INFRANOR
SERVO DRIVES & MOTION CONTROL

CD1-k
Installation Guide

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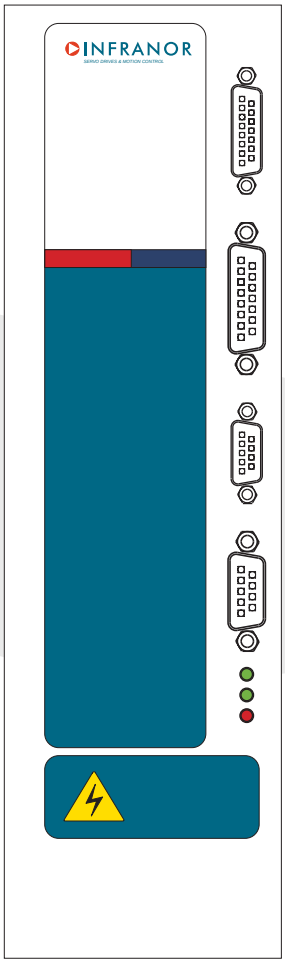

CANopen drive

INFRANOR®

WARNING

This is a general manual describing a series of servo speed amplifiers having output capability suitable for driving AC brushless sinusoidal servo motors. This manual may be used in conjunction with appropriate and referenced drawings pertaining to the various specific models**.**

For the use of the drive (dimensions, wiring,...), see manual "CD1-k User Guide".

For the CANopen communication, see manual "CD1-k – CANopen Communication Protocol".

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 amplifiers 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 amplifiers (a residual voltage of several hundreds of volts may remain during a few minutes).

INFRANOR drives are conceived to be best protected against electrostatic discharges. However, some components are particularly sensitive and may be damaged. Before handling the drives and, particularly, before any contact with the connectors, the user himself must be earthed. Place or store the drives on conducting or electrostatically neutral areas but not on plastic areas, carpeting or insulation material that may be electrostatically loaded.

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.

This manual is a translation of the original document and does not commit INFRANOR's responsibility. The french manual is the only reference document.

Issue: **4.1**

Content

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Chapter 1 – General description

1 - INTRODUCTION

Series **CD1-k** drives with CANopen interface are PWM servo drives for the control of AC sinusoidal motors (brushless) with transmitter resolver.

The CD1-k system is available as:

- a stand-alone single-axis block available in both mains operated versions 230 VAC and 400/480 VAC,
- a three-axis housing in 400/480 VAC.

2 - DESCRIPTION / COMPLIANCE WITH THE STANDARDS

2.1 - GENERAL DESCRIPTION

Series CD1-k drives have their own supply.
An auxiliary supply 24VDC +/- 15 % is required for the supply of the DC/DC converter. A 24 VDC battery supply with specific wiring allows to keep the position even after switching off the 24 VDC auxiliary supply. This wiring can be used for "absolute" operation with the CD1-k drive (see Chapter 4 - Connections).

The power supply is depending on the drive type:

- **CD1-k-230/I**: 230 VAC single-phase mains operated power supply or three-phase via a transformer or an autotransformer (or direct three-phase mains operation if there are three-phase mains available in 200 to 230 VAC).
- **CD1-k-400/I**: mains operated three-phase power supply in 400 to 480 Vac.
- **CD1-k-400/14 P3**: mains operated three-phase power supply in 400 to 480 Vac.

A soft start system of the power supply allows to limit the inrush current at power on.

The very small dimensions of the CD1-k drive allow an optimum integration in 300 mm deep cabinets (connectors included).

2.2 - REFERENCE TO THE STANDARDS: "CE" CERTIFICATION

Series CD1-k drives have been approved with regard to their conformity with the Electromagnetic Compatibility standards concerning the power servos referenced in the EN 61800-3 standard "Electrical variable speed power servo systems":

- EN 55011, group 1, class A, regarding radiated radioelectric disturbances,
- EN 61000.4-2-3-4-5 regarding immunity.

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

These items have been "CE" marked since year 2000.

2.3 - REFERENCE TO THE STANDARDS: "UL" LISTING

CD1-k series have been « $_{c}UL_{us}$ » 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),
- the CSA Standard for Industrial Control Equipment, C22.2 N° 14-95, dated August 1995 for the Canadian UL Listing (CNL).

Providing that the manual is specifying that the end user has to provide an isolated power supply, for 24 VDC 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 UL 840.**

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

Ground connection is fixed in the frame of the device by a rivet, Avibulb masse, BN10-5168. The connector complies with standard dimensions given in table 6.2 of UL 310, the standard for Electrical Quick connect terminals.

3 - OTHER DOCUMENTS REQUIRED FOR THE COMMISSIONING

- CD1-k User Guide,
- CANopen communication protocol.

Chapter 2 – Specifications

1 - MAIN TECHNICAL DATA

1.1 - CD1-k-230/I SINGLE-AXIS DRIVE

Mains operated power supply voltage	230 Vac +10 % / -15 % single-phase or 3-phase 50 to 60 Hz
Isolated auxiliary logic and motor brake supply voltage	24 Vdc +/-15 % - 320 mA without brake
Motor phase-phase output voltage	200 Vrms
Integrated braking system	**External** resistor 100 Ohm / 100 W (dp 100/100) Minimum resistance: 50 Ohm
Minimum inductance between phases	1 mH

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

DRIVE TYPE	U rated (Vrms)	I max (Arms) +/- 5%	I rated (Arms)	Power losses (W)	UL listed
CD1-k-230/2.25	230	2.25	1.1	25	yes
CD1-k-230/4.5	230	4.5	2.25	30	yes
CD1-k-230/7.5	230	7.5	3.75	44	yes
CD1-k-230/10.5	230	10.5	5.25	55	yes
CD1-k-230/16.5	230	16.5	8.25	66	yes

1.2 - CD1-K-400/I SINGLE-AXIS DRIVE

Mains operated power supply voltage	400 to 480 Vac +10 % / -15 % 3-phase, TN or TT system with earthed neutral point 50 to 60 Hz (phase-earth voltage must be balanced)
Auxiliary logic and motor brake supply voltage	24 Vdc +/-15 % - 320 mA without brake
Motor phase-phase output voltage	380 to 460 Vrms depending on the mains
Integrated braking system	CD1-k-400/1.8 to 7.2 A: **External** resistor: 200 Ohm / 100 W (dp 200/100) CD1-k-400/14 A: **External** resistor: 50 Ohm / 200 W (dp 50/200) CD1-k-400/30 and 45 A : **External** resistor : 33 Ω/280 W (dp 33/280)
Minimum inductance between phases	2 mH

OUTPUT CURRENT RATINGS (at a maximum room temperature of 40°C)
Output voltage range for 400-480 VAC (rms) three-phase mains
Output current range: 1.8 A, 2.7 A, 5.1 A, 7.2 A, 14 A, 30 A, 45 A (rms)

DRIVE TYPE	Max. output current for 1 s (480 VAC)	Rated output current (480 VAC)	Power losses (W)	Rated input current (480 VAC-60 Hz)	Housing dimensions	Max. branch circuit protection Listed RK5 (Bussman / Littelfuse) fuses	Short-circuit withstand rating	UL listed
CD1-k-400/1.8	1.8	0.9	35	0.9	230x230x65	2 A	5 kA	yes
CD1-k-400/2.7	2.7	1.35	43	1.35	230x230x65	2 A	5 kA	yes
CD1-k-400/5.1	5.1	2.55	71	2.55	230x230x65	4 A	5 kA	yes
CD1-k-400/7.2	7.2	3.6	93	3.6	230x230x65	4 A	5 kA	yes
CD1-k-400/14	14.0	7.0	200	7.0	230x258x83	8 A	5 kA	yes
CD1-k-400/30	30.0	15.0	400	15.0	230x288x110	20 A	5 kA	yes
CD1-k-400/45	45.0	20.0	560	20.0	230x288x110	20 A	5 kA	yes

1.3 - CD1-k-400/14 P3 THREE-AXIS DRIVE

Mains operated power supply voltage	400 to 480 VAC + 10 %/- 15 % 3~, TN or TT system with earthed neutral point 50 to 60 Hz (phase-earth voltage must be balanced)
Auxiliary logic and motor brake supply voltage	24 Vdc +/-15 % - 800 mA without brakes
Motor phase-phase output voltage	380 to 460 Vrms depending on the mains
Integrated braking system	**External** resistor: 33 Ohm / 280 W (dp 33/280) or **optional**: internal resistor 47 Ohm / 140 W
Minimum inductance between phases	2 mH

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

DRIVE TYPE	Max. output current for 1 s (480 VAC)	Rated output current (480 VAC)	Power losses (W)	Rated input current (480 VAC – 60 Hz)	Housing dimensions	Max. branch circuit protection Listed RK5 (Bussman/Littelfuse) fuses	Short-circuit withstand rating	UL listed
CD1-k-400/14 P3	14	7	600	7	245x380x159	20A	5 kA	yes

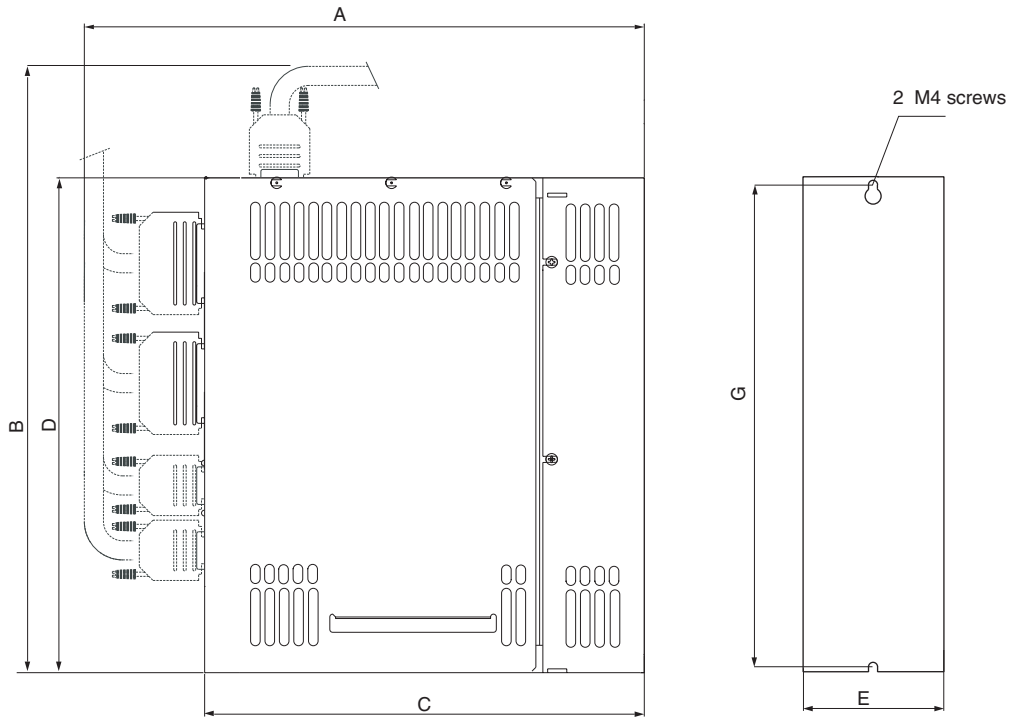
1.4 - COMMON SPECIFICATIONS TO THE THREE DRIVE TYPES CD1-k-230/I, CD1-k-400/I and CD1-k-400/14 P3

