ACOMEL

K4000 - USER MANUAL

Solutions by DANAHER MOTION

25-11-03

S476 -gb-0348

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Valid from Software Version V15 dated January 2002 or later

Safety instructions

Information on the Operating Manual

This operating manual applies to the K4000 frequency inverter family. It describes the connections and basic functions of the standard models.

CAUTION! Danger of death by electrocution

CAUTION! Absolutely essential

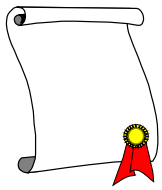
FORBIDDEN! Incorrect operation, may lead to damage.

The Basic Safety Rules

First read the user manual
Before installing and commissioning, it is important for such personal to read carefully the operating instructions and safety warnings.

Electric drives are potentially dangerous

- Electrical voltages > 230 V/460 V
  High voltages may still be present up to 5 minutes after the power has been cut off. Therefore you must always check for presence of power and voltages!
- In STOP mode, the drive remains active and the motor terminals are at a potential of 300 VDC against the ground.
- Rotating parts
- Hot surfaces



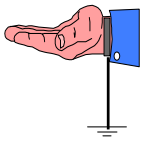
Your qualification

- In order to prevent personal injury and damage to property, only personnel with electrical engineering qualifications may work on the device.
- According to IEC364, DIN VDE0100, the qualified personnel must be familiar with the User Manual
- Have knowledge of national standards and accident prevention regulations

Working instruction

During installation observe the following instructions:

- Always comply with the connection conditions and technical specifications.
- Comply with the standards for electrical installations, such as regarding wire gauges, grounding lead and ground connections



The converter control board uses a large number of MOS (Metal Oxide Semiconductor) which are highly sensitive to electrostatic charge.

To avoid any damages to the control board

- wear an earthing strap and always handle the board by the extractors
- make sure you are working on an earthen anti-static floor
- use anti-static packing material only

Overspeed protection

If an overspeed protection is required, it must be provided by the motor manufacturer as this function is not integrated in the drive

Proper installation

Inverter drives are components that are intended for installation within electrical systems or machines. The inverter may not be commissioned or put into operation until it has been established that the machine as a unit complies with the provisions of the EC Machinery Directive (89/392/EEC) as well with the standard EN 60204 (Safety of machines).

If the frequency inverter is used for special applications the specific standards and regulations for this environment must always be observed.

Repairs may only be carried out by authorized repair workshops. Unauthorized opening and incorrect intervention could lead to physical injury or material damage. The warranty provided by DANAHER-MOTION would thereby be void.

Responsibility

Electronic devices are fundamentally not fail-safe. The company setting up and/or operating the machine or plant is itself responsible for ensuring that the drive is rendered safe if the device fails.

The standard EN 60204-1/DIN VDE 0113 “Safety of machines”, in the section on “Electrical equipment of machines”, stipulates safety requirements for electrical controls. The requirements to comply with are intended to protect the integrity of personnel and machines and to maintain the function capability of the machine or plant. The function of an emergency off system does not necessarily have to cut the power supply to the drive.

To protect against risk of injury, it may be more beneficial to maintain individual drives in operation or to initiate specific safety sequences. The emergency stop process may be assessed by means of a risk analysis of the machine or plant, including the electrical equipment to EN 1050. Part of this analysis is determined by the selection of the circuit category in accordance with prEN 954 “Safety of machines – Safety related parts of controls”.

A comprehensive range of product

Product basics

The **K4000** is a high frequency inverter designed for application up to **4000 Hz**. The **K4000** family consists of several models with output ratings from **5 to 120 kVA.** the selective harmonic suppression -**SHS** - developed by DANAHER-MOTION, is aimed at reducing motor losses and winding stresses without output filter.

- The KEYPAD PC560 control unit can be integrated on the front panel or supplied as a separate remote control unit.
- The drive is equipped with a RS232 / 422 serial link. A communication protocol in terminal mode for PC is available on request
- The **UL certification of the KT4000 is in process**
- The 19" rack version KL4000 will not be UL certified

Main technical data

- Input voltage, all units, 3 x 200 V to 3 x 480 V auto-ranging, no line transformer
- Output voltage V_{RMS} : 0 … U_{IN}, max. 3 x 460 V
- Output frequency range 0 … 4000 Hz
- Ambient temperature 40°C
- Continuous current overload 120% without time limitation
- Max current overload 150% for 1 min / every 10 min
- Short-circuit protection: suitable for use on a circuit capable of delivery not more than 5000 A_{RMS} symmetrical Amperes, 480 V maximum.

Current and Power ratings

Model	**Output Current A_{RMS}**			**Typical motor power**
	Nominal	Continuous	Peak	kW @ 3 x 400 V
KT4005	5	6	10	2.5
KT4010	10	12	15	5
KT4015	15	18	23	7.5
KT4020	20	24	30	10
KT4030	30	36	45	15
Input current:	All units are rated for a maximal input current of 32 **A_{RMS}**			
Input terminals:	10 mm^2			
Input cables:	Minimum section 6 mm^2 resp. 10 AWG Use copper conductors 75°C **only**			

Model	**Output Current A_{RMS}**			**Typical motor power**
	Nominal	Continuous	Peak	kW @ 3 x 400 V
KT4040	40	50	60	20
KT4060	60	75	90	30
Input current:	All units are rated for a maximal input current of 63 **A_{RMS}**			
Input terminals:	35 mm^2			
Input cables:	Minimum section 25 mm^2 resp. AWG 4 Use copper conductors 75°C **only**			

Model	**Output Current A_{RMS}**			**Typical motor power**
	Nominal	Continuous	Peak	kW @ 3 x 400 V
KT4090	90	110	135	45
KT4120	120	145	180	60
Input current:	All units are rated for a maximal input current of 160 **A_{RMS}**			
Input terminals:	70 mm^2			
Input cables:	Minimum section 50 mm^2 resp. AWG 1 Use copper conductors 75°C **only**			

Dissipation and Dynamic Braking Resistors ratings

Model	Dissipation	Braking resistors
	Watts	Ω / Watts - external
KT4005	200	22Ω/400W
KT4010	400	22Ω/400W
KT4015	600	22Ω/400W
KT4020	750	15Ω/1200W
KT4030	900	15Ω/1200W
KT4040	1200	6Ω/1500W
KT4060	1800	6Ω/1500W
KT4090	2700	4Ω/2000W
KT4120	3600	4Ω/2000W

Type Part Numbering

Standalone IP20 units

KT40xx-00	**Without** PC560 **and** external dynamic braking resistor
KT40xx-01	**Without** PC560, **with** external dynamic braking resistor
KT40xx-10	**With** PC560 and **without** external dynamic braking resistor
KT40xx-11	**With** PC560 and **with** external dynamic braking resistor

IP54 cabinet unit

KU40xx for cabinet with convection cooling up to KU4015
for cabinet with fan cooling for larger power ratings

KV40xx for cabinet with heat exchanger air – air

KW40xx for cabinet with heat exchanger air – water

KQ40xx for cabinet with air conditioning

Overload protection

UL requires an external overload protection

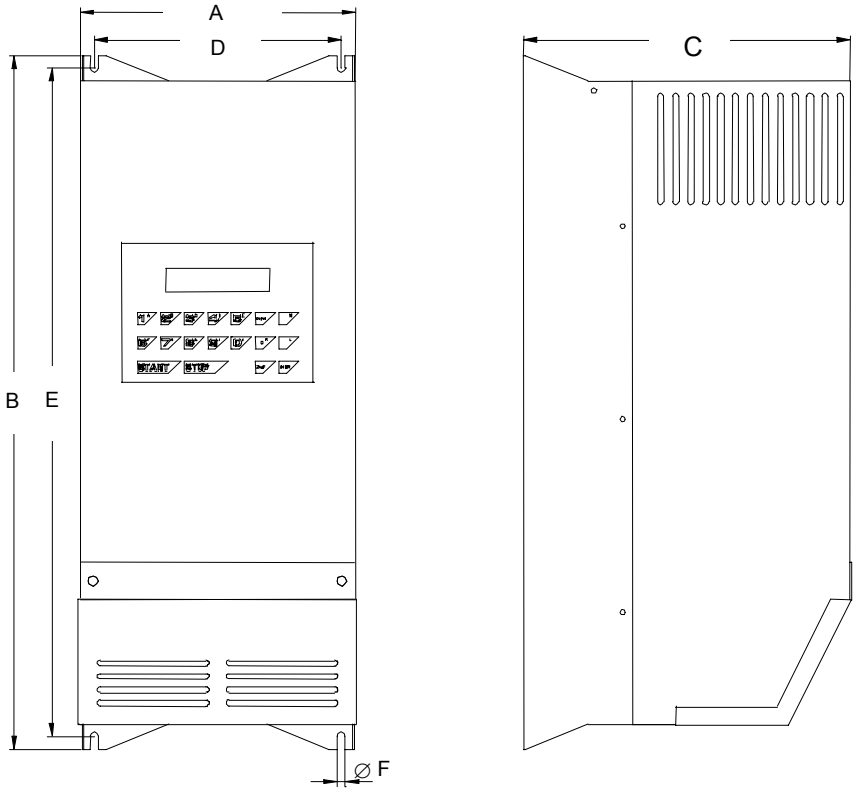
Connecting the K4000 to a transformer

The K4000 can be connected to any input voltage from 3 x 200 V to 3 x 480 V, 50 / 60 Hz, without a line transformer.

Nevertheless, if the input voltage is higher than 480 V or the installation requires a galvanic insulation in front of the drive, following rules must be respected:

- Don't use an auto-tranformer but only a **transformer with separated windings.**
- The output voltage of the transformer should not be higher than **460 V.**

The dimensions of the KT4000



Model	Overall Dimensions			Mounting Dimensions				Weight
	A	B	C	D	E	F	Screws	
KT4005	**223**	**557**	**265**	**199**	**537**	**7**	**4 x M6**	**29 kg**
KT4010								
KT4015								
KT4020								
KT4030								
KT4040	**484**	**820**	**350**	**450**	**800**	**11**	**4 x M10**	**71 kg**
KT4060								
KT4090								**91 kg**
KT4120								

All dimensions are in mm

Cabinet enclosure

1. The cabinet size and / or cabinet fan cooling, heat exchanger, air conditioning must be sized according the power dissipation shown on the table page 7.

2. The minimum distances between cabinet walls and the drive (left, right, top and bottom) as well between drives mounted side by side in the same cabinet are 100 mm.

The 19" – rack versions, KL4000

Current and Power ratings

Model	Output Current A_{RMS}			Typical motor power
	Nominal	Continuous	Peak	kW @ 3 x 400 V
KL4005	5	6	10	2.5
KL4010	10	12	15	5
KL4015	15	18	23	7.5
KL4020	20	24	30	10
KL4030	30	36	45	15
Input current:	All units are rated for a maximal input current of 32 A_{RMS}			
Input terminals:	10 mm^2			
Input cables:	Minimum section 6 mm^2 resp. 10 AWG Use copper conductors 75°C **only**			

Type Part Numbering

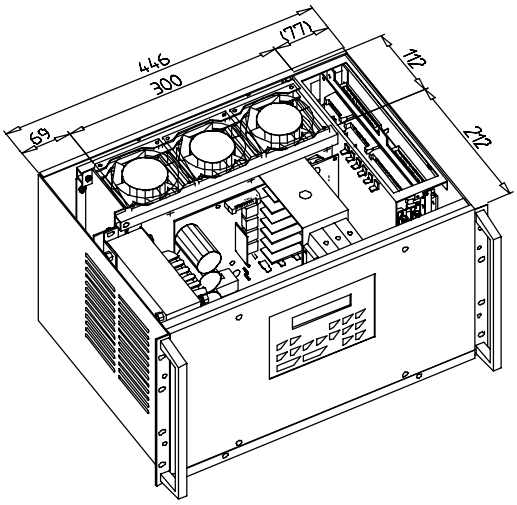
Connection from front

KL40xx-00F	**Without** PC560 **and** external dynamic braking resistor
KL40xx-01F	**Without** PC560, **with** external dynamic braking resistor
KL40xx-10F	**With** PC560 and **without** external dynamic braking resistor
KL40xx-11F	**With** PC560 and **with** external dynamic braking resistor

Connection from rear

KL40xx-00R	**Without** PC560 **and** external dynamic braking resistor
KL40xx-01R	**Without** PC560, **with** external dynamic braking resistor
KL40xx-10R	**With** PC560 and **without** external dynamic braking resistor
KL40xx-11R	**With** PC560 and **with** external dynamic braking resistor

The dimensions of the KL4000



All units have the same dimensions

Mounting Instructions

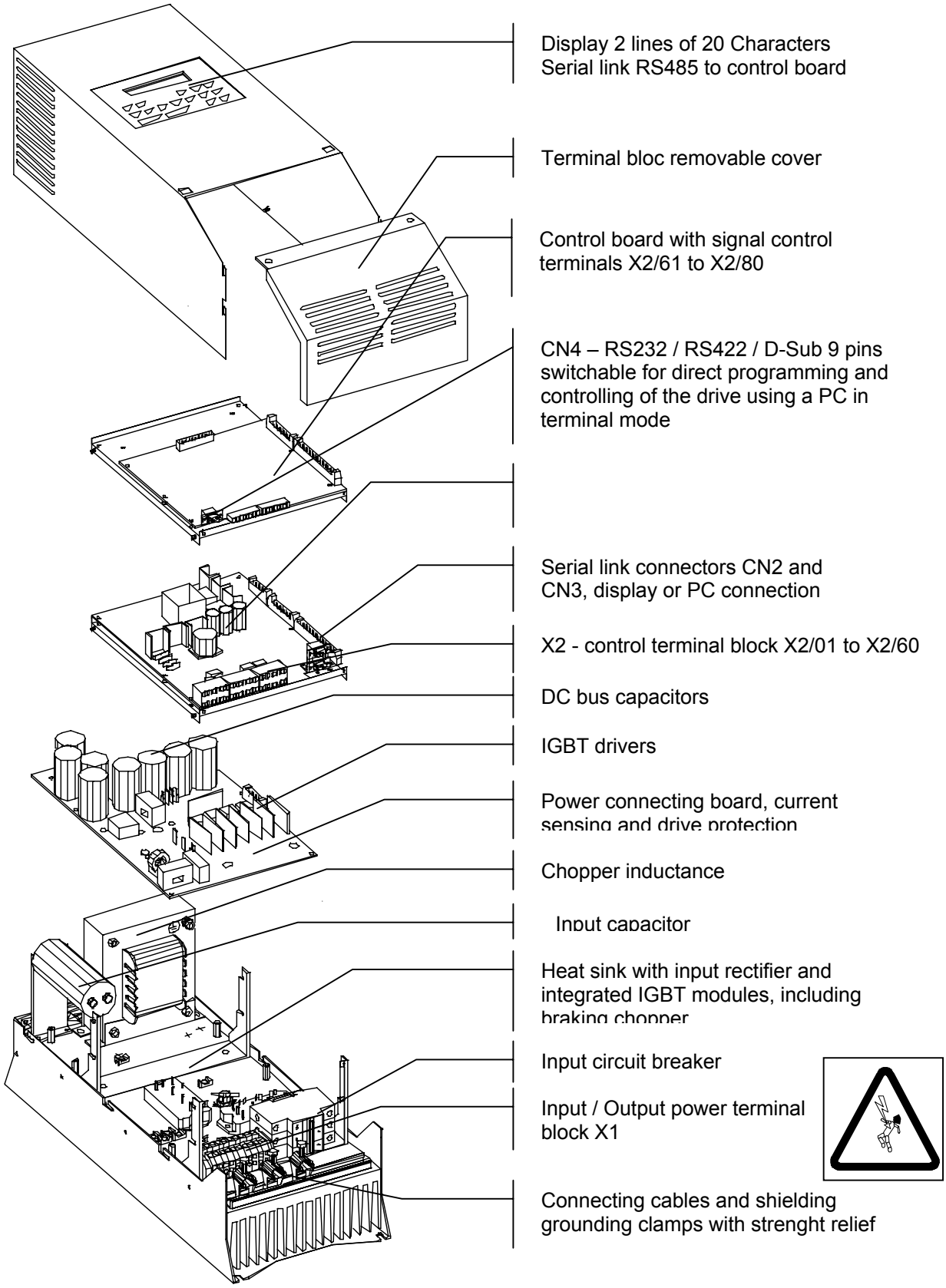
1. The area on top of the 3 fans, whole width and 112 mm depth, must remain free for correct cooling of the heat sink. At least 50 mm must be available on bottom and top of this area.

