  Min. section: S = 0.21 mm<sup>2</sup>.

Brake equipped motors must also have their brake cables shielded in order to be EMC compliant.

#### Maximum cable length:

- resolver:  $\leq 100$  m
- encoder:  $\leq 25$  m
- motor:  $\leq 25$  m.

For cable length > 25 m, we advise:

- to use the maximum cable section allowed by the connectors,
- to mount a reactance with an inductive value between 1 % and 3 % of the motor inductive value. The reactance inductive value must be taken into account in the calculation of the current loops. The current rating of the reactance must be higher than or equal to the amplifier rating.

The reactance must be mounted at the amplifier output.

Due to the use of a reactance, a shielded cable is not mandatory anymore.

A more complex sinus filter type FN510 by Schaffner may also be mounted in place of the reactance.

## UNDESIRABLE EFFECTS OF MOTOR CABLES LONGER THAN 25 M:

- Heating of the power module, the motor and the cable.
- High overvoltages on the motor windings involving a shortening of their life time.

The reactance reduces the undesirable effects on motor and amplifier but it may be quite heated. This requires an appropriate fan.

### 4.5.4 – SERIAL LINK AND CAN COMMUNICATION CABLES

Serial link and CAN communication cables must also be shielded according to the shield connection recommendations above.



#### CAUTION!

Control cables (resolver, serial link, CAN) and power cables must be connected and disconnected with the amplifier **OFF**.

#### Reminder:

The power voltage may remain several minutes at the power capacitor terminals. A contact with high voltage may involve severe physical damage.

### 4.5.5 – CONNECTION CABLES OF THE BRAKING RESISTOR

The connection cable to the braking resistor housing must bear the high voltage and temperature of 600 V and 105 °C. Recommended cable: UL1015 gauge 14.

Fastening torque on the connector of the braking resistor housing:  $\text{dp} = 0.9 \text{ Nm}$ .

## 4.6 – FIRST POWERING OF THE AMPLIFIER

### 4.6.1 – VERY IMPORTANT

Check the connections, especially of the 24 VDC and power supplies. Check that the housing serigraphy actually corresponds to the power connections.

**The 400 Vac connection of a 230 V amplifier will destroy it.**

**If a logic input is software configured with the Enable function, it must be deactivated.**

Check for the braking resistor specifications if connected in place of the internal braking resistor:  $\text{dp} 50/200$ . Check for the correct groundings as well as the 360° shield connections.



#### WARNING !

During the machine adjustments, amplifier connection or parametrization mistakes may involve dangerous axis movements. It is the user's responsibility to take all necessary steps in order to reduce the risk due to uncontrolled axis movements during the operator's presence in the concerned area.

### 4.6.2 – CONNECTION OF THE 24 VDC SUPPLY

The red **Err** LED on the front panel must be flashing ("Undervolt." error).

The **AOK** signal (pins 4 and 14 of X2) is closed. The power voltage relay (Rpu) can then be controlled according to the recommendations of Chapter 4, section 1 (connection diagram). The connection must be made in compliance with the X8 connector serigraphy.

### 4.6.3 – CONNECTION OF THE 230 VAC POWER SUPPLY

The red **Err** front panel LED must be unlit.

Note: If a fault occurs, the red **Err** LED remains continuously lit.

#### 4.6.4 – STARTING PROCEDURE

See **XtrapulsPac – User Guide**.

#### 4.7 – UL STANDARD REQUIREMENTS

The UL listing requires the following conditions.

##### 4.7.1 - 24 V SUPPLY

The final user has to provide an isolated auxiliary 24 Vdc supply (e.g. with isolation transformer) for the auxiliary supply input, and protected by a 4 A UL certified fuse.

##### 4.7.2 – POWER SUPPLY AND UL FUSE RATINGS

The recommended fuse model is a "semiconductor protection" type. The maximum mains short-circuit power must not exceed 5000 Arms at a voltage of 230 V, when protected by a UL fuse type A60Q.

