INFRANOR
SERVO DRIVES & MOTION CONTROL

Gem Drive Installation Guide

gb

Actuator

INFRANOR®

GD1

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 GD1 User Guide for the operation of the drive (commissioning, configuration, …).

For the CANopen communication, see manual GD1 – CANopen Communication Profile.

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 for at least 10 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 wheel 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.

Issue : **1.1**

General content

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GEM DRIVE

PART 1

GD1 AMPLIFIER

GEM DRIVE

Content Part 1

Page

Chapter 1 – General description

1.1 – INTRODUCTION

GD1 all-digital drives with sinusoidal PWM control are servo drives that provide the control of brushless AC motors with a sensor (resolver, encoder or, as an option, second encoder sensor on the load).

Several versions are available:

- with integrated power supply unit: 230 V_{AC} single-phase or 230 to 480 V_{AC} three-phase or
- with external 230 to 480 V_{AC} three-phase power supply unit (GDPS) – See Part 2.

The very small dimensions allow an easy mounting in low depth cabinets.

Height (235 mm) and depth (224 mm) are the same for all voltage and current ratings.

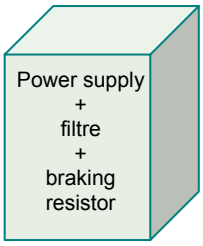
The drives with current rating ≤ 45 A have a single width with 74.5 mm pitch whereas drives with 60 A and 90 A ratings have a double width with 145 mm pitch.

The drives with current ratings smaller than 8 A in 230 V have reduced 175 mm depth. The angle brackets can be reverse side mounted in order to allow a wall-crossing fastening. This solution offers the advantage to separate the part of the drive which requires heat dissipation.

1.2 – HARDWARE ARCHITECTURE TYPES

1.2.1 – SINGLE-AXIS CONFIGURATION

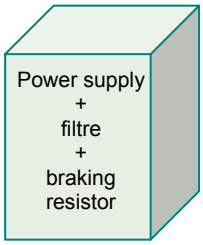
INTEGRATED 230 V_{AC} SINGLE-PHASE POWER SUPPLY UNIT
RATED POWER < 4 kW



GD1- 230/05 to 30 - PS-R

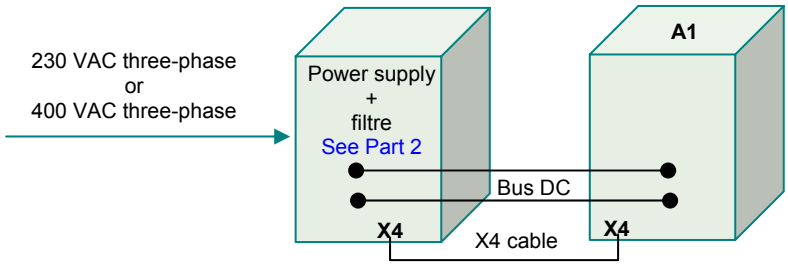
* GD1-230/05 and 08 without braking resistor.

INTEGRATED 400/480 V_{AC} THREE-PHASE POWER SUPPLY UNIT
RATED POWER < 7 kW



GD1- 400/05 to 20 - PS-R

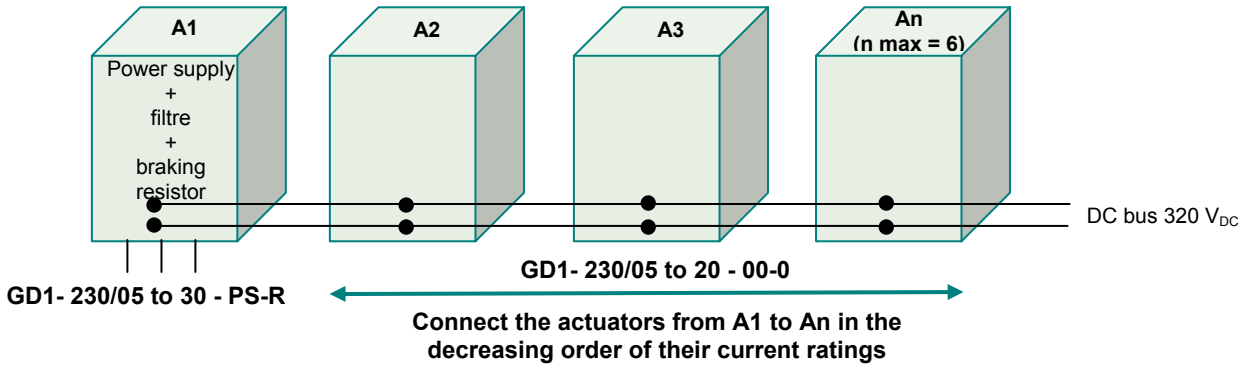
EXTERNAL POWER SUPPLY UNIT GDPS-400/xx
RATED POWER > 4 kW IN 230 V_{AC}
RATED POWER > 7 kW IN 400 V_{AC}



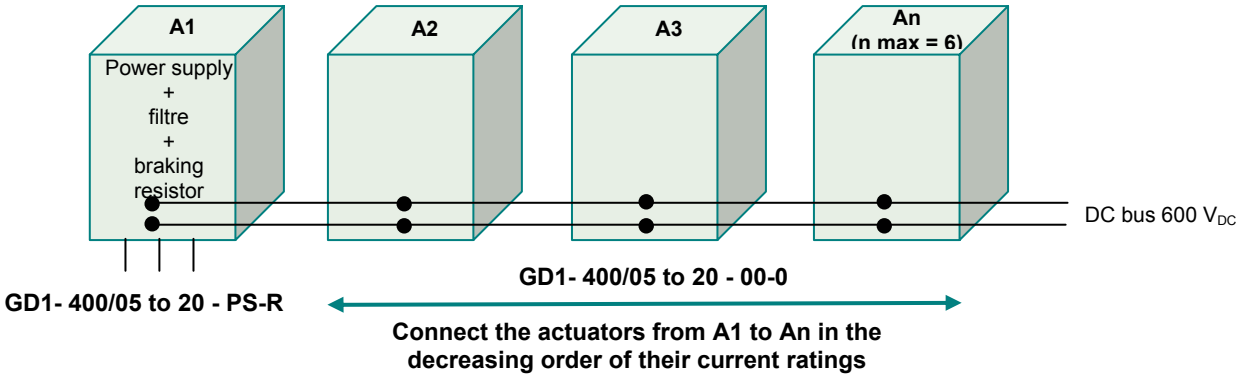
GDPS- 400/xx **GD1- 400/30 to 90**

1.2.2 – MULTIAXIS CONFIGURATION

MULTIAXIS CONFIGURATION WITH INTEGRATED 230 V_{AC} SINGLE-PHASE POWER SUPPLY UP TO A RATED POWER < 4 kW



MULTIAXIS CONFIGURATION WITH INTEGRATED 400/480 V_{AC} THREE-PHASE POWER SUPPLY UP TO A RATED POWER < 7 kW

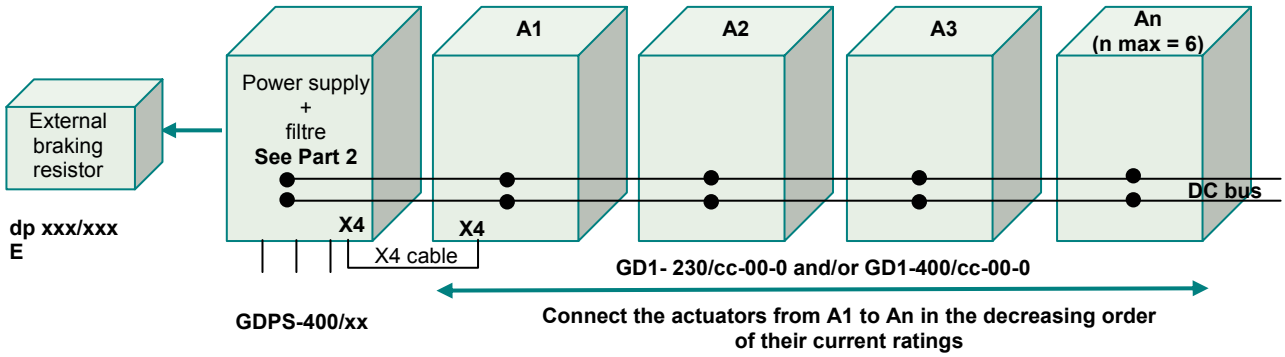


MULTIAXIS CONFIGURATION WITH EXTERNAL POWER SUPPLY UNIT: GDPS-400/xx

The external GDPS power supply **must be connected to the three-phase mains**.
Its operating range is between 230 V_{AC} and 480 V_{AC}.

POWER SUPPLY SOURCE: 230 V_{AC} THREE-PHASE

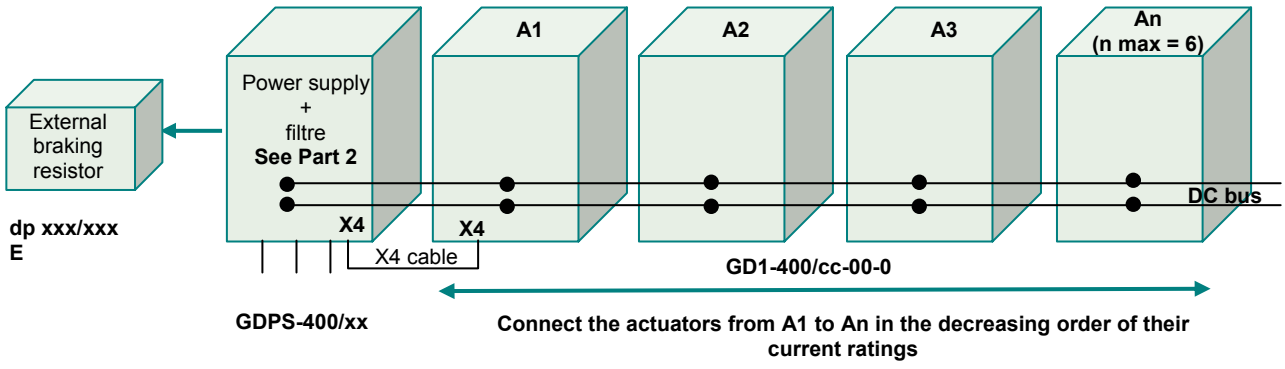
When connected to a **230 V_{AC} three-phase** power supply source, it provides a 320 V_{DC} DC Bus voltage compliant with the whole GD1-230 and 400 range (GD1-400/cc-00-0 compliant with 230 V_{AC}).



With a 230 V_{AC} power supply, the first axis on which the X4 cable is connected must be a GD1-230V.
The GD1-400 actuator(s) used with a 230 V_{AC} power supply must be configured with: "Operating voltage = 230 V" in the Gem Drive Studio software.

POWER SUPPLY SOURCE: 400 V_{AC} THREE-PHASE

When connected to a **400 V_{AC} three-phase** power supply source, it provides a 600 V_{DC} DC Bus voltage which is only compliant with the actuator range GD1-400 (400 V_{AC}).



Connecting the 600 V_{DC} bus with GD1-230 actuators will destroy then immediately.
The use of GD1-400/cc/PS drives instead of GD1-400/cc/00 will generate the "FP" (Fault phase) error.
For running the drive in this case, the "FP" error may be parametrized as "Warning" (see GD1 User Guide)

***CALCULATION OF THE AVERAGE RATED POWER OF THE APPLICATION*: see section 4.9.2**

1.3 – COMMUNICATION INTERFACES

The standard version of the GD1 is delivered with the CANopen® communication interface. But this drive is also available with other interfaces.

1.4 – PROTECTIONS

(according to EN 954-1 standard)

- Safe torque off (see appendix)
-

1.5 – PROGRAMMABILITY

- Servo functions
- User program (see Programmation Guide)

1.6 – COMPLIANCE WITH THE STANDARDS

1.6.1 – GENERAL DESCRIPTION

The supply of the DC/DC converter requires an auxiliary 24 V supply +/-15%. A 24 V_{DC} battery supply with specific wiring allows to keep the position even after switching off the auxiliary 24 V_{DC} supply.