2. On the left side they are ventilation opening to allow a correct cooling of the chopper inductance. Those opening must not be covered.

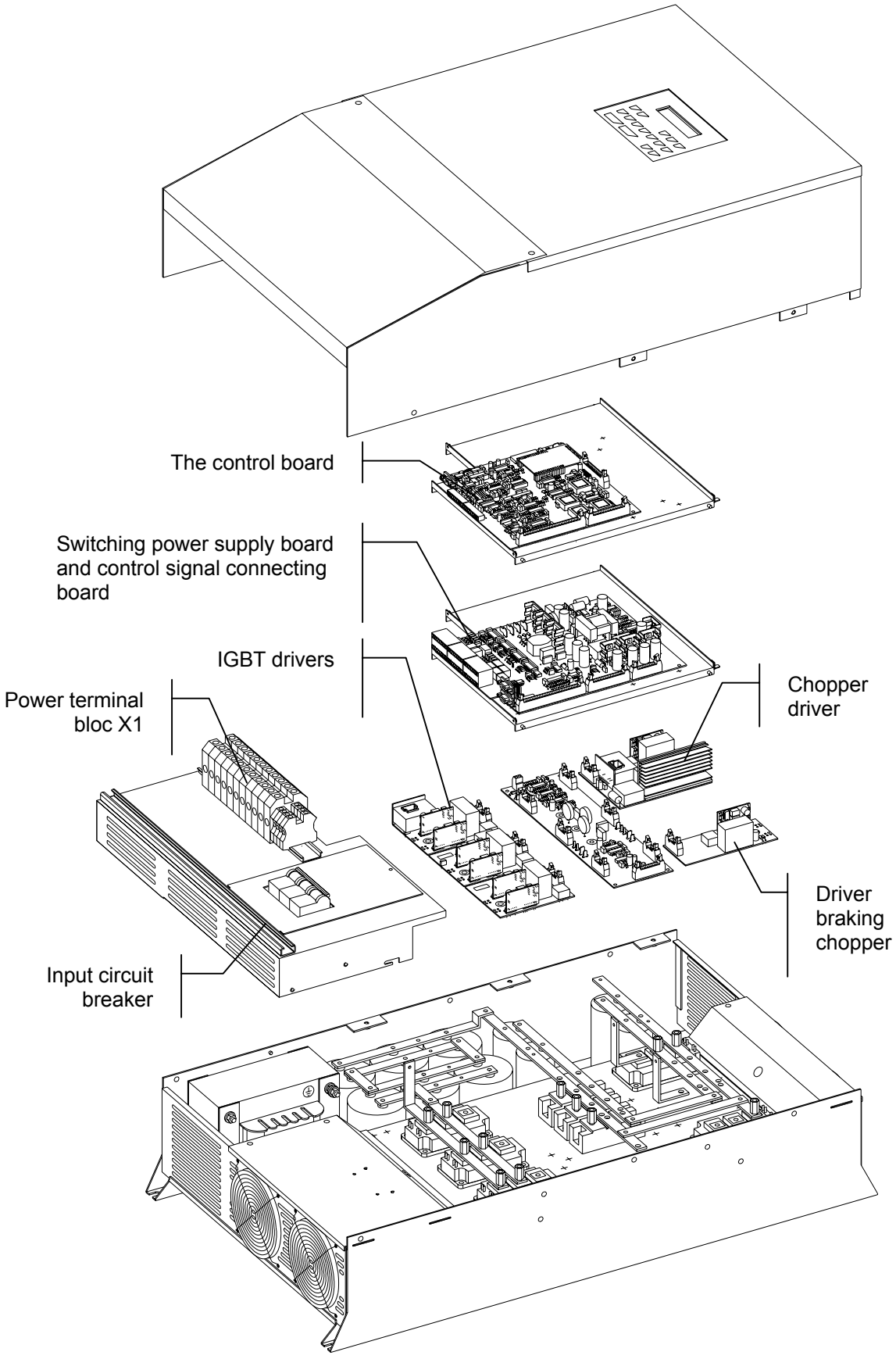
Unit height: 6U = 265.9 mm
Weight: 29 kg

K4000 - Drive overview

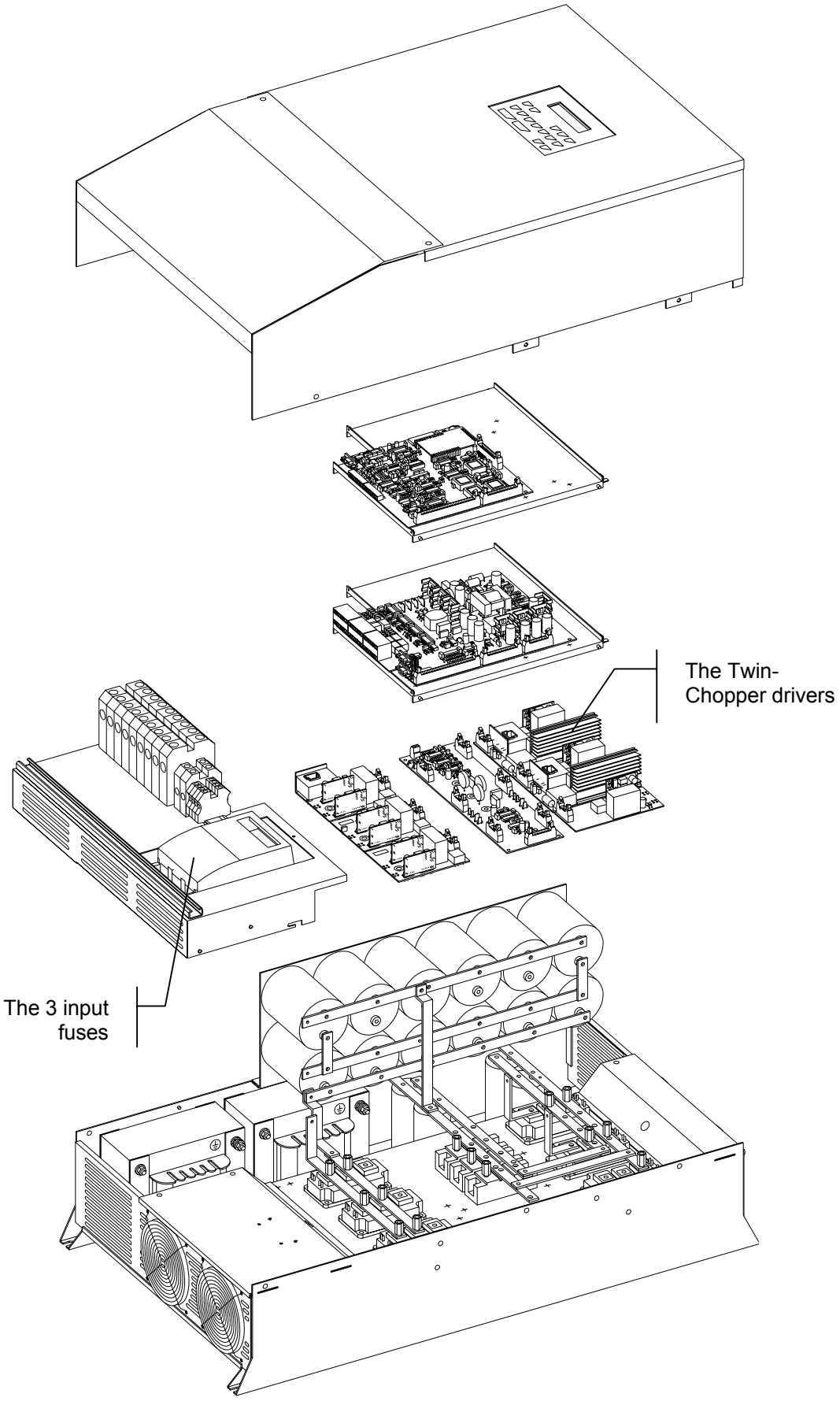
The KT4005, KT4010, KT4015, KT4020 and KT4030



The KT4040 and KT4060

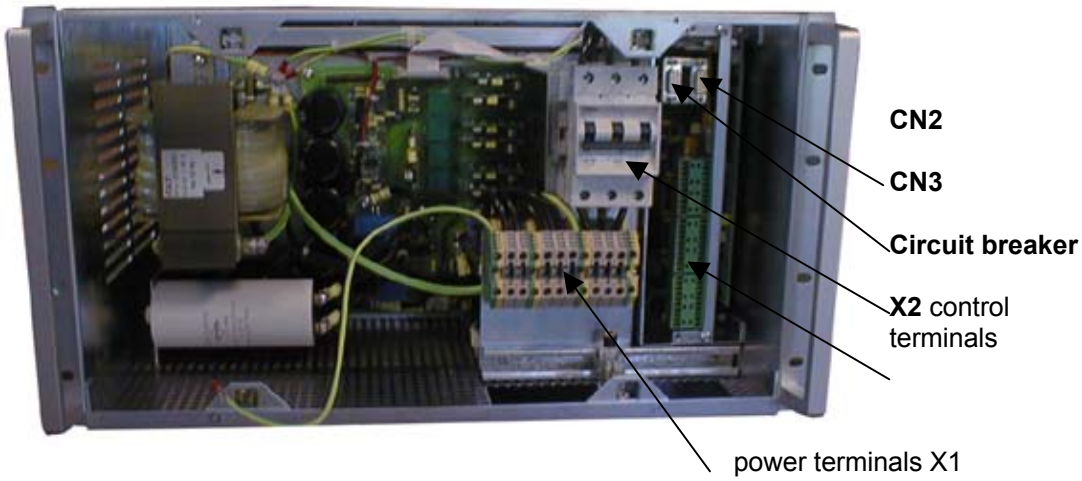


The KT4090 and KT4120

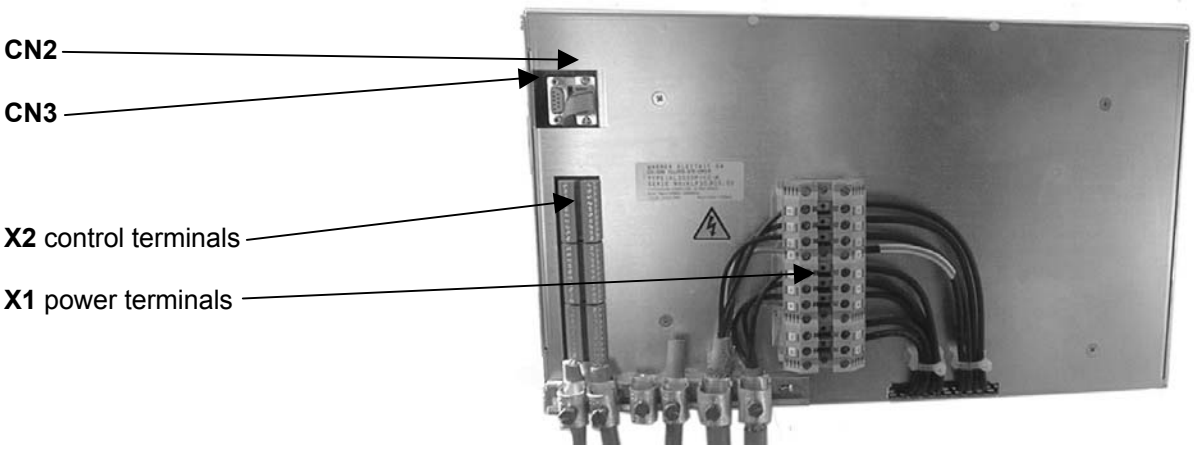


The 19” – rack version KL4000

The terminal blocks, connection for front access:

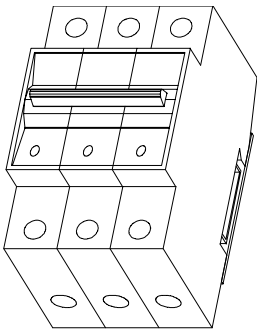


The terminal blocks, connection for access from the back



K4000 - Terminals descriptions

Input circuit breaker



This is not a power switch

The converter is protected against ground short circuit by a fast circuit breaker.

Resetting is performed manually by pushing a lever, during this operation tripping is disabled, so that the converter is no longer protected.

It is therefore important to disconnect the converter from the power line prior to resetting the circuit breaker.