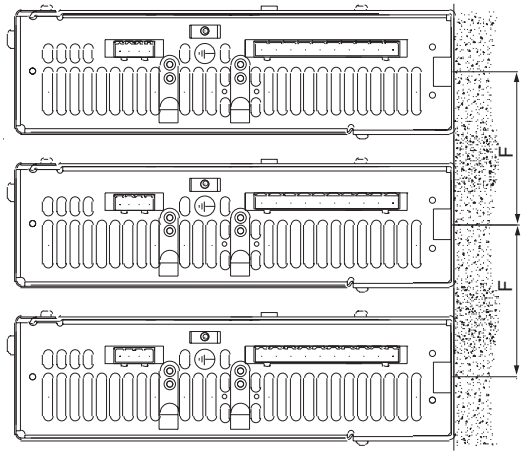
Servo loops: current, speed and position	Digital
Mains filter on power supply	Integrated in the drive
Common mode filter on auxiliary supply	Integrated in the drive
Common mode filter on motor brake supply	Integrated in the drive
Position measurement sensor	Transmitter resolver - Reference = 4 kHz - Resolution: 12 bits for CD1-k - Resolution: 16 bits for CD1-k2
Power stage protections	See table of the main protections in the CD1-k User Guide
Motor brake control	1.5 A maximum with 24 Vdc.
PWM switching frequency	8 kHz
Minimum inductance between phases	1 mH pour 230 V / 2 mH pour 400 V
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 I rated: 20 % to 50 % Authorized Imax duration = 1 second
Digital speed and position regulators	Sampling period = 0.5 ms 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 10 000 rpm
Logic inputs	INHIBIT LIMIT SWITCHES FC+ and FC- INDEX CAPTURE LOW SPEED
Logic outputs	4 logic outputs activated by the bus
Relay outputs	Relay contact: open if error Umax = 50 V Imax = 100 mA, Pmax = 10 W
Open collector output protected against load short-circuit	Motor brake coil with 24 VDC/1.5 A
CAN interface	CANopen protocol (DS 301 – DSP 402)
Error display	LEDs on front panel + diagnostic via serial link RS 232 + diagnostic via CANopen.
Motor and application parameter setting	Serial link RS 232 or bus interface with CANopen 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.	EMC standards: - immunity: EN 61000.4-2-3-4-5 - conducted and radiated disturbances: EN 55011, Group 1, class A Electrical standards for industrial machines: - EN 60204-1: insulator 1500 Vac / 1 mn leakage current > 30 mA (EMI filters).
Conformity with the standards: **UL** listing "360°" shield; equipotentiality according to the wiring rules.	CD1-k series have been "$_{c}UL_{us}$" 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), - the CSA Standard for Industrial Control Equipment, C22.2 N° 14-95, dated August 1995 for the Canadian UL Listing (CNL).
Temperature - 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 Max. temperature: 50° C
Altitude	1000 m
Moisture	< 50% to 40° C and < 90% to 20° C: EN 60204-1 standard **Condensation prohibited**
Cooling	Forced air (fan integrated in the CD1-k drive) Check for free ventilation and no upper or lower obstruction of the air admissions
Mounting position	Vertical
Environment	Open chassis to be mounted in a housing protecting the drive from conducting dust and condensation (pollution degree 2 environment)
Mounting location	Closed cabinet without any conducting and/or corroding agents and according to the environment conditions requirements **Condensation prohibited**
Weight	CD1-k-230/l: about 1 kg CD1-k-400/1.8 to 7.2 A: about 1.5 kg CD1-k-400/14: about 3 kg CD1-k-400/14-P3: about 6.7 kg CD1-k-400/30 and 45: about 4.8 kg

2 - DIMENSIONS

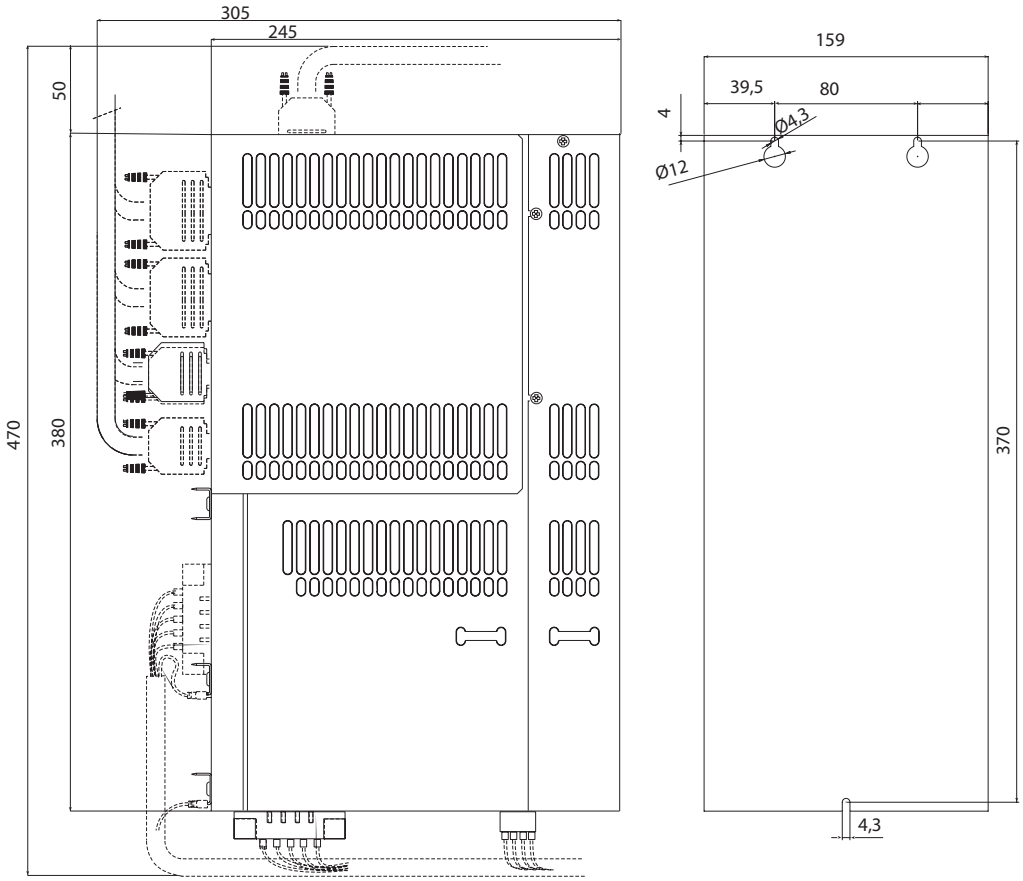
2.1 - SINGLE-AXIS DRIVES CD1-k-230/I AND CD1-k-400/I

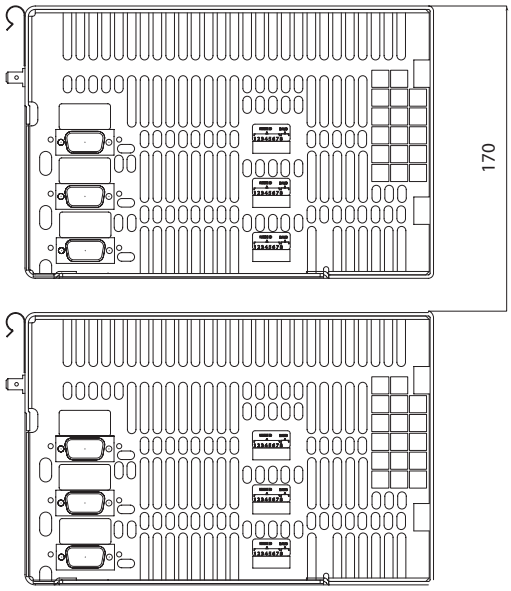




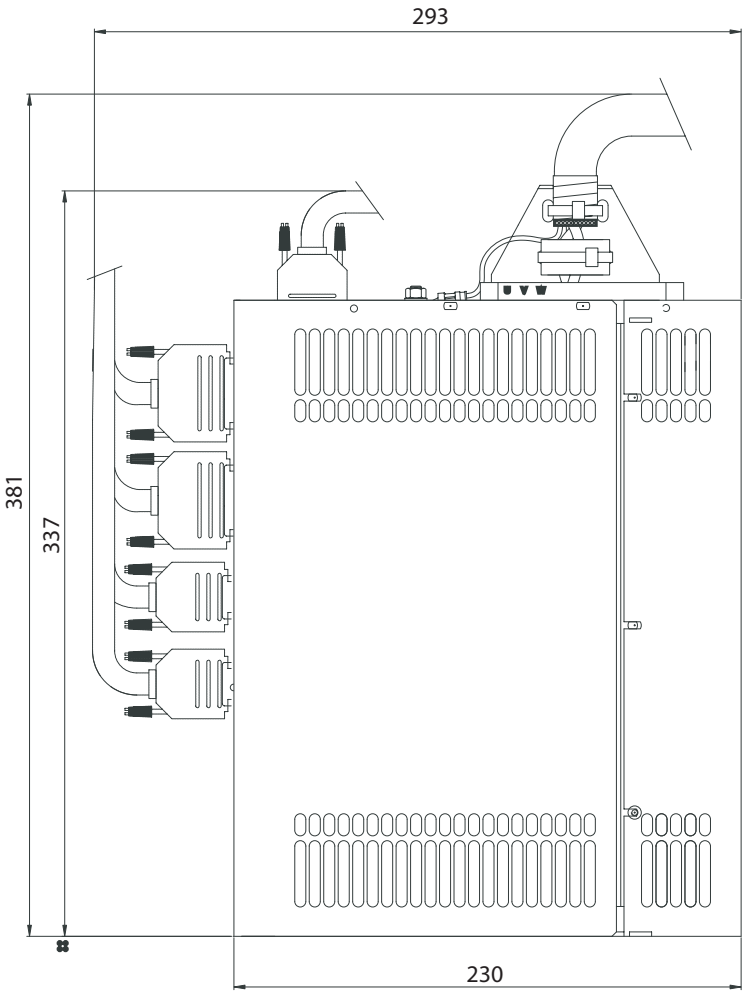
Drive type / Dimensions	A	B	C	D	E	F	G
CD1-k-230 / I	260	250	199	200	65	80	192
CD1-k-400/1.8 to 7.2	293	278	230	228	65	80	220
CD1-k-400 / 14	293	308	234	258	83	100	250
CD1-k-400 / 30 and 45	293	381	234	288	110	125	278,50