The power supply is depending on the drive type:

- **GD1-230/05 A to 30 A**: integrated 230 V_{AC} single-phase mains operated power supply
- **GD1-400/05 A to 20 A**: integrated 230 to 480 V_{AC} three-phase mains operated power supply
- **GD1-400/30 – 45 – 60 - 90 A**: 230 to 480 V_{AC} three-phase mains operated supply with external power supply unit GDPS-400

An integrated soft start system of the power supply limits the inrush current at power on.

The small dimensions of the GD1 drive allow an optimum integration:

- in 300 mm deep cabinets (connectors included) when fastened on the cabinet rear wall,
- in 240 mm deep cabinets with wall-crossing fastening (see diagram in chapter 2, section 2.2),
- Mounting pitch: 74.5 mm up to a current rating of 45 A and double-pitch for higher currents (60 A and 90 A).

1.6.2 – REFERENCE TO THE CE STANDARDS

According to the Directive 2004/108/EC, the GD1 drives have been approved with regard to their compliance with the Electromagnetic Compatibility standards concerning the power servos referenced in the EN 61800-3 standard "Electrical variable speed power servo systems", Part 3:

EMISSION EN 61800-3:2004 – Part 3: Section 6, 4-2 (C3 class equipment – see tables 17 and 18)

IMMUNITY EN 61000.4-2-3-4-5-6

Use: **Second environment** type including other places than those directly supplied by low voltage mains.

NOTE: Industrial areas and technical rooms are an example of "second environment type".

Class of the drive equipment: C3.

Standard to be applied to the electrical equipment of industrial machines: EN 60204-1.

1.6.3 – REFERENCE TO THE UL STANDARDS

GD1 series drives have been "UL_{US}" 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),

Providing that the manual is specifying that the end user has to provide an isolated power supply, for 24 V_{DC} auxiliary input protected by a 4 A UL Listed fuse, the power board is considered within a limited voltage/current circuit per section 31.4 of UL508C. Therefore, spaces on the power board are not required to be evaluated per **section 31.2 of UL508C and were evaluated according to UL840.**

Per UL 840 (Second Edition, dated May 20, 1993) requirements, spaces are limited to 2.5 mm assuming pollution degree 2 environment.

1.7 – OTHER DOCUMENTS REQUIRED FOR THE COMMISSIONING

GD1 User Guide,

Communication protocol,

Programmation Guide.

1.8 – OTHER DOCUMENTS REQUIRED FOR EXTENSION BOARDS

Encoder output "EO" manual,

Profibus manual,

Ethercat manual.

Chapter 2 – Specifications

2.1 – MAIN TECHNICAL DATA

2.1.1 – GD1-230/I SINGLE-AXIS DRIVE

Mains operated power supply voltage	230 V_{AC} +10% / -15% single-phase 50-60 Hz
Isolated auxiliary logic supply	Input voltage: 24 V_{DC} +/-15% Input current: I_{XN} = 320 mA without brake
Motor phase-phase output voltage	≥ 200 Vrms
Integrated braking system	200 Ω / 65 W or external resistor: min. 50 Ω (dp 50/200)
Triggering threshold of the braking system	400 V +/-10 V

OUTPUT CURRENT RATINGS (at a maximum room temperature of 40° C)

Drive type	Max. output current (Arms) for 1 sec. +/-5% (230 V_{AC})	Rated output current (Arms) (230 V_{AC})	Rated power (kW)	Power losses (W)	Rated input current (Arms) (230 V_{AC} 60 Hz)	Max. protection fuses for line circuit A60Q listed (Ferraz)	Short-circuit power of the mains	UL listed
Use with integrated single-phase 230 V_{AC} power supply unit: Drive type: GD1-230/cc-PS								
GD1-230/05	5	2.5	1		2.5	2 A	5 kA	Yes
GD1-230/08	8	4	1.6		4	4 A	5 kA	Yes
GD1-230/11	11	5.5	2.2		5.5	6 A	5 kA	Yes
GD1-230/17	17	8.5	3.4		8.5	10 A	5 kA	Yes
GD1-230/30	30	10	4		10	15 A	5 kA	Yes
Use with external power supply unit GDPS supplied in 230 V_{AC} three-phase Drive type: GD1-230/cc-00-0								
GD1-230/05	5	2.5	1		2.5	2 A	5 kA	Yes
GD1-230/08	8	4	1.6		4	4 A	5 kA	Yes
GD1-230/11	11	5.5	2.2		5.5	6 A	5 kA	Yes
GD1-230/17	17	8.5	3.4		8.5	10 A	5 kA	Yes
GD1-230/30	30	15	6		15	15 A	5 kA	Yes

2.1.2 – GD1-400/I SINGLE-AXIS DRIVE

Mains operated power supply voltage	230 V_{AC} -15% to 480 V_{AC} +10% three-phase, TN or TT system with grounded neutral point. 50 to 60 Hz (phase-ground voltage must be balanced) IT system supported but not recommended
Voltage unbalance	Max. 3 % of the mains voltage fundamental
Isolated auxiliary logic supply	Input voltage: 24 Vdc +/-15% Input current: 320 mA
Auxiliary supply for the motor brake	Input voltage: 24 Vdc +/-15% Input current: max. 1.5 A
Motor phase-phase output voltage	380 to 460 Vrms depending on the mains
Integrated braking system	GD1-400/05 to 20 A: 200 Ω / 65 W or **external resistor: min**. 33 Ω (dp 33/280) GD1-400/45 to 90 A: **external** resistor: on GDPS supply module
Triggering threshold of the braking system	800 V +/-10 V

OUTPUT CURRENT RATINGS (at a maximum room temperature of 40° C)
Output voltage range for 400-480 V_{AC} (rms) three-phase mains

Drive type	Max. output current (Arms) for 1 sec. (480 VAC)	Rated output current (Arms) (480 V_{AC})	Rated power (kW)	Power losses (W)	Rated input current (Arms) (480 V_{AC} 60 Hz)	Max. protection fuses for line circuit A60Q listed (Ferraz)	Short-circuit power of the mains	UL listed (*)
Use with integrated power supply unit Drive type: GD1-400/cc-PS								
GD1-400/05	5	2.5	1.7		2.5	2 A	5 kA	Yes
GD1-400/08	8	4	2.7		4	4 A	5 kA	Yes
GD1-400/14	14	7	5		7	8 A	5 kA	Yes
GD1-400/20	20	10	7		10	10 A	5 kA	Yes
Use with external power supply unit GDPS-400/xx Drive type: GD1-400/cc-00-0								
GD1-400/05	5	2.5	1.7		2.5	2 A	5 kA	Yes
GD1-400/08	8	4	2.7		4	4 A	5 kA	Yes
GD1-400/14	14	7	5		7	8 A	5 kA	Yes
GD1-400/20	20	10	7		10	10 A	5 kA	Yes
GD1-400/30	30	15	10		15	15 A	5 kA	Yes
GD1-400/45	45	20	14		20	20 A	5 kA	Yes
GD1-400/60	60	30	20		30	30 A	5 kA	Yes
GD1-400/90	90	35	25		35	40 A	5 kA	Yes

(*) NOTE: UL Listing up to 400 V_{AC} rms input voltage.

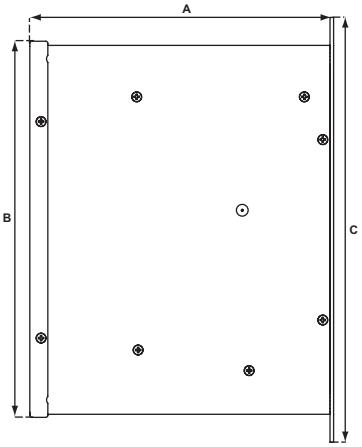
2.1.3 – TECHNICAL FEATURES

Servo loops: current, speed and position	Digital. Sampling period:
Mains filter on power supply	Integrated
Common mode filter on auxiliary supply	Integrated
Common mode filter on motor brake supply	Integrated
Position measurement sensor	Transmitter resolver Absolute single-turn encoder (ERN1085 or compliant) Incremental encoder (TTL or SinCos signals) Incremental encoder + Hall Effect Sensors
Second position sensor	Option (encoder only)
Power stage protections	See table of the main protections in the GD1 User Guide
PWM switching frequency	Programmable: 4, 8 or 16 kHz (8 kHz by default)
Minimum inductance between phases	1 mH for 230 V / 2 mH for 400 V for a PWM of 8 kHz
Digital current regulator (PI)	Adjustable
Current loop bandwidth	Cut-off frequency for 45° phase shift: 1000 Hz
Internal current limitation	Imax: 20% to 100% and Irated: 20% to 50% Authorized Imax duration = 1 second
Digital speed and position regulators	Sampling period = Anti-wind-up system of the integrator Adjustable digital gains
Speed loop bandwidth	Selectable cut-off frequency for 45° phase shift: 50 Hz, 75 Hz or 100 Hz
Max. motor speed	Adjustable from 100 rpm to 25 000 rpm
Resolver input	Resolution: 65536 (16 bit) Excitation frequency: 8 kHz Transformation ratio: 0.3 to 0.5 (other values need factory adjustment)
Encoder input	Software selectable: Quadrature signals A & B with Z marker pulse RS 422 line receiver Maximum pulse frequency: 1 MHz Resolution: 500 to 10^6 ppr Incremental Sin/Cos encoder Heidenhain 1 Vcc Sin/Cos type or compliant Maximum signal frequency: 200 kHz Resolution: 500 to 10^6 ppr Interpolation factor: 1024 Absolute single-turn Sin/Cos encoder Heidenhain ERN 1085 or compliant Maximum signal frequency: 200 kHz Resolution: 2048 or 512 ppr Interpolation factor: 1024

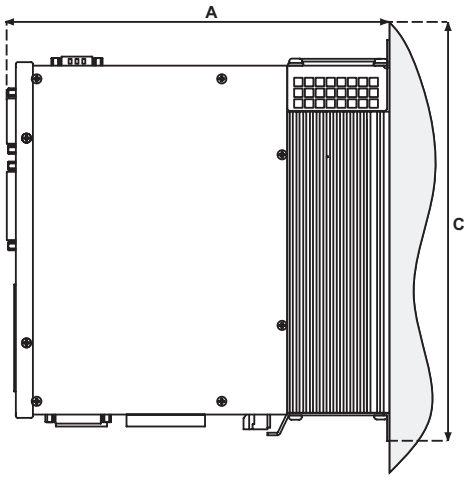
Optocoupled logic inputs (programmable)	INX: 10 programmable inputs
Analog inputs (programmable)	AN1 (12 bit) AN2 (12 bit)
Optocoupled logic outputs (programmable)	OUTX: 4 programmable outputs VLS2 (optional safety function) VLS1 (optional safety function)
Analog outputs (programmable)	AN_OUT1 (8 bit) filtered PWM analog output AN_OUT2 (8 bit) filtered PWM analog output
Opto-relay outputs	"OptoMos" relay: output open if error Umax = 50 V, Imax = 300 mA
Brake output protected against load short-circuit	Motor brake winding under 24 V_{DC} / 1.5 A (brake supply is independent from the logic 24 V)
Fieldbus: - CAN - Profibus	CANopen® protocol (DS 301 – DSP 402) PROFIBUS® DP (PP01 to PP04)
Error display	LEDs on front panel + diagnostic via serial link RS 232 + diagnostic via fieldbus
Motor and application parametrization	Serial link RS 232 or 422 (option) Bus interface with communication protocol
Automatic functions	Drive adjustment to the motor (AUTO-PHASING) Servo control adjustment (AUTO-TUNING)
Compliance with the standards: **CE** certification. "360°" shield connection, equipotentiality according to the wiring rules • GD1-230/cc-PS: with FN612-20-06 mains filter • GD1-400/cc-PS: with F400 mains filter • GD1-400/cc-00 + GDPSxx	EMC requirements: EN 61800-3:2004, Part 3 - immunity: EN 61000.4-2-3-4-5-6 - conducted and radiated emissions: class 3 equipment Electrical standards for industrial machines: - EN 60204-1: insulator 2000 V_{AC} / 1 mn leakage current > 30 mA (EMI filters)
Compliance with the standards: **UL** listing "360°" shield; equipotentiality according to the wiring rules • GD1-230/cc-PS: with FN612-20-06 mains filter • GD1-400/cc-PS: with F400 mains filter • GD1-400/cc-00 + GDPSxx	GD1 series have been "UL_{US}" 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),