On **XtrapulsPac-230/I** drives, the fuse rating must be the following:

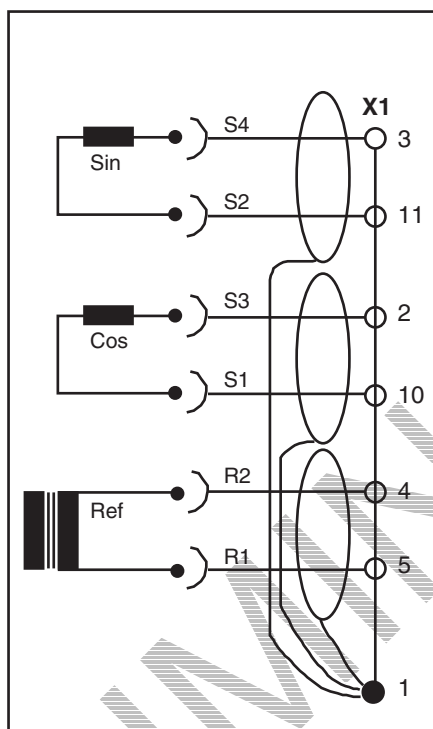
Pac-k	230/5-8-11	230/17	Multiaxis
FERRAZ Type A60Q	A60Q20-2	A60Q25-2	$0,3 \times \sum_{\text{amplifier name}}^N I$

In a multiaxis application with N amplifiers, the fuse rating is calculated by the formula given in the table above. But a rating of 25 A shall not be exceeded on 230 V amplifiers.

## Chapter 5 - Appendix

### 5.1 – ADJUSTMENT TO VARIOUS RESOLVER TYPES

For the use of other resolvers than those mounted on MAVILOR motors in their standard version, see following wiring diagram as well as the manufacturer's diagram:



When using **resolvers** with **transformation ratios** out of the range 0.3 to 0.5, the adjustment must be factory set by INFRANOR.

### 5.2 - MAINTENANCE

The XtrapulsPac drive does not need any special maintenance in a specified environment.

The opening of the housing cancels the warranty.

In a dusty environment (e.g. textile fibres), it may be necessary to preventively clean the heatsink near the fan.



#### **WARNING !**

The use of an air spray gun must be strictly limited to the heatsink. Blowing into the drive is prohibited because humid air may enter the drive and damage the electronic boards.

### 5.3 – SERVICE ENVIRONMENT CONDITIONS



#### A - CLIMATIC CONDITIONS

- 1 - Cooling temperature Air: 0 °C 0 +40 °C  
+5 °C to +40 °C.  
From 40 °C, the peak currents are reduced of 3% per °C, maximum 50 °C.
- 2 - Room temperature
- 3 - Relative moisture 5 % to 85 % **without condensation**
- 4 - Dust and particles Clean air (pollution degree 2)  
Drive must be protected against conducting dust
- 5 - Standstill periods  
< 1 year: no restriction  
> 1 year: re-format the power capacitors by supplying the drive with a voltage ≤ 50 % of the drive rated voltage during 30 minutes.



#### B - MECHANICAL INSTALLATION CONDITIONS

The drive must be mounted on a stiff surface, in rooms or additional housings without hindering cooling and fan. The liability can be increased by installing a cooling system (avoid condensation). Other installation conditions must be specifically examined and be subjected to a technical specification and a consultation of INFRANOR.

##### Mechanical mounting

Vertical, on cabinet rear wall.

##### Vibrations

Vibrations must remain within the limit values of the IEC 60721-3-3, class 3M1 standard for fixed equipment.

Frequency (Hz)	Amplitude (mm)	Acceleration (m/s <sup>2</sup> )
$2 \leq f < 9$	0.3	-
$g \leq f < 200$	-	1

Vibrations beyond these limits or the use on a mobile equipment are considered as unusual service conditions.



## **C - UNUSUAL ENVIRONMENT AND SERVICE CONDITIONS**

The use of the power converter, of its pertaining control system and of the servo in conditions diverging from the usual ones defined by the IEC 60146-1-1 standard must be considered as abnormal. These abnormal service conditions must be specified by the purchaser.