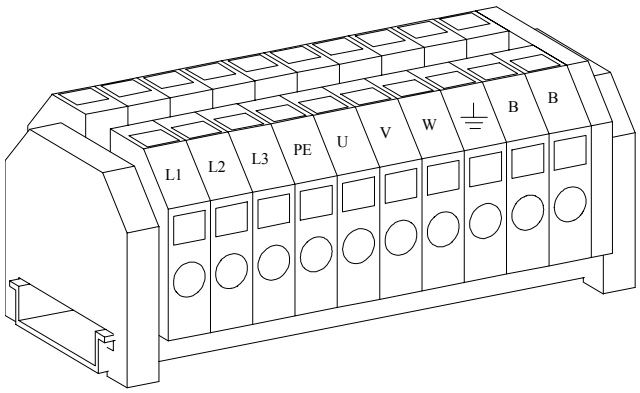
The power terminals

Motor output terminals U-V-W
In STOP mode, the drive remains active and the motor terminals are at a potential of 300 VDC against the ground. Before any intervention on the drive, make sure that the power supply has been removed.

DC-bus voltage

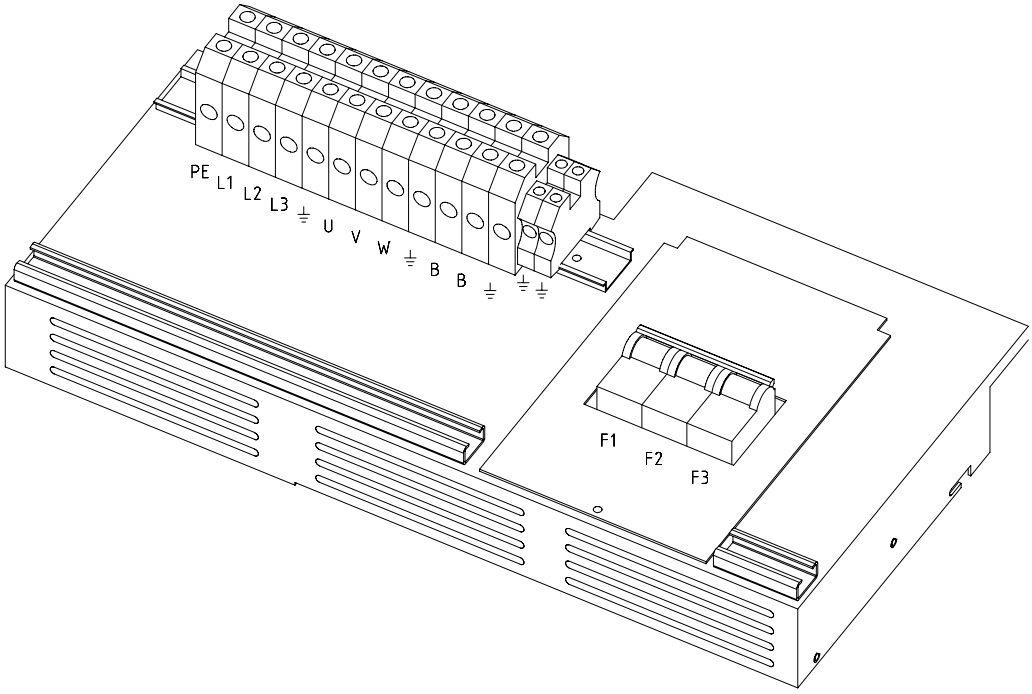
Large capacitors are installed on the intermediate DC-bus voltage. Please wait at least > 5 min. before to remove the cover of the terminal bloc and to access to the internal part of the drive. Please check of voltage free intermediate DC bus.

Terminal bloc X1 of the KT4005 to KT4030

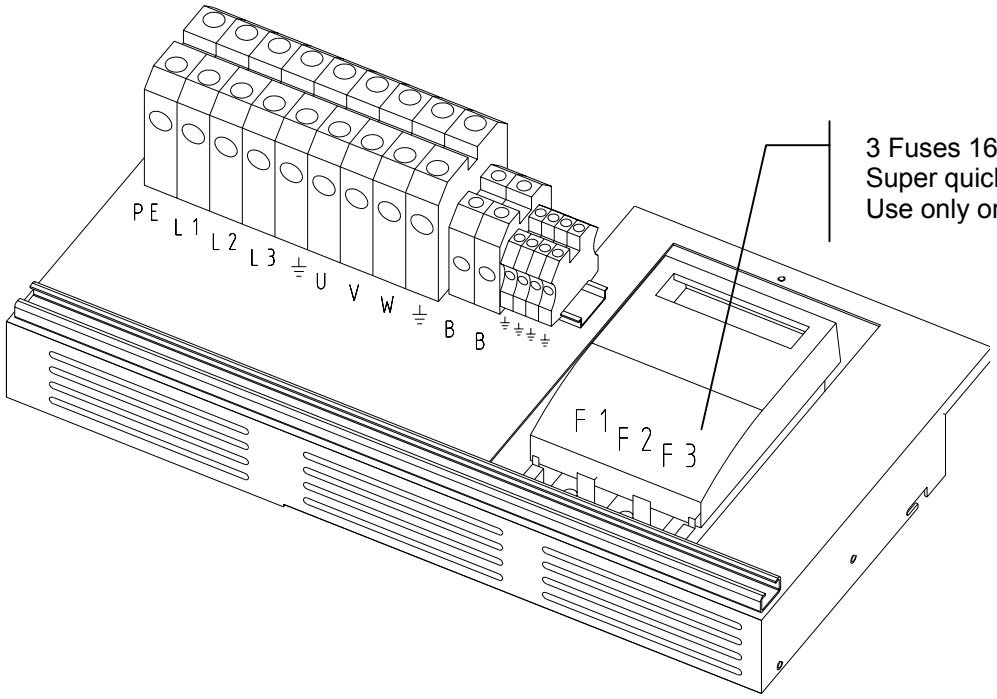


PE	Principal earth terminals
L1-L2-L3	Line input, 3 phases 200 V to 480 V +10% / -15%
U-V-W	Motor output, MAX. 460 V
B, B	Terminals for dynamic braking resistor

Terminal bloc X1 of the KT4040 and the KT4060

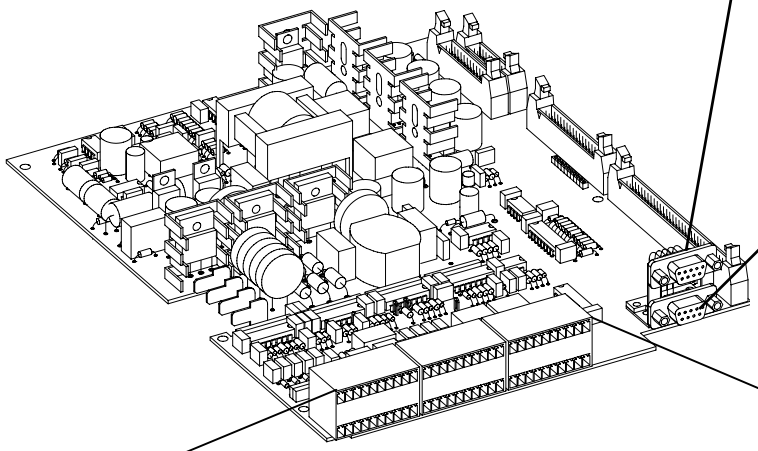


Terminal bloc X1 of the KT4090 and the KT4120



View of the control terminal bloc X2

The Power switching board with terminals X2/1 – 60 and the D-sub connectors CN2 and CN3. Reference P/N HB7451

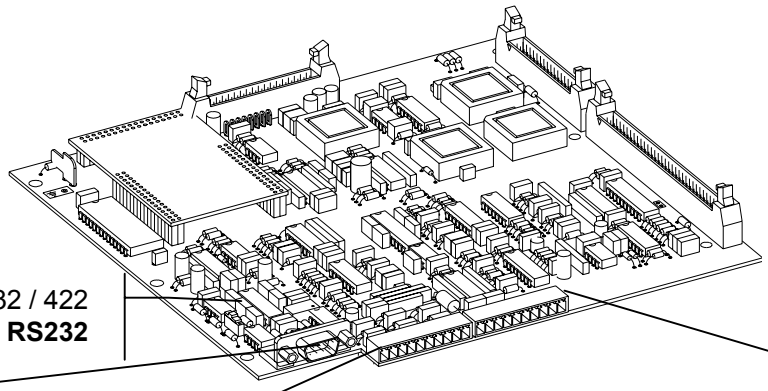


CN3 - 9 pins D-Sub connector for remote display DD550 only. A PC560 must be Connected to CN2.

CN2 - 9 pins D-Sub connector for RS485 serial link. to be used for KEYPAD PC560

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60

The control Board with terminals X2/ 61 – 80 and the D-sub connector CN4 Reference part number HB7701



Switch RS232 / 422
Factory setting RS232

61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80

CN4 - RS232 / RS422 / D-Sub 9 pins
For direct programming and controlling the drive through a PC in terminal mode
For additional information see "Terminal Mode Programming Manual"

RS232

PIN 2 Transmit from K4000 to PC
PIN 3 Receive from PC to K4000
PIN 5 Ground
All other PIN are not used for this connection

RS422

PIN 5 Ground
PIN 6 Transmit from K4000 to PC –
PIN 7 Transmit from K4000 to PC +
PIN 8 Receive from PC to K4000 +
PIN 9 Receive from PC to K4000 –
All other PIN are not used for this connection

The + 25 VDC - Auxiliary Power Supply

On the control terminal bloc X2, they are a number of terminals where the +25 VDC internal power supply is available. This power supply is only available for the inputs and outputs of the K4000, no other device must be connected.

The total load must not exceed 400 mA.

The control terminals description

Our digital inputs are **not** galvanic insulated. You must take care that no external potential (24 VDC) is applied to those inputs before our own internal auxiliary power supply 25 VDC has been built up. Non respect of this process could lead to **major damages** to the motor and / or the drive.

Term No	Short Name	Description	How to activate	K3000 X2 Ref.
1	Pot. +	+ 10 VDC	To connect an external pot. for speed reference input	7
2	Pot. -	- 10 VDC		4
3	AGND	Analog Ground		1
4	CMD1 +	Diff. speed reference analog input	Use to connect the 0 ...10V analog reference from CNC	6
5	CMD1 -	Diff. speed reference analog input		5
6	2^0	MCM selection – value 1	Apply +25 VDC	N/A
7	2^1	MCM selection - value 2	Apply +25 VDC	N/A
8	COM	Common terminal to Start / Stop	Show 25 VDC if no failure	8
9	STOP	Stop input - stop the drive if open		9
10	START	Start input	Apply +25 VDC	10
11	+25VDC	25 VDC auxiliary power supply	Available for input activation	19
12	COMC	Return the control of the speed to the KEYPAD	Apply +25 VDC	N/A
13	+25VDC	25 VDC auxiliary power supply	Available for input activation	22
14	SH	Sample hold for MCM function	Apply +25 VDC	25
15	RT-	R_{TRIP} -	External resistor to set the motor current reference	54
16	RT+	R_{TRIP} + (AGND)		24
17	SDIG+	Digital output +	Digital pulses train as frequency digital output	11
18	SDIG-	Digital output +		12
19	CDI+	Digital speed signal input +	Speed input using a pulse sensor	13
20	CDI-	Digital speed signal input -		14
21	+25VDC	25 VDC auxiliary power supply	Available for input activation	26
22	RE5-NO	Output relay 5 - contact NO	Contact will close **When relay is energized** Contact will open	44
23	RE5-COM	Output relay 5 - common		45
24	RE5-NC	Output relay 5 - contact NC		46
25	RE1-NO	Output relay 1 - contact NO	Contact will close **When relay is energized** Contact will open	31
26	RE1-COM	Output relay 1 - common		32
27	RE1-NC	Output relay 1 - contact NC		33
28	RE2-NO	Output relay 2 - contact NO	Contact will close **When relay is energized** Contact will open	34
29	RE2-COM	Output relay 2 - common		35
30	RE2-NC	Output relay 2 - contact NC		36
31	+25VDC	25 VDC auxiliary power supply	Available for input activation	28
32	ISR	Reverse the rotation direction	Apply + 25VDC	20
33	+25VDC	25 VDC auxiliary power supply	Available for input activation	55
34	2^0	Partition selection - value 1	Apply + 25VDC	56
35	2^1	Partition selection - value 2	Apply + 25VDC	57
36	2^2	Partition selection - value 4	Apply + 25VDC	58
37	2^3	Partition selection - value 8	Apply + 25VDC	59
38	2^4	Partition selection - value 16	Apply + 25VDC	60
39	+25VDC	25 VDC auxiliary power supply	Available for input activation	30
40	EXT	External interlock - Apply 25 VDC	Drive stop when open	21

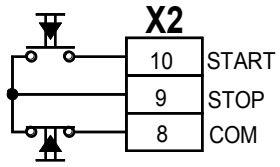
Term No	Short Name	Description	How to activate	K3000 X2 Ref.
41	SAN1	Analog output 1	Internal programmable	17
42	AGND	Analog ground	parameter 0 ... 10 VDC	18
43	SAN2	Analog output 2	Internal programmable	na
44	AGND	Analog ground	parameter 0 ... 10 VDC	na
45	CSM+	Catch a spinning motor	To activate apply +25 VDC	na
46	CSM-	Catch a spinning motor	Must be connected to AGND	na
47	KEY	Program access key	Access possible when	na
48	AGND	Analog ground	connected to AGND	na
49	RST	Reset	Apply +25VDC to RESET	29
50	+25VDC	25 VDC auxiliary power supply	Available for input activation	50
51	+25VDC	25 VDC auxiliary power supply	Available for input activation	na
52	RE3-NO	Output relay 3 - contact NO	Contact will close	37
53	RE3-COM	Output relay 3 - common	**When relay is energized**	38
54	RE3-NC	Output relay 3 - contact NC	Contact will open	39
55	RE4-NO	Output relay 4 - contact NO	Contact will close	41
56	RE4-COM	Output relay 4 - common	**When relay is energized**	42
57	RE4-NC	Output relay 4 - contact NC	Contact will open	43
58	PTC+	Terminal for motor PTC +	Activated when motor	23
59	AGND	Analog ground	temperature too high	24
60		NOT USED		40
61	AI1	Analog input 1	Analog input 0 … 10 V Comparator level and time delay to be programmed in menu C	na
62	AGND	Analog ground		
63	INHA	Inhibition of the analogue speed reference input	Apply + 25VDC	27
64	AGND	Analog ground		
65		NOT USED		
66		NOT USED		
67	2^5	Partition selection - value 32	Apply + 25VDC	na
68		NOT USED		
69		NOT USED		
70	AGND	Analog ground	parameter 0 ... 10 VDC	na
71	AGND	Analog ground	Connect NTC return	na
72	NTC+	Terminal for motor NTC	Connect NTC+	na
73	2^0	Pre-set speed - value 1	Apply + 25VDC	na
74	2^1	Pre-set speed - value 2	Apply + 25VDC	na
75				
76				
77				
78				
79				
80				