2.2 – DIMENSIONS

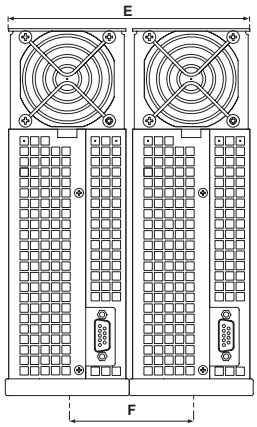
SIDE VIEW
Power supply unit
and small current drives I ≤ 8 A



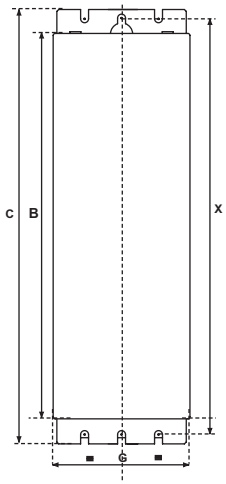
SIDE VIEW
Drive



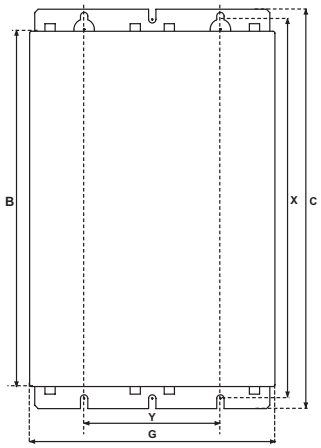
UPPER VIEW
(pitch between 2 axes)



FRONT SIDE
Power supply
Amplifiers up to 45 A

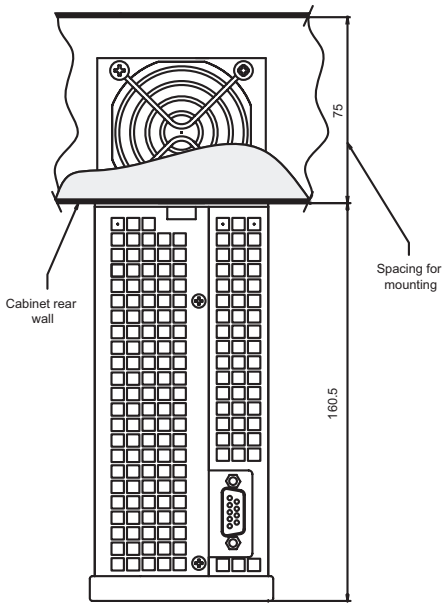


FRONT SIDE
Amplifiers 60 and 90 A

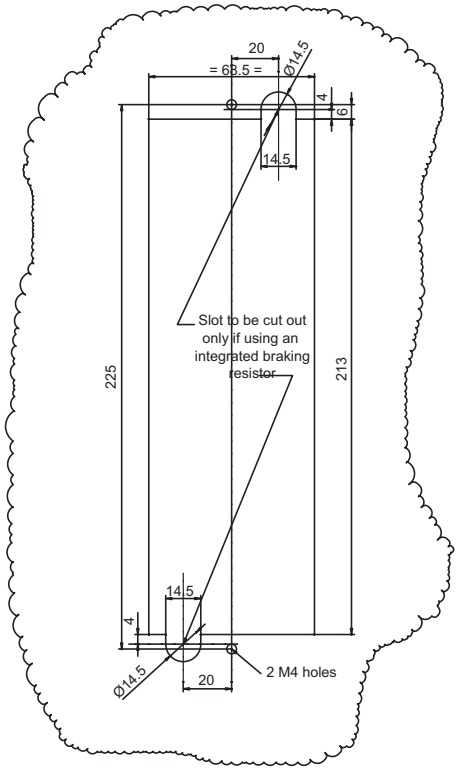


	A	B	C	E	F	G	DRILLING M4	
							X	Y
GD1-230/05 to 08	175	208.5	235	149	74.5	74.5	224.5	-
GD1-230/11 to 30	224.3	208.5	235	149	74.5	74.5	224.5	-
GD1-400/05 to 45	224.3	208.5	235	149	74.5	74.5	224.5	-
GD1-400/60 to 90	224.3	208.5	235	298	74.5	144.5	224.5	74.5
GDPS-400/16	175	208.5	235	149	74.5	74.5	224.5	-
GDPS-400/32	175	208.5	235	149	74.5	74.5	224.5	-

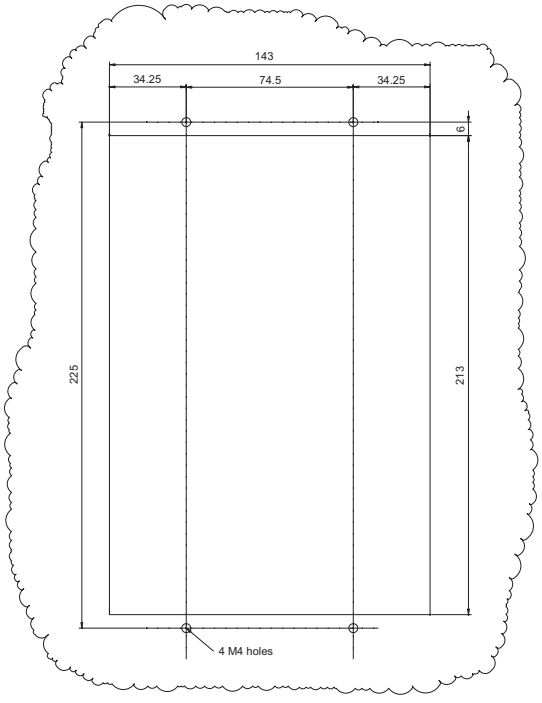
UPPER VIEW
(wall crossing mounting)



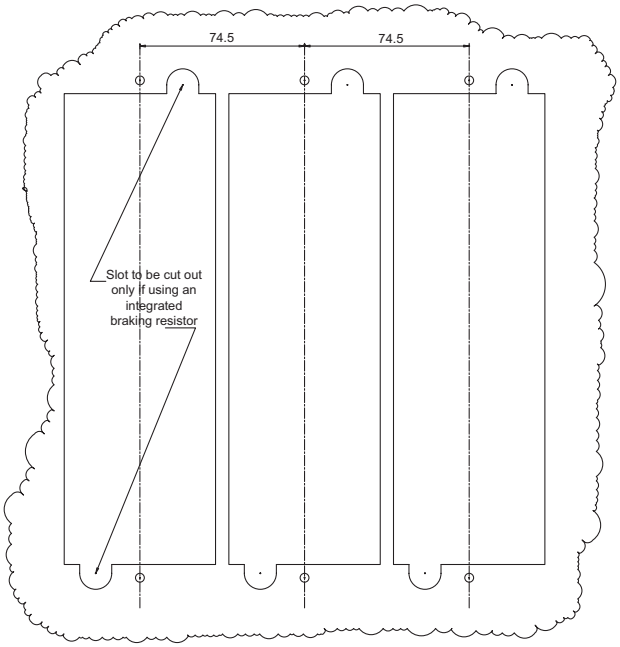
SINGLE-AXIS
WALL-CROSSING MOUNTING



DOUBLE-AXIS
WALL-CROSSING MOUNTING

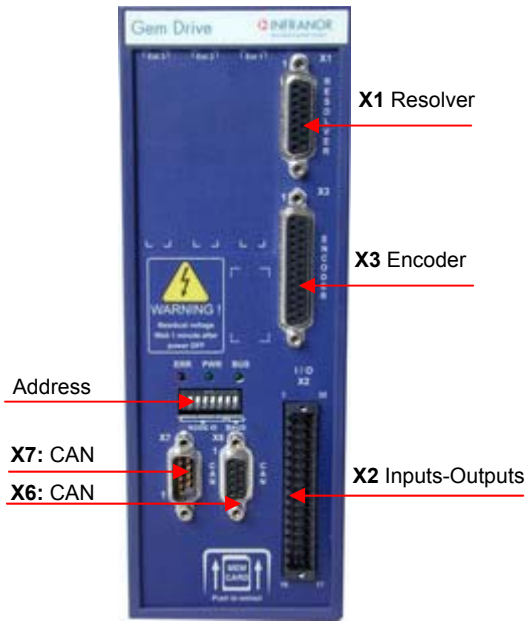


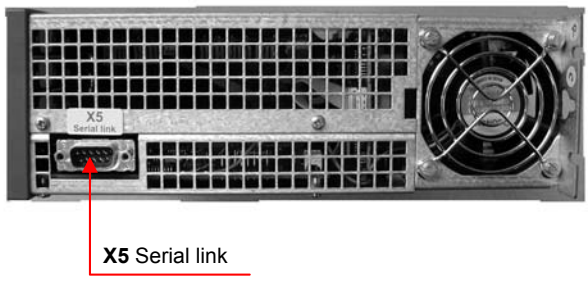
MULTIAXIS
WALL-CROSSING MOUNTING



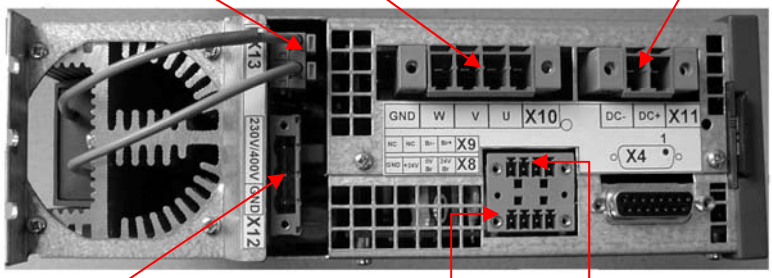
Chapter 3 – Inputs-Outputs

3.1 – LOCATION OF THE GD1-uuu/cc CONNECTORS





BOTTOM VIEW



M	O	T	O	R	
4	3	2	1		X10
GND	W	V	U		

D	C	B	U	S	
2	1				X11
DC-	DC+				

1	2	3		
L1	Neutral	GND	X12	230 V

1	2	3	4		
L1	L2	L3	GND	X12	400 V

B	R	A	K	E
4	3	2	1	X9
NC	NC	Br -	Br +	

AUXILIARY SUPPLY 24 V

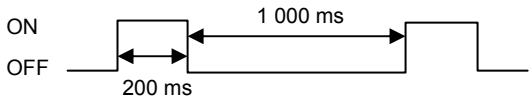
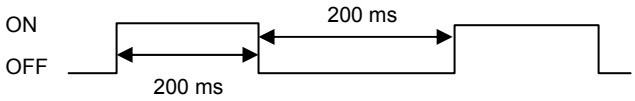
4	3	2	1	
GND	+24V	0V Br	24V Br	X8

3.2 – LED DISPLAY

3.2.1 – IDENTIFICATION OF THE LEDS

	STATE	DESCRIPTION
ERROR LED (red)	ON Flashing OFF	Error "Undervolt. " Fault No fault } Error list: see GD1 User Guide
SYS LED (green)	ON Quick flashing or OFF	System OK Firmware upgrade
BUS LED (green)	RUN LED CANopen	

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

CAN RUN LED	STATUS	
SINGLE FLASH	STOP	
FLASHING	PRE-OPERATIONAL	
ON	OPERATIONAL	

3.3 – DRIVE ADDRESSING: SELECTION OF THE TRANSMISSION SPEED

Each drive of the network shall be configured with one single address.
A DIP8 switch accessible by the operator allows to configure the drive address as well as the communication speed of the **CANopen** bus.

Adressing (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 Mbit
OFF	ON	500 kbits
ON	OFF	250 kbits

NOTE:

- The "**00**" address is only to be used in **Local** mode.
- An address ≠ **00** is to be used in **Remote** mode (use of the CANopen bus).

3.4 – X1 CONNECTOR: RESOLVER

SUB D 15 pins female
Section: 4 x 2 x 0.25 mm^2 (AWG22) twisted pairs, shielded, max. 100 m.
Housing width ≤ 15,3 mm. Example: MH connectors Ref. 6260-0105-02 (width = 15 mm).
Mandatory width ≤ 15,3 mm if the drive is equipped with an extension board.