Abnormal service conditions as those listed below may require a special construction or special protections. The conditions below must be notified if they are known, or specified:

1. Exposure to corrosive gas.
2. Exposure to excessive moisture (relative moisture exceeding 85 %).
3. Exposure to excessive dust.
4. Exposure to abrasive dust.
5. Exposure to water steam or condensation.
6. Exposure to oil steam.
7. Exposure to explosive dust or gas mixtures.
8. Exposure to salt air.
9. Exposure to abnormal vibrations, shocks, jerks.
10. Exposure to inclemency or water dripping.
11. Exposure to unusual storage or freight conditions.
12. Exposure to sudden or rough temperature variations.
13. Abnormal exiguity of the available room.
14. Abnormally high nuclear radiations.
15. Altitude higher than 1000 m.
16. Long standstill periods.
17. Outdoor equipment.



## **D - INSTALLATION, COMMISSIONING AND OPERATION**

Normal and abnormal service conditions apply the same way to installation, commissioning and use.



## **E - EQUIPMENT STORAGE**

At receipt, the equipment must be immediately stored under an appropriate shelter. Transport packaging is not suited to outdoor or non-protected storage.

### **Climatic conditions**

Equipments must be stored in the environment conditions specified by the IEC 60721-3-1 standard. This includes:

- |     |                              |                 |
|-----|------------------------------|-----------------|
| 1 - | Room temperature: class 1K4  | -25 °C to 55 °C |
| 2 - | Relative moisture: class 1K3 | 5 % to 95 %     |

Modules and panels must be protected against condensation. Rough temperature and moisture variations should be avoided, as far as possible. If the temperature of the storage room is varying such as to subject the equipment to condensation or to frost, the equipment must then be protected by a reliable heating system which will keep it at a temperature slightly higher than the room temperature. If the equipment has been subjected to low temperature during a long time, it should not be unpacked before having reached the room temperature, in order to avoid condensation. Such a moisture in some parts of the equipment may involve a defective electric insulation.



## F - PARTICULAR STORAGE RISKS

The following risks must be very carefully considered:

1. Water: The equipment must be protected against rain, snow, rime, etc....
2. Altitude: The equipment should not be stored at an altitude higher than 3000 m AMSL.
3. Corrosive agents: The equipment must be protected against salty sea spray, emanations of dangerous gasses or corrosive liquids, etc...
4. Duration: the specifications of the above mentioned items are only valid for a total transport and storage period of up to six months. Longer periods may require a special treatment (smaller room temperature range such as in class 1K3).
5. Rodents and mould: the storage conditions must avoid exposure to rodents and mould.



## G - TRANSPORT

### 1 – Climatic conditions

The equipment can be transported in its standard packing in the environment conditions specified by class 2K3 of the IEC 60721-3-2 standard. This includes:

- a - Room temperature: -25 °C to +70 °C  
NOTE: The room temperature is the temperature which is the nearest to the equipment (e.g. the inside of the container).
- b - Relative moisture: 95 % at +40 °C  
NOTE: Some temperature and moisture combinations may generate condensation.

### 2 – Unusual climatic conditions

The possible transport of the equipment at temperatures lower than -25 °C requires either a re-heating or the removal of components sensitive to low temperature.

### 3 – Mechanical conditions

The equipment may be transported in its standard packing in the conditions specified by class 2M1 of the IEC 60721-3-2 standard.

This includes vibrations and shocks (see tables 4 and 5).

**TABLE 4 – Vibration limits during the transport**

Frequency (Hz)	Amplitude (mm)	Acceleration (m/s <sup>2</sup> )
$2 \leq f < 9$	3.5	-
$9 \leq f < 200$	-	10
$200 \leq f < 500$	-	15

**TABLEAU 5 – Shock limits during the transport**

Mass (kg)	Free fall height (m)
$M < 20$	0.25
$20 \leq M < 100$	0.25
$100 \leq M$	0.10

NOTE: If the equipment may be subjected to shocks or vibrations beyond these limits, it will require special packaging or transport conditions.