Compulsory Connections

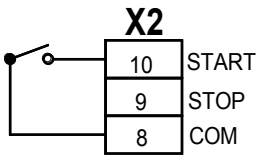
Some of the connections are optional, depending on what functions are required and whether these functions are to be accessed in digital mode from KEYPAD or from the TERMINAL BLOC X2 . For further information, refer to the bloc diagram. **Even to control the drive through the user interface PC560**, the following connections **are compulsory**:

- Mains input: terminals X1: L1, L2, L3 and PE
- Converter outputs: X1: U, V, W and PE
- STOP: terminals X2/8 - X2/9 must be strapped together. In case of KEYPAD PC560 control, opening this contact will stop the motor.
- External interlocks: terminals X2/39 - X2/40 must be strapped together if the external interlocks are not used.
- The access key terminals must be strapped, terminals X2/47 – X2/48
- Motor temperature probe PTC: terminals X2/58 - X2-59 must be strapped together if the motor has no temperature probe. **UL requires an External Motor Overload Protection.**

The START / STOP functions

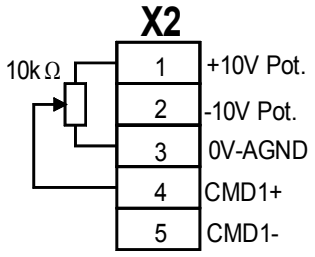


START command with impulse contact.
The START remains active until the STOP circuit between terminals 8 and 9 is interrupted.
When the drive is “READY”, +24VDC is available on terminal COM



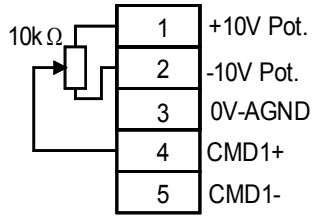
START / STOP command using permanent contact.
Caution: If the permanent start contact is closed when the inverter is powered up, the motor will start automatically if a RESET is performed.

The Speed Reference Input

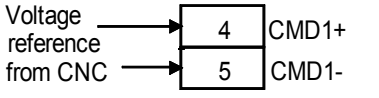


Note: Any input reference voltage < 100 mV is considered as speed reference **0** i.e speed range 1% to 100%.

Input 0 ... +10 V
Reversing through terminal bloc X2/32 or
user interface PC560, depending on the programming



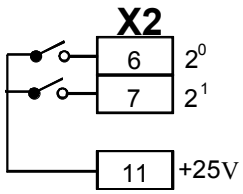
Input ± 10 V
Reversing of direction when crossing 0 V
The reversing from the terminal bloc X2/32 must be open



Differential input from outside source
Can be 0 ... + 10 or ± 10 V
Reversing from terminal bloc or crossing 0 V

The digital and analog programmable outputs and Inputs

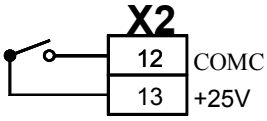
Selection of the MCM reference



The selection of one of the 4 MCM sensitivity level is made by applying 25V to the 2 terminals X2/6 and / or X2/7 using a BCD coding.

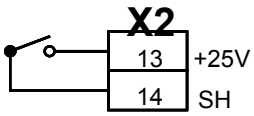
Sensitivity	1:	no 25 V applied
	2:	25 V to X2/6
	3:	25 V to X2/7
	4:	25 V to X2/6 and X2/7

Selection of the speed control source



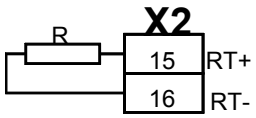
Using an external information, you can return the control of the speed to the KEYPAD, even if it has been assign to the TERMINAL BLOC X2 in the menu B. Just close the contact and you will be able to control the speed from your KEYPAD .

The Sample Hold of the MCM function



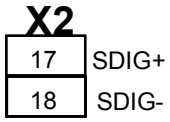
"Sample" command for motor current monitor in Sample & Hold mode (measure and store motor current under no-load conditions). Used mainly for gap elimination.

Current parametric resistor R_{TRIP}



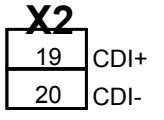
This parametric resistor set the current limit level I_{REF} when function is selected from the terminal block. Tolerance of the current limit is -10% / +15%. This resistor is often integrated into the spindle connector to provide automatic current limitation setting for different spindles. Resistance value Ω = 3000 / I_{REF} (A)

Digital Output SDIG



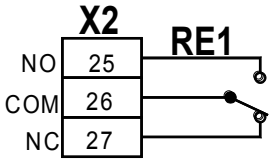
Digital output from converter clock. The number of motor poles (as set in Menu B – max. 24 poles) is taken into consideration so that the signal SDIG is a true indication of the set speed respectively the motor speed in RPM if the speed measurement option is integrated. Output frequency time 10 equal speed in RPM. Signal level 24 VDC, 20 mA

Digital speed input



Input for rotor incremental encoder. Signal level 24 VDC, 20 mA.
If the signal is supplied by a magneto-resistive sensor, use the TACHO PRINT option to shape the signal.

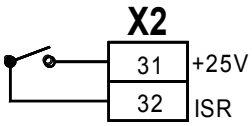
The relay contact outputs



Digital outputs No 1, 2, 3, 4 and 5
Contact rating 25 VDC - 100 mA
NO Output relay 1- contact normally open
COM Output relay 1 - middle point
NC Output relay 1 - contact normally close

Terminals 25, 26, 27: relay No 1
Terminals 28, 29, 30: relay No 2
Terminals 52, 53, 54: relay No 3
Terminals 55, 56, 57: relay No 4
Terminals 22, 23, 24: relay No 5

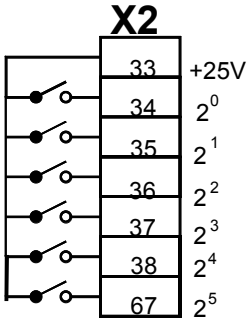
Reversing from the terminal block



External motor-reversing contact
This function must be set for terminal block mode

Partition selection from terminal block

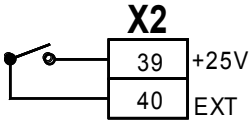
The selection of the partition is made using BCD coding. The sequence of the partition selection using the TERMINAL BLOC X2 is shown here.
Partition No 0 doesn't exist in **TERMINAL BLOC** mode. If no voltage is applied to terminals 34 to 38, the error message "*Partition selection missing"* will be displayed.



- Partition No 1 = terminal 34
- Partition No 2 = terminal 35
- Partition No 3 = terminals 34+35
- Partition No 4 = terminal 36
- Partition No 5 = terminals 34+36
- Partition No 6 = terminals 35+36 and so long until ....
- Partition No 63 = terminals 34, 35, 36, 37, 38 and 67

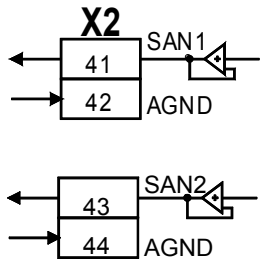
We have represented here the selection using relays or jumpers integrated in a connecting plug. The partition selection can be done too, using signals coming from the CNC control.

External Interlocks



When this circuit is open, a converter error condition is generated. This failure is considered as non destructive (see programming section)This interlock is used for monitoring external functions such as spindle lubrication, safety door etc...

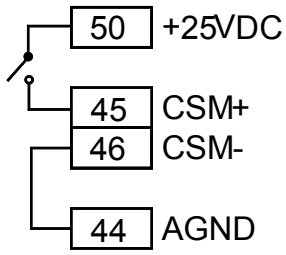
The programmable analog output SAN1 and SAN2



The output is 0 ... 10 V
Maximal load 10 mA
The load must be ≥4.7 kΩ respectively ≤10 kΩ
Use one of the 0 V (electronic ground) on the terminal bloc X2 for the return.

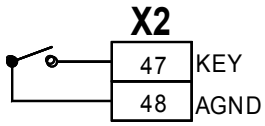
SAN1 connects to terminals X2/41 and the ground X2/42
SAN2 connects to terminals X2/43 and the ground X2/44

Catch a spinning motor



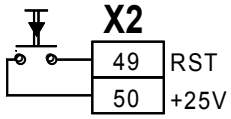
When this function is activated, it is possible to catch a spinning motor and to accelerate it back to the set speed.

The access key



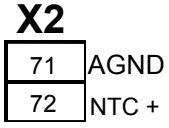
The access to the programming menus can be locked using the terminal X2/47. The access is only possible when the connection to ground is closed. The menus to lock, i.e. B and C or B,C,D,E,F and J are selected in the beginning of the menu B.

The RESET



In case of failure, the drive can be reset by applying +25 VDC to the terminal X2/49. A RESET is only possible when the intermediate DC bus voltage is < 40 VDC, if higher, just wait before to redo RESET.

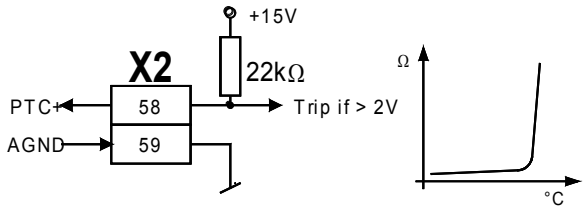
Connecting a NTC temperature sensor



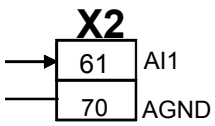
Instead of a PTC, the motor can be fit with a true temperature sensor. In this case the connection of the sensor will be made between terminals X/71 and X/72.

Connecting the PTC - motor temperature protection

The PTC - motor temperature protection sensor will be connected between terminal X2/58 and X2/59. This input is protected against overvoltage by a Zener diode. In case of overvoltage on this input, the Zener diode will blow and must be replaced for proper operation.

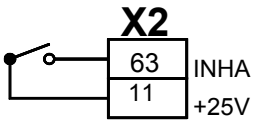


The analog input AI1



Input for an analog voltage comparator. Input value 0 …10 VDC
The activation level of the comparator and the time delay and the output relay to be triggered are programmed in menu C.

Inhibit the analog speed reference input

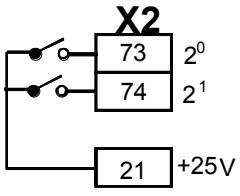


The analog speed reference input voltage can be affected by inducted disturbances. To reduce or eliminate the impact of those signal noises, the EMC mounting instructions specified at the end of this manual must be respected.

Such speed variations during the machining process are often not welcome. The K4000 frequency inverter offers a great solution to this problem. A digital signal, coming from the CNC controller, can be used to inhibit the analog speed reference signal during machining.

Closing a contact between terminals X2/11 and X2/63 will inhibit the processing of the analog speed reference signal and the speed will be hold constant at the last registered value. To activate again the analog speed reference input, just open the contact.

Selecting one of the pre-set speeds



The selection of one of the 3 pre-set speeds is made by applying 25V to the 2 terminals X2/73 and / or X2/74 using a BCD coding.

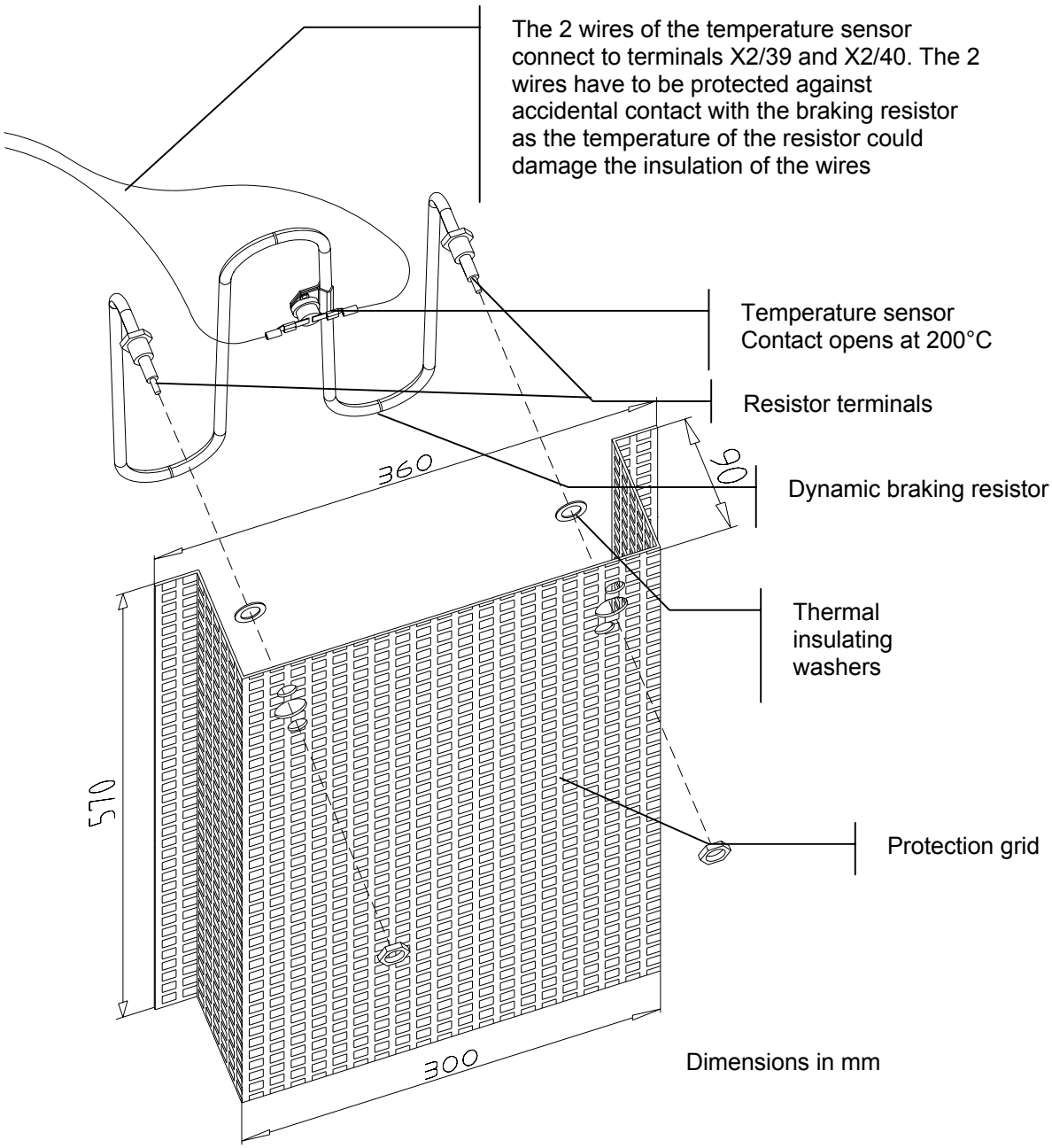
No 25 V applied	Analog speed reference active
25 V to X2/73	Pre-set speed 1
25 V to X2/74	Pre-set speed 2
25 V to X2/73 and X2/74	Pre-set speed 3

Connecting the dynamic braking resistor

The dynamic braking resistor is a potential free stainless steel heating resistor. The 2 terminals of the resistor connect to the 2 power terminals X1/**B.**

The kit shown on the picture consists of the resistance with a 200°C temperature sensor (opening contact), a protection grid and mounting accessories.