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 connector
10	S1 (cosine -)	I	Resolver connector
11	S2 (sine +)	I	Resolver connector
3	S4 (sine -)	I	Resolver connector
5	R1 (reference +)	I	Resolver connector
4	R2 (reference -)	I	Resolver connector
7	5 V	O	
8	GND	O	
9	Non connected	O	
14	I2C-SCL	I	BUS I2C communication
15	I2C-SDA	I	BUS I2C communication

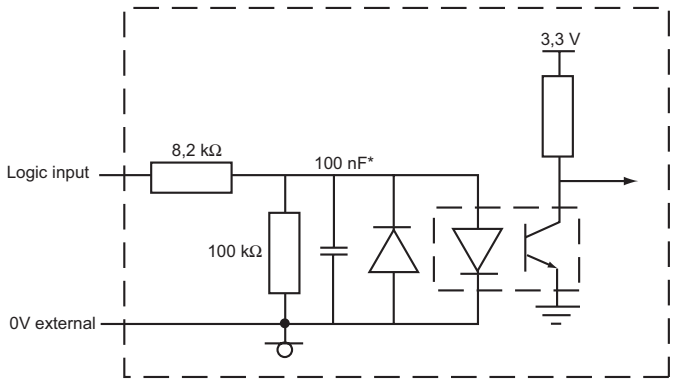
3.5 – X2 CONNECTOR: INPUTS-OUTPUTS

Weidmuller D 32 pins male
Section: 0.25 mm^2 (AWG22)

PIN	SIGNAL	I/O	DESCRIPTION
1	IN1	I	Positive logic – Optocoupled inputs
2	IN2	I	
3	IN3	I	
4	IN4	I	Positive logic – Optocoupled inputs "FAST INPUT"
5	IN5	I	
6	IN6	I	Positive logic – Optocoupled inputs used for safety function STO
7	IN7	I	
8	IN8	I	Positive logic – Optocoupled inputs MA – GV1 / MA – GV2
9	IN9	I	
10	ANA 1+	AI	Differential analog inputs : +/-10 V
11	ANA 1-	AI	
12	ANA 2+	AI	
13	ANA 2-	AI	
14	Non connected		
15	+24 V **internal**	O	For test purpose only Connect 0V internal to 0V external for STO function
16	0 V **internal**	O	
17			Not used
18			
19	+24 V **external**	I	External 24 V supply (*) Wired if the logic outputs are used (*)
20	0 V **external**	I	
25	STO_OUT-	O	Relay contact. Output safety relay 24 Vdc – 2 A. Normally closed
26	STO_OUT+	O	
27	OUT4	O	Optocoupled output
28	OUT3	O	
29	OUT2	O	
30	OUT1	O	
31	AOK-		"OptoMos" relay: high impedance output if fault. Umax = 50 V, Imax = 300 mA. Polarity must be observed: AOK+/positive potential AOK-/negative potential
32	AOK+	O	

(*) +24 V: this input is only useful if the outputs OUT1, OUT2, OUT3 and OUT4 are used.

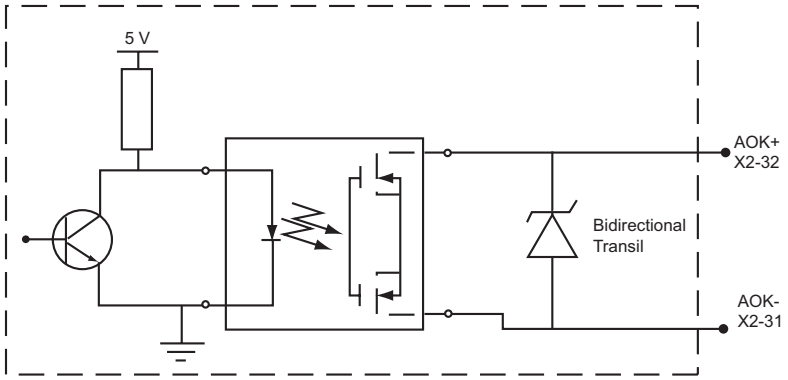
3.5.1 – SPECIFICATION OF THE LOGIC INPUTS INX



(*): 100 pF for Index and Capture inputs

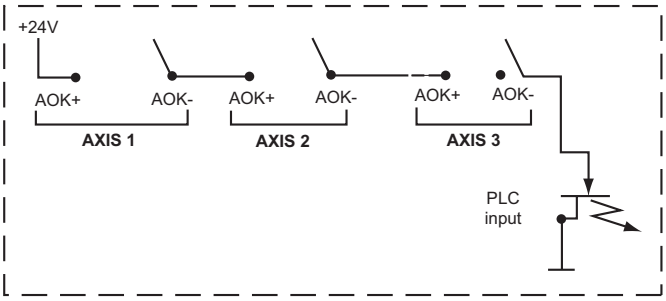
These optocoupled inputs operate in positive logic.
The input voltage corresponding to level 1 must be between 18 V and 30 V.

3.5.2 – SPECIFICATION OF THE AOK LOGIC OUTPUT ON OPTORELAY

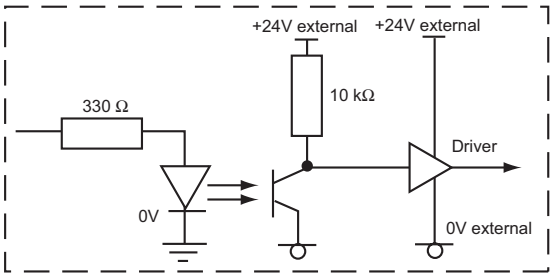


Opto-relay polarised contact. Closed if drive OK, open if fault: the polarity AOK+ positive potential with regard to AOK- must be observed.
Pmax = 10 W with Umax = 50 V – Imax = 300 mA.

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



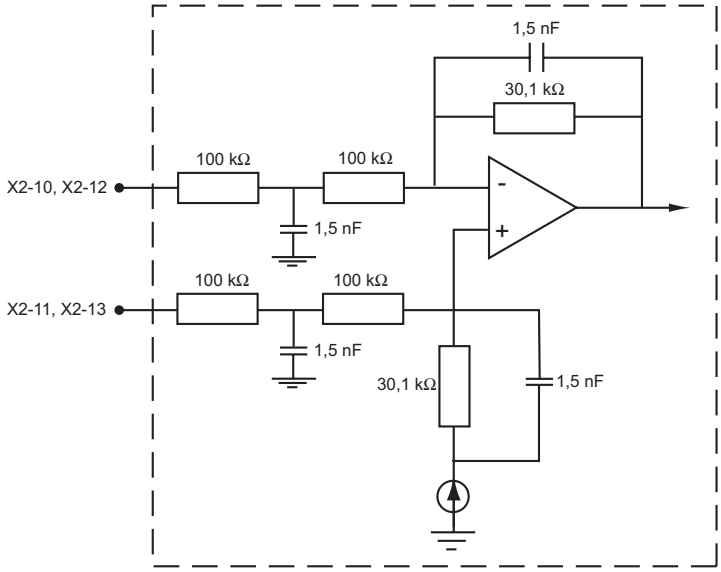
3.5.3 – SPECIFICATION OF THE LOGIC OUTPUTS OUTX



- External supply +24 V (18 V < U < 30 V)
- Maximum voltage drop: 2 V
- Protection agains overload
- Available output current per output (mA)

Number of activated outputs / Cycle ratio (%)	100 %	70 %	50 %	30 %
2	200 mA	200 mA	200 mA	200 mA
4	100 mA	150 mA	200 mA	200 mA

3.5.4 – SPECIFICATION OF THE ANALOG INPUTS CV1+, CV1-, I_{LIM+}, I_{LIM-}



3.6 – X3 CONNECTOR: ENCODER

3.6.1 – X3 CONNECTOR FOR "TTL & HES INCREMENTAL ENCODER" INPUT (SUB D 25 PINS FEMALE)

The "TTL incremental encoder & HES" configuration is software selectable and stored in the drive EEPROM.

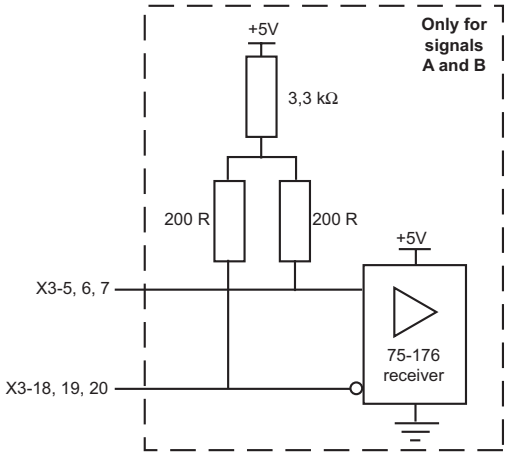
Section: 2 x 0,25 mm^2 (AWG22) twisted pairs, shielded, max 25 m (see section 4.5).

Housing width ≤ 16 mm.

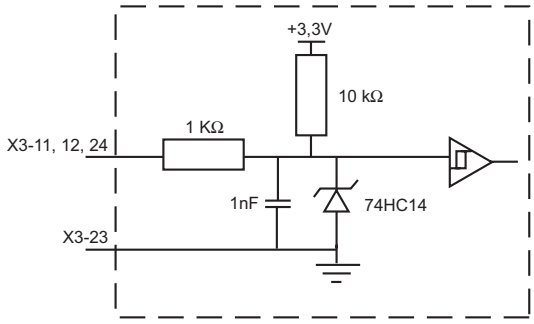
The corresponding X3 connector pin functions are described below:

PIN	FUNCTION	DESCRIPTION	
18	Marker Z/	Differential input of the encoder marker pulse Z/	
5	Marker Z	Differential input of the encoder marker pulse Z	
19	Channel A/	Differential input of the encoder channel A/	
6	Channel A	Differential input of the encoder channel A	
20	Channel B/	Differential input of the encoder channel B/	
7	Channel B	Differential input of the encoder channel B	
8	+5 V	Encoder supply voltage (max. current = 300 mA)	Section: 0.8 mm^2 AWG18
21	GND	Encoder supply GND	
11	HALL U	Hall sensor input signal phase U	
24	HALL V	Hall sensor input signal phase V	
12	HALL W	Hall sensor input signal phase W	
10	+9.2 V	Hall sensors supply voltage: max. 150 mA available	
23	AGND	Hall sensors supply GND	
9	TC+	Motor thermal sensor input	
22	TC-	Motor thermal sensor input	
Others	Reserved		

ENCODER INPUT LINES SPECIFICATION



HALL SENSORS INPUT LINES SPECIFICATION



3.6.2 –X3 CONNECTOR FOR "SIN/COS & HES INCREMENTAL ENCODER" INPUT (SUB D 25 PINS FEMALE)

The "SinCos & HES" incremental encoder configuration is software selectable and stored in the drive EEPROM.

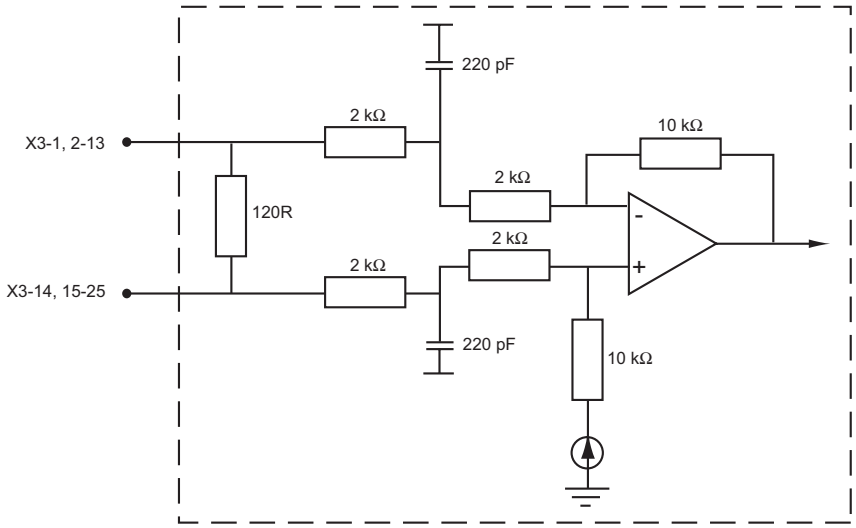
Section: 2 x 0.25 mm^2 (AWG22) twisted pairs, shielded, max. 25 m (see section 4.5).