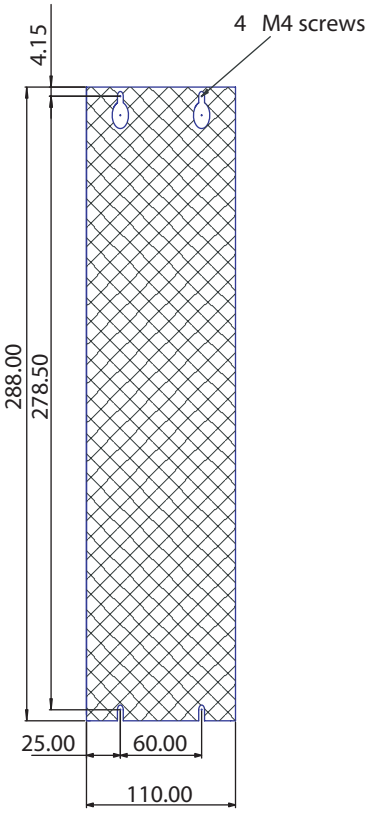
2.2 - THREE-AXIS DRIVE CD1-k-400/14 P3

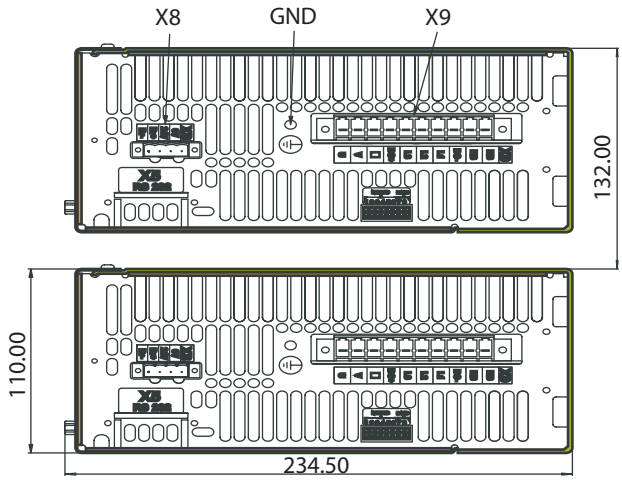




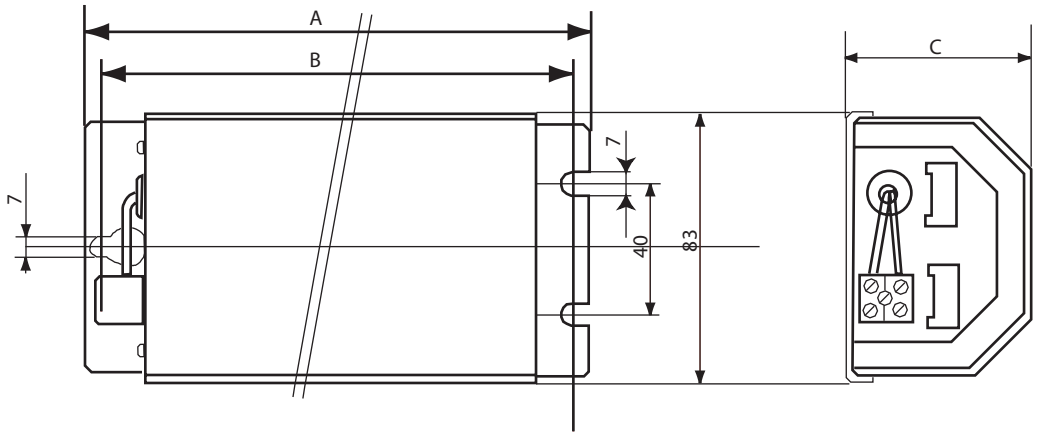
2.3 – CD1-k-400/30 and 45 DRIVE







2.4 - BRAKING RESISTOR dp 100/100, dp 200/100, dp 50/200 AND dp33/280

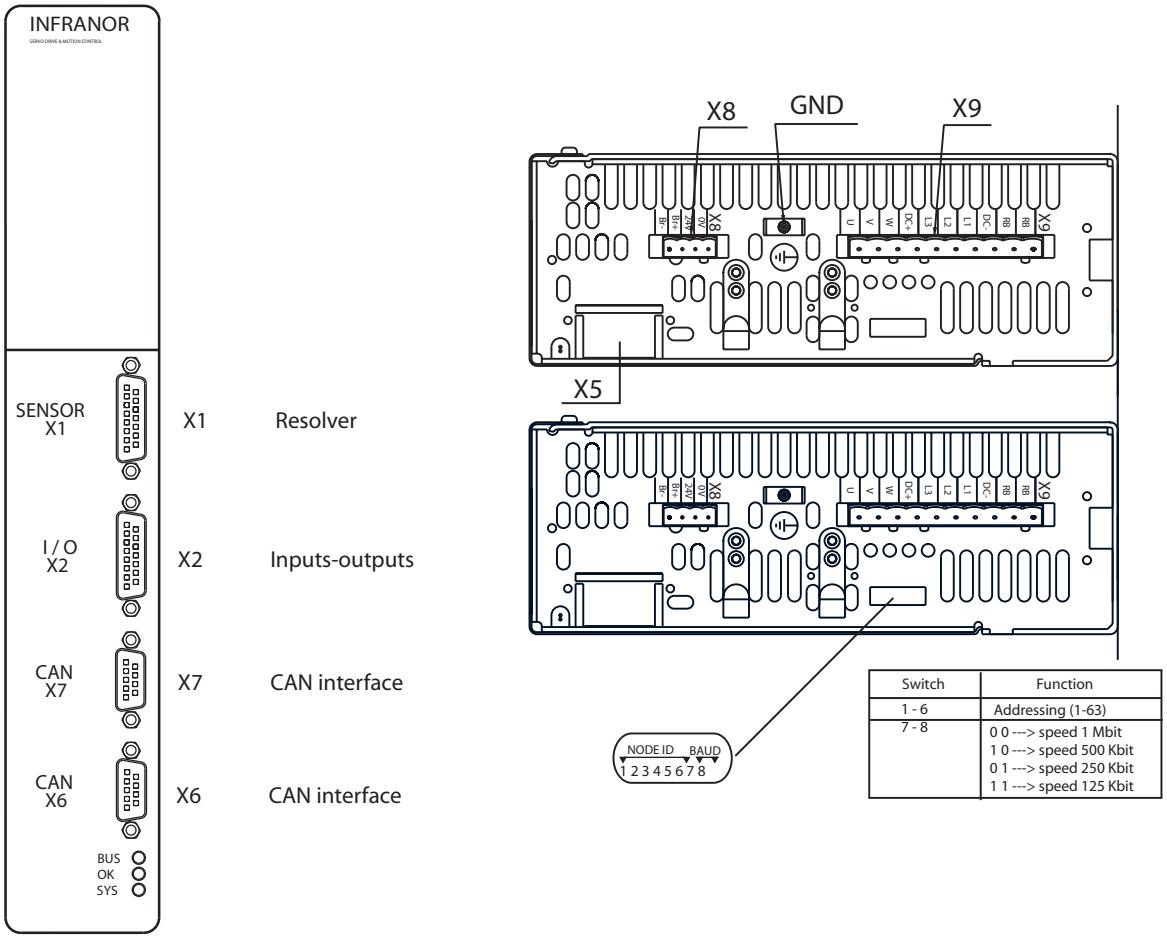


DIMENSIONS	dp 50/200, dp 100/100 and dp 200/100	dp 33/280
A	157 mm	290 mm
B	145 mm	278 mm
C	52 mm	57 mm

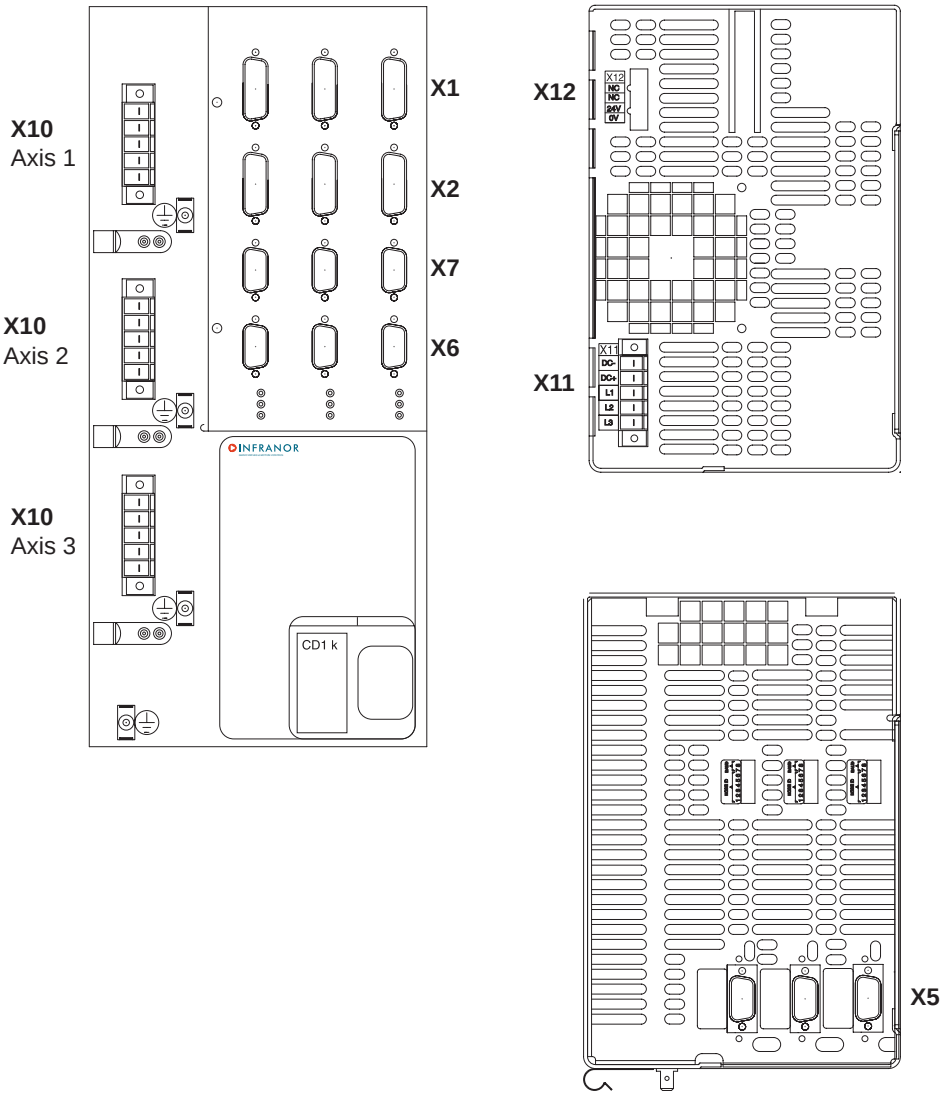
Chapter 3 – Inputs-Outputs

1 - CONNECTORS LOCATION

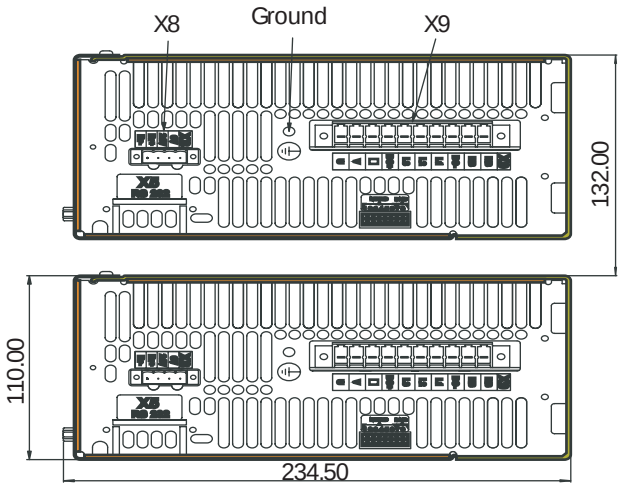
1.1 - SINGLE-AXIS DRIVES CD1-k-230-I AND CD1-k-400-I



1.2 - THREE-AXIS HOUSING CD1-k-400 P3



1.3 – CD1-k-400/30 AND 45 DRIVE



2 - LED DISPLAY

2.1 - IDENTIFICATION OF THE LEDs

BUS (green)
OK (green)
SYS (red)

SYS: System error

SYS LED is continuously lit if System error,
SYS LED is unlit if no error.

OK: Errors are regrouped on the 'OK' LED: These errors are coded and can be displayed by means of the parameter setting software, via the serial link RS-232 or via the CANopen bus.

OK LED: continuously blinking if error,
OK LED: continuously lit if no error.

The **OK** LED regroups the following errors:

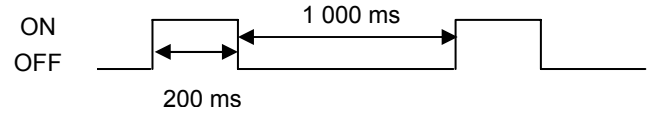
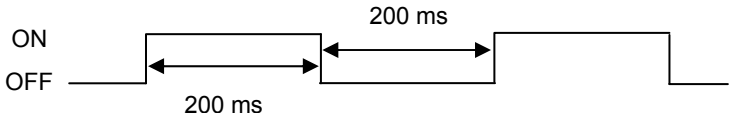
Power supply overvoltage
No power voltage
Out of 24 Vdc supply range (18 to 29 V),
Phase / GND short-circuit
Braking system short-circuited or overheated
Fan
Short-circuit in the motor stall brake
Short-circuit, temperature, power stage supply, PWM error
Triggering of the I^2t protection
Counting error
Position following error
Low speed overshoot
EEPROM error
Procedure execution error (busy)
Init-400 V error
Current offset error
Motor temperature error
Resolver cable interruption.

Notes:

Any of these errors (except for the "Undervolt." error) involves:
- the drive disabling,
- the motor brake control,
- 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 zero type standstill.

The error "No power voltage" involves:
- the drive disabling,
- the motor brake control.

BUS: CANopen RUN LED
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	
BLINKING	PRE-OPERATIONAL	
ON	OPERATIONAL	

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

3 - DRIVE ADDRESSING: SELECTION OF THE TRANSMISSION SPEED

Each drive of the network must be configurated 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.

- 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	ON	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
ON	ON	125 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).

4 - X1 CONNECTOR: RESOLVER

SUB D 15 PINS FEMALE (SAME FOR ALL DRIVE TYPES CD1-k-230-I, CD1-k-400-I, CD1-k-400-14-P3)

PIN	FUNCTION	DESCRIPTION
1	Shield connection	If no "360°" connection on the connector
12	TC (thermal sensor)	If motor thermal switch connected to X1
13	TC (thermal sensor)	If motor thermal switch connected to X1
2	S3 (cosine +)	Resolver connector
10	S1 (cosine -)	Resolver connector
11	S2 (sine +)	Resolver connector
3	S4 (sine -)	Resolver connector
5	R1 (reference +)	Resolver connector
4	R2 (reference -)	Resolver connector

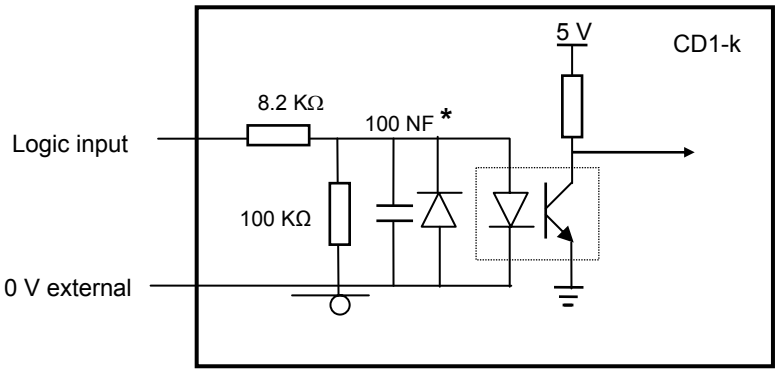
For the connection of other resolver types, see chapter 5, section 2.