It is mandatory to connect the temperature sensor to the external interlocks to avoid overheating of the resistance (risk of fire) in case of breakdown of the braking chopper (short-circuit).



OPTIONS: Temperature sensor rated at lower level than 200°C. The required temperature must clearly be specified on order. The unit will get a specific part number.

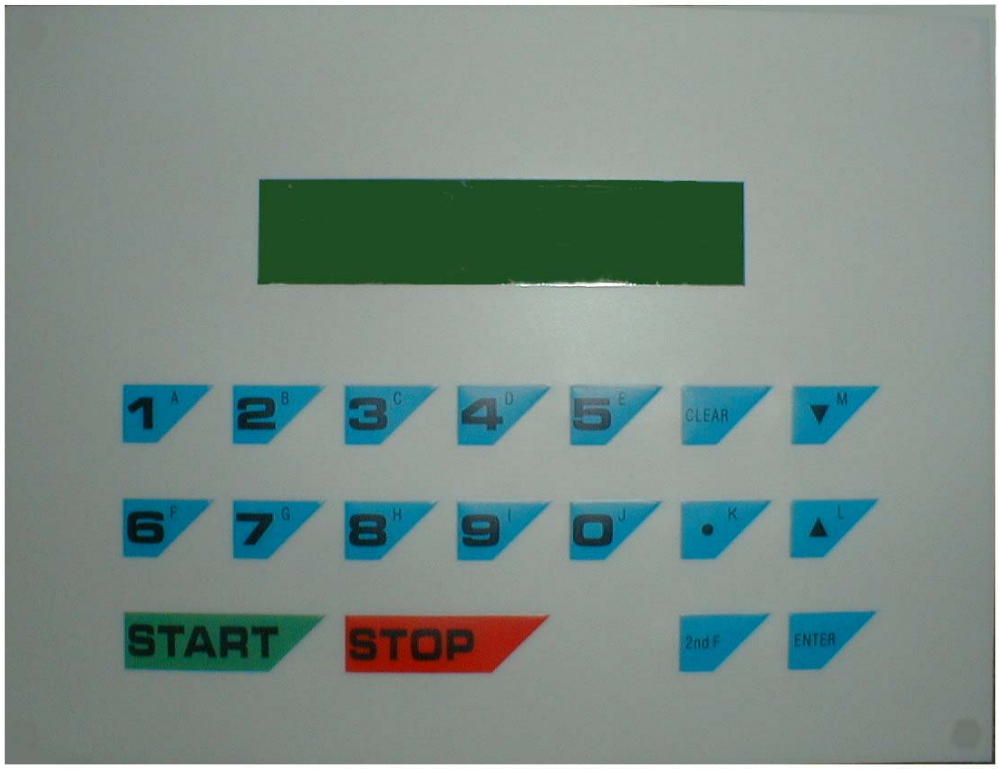
Programming the K4000

The Menus

- Menu A Inverter parameters
- Menu B Part 1 – Operation related parameter
  Part 2 – Motor related parameter
- Menu C Allocation of the digital and analog outputs
- Menu D The parameters accessible in START mode
- Menu E Reversing from KEYPAD PC560
- Menu F Speed reference input
- Menu G Display bloc selection
- Menu H Display of the last 8 failures (FIFO)
- Menu I RESET
- Menu J Memorized the last speed reference as default speed

To access to the desired Menu, press **2ndF** followed by the corresponding letter:
Example: **2ndF B** for menu B

The User Interface PC560

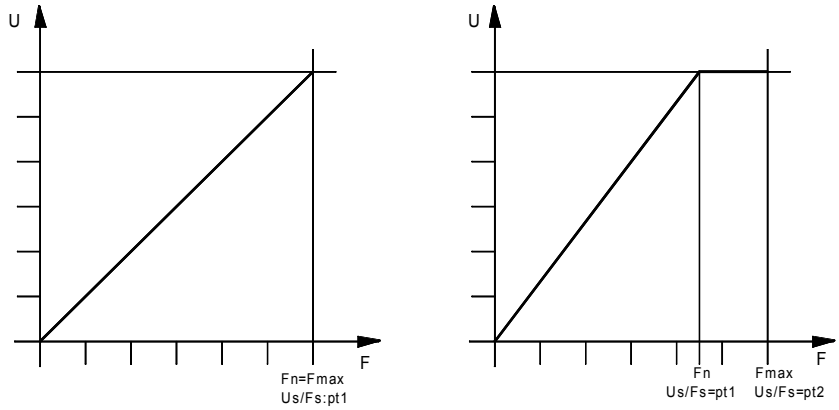


3. Compulsory connections

Check that all compulsory connections according page 20, have been done.

4. The characteristic Voltage / Frequency or Power / Frequency

For optimal performances of the motor **and** its frequency inverter, it is important that



this characteristic has been correctly inputted. This operation is done at the last step of the menu B.
Left, a typical linear characteristic. In this case, the maximum operating frequency of the motor F_{MAX} is identical to F_N

Right a typical characteristic with a break point. In this case, the base speed F_N is lower than the maximum operating frequency of the motor F_{MAX} . We have to input here the maximum operating frequency F_{MAX} as well as the base frequency F_N.

This U/F or V/Hz characteristic can have up to 32 point**,** the next higher point must show V and Hz values equal or higher than the last one.

Caution: A wrong setting of the U/F characteristic can lead to destructive damages of the motor.

5. The input of the parameters

This is done using the keys of the KEYPAD PC560.
The drive is delivered which pre-programmed default values selecting operation with the user interface PC560, acceleration and deceleration of 10 s etc.. ***Only few parameters have to be entered in the menu B*** before to be able to start your motor using the KEYPAD. The **actions** to be done are in **bold.** Use the 🡻 and 🡹 to progress inside of the menu and press the ENTER key to confirm an input.

In the column **"Display"** is represented the text shown on the display

Display	Value	Key to press	Comments
		2ndF B	
0=F 1=GB 2=D 3=I 4=E	**1**	**ENTER**	Selection of the English language
Menu locking 0=B,C	**0**	**ENTER**	Access locking through X2/47-48
Start/Stop (choice) 0=PC560 1=T.BI.?	**0**	**ENTER**	Assign the Start / Stop function to the KEYPAD PC560
Speed display units 0=Hz 1=rpm ?	**1**	**ENTER**	Set the speed in RPM
		⇓⇓	Until you reach
Mains voltage Ur (V) =	**xxx**	**ENTER**	Input the mains voltage in volt
Partition selection 0=PC560 1=T.BI. ?	**0**	**ENTER**	Assign the partition selection to the KEYPAD PC560
		⇓⇓	Until you reach
PASSWORD:	**616**	**ENTER**	Give you access to the motor partitions
Partition No =	**1**	**ENTER**	Open partition 1
Number of poles =	**x**	**ENTER**	The number of poles, not of pairs
Motor power P(kW) =	**x**	**ENTER**	Input the max. power of the motor, including overload
Iref source 0=PC560 1=Rtrip?	**0**	**ENTER**	Assign the input for the motor reference current $\mathbf{I_{REF}}$ to the KEYPAD PC560
Motor nom. Current Inom (A) =	**x**	**ENTER**	Enter the nominal current of the motor. Will be used to check other current inputs
Current accel/decel Iacc (A) =	**xxx**	**ENTER**	Input the acceleration current in A
Motor current Iref (A) =	**xxx**	**ENTER**	Input the nominal motor current in A
Acceleration time	**10**	**ENTER**	Set the acceleration time to 10 s
Deceleration time	**10**	**ENTER**	Set the deceleration time to 10 s
		⇓⇓	Until you reach
Us/Fs Pt. 1 (V/Hz) Us = Fs =		**ENTER**	Enter the U/F characteristic. Start point 0V/0Hz is already stored.
		**2ndF ENTER**	The content of the partition inputs must be confirmed by entering **2ndF ENTER**

6. The START

Display show bloc G1		**2nfF F**	Open the menu to input a speed
New frequency (rpm) =	**≤ 1000**	**ENTER**	Input a speed. We suggest 25% of the maximum motor speed but maximum 1000 rpm
		START	The motor will run at the inputted speed
		STOP	The motor will stop

THE QUICK START IS NOW COMPLETED AND YOU CAN PROCEED TO THE FINAL AND COMPLETE PROGRAMMING

The programmable parameters

Menu A : Inverter Related Parameters

Access in STOP mode only by entering **2ndF A**

Display	Description	Values
Max. current. (A) =	Display the maximum output current of the inverter. This parameter is related to the drive rating and is used to protect the drive in overload conditions as well short circuit between phases and phase to ground.	**K4005 = 10 A** **K4010 = 15 A** **K4015 = 23 A** **K4020 = 30 A** **K4030 = 45 A** **K4040 = 60 A** **K4060 = 90 A** **K4090 = 135 A** **K4120 = 180 A**
Softwareversion V-	Release number of the installed software. In case of programming problems, please indicate this number when calling our customer support.	**V.xx.x**
Date of delivery	Shipping date of the unit. This is the date the unit left our manufacturing plant in Switzerland.	**?**
Serial number K-	Specific to each unit. The first 4 digits "xxxx" are related to the power rating of the units. The yyyyy.zz are related to our internal codification.	**Kxxxx.yyyyy.zz**
Running timer (h)=	Cumulated time in START mode	**0.0 H**
Time power applied (h)=	Cumulated time input voltage ON	**0.0 H**

The Menu A is a read only. No information can be modified by the customer

Menu B – Part 1: Operation related parameters

Access in STOP mode only

Display	Description
0=F 1=GB 2=D 3=I 4=E	Selection of the user language. Enter: • 0 for French • 1 for English • 2 for German • 3 for Spanish • 4 for Italian For the time being only English, German and French manuals are available.
Menu locking 0=B,C 1=B→F,J	Locking the acces to menus, using terminals X2/47-48 **0** Locking acces to menus B and C **1** Locking access to menus B, C, D, E, F, J Only menus G (Display), H (faults list) and I (Reset) remain accessible **CAUTION:** The STOP key of the keypad is always active.
Start/Stop (choice) 0=PC560 1=T.Bl.?	The START / STOP function can be assigned to: **0** KEYPAD PC560 **1** TERMINAL BLOC X2 This allocation is an "OR" function for the START, but an "AND" function for the STOP, the STOP key on the KEYPAD being always active.
Speed display units 0=Hz 1=rpm ?	Here you pre-set the displayed units for the speed. • Enter **0** for **Hz** • **1** for **RPM**, the number of poles of the motor will be taken into consideration automatically.

Menu B – Part 1 : Operation related parameters (continued …)

Display	Description
Motor reversing 0=NO , 1=YES	If you want to lock any reversing of the rotating direction of the motor you can do it here. Enter: **0** Reversing forbidden **1** Reversing according assignment either from KEYPAD or TERMINAL BLOC X2
Motor reversing 0=PC560 1=T.Bl.?	Motor reversing means changing the direction of the rotation. This function can be allocated to the KEYPAD or to the TERMINAL BLOC. Enter: • **0** for **KEYPAD** • **1** for **TERMINAL BLOC.** The reversing function is now allocated to terminal 31 and 32 of the terminal bloc X2. Closing this contact will reverse the direction of the rotation. For safety reason the factory setting is 1 to avoid KEYPAD reversing by mistake, pushing key E instead of F after 2ndF.
Filter freq. ctrl (1 a 10) =	Input here a filter value for the analog speed reference input. This factor need to smooth speed variations due to signal noise. Value **1** to **10**
Freq.ctrl 0=-10/+10V 1= 0 to 10V ?	Define here if your analog speed input reference is unipolar or bipolar. Enter : • **0** for bipolar -10V … +10V • **1** for unipolar 0 … 10 V
Mains voltage Ur (V) =	Enter here the nominal value in V, of the voltage of your power supply. This value is used to detect a mains anomaly. Input value between 200 and 480 V. All mains voltages between 170 VAC and 530 VAC are considered being inside of the tolerances.
Partition selection 0=PC560 1=T.Bl.?	At this step you decide the way you want to select the active partition using either the **KEYPAD** or the **TERMINAL BLOC X2** • Enter **0** for KEYPAD control. At the next step, you will have to enter the partition No you want to be active. The **first partition is No "1".** • Enter **1** for **TERMINAL BLOC X2**. The selection of the active partition will be made using the terminals 34,35, 36, 37 and 38 of the TERMINAL BLOC X2.
Stop by default ? 0=Coast , 1=Stop.	For all non-destructive failure where the STOP can be monitored, like **Converter temperature, External Interlocks, ….** We can choice between 2 ways of stopping the motor: **0** Coast to rest **1** Braking down using the deceleration's ramp
Delay time (s)=	For all non-destructive failure where the turn off can be delayed, like **Converter temperature, External Interlocks, Motor temperature, …** a delay time of 0 to 5 s can be input here. This function is to allow the CNC to monitor the machine motion before the converter trips.
Catch spinning mot. 0=NO , 1=YES ?	When this function is activated, it is possible to catch a spinning motor and to accelerate it back to the set speed. Enter: • **0** to lock this function • **1** to activate it
PASSWORD:	To be able to read and / or modify the content of the available 32 partition you have to enter here the correct access password, which is 616.

Menu B - Part 2: Motor related parameters

This section of the menu B related to parameters that are linked to a specific partition. 32 partitions can be entered and recorded. They can be different motors or specific values for the same motor: for example if you want to limit the maximum speed at a lower value for reverse operation you enter a new partition and specify the speed you want. For the reverse operation you select then this specific partition. The following parameter group of the menu B can be entered **32** times.

Display	Description
Partition No =	During the programming process, you have to **Enter** now the **Partition No** to which the following parameters are related. During the operating process, you will select at this step the active partition. • Having selected KEYPAD control for the partition selection by entering **"0"** at the previous step, you can now **input** the **partition No** by just entering its numerical value 1 to 32. The first partition is No 1, the last one No 32. • Having selected **TERMINAL BLOC** control for the partition selection by entering "**1"** at the previous step, the selection will be done by applying +25 V to the terminals 34, 35, 36, 37 and 38 of the **TERMINAL BLOC X2.** As source for the +25V you can use any of the +25V terminals, the closest one is on terminal 33. The sequence of the partition selection using the TERMINAL BLOC X2 is the following: • Partition No 1 = terminal 34 • Partition No 2 = terminal 35 • Partition No 3 = terminals 34+35 • Partition No 4 = terminal 36 • and so on until Partition No 63 = all terminals 34, 35, 36, 37, 38 and 67 connected to +25 VDC (terminal 33) In **TERMINAL BLOC** mode if no selection is applied to terminals 34, to 67, the error message *"Partition selection missing"* will be displayed at START.
Number of poles	This is the number of poles and not the number of pairs. It must be an even number. This value is shown on the motor plate and/or in the motor data sheet. Maximum number of poles: 24
Motor power P(kW) =	Input here the power of the motor which will correspond to a 10 V signal when P_W is allocated to the analog output SAN
Iref source 0=PC560 1=Rtrip?	Motor current reference source. This function can be allocated to the KEYPAD or to a resistor R_{TRIP} connected to TERMINAL BLOC. Enter: • **0** for **KEYPAD** • **1** for R_{TRIP} to **TERMINAL BLOC.** R_{TRIP} is connected to terminals X2/15 and X2/16. For the setting of the current see page 18.
Motor nom. Current Inom (A) =	Value in A. This input is use to check the setting of current related parameters as follow: $\mathbf{I_{REF}}$ ≤ 150% of $\mathbf{I_{NOM}}$ **IFCC** ≤ 100% of $\mathbf{I_{NOM}}$ **IFCP** ≤ 20% of $\mathbf{I_{NOM}}$
Current accel/decel Iacc (A) =	Set here the maximum allowed current during acceleration / deceleration. The limit value is 200% of $\mathbf{I_{NOM}}$. The function **If I_m > I_{REF}:** is inhibited during acceleration and deceleration.

Menu B – Section 2 : Motor related parameters (cont…)

Display	Description
Motor current Iref (A) =	Enter here the reference current of the motor. Normally a value of maximum 150% of the nominal current of the motor is used. Any lower value can be set.
If Im>Iref 0=trip 1=dec. 2=ignore ?	Set here the reaction of the drive when the motor current I_m exceed the set reference value I_{REF}. Set: • **0** if you want to trip the drive • **1** if you want to reduce the output frequency F_S to keep the motor current lower than the reference current • **2** if you want to ignore the information. In this case the maximum current of the inverter will be available for the motor. The information that the current $I_m > I_{REF}$ can be allocated to one of the output relay (see menu C).
RI-compensation (V) =	The resistance **R** of the motor winding is source of a voltage drop proportional to the motor current **I**. The **RI** voltage will be added to the output voltage U_S to obtain the nominal torque over the entire frequency range. This function is mainly used when operating at the lower part of the range. The value can be set between 0 and 38 V.
Acceleration time (s) =	The **acceleration** time is set in seconds, between 1 to 255. This is the acceleration time needed to reach the full speed of the motor. If the set speed is the half of the full speed, the time to reach this speed will be the half of the acceleration set time. This value is a minimum and can't be reduced in menu D.
Deceleration time (s) =	The **deceleration** time is set in seconds, between 1 to 255. This is the deceleration time needed to reach zero speed from the full speed of the motor. If the set speed is the half of the full speed, the time to stop will be the half of the deceleration set time. This value is a minimum and can't be reduced in menu D.
Freq ctrl source 0=PC560 1=T.Bl.?	At this step you can set if you want to control the output frequency of the drive, respectively the motor speed using the KEYPAD or the TERMINAL BLOC X2. • Enter **0** for the **KEYPAD** control. You will here set the speed using the function **2ndF F** followed by the value of the **frequency** in Hz **or** the **speed** in RPM depending on your setting of the displayed unit - see **Speed display units** above. • Enter **1** for the **TERMINAL BLOC** control. The connections are described in paragraph **"The Speed Reference Input"** page 17.
Default frequency (Hz) =	In case of selection of the **Freq. ctrl source** selection from the **KEYPAD** frequency control, the value entered or shown here will be taken as speed reference input when the inverter is being turned ON. In programming mode you can change the value just by entering a new one. Here again, the input must be in Hz, input in RPM is not allowed and will lead to a mis-setting. In operating mode you can record here the last input made by **2ndF F**, using the quick recording process **2ndF J.**
Minimum frequency (Hz) =	Enter the minimum allowed operating frequency in Hz. Input in RPM is here not allowed and will lead to a mis-setting. • Any reference input lower than this value will be ignored. • This low limit is active when the **Freq. ctrl source** has been selected either from the **TERMINAL BLOC** from the **KEYPAD** • Possible values:0 to F_{MAX}

Menu B – Section 2 : Motor related parameters (cont…)

Display	Description
Pre-set Frequency 1	If you have selected the **Freq. ctrl source** from the **TERMINAL BLOCK** in the Menu B- Part 1, you have the possibility to define up to 3 pre-set speeds. The selection of one of those pre-set speeds will be done applying +24V to the terminals 73 and 74 of the TERMINAL BLOCK X2. If this feature has been activated and no selection made through terminals , the analog reference input will be active. Here again, the input must be in Hz, input in RPM is not allowed and will lead to a wrong setting. • Enter pre-set frequency **1** • In operating mode, the selection is made applying +25V to terminal X2/73 of TERMINAL BLOCK X2
Pre-set frequency 2	• Enter pre-set frequency **2** • In operating mode, the selection is made applying +25V to terminal X2/74 of TERMINAL BLOCK X2
Pre-set frequency 3	• Enter pre-set frequency **3** • In operating mode, the selection is made applying +25V to terminals X2/73 and X2/74 of TERMINAL BLOCK X2
Proh. Frequency 1 (Hz)=	With the K4000 it is possible to define up to three prohibited operating frequency fields. This feature can be used to avoid having the system running at speeds where a vibration resonance area exist or may exist. Any speed reference inside of the prohibited area will run at the closest lowest or highest limit of the area. Here again, the input must be in Hz, input in RPM is not allowed and will lead to a mis-setting. The overlap of prohibited frequencies is **not allowed**. Prohibited area 1 - based frequency • Enter first prohibited frequency in Hz. This value is the middle of the bandwidth set in the next step.
Proh. Band 1 (Hz)=	Prohibited area 1 - frequency bandwidth • Enter bandwidth in Hz.
Proh. Frequency 2 (Hz)=	Prohibited area 2 - based frequency • Enter first prohibited frequency in Hz. This value is the middle of the bandwidth set in the next step.
Proh. Band 2 (Hz)=	Prohibited area 2 - frequency bandwidth • Enter bandwidth in Hz.
Proh. Frequency 3 (Hz)=	Prohibited area 3 - based frequency • Enter first prohibited frequency in Hz. This value is the middle of the bandwidth set in the next step.
Proh. Band 3 (Hz)=	Prohibited area 3 - frequency bandwidth • Enter bandwidth in Hz.
Measure speed 0-no, 1-yes	If the frequency converter is equipped with the option “Speed Sense”, enter here a **1,** in other case enter **0.** This is only a speed measurement and not a speed closed loop.
Nbre pulses/revol. =	If the motor is fit with a speed feedback, the speed measurement option installed and the function **1** selected above, you have to enter here the number of pulses per revolution. Value: **1** to **256**
Slip in % =	Using the speed feedback is it possible to monitor the slip of the motor and issue a signal when the slip exceed a pre-set value. Input of the maximum slip: 0.1 to 10.0 %

Menu B – Section 2 : Motor related parameters (cont…)

Display	Description
MCM - 0 = Abs. 1 = SH 2 = DTO 3 = none	Motor Current Monitoring: functions =, 1 and 2 can be allocated to one of the relay output. • **0 =** you are working in **Abs**olute value. The motor current is compared to the value entered in the next step. • **1** = **S**ample & **H**old: the motor current is compared to a reference value recorded by closing a contact between terminals X2/13 and X2/14. The current reference is the motor current at closing of the contact. • **2** = **D**ynamic **T**ool t**O**uch. The dynamic variation of the motor current is compared to a factor set in the next step. • **3** = No current monitoring is active. This is our standard factory setting. **For each partition up to 4 sensitivity level can be programmed.** Selection is made using the terminals X2/6 and X2/7
Depending on the selection of the MCM type (ABS, SH or DTO) we have to input now for **MCM1,** the required sensitivity. **MCM1** is selected when no 25 V is applied to terminals X2/6 and X2/7	
Current Iabs 1 (A) =	Set here the absolute reference value to which the motor current must be compared to trigger the allocated output.
Current Ish 1 (A) =	The value to set here is the sensitivity of the SH monitoring. The value set is the current increase (A) versus the recorded one, which will trigger the corresponding output. At the opening of the contact between X2/13 and X2/14, the instant value of I_m is recorded. As soon the motor current exceed "***the recorded I_m + I_{SH}***", the allocated output will be triggered
Current IDTO 1 =	Enter here the dynamic sensitivity factor, value between 0 to 300. Higher is the factor, lower is the sensitivity. The allocated relay will switch for approximately 200 ms.
Depending on the selection of the MCM type (ABS, SH or DTO) we have to input now for **MCM2,** the required sensitivity. **MCM2** is selected when 25 V is applied to terminals X2/6	
Current Iabs 2 (A) =	Set here reference value as describe above
Current Ish 2 (A) =	Set here reference value as describe above
Current IDTO 2 =	Set here reference value as describe above
Depending on the selection of the MCM type (ABS, SH or DTO) we have to input now for **MCM3,** the required sensitivity. **MCM3** is selected when 25 V is applied to terminals X2/7	
Current Iabs 3 (A) =	Set here reference value as describe above
Current Ish 3 (A) =	Set here reference value as describe above
Current IDTO 3 =	Set here reference value as describe above
Depending on the selection of the MCM type (ABS, SH or DTO) we have to input now for **MCM4,** the required sensitivity. **MCM4** is selected when 25 V is applied to terminals X2/6 and X2/7	
Current Iabs 4 (A) =	Set here reference value as describe above
Current Ish 4 (A) =	Set here reference value as describe above
Current IDTO 4 =	Set here reference value as describe above

Menu B – Section 2 : Motor related parameters (cont…)

Display	Description
FCC duration (s) =	DC braking current duration. This function, when activated, is automatically initiated after a STOP command, when the DC bus reaches 10% (≤ 35 V).
FCC current IFCC(A) =	Value of the DC injected braking current. IFCC should not be higher than the nominal current of the motor.
Permanent current IFCP(A) =	Value of the permanent injected DC braking current. This function is used when the motor needs to be braked (holding torque) at standstill, for example to keep air bearing spindle from rotating at stop. We suggest setting this current not higher than 20% of the motor nominal current.
Low freq. smoothing =	Low frequency smoothing. Some standard motors may show stability problems at low frequency, particularly around 30 Hz. The stability can be improved by setting here a smoothing factor, value between **0 and 250**.
Slip compensation =	The torque of a synchronous motor is generated by the slip, i.e. the speed difference between the rotor and the rotating field in the stator. This slip increase with the load, consequently the speed will drop. The correct setting of this factor, a value between **0 and 254**, will compensate the speed reduction due to the load and keep the speed close to constant. The correct factor will be found by measuring the speed under load and increasing the factor until the speed remains constant. Factor **254** correspond to 10% compensation for $\mathbf{I_m = I_{REF}}$, if $\mathbf{I_m = 0.5*I_{REF}}$, the compensation will be 5%.
U_S /F_S Pt. 1 (V/Hz) **U_S = F_S =**	Enter the **U/F** characteristic. Start point **0V/0Hz** is already stored. For input information, see page 27
	**To complete and close the input of one partition or group of parameters, you must, after having confirmed the last point of the U_S /F_S, key in "2ndF" followed by "ENTER". If not, your last input will be lost.**

Menu C : Allocation of the relay outputs

Access in STOP mode only

The digital outputs are: relay RE1, output No 1 = terminals 25, 26, 27
relay RE2, output No 2 = terminals 28, 29, 30
relay RE3, output No 3 = terminals 52, 53, 54
relay RE4, output No 4 = terminals 55, 56, 57
relay RE5, output No 5 = terminals 22, 23, 24

The digital outputs are located on the TERMINAL BLOC X2. To allocate one or more of the available functions, just input the corresponding relay Nr.