Housing width ≤ 16 mm.

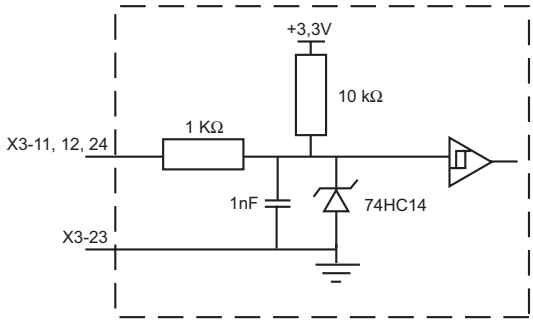
The corresponding X3 connector pin functions are described below:

PIN	FUNCTION	DESCRIPTION	
25	Marker R/	Differential input of the Sin/Cos encoder reference pulse R/	
13	Marker R	Differential input of the Sin/Cos encoder reference pulse R	
14	Channel A/	Differential input of the Sin/Cos encoder channel A/	
1	Channel A	Differential input of the Sin/Cos encoder channel A	
15	Channel B/	Differential input of the Sin/Cos encoder channel B/	
2	Channel B	Differential input of the Sin/Cos encoder channel B	
8	+5 V	Encoder supply voltage (max. current = 300 mA)	Section: 0.8 mm^2 (AWG18)
21	GND	Encoder supply GND	
11	HALL U	Hall sensor input signal phase U	
24	HALL V	Hall sensor input signal phase V	
12	HALL W	Hall sensor input signal phase W	
10	+9.2 V	Hall sensors supply voltage (max. 150 mA available)	Section: 0.8 mm^2 (AWG18)
23	AGND	Hall sensors supply GND	
9	TC+	Motor thermal sensor input	
22	TC-	Motor thermal sensor input	
Others	Reserved		

SPECIFICATION OF THE SIN/COS ENCODER SIGNALS



SPECIFICATION OF THE HALL SENSORS INPUT LINES



3.6.3 – X3 CONNECTOR FOR "ABSOLUTE SINGLE-TURN SIN/COS ENCODER" INPUT (SUB D 25 PINS FEMALE)

The "SinCos absolute single-turn" incremental encoder configuration (Heidenhain ERN 1085 or compliant) is software selectable and stored in the drive EEPROM.

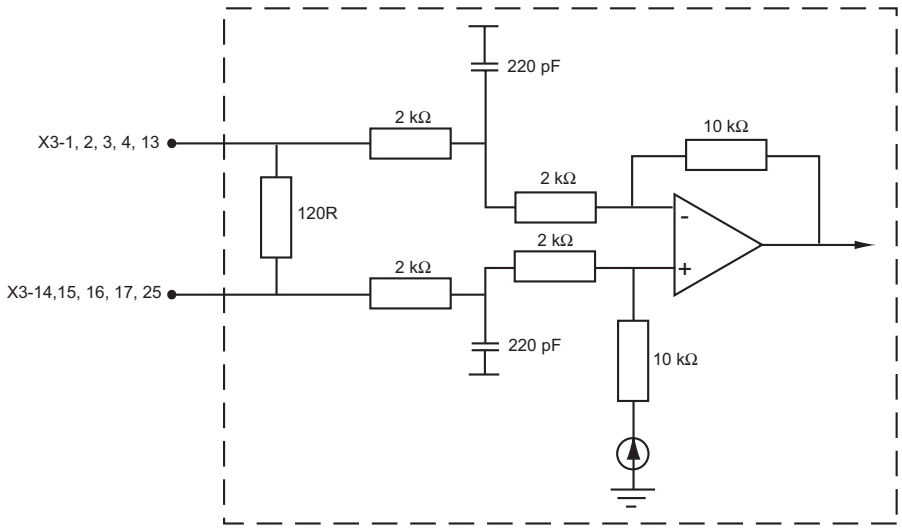
Section: 6 x 2 x 0.25 mm^2 (AWG22) twisted pairs, shielded, max. 25 m (see section 4.5).

Housing width ≤ 16 mm.

The corresponding X3 connector pin functions are described below:

PIN	FUNCTION	DESCRIPTION	
25	Marker R/	Differential input of the Sin/Cos encoder reference pulse R/	
13	Marker R	Differential input of the Sin/Cos encoder reference pulse R	
14	Channel A/	Differential input of the Sin/Cos encoder channel A/	
1	Channel A	Differential input of the Sin/Cos encoder channel A	
15	Channel B/	Differential input of the Sin/Cos encoder channel B/	
2	Channel B	Differential input of the Sin/Cos encoder channel B	
16	Channel C/	Differential input of the Sin/Cos encoder channel C/	
3	Channel C	Differential input of the Sin/Cos encoder channel C	
17	Channel D/	Differential input of the Sin/Cos encoder channel D/	
4	Channel D	Differential input of the Sin/Cos encoder channel D	
8	+5 V	Encoder supply voltage (max. current = 300 mA)	Section: 0.8 mm^2 (AWG18)
21	GND	Encoder supply GND	
9	TC+	Motor thermal sensor input	
22	TC-	Motor thermal sensor input	
Others	Reserved		

SPECIFICATION OF THE SIN/COS ENCODER SIGNALS



3.7 – X4 CONNECTOR

Connection cable between the GDPS power supply unit and the first axis drive: cable provided with the GDPS unit (see Part 2). To be connected only between the first GD1 axis and the GDPS-400/xx unit (see Part 2).

3.8 – X5 CONNECTOR: SERIAL LINK RS-232 / RS-422

SUB D 9 pins male
Section: 3 x 2 x 0.25 mm2 (AWG22), twisted pairs, shielded, max. 10 m.

PIN	FUNCTION	DESCRIPTION
5	0 Volt	GND (shield connection if no "360°" connection on the connector)
3	TXD	Transmit data RS-232
2	RXD	Receive data RS-232
6	TXD-H	Transmit data RS-422 (option)
7	TXD-L	Transmit data RS-422 (option)
8	RXD-L	Receive data RS-422 (option)
9	RXD-H	Receive data RS-422 (option)

3.9 – X6 AND X7 CONNECTORS: CAN-OPEN

SUB D 9 pins male and female
Section: 3 x 0.25 mm^2 (AWG22) twisted, shielded, max. 10 m.

PIN	FUNCTION	DESCRIPTION
2	CAN-L	CAN-L line (dominant low)
3	CAN-GND	CAN Ground
7	CAN-H	CAN-H line (dominant high)

3.10 – X8 CONNECTOR: AUXILIARY SUPPLY AND BRAKE SUPPLY

4 pin male connector with 3.81 mm pitch (female connector provided).
Tightening torque of the connector screws: 0.22 to 0.25 Nm.
Section: 0.8 mm^2 (AWG18): check voltage drop.

PIN	SIGNAL	I/O	FUNCTION	DESCRIPTION	
4	GND	I	Potential reference of the 24 V_{DC} auxiliary supply	Grounded potential reference	
3	+24 V_{DC}	I	24 V_{DC} auxiliary supply (mains isolated)	24 V_{DC} +/-15% - 320 mA Regulation with load: 3%	UL: Protection by 4 A UL fuse
1	+24 V brake	I	24 V brake supply	Max. 1.5 A	
2	0 V brake	I	Reference of the 24 V brake supply		

3.11 – X9 CONNECTOR: BRAKE

4 pin male connector with 3.81 mm pitch (female connector provided).
Tightening torque of the connector screws: 0.22 to 0.25 Nm.
Section: 0.8 mm^2 (AWG18): check voltage drop.

PIN	SIGNAL	I/O	FUNCTION	DESCRIPTION
1	Brake +	O	Motor brake supply	Currentless brake 24 V_{DC} / 1.5 A
2	Brake -	O	Brake supply reference	Brake GND
3	NC		Non connected	
4	NC		Non connected	

3.12 –CONNECTOR X10: POWER – MOTOR OUTPUT

4 pins male (female connector provided).
7.62 mm pitch for current ratings ≤ 45 A.
10.16 mm pitch for current ratings > 45 A.

Tightening torque of the connector screws:
0.5 to 0.6 Nm for connectors with 7.62 mm pitch
1.2 to 1.5 Nm for connectors with 10.16 m pitch

PIN	SIGNAL	I/O	FUNCTION	DESCRIPTION
3	W	O	Motor phase W	GD1-uuu/05 to 20 A: section 1 mm^2 (AWG14) GD1-uuu/30 to 45 A: section 2.5 mm^2 (AWG10) GD1-uuu/60 and 90 A: section 6 mm^2 (AWG8) 600 V / 105° shielded. Max. 25 m
2	V	O	Motor phase V	
1	U	O	Motor phase U	
4	GND		Motor ground	

3.13 – X11 CONNECTOR: POWER – DC BUS

2 pins male (female connector provided).
7.62 mm pitch for current ratings ≤ 45 A
10.16 mm pitch for current ratings > 45 A

Tightening torque of the connector screws:
0.5 to 0.6 Nm for connectors with 7.62 mm pitch
1.2 to 1.5 Nm for connectors with 10.16 mm pitch
Use a cable termination for 2 same section wires.

PIN	SIGNAL	I/O	FUNCTION	DESCRIPTION
1	DC+	I/O	Parallel connection of the DC bus	GD1-uuu/05 to 45 A: section 2.5 mm^2 (AWG14) GD1-uuu/60 and 90 A: section 6 mm^2 (AWG10) 600 V / 105°
2	DC-	I/O	Parallel connection of the DC bus	

The DC+/DC- polarity with the multiaxis power supply unit and between the drives **MUST** be observed.
Max. length: 200 mm

IMPORTANT
The motor and brake cable must be shielded and connected over 360° on the cabinet rear wall, as near as possible to the drives.

- The GND reference must be connected to the GND pins.
- Please use only copper conductors for the cable terminations.
- Torque value for the wiring terminations: this value must comply with the certified terminal block.

3.14 – X12 CONNECTOR: POWER SUPPLY INPUT (internal supply)

3.14.1 – SINGLE-PHASE POWER INPUT CONNECTOR FOR THE 230 V_{AC} SINGLE-AXIS CONFIGURATION

3 pins male with 7.62 mm pitch (female connector provided).
Tightening torque of the connector screws: 0.5 to 0.6 Nm

PIN	SIGNAL	I/O	FUNCTION	DESCRIPTION
1	Phase L1	I	Power input 230 V_{AC} single-phase	Irms rated = max. 10 A 600 V / 105°. Section: 1 mm^2 (AWG16)
2	Neutral	I		
3	GND		Mains ground	

3.14.2 – THREE-PHASE POWER INPUT CONNECTOR FOR THE 400 V_{AC} SINGLE-AXIS CONFIGURATION

4 pins male with 7.62 mm pitch (female connector provided).
Tightening torque of the connector screws: 0.5 to 0.6 Nm.