5 - X2 CONNECTOR: INPUTS-OUTPUTS

SUB D 15 PINS MALE (SAME FOR ALL DRIVE TYPES CD1-k-230-I, CD1-k-400-I, CD1-k-400-14-P3)

PIN	SIGNAL	I/O	DESCRIPTION
1	Enable	I	Positive logic - Galvanic insulation
2	GND	I	For the shield connection if no "360°" connection
3	Limit switch +	I	Positive logic - Galvanic insulation
4	Limit switch -	I	Positive logic - Galvanic insulation
5	Output 3	O	Optocoupled logic output ; I = 100 mA
6	Low speed	I	Positive logic - Galvanic insulation
7	Capture 2 Index	I	Positive logic - Galvanic insulation
8	Capture 1	I	Positive logic - Galvanic insulation
9,10	AOK relay contact	O	Relay contact open if error Pmax = 10 W with Umax = 50 V or Imax = 100 mA
11	Output 0	O	Optocoupled logic output ; I = 100 mA
12	Output 1	O	Optocoupled logic output ; I = 100 mA
13	Output 2	O	Optocoupled logic output ; I = 100 mA
14	+ 24 external	I	To be wired if the logic output are used
15	0 V external	I	

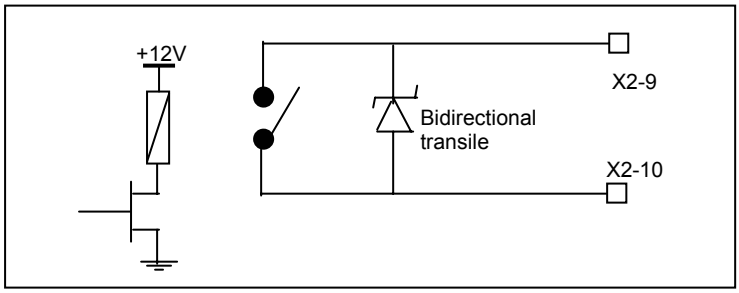
5.1 - SPECIFICATION OF THE LOGIC INPUTS: INHIBIT, FC+, FC-, INDEX, CAPTURE, LOW SPEED



(*) : 100 pF for Index and Capture

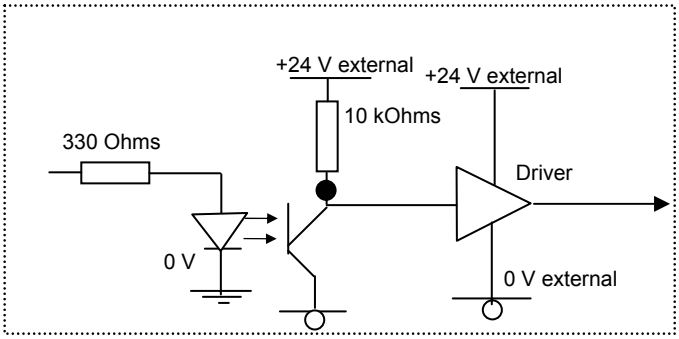
These optocoupled inputs are operating in positive logic.
The input voltage corresponding to level 1 must be between 18 V and 30 V.

5.2 - SPECIFICATION OF THE LOGIC OUTPUT "AOK" ON RELAY



Relay contact closed if drive OK and open if error.
Pmax = 10 W with Umax = 50 V - Imax = 100 mA

5.3 - SPECIFICATION OF THE LOGIC OUTPUTS



6 - X6 AND X7 CONNECTORS: CAN-OPEN

SUB D 9 PINS MALE AND FEMALE (SAME FOR ALL DRIVE TYPES CD1-k-230-I, CD1-k-400-I, CD1-k-400-14-P3)

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

7 - X5 CONNECTOR: RS-232

SUB D 9 POINTS MALE (SAME FOR ALL DRIVE TYPES CD1-k-230-I, CD1-k-400-I, CD1-k-400-14-P3)

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

8 - X8 CONNECTOR: AUXILIARY SUPPLY AND BRAKE

(ONLY FOR CD1-k-230 V AND CD1-k-400 V SINGLE-AXIS DRIVES)

4 pins male connector with 5.08 mm pitch
Screws tightening torque of the connector: 0.5 Nm.

PIN	SIGNAL	I/O	FUNCTION	DESCRIPTION	
1	GND	I	Potential reference of the 24VDC supply	Grounded potential reference	
2	+24 Vdc	I	24 VDC auxiliary supply isolated from the mains	24 Vdc +/-15% - 0,320 A without brake Regulation with load: 3%	UL: Protection by 4A UL fuse
3	Brake + 24 V	O	Motor brake supply with 24 VDC	Powerless brake: 24 Vdc / 1,5 A	
4	Brake -	O	Direct motor brake control Imax = 1,5 A	Open collector output protected against load short-circuits	

If there is no brake on the motor, the electronic brake control circuit is detecting the missing load and displays the « brake » error. In this case, remove the BR jumper located on the hardware adjustments diagram (see chapter 5).

9 - X9 CONNECTOR: POWER

(ONLY FOR CD1-k-230 V AND CD1-k-400 V SINGLE-AXIS DRIVES)

CD1-k-230/I: 10 pins male connector with 5.08 mm pitch.
CD1-k-400/I: 10 pins male connector with 7.62 mm pitch.

Screws tightening torque of the connector: 0.5 Nm.

PIN	SIGNAL	I/O	FUNCTION	DESCRIPTION
1	RB	O	Energy dissipation at the motor braking with high inertia and high speed	CD1-k-230/I: 100 Ω / 100 W (dp 100/100) CD1-k-400/1.8 to 7.2: 200 Ω / 100 W (dp 200/100) CD1-k-400/14: 50 Ω / 200 W (dp 50/200) CD1-k-400/30 and 45: 33 Ω / 280 W (dp 33/280) The braking resistors must be separately ordered.
2	RB	O		
3	DC-	I/O	Parallel connection of the DC bus	Only on UL listed items
4	L1	I	Mains input Integrated mains filter	**CD1-k-230/I 230 Vac single-phase or three-phase** **CD1-k-400/I 400 to 480 Vac three-phase**
5	L2	I		
6	L3	I		
7	DC+	I/O	Parallel connection of the DC bus	Only on UL listed items
8	W	O	Motor W phase	Motor cable with grounded connection by means of Faston socket and 360° shield connection on grounded collar
9	V	O	Motor V phase	
10	U	O	Motor U phase	

IMPORTANT
The motor and brake cables must be shielded and connected over 360° on the collars mounted for this purpose on the housing.
The ground wire of the motor cable MUST be connected to the Faston socket marked "GND".
The ground reference must also be connected on the second Faston socket.

- The installer of the drives has to use a UL Listed Quick connect for ground connection (0.250 inches or 6.35 mm wide nominal).
- Field wiring terminals have to use copper conductors only.
  Torque value for field wiring terminals: value to be according to the Recognized terminal block used.

10 - X10 CONNECTOR: POWER

(ONLY FOR THE 3-AXIS DRIVE CD1-k-400 P3)

Male connectors: PHOENIX PC4/5 - G - 7.62 (one connector per axis)
Fastening torque of the connector screws: 0,5 Nm.
Female connector: PHOENIX PC 4/5-STF 7.62 not provided

PIN	SIGNAL	I/O	FUNCTION	DESCRIPTION
1	BR-	O	Direct motor brake control Imax = 1.5 A	Output protected against load short-circuits
2	BR+	O	Motor brake supply with 24 VDC	Powerless brake: 24 Vdc / 1,5 A
3	U	O	Motor U phase	Motor cable with grounded connection by means of Faston socket and 360° shield connection on grounded collar
4	V	O	Motor V phase	
5	W	O	Motor W phase	

11 - X11 CONNECTOR: MAINS

(ONLY FOR THE 3-AXIS DRIVE CD1-k-400 P3)

Male connectors: PHOENIX PC4/5 - G - 7.62
Fastening torque of the connector screws: 0,5 Nm.
Female connector: PHOENIX PC 4/5-STF 7.62 not provided

PIN	SIGNAL	I/O	FUNCTION	DESCRIPTION
1	DC-	I/O	Parallel connection of the DC bus	
2	DC+	I/O	Parallel connection of the DC bus	
3	L1	I	Mains inputs with integrated mains filter	**400 to 480 Vac 3-phase**
4	L2	I		
5	L3	I		

12 - X12 CONNECTOR: AUXILIARY SUPPLY

(ONLY FOR THE 3-AXIS DRIVE CD1-k-400 P3)

Male connectors: PHOENIX MSTB2.5/4 – GF – 5.08
Fastening torque of the connector screws: 0,5 Nm.
Female connector: PHOENIX MSTB 2.5/4-STF 5.08 not provided

PIN	SIGNAL	I/O	FUNCTION	DESCRIPTION
1	NC			
2	NC			
3	+24 Vdc	I	24 Vdc auxiliary supply isolated from the mains	24 Vdc +/-15% - 0,8 A without brake Regulation with load: 3% Protection by 4 A UL fuse
4	GND	I	Potential reference of the 24 Vdc supply	Grounded potential reference

13 – CONNECTION OF THE BRAKING RESISTOR FOR THE 3-AXIS DRIVE CD1-K-400-P3

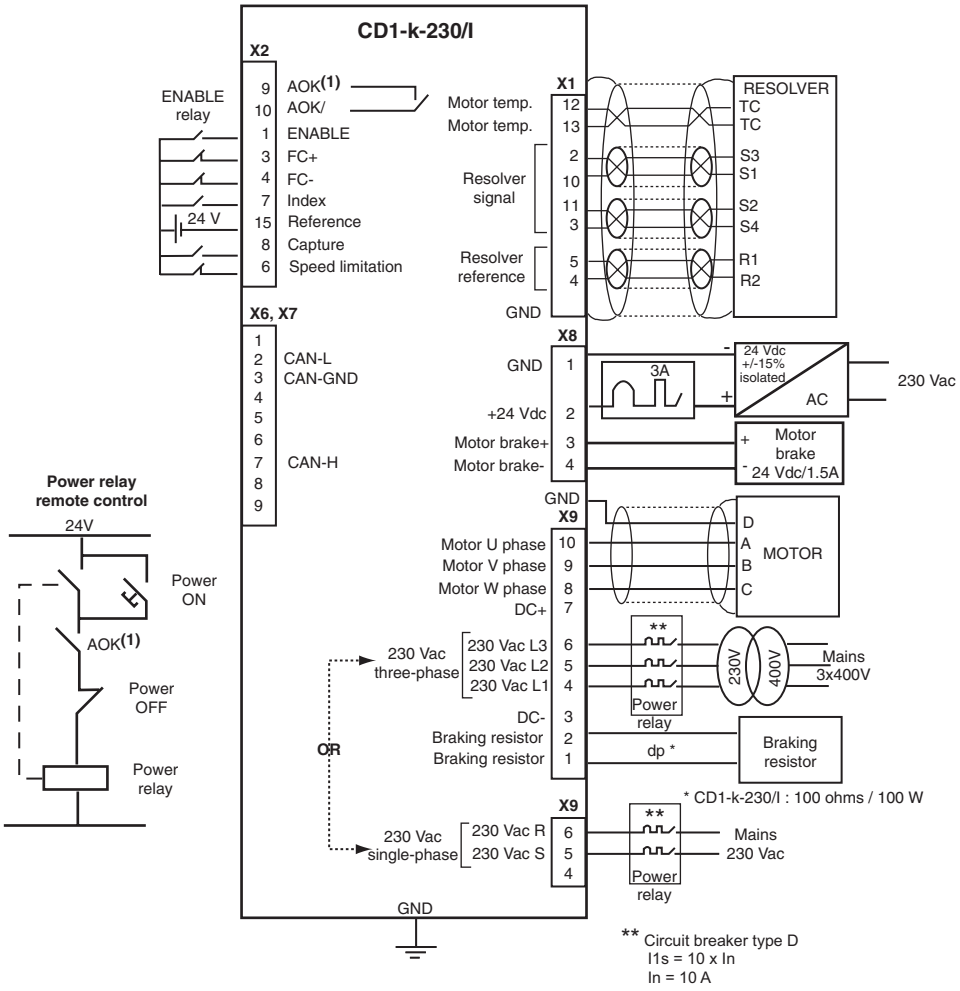
The braking resistor dp 33/280 (33 Ω / 280 W) is connected by means of two 300 mm long cables.
Fastening torque on the connector of the dp 33/280 braking resistor housing: 0.9 Nm (connection of the external braking resistor: see note of chapter 4, section 2.6).