Functions to allocate	Comments on the allocated function
Reached frequency: **Relay nr. =**	The allocated relay contact will switch as soon the output frequency of the converter is higher than 95% of the set value.
Reached speed: **Relay nr. =**	The allocated relay contact will switch as soon the measured motor speed 95% of the set value. This function need the option “Speed Sense”
Zero frequency: **Relay nr. =**	The allocated relay contact will switch as soon the output frequency of the converter is under 0.5 Hz **This function is only active in STOP mode**
Zero speed: **Relay nr. =**	The allocated relay contact will switch as soon the measured output speed is lower than 2 pulses / sec.. This function is active only in STOP status
Start/stop: **Relay nr. =**	The allocated relay contact will switch as soon the converter is in START mode
Motor overload: **Relay nr. =**	The allocated relay contact will switch as soon the motor current is higher than the reference current: $\mathbf{I_m > I_{REF}}$. This choice is only possible if the condition “ 2 = None” has been programmed in menu B.
MCM output: **Relay nr. =**	The allocated relay contact will switch as soon the **MCM** condition set in menu B is true.
Slip Output: **Relay nr. =**	The allocated relay contact will switch as soon as the **SLIP** is higher than the programmed value. Need **SpeedSense** option.
Alarm output: **Relay nr. =**	The allocated relay contact will switch as soon as an **alarm** has been triggered. This function is used in combination with the delayed trip by non destructive failure (see programming in the menu B)
Comp. output: **Relay nr. =**	The allocated relay contact will switch, after the programmed delay, when the analog input exceed the programmed level.
Failure: **Relay nr. =**	**This function is an inverted one.** In failure free status, the allocated relay is powered on. The relay will fall down for any failure. **Never combine this function with an other one.**
Ext. interlocks: **Relay nr. =**	The allocated relay contact will switch as soon the external interlock circuitry is open. Terminals 39 / 40 of the TERMINAL BLOC X2. If this function is not used, a strap must be placed between terminals 39 and 40.
Converter overload: **Relay nr. =**	The allocated relay contact will switch if the output current exceeds the maximum current of the converter. This current value is shown in the **Menu A.**
Def. aux. supply: **Relay nr. =**	In failure free status, the allocated relay is powered off. The relay will pull in case of auxiliary power supply failure and an output signal will be triggered.
Motor temp (PTC): **Relay nr. =**	The allocated relay contact will switch if the motor temperature is to high respectively is the resistance of the circuitry between terminals 58 / 59 of the TERMINAL BLOC X2 exceed 3000 Ω. If this function is not used, a strap must be placed between terminal X2/58 and X2/59

Menu C : Allocation of the analog output

Access in STOP mode only

Functions to allocate to one of the digital outputs	Comments on the allocated function
Converter temp (NTC) Relay nr. =	The allocated relay switches if the heatsink temperature exceeds 70°C, tolerance ± 3°C..
Mains anomaly: Relay nr. =	The mains voltage is compared to the value entered in Menu B - part 1 and the allocated relay will switch if the mains voltage is out of the tolerance of 480 V+10 % respectively 200 V –15%.
SAN1:1=Fs, 2=Im, 3=N4=Pw, 5=Iw, 6=Us	Set here the parameter you want to allocate to the analog output **SAN1**, TERMINAL BLOC X2/41 – X2/42 • **1** for the output frequency: 10 V = $\mathbf{F_{max}}$ • **2** for the motor current : 10 V = $\mathbf{I_{NOM}}$ • **3** speed of the motor 10 V = $\mathbf{N_{MAX}}$ need the option “Speed Sense” • **4** active output power 10 V = $\mathbf{P_{MAX}}$ of motor • **5** active output current 10 V = $\mathbf{P_{MAX}}$ **/** 1.28 $\mathbf{U_S}$ • **6** for output voltage: 10 V = last $\mathbf{U_S}$ **/** $\mathbf{F_S}$ **Pt.**
SAN2:1=Fs, 2=Im, 3=N4=Pw, 5=Iw, 6=Us	Set here the parameter you want to allocate to the analog output **SAN2**, TERMINAL BLOC X2/69 – X2/70
Comp. level (0-10) (V) =	Enter here you comparison level between 0 … 10 VDC. This is the comparison value for AI1
Time delay (s) =	Delay to trigger the output when the above comparison level has been exceeded. Delay 0 … 5 s

Menu D: The parameters accessible in START mode

Access allowed in START mode

The following parameters have been described in the menu B. For complete information please refer to **Menu B**

Display	Description
Filter freq. ctrl (1 to 10) =	1 to 10
Acceleration time	1 to 255 s – Values < the one of menu B are not accepted
Deceleration time	1 to 255 s – Values < the one of menu B are not accepted
Freq ctrl source 0=PC560 1=T.Bl.?	Keypad = 0, Terminal block = 1
MCM - 0 = Abs. 1 = SH 2 = DTO 3 = none?	The current monitoring function. Only the MCM value selected through terminals X2/6 and X2/7 will be displayed
Courant labs(A) =	A current $< I_{REF}$
Courant Ish(A) =	A sensitivity value
Courant IDTO =	A dynamic factor between 0 and 300. In START a $ will be displayed on pos. 18 / second line when the condition is true, i.e. the allocated relay pulls.
FCC duration s) =	A time between 0 and 60 s
FCC current IFCC(A) =	A current $\leq$ $\mathbf{I_{NOM}}$ of the motor
Permanent current IFCP(A) =	A current $\leq$ 20% of $\mathbf{I_{NOM}}$ of the motor
Low freq. smoothing =	A smoothing factor between **0 and 250**
Slip compensation =	A compensation factor between **0 and 254**

Menu E : reversing from KEYPAD

2ndF E will reverse the rotation direction of the motor, but only if **0** has been programmed in the corresponding step of the **Menu B - part 1**. If reversing from the **TERMINAL BLOC** X2 has been selected the following message will be displayed: **"Reversing assigned to T. Bloc!!!"**

If in the menu B, within the active partition, the reversing has been prohibited, the message: **"Reversing prohibited"** will be displayed.

Menu F : Setting a new speed using the KEYPAD

2ndF F will allow to change the speed of the motor, but only if **0** has been programmed in the corresponding step of the **Menu B - part 1**. Following messages can be displayed:

Display	Description
New frequency (Hz) =	If frequency has been selected as unit in **Menu B - Part 1** See "**Speed display units"**
New frequency (rpm) =	If speed has been selected as unit in **Menu B - Part 1** See **"Speed display units"**
Freq ctrl assigned to T.Block !!!	If **TERMINAL BLOC** has been selected in Menu B - Part 1 See **"Freq. ctrl source"**

To enter the new frequency or speed just type in the desired value of the frequency in Hz or the speed in RPM and confirm with **ENTER**

Menu G : Selection of the display bloc

Allow to select between 3 blocs of information to be displayed.
Any time you enter **2ndF G** you will switch to the next display bloc.

Bloc 1		**Bloc 2**		**Bloc 3**	
P =	F_c =	F =	U =	P_w =	U_d =
I =	F =	I =	U_r =	I_w =	I_{REF} =

P	Partition number	U_r	Mains voltage
I	Motor current in A	U_d	DC bus voltage
F_c	Output frequency reference	P_w	Active power W
F	Output frequency actual	I_w	Active current A
U	Output voltage V	I_{REF}	Motor reference current A

Bloc 2 is displayed only in **START**

Bloc 4 is described hereafter.

Display of the digital I/O status

With the display bloc 4 you can visualize, using the 2 lines of 20 characters, the status of the digital Inputs and Outputs available on TERMINAL BLOC X2. Each assigned character show a **0** if the corresponding input is not activated or **low**, respectively a **1** if activated or **high.**

Regarding the assignment of the analogue outputs **SAN1** and **SAN2,** characters 18 and 19 of the second line, a number between 1 and 6 will be displayed, according the number of the parameter assigned by program – see page 28

Pos	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20
N1	INPUTS			G^0	G^1	G^2	G^3	G^4	G^5	SH	FF^0	FF^1	Key	NTC		EXT	RST	COMC	M	RS
X2	TERM. BLOC X2			34	35	36	37	38	67	14	73	74	47	--		40	49	12	---	---
N2	ISR	MC^0	MC^1	INHA	OUTPUTS				STP	STR		RE1	RE2	RE3	RE4	RE5		SAN1	SAN2	
X2	32	06	07	63	TERMINAL BLOC X2				9	10		22	41	37	34	31		17	69	

Character	Short name	Description	X2 / term. No
Line 1 – 01	***INPUTS***	Not used	
02		Not used	
03		Not used	
04	**G^0**	Partition selection **2^0**	**34**
05	**G^1**	Partition selection **2^1**	**35**
06	**G^2**	Partition selection **2^2**	**36**
07	**G^3**	Partition selection **2^3**	**37**
08	**G^4**	Partition selection **2^4**	**38**
09	**G^5**	Partition selection **2^5**	**67**
10	**SH**	Sample Hold sampling signal	**14**
11	**FF^0**	Pre-set frequency selection **2^0**	**73**
12	**FF^1**	Pre-set frequency selection **2^1**	**74**
13	**KEY**	Program access key	**47**
14	**NTC**	Heatsink temperature sensor	**-**
15		Not used	
16	**EXT**	External interlocks	**40**
17	**RST**	Reset on TERMINAL BLOC X2	**49**
18	**COMC**	Selection of drive control source	**12**
19	**M**	Drive in Start mode	**-**
20	**RS**	By ± 10 V speed reference, display the sign of the input 0 (-) or 1 (+)	**-**
Line 2 - 01	**ISR**	Reversing signal on TERMINAL BLOC	**32**
02	**MC^0**	MCM selection **2^0**	**06**
03	**MC^1**	MCM selection **2^1**	**07**
04	**INHA**	Inhibit of the analogue speed reference	**63**
05		Not used	
06	***OUTPUTS***	Not used	
07		Not used	
08		Not used	
09	**STP**	Input signal for STOP	**09**
10	**STR**	Input signal for START	**10**
11			
12	**RE1**	Relay 1 – Status of the NO contact	**31**
13	**RE2**	Relay 2 – Status of the NO contact	**34**
14	**RE3**	Relay 3 – Status of the NO contact	**37**
15	**RE4**	Relay 4 – Status of the NO contact	**41**
16	**RE5**	Relay 5 – Status of the NO contact	**22**
17			
18	**SAN1**	Display the number of the assigned functions to analogue outputs	**41**
19	**SAN2**		**69**
20		Not used	

Menu H : Display of the last 8 failures

Allow to display the last 8 failures recorded in a FIFO table.

Menu I : RESET

2ndF I will RESET the drive and allow to start again if the cause of the failure has been removed.

Menu J : Save the last speed reference as default

In the **KEYPAD** operation this instruction allows a fast save of the last inputted speed reference value, without to go through the all **Menu B**.

Setting a value using the “Arrow UP” and “Arrow DOWN”

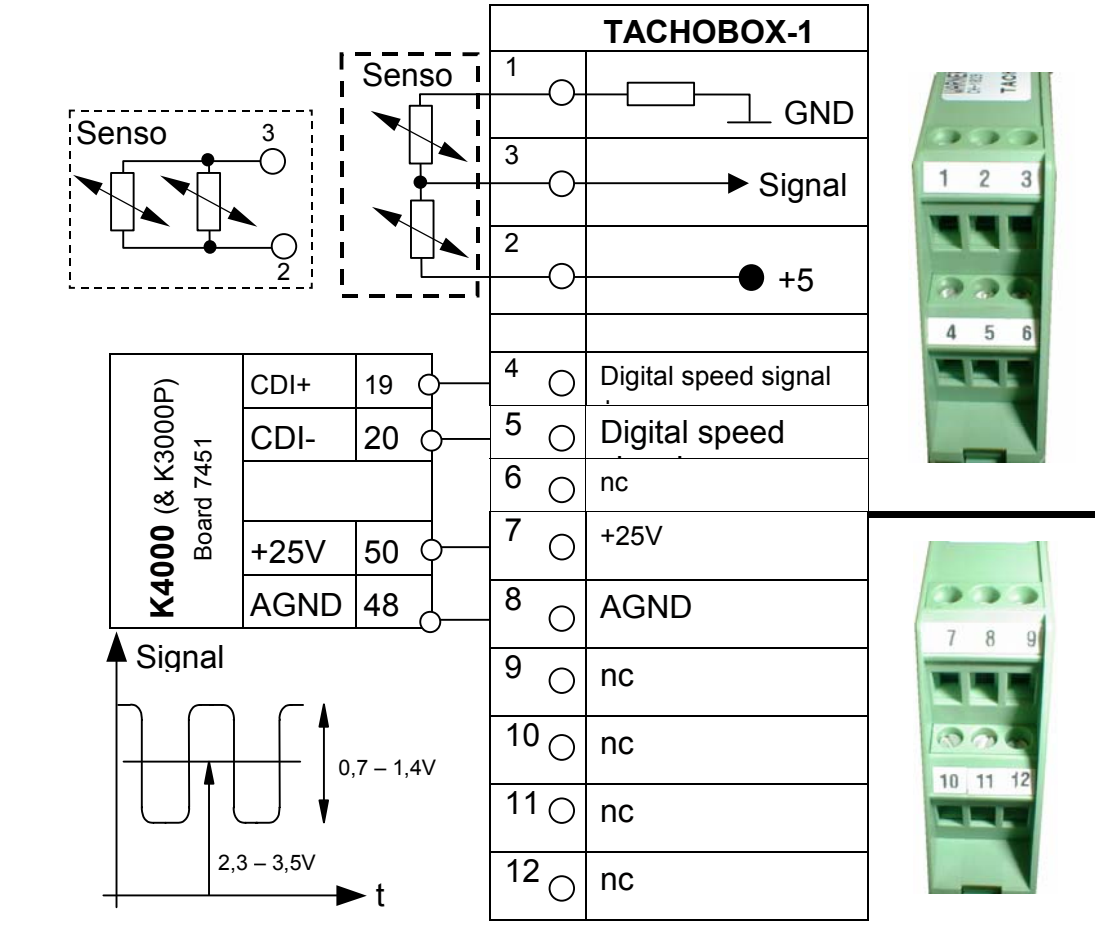
Two parameters can be set using the “Arrow UP” and “Arrow DOWN” of the KEYPAD

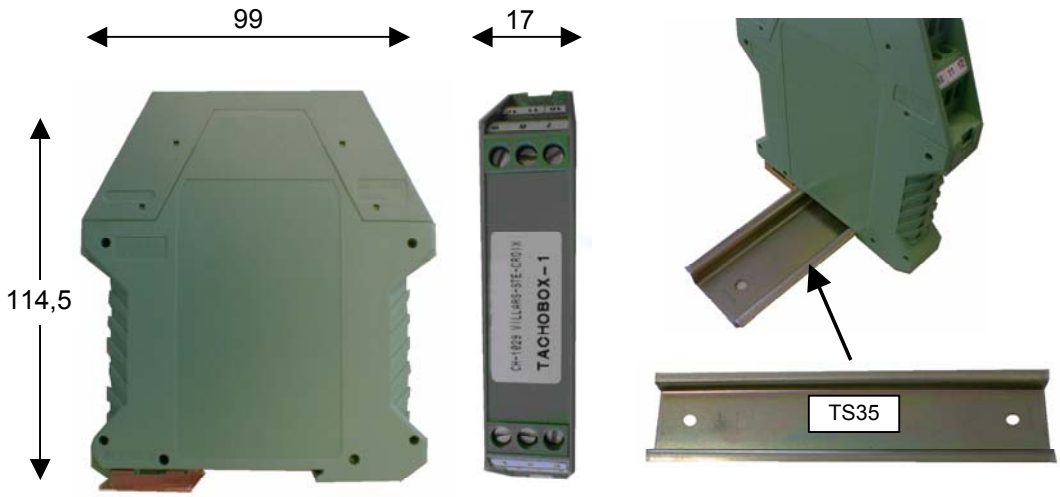
- The speed reference **2ndF F**
- The $\mathbf{I_{DTO}}$ value of the **MCM** when accessed from **menu D**

Once you arrived to the corresponding menu step, the function is automatically activated. To leave the step and confirm the value, just key in **Enter**.