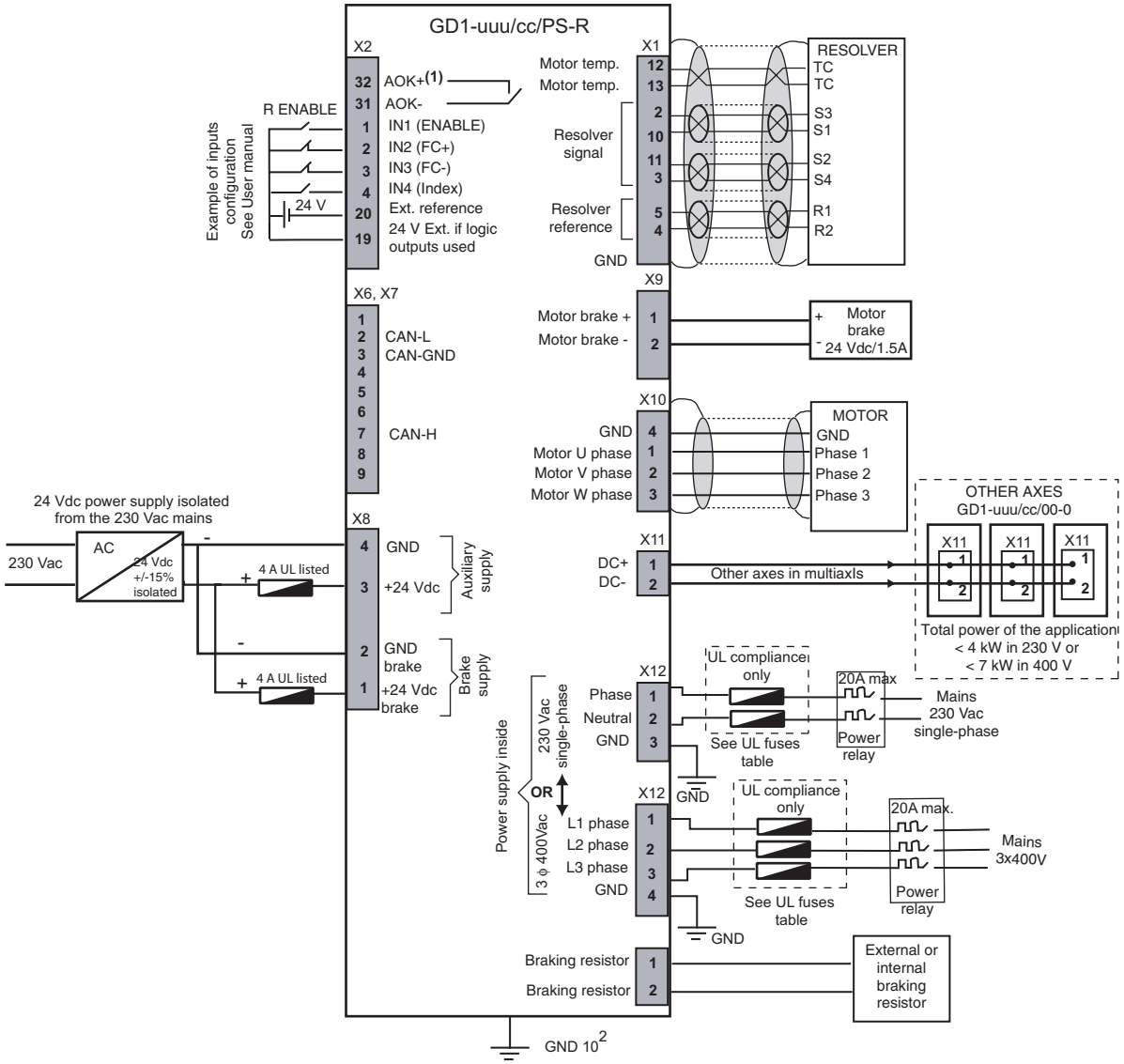
PIN	SIGNAL	I/O	FUNCTION	DESCRIPTION
1	Phase L1	I	Power input 400 V_{AC} three-phase	Irms rated = max. 10 A 600 V / 105°. Section: 1 mm^2 (AWG16)
2	Phase L2	I		
3	Phase L3	I		
4	GND		Mains ground	

3.14.3 – X13 CONNECTOR: ADDITONNAL BRAKING RESISTOR

2 pins female spring contact connector (no polarity).
Connection of the internal additional resistor 200 R/65 W or
Connection of the external additional resistor, type dp 50/200 for internal single-phase 230 V_{AC} supply or
Connection of the external additional resistor, type 33/280 for internal 3-phase 400 V_{AC} supply.

Chapter 4 – Connections

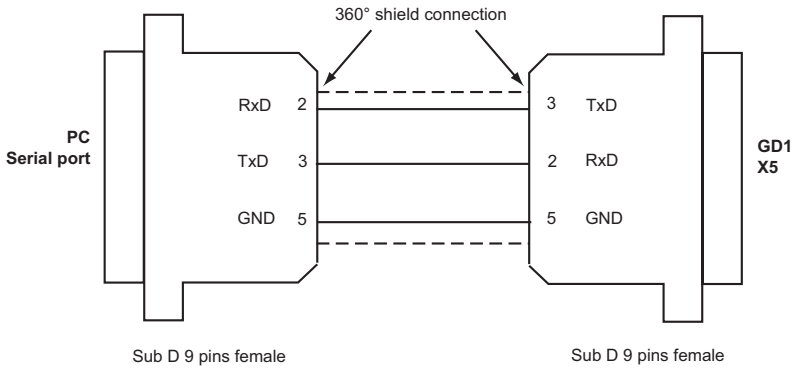
4.1 – CONNECTION DIAGRAM OF GD1 – STAND-ALONE 230 V_{AC} OR 400 V_{AC}



(1) **CAUTION** ! Imax = 300 mA, Umax = 50 V (see AOK output specifications)
Respect the AOK+ polarity = positive potential/AOK-

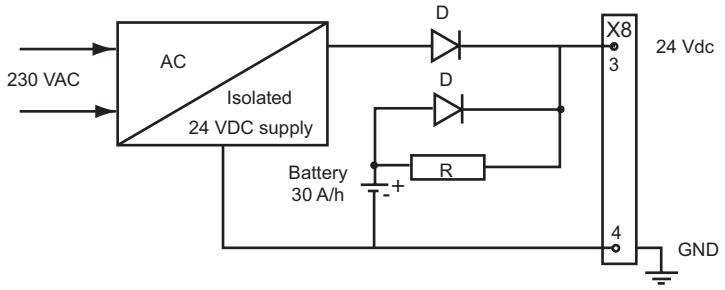
IMPORTANT
The protection, on source side, of the 24 V and power supplies protection must be made by the user.
Please use only copper conductors for the wiring terminations.
Torque value for the wiring terminations: this value must comply with the certified terminal block.

4.2 – CONNECTION OF THE SERIAL LINK RS-232



REMARK:
For PCs which are not equipped with the serial link RS232, RS232/USB converters must be used. But, since RS232/USB converters are generally an office equipment, they are not meant to be used in an industrial environment subjected to EMC disturbances. So, the serial link RS232 must be mandatorily shielded and equipped with metal connectors at both ends for the 360° shield connection.
The RS232/USB converter must also be correctly shielded with a 360° shield connection at both ends.

4.3 – CONNECTION OF A BACKUP BATTERY



The consumption of the GD1 drive is 320 mA with 24 V_{DC}. So, a 24 V / 30 A/h battery can keep the drive powered during i.e. 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 – WIRING RECOMMENDATIONS

(according to EN61000.4-2-3-4-5-6 and EN61800-3-Part 3 standards. See diagram "Shield connection on the connectors", section 4.2.2).

4.4.1 – GROUND CONNECTIONS 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 centimetres; 10 centimetres is prohibited),
- by a "360°"shield connection. This means that the whole circumference of the shield sleeve must be connected to the reference conduction 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 connections have a very low impedance (<0.1 Ω). Any shield that is used as a conductor can be connected at both ends with 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: section 10 mm2

Cables with low potential should **never** run in the proximity of power lines.
If there is a potential reference, i.e. a main chassis or cabinet with a low impedance between its various elements, it should be used to connect ALL references to it and also being grounded itself.

LEAKAGE CURRENT TO GROUND

This drive may generate direct current in the protection conductor. When a protection by residual current device (RCD) is used for the protection in case of direct or indirect contact, **only an RCD type B** is allowed on the drive supply side.

RECOMMENDATIONS FOR THE GROUNDING OF THE PROTECTION CONDUCTOR

The **Power Electronics Unit** equipment, which includes the controller, the drive, the motor and the sensors, generates a leakage current to ground higher than 10 mA continuous. So, the protection conductor section must be **at least of 10 mm^2** (copper) or 16 mm^2 (aluminium).

4.4.2 – 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 pertaining pin of the SUB-D connector.

4.5 – 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 diagram (see section 4.4.2).

The encoder inputs A, B, C, D, Z and R require a pair twisted and shielded cable. The shield must have a "360°" connection via metallic collars at both ends. If the shield is connected by means of a pig tail, it must be connected at one end to the GND pin of the connector on drive 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:

$$\Delta U[V] = 40.10^{-6}. \frac{Lc[m].I[mA]}{S[mm^2]}$$

with ΔU : voltage drop in volts
Lc : cable length in metres
I : encoder current in milliamps (see technical specifications)
S : cross section in square millimetres

Due to this voltage drop:

- an encoder with a large power supply voltage range should be preferred,
- 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 the GD1 range),
- if none of both solutions above can be used, the user has to supply the encoder by means of an external power supply.

Example

The application requires an Heidenhain linear encoder supplied by 5 V +/-5% / 300 mA with 25 m cable length.
Min. power voltage: 5 V +/-5% ⇨ ΔUmax = 0.25 V ⇨Min. cross section: S = 1.2 mm^2.

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

- either connect the SENSE feedback signal lines with power supply lines, while the needed wires cross section will be the half (0.6 mm^2),
- or use the same encoder type but the version which allows its power supply voltage from 3.6 V to 5.25 V / 300 mA.
  Min power voltage 3.6 V ⇨ ΔUmax = 1.4 V ⇨ Min. cross section: S = 0.21 mm^2.

The cable of brake-equipped motors must also have their brake cables shielded, in order to be EMC compliant.

Maximum cable length:
- Resolver: ≤ 100 m
- Encoder: ≤ 25 m
- Motor: ≤ 25 m

For motor 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 equal to or higher than the drive rating.

The reactance must be mounted at the drive 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 instead 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 drive but it may be quite heated. This requires an appropriate fan.

4.6 – 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 drive OFF.
Recall:
The power voltage may remain several minutes at the capacitors terminals. A contact under high voltage may involve severe physical damage.

4.7 – 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.
Tightening torque on the connector of the braking resistor housing: dp = 0.9 Nm.

4.8 – FIRST POWERING OF THE DRIVE

4.8.1 – VERY IMPORTANT

Check the connections, especially of the 24 V_{DC} and power supplies. There are tow different voltage ratings: 230 V_{AC} and 400 V_{AC}. Check that the appropriate sticker actually corresponds to the power connections.
The 400 V_{AC} connection of a 230 V drive will destroy it.
The ENABLE signal (X2 connector, pin 1) must be disabled.

Any braking resistor value lower than the minimum value specified in the technical specifications wil definitely damage the braking system.

Check for the correct groundings as well as the 360° shield connections.

WARNING !
During the machine adjustments, drive connection or parametrization errors 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 exposed area.

4.8.2 – SWITCHING ON THE 24 V_{DC} SUPPLY

The red **ERROR** LED on the front panel must be flashing ("Undervolt." error displayed).
The AOK relay (pins 9 and 10 of X2) is closed. It is then possible to control the power relay (R_{PU}) according to the instruction of section 4.1 : Connection diagram.
On a GDPS-400/xx multiaxis module, the green LED **Logic ON** goes on.

4.8.3 – SWITCHING ON THE POWER SUPPLY (230 V_{AC} OR 400 V_{AC} ACCORDING TO THE DRIVE TYPE: GD1-UUU/CC-PS-R)

The red **ERROR** LED on the front panel must go off.

For further details regarding the drive commissioning, please see manual GD1 – User Guide.

4.9 – REQUIREMENTS FOR THE COMPLIANCE WITH THE UL STANDARDS

The UL listing requires the following conditions to be fulfilled by the installer of the drives.

4.9.1 – 24 V SUPPLY

The end user has to provide a 24 V_{DC} isolated power supply (i.e. with an isolation transformer for the auxiliary supply input, protected by a 4 A UL listed fuse.

4.9.2 – POWER SUPPLY AND UL FUSE RATING

The fuse type recommended for drive application is semiconductor protection fuses. The maximum short-circuit power of the mains must not exceed 5000 Arms at a voltage of 480 V, when protected by a UL fuse range A60Q.

On GD1-230/cc-PS-R and GD1-400/cc-PS-R drives (power supply inside), the fuse ratings must be the following:

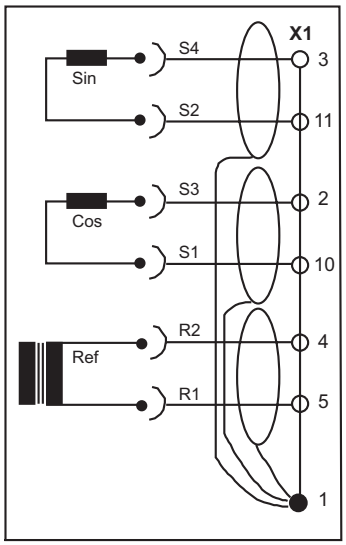
GD1	400/0.5 TO 20	MULTIAXIS
FERRAZ	A60Q20-2	0.3 X $\sum_{1}^{N}$ Irated amplifier

For a multiaxis application with N drives, the fuse rating is calculated by the formula given in the table above. But a rating of 20 A must not be exceeded.