Chapter 4 - Connections

1 - CONNECTION DIAGRAMS

1.1 - CD1-k-230/I DRIVE

(For the UL compliant connection, see chapter 4, section 4.4).

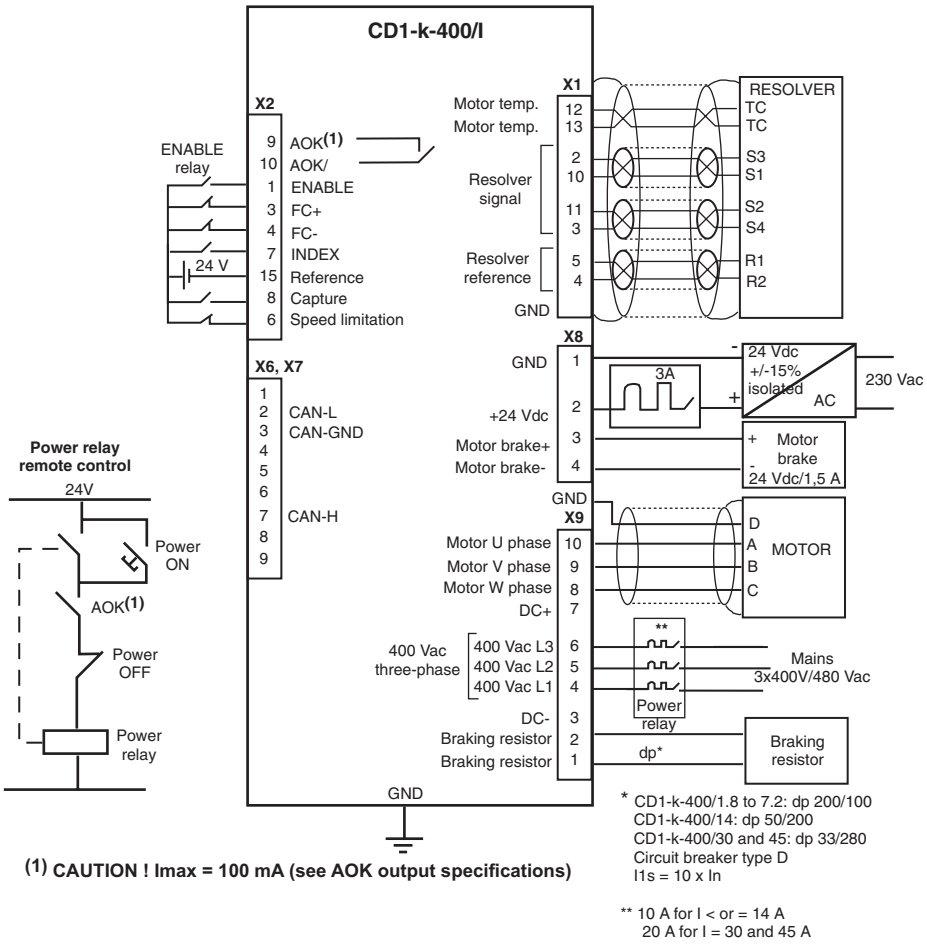


(1) **CAUTION ! Imax = 100 mA (See AOK output specifications).**

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

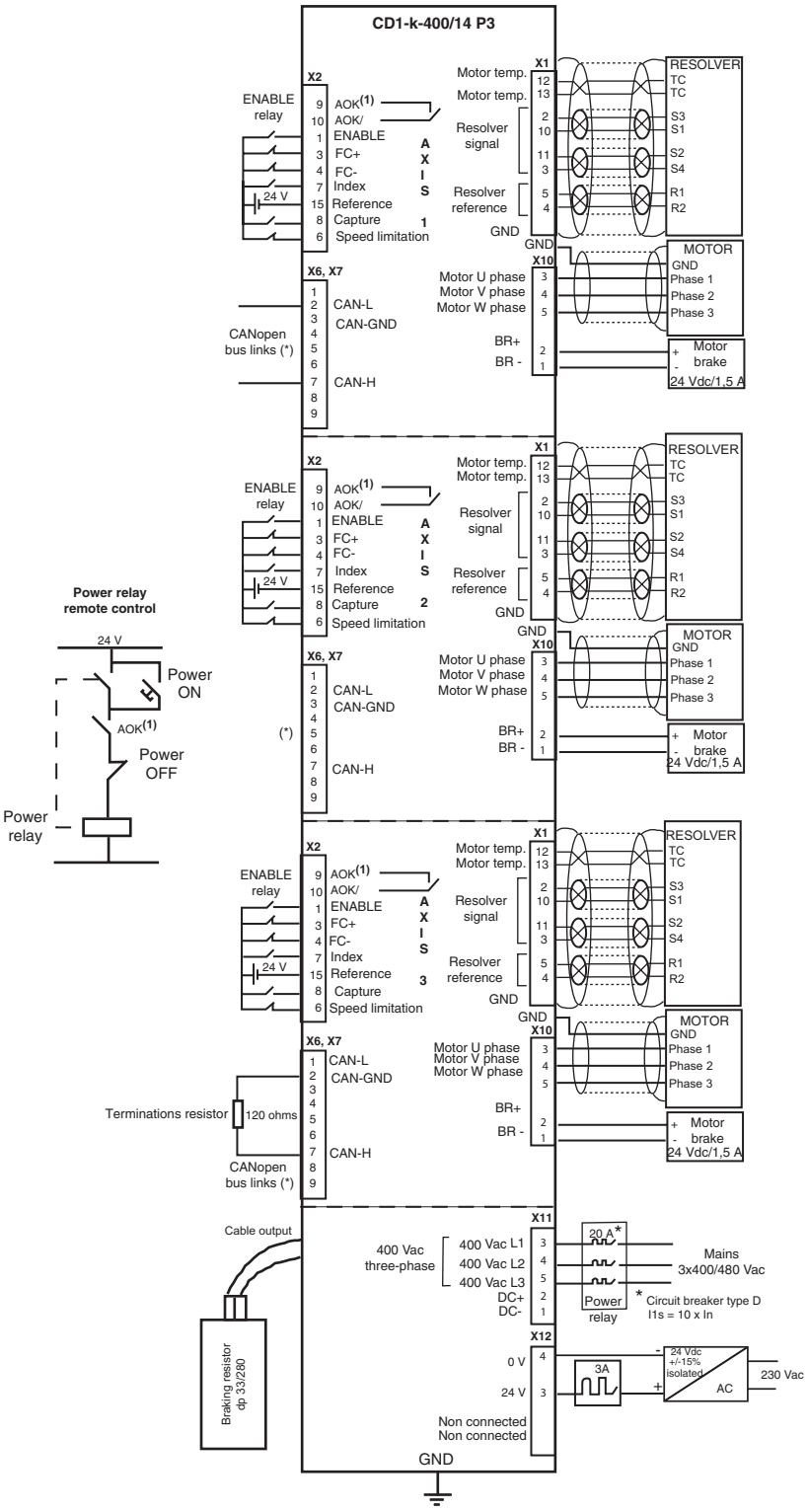
1.2 - CD1-k-400/I DRIVE

(For the UL compliant connection, see chapter 4, section 4.5)



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

1.3 - CD1-k-400/14 P3 DRIVE

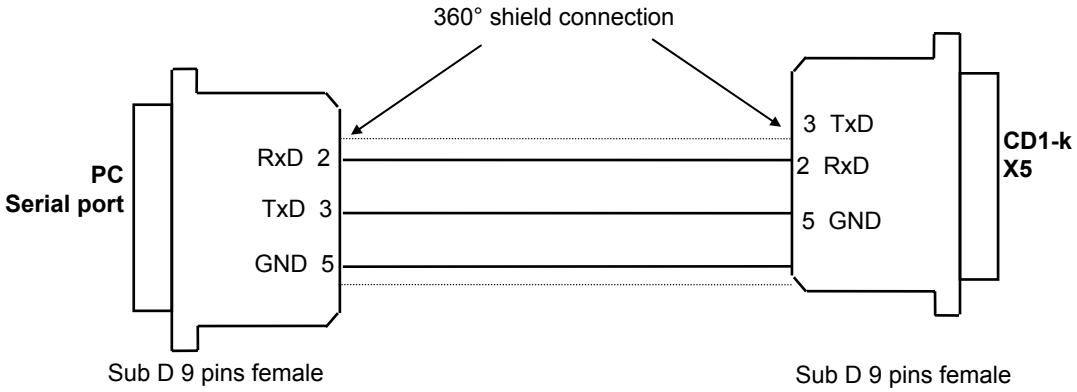


The protection, on source side, of both 24 V and power supplies must be made by the user.

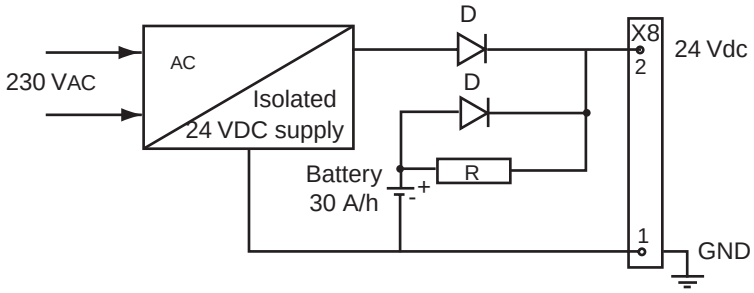
(*) Links are factory made for CAN-H, CAN-L, CAN-GND.

(1) **CAUTION** ! Imax = 100 mA (see AOK output specifications)

1.4 - CONNECTION OF THE SERIAL LINK

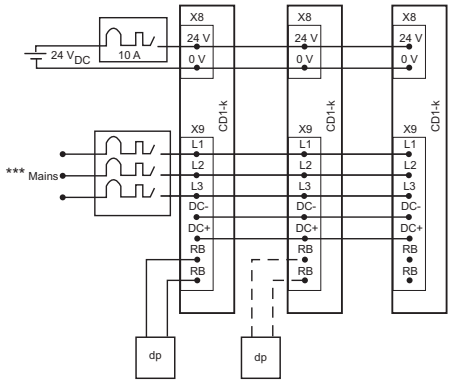


1.5 - CONNECTION OF A BACKUP BATTERY



The consumption of the CD1-k drive is 320 mA with 24VDC. So, a 24 V / 30 A/h battery can keep the drive under voltage 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 mains switched off.

1.6 - CONNECTION FOR A MULTIAXIS APPLICATION



*** CD1-k-230/I : 3 x 230 V
CD1-k-400/I : 3 x 400 V
Circuit breaker type D
I1s = 10 x In

For a multiaxis application with n drives, the circuit breaker rating is give by the formula:

$In = 0,3 \sum_{1}^{n} I\ amplifier$

But, the ratings below must not be exceeded:
- 20 A on 230 V drives,
- 20 A on 400 V / 1,8 to 14 A drives,
- 40 A on 400 V / 30 A and 45 A drives.

2 - WIRING RECOMMENDATIONS

(according to EN61000.4-2-3-4-5 and EN55011 standards - see diagram "Shield connection on the connectors " – chapter 4, section 2.2).

2.1 - 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 centimeters; 10 centimeters 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.