During the setting of the $\mathbf{I_{DTO}}$ of MCM, a **$** sign will be displayed at the position 18 of the second line of the display.

The Tachobox Option



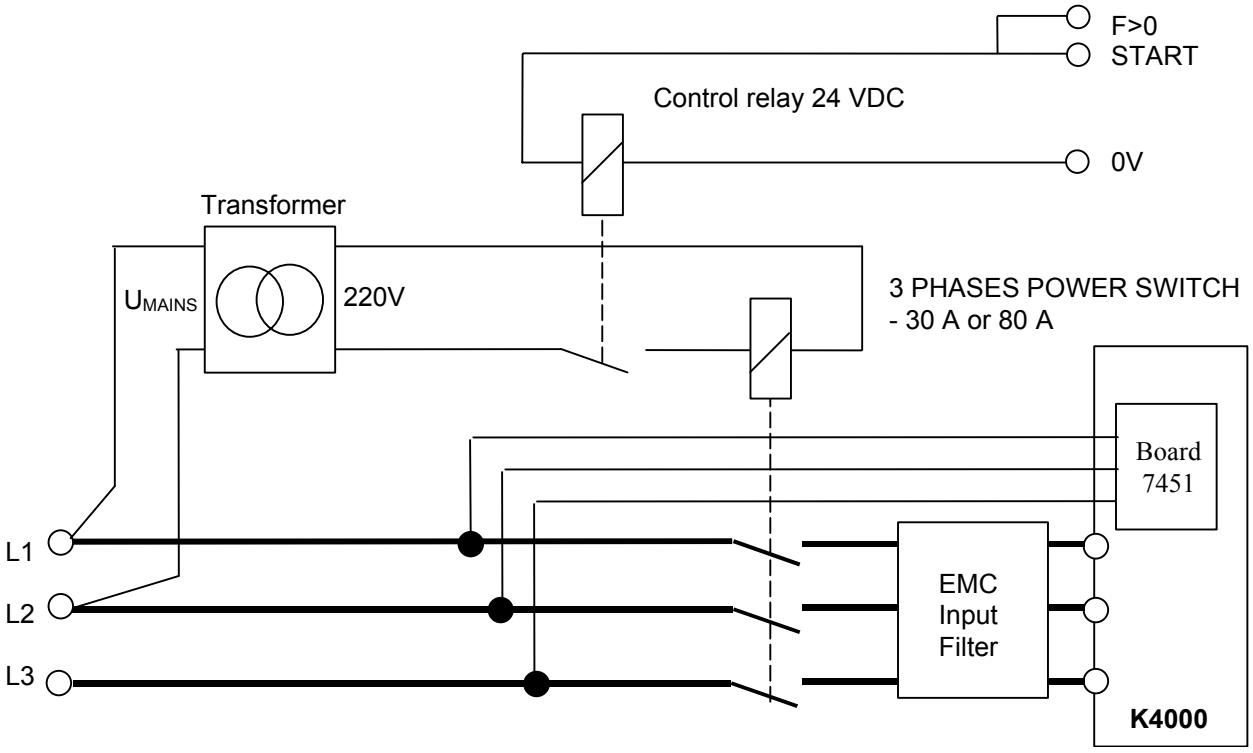


Galvanic insulation of the power circuitry

Function

This option includes a EMC input line filter and the galvanic interruption of the power connections in front of the filter when the drive is in STOP mode, the control part of the inverter remains powered.

Principle



Part Numbers

- **HPSF30** for input current up to 30 A, i.e. up to K4030
- **HPSF80** for input current up to 80 A, i.e. up to K4060
- **The design for the K4090 and K4120 is not yet completed**

Order instruction

The Power Switch Option will be an additional line on the order, exemple:

1 HKU4030-20
1 PSF30

K4000 – List of Error messages

Messages	Explanation
No communication	Fatal error. No communication between the KEYPAD PC580 and the drive. Check connecting cable.
Freq ctrl assigned on T.Block	The speed control function has been assigned to TERMINAL BLOC X2 in menu B and you try to change the speed from the KEYPAD
Partition coding is missing	You selected the partition coding via the terminal block and no selection is made. This message is displayed only after a START command has been issued to the drive.
Partition coding through T.Block	Partition selection is allocated to TERMINAL BLOC X2 and you want to select it using the KEYPAD
Reversing assigned on T.Block	The direction reversing function has been assigned to TERMINAL BLOC X2 in menu B and you try to reverse direction from the KEYPAD
Access locked	The is locked by the KEY function on TERMINAL BLOC X2/47 AND X2/48
Motor overload Im>Iref	The converter tripped because the motor current was higher than the programmed reference current. This function is programmed in menu C and a relay will be allocated to it. A time delay can be allocated too.
Please wait before resetting again	Display when trying to do a RESET when the intermediate DC bus voltage is still higher than 30 VDC. Just wait for a while and perform a new reset.
Converter temp. to high !!!	The temperature of the heatsink exceed 75°C
Motor temperature to high (PTC)	Overheating of the motor, detected by the PTC
Motor temperature to high (NTC)	Overheating of the motor, detected by the NTC
External Interlocks !!!	External interlock circuitry open See TERMINAL BLOC X2/39 – X2/40
Converter overloaded	Displayed in case of short-circuit at the output or high current peak exceeding the capacity of the drive.
Defect auxiliary supply !!!	In case of problem with the auxiliary power supply 24, ± 15 or 5 VDC
Mains out of tolerance !! !	Displayed if your mains voltage is lower than 170 VAC respectively higher than 530 VAC. Any value in between is considered being within the tolerances
Failure on module No 1	The output power IGBT No1 is broken
Failure on module No 2	The output power IGBT No2 is broken
Failure on module No 3	The output power IGBT No3 is broken
Failure on Chopper module	The IGBT of the chopper is broken
Failure on Brake module	The IGBT of the braking chopper is broken
"Stop" circuit open !!!	When you try to START. Check connection X2/8 – X2/9 on terminal block. This circuitry must be closed to START.
Switch to catch a spinning motor OPEN	To catch a spinning motor. Check the circuitry X2/45 and X2/46
"Start/Stop" assigned to Terminal Block	START function is allocated to TERMINAL BLOC X2 and you tried to start using the KEYPAD
"Start/Stop" assigned to keypad !!	START function is allocated to KEYPAD and you tried to start using the TERMINAL BLOC X2
Not allowed in STOP !!!"	You tried to reverse direction in STOP
Access forbidden During WORK	The drive is in START mode and you try to access to Menu B or C using the KEYPAD
No errors recorded !!!	Displayed after **2ndF H** if the memory of failure is empty

Part numbers for spares, options and accessories

Part Number	Spare
HB7701	Control board
HB7451	Power supply board
HPC560DX0	KEYPAD for mounting in cabinet door, without cable
H9000099-LL	Cable for PC560DX0, LL is the length in meter
HPC560DX1	Keypad with housing for remote control, without cable
H9000103-LL	Cable for PC560DX1, LL is the length in meter
	Braking resistors without protective grid
HFRR4015-200-NG	For K4005, 4010, 4015, temperature sensor 200°C
HFRR4015-080-NG	As above, temperature sensor 80°C
HFRR4030-200-NG	For K4020 and 4030, temperature sensor 200°C
HFRR4030-080-NG	As above, temperature sensor 80°C
HFRR4060-200-NG	For K4040 and 4060, temperature sensor 200°C
HFRR4060-080-NG	As above, temperature sensor 80°C
HFRR4120-200-NG	For K4090 and 4120, temperature sensor 200°C
HFRR4120-080-NG	As above, temperature sensor 80°C
	Options
HTACHOBOX-1	Tachobox
HPC600DX0	KEYPAD for mounting in cabinet door, without cable High luminosity display
H9000099-LL	Cable for PC600DX0, LL is the length in meter
HPC600DX1	Keypad with housing for remote control, without cable High luminosity display
H9000103-LL	Cable for PC600DX1, LL is the length in meter
HPSF30	Galvanic insulation of the power circuitry For K4005, 4010, 4015, 4020, 4030
HPSF80	Galvanic insulation of the power circuitry For K4040 and 4090
	Accessories
HKIT-K3030/K4030	Converting kit to replace a KT3030 drive with a KT4030. The kit includes: - mounting plate - cable - screws, nuts, bolts - instructions
HKIT-K4030/K3030	Converting kit to replace a KT4030 drive with a KT3030 - kit content as above

Assistance and Trouble shooting

All our products are manufactured in accordance with an accurate quality process. Before delivery they are checked for many hours under power. The quality system and production process guarantee that all products are shipped free of default.

The respect of the installation procedure describes in this manual and a correct definition of the application should avoid any commissioning problems.

Should you meet some problems during installation or commissioning of the frequency inverter our technical staff are available for assistance. Please contact your local supplier or the local DANAHER-MOTION subsidiary.

Please includes following information:

1. Description of the application
2. Default or problem you met
3. Copy of the programmed parameters, Menu B and C
4. Wiring diagram

Overview of Menu A, B and C

Menu A: Converter parameters

Display	Please copy Menu A data
Max. current. A	
Softwareversion	
Date of delivery	
Serial number	
Running timer	
Time power applied	

Menu B : Operation / Motors

Display	FS	CS
0=F 1=GB 2=D 3=I 4=E	**1**	
Menu locking 0=B,C	**0**	
Start/Stop (choice) 0=PC560	**0**	
Speed display units 1=rpm	**1**	
Motor reversing 0=NO	**0**	
Motor reversing 0=PC560	**0**	
Filter analog frequence ctrl.	**1**	
Frequence ctrl 1= 0 to 10V	**1**	
Mains voltage V	**400**	
Partition selection 0=PC560	**0**	
Stop by default ? 0=Coast	**0**	
Delay time s	**0**	
Catch spinning mot. 0=NO	**0**	
PASSWORD:	**xxx**	
Partition No =	**1**	
Number of poles	**2**	
Motor power P(kW)	**1**	
Iref source 0=PC560	**0**	
Motor nom. Current Inom A	**1**	
Current accel/decel Iacc A	**1**	
Motor current Iref A	**1**	
If Im>Iref 0=trip	**0**	
RI-compensation V	**0**	
Acceleration time s	**10**	
Deceleration time s	**10**	
Freq ctrl source 0=PC560	**0**	
Default frequency Hz	**1**	
Minimum frequency Hz	**1**	
Pre-set Frequency 1 Hz	**0**	
Pre-set frequency 2 Hz	**0**	
Pre-set frequency 3 Hz	**0**	
Proh. Frequency 1 Hz	**0**	
Proh. Band 1 Hz	**0**	
Proh. Frequency 2 Hz	**0**	
Proh. Band 2 Hz	**0**	
Proh. Frequency 3 Hz	**0**	
Proh. Band 3 Hz	**0**	
Measure speed 0-no	**0**	
Nbre pulses/revolution	**0**	
Slip in %	**0**	

Display	FS	CS
MCM - 3 = none	**3**	
Current Iabs 1 A	**0**	
Current Ish 1 A	**0**	
Current IDTO 1 A	**0**	
Current Iabs 2 A	**0**	
Current Ish 2 A	**0**	
Current IDTO 2 A	**0**	
Current Iabs 3 A	**0**	
Current Ish 3 A	**0**	
Current IDTO 3 A	**0**	
Current IDTO 3 A	**0**	
FCC duration s	**0**	
FCC current IFCC A	**0**	
Permanent current IFCP A	**0**	
Low freq. smoothing	**0**	
Slip compensation	**0**	
U_S /F_S Pt. 1 U_S = F_S =	**1/50**	
Us/Fs Pt. 2 Us = Fs =		
Us/Fs Pt. 3 Us = Fs =		
Us/Fs Pt. 4 Us = Fs =		

Menu C : Inputs / Outputs

Display	
Reached frequency	Rel. No = 0
Reached speed	Rel. No = 0
Zero frequency	Rel. No = 0
Zero speed	Rel. No = 0
Start/stop	Rel. No = 0
Motor overload	Rel. No = 0
MCM output	Rel. No = 0
Slip Output	Rel. No = 0
Alarm output	Rel. No = 0
Comp. output	Rel. No = 0
Failure	**Rel. No = 5**
Ext. interlocks	Rel. No = 0
Converter overload	Rel. No = 0
Def. aux. supply	Rel. No = 0
Motor temp (PTC)	Rel. No = 0
Converter temp (NTC)	Rel. No = 0
Mains anomaly	Rel. No = 0
SAN1:1=Fs, 2=Im, 3=N4=Pw, 5=Iw, 6=Us	Output No 1
SAN2:1=Fs, 2=Im, 3=N4=Pw, 5=Iw, 6=Us	Output No 2
Comp. level V	
Time delay s	

FS : Factory setting
CS : Customer setting

DECLARATION OF CONFORMITY

We: **Danaher Motion**

declare under our sole responsibility that the products of the family

K4000

are exclusively designed for incorporation in an other machine. The operation of the product is submitted to the conformity of the complete equipment, following the provisions of the directive **89/392/EEC**

The conformity of the above specified products with the provisions of the Directive **73/23/EEC** is supported by the respect of the standards **CEI/IEC 1010-1**

If the mounting and connecting instructions of the installation's manual have been respected, this product will be conform to the standards **EN50081-1** and **EN50082-1** relating to the EMC directive **89/336/EEC**.

Mounting instructions related to the EMC - directive 89/336/EEC

1. The frequency converter must be mounted in a closed metal cabinet.
2. The power connection between converter and motor must be MADE using shield cable.
3. The control connection must utilize shielded cables.
4. The shield of the cables must be grounded at both ends.
5. Power connections and control connection must be placed in separated canals.
6. A line filter must be installed. The machine manufacturer has the option to use a single filter for all of his equipment. In this case the correct definition and sizing of the filter is his responsibility. If the option of a separate filter is selected, this filter will have to match the following specification:

Units	Filter type	I_{Nom} (A)
K4005	FMAC-0931-0810	8
K4010	FMAC-0932-1610	16
K4015	FMAC-0932-1610	16
K4020	FMAC-0932-2510	25
K4030	FMAC-0934-3610	36
K4040	FMAC-0934-5010	50
K4060	FMAC-0953-6410	64
K4090	FMAC-0954-H110	110
K4120	FMAC-0955-H210	180

Supplier: Timonta, Mendrisio (Switzerland)