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 of the **X1** connector as well as the manufacturer's diagram:



The factory-set resolver calibration allows an optimum operation for resolvers which transformation ratio is between 0.3 and 0.5.

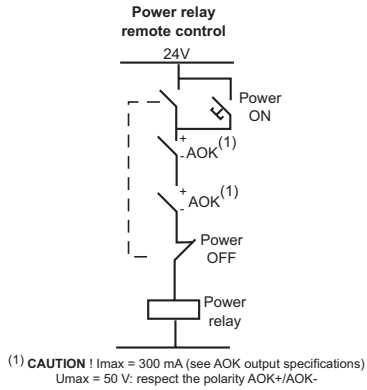
For the use of **resolvers** with **transformation ratios** out of the range 0.3 to 0.5, please contact the INFRANOR factory.

NOTE
When using resolvers with a number of pole pairs N > 1, all speed values displayed in the drive are equal to N times the motor rotation speed.

5.2 – USE OF THE "AOK" OUTPUT

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 diagrams).
The wiring of the opto-relay output must observe the AOK+ / AOK- polarity (see diagram below).

The correct drive operation requires this connection logic. Switching on the power supply before initializing via the 24 V_{DC} auxiliary supply will hinder the operation. It will then be necessary to proceed according to the instructions contained in this manual.



5.3 – ENERGY RECUPERATION VIA A BRAKING RESISTOR

All GD1 drives 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 drive. This energy is dissipated inside a resistor called "braking resistor".

Two configurations of the braking resistor are available: integrated or external (see Chapter 2).

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

For an optimum power feedback by the drives in a multiaxis application, it is possible and recommended to connect the DC bus (DC+ and DC-) in parallel (see diagram in section 4.2).

It is recommended to mount the braking resistor on the axis with highest current rating.
An electronic control of the reflected power avoids the overload of the braking resistor. So, if the energy reflected to the drives with parallel mounted DC busses is too high, the DC bus voltage will rise up to the triggering of the "**Overvoltage**" fault. A second resistor must then be mounted on the second axis which shall then be equipped with "Power supply inside" unit.

5.4 – MAINTENANCE

The GD1 drive does not require any special maintenance in a specified environment.

The opening of the housing will cancel the warranty.

In an environment containing a dust type such as i.e. cloth fibres, it may be necessary to preventively clean the heatsink.

WARNING !

Do not use an air gun outside the heatsink. Blowing inside the drive is prohibited (risk of moistured air on the electronic cards).

5.5 – ORDER CODE

GD1 – uuu / cc – PS – R – SI – Ex1 – Ex2 – Ex3 – 00 - RS

Voltage: 230 or 400 Vac

Peak current

Power supply inside (00: without)

Additional braking resist. integrated (0: without)

Safety integrated: S1 = Safe Torque Off

Extensions Ex1, Ex2, Ex3:
Each extension position can receive an extension board.
Can be selected: One bus interface:
PR = Profibus DP, I1 = additional input/output,
EO = Encoder Output
ET = Ethercat
00 = without

00 = reserved

Serial link RS-422 integrated (00 = standard = RS232)

GEM DRIVE

PART 2

GDPS
POWER SUPPLY

GEM DRIVE

Content Part 2

Page

Chapter 1 - Specifications

1.1– INTRODUCTION

The external GDPS-400/xx power supply unit is the power supply for the GD1 actuators which power required for the application is higher than 4 kW in 230 V_{AC} or 7 kW in 400/480 V_{AC}.

GD1 actuators using the external GDPS power supply are not equipped with an integrated power supply (GD1-uuu/cc/00-0).

For the various configurations, see Part 1, section 1.1.

NOTE
The GDPS-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}.

1.2 – MULTIAXIS POWER SUPPLY UNIT GDPS-400/16-32

Mains operated power supply voltage	230 V_{AC} -15% to 480 V_{AC} +10% three-phase, TN or TT system with grounded neutral point. 50 to 60 Hz (phase-ground voltage must be balanced) IT system supported but not recommended	
Voltage unbalance	Max. 3 % of the mains voltage fundamental	
Output power	**400 to 480 V_{AC} supply**	**230 V_{AC} supply**
	GDPS/16: 16 kW rated / 45 kW peak GDPS/32: 32 kW rated / 90 kW peak	GDPS/16: 8 kW rated / 25 kW peak GDPS/32: 16 kW rated / 45 kW peak
Output DC voltage	**400 to 480 V_{AC} supply**	**230 V_{AC} supply**
	550 to 800 V_{DC} according to the mains voltage and during the braking on the braking resistor. Connection of the DC bus to the GD1-400/I modules	300 V_{DC} to 400 V_{DC}
Triggering threshold of the braking system	**Operation voltage 400 V_{AC}**	**Operation voltage 230 V_{AC}**
	800 V +/-5 V	400 V +/-5 %
Braking resistor	33 Ω / 280 W (dp 33/280) for GDPS-400/16 16.5 Ω / 560 W (type E) for GDPS-400/32	
Pulse power of the braking system	**Operation voltage 400 V_{AC}**	**Operation voltage 230 V_{AC}**
	20 kW (GDPS 16 kW) 40 kW (GDPS 32 kW)	4,5 kW (GDPS 16 kW) 9 kW (GDPS 32 kW)
Mains filter integrated		

NOTE: UL Listing up to 400 V_{AC} rms input voltage.

Low level link cable between the GDPS power supply unit and the first axis supplied with the GDPS power supply unit and to be connected to the first axis.

The polarity DC+ with DC+ and DC- with DC- between the GD1-uuu/cc drives and the GDPS power supply unit must be observed.
Otherwise, the drive will be immediately destroyed.

When using GD1-400/cc-00-0 actuators with a 230 VAC supply voltage, make sure that the operation voltage is correctly entered in the Gem Drive Studio software.

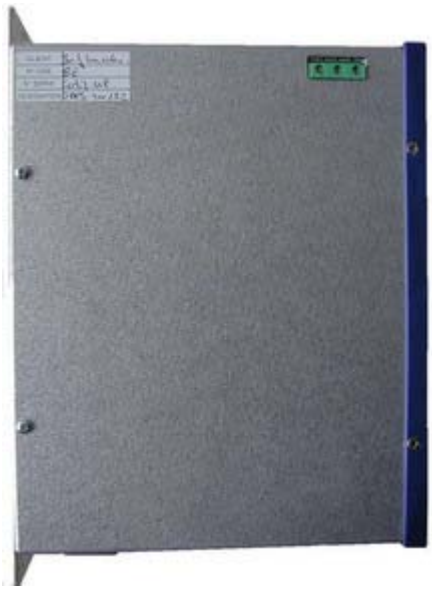
Calculation of the necessary average power in a given application:

$$P_{average}\ \text{GDPS xxx/xxx} = 0.4 \times \sum_{1}^{N} P_{rated}\ \text{axis application in servo mode}$$

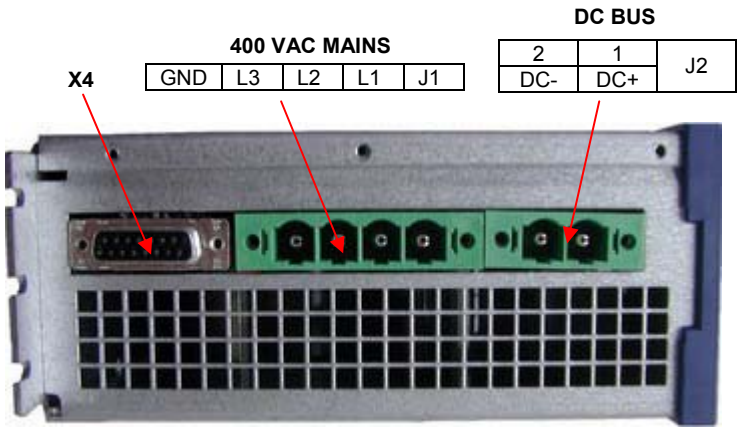
Chapter 2 - Connectors

2.1 – LOCATION OF THE GDPS CONNECTORS

CONNECTION OF GDPS BRAKING RESISTOR



BOTTOM VIEW



2.2 – J1 CONNECTOR: THREE-PHASE 400 V POWER INPUT FOR THE CONFIGURATION WITH EXTERNAL POWER SUPPLY UNIT (GDPS)

External power supply unit GDPS-400/cc
4 pins male with 10.16 mm pitch (female connector provided)
Tightening torque of the connector screws: 1.2 to 1.5 Nm

PIN	SIGNAL	I/O	FUNCTION	DESCRIPTION
1	Phase L1	I	Power input 400 V_{AC} three-phase	Irms rated = max. 42 A 600 V / 105°. Section: 6 mm^2 (AWG10)
2	Phase L2	I		
3	Phase L3	I		
4	GND		Mains ground	

2.3 – J2 CONNECTOR: DC BUS FOR THE CONFIGURATION IN 400 V WITH EXTERNAL POWER SUPPLY UNIT (GDPS)

2 pins male with 10.16 mm pitch (female connector provided)
Tightening torque of the connector screws: 1.2 to 1.5 Nm
Section: 2.5 mm^2 (AWG14) for GDPS-400/16.
Section: 6 mm^2 (AWG10) for GDPS-400/32.
600 V / 105°.

PIN	SIGNAL	I/O	FUNCTION	DESCRIPTION
1	DC+	O	Parallel connection of the DC bus	Connected to the X11 connector of the drives
2	DC-	O	Parallel connection of the DC bus	Connected to the X11 connector of the drives

The DC+/DC- polarity with the multiaxis power supply unit and between the drives MUST be observed. Length max. = 200 mm.

2.4 – X6 CONNECTOR: EXTERNAL BRAKING RESISTOR

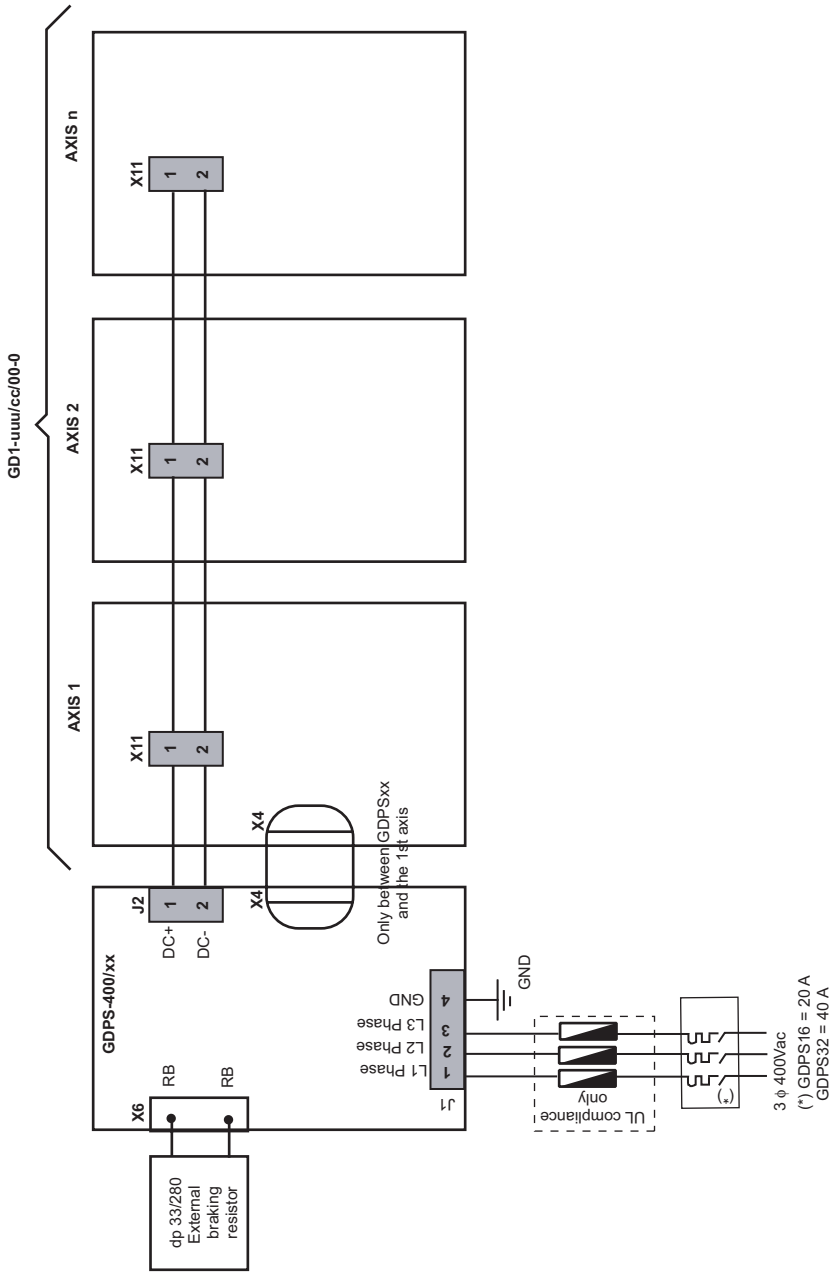
3 pins female screw connector with 7.5 mm pitch.
Tightening torque of the connector screws: 0.5 to 0.6 Nm.
Section: 2.5 mm^2 (AWG14).
600 V / 105°.