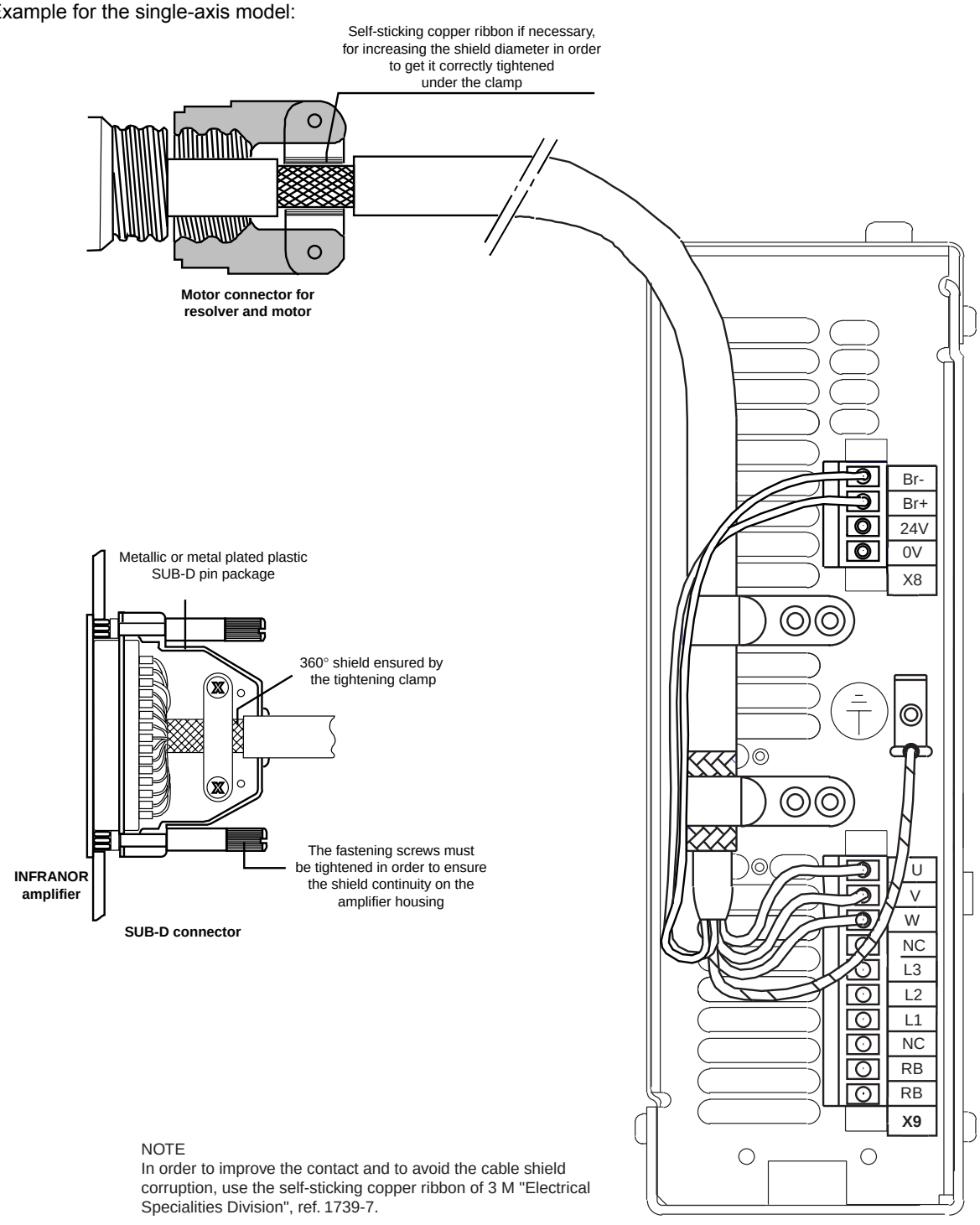
Cables with low potential should **never** run in the proximity of power lines.

If there is a potential reference, i.e. a main chassis or cabinet with a low impedance between its different elements, it should be used to connect ALL references to it and also being grounded itself.

2.2 - SHIELD CONNECTION OF THE CONNECTORS

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

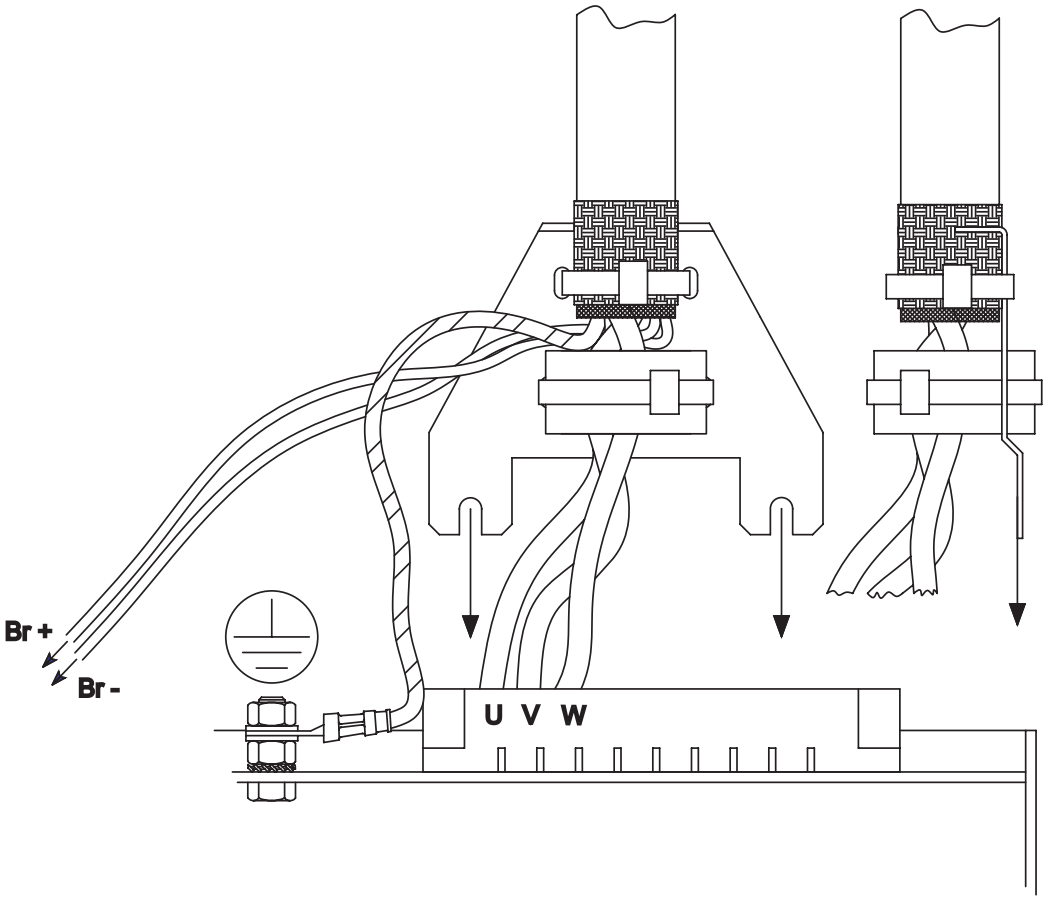
Example for the single-axis model:



NOTE
In order to improve the contact and to avoid the cable shield corruption, use the self-sticking copper ribbon of 3 M "Electrical Specialities Division", ref. 1739-7.

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

2.3 – CONNECTION VUE OF CD1-K-400/30 AND 45



2.4 - MOTOR AND RESOLVER CABLES

Motors and resolvers 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.
The cables of brake equipped motors must also have their brake cables shielded in order to be EMC compliant.

Maximum cable length:
- resolver: ≤ 100 m
- motor: 25 m ≤ d ≤ 100 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 cooling.

2.5 - 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 on the capacitors terminals. A contact under high voltage may involve severe physical damage.

2.6 – CONNECTION CABLES OF THE BRAKING RESISTOR

The connection cable to the braking resistor housing must bear the high voltage and temperature (600 V/105° C).
Recommended cable: UL1015 gauge 14.
Fastening torque on the connector of the braking resistor housing: dp = 0.9 Nm.

NOTE: Special case of the 400-P3 drive:
This drive is delivered with a 3 pin female connector.
The end user has to remove the protection terminal (for the shipment), connected to the braking resistor supply wires, before installation on the dp 33/280 housing.

3 - FIRST POWERING OF THE DRIVE

3.1 - VERY IMPORTANT

Check the connections, especially of the 24 VDC and power supplies. There are two different voltage ratings: 230 Vac and 400 Vac. Check that the appropriate sticker actually corresponds to the power connections.
A 400 Vac connection on a 230 V drive will destroy it.
The INHIBIT signal (X2 connector, pin 1) must be disabled.

Check for the braking resistor sizing:
- dp 100/100 for 230 VAC,
- dp 200/100 for 400 VAC and current ratings 1.8 to 7.2,
- dp 50/200 for 14 A current rating,
- dp 33/280 for 30 and 45 A current ratings and 3-axis drive 400-P3.

Any braking resistor value lower than 200 Ω for the CD1-k-400/1.8 to 7.2 A amplifiers will definitely damage the braking system.

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

WARNING !
During the machine adjustments, some drive connection or parameter setting 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 operators' presence in the concerned area.

3.2 - SWITCHING ON THE 24Vdc SUPPLY

The green "OK" LED on the front panel must be blinking (error "No power voltage" displayed).
The AOK relay (pins 9 and 10 of X2) is closed. It is then possible to control the power relay (Rpu) according to the instruction of chapter 4, section 1: Connection diagrams.

3.3 - SWITCHING ON THE POWER SUPPLY (230 Vac or 400 Vac according to the drive type)

The green "OK" LED on the front panel must be continuously lit.

3.4 - COMMISSIONING

For further details regarding the drive commissioning, please see manual **CD1-k – User Guide**.

4 - REQUIREMENTS FOR THE COMPLIANCE WITH THE UL STANDARDS

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

4.1 - CONNECTION BY MEANS OF A FASTON SOCKET

The installer of the drives must use a UL Listed Quick connect for ground connection (0.250 inches or 6.35 mm wide nominal) on all drives equipped with FASTON sockets.
On drives equipped with a screwed ground connector, the connection must be made via UL listed sockets.

4.2 - 24 V SUPPLY

The end user has to provide a 24 VDC isolated power supply (e.g. with isolated transformer) for the auxiliary supply input, protected by a 4 A UL listed fuse.

4.3 - POWER SUPPLY AND UL FUSE RATING

The fuse type recommended for motor applications is of class RK5. 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 of type RK5.

On CD1k-400/I drives, the fuse ratings must be the following:

CD1-k	400/1.8 to 7.2	400/14	400/30 and 45	Multiaxis
BUSSMANN Class RK5 Type FRS-R	FRS-R-4	FRS-R-8	FRS-R-20	$0,3\times\sum_1^N I_{amplifier}$
LITTELFUSE Class RK5 Type FLSR-ID	FLSR2ID	FLSR8ID	FLSR20ID	$0,3\times\sum_1^N I_{amplifier}$

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 on 400/1.8 A to 14 A drives and 40 A must not be exceeded on 400/30 A and 45 A drives (see chapter 4, section 4.7).

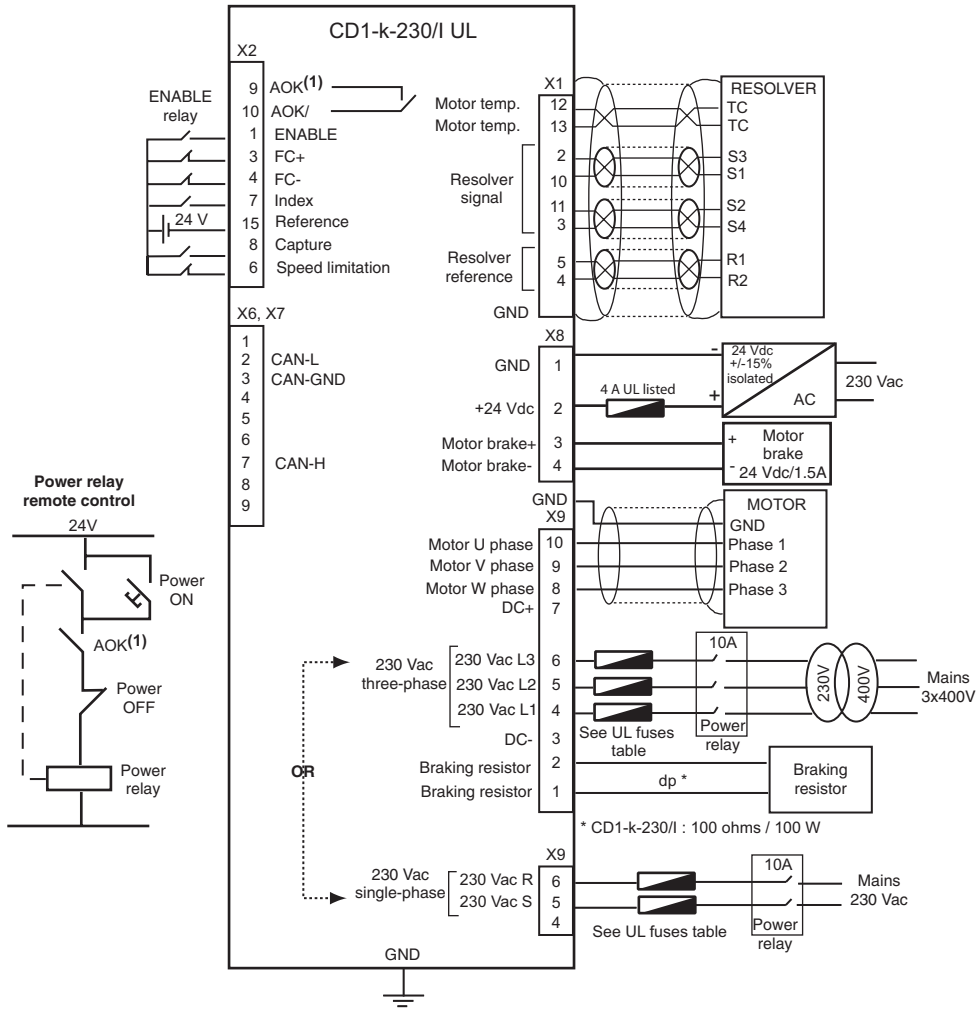
On CD1k-230/I drives, the fuse ratings must be the following:

CD1-k	230/2.5 to 10.5	230/16.5	Multiaxis
BUSSMANN Class RK5 Type FRN-R	FRN-R-6	FRN-R-9	$0,3\times\sum_1^N I_{amplifier}$
LITTELFUSE Class RK5 Type FLNR-ID	FLNR6ID	FLNR9ID	$0,3\times\sum_1^N I_{amplifier}$

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 on 230 V drives (see chapter 4, section 1.6).

4.4 - CD1-k-230/I DRIVE: CONNECTION DIAGRAM WITH PROTECTIONS BY "UL" FUSES

(According to section 4.3 of this chapter)



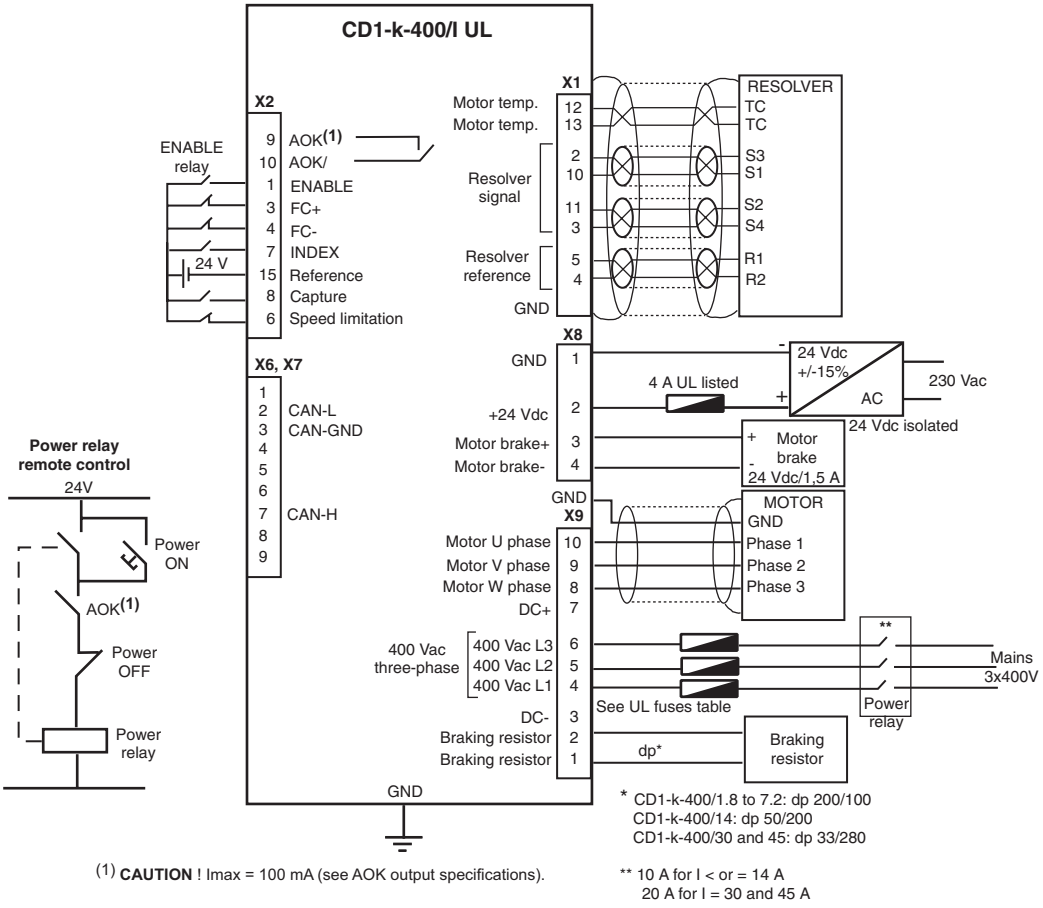
(1) **CAUTION** ! Imax = 100 mA (see AOK output specifications)

IMPORTANT

- **The installer of the drives has to use a UL listed quick connect for ground connection (0.250 inches or 6.35 mm wide nominal)**
- **Field wiring terminals must use copper conductors only**
- **Torque value for field wiring terminals: according to the Recognized terminal block used.**

4.5 - CD1-k-400/I DRIVE: CONNECTION DIAGRAM WITH PROTECTIONS BY "UL" FUSES

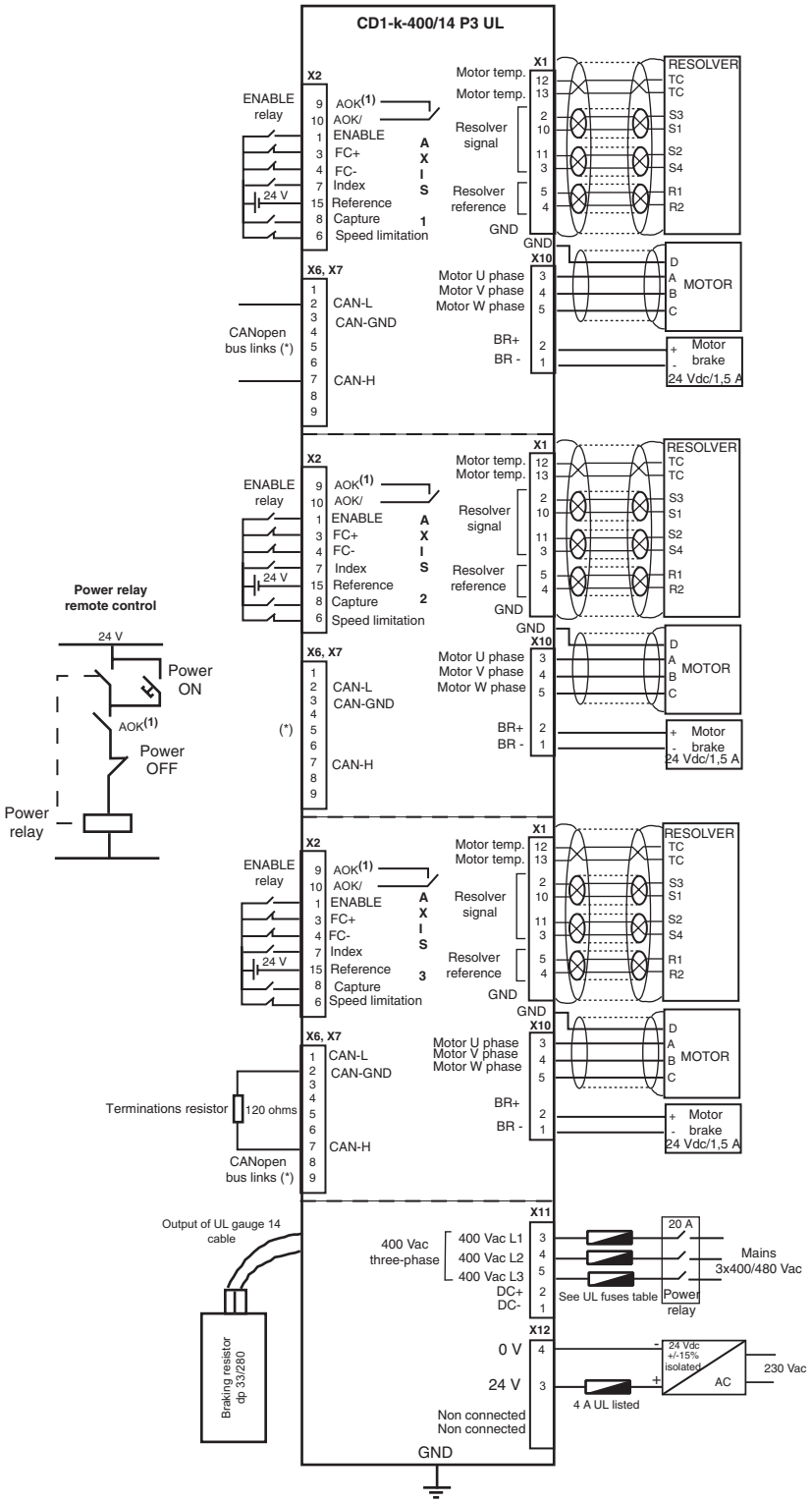
(According to section 4.3 of this chapter)



IMPORTANT

- **The installer of the drives has to use a UL listed quick connect for ground connection (0.250 inches or 6.35 mm wide nominal)**
- **Field wiring terminals must use copper conductors only**
- **Torque value for field wiring terminals: according to the Recognized terminal block used.**

4.6 – CD1-k-400/14 P3: CONNECTION DIAGRAM WITH PROTECTIONS BY "UL" FUSES

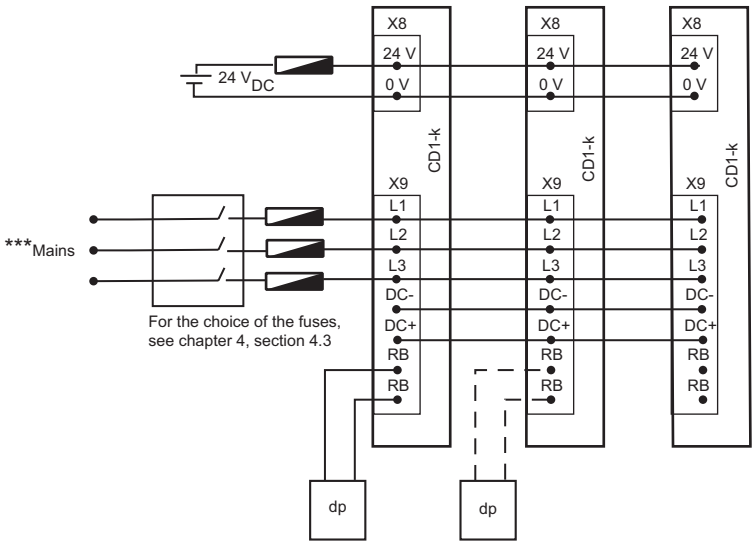


The protection, on source side, of both 24 V and power supplies must be made by the user.

(*) Links are factory made for CAN-H, CAN-L, CAN-GND.

(1) **CAUTION** ! Imax = 100 mA (see AOK output specifications).