PIN	SIGNAL	I/O	FUNCTION
1	RB	O	No connection polarity
2	NC	O	External braking resistor type dp 33/280 (GDPS-400/16)
3	RB	O	External braking resistor type E (GDPS-400/32)

Chapter 3 – Connexions

3.1 – CONNEXION DIAGRAM OF THE SUPPLIES IN MULTIAXIS CONFIGURATION WITH GDPS 400/XX POWER SUPPLY UNIT

This connection type is required when the installation rated power of the application is higher than 7 kW in 400 V_{AC}.



3.2 – POWER SUPPLY AND UL FUSE RATING

For the GDPS-400/xx multiaxis power supply unit:

GDPS	400/16	400/32
FERRAZ	A60Q20-2	A60Q40-2

Chapter 4 – Order code

4.1 – ORDER CODE

GDPS – 400 / xx

Voltage: 400 V_{AC}

Rated power: 16 or 32 kW

4.2 – ACCESSORIES

BRAKING RESISTOR

dp 50/200 (50 Ω/200 W) braking resistor
external braking resistor on GD1-230/cc with internal power supply if 200 Ω/65 W integrated braking resistor is not enough (to be connected on X3)

dp 33/280 (33 Ω/280 W) braking resistor
for GDPS-16

type E (16.5 Ω/560 W) braking resistor
for GDPS-32

MAINS FILTER
F400 for GD1-400/cc-PS

FN612-20-06 for GD1-230/cc-PS

GEM DRIVE

PART 3

APPENDIX

GEM DRIVE

Content Part 3

Page

1 – OPERATING ENVIRONMENT CONDITIONS

A - CLIMATIC CONDITIONS

1	-	Cooling temperature	Air: 0°C to +40° C
2	-	Room temperature	+5°C to +40°C. As from 40°C, the peak currents are reduced of 3% per °C
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	-	Operationless periods	< 1 year: no restrictions > 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 indoor, on a stiff surface, in rooms or additional housings without hindering the heatsink and the fan. The liability may be increased by installing a cooling system.
Other installation conditions must be specifically analysed and be subjected to a technical specification agreed by INFRANOR.

Mechanical mounting

There are two possible mountings:
- Normal mounting on the cabinet rear wall,
- Wall-crossing fastening (see dimensions in section 2.2 of this chapter), which requires to turn over the fastening hooks. The advantage of this solution in the energy dissipation outside the cabinet part where the electronics (control, PLC, etc.) are located.

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^2)
$2 \leq f < 9$	0.3	-
$9 \leq f < 200$	-	1

Vibrations which exceed these limits or the use on mobile equipment are considered as unusual operating conditions.

C - UNUSUAL OPERATING ENVIRONMENT CONDITIONS

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

Abnormal operating 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, jerking.
10. Exposure to inclemency or water dripping.
11. Exposure to unusual storing or freight conditions.
12. Exposure to sudden or rough temperature variations.
13. Abnormal exiguity of the available room.
14. Abnormal high nuclear radiations.
15. Altitude higher than 1000 m.
16. Long standstill periods.
17. Outdoor equipment.

D - INSTALLATION, COMMISSIONING AND OPERATION

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

E - EQUIPMENT STORING

At receipt, the equipment must be immediately stored under adequate shelter. The transport packaging is not fitted for outdoor or non-protected storing.

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 storing 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 a low temperature during a long time, it should be 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 faulty electric insulation.

F - PARTICULAR STORING RISKS

The following risks must be 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.
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 storing 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 storing conditions must avoid exposure to rodents and mould.

G - TRANSPORT

1 - Climatic conditions

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

a - Room temperature: -25°C to +70°C
NOTE: The room temperature is the temperature which is the nearest to the equipment, i.e. the inside of the container.
b - Relative moisture: 95% at +40°C
NOTE: Some temperature and moisture combinations may cause 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 package in the conditions specified by class 2M1 of the IEC 60721-3-2 standard.

This includes vibrations and shocks (see tables below).

TABLE 4 – Vibration limits during the transport

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

TABLE 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

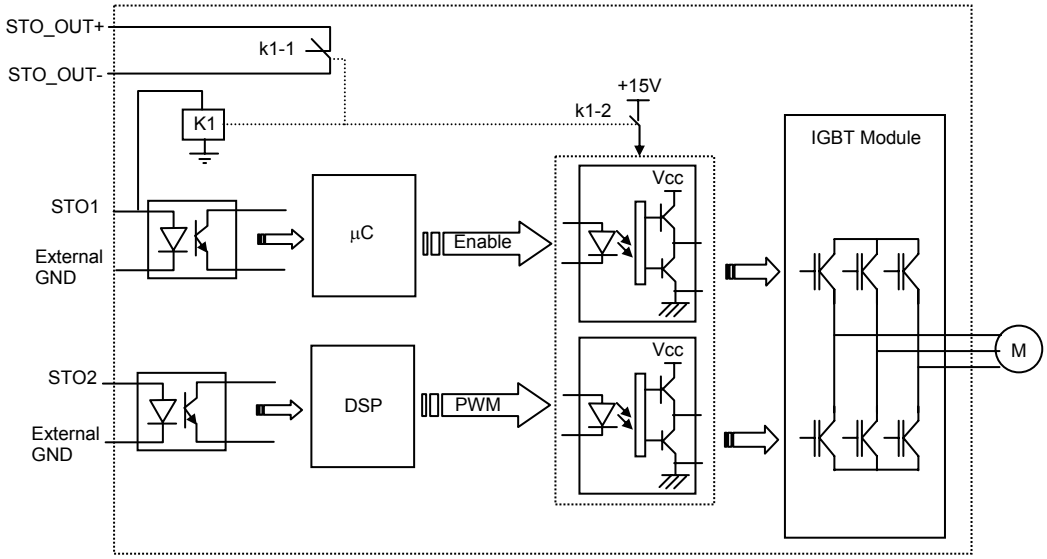
NOTE: If the equipment may be subjected to shocks or vibrations beyond these limits, it will require special packaging or transport conditions.

2 – "SAFE TORQUE OFF" OPTION

2.1- DESCRIPTION

Safe Torque Off (STO) definition according to the EN 61800-5-2 standard:
"Power, that can cause rotation (or motion in the case of a linear motor), is not applied to the motor. The drive will not provide energy to the motor which can generate torque (or force in the case of a linear motor)'.

The STO function corresponds to an uncontrolled stopping in accordance with the stop category 0 of the EN 60204-1 standard.
The STO function may be used where power removal is required to prevent an unexpected start-up.
In circumstances where external influences (with vertical loads for example) are present, additional measures (mechanical brakes for example) may be necessary to prevent any hazard.
The standard output of the drive must not be considered as a safe output. When using a mechanical brake, it will be mandatory to introduce a safe contact from an external device in the brake actuation line.
The STO function cannot be considered as a safe insulation device for the motor. It does not prevent from any voltage on the motor terminal block.



Functional block diagram

2.2– RECOMMENDATIONS FOR THE INTEGRATION

2.2.1 – SAFETY INSTRUCTIONS

The integration of the STO function must be the result of a risk analysis of the complete machine. All control components must comply with the requirements of this risk analysis.
Installing and commissioning of safety functions must be performed by skilled personnel only.

Short-circuit avoidance:
Install the drive in a control cabinet with a minimum IP54 protection.
Avoid control signals proximity. Any short-circuit between two control signals must be detected:
- the short circuit will either be detected by the circuit breaking system (fuse for example); in this case, the voltage reference is grounded, and shielded pair cables must be used (shield is connected to the ground), or a ribbon cable with all unused wires connected to the ground to prevent proximity with high potential signals,
- or a short-circuit detection device must be integrated.

Take care that, as the STO function performs the motor power removal without shutting down the power supply, electrical risks remain unchanged when the STO function is active or inactive.

In case of applications with vertical axes, additional measures (mechanical brake) may be necessary.

Refer to the EN13849-2 standard for any complementary information.

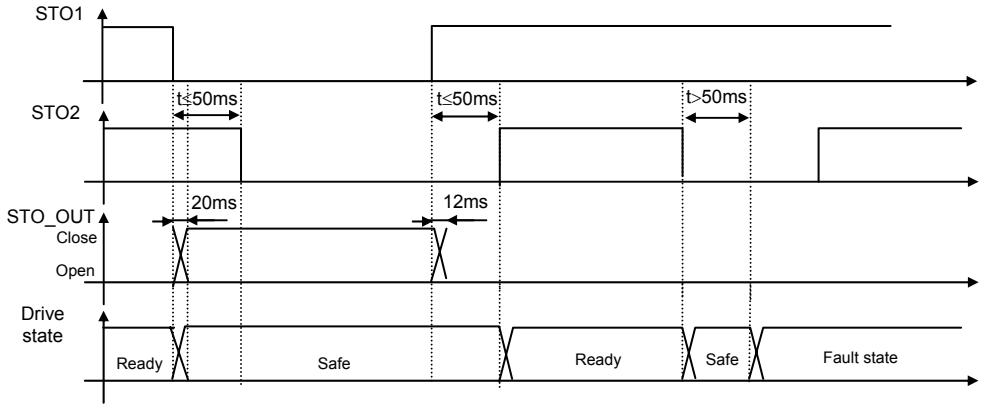
2.2.2 – STO CONNECTION

X2 N°	SIGNAL	FUNCTION	DESCRIPTION
7	IN7	STO1	Channel 1 for the STO function inhibition 24 Vdc releases the enabling
6	IN6	STO2	Channel 2 for the STO function inhibition 24 Vdc releases the enabling
16	0 V internal	GND internal	Voltage reference of the STO1 and 2 inputs. 0 V internal and 0 V external must be connected together.
20	0 V external	GND external	
25	STO_OUT-	STO_OUT-	NC dry contact for the display of the STO1 input state. 24 Vdc – 2 A
26	STO_OUT+	STO_OUT+	

During the installation, take care to avoid proximity between any STO signal and high potential.

2.2.3 – TIMINGS

The STO function is based on forcibly guided relay technology. Its response time is given by the typical Operate Time/Release Time of the relay: 12 ms / 20 ms.
Refer to the following chronogram for more detailed explanation:



The STO function has two feedbacks: the "STO_OUT" contact and detailed state available in object 0x3001. Only the output "STO_OUT" is a safe output. An incoherent state detected between inputs STO1 and STO2 leads to a fault state.

Used alone, the STO function corresponds to an uncontrolled stop in accordance with stop category 0 of the EN60204-1 standard. So, this function is suitable for machines with low inertia or high resistive torque.

When using high inertia or low resistive torque machines, the user should initiate a controlled stop. To achieve a controlled stop in accordance with stop category 1 of the EN60204-1 standard, the control system of the machine must generate the following sequences:

- deceleration of the load by means of the drive,
- when the load is at standstill or almost, shutting down of the PWM by disabling the "enable/inhibit signal" using the appropriate digital input or network signal when connected,
- finally, activation of the STO function.