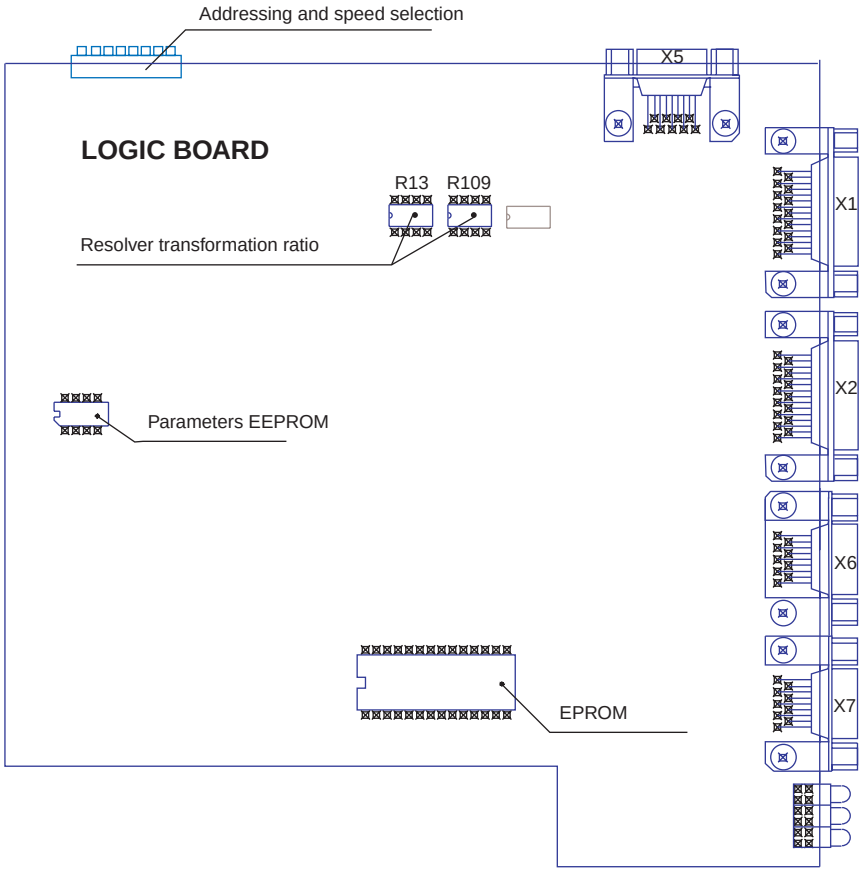
4.7 - CONNECTION EXAMPLE FOR A UL COMPLIANT MULTIAXIS APPLICATION



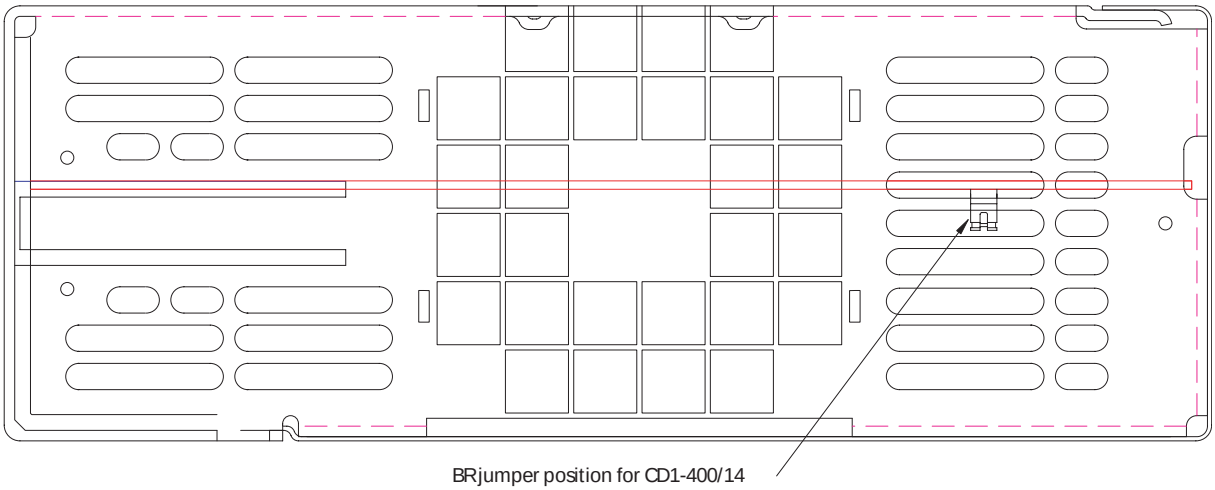
*** CD1-k-230/I : 3 x 230 V
CD1-k-400/I : 3 x 400 V

Chapter 5 - Appendix

1 - HARDWARE ADJUSTMENTS OF THE LOGIC BOARD

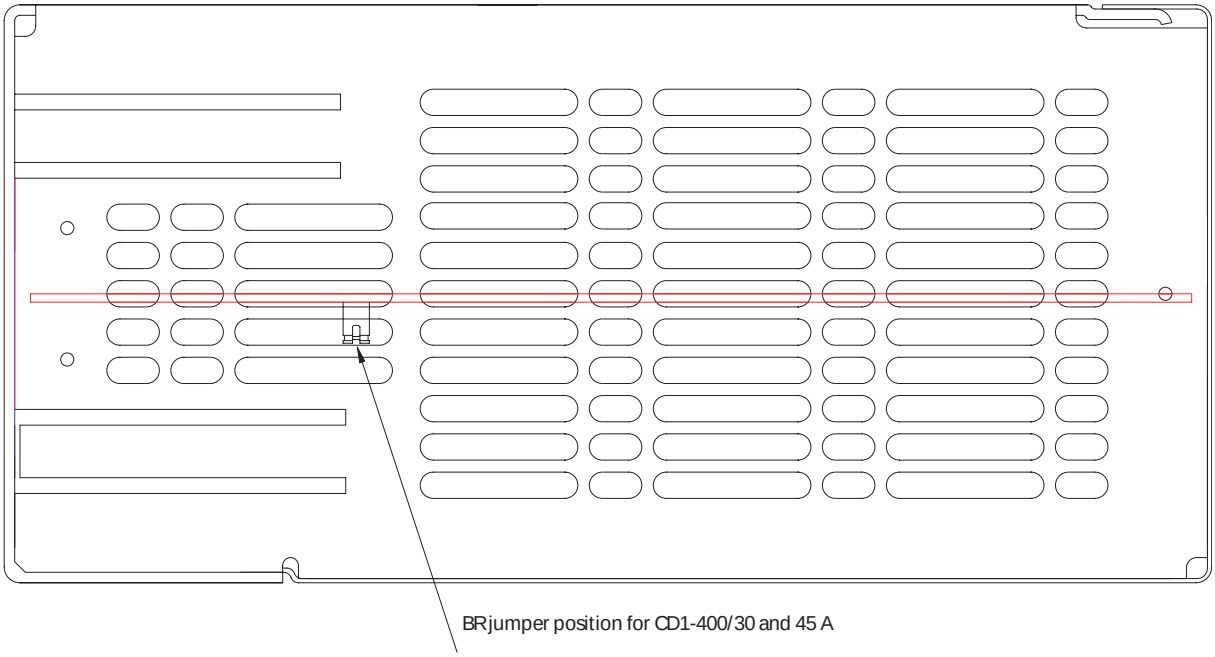


2 - BR JUMPER POSITION FOR CD1-400/14



Position of the BR jumper (to be removed through the hood louver without opening the drive if the MOTOR BRAKE output is not used).

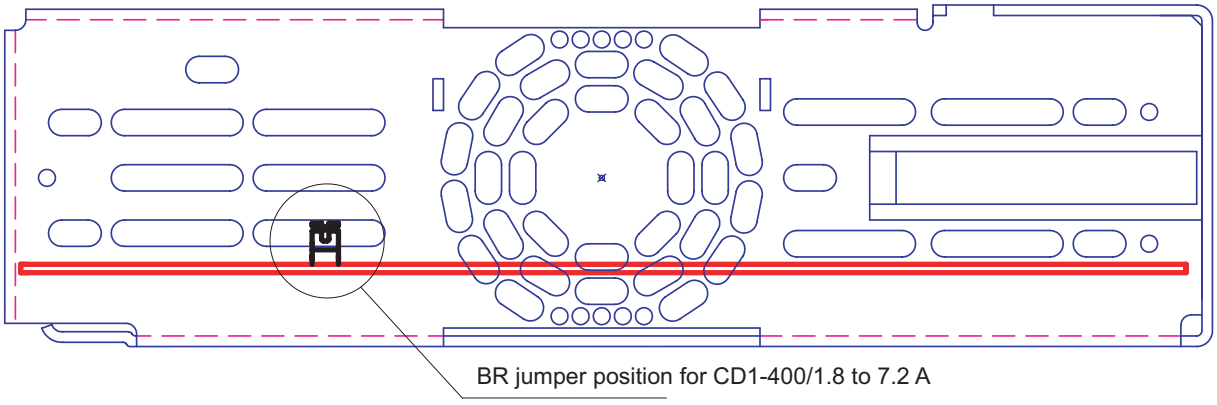
3 - BR JUMPER POSITION FOR CD1-400/30 AND 45



Position of the BR jumper (to be removed through the hood louver without opening the drive if the MOTOR BRAKE output is not used).

4 – POSITION OF THE BR JUMPER ON CD1-400 DRIVES IN 1.8 TO 7.2 A

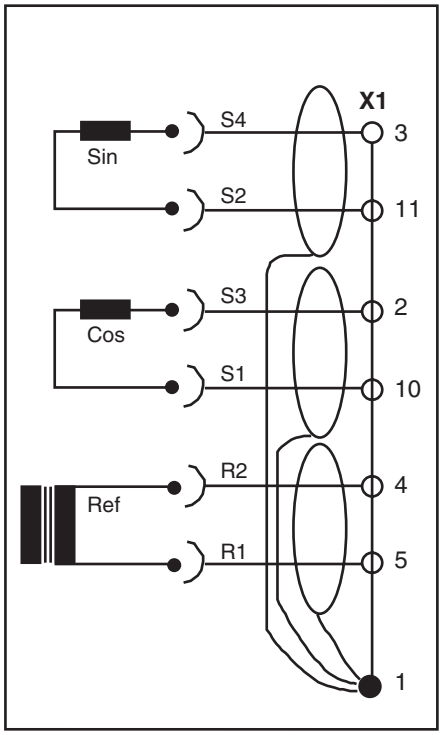
This jumper is available on drives which traceability index mentioned on the ID sticker is "J" or higher.



Position of the BR jumper (to be removed through the hood louver without opening the drive if the MOTOR BRAKE output is not used).

5 - ADJUSTMENT TO VARIOUS RESOLVER TYPES

For the connection of resolvers, see following wiring diagram of the **X1** connector as well as the manufacturer's diagram:



For the use of **resolvers** with other **transformation ratios** than 0.5, the Cos and Sin signal amplitude must be adjusted by means of the **R109** and **R13** components according to the table below:

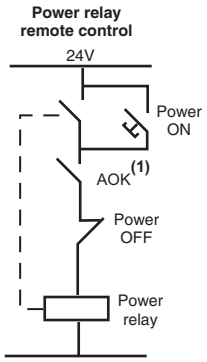
CD1-k version				
Resolver transformation ratio	0,3	0,45	0,5	1
R109 – Ohmic value – Tolerance < 1 %	6.5 Kohms	4.5 Kohms	3.92 Kohms	2 Kohms
R13 – Ohmic value – Tolerance < 1%	12.7 Kohms	12.7 kohms	12.7 Kohms	12.7 Kohms

CD1-k2 version				
Resolver transformation ratio	0,3	0,45	0,5	1
R109 – Ohmic value – Tolerance < 1 %	21 Kohms	14.3 Kohms	12.7 Kohms	6.34 Kohms
R13 – Ohmic value – Tolerance < 1%	NC	NC	NC	NC

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.

6 - USE OF THE "AOK" OUTPUT

The "AOK" output MUST be used on a potential free relay in order to allow the connection of the power supply (see Chapter 4, section 1: Connection diagrams).
The correct drive operation requires this connection logic. Switching on the power supply before initializing by means of the 24 VDC auxiliary supply will hinder the operation. It will then be necessary to proceed according to the instructions contained in this manual.



(1) **CAUTION** ! Imax = 100 mA (see AOK output specifications)

7 - ENERGY RECUPERATION VIA A BRAKING RESISTOR

All CD1 series drives are equipped with an energy dissipation 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 so-called "braking resistor".

In order to avoid heat dissipation inside the drive, the braking resistor must **ALWAYS** be mounted outside the drive. It **MUST** be mounted out of range of elements sensitive to heat and inflammable (plastic, cable sleeves, etc.).

For an optimum energy recuperation by the drives in a multiaxis application, the DC bus (DC+ and DC-) can be connected in parallel (see diagram in chapter 4, section 1.5).
In this case, the mains input must also be parallel wired in order to balance the current load inside the AC/DC converters.

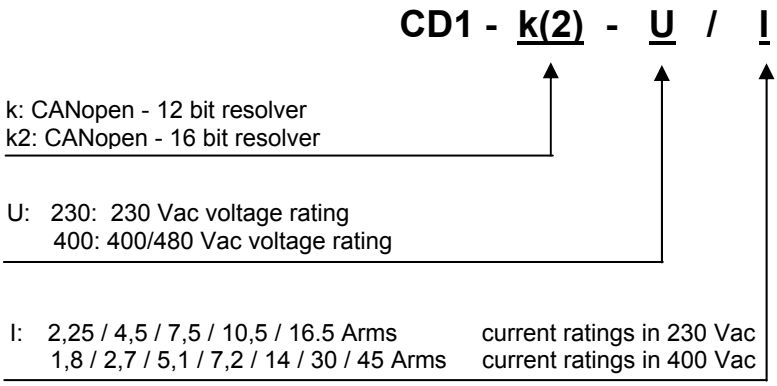
It is recommended to mount the braking resistor on the drive with highest current rating.
On 400 V drives,
CD1-k-400/1.8 to 7.2 A, as from index "J",
CD1-k-400/14 A, as from index "J",
CD1-k-400/30 et 45 A, as from index "A"
CD1-k-400/P3, as from index "A"
an electronic control of the reflected power avoids the braking resistor overload. 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**" error. A second resistor must then be mounted on the second axis.

AVAILABILITY OF THIS FUNCTION ON 400 V DRIVES ACCORDING TO TABLE BELOW:

DRIVE TYPE	TRACEABILITY INDEX
CD1-k-400 / 1.8 to 7.2 A	≥ J
CD1-k-400/14 A	≥ J
CD1-k-400/30 and 45 A	≥ A
CD1-k-400/P3	≥ A

8 - ORDER CODE

Single-axis version:



Three-axis version: