vacon

DRIVEN BY DRIVES

USER'S MANUAL

NX LIQUID-COOLED
FREQUENCY CONVERTERS

AT LEAST THE FOLLOWING STEPS OF THE *START-UP QUICK GUIDE* MUST BE PERFORMED DURING THE INSTALLATION AND COMMISSIONING.

IF ANY PROBLEMS OCCUR, PLEASE CONTACT YOUR LOCAL DISTRIBUTOR.

Start-up Quick Guide

1. Check that the delivery corresponds to your order, see Chapter 3.
2. Before taking any commissioning actions read carefully the safety instructions in Chapter 1.
3. Check the size of the motor cable, mains cable, mains fuses and check the cable connections, read Chapters 6.1.1.1 – 6.1.2.
4. Follow the installation instructions, see Chapter 6.1.3.
5. Control connections are explained in Chapter 6.2.2.
6. Ensure the adequate pressure and flow of the cooling agent you are using. See Chapter 5.2.
7. If the Start-Up wizard is active, select the language of the keypad and the application you want to use and confirm by pressing the *Enter button*. If the Start-Up wizard is not active, follow the instructions 7a and 7b.

7a. Select the language of the keypad from the Menu **M6**, page **6.1**. Instructions on using the keypad are given in Chapter 7.

7b. Select the application you want to use from the Menu **M6**, page **6.2**. Instructions on using the keypad are given in Chapter 7.

8. All parameters have factory default values. In order to ensure proper operation, check the rating plate data for the values below and the corresponding parameters of parameter group G2.1.
   - nominal voltage of the motor
   - nominal frequency of the motor
   - nominal speed of the motor
   - nominal current of the motor
   - motor cosφ

   All parameters are explained in the All in One Application Manual.
9. Follow the commissioning instructions, see Chapter 8.
10. The Vacon NX Liquid-Cooled Frequency Converter is now ready for use.

Vacon Plc is not responsible for the use of its products against instructions.

CONTENTS

VACON NX LIQUID-COOLED FREQUENCY CONVERTERS AND INVERTERS USER'S MANUAL

INDEX

1 SAFETY

2 EU DIRECTIVE

3 RECEIPT OF DELIVERY

4 TECHNICAL DATA

5 INSTALLATION

6 ELECTRICAL CABLING AND CONNECTIONS

7 CONTROL KEYPAD

8 COMMISSIONING

9 FAULT TRACING

ABOUT THE VACON NX LIQUID-COOLED FREQUENCY CONVERTERS AND INVERTERS USER'S MANUAL

Congratulations for choosing the Smooth Control provided by Vacon NX_W Liquid Cooled drives!

The User's Manual will provide you with the necessary information about the installation, commissioning and operation of Vacon NX Liquid-Cooled drives. We recommend that you carefully study these instructions before powering up the frequency converter for the first time.

This manual is available in both paper and electronic editions. We recommend you to use the electronic version if possible. If you have the **electronic version** at your disposal you will be able to benefit from the following features:

The manual contains several links and cross-references to other locations in the manual which makes it easier for the reader to move around in the manual, to check and find things faster.

The manual also contains hyperlinks to web pages. To visit these web pages through the links you must have an internet browser installed on your computer.

Vacon NX Liquid-Cooled Frequency Converters and Inverters User's Manual

Index

Document code: ud00907
Date: 7.7.2006

1. SAFETY 8
1.1 Warnings 8
1.2 Safety instructions 8
1.3 Earthing and earth fault protection 9
1.4 Running the motor 9
2. EU DIRECTIVE 10
2.1 CE marking 10
2.2 EMC directive 10
2.2.1 General 10
2.2.2 Technical criteria 10
2.2.3 Vacon frequency converter EMC classification 10
2.2.4 Manufacturer's declaration of conformity 11
3. RECEIPT OF DELIVERY 13
3.1 Type designation code 13
3.2 Storage and shipping 14
3.3 Maintenance 14
3.4 Warranty 14
4. TECHNICAL DATA 15
4.1 Introduction 15
4.2 Power ratings 17
4.2.1 Frequency converters 17
4.2.2 Inverter units 21
4.3 Technical data 24
5. INSTALLATION 26
5.1 Mounting 26
5.1.1 Lifting the drive 26
5.1.2 NX Liquid-Cooled dimensions 29
5.2 Cooling 38
5.2.1 Condensation 43
5.2.2 Cooling system connections 44
5.2.3 External cooling fan for CH4 49
5.3 Drive derating 50
5.4 Input chokes 51
5.4.1 Installation of input chokes 53
5.5 Inverter charging circuit 56
5.5.1 Control with switch fuse 56
5.5.2 Control with contactor 57
6. ELECTRICAL CABLING AND CONNECTIONS 58
6.1 Power unit 58

6.1.1 Power connections 58
6.1.2 Drive protection – Fuses 64
6.1.3 Cable installation instructions 71
6.1.4 Supply busbars for inverter units 73
6.1.5 Installation space 74
6.1.6 Earthing of power unit 75
6.1.7 Installation of ferrite rings (option) on the motor cable 75
6.1.8 Cable installation and the UL standards 76
6.1.9 Cable and motor insulation checks 76
6.2 Control unit 77
6.2.1 Control board power-up 78
6.2.2 Control connections 79
6.2.3 Control terminal signals 81
6.2.4 Control unit mounting box 84
6.3 Internal connections 86
6.3.1 Connections between Power Unit ASIC and Driver Boards 86
6.3.2 Connections between power unit ASIC and the control unit 90
6.3.3 Connections between mains device and inverter power module 92

7. CONTROL KEYPAD 94

7.1 Indications on the Keypad display 94
7.1.1 Drive status indications 94
7.1.2 Control place indications 95
7.1.3 Status LEDs (green – green – red) 95
7.1.4 Text lines 95
7.2 Keypad push-buttons 96
7.2.1 Button descriptions 96
7.3 Navigation on the control keypad 97
7.3.1 Monitoring menu (M1) 99
7.3.2 Parameter menu (M2) 100
7.3.3 Keypad control menu (M3) 102
7.3.4 Active faults menu (M4) 104
7.3.5 Fault history menu (M5) 111
7.3.6 System menu (M6) 112
7.3.7 Expander board menu (M7) 126
7.4 Further keypad functions 126

8. COMMISSIONING 127

8.1 Safety 127
8.2 Commissioning of the frequency converter 127

9. FAULT TRACING 130

9.1 Fault codes 130
9.2 Load test with motor 133
9.3 DC link test (without motor) 134

10. BRAKE CHOPPER UNIT (NXB) 135

10.1 Introduction 135
10.2 Type designation code 135
10.3 Diagrams 135
10.3.1 NXB Brake Chopper Unit block diagram 135

10.3.2 NXB topologies and connection 136
10.4 Brake chopper unit technical data 137
10.5 BCU power ratings 139
10.5.1 Vacon NXB; DC voltage 460–800V 139
10.5.2 Vacon NXB; DC voltage 640–1100V 140
10.6 Vacon brake resistors and brake chopper dimensioning 141
10.6.1 Braking energy and losses 141
10.6.2 Braking power and resistance, mains voltage 380–500Vac/600–800Vdc 142
10.6.3 Braking power and resistance, mains voltage 525–690Vac/840–1100Vdc 144
10.7 Brake chopper unit – Fuse selection 145
11. APPENDICES 146

1. SAFETY

ONLY A COMPETENT ELECTRICIAN MAY CARRY OUT THE ELECTRICAL INSTALLATION

1.1 Warnings

1	The Vacon NX Liquid-Cooled drive is meant for fixed installations only.
2	Do not perform any measurements when the frequency converter is connected to the mains. Prior to measurements on the motor or the motor cable, disconnect the motor cable from the frequency converter.
3	Do not perform any voltage withstand tests on any part of Vacon NX Liquid-Cooled drive. There is a certain procedure according to which the tests shall be performed. Ignoring this procedure may result in damaged product.
4	The frequency converter has a capacitive leakage current.
5	If the frequency converter is used as a part of a machine, the machine manufacturer is responsible for providing the machine with a main switch (EN 60204-1).
6	Only spare parts delivered by Vacon can be used.
7	The motor starts at power-up if the start command is 'ON'. Furthermore, the I/O functionalities (including start inputs) may change if parameters, applications or software are changed. Disconnect, therefore, the motor if an unexpected start can cause danger.
8	Do not touch the components on the circuit boards. Electrostatic voltage discharge may damage the components.

1.2 Safety instructions

1	The components of the power unit of the frequency converter are **live** when Vacon NX Liquid-Cooled drive is connected to mains potential. **Coming into contact with this voltage is extremely dangerous and may cause death or severe injury.** The control unit is isolated from the mains potential.
2	The motor terminals U, V, W and the DC-link/brake resistor terminals are **live** when Vacon NX Liquid-Cooled drive is connected to mains, **even if the motor is not running**.
3	After disconnecting the frequency converter from the mains, wait until the indicators on the keypad go out (if no keypad is attached see the indicators on the cover). Wait 5 more minutes before doing any work on Vacon NX Liquid-Cooled drive connections. Do not touch the enclosure before this time has expired.
4	The control I/O-terminals are isolated from the mains potential. However, the relay outputs and other I/O-terminals may have a dangerous control voltage present even when Vacon NX Liquid-Cooled drive is disconnected from mains.
5	Before connecting the NX Liquid-Cooled drive to mains, ensure the functionality of the coolant circulation and check the circulation for possible leaks.
6	Before connecting the drive to mains make sure that the enclosure door is closed.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

1.3 Earthing and earth fault protection

The Vacon NX Liquid-Cooled frequency converter must always be earthed with an earthing conductor connected to the earthing terminal ⏚. See page 75.

The earth fault protection inside the frequency converter protects only the converter itself against earth faults in the motor or the motor cable. It is not intended for personal safety.

Due to the high capacitive currents present in the frequency converter, fault current protective switches may not function properly.

1.4 Running the motor

Warning symbols
For your own safety, please pay special attention to the instructions marked with the following symbols:

= *Dangerous voltage*

= *General warning*

= *Hot surface – Risk of burn*

MOTOR RUN CHECK LIST

	1	Before starting the motor, check that it is mounted properly and ensure that the machine connected to the motor allows the motor to be started.
	2	Set the maximum motor speed (frequency) on the frequency converter according to the motor and the machine connected to it.
	3	Before reversing the motor make sure that this can be done safely.
	4	Make sure that no power correction capacitors are connected to the motor cable.
	5	Make sure that the motor terminals are not connected to mains potential.
	6	Before the NX_W Liquid Cooled drive can be used to control the motor, the proper functioning of the liquid-cooling system must be ensured.

2. EU DIRECTIVE

2.1 CE marking

The CE marking on the product guarantees the free movement of the product within the EEA (European Economic Area).

Vacon NX frequency converters carry the CE label as a proof of compliance with the Low Voltage Directive and the Electro Magnetic Compatibility Directive (EMC). The company SGS FIMKO has acted as the Competent Body.

2.2 EMC directive

2.2.1 General

The EMC Directive provides that the electrical apparatus must not excessively disturb the environment it is used in, and, on the other hand, it shall have an adequate level of immunity toward other disturbances from the same environment.

The compliance of Vacon NX Liquid-Cooled frequency converters with the EMC directive is verified with Technical Construction Files (TCF) checked and approved by SGS FIMKO, which is a Competent Body. The Technical Construction Files are used to authenticate the conformity of Vacon frequency converters with the Directive because such a large-sized product family is impossible to be tested in a laboratory environment and because the combinations of installation vary greatly.

2.2.2 Technical criteria

Our basic idea was to develop a range of frequency converters offering the best possible usability and cost-efficiency. EMC compliance was a major consideration from the outset of the design.

Vacon NX Liquid-Cooled frequency converters are marketed throughout the world, a fact which makes the EMC requirements of customers different. As far as the **immunity** is concerned, all Vacon NX Liquid-Cooled frequency converters are designed to fulfil even the strictest requirements.

2.2.3 Vacon frequency converter EMC classification

Vacon NX Liquid-Cooled frequency converter and inverter modules delivered from factory fulfil all **EMC immunity requirements (standards EN 50082-1, 50082-2 and EN 61800-3)**.

The basic liquid cooled modules do not have any inherent emission filtering. **If filtering is needed and a certain EMC emission level is required, external RFI filters must be used**.

Class N:
The NX Liquid-Cooled drives of this class do not provide EMC emission protection. This kind of drives are mounted in enclosures. External EMC filtering is usually required to fulfil the EMC emission requirements.

Class T:
The T-class converters have a smaller earth leakage current and are intended to be used with IT supplies only. If they are used with other supplies no EMC requirements are complied with.

Warning: This is a product of the restricted sales distribution class according to IEC 61800-3. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

2.2.3.1 IT networks

The grounding of input capacitors made by default with the grounding screw at terminal X41 of the bus board in all drives is imperative in all variations of TN/TT networks. Should the drive be used in IT networks, the screw at X41 must be removed. **It is strongly recommended that this be done by Vacon personnel**. Ask you local distributor for more information.

2.2.4 Manufacturer's declaration of conformity

The following pages present the Manufacturer's Declarations of Conformity assuring the compliance of Vacon frequency converters with the EMC-directives.

EU DECLARATION OF CONFORMITY

We

Manufacturer's name:	Vacon Oyj
Manufacturer's address:	P.O.Box 25 Runsorintie 7 FIN-65381 Vaasa Finland

hereby declare that the product

Product name:	Vacon NX Liquid-Cooled Frequency converter
Model designation:	Vacon NX Liquid-Cooled

has been designed and manufactured in accordance with the following standards:

Safety:	EN50178 (1997); EN61800-5-1 (2003)
EMC (immunity):	EN61800-3 (1996)+A11 (2000) (only immunity); EN61000-2 (1999)

and conforms to the relevant safety provisions of the Low Voltage Directive (73/23/EEC) as amended by the Directive (93/68/EEC) and EMC Directive 89/336/EEC as amended by 92/31/EEC.

It is ensured through internal measures and quality control that the product conforms at all times to the requirements of the current Directive and the relevant standards.

In Vaasa, 7th of July, 2006

Vesa Laisi
President

The year the CE marking was affixed: 2006

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

3. RECEIPT OF DELIVERY

The standard delivery of Vacon liquid-cooled drives includes all or part of the following components:

- power unit
- control unit
- main line connecting hoses and conduits (1.5m) + aluminium adapters for Ch5-Ch74; Hoses in different lengths also available
- Tema 1300 series fast connectors for Ch3-Ch4
- choke (not DC-fed inverters, type code I)
- control unit mounting kit
- cooling fan for boards (CH4)
- optic fibre & cable set (1.5m) for control unit; Optic sets in different lengths also available
- optic fibre cable set for 2*CH64/CH74: 1.8m/11 fibres (Power module 1) and 3.8m/8 fibres (Power module 2)

Vacon liquid-cooled frequency converters have undergone scrupulous tests and quality checks at the factory before they are delivered to the customer. However, after unpacking the product, check that no signs of transport damages are to be found on the product and that the delivery is complete (compare the type designation of the product to the code below, Figure 3-1).

Should the drive have been damaged during the shipping, please contact primarily the cargo insurance company or the carrier.

If the delivery does not correspond to your order, contact the supplier immediately.

3.1 Type designation code

The type designation code for the NX Liquid-Cooled drives is presented below. Should you need more or closer information about the type code, see Appendix 1.

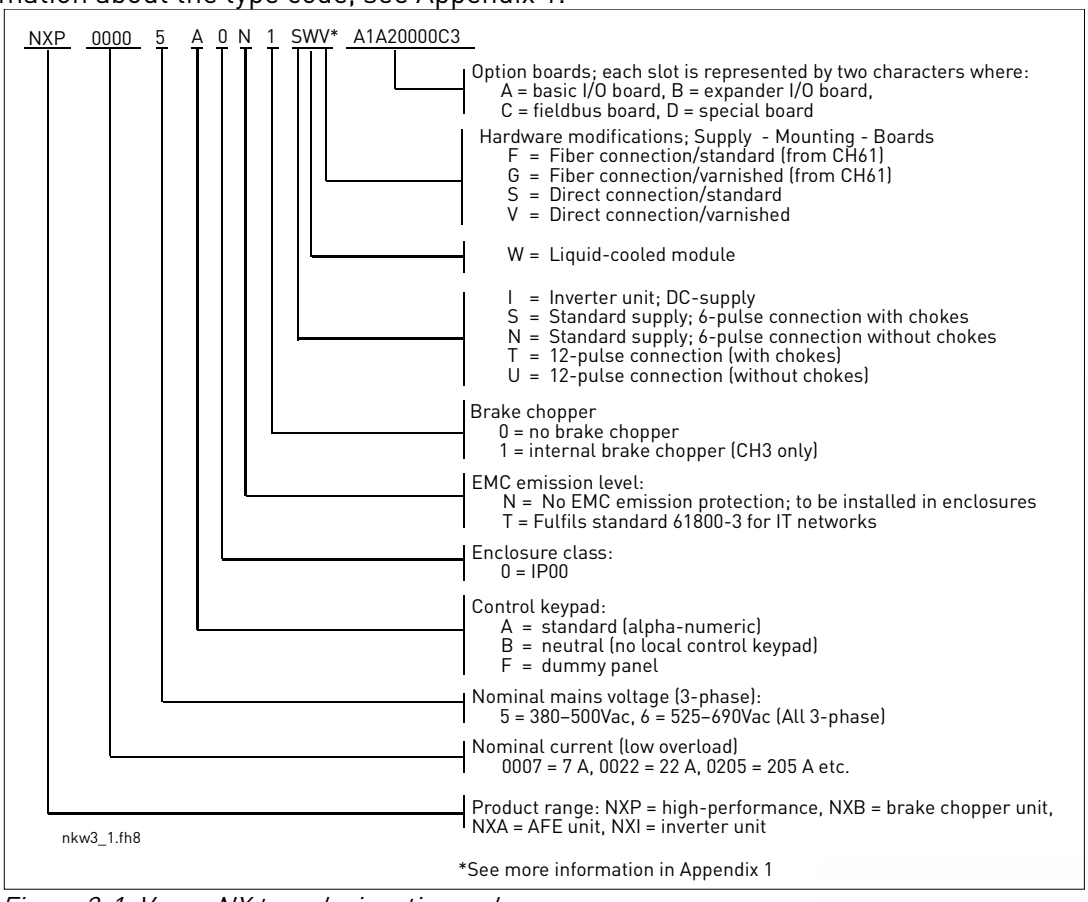


Figure 3-1. Vacon NX type designation code

3.2 Storage and shipping

If the frequency converter is to be kept in store before use make sure that the ambient conditions are acceptable:

Storing temperature	–40...+70°C (no cooling liquid inside cooling element allowed below 0°)
Relative humidity	<96%, no condensation

If the storage time exceeds 12 months the electrolytic DC capacitors need to be charged with caution. Therefore, such a long storage time is not recommended. See chapter 9.3 and the NX Liquid-Cooled Drives Service Manual for instructions on charging. See also chapter 3.3.

Warning: Always remove all cooling agent from the cooling element(s) before shipping to avoid damage caused by freezing.

3.3 Maintenance

In normal conditions, Vacon NX Liquid-Cooled frequency converters are maintenance-free. However, if the frequency converter is used in conditions with temperatures below the freezing point and the liquid used for cooling is likely to freeze, **be sure to empty the cooling element if the converter must be moved or if it is taken out of use for a longer time**. See also chapter 3.2.

It may also be necessary to clean up the coolant ducts in the cooling element. Contact the factory for more information.

The instructions for the cooling system provided by its manufacturer shall be followed.

Change the glycol coolant every 2 years or add inhibitor.

3.4 Warranty

Only manufacturing defects are covered by the warranty. The manufacturer assumes no responsibility for damages caused during or resulting from transport, receipt of the delivery, installation, commissioning or use.

The manufacturer shall in no event and under no circumstances be held responsible for damages and failures resulting from misuse, wrong installation, unacceptable ambient temperature, running motor with lower coolant flow than minimum flow, condensation, dust, corrosive substances or operation outside the rated specifications.

Neither can the manufacturer be held responsible for consequential damages.

Note! Vacon NX Liquid-Cooled drives must not be run with the liquid cooling system disconnected. Furthermore, the requirements of the liquid cooling specifications, e.g. minimum flow rate (see and Table 5-6) must be satisfied. Ignoring this will render the warranty null and void.

The Manufacturer's time of warranty is 18 months from the delivery or 12 months from the commissioning whichever expires first (Vacon Warranty Terms).

The local distributor may grant a warranty time different from the above. This warranty time shall be specified in the distributor's sales and warranty terms. Vacon assumes no responsibility for any other warranties than that granted by Vacon itself.

In all matters concerning the warranty, please contact first your distributor.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

4. TECHNICAL DATA

4.1 Introduction

The Vacon NX_W liquid-cooled product range consists of both **inverters** and **frequency converters**. Figure 4-1 and Figure 4-2 present the block diagram of the Vacon NX Liquid-Cooled inverter and frequency converter. Mechanically, the product consists of two units, the Power Unit and the Control Unit. The power unit can contain one to six modules (cooling plates), depending on the drive size. Instead of air, Vacon NX Liquid-Cooled inverters and frequency converters use liquid for cooling. A charging circuit is embodied in the frequency converters but not in inverters.

An external three-phase AC-choke (1) at the mains input together with the DC-link capacitor (2) form an LC-filter. In frequency converters, the LC-filter together with the diode bridge produce the DC-voltage supply to the IGBT Inverter Bridge (3) block. The AC-choke also functions as a filter against High Frequency disturbances from the mains as well as against those caused by the frequency converter to the mains. In addition, it enhances the waveform of the input current to the frequency converter. In chasses with multiple parallel line-rectifiers (CH74) AC-chokes are required to balance the line current between the rectifiers.

The power drawn by the frequency converter from the mains is mostly active power.

The IGBT Inverter Bridge produces a symmetrical, 3-phase Pulse Width Modulated AC-voltage to the motor.

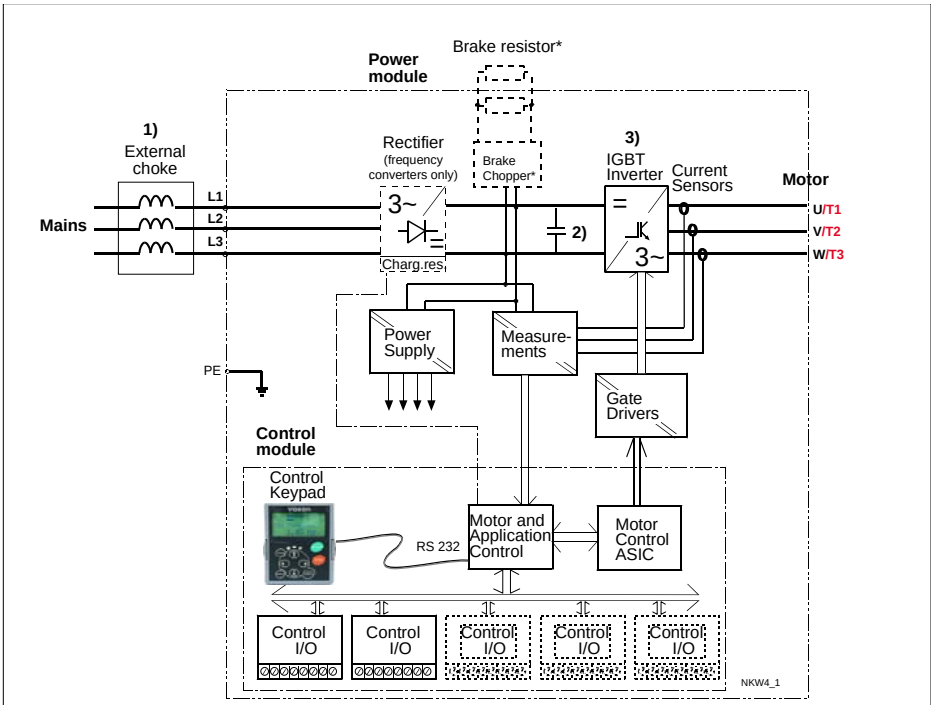
The Motor and Application Control Block is based on microprocessor software. The microprocessor controls the motor basing on the information it receives through measurements, parameter settings, control I/O and control keypad. The motor and application control block controls the motor control ASIC which, in turn, calculates the IGBT positions. Gate drivers amplify these signals for driving the IGBT inverter bridge.

The control keypad constitutes a link between the user and the frequency converter. The control keypad is used for parameter setting, reading status data and giving control commands. It is detachable and can be operated externally and connected via a cable to the frequency converter. Instead of the control keypad, a PC can also be used to control the frequency converter if connected through a similar cable (±12V).

You can have your frequency converter equipped with a control I/O board which is either isolated (OPT-A8) or not isolated (OPT-A1) from the frame. Optional I/O expander boards that increase the number of inputs and outputs to be used are also available. For closer information, contact the Manufacturer or your local distributor (see back cover).

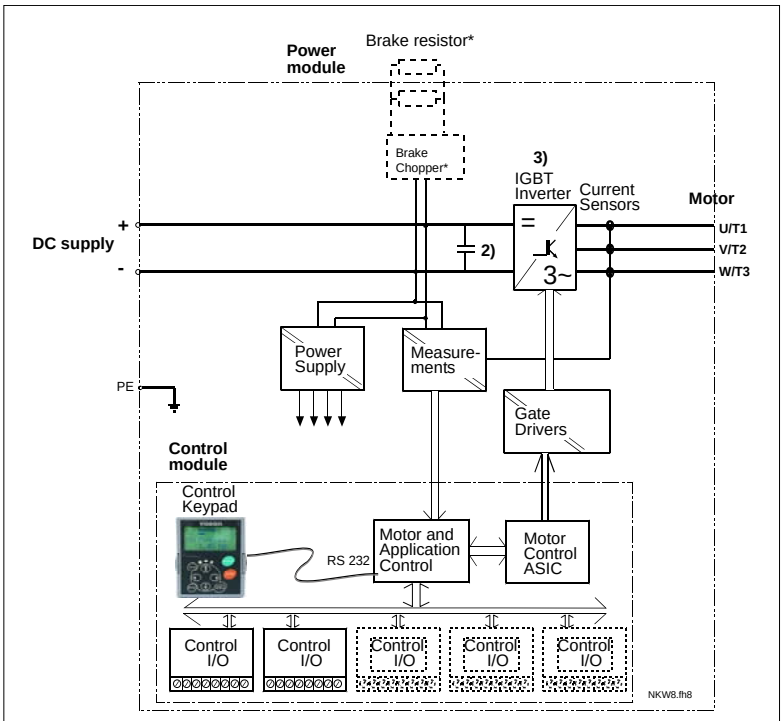
The basic control interface and the parameters (the Basic Application) are easy to use. If a more versatile interface or parameters are required, a more suitable application can be chosen from the "All in One" Application Package. See the "All in One" Application Manual for more information on the different applications.

An internal brake chopper is available as standard for chassis CH3. For all other sizes the brake chopper is available as option and installed externally. The standard product does not include a brake resistor. It should be acquired separately.



*Brake resistor is available as optional equipment for all sizes (CH3 to CH7).
An internal brake chopper belongs to standard equipment in size CH3 only, while in all other sizes it is optional and installed externally.

Figure 4-1. Vacon NX Liquid-Cooled frequency converter principal block diagram



*Brake resistor is available as optional equipment for all sizes (CH3 to CH7).
An internal brake chopper belongs to standard equipment in size CH3 only, while in all other sizes it is optional and installed externally.

Figure 4-2. Vacon NX Liquid-Cooled inverter principal block diagram

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

4.2 Power ratings

Vacon Liquid-Cooled product range consists of both **frequency converters** (AC input, AC output) and **inverter units** (DC input, AC output). The following tables present the drive output values for both and an indication of motor shaft power at I_{th} and I_L at different mains voltages as well as the drive losses and mechanical sizes. The power achieved is given as per the supply voltage.

4.2.1 Frequency converters

4.2.1.1 Vacon NX Liquid-Cooled Frequency Converter – Mains voltage 400—500 VAC

Mains voltage 400-500 VAC, 50/60 Hz, 3~, 6-pulse drives							
Converter type	Drive output					Power loss c/a/**T***) [kW]	Chassis
	Current			Motor output power			
	Thermal I_{th} [A]	Rated cont. I_L [A]	Rated contin. I_H [A]	Optimum motor at I_{th} (400V) [kW]	Optimum motor at I_{th} (500V) [kW]		
0016_5	16	15	11	7,5	11	0,4/0,2/**0,6**	CH3
0022_5	22	20	15	11	15	0,5/0,2/**0,7**	CH3
0031_5	31	28	21	15	18,5	0,7/0,2/**0,9**	CH3
0038_5	38	35	25	18,5	22	0,8/0,2/**1,0**	CH3
0045_5	45	41	30	22	30	1,0/0,3/**1,3**	CH3
0061_5	61	55	41	30	37	1,3/0,3/**1,5**	CH3
0072_5	72	65	48	37	45	1,2/0,3/**1,5**	CH4
0087_5	87	79	58	45	55	1,5/0,3/**1,8**	CH4
0105_5	105	95	70	55	75	1,8/0,3/**2,1**	CH4
0140_5	140	127	93	75	90	2,3/0,3/**2,6**	CH4
0168_5	168	153	112	90	110	4,0/0,4/**4,4**	CH5
0208_5	208	186	137	110	132	5,0/0,5/**5,5**	CH5
0261_5	261	237	174	132	160	6,0/0,5/**6,5**	CH5
0300_5	300	273	200	160	200	7,0/0,6/**7,6**	CH61
0385_5	385	350	257	200	250	9,0/0,7/**9,7**	CH61
0460_5	460	418	307	250	315	6,5/0,5/**7,0**	CH72
0520_5	520	473	347	250	355	7,5/0,6/**8,1**	CH72
0590_5	590	536	393	315	400	9,0/0,7/**9,7**	CH72
0650_5	650	591	433	355	450	10,0/0,7/**10,7**	CH72
0730_5	730	664	487	400	500	12,0/0,8/**12,8**	CH72
0820_5	820	745	547	450	560	12,5/0,8/**13,3**	CH63
0920_5	920	836	613	500	600	14,4/0,9/**15,3**	CH63
1030_5	1030	936	687	560	700	16,5/1,0/**17,5**	CH63
1150_5	1150	1045	766	600	750	18,5/1,2/**19,7**	CH63
1370_5	1370	1245	913	700	900	19,0/1,2/**20,2**	CH74
1640_5	1640	1491	1093	900	1100	24,0/1,4/**25,4**	CH74
2060_5	2060	1873	1373	1100	1400	32,5/1,8/**34,3**	CH74
2300_5	2300	2091	1533	1250	1500	36,3/2,0/**38,3**	CH74
2470_5	2470	2245	1647	1300	1600	38,8/2,2/**41,0**	2*CH74
2950_5	2950	2681	1967	1550	1950	46,3/2,6/**48,9**	2*CH74
3710_5	3710	3372	2473	1950	2450	58,2/3,0/**61,2**	2*CH74
4140_5	4140	3763	2760	2150	2700	65,0/3,6/**68,6**	2*CH74

Table 4-1. Power ratings and dimensions of NX Liquid-Cooled frequency converter (6-pulse), supply voltage 400-500VAC

Mains voltage 400-500 VAC, 50/60 Hz, 3~, 12-pulse drives							
Converter type	Drive output					Power loss c/a/**T***) [kW]	Chas-sis
	Current			Motor output power			
	Thermal I_{th} [A]	Rated cont. I_L [A]	Rated contin. I_H [A]	Optimum motor at I_{th} (400V) [kW]	Optimum motor at I_{th} (500V) [kW]		
0460_5	460	418	307	250	315	6,5/0,5/**7,0**	CH72
0520_5	520	473	347	250	355	7,5/0,6/**8,1**	CH72
0590_5	590	536	393	315	400	9,0/0,7/**9,7**	CH72
0650_5	650	591	433	355	400	10,0/0,7/**10,7**	CH72
0730_5	730	664	487	400	450	12,0/0,8/**12,8**	CH72
1370_5	1370	1245	913	700	900	19,0/1,2/**20,2**	CH74
1640_5	1640	1491	1093	850	1050	24,0/1,4/**25,4**	CH74
2060_5	2060	1873	1373	1050	1350	32,5/1,8/**34,3**	CH74
2470_5	2470	2245	1647	1300	1600	38,8/2,2/**41,0**	2*CH74
2950_5	2950	2681	1967	1550	1950	46,3/2,6/**48,9**	2*CH74
3710_5	3710	3372	2473	1950	2450	58,2/3,0/**61,2**	2*CH74
4140_5	4140	3763	2760	2150	2700	65,0/3,6/**68,6**	2*CH74

Table 4-2. Power ratings and dimensions of NX Liquid-Cooled frequency converter (12-pulse), supply voltage 400-500VAC

I_{th} = Thermal maximum continuous RMS current. Dimensioning can be done according to this current if the process does not require any overloadability or the process does not include any torque ripple or margin for overloadability.

I_L = Low overloadability current. Allows +10% torque ripple. 10% exceeding can be continuous.

I_H = High overloadability current. Allows +50% torque ripple. 50% exceeding can be continuous.

All values with cosφ = 0,83 and efficiency = 97%
*) c = power loss into coolant; a = power loss into air; **T = total power loss**; power losses of input chokes not included, see chapter 5.4. All power losses obtained using max. supply voltage, I_{th} and switching frequency of 3.6 kHz and ClosedLoop control mode. All power losses are worst case losses.

If some other mains voltage is used, apply the formula $P = \sqrt{3}$ *x Un x In x cosφ x eff%* to calculate the NX Liquid-Cooled drive output power.
The enclosure class for all NX Liquid-Cooled frequency converters is IP00.

If the motor is continuously (besides start and stop ramps) run at frequencies below 5 Hz, pay attention to the drive dimensioning for low frequencies, i.e. maximum $I_H = 0.66 * I_{th}$ or choose drive according to I_H. It is recommended to check the rating with your distributor or Vacon.
Drive overrating may also be necessary if the process requires high starting torque.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

4.2.1.2 Vacon NX Liquid-Cooled Frequency Converter – Mains voltage 525—690 VAC

Mains voltage 525-690 VAC, 50/60 Hz, 3~, 6-pulse drives							
Converter type	Drive output					Power loss c/a/**T**[*)] [kW]	Chas-sis
	Current			Motor output power			
	Thermal I_{th} [A]	Rated contin. I_L [A]	Rated contin. I_H [A]	Optimum motor at I_{th} (525V) [kW]	Optimum mo-tor at I_{th} (690V) [kW]		
0170_6	170	155	113	110	160	7,5/0,4/**7,9**	CH61
0208_6	208	189	139	132	200	9,0/0,5/**9,5**	CH61
0261_6	261	237	174	160	250	6,5/0,3/**6,8**	CH61
0325_6	325	295	217	200	300	7,5/0,4/**7,9**	CH72
0385_6	385	350	257	250	355	9,0/0,5/**9,5**	CH72
0416_6	416	378	277	250	355	9,4/0,5/**9,9**	CH72
0460_6	460	418	307	300	400	10,0/0,5/**10,5**	CH72
0502_6	502	456	335	355	450	12,0/0,6/**12,6**	CH72
0590_6	590	536	393	400	560	13,0/0,7/**13,7**	CH63
0650_6	650	591	433	450	600	16,0/0,8/**16,8**	CH63
0750_6	750	682	500	500	700	18,0/0,9/**18,9**	CH63
0820_6	820	745	547	560	800	19,0/1,0/**20,0**	CH74
0920_6	920	836	613	650	850	21,3/1,2/**22,5**	CH74
1030_6	1030	936	687	700	1000	22,0/1,1/**23,1**	CH74
1180_6	1180	1073	787	800	1100	25,0/1,3/**26,3**	CH74
1300_6	1300	1182	867	900	1200	31,0/1,6/**32,6**	CH74
1500_6	1500	1364	1000	1050	1400	38,0/1,9/**39,9**	CH74
1700_6	1700	1545[1)]	1133[1)]	1150	1550	NA	CH74
1850_6	1850	1682	1233	1250	1650	39,6/2,0/**41,6**	2*CH74
2120_6	2120	1927	1413	1450	1900	45,0/2,4/**47,4**	2*CH74
2340_6	2340	2127	1560	1600	2100	55,8/2,9/**58,7**	2*CH74
2700_6	2700	2455	1800	1850	2450	68,4/3,4/**71,8**	2*CH74
3100_6	3100	2818[1)]	2066[1)]	2150	2800	NA	2*CH74

Table 4-3. Power ratings and dimensions of NX Liquid-Cooled frequency converter (6-pulse), supply voltage 525—690VAC

[1)] Calculated

Mains voltage 525-690 VAC, 50/60 Hz, 3~, 12-pulse drives							
Converter type	Drive output					Power loss c/a/T*) [kW]	Chas-sis
	Current			Motor output power			
	Thermal I_{th} [A]	Rated contin. I_L [A]	Rated contin. I_H [A]	Optimum motor at I_{th} (525V) [kW]	Optimum mo-tor at I_{th} (690V) [kW]		
0325_6	325	295	217	200	250	7,5/0,4/**7,9**	CH72
0385_6	385	350	257	250	355	9,0/0,5/**9,5**	CH72
0416_6	416	378	277	250	355	9,4/0,5/**9,9**	CH72
0460_6	460	418	307	315	400	10,0/0,5/**10,5**	CH72
0502_6	502	456	335	355	450	12,0/0,6/**12,6**	CH72
0820_6	820	745	547	600	750	19,0/1,0/**20,0**	CH74
0920_6	920	836	613	650	850	21,3/1,2/**22,5**	CH74
1030_6	1030	936	687	750	950	22,0/1,1/**23,1**	CH74
1180_6	1180	1073	787	800	1100	25,0/1,3/**26,3**	CH74
1300_6	1300	1182	867	950	1200	31,0/1,6/**32,6**	CH74
1500_6	1500	1364	1000	1050	1400	38,0/1,9/**39,9**	CH74
1850_6	1850	1682	1233	1250	1650	39,6/2,0/**41,6**	2*CH74
2120_6	2120	1927	1413	1450	1900	45,0/2,4/**47,4**	2*CH74
2340_6	2340	2127	1560	1600	2100	55,8/2,9/**58,7**	2*CH74
2700_6	2700	2455	1800	1850	2450	68,4/3,4/**71,8**	2*CH74
3100_6	3100	2818	2067	2150	2800	NA	2*CH74

Table 4-4. Power ratings and dimensions of NX Liquid-Cooled frequency converter (12-pulse), supply voltage 525—690VAC

I_{th} = Thermal maximum continuous RMS current. Dimensioning can be done according to this current if the process does not require any overloadability or the process does not include any torque ripple

I_L = Low overloadability current. Allows +10% torque ripple. 10% exceeding can be continuous.

I_H = High overloadability current. Allows +50% torque ripple. 50% exceeding can be continuous.

All values with cosφ = 0,83 and efficiency = 97%
*) c = power loss into coolant; a = power loss into air; **T = total power loss**; power losses of input chokes not included, see chapter 5.4. All power losses obtained using max. supply voltage, I_{th} and switching frequency of 3.6 kHz and ClosedLoop control mode. All power losses are worst case losses.

If some other mains voltage is used, apply the formula $P = \sqrt{3}$ *x Un x In x cosφ x eff%* to calculate the NX Liquid-Cooled drive output power.
The enclosure class for all NX Liquid-Cooled frequency converters is IP00.

If the motor is continuously (besides start and stop ramps) run at frequencies below 5 Hz, pay attention to the drive dimensioning for low frequencies, i.e. maximum $I_H = 0.66*I_{th}$ or choose drive according to I_H. It is recommended to check the rating with your distributor or Vacon.
Drive overrating may also be necessary if the process requires high starting torque.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

4.2.2 Inverter units

4.2.2.1 Vacon NX Liquid-Cooled Inverter Unit – Mains voltage 465—800 VDC

Mains voltage 465-800 VDC							
Inverter type	Drive output					Power loss c/a/**T***) [kW]	Chas-sis
	Current			Motor output power			
	Thermal I_{th} [A]	Rated cont. I_L [A]	Rated cont. I_H [A]	Optimum motor at I_{th} (540VDC) [kW]	Optimum motor at I_{th} (675VDC) [kW]		
0016_5	16	15	11	7,5	11	0,4/0,2/**0,6**	CH3
0022_5	22	20	15	11	15	0,5/0,2/**0,7**	CH3
0031_5	31	28	21	15	18,5	0,7/0,2/**0,9**	CH3
0038_5	38	35	25	18,5	22	0,8/0,2/**1,0**	CH3
0045_5	45	41	30	22	30	1,0/0,3/**1,3**	CH3
0061_5	61	55	41	30	37	1,3/0,3/**1,5**	CH3
0072_5	72	65	48	37	45	1,2/0,3/**1,5**	CH4
0087_5	87	79	58	45	55	1,5/0,3/**1,8**	CH4
0105_5	105	95	70	55	75	1,8/0,3/**2,1**	CH4
0140_5	140	127	93	75	90	2,3/0,3/**2,6**	CH4
0168_5	168	153	112	90	110	2,5/0,3/**2,8**	CH5
0208_5	208	186	137	110	132	3,0/0,4/**3,4**	CH5
0261_5	261	237	174	132	160	4,0/0,4/**4,4**	CH5
0300_5	300	273	200	160	200	4,5/0,4/**4,9**	CH61
0385_5	385	350	257	200	250	5,5/0,5/**6,0**	CH61
0460_5	460	418	307	250	315	5,5/0,5/**6,0**	CH62
0520_5	520	473	347	250	355	6,5/0,5/**7,0**	CH62
0590_5	590	536	393	315	400	7,5/0,6/**8,1**	CH62
0650_5	650	591	433	355	450	8,5/0,6/**9,1**	CH62
0730_5	730	664	487	400	500	10,0/0,7/**10,7**	CH62
0820_5	820	745	547	450	560	12,5/0,8/**13,3**	CH63
0920_5	920	836	613	500	600	14,4/0,9/**15,3**	CH63
1030_5	1030	936	687	560	700	16,5/1,0/**17,5**	CH63
1150_5	1150	1045	766	600	750	18,4/1,1/**19,5**	CH63
1370_5	1370	1245	913	700	900	15,5/1,0/**16,5**	CH64
1640_5	1640	1491	1093	900	1100	19,5/1,2/**20,7**	CH64
2060_5	2060	1873	1373	1100	1400	26,5/1,5/**28,0**	CH64
2300_5	2300	2091	1533	1250	1500	29,6/1,7/**31,3**	CH64
2470_5	2470	2245	1647	1300	1600	36,0/2,0/**38,0**	2*CH64
2950_5	2950	2681	1967	1550	1950	39,0/2,4/**41,4**	2*CH64
3710_5	3710	3372	2473	1950	2450	48,0/2,7/**50,7**	2*CH64
4140_5	4140	3763	2760	2150	2700	53,0/3,0/**66,0**	2*CH64

Table 4-5. Power ratings and dimensions of NX Liquid-Cooled inverter unit, supply voltage 540—675VDC.

I_{th} = Thermal maximum continuous RMS current. Dimensioning can be done according to this current if the process does not require any overloadability or the process does not include any torque ripple

I_L = Low overloadability current. Allows +10% torque ripple. 10% exceeding can be continuous.

I_H = High overloadability current. Allows +50% torque ripple. 50% exceeding can be continuous.

All values with cosφ = 0,83 and efficiency = 97%

*) c = power loss into coolant; a = power loss into air; **T = total power loss**

All power losses obtained using max. supply voltage, I_{th} and switching frequency of 3.6 kHz and ClosedLoop control mode. All power losses are worst case losses.

If some other mains voltage is used, apply the formula *DC P = (Un/1.35)*$\sqrt{3}$ *In*cosφ*eff%* to calculate the NX Liquid-Cooled drive electrical output power.

If the motor is continuously (besides start and stop ramps) run at frequencies below 5 Hz, pay attention to the drive dimensioning for low frequencies, i.e. maximum $I_H = 0.66*I_{th}$ or choose drive according to I_H. It is recommended to check the rating with your distributor or Vacon.
Drive overrating may also be necessary if the process requires high starting torque.

The voltage classes for the inverter units used in the tables above have been defined as follows:

Input 540VDC	=	Rectified 400VAC supply
Input 675VDC	=	Rectified 500VAC supply

The enclosure class of all inverter units is IP00.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

4.2.2.2 Vacon NX Liquid-Cooled Inverter Unit – Mains voltage 640—1100 VDC

Mains voltage 640-1100 VDC							
Inverter type	Drive output					Power loss c/a/**T**[*)] [kW]	Chassis
	Current			Motor output power			
	Thermal I_{th} [A]	Rated cont. I_L [A]	Rated cont. I_H [A]	Optimum motor at I_{th} (710VDC) [kW]	Optimum motor at I_{th} (930VDC) [kW]		
0170_6	170	155	113	110	160	4,5/0,2/**4,7**	CH61
0208_6	208	189	139	132	200	5,5/0,3/**5,8**	CH61
0261_6	261	237	174	160	250	5,5/0,3/**5,8**	CH61
0325_6	325	295	217	200	300	6,5/0,3/**6,8**	CH62
0385_6	385	350	257	250	355	7,5/0,4/**7,9**	CH62
0416_6	416	378	277	250	355	8,0/0,4/**8,4**	CH62
0460_6	460	418	307	300	400	8,5/0,4/**8,9**	CH62
0502_6	502	456	335	355	450	10,0/0,5/**10,5**	CH62
0590_6	590	536	393	400	560	10,0/0,5/**10,5**	CH63
0650_6	650	591	433	450	600	13,5/0,7/**14,2**	CH63
0750_6	750	682	500	500	700	16,0/0,8/**16,8**	CH63
0820_6	820	745	547	560	800	16,0/0,8/**16,8**	CH64
0920_6	920	836	613	650	850	18,0/0,9/**18,9**	CH64
1030_6	1030	936	687	700	1000	19,0/1,0/**20,0**	CH64
1180_6	1180	1073	787	800	1100	21,0/1,1/**22,1**	CH64
1300_6	1300	1182	867	900	1200	27,0/1,4/**28,4**	CH64
1500_6	1500	1364	1000	1050	1400	32,0/1,6/**33,6**	CH64
1700_6	1700	1545[1)]	1133[1)]	1150	1550	NA	CH64
1850_6	1850	1682	1233	1250	1650	34,2/1,8/**36,0**	2*CH64
2120_6	2120	1927	1413	1450	1900	37,8/2,0/**39,8**	2*CH64
2340_6	2340	2127	1560	1600	2100	48,6/2,5/**51,1**	2*CH64
2700_6	2700	2455	1800	1850	2450	57,6/3,0/**60,6**	2*CH64
3100_6	3100	2818[1)]	2066[1)]	2150	2800	NA	2*CH64

Table 4-6. Power ratings and dimensions of NX Liquid-Cooled inverter unit, supply voltage 710—930VDC.

[1)] Calculated

I_{th} = Thermal maximum continuous RMS current. Dimensioning can be done according to this current if the process does not require any overloadability or the process does not include any torque ripple

I_L = Low overloadability current. Allows +10% torque ripple. 10% exceeding can be continuous.

I_H = High overloadability current. Allows +50% torque ripple. 50% exceeding can be continuous.

All values with cosφ = 0,83 and efficiency = 97%

*) c = power loss into coolant; a = power loss into air; T = total power loss

All power losses obtained using max. supply voltage, I_{th} and switching frequency of 3.6 kHz and ClosedLoop control mode. All power losses are worst case losses.

If some other mains voltage is used, apply the formula *DC P = (Un/1.35)*$\sqrt{3}$ *In*cosφ*eff%* to calculate the NX Liquid-Cooled drive output power.

The voltage classes for the inverter units used in the tables above have been defined as follows:

Input 710VDC = Rectified 525VAC supply
Input 930VDC = Rectified 690VAC supply

The enclosure class of all inverter units is IP00.

If the motor is continuously (besides start and stop ramps) run at frequencies below 5 Hz, pay attention to the drive dimensioning for low frequencies, i.e. maximum $I_H = 0.66*I_{th}$ or choose drive according to I_H. It is recommended to check the rating with your distributor or Vacon.
Drive overrating may also be necessary if the process requires high starting torque.

4.3 Technical data

Mains connection	Input voltage U_{in}	400...500VAC; 525...690VAC; (–10%...+10%) 465...800VDC; 640...1100VDC (–0%...+0%)
	Input frequency	45...66 Hz
	Connection to mains	Once per minute or less
Motor connection	Output voltage	0—U_{in}
	Continuous output current	Rated current at nominal inflow cooling water temperature according to dimensioning charts
	Output frequency	0...320 Hz (standard); 7200 Hz (Special software)
	Frequency resolution	Application dependent
Control characteristics	Control method	Frequency control U/f Open Loop Sensorless Vector Control Closed Loop Vector Control
	Switching frequency (see parameter 2.6.9)	**NX_5:** Up to and including NX_0061: 1...16 kHz; Factory default 10 kHz From NX_0072: 1...12 kHz; Factory default 3.6 kHz **NX_6:** 1...6 kHz; Factory default 1.5 kHz **Note! Derating required if higher switching frequency than the default is used!**
	Frequency reference Analogue input Panel reference	 Resolution 0.1% (10-bit), accuracy ±1% Resolution 0.01 Hz
	Field weakening point	8...320 Hz
	Acceleration time	0.1...3000 sec
	Deceleration time	0.1...3000 sec
	Braking torque	DC brake: 30% * T_N (without brake option)
Ambient conditions	Ambient operating temperature	–10°C (no frost)...+50°C (at I_{th}) +50...+70 derating required, see chapters 5.2.1 and 5.3
	Storage temperature	–40°C...+70°C; No liquid in heatsink under 0°C
	Relative humidity	5 to 96% RH, non-condensing, no dripping water
	Air quality: - chemical vapours - mechanical particles	 IEC 721-3-3, unit in operation, class 3C2 IEC 721-3-3, unit in operation, class 3S2 (no conductive dust allowed) No corrosive gases
	Altitude	100% load capacity (no derating) up to 1,000 m; above 1,000 m derating of 1% per each 100 m required
	Vibration EN50178/EN60068-2-6	5...150Hz Displacement amplit. 1 mm (peak) at 5...15.8 Hz (CH5), 0.25 mm (peak) at 3...31 Hz (other chassis) Max acceleration amplitude 1 G at 15.8...150 Hz (CH5), 31...150 Hz (other chassis)
	Shock EN50178, EN60068-2-27	UPS Drop Test (for applicable UPS weights) Storage and shipping: max 15 G, 11 ms (in package)
	Enclosure class	IP00/Open Frame standard in entire kW/HP range
EMC	Immunity	Fulfils all EMC immunity requirements
	Emissions	EMC level N for TN/TT networks EMC level T for IT networks

Safety		EN50178, EN60204-1, CE, UL, CUL, FI, GOST R, (see unit nameplate for more detailed approvals)
	Safe disable board	The drive is equipped with Vacon OPT-AF board for prevention of torque on motor shaft . Standards: EN954-1, cat. 3 (hardware disable); BGIA (Safe Disable function) See Vacon manual ud01066 for detailed information.
Control connections (apply to boards OPT-A1, OPT-A2 and OPT-A3)	Analogue input voltage	0...+10V, R_i = 200kΩ, (–10V...+10V joystick control) Resolution 0.1%, accuracy ±1%
	Analogue input current	0(4)...20 mA, R_i = 250Ω differential
	Digital inputs (6)	Positive or negative logic; 18...24VDC
	Auxiliary voltage	+24V, ±10%, max volt. ripple < 100mVrms; max. 250mA Dimensioning: max. 1000mA/control box 1A external fuse required (no internal short-circuit protection on the control board)
	Output reference voltage	+10V, +3%, max. load 10mA
	Analogue output	0(4)...20mA; R_L max. 500Ω; Resolution 10 bit; Accuracy ±2%
	Digital outputs	Open collector output, 50mA/48V
	Relay outputs	2 programmable change-over relay outputs Switching capacity: 24VDC/8A, 250VAC/8A, 125VDC/0.4A Min. switching load: 5V/10mA
Protections	Overvoltage trip limit Undervoltage trip limit	NX_W5: 911V; NX_W6: 1200V (all VDC) NX_W5: 333V; NX_W6: 461V (all VDC)
	Earth fault protection	In case of earth fault in motor or motor cable, only the frequency converter is protected
	Mains supervision	Trips if any of the input phases is missing (frequency converters only)
	Motor phase supervision	Trips if any of the output phases is missing
	Unit overtemperature protection	Alarm limit: 65°C (heatsink); 70°C (circuit boards) Trip limit: 70°C (heatsink); 85°C (circuit boards)
	Overcurrent protection	Yes
	Motor overload protection	Yes
	Motor stall protection	Yes
	Motor underload protection	Yes
	Short-circuit protection of +24V and +10V reference voltages	Yes
Liquid cooling	Allowed cooling agents	Drinking water (see specification on page 39) Water-glycol mixture See derating specifications , chapter 5.3
	Volume	See page 41.
	Temperature of cooling agent	0...35°C (I_{th})(input); 35...70°C: derating required, see Chapter 5.3 Max. temperature rise during circulation max. 5°C No condensation allowed. See Chapter 5.2.1.
	Cooling agent flow rates	See Table 5-6.
	System max. working pressure	6 bar
	System max. peak pressure	40 bar
	Pressure loss (at nom. flow)	Varies according to size. See Table 5-8.

Table 4-7. Technical data

5. INSTALLATION

5.1 Mounting

Vacon NX Liquid-Cooled Drive modules must be installed into an enclosure. The drives consisting of one module will be mounted on the mounting plate. The drives that include two or three modules are mounted inside a mounting bracket (see) which will then be installed in the enclosure.

Note: If any other than vertical installation position is required, please contact your distributor!

In chapter 5.1.2 you will find the dimensions of Vacon NX Liquid-Cooled drives installed on mounting bases (plates and brackets).

5.1.1 Lifting the drive

We recommend you to always use a jib crane or similar elevating device to lift the frequency converter/ inverter unit. See figures below for correct lifting points.

For units with no mounting bracket (see chapter 5.1.2.2), the best place for hoisting is the hole(s) in the middle of the mounting plate (Lifting point 1). Vacon NX Liquid-Cooled drives consisting of several modules can the most safely and easily be lifted by the holes in the mounting bracket (Lifting point 2) using a screw pin shackle. Pay also attention to the recommended dimensions of the hoisting belt and the beam. See Figure 5-1.

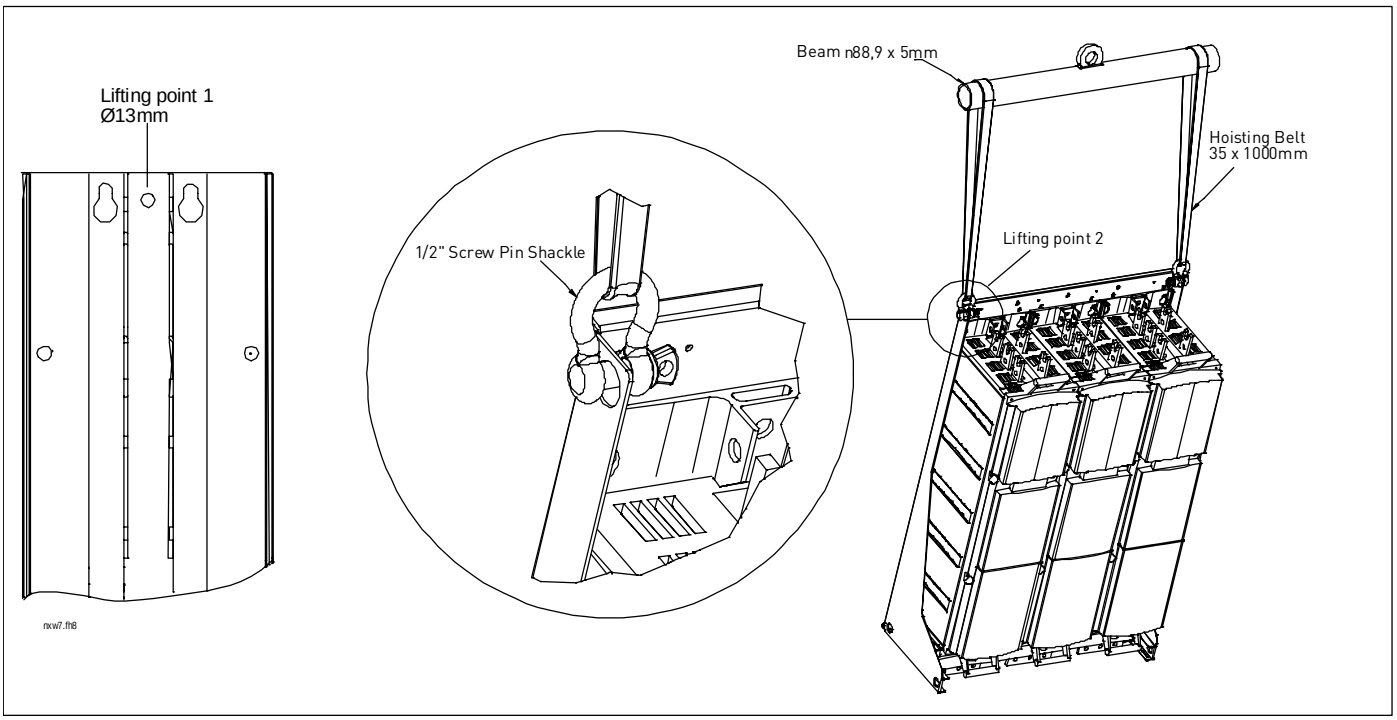


Figure 5-1. Lifting points for drives consisting of one module (left) and several modules

In cabinet installation, the hoisting procedure described above right may, however, become difficult or even impossible if the cabinet width does not allow the use of the screw pin shackle in Lifting point 2 (see above).
In such case, follow the lifting procedure described in Figure 5-2. The mounting becomes easier and safer if the drive can be laid on a *supporting girder* fixed on the cabinet frame. We also recommend to use an *aligning stud* to guarantee an easy and safe mounting.

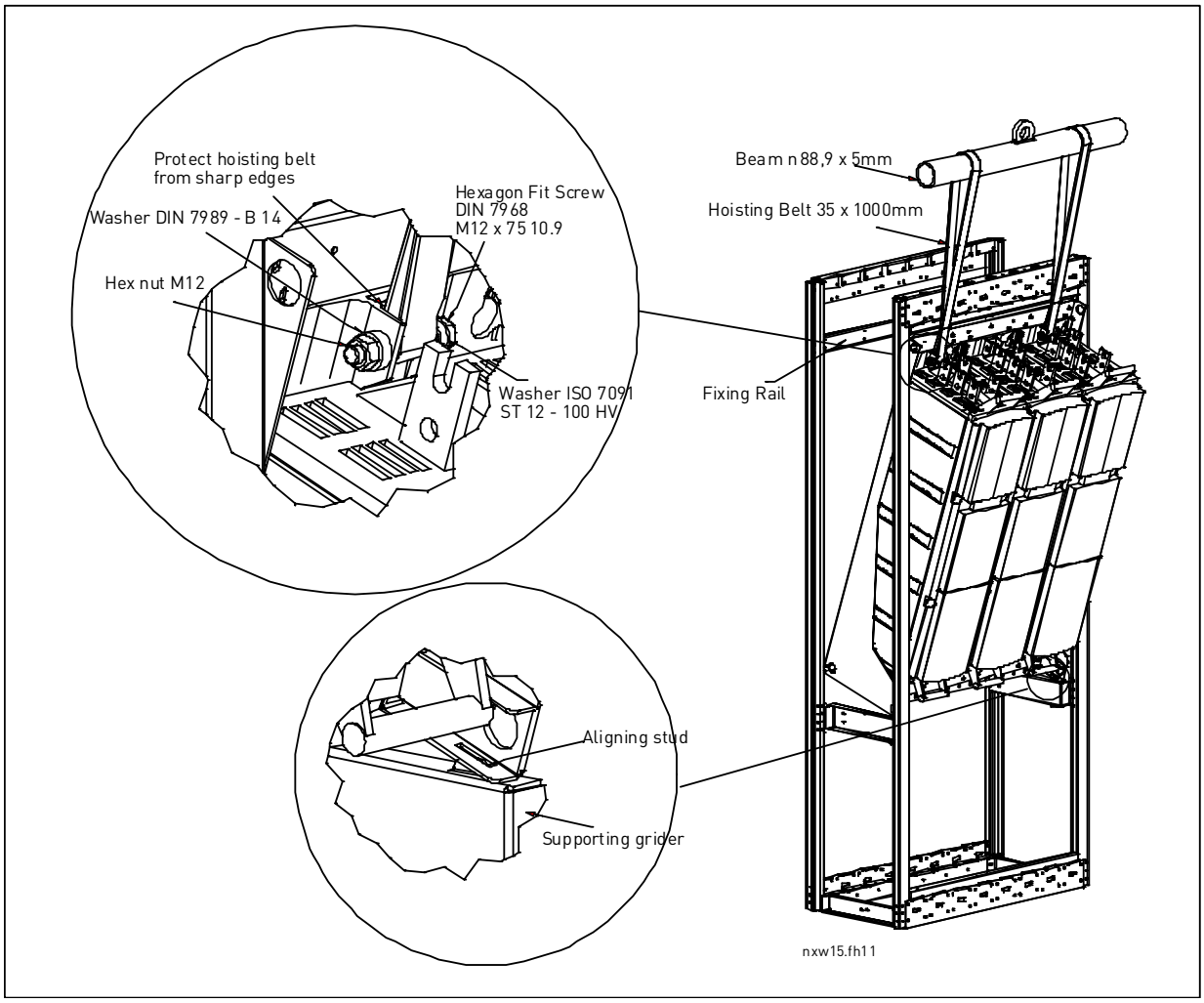


Figure 5-2. Lifting of drive into a narrow mounting space

To additionally stabilize the cabinet with the drive, we recommend to mount a fixing rail on the back of the cabinet, to which the top of the drive can be fastened with 5 or 6 M5 screws. The cut-out is compatible with Rittal or Veda cabinets. Also secure the drive with M8 nuts and studs to the supporting girder. See figures 5-2 and 5-3.

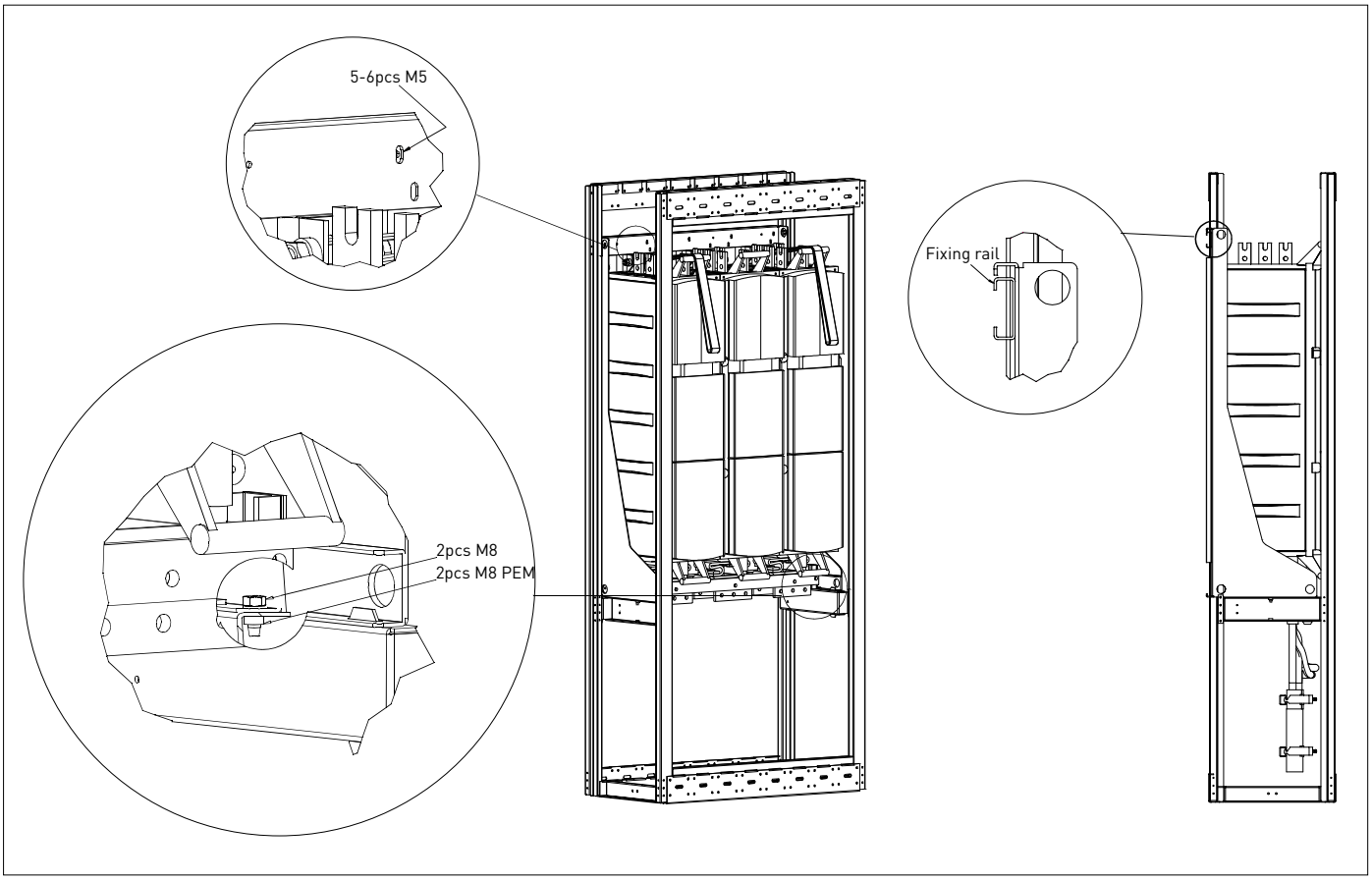


Figure 5-3. Securing the drive to the cabinet frame

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

5.1.2 NX Liquid-Cooled dimensions

5.1.2.1 Drives consisting of one module

Chassis	Width	Height	Depth	Weight
CH3	160	431	246	30
CH4	193	493	257	35
CH5	246	553	264	40
CH61/62	246	658	372	55
CH72	246	1076	372	90

Table 5-1. One-module drive dimensions (mounting base included)

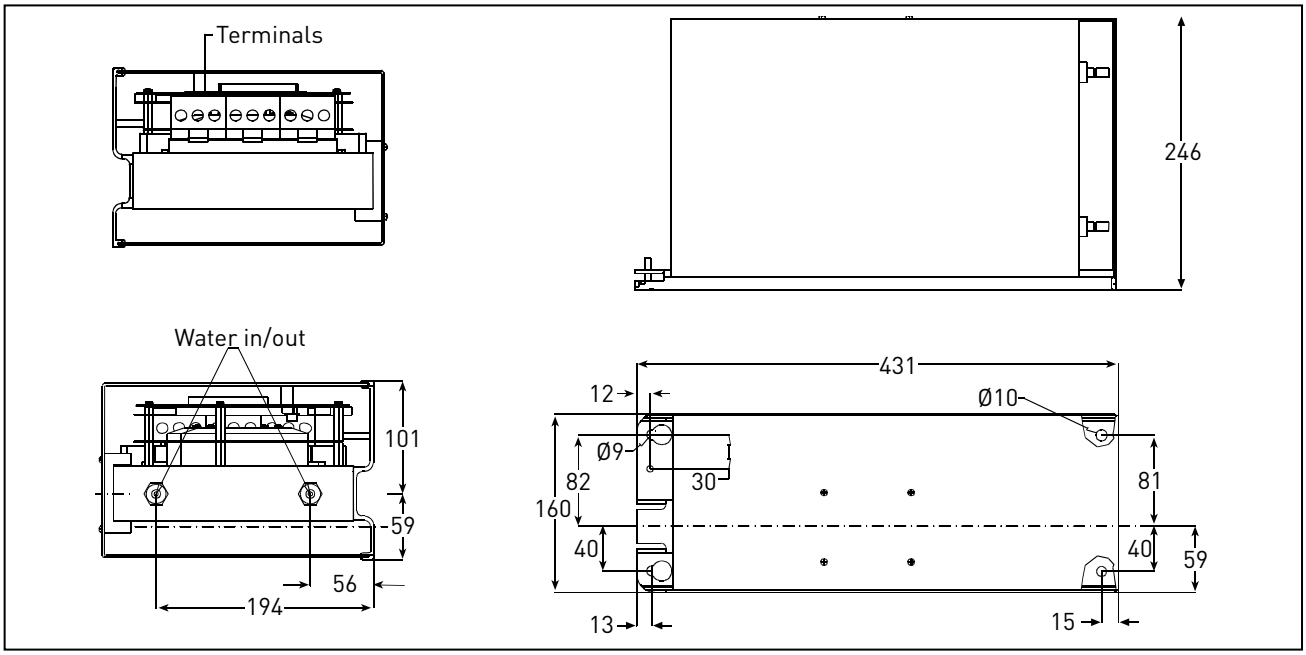


Figure 5-4. Vacon NX Liquid-Cooled drive dimensions, CH3

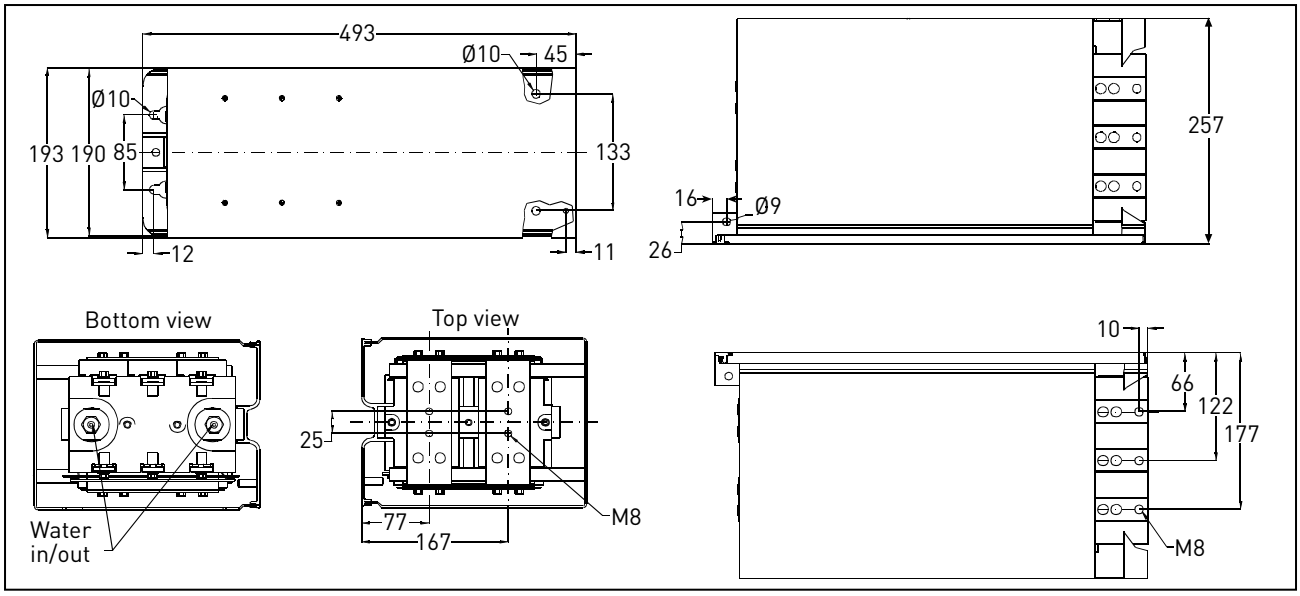


Figure 5-5. Vacon NX Liquid-Cooled drive dimensions, CH4

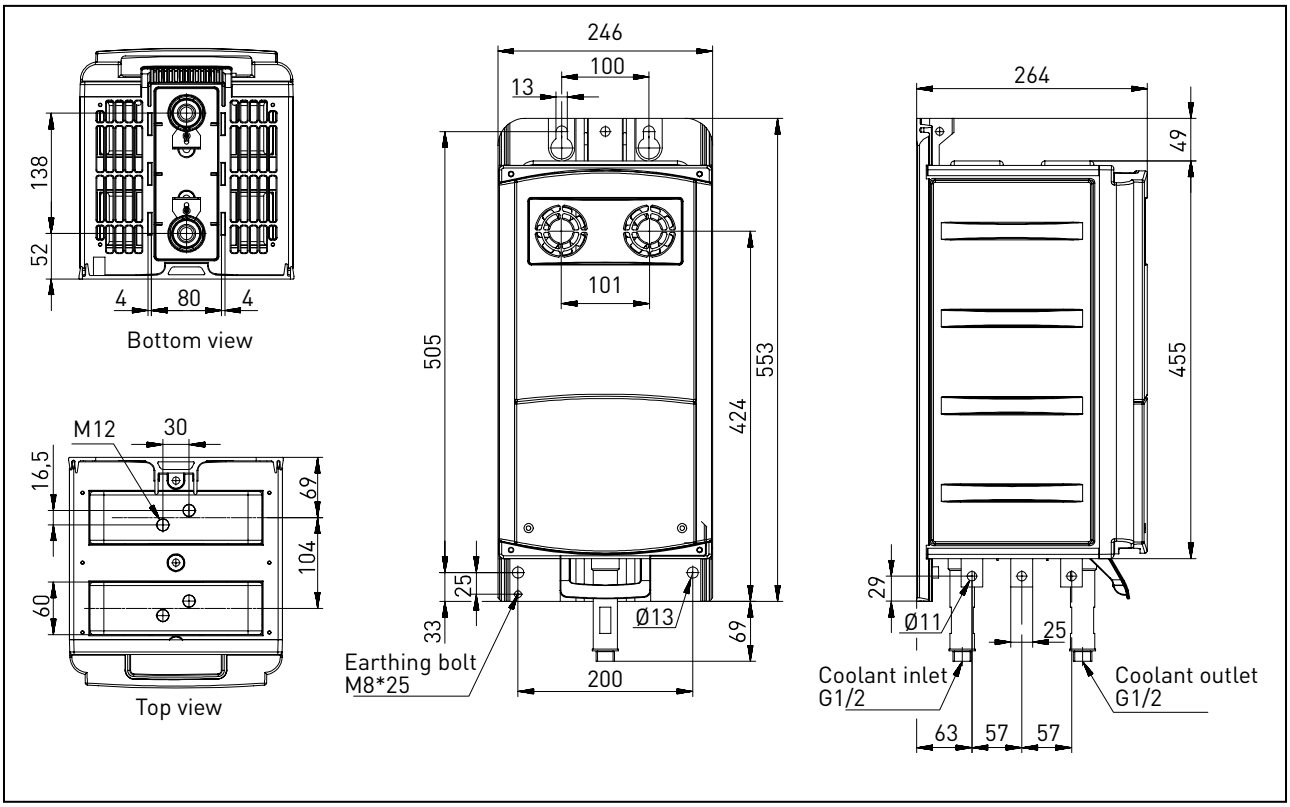


Figure 5-6. Vacon NX Liquid-Cooled dimensions, CH5 frequency converter

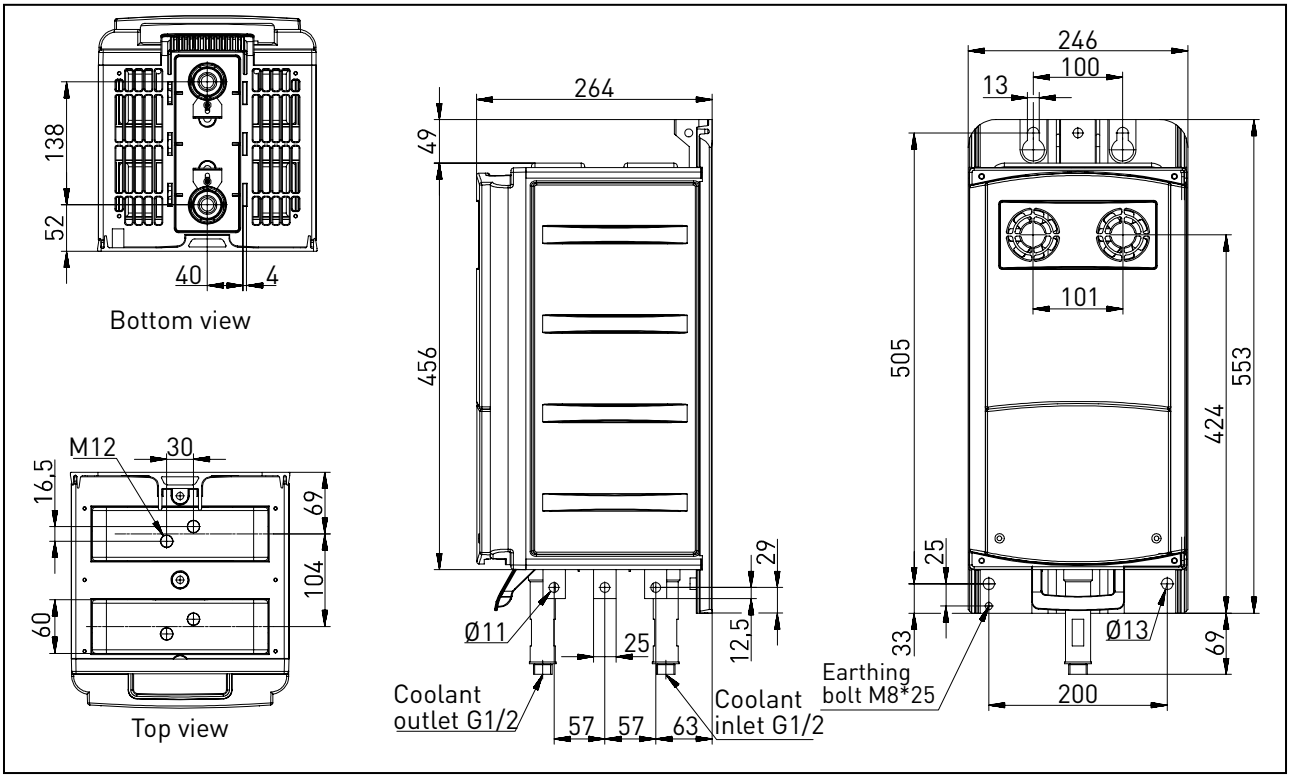


Figure 5-7. Vacon NX Liquid-Cooled dimensions, CH5 inverter

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

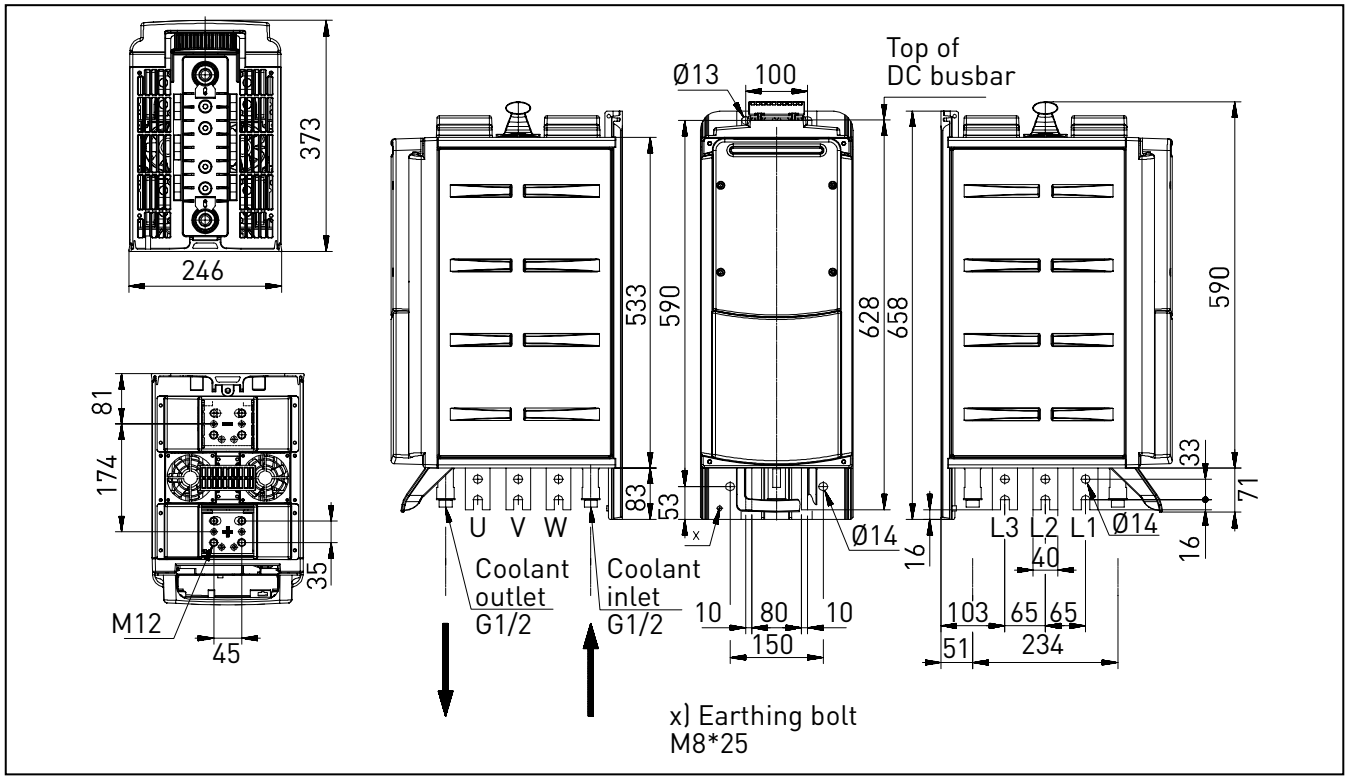


Figure 5-8. Vacon Liquid-Cooled frequency converter, CH61

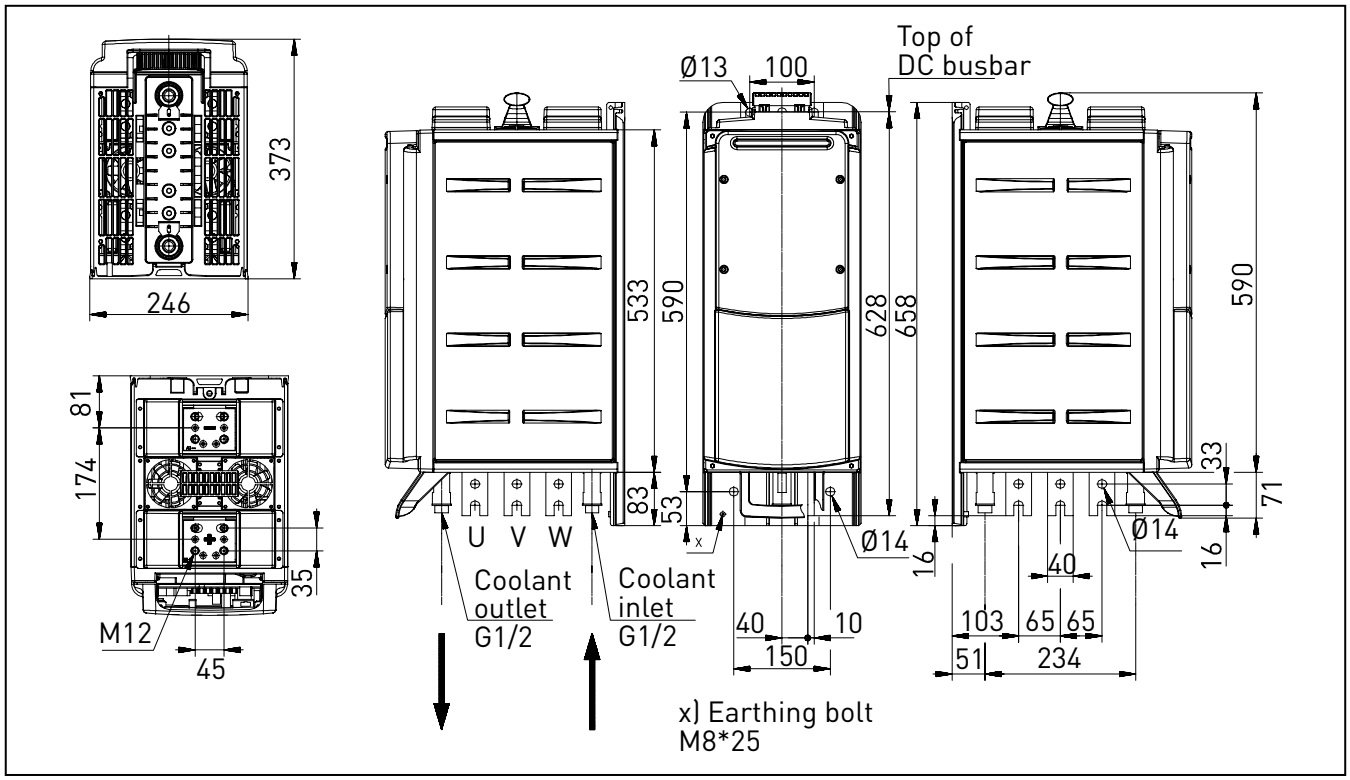


Figure 5-9. Vacon Liquid-Cooled inverter, CH61

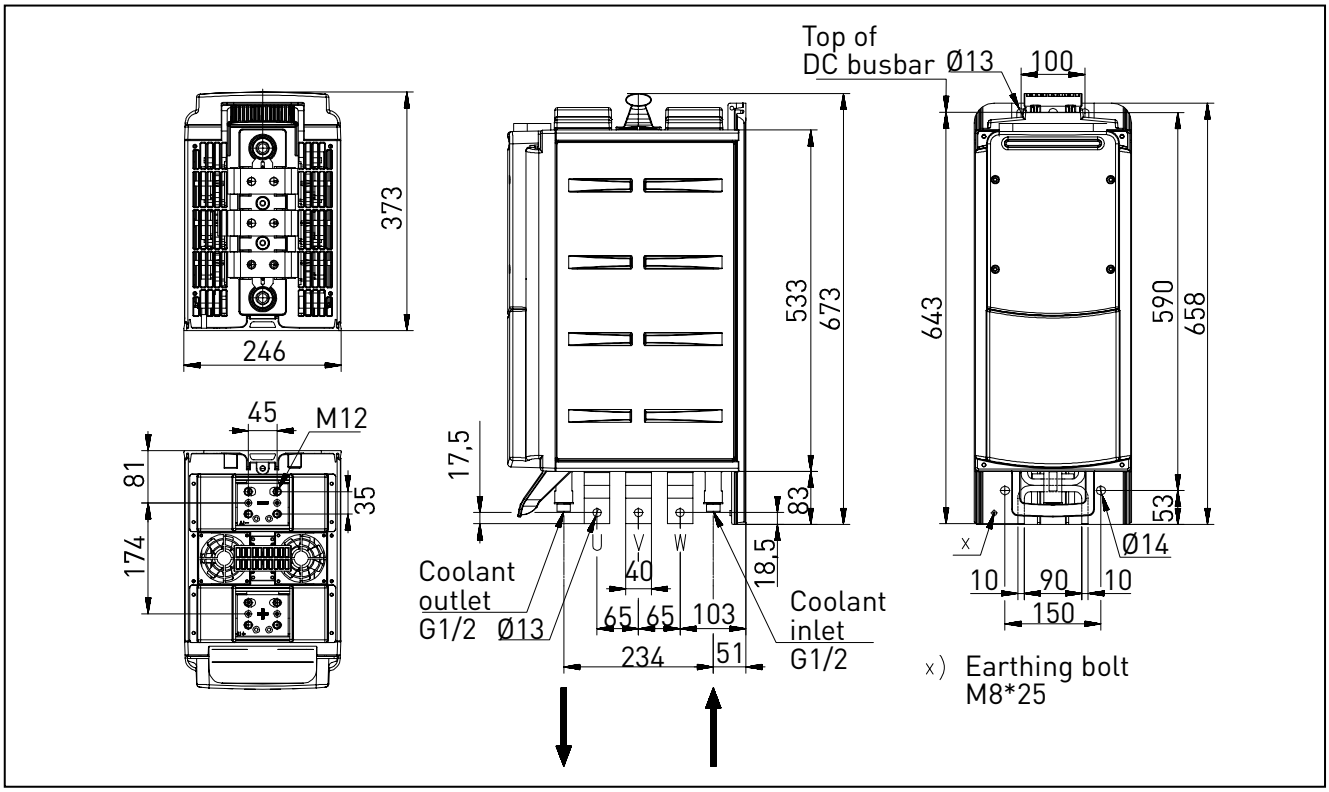


Figure 5-10. Vacon Liquid-Cooled inverter, CH62

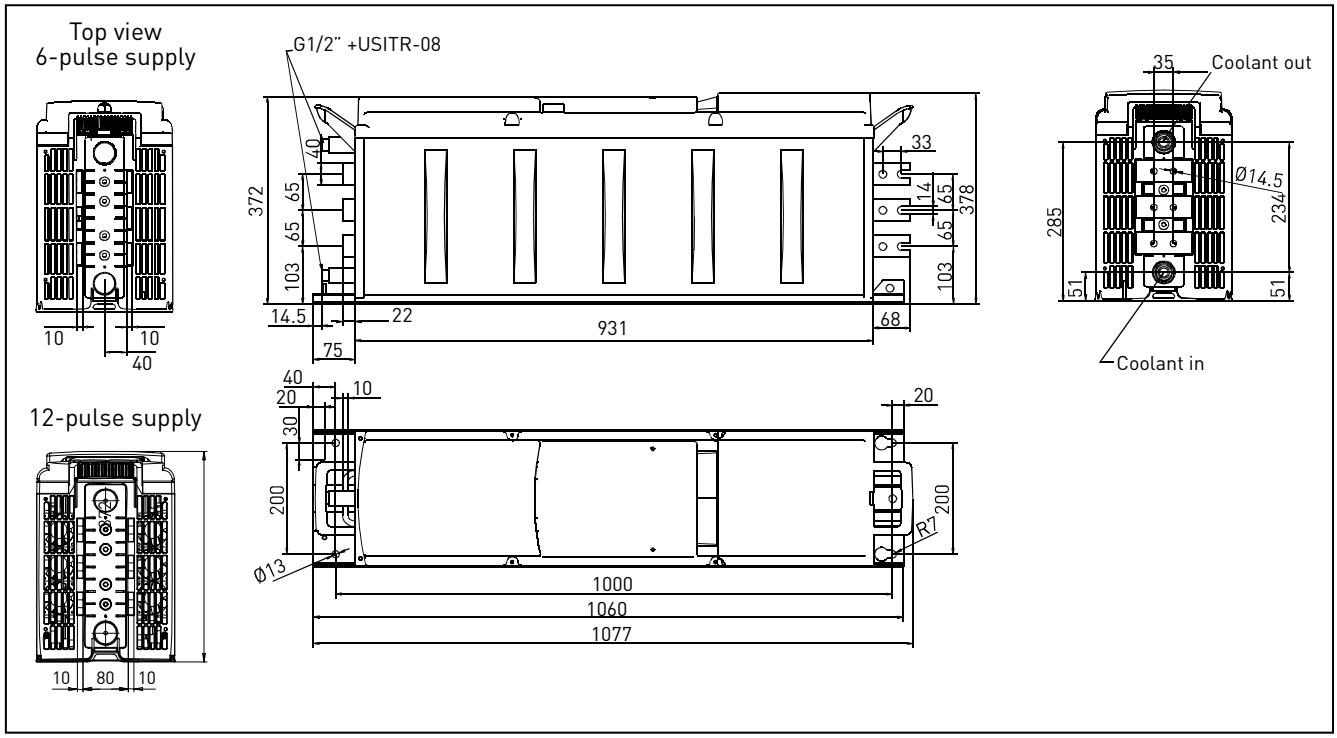


Figure 5-11. Vacon Liquid-Cooled frequency converter, CH72

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

5.1.2.2 Drives consisting of several modules

Vacon NX Liquid-Cooled drives consisting of several modules are mounted in a mounting bracket as presented in Figure 5-12.

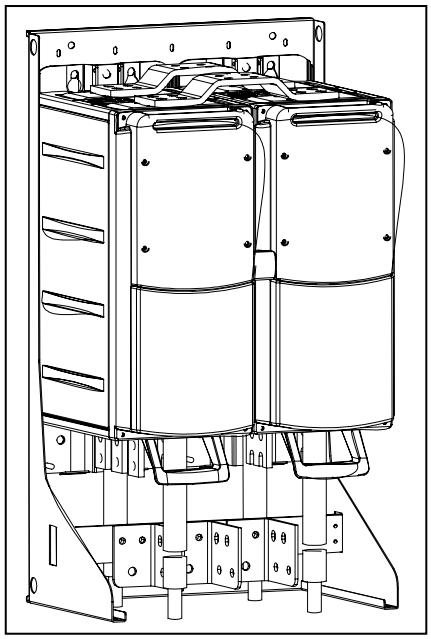


Figure 5-12. Drive mounted inside mounting bracket

Chassis	Width	Height	Depth	Weight
CH63	505	924	375	120
CH64	746	924	375	180
CH74	746	1175	385	280

Table 5-2. Several-module drive dimensions (mounting bracket included)

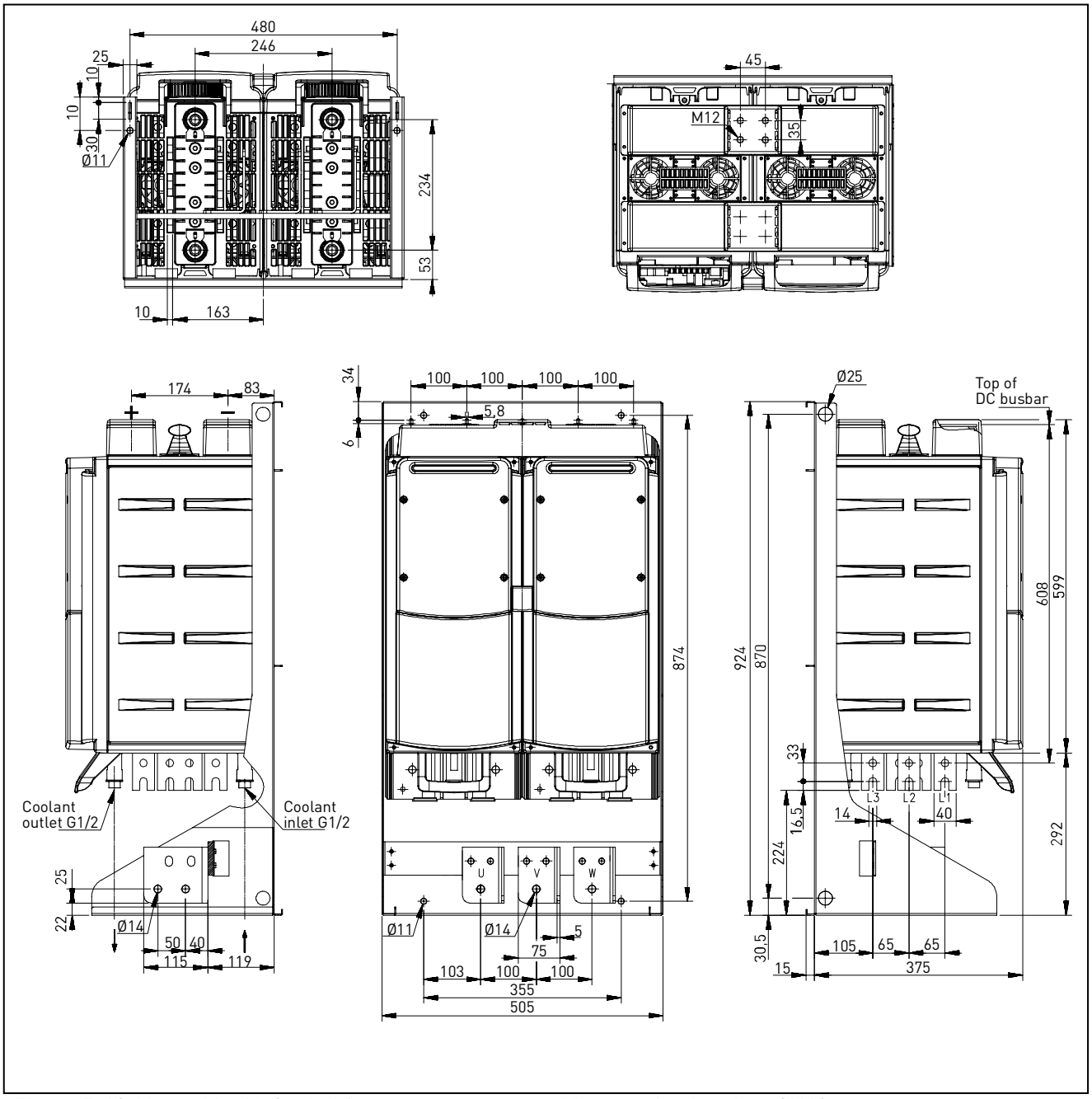


Figure 5-13. Vacon Liquid-Cooled frequency converter with mounting bracket, CH63

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

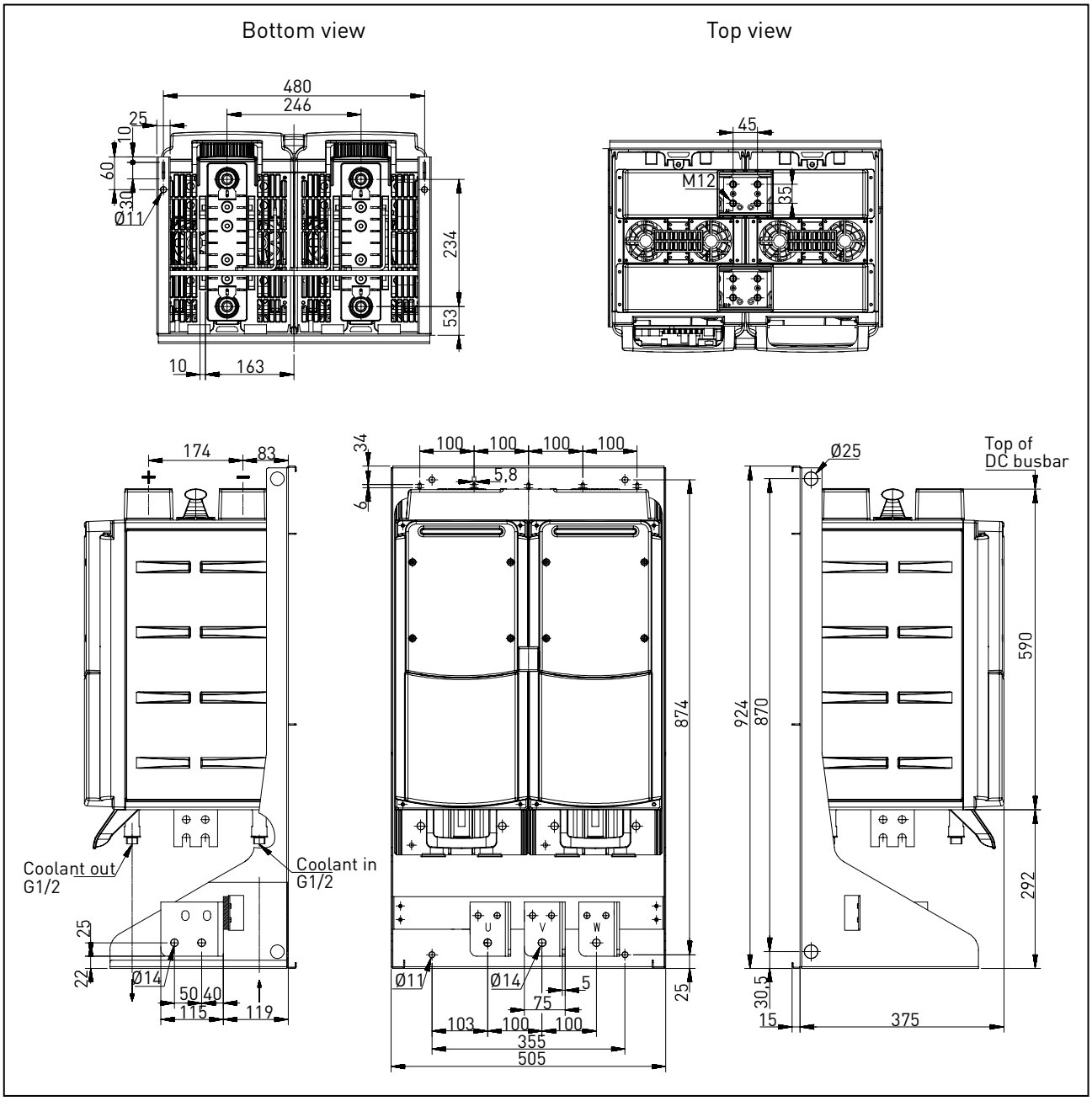


Figure 5-14. Vacon Liquid-Cooled inverter with mounting bracket, CH63

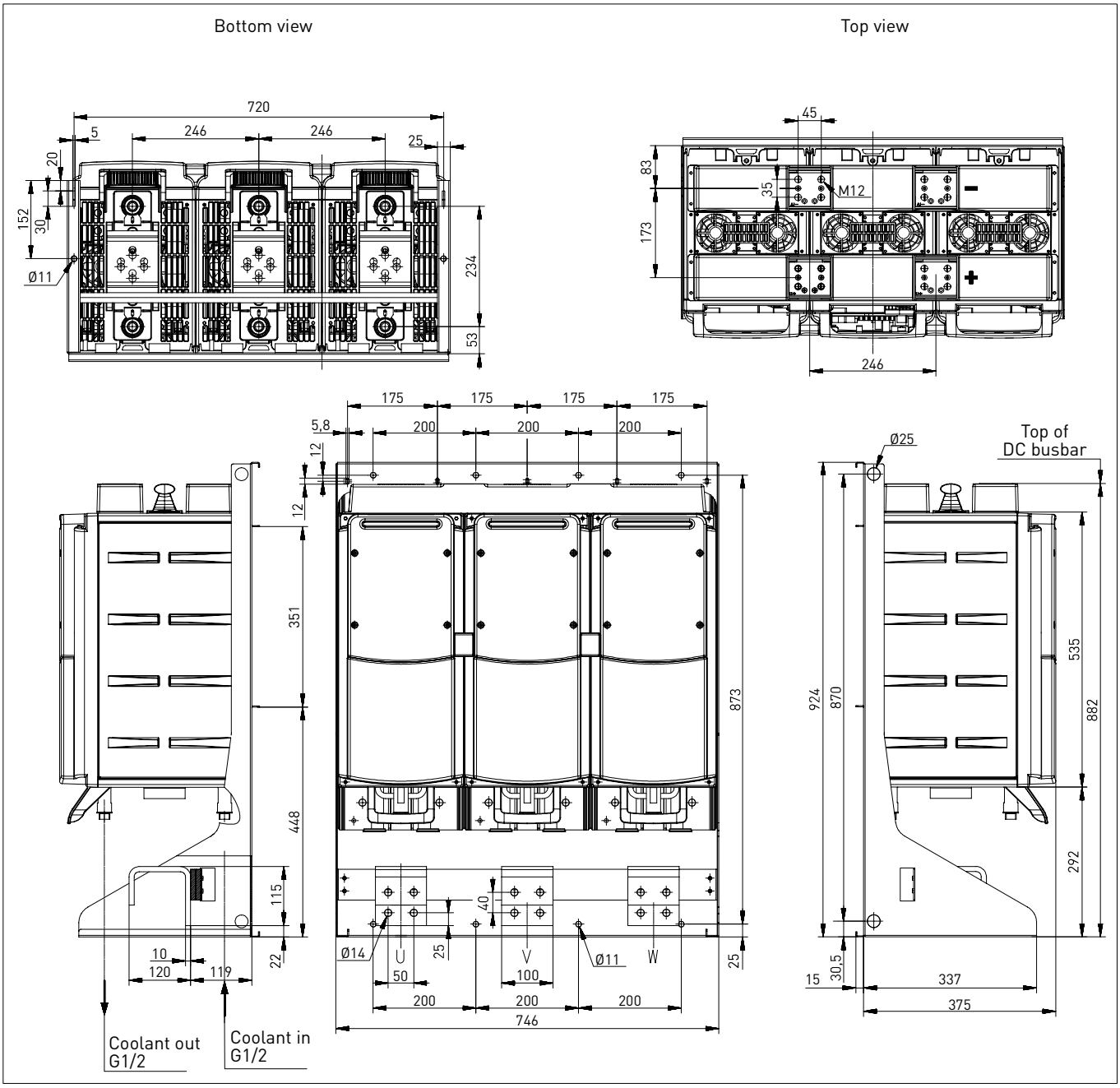


Figure 5-15. Vacon NX Liquid-Cooled inverter dimensions, CH64, IP00

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

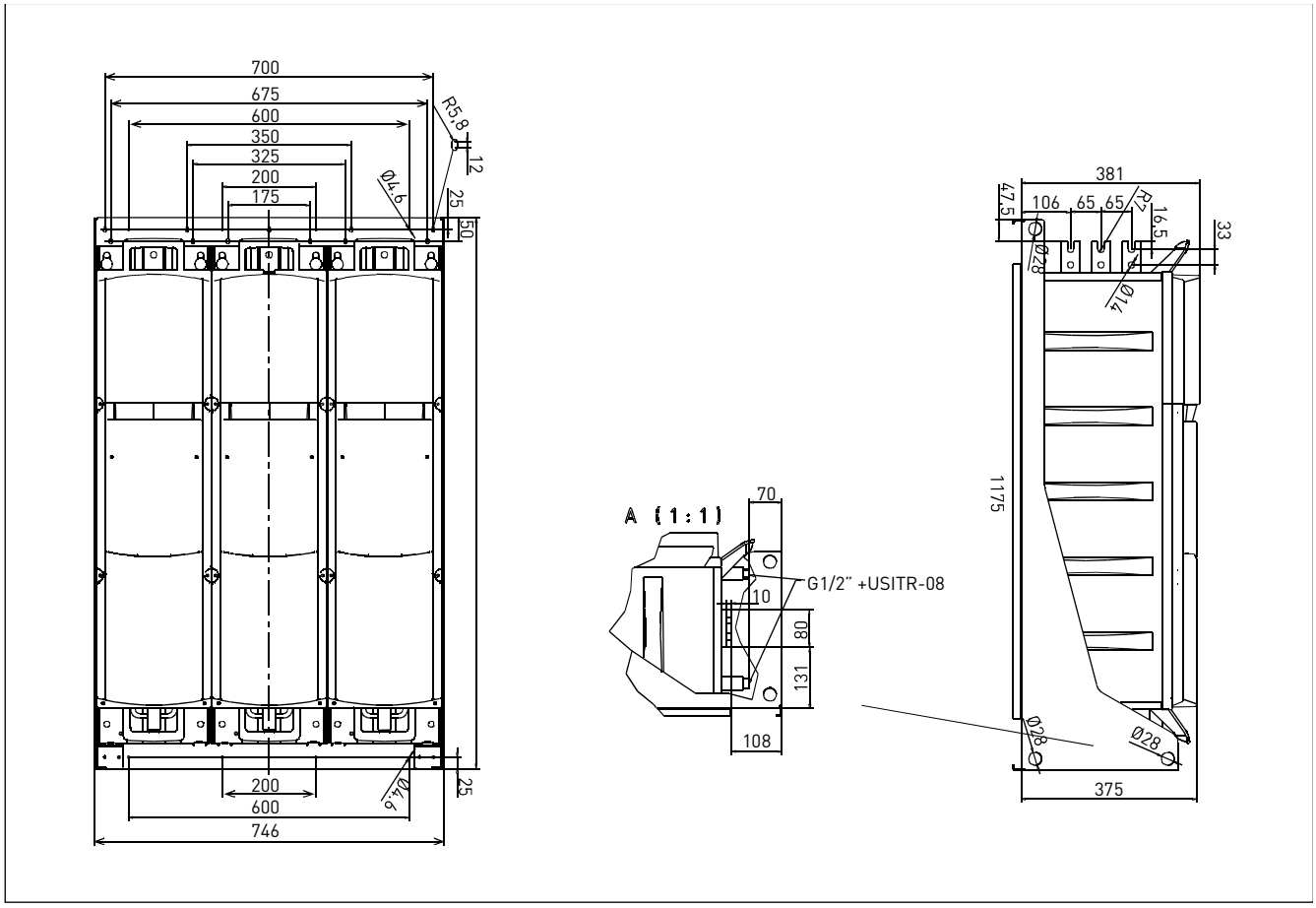


Figure 5-16. Vacon NX Liquid-Cooled frequency converter front and side dimensions, CH74, IP00

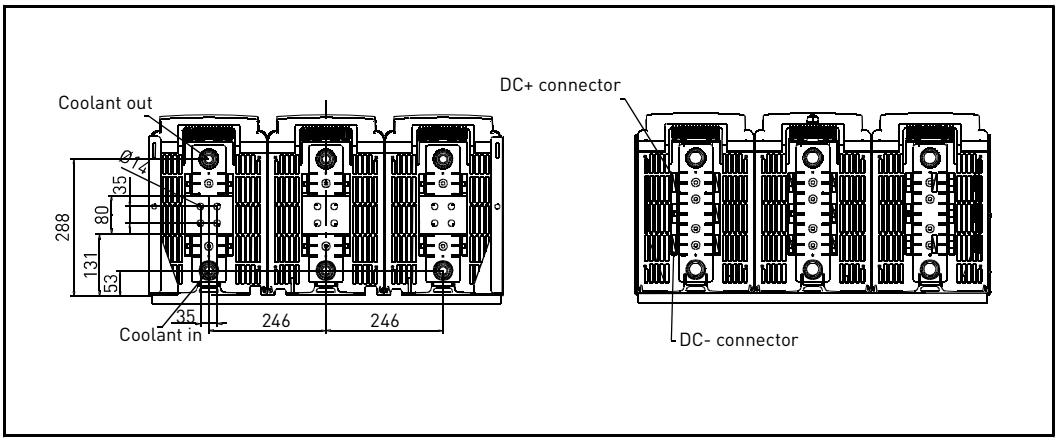


Figure 5-17. Vacon NX Liquid-Cooled frequency converter top and bottom dimensions, CH74, IP00

5.2 Cooling

Instead of using air for cooling, Vacon NX Liquid-Cooled drives are cooled with liquid. The liquid circulation of the drive is usually connected to a **heat-exchanger** (liquid-liquid/liquid-air) which cools down the liquid circulating in the cooling elements of the drive. Because the cooling elements are made of aluminium, the cooling agents allowed to be used are **drinking water, demineralized water** or a **mixture of water and glycol**. In a **closed circulation system**, the following figures are recommended reference values. To avoid electrochemical corrosion, we furthermore recommend to add an inhibitor (e.g. Ferrolix 332/Henkel or **Cortec VpCI-649**) in the cooling agent.

The heat-exchanger delivered by Vacon (HXL) consists of stainless steel materials. The good corrosion performance of stainless steel in district water systems is utilized and no disadvantage of divergent metal filler is included. Nevertheless, some precautions must be taken to reduce the corrosion risk on the stainless steel in high chloride waters, see Table 5-5. We recommend to use a Vacon HXL heat exchanger whenever possible.

Note: If no heat-exchanger is used, actions must be taken to avoid electrochemical corrosion. Specifically no brass or copper elements may be used in the liquid circulation of the drive.

Specification: Drinking water

The attached table gives the chemical requirements for drinking water provided for by the Finnish Ministry of Social Affairs and Health. These values are indicative.

Quality	Unit	Value
Acrylamide	µg/l	0.10
Antimony	µg/l	5.0
Arsenic	µg/l	10
Benzene	µg/l	1.0
Benzopyrene	µg/l	0.010
Boron	mg/l	1.0
Bromate	µg/l	10
Cadmium	µg/l	5.0
Chromium	µg/l	50
Copper	mg/l	2.0
Cyanides	µg/l	50
1,2-Dichloroethane	µg/l	3.0
Epichlorohydrin	µg/l	0.10
Fluoride	mg/l	1.5
Lead	µg/l	10
Mercury	µg/l	1.0
Nickel	µg/l	20

Quality	Unit	Value
Nitrate (NO_3^-)	mg/l	50
Nitrate-Nitrogen (NO_3-N)	mg/l	11.0
Nitrite (NO_2^-)	mg/l	0.5
Nitrite-Nitrogen (NO_2-N)	mg/l	0.15
Bactericides	µg/l	0.10
Bactericides, total	µg/l	0.50
Polynuclear aromatic hydrocarbons	µg/l	0.10
Selenium	µg/l	10
Tetrachloroethylene and trichloroethylene tot.	µg/l	10
Trihalomethanes tot.	µg/l	100
Vinyl chloride	µg/l	0.50
Chlorophenols total	µg/l	10

Table 5-3. Drinking water chemical specification

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

Quality	Unit	Max. value
Aluminium	µg/l	200
Ammonium (NH_4^+)	mg/l	0.50
Ammonium (NH_4-N)	mg/l	0.40
Chloride[1]	mg/l	<100
Manganese	µg/l	50
Iron	µg/l	<0.5
Sulphate[1] [2]	mg/l	250
Sodium	mg/l	200
Oxidizability (COD_{Mn}-O_2)	mg/l	5,0
Quality	**Unit**	**Desired value**
Clostridium perfringens (including spores)	pmy/100 ml	0
Coliform bacteria	pmy/100 ml	0
Bacterial count (22°C)		No unusual changes
pH[1]	pH	6...8
Electrical conductivity[1]	µS/cm	<100
Turbidity		To be approved by user and no unusual changes
Colour		No unusual changes
Smell and taste		No unusual changes
Total organic carbon (TOC)		No unusual changes
Tritium	beq/l	100
Indicative total dose	mSv/year	0.10
Water hardness	°dH	3...10
Max. particle size in coolant	µm	300

Table 5-4. Drinking water quality recommendations

Notes:

1) No aggressive water allowed
2) To avoid corrosion of piping, the sulphate content must not exceed **150 mg/l**.

The cleanness of the heat exchanger, and therefore the heat exchanging capacity, depend on the purity of the process water. The more impure the water, the more frequently the heat exchanger needs cleaning. The following figures are reference values required of cooling circuit process water:

Specification: Process water

Quality	Unit	Value
pH		6...9
Water hardness	°dH	<20
Electrical conduc-tivity	µS/cm	<100
Chlorides (Cl) [1]	mg/l	<100
Iron (Fe)	mg/l	<0.5

Table 5-5. Process water specification

1) The allowed concentration of chloride ions (Cl–): <1000 ppm at 20°C, <300 ppm at 50°C and <100 ppm at 80°C; the values are given as guidance to reduce the corrosion risk on stainless steel. The values are valid for pH=7. Lower pH value increases the risk.

The design temperature of the cooling agent entering the drive module(s) is 35°C. While circulating inside the cooling element, the liquid transfers the heat produced by the power semiconductors (and the capacitors). The design temperature rise of the cooling agent during the circulation is less than 5°C. Typically, 95% of the power losses is dissipated in the liquid. We advise you to equip the cooling agent circulation with temperature supervision.

The heat exchanging equipment can be located outside the electrical room in which the frequency converters are. The connections between these two are made on site. In order to minimize the pressure drops, the pipings shall be made as straight as possible. We further recommend that a regulating valve equipped with a measurement point is mounted. This makes the measurement and regulation of liquid circulation possible in the commissioning phase.
In order to prevent dirt particles from accumulating in the connections and thus gradually weakening the cooling effect, installation of filters is also recommended.

The highest point of the piping must be equipped with either an automatic or a manual venting device. The material of the piping must comply with at least AISI 304 (AISI 316 is recommended).

Prior to the actual connection of the pipes, the bores shall be cleaned thoroughly. If cleaning with water is not possible, although recommended, pressured air must be used to remove all loose particles and dust.

To facilitate the cleaning and venting of the coolant circulation, we recommend you to install a bypass valve in the main line and valves at each frequency converter inlet. Open the bypass valve and shut the valves to the frequency converter when cleaning and airing the system. On commissioning the system, the bypass valve shall be closed and the valves to the converters opened.

Below you will find a simplified example of the cooling system as well as an example of the connections between the frequency converters and the cooling system.

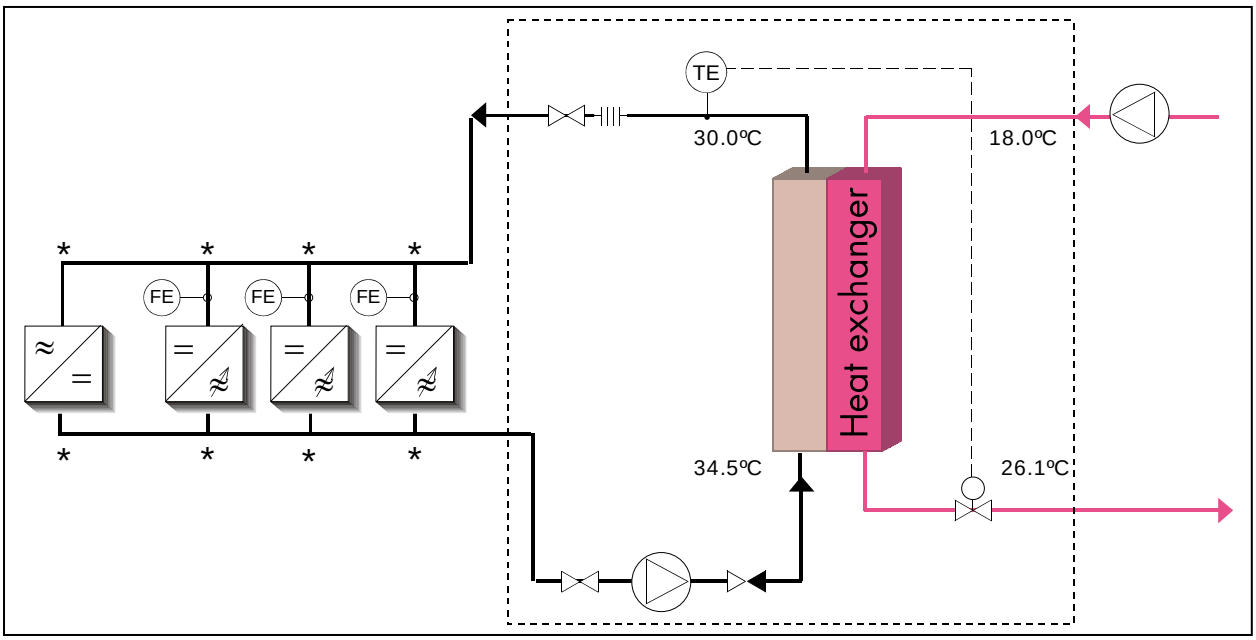


Figure 5-18. Example of cooling system

Vacon recommends to equip the cooling system with pressure and flow supervision (FE). The flow supervision can be connected to digital input function *External fault.* If the coolant flow is found too low, the frequency converter will be stopped.
The flow supervision and other actuators, e.g. a constant flow valve, are available as options. The options shall be mounted at the junction of the main line and the branching line to the element, indicated with an asterisk (*) in the figure above.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

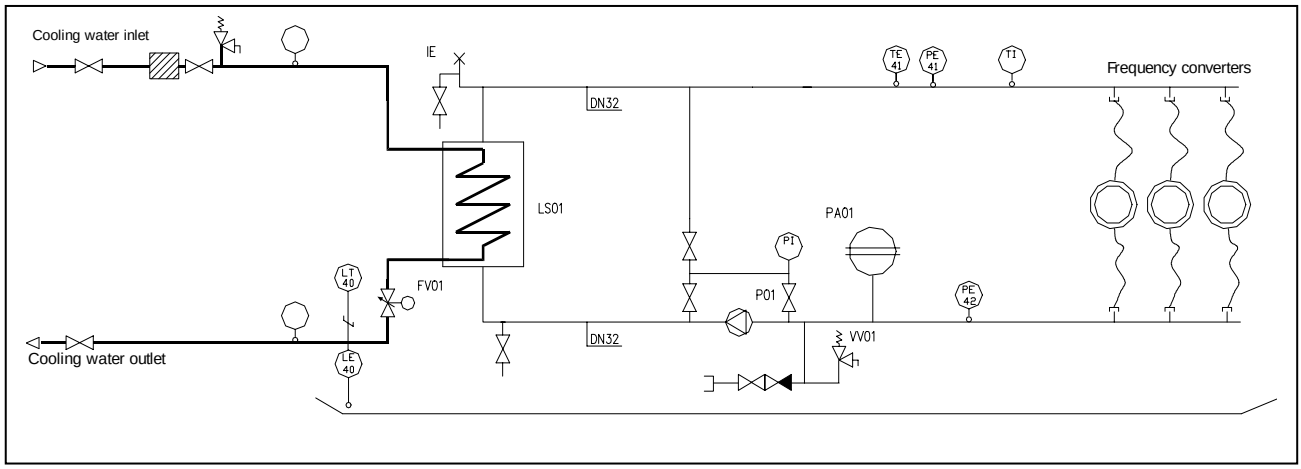


Figure 5-19. Example: PI-diagram of the cooling system and the connections

In tables below you will find the specifications related to the cooling agent and its circulation. See also on page 25.

Chassis	Min. liquid flow per element (drive) [dm³/min]	Nom. liquid flow per element (drive) [dm³/min]			Max. liquid flow per element (drive) [dm³/min]	Liquid volume/ element [l]
	A	A	B	C	A	A
CH3	3 (3)	5 (5)	5,4 (5,4)	5,8 (5,8)	20 (20)	0.11
CH4	8 (8)	10 (10)	11 (11)	12 (12)	20 (20)	0.15
CH5	10 (10)	15 (15)	16 (16)	17 (17)	40 (40)	0.22
CH61	20 (20)	25 (25)	27 (27)	29 (29)	40 (40)	0.38
CH62	20 (20)	25 (25)	27 (27)	29 (29)	40 (40)	0.38
CH63	20 (40)	25 (50)	27 (54)	29 (58)	40 (80)	0.38
CH64	20 (60)	25 (75)	27 (80)	29 (86)	40 (120)	0.38
CH72	20 (20)	35 (35)	37 (37)	40 (40)	40 (40)	1.58
CH74	20 (60)	35 (105)	37 (112)	40 (121)	40 (120)	1.58

Table 5-6. Information about cooling agent and its circulation

A = 100% water; **B** = Water/Glycol mixture 80:20; **C** = Water/Glycol mixture (60:40)

Definitions: **Min liquid flow** = Minimum flow rate to ensure of total venting of the cooling element
Nom liquid flow = Flow rate that allows running the drive at I_{th}
Max liquid flow = If flow rate exceeds max liquid flow, risk of cooling element erosion increases

Liquid ref temperature, input: 30°C
Max temperature rise during circulation: 5°C

Note: *Unless minimum liquid flow rate is ensured, air pockets may develop in the cooling elements.*

The following table will help you to determine the appropriate flows of cooling agent (l/min) with given power losses (see chapter 4.2).

Power loss [kW]	Glycol/Water ratio					
	100/0	80/20	60/40	40/60	20/80	0/100
1	4,41	3,94	3,58	3,29	3,06	2,87
2	8,82	7,88	7,15	6,58	6,12	5,74
3	13,23	11,82	10,73	9,87	9,18	8,61
4	17,64	15,75	14,31	13,16	12,24	11,48
5	22,05	19,69	17,88	16,45	15,30	14,35
6	26,46	23,63	21,46	19,74	18,36	17,22
7	30,86	27,57	25,03	23,03	21,42	20,10
8	35,27	31,51	28,61	26,32	24,48	22,97
9	39,68	35,45	32,19	29,61	27,54	25,84
10	44,09	39,38	35,76	32,90	30,60	28,71

Table 5-7.Cooling agent flow rates (l/min) in relation to power loss at certain glycol/water mixture

Note: In order to ensure a sufficient cooling of boards, capacitors and DC-buses, Vacon NX Liquid-Cooled drives of chassis CH4 are equipped with one additional fan per module. The fan is placed underneath the module and it is supplied externally. See chapter 5.2.3.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

5.2.1 Condensation

Condensation on the cooling plate of the NX Liquid-Cooled drive must be avoided. Therefore, the temperature of the cooling liquid must be kept higher than the temperature of the electrical room. Use the graph below to determine if the drive operating conditions (combination of room temperature, humidity and cooling liquid temperature) are safe, or, to choose the allowed temperature for the cooling liquid.

The conditions are safe when the point is below the respective curve. If not, take adequate precautions by decreasing the room temperature and/or the relative humidity or increase the cooling liquid temperature. Note that increasing the temperature of the cooling liquid above figures in loadability charts decreases the nominal output current of the drive. The below curves are valid at sea level altitude (1013 mbar).

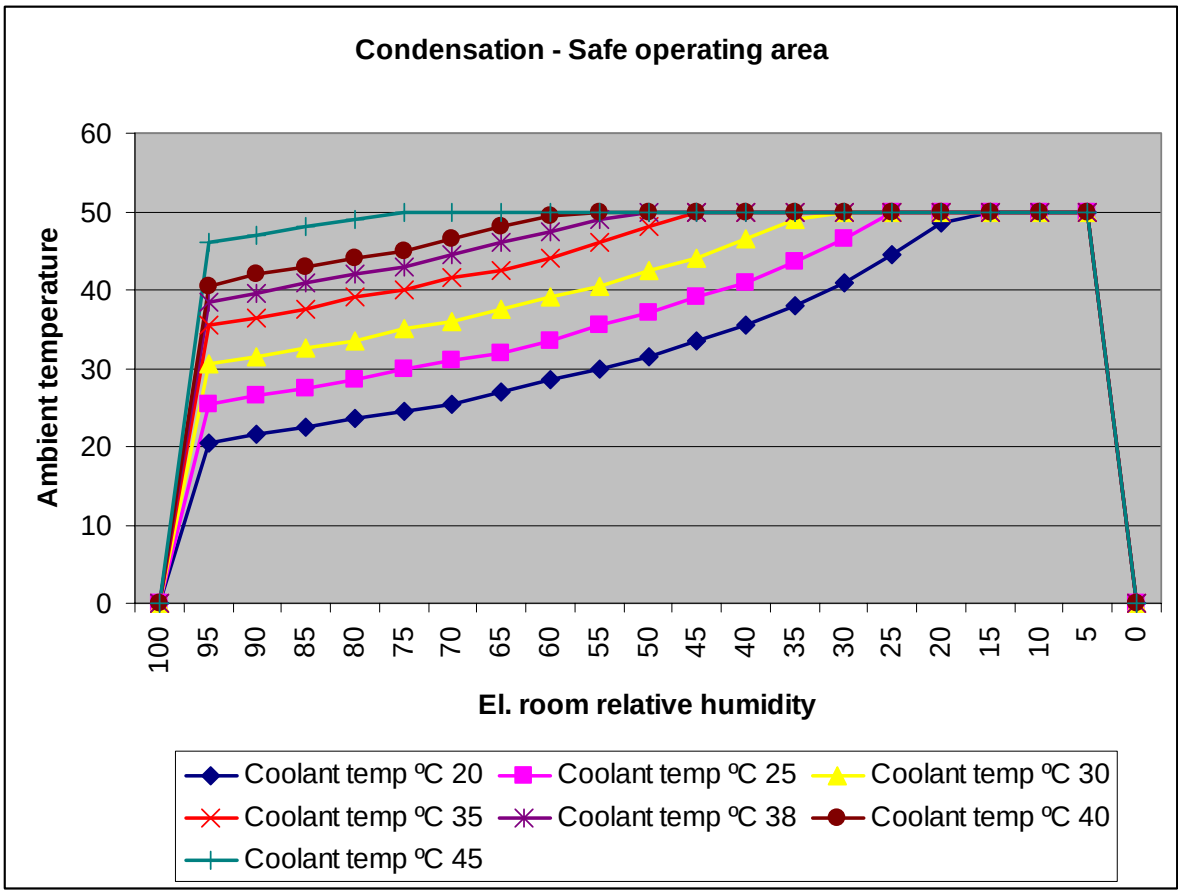


Figure 5-20. Safe operating conditions in relation to condensation

5.2.2 Cooling system connections

The external cooling system shall be connected to each one of the cooling elements of the inverter or frequency converter.

NOTE: It is forbidden to connect the cooling elements in series.

The delivery comprises hoses (Technobel Noir Tricoflex, Art.no 135855) 1.5m in length and 16mm in diameter (CH5, CH6, CH7). The hoses are inserted in 1400-mm UL94V0 approved conduits (type HFX40). These hoses have screw type connectors with internal thread. The connection of the hoses is made on the aluminium adapter (external thread) of the cooling element. The connection of the line hose shall be made avoiding any twisting of the hose on the element.

Figure 5-21. Aluminium hose adapters

Figure 5-22. External thread of hose adapter

For all other chasses (CH3, CH4), the standard delivery includes fast connectors of type 'Tema', series 1300 or 1900. The fast connectors are available as option also for CH5, CH6, CH7.

Chassis	**Thread on element** (internal) BSPP [1]	**Connector type or hose type**	**Thread** (cust.) BSPP [2]	**Max. pressure** (entire system)	**Pressure loss,** (fast connector + element)	**Pressure loss,** (hoses + element)
CH3	G3/8"	1300NE2 1/4"		6 bar	0.25 bar	
CH4	G3/8"	1300NE2 1/4"		6 bar	0.25 bar	
CH5	G3/4"	Technobel 16*23.5	G1/2"	6 bar		0.2 bar
CH6	G3/4"	Technobel 16*23.5	G1/2"	6 bar	See table below	See table below
CH7	G3/4"	Technobel 16*23.5	G1/2"	6 bar	See table below	See table below

Table 5-8. Liquid connector types (all pressure values at nominal flow)

[1] Use sealing (e.g. Usit-R Metal washer-rubber sealing) for this type of connection according to ISO standard 228-1
[2] Use sealant or sealing tape for this type of connection

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

5.2.2.1 Pressure losses

CH6x with standard 1.5m hoses and optional fast connectors TEMA							
Volume flow rate (l/min)	Pressure loss; Tema, inflow (bar)	Pressure loss; inflow hose (bar)	Pressure loss; ele-ment (bar)	Pressure loss; outflow hose: (bar)	Pressure loss; Tema, outflow (bar)	Pressure loss total (inflow hose, element and outflow hose) (bar)	Pressure loss total (Tema, inflow and outflow hoses and element) (bar)
40,0	0,59	0,30	0,28	0,29	0,51	0,87	1,96
30,0	0,30	0,17	0,16	0,16	0,25	0,49	1,04
20,0	0,10	0,09	0,08	0,07	0,09	0,24	0,43
17,0	0,06	0,07	0,06	0,03	0,07	0,16	0,29

Table 5-9. Pressure losses; CH6x

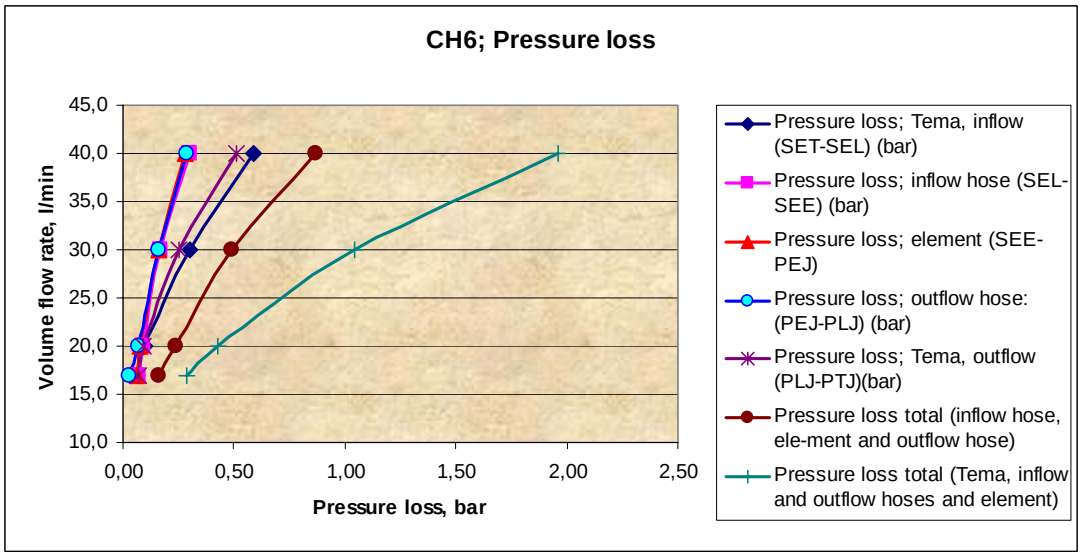


Figure 5-23. Pressure loss, CH6x

CH7x (16) with standard 1.5m hoses and optional fast connectors TEMA							
Volume flow rate (l/min)	Pressure loss; Tema, inflow (bar)	Pressure loss; inflow hose (bar)	Pressure loss; element (bar)	Pressure loss; outflow hose: (bar)	Pressure loss; Tema, outflow (bar)	Pressure loss total (inflow hose, element and outflow hose) (bar)	Pressure loss total (Tema, inflow and outflow hoses and element) (bar)
40,0	0,61	0,30	0,28	0,28	0,50	0,87	1,97
30,0	0,31	0,17	0,17	0,16	0,26	0,50	1,07
20,0	0,11	0,09	0,08	0,07	0,10	0,24	0,44

Table 5-10. Pressure losses; CH7x

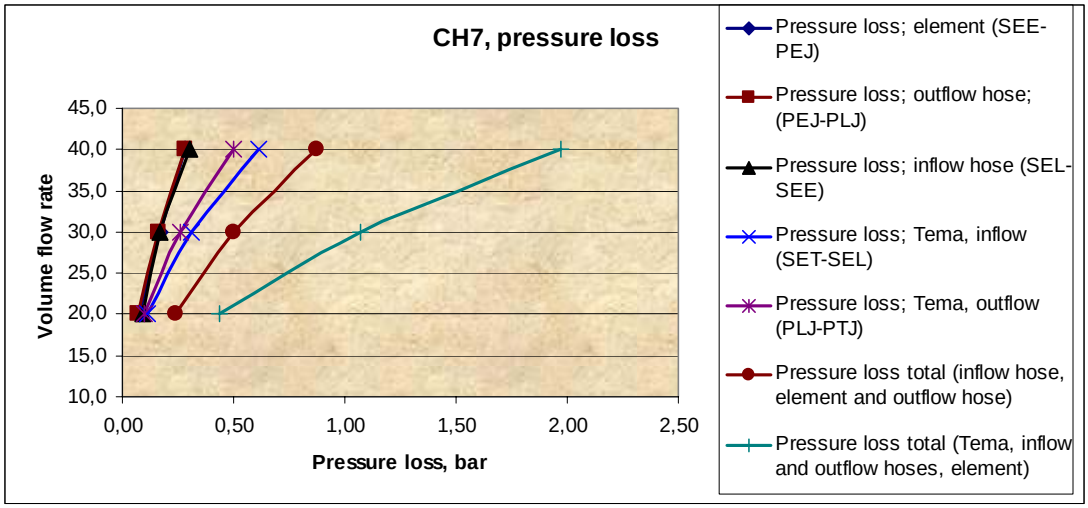


Figure 5-24. Pressure loss, CH7x

The liquid carrying hoses from the network to the cooling elements of the drive **must not be electrically conductive**. **Risk of electrical shock and device damage!** To avoid electrochemical corrosion, we furthermore recommend to add an inhibitor (e.g. Ferrolix 332/Henkel, Cortec VpCI-649l in the cooling liquid. The following main line hose materials are allowed:

- plastic (PVC)
- rubber (EPDM only)
- aluminium
- other stainless and acid-proof materials

The hoses must tolerate a **peak pressure** of 40 bar.

Connect the line hose to its counterpart (screw connector or fast connector) on the cooling element of the frequency converter/inverter. The coolant inlet connector is the one closer to the mounting plate and the outlet connector the one closer to the face of the drive, see Figure 5-26. Due to high pressure in the line hose, it is recommended to equip the liquid line with a shut-off valve, which makes the connection easier. In order to prevent water from spraying in the installation room we also recommend to wrap e.g. linters around the connection on installing.

Vacon furthermore recommends to equip the pipe branches to the cooling elements with valves.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

5.2.2.2 Installation of flow switch

As stated on page 40, Vacon recommends the installation of flow supervision in the liquid cooling system. If requested, Vacon delivers the flow switch as option. The specification of the flow switch as well as notes as concerns its installation are given below.

About the installation:

Vacon recommends to mount the flow switch on the inflow side of the system (see Figure 5-18). Pay attention to the direction of flow. The switch reaches the highest accuracy when it is mounted in horizontal position. If mounted vertically, the mechanical sensor is affected by the Earth's gravity which reduces the accuracy according to the data given in Table 5-11.

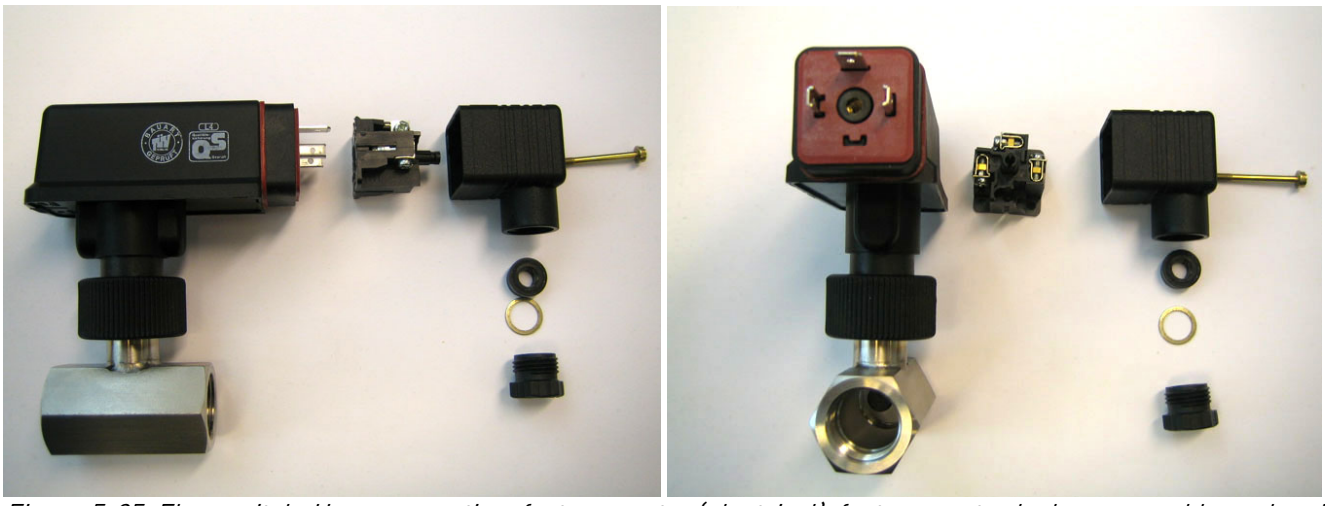


Figure 5-25. Flow switch: Hose connection, fast connector (electrical), fast connector lock screw, cable seal and clamp

Hose connection	G1/2" female, internal thread ISO228-1
Closing	The switch closes if the flow exceeds 20 l/min.
Switching accuracy: Horizontal installation Vertical installation	 –5...+15% (19...23 l/min) ±5% (19...21 l/min)

Table 5-11. Flow switch data

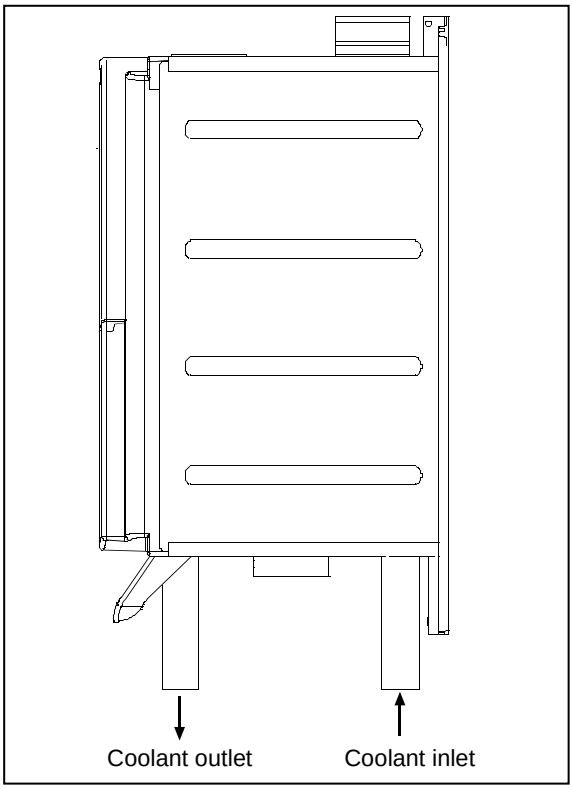


Figure 5-26. Direction of coolant circulation

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

5.2.3 External cooling fan for CH4

In order to provide sufficient cooling for the power board, capacitors and DC-buses in the NX Liquid-Cooled drive of chassis CH4, one additional cooling fan and a steel pallet for mounting are included in the standard delivery.

The fan shall be mounted underneath the module on the steel pallet with four 5.8mm screws and it needs a +24V external power supply.

See Appendix 3 for drawings of the fan and the mounting pallet.

5.3 Drive derating

The tables below state the maximum coolant temperatures for Vacon liquid-cooled drives at given switching frequencies. Drive derating is required if the maximum temperatures are exceeded.

Supply voltage 400-500 VAC, switching frequency 3,6 kHz			
Chassis	Type	Max coolant temperature [°C] Supply voltage 400V	Max coolant temperature [°C] Supply voltage 500V
CH61	NXP0385_5	47	43
CH62	NXP0730_5	40	37
CH63	NXP1150_5	38	36
CH64	NXP2060_5	37	34
CH64	NXP2300_5	42	40
CH72	NXP0730_5	42	40
CH74	NXP2060_5	37	34
CH74	NXP2300_5	37	34

Table 5-12. Max temperatures of coolant at switching frequency of 3.6 kHz

Supply voltage 400-500 VAC, switching frequency 1,5 kHz			
Chassis	Type	Max coolant temperature [°C] Supply voltage 400V	Max coolant temperature [°C] Supply voltage 500V
CH61	NXP0385_5	52	49
CH62	NXP0730_5	47	45
CH63	NXP1150_5	44	42
CH64	NXP2060_5	49	47
CH64	NXP2300_5	44	42
CH72	NXP0730_5	45	43
CH74	NXP2060_5	49	47
CH74	NXP2300_5	44	43

Table 5-13. Max temperatures of coolant at switching frequency of 1.5 kHz

Supply voltage 525-690 VAC, switching frequency 3,6 kHz			
Chassis	Type	Max coolant temperature [°C] Supply voltage 525V	Max coolant temperature [°C] Supply voltage 690V
CH61	NXP0261_6	45	39
CH62	NXP0502_6	41	33
CH63	NXP0750_6	42	36
CH64	NXP1500_6	41	34
CH72	NXP0502_6	38	32
CH74	NXP1500_6	41	34

Table 5-14. Max temperatures of coolant at switching frequency of 3,6 kHz

Supply voltage 525-690 VAC, switching frequency 1,5 kHz			
Chassis	Type	Max coolant temperature [°C] Supply voltage 525V	Max coolant temperature [°C] Supply voltage 690V
CH61	NXP0261_6	54	51
CH62	NXP0502_6	52	47
CH63	NXP0750_6	53	50
CH64	NXP1500_6	52	47
CH72	NXP0502_6	51	46
CH74	NXP1500_6	52	48

Table 5-15. Max temperatures of coolant at switching frequency of 3,6 kHz

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

5.4 Input chokes

The input choke carries out several functions in the Vacon NX Liquid-Cooled frequency converter. Connection of the input choke is necessary except if you have a component in your system that performs the same tasks (e.g. a transformer). The input choke is needed as an essential component for motor control, to protect the input and DC-link components against abrupt changes of current and voltage as well as to function as a protection against harmonics.

The input chokes are included in the standard delivery of Vacon liquid-cooled frequency converters (not inverters). However, you can also order your frequency converter without the choke.

The Vacon chokes listed below are meant for supply voltages of 400-500 and 525-690V.

Converter types (400—500VAC)	Converter types (690VAC)	Choke type	Thermal current [A]	Nominal inductance [µH] A/B*	Calculated loss [W]
0016...0022	0012...0023	CHK0023N6A0	23	1900	145
0031...0038	0031...0038	CHK0038N6A0	38	1100	170
0045...0061	0046...0062	CHK0062N6A0	62	700	210
0072...0087	0072...0087	CHK0087N6A0	87	480	250
0105...0140	0105...0140	CHK0145N6A0	145	290	380
0168...0261	0170...0261	CHK0261N6A0	261	139/187	460
0300...0385	0325...0385 ***0820...1180*** ***1850...2340***	CHK0400N6A0	400	90/126	610
0460...0520 ***1370 (CH74)***	0416...0502 ***1300...1500*** ***2700...3100***	CHK0520N6A0	520	65/95	810
0590...0650 ***1640***	0590...0650 ***1700...1900***	CHK0650N6A0	650	51/71	890
0730 ***2060***	0750	CHK0750N6A0	750	45/61	970
0820 ***2300***	-	CHK0820N6A0	820	39/53	1020
0920...1030	-	CHK1030N6A0	1030	30/41	1170
1150	-	CHK1150N6A0	1150	26/36	1420
2470...2950		CHK0520N6A0	520	65/95	810
3710		CHK0650N6A0	650	51/71	890
4140		CHK0750N6A0	750	45/61	970

Table 5-16. Input choke dimensioning, 6-pulse supply

*Converter types written **bold italic** require three (3) chokes of the designated kind per unit with 6-pulse supply.*

Converter types (400—500VAC)	Converter types (690VAC)	Choke type (2 chokes needed)	Thermal current [A]	Nominal inductance [µH] A/B*	Calculated loss [W]
0460...0520	0325...0502	CHK0261N6A0	261	139/187	460
0590...0730	0590...0750	CHK0400N6A0	400	90/120	610
0820...1030	0820...1030 ***1850***	CHK0520N6A0	520	65/95	810
1150 ***2300*** ***2470***	1180...1300 ***2120...2340***	CHK0650N6A0	650	51/71	890
1370 ***2950***	1370 ***2700***	CHK0750N6A0	750	45/61	970
1640	1500 ***3100***	CHK0820N6A0	820	39/53	1020
2060 ***3710***	1700...1900	CHK1030N6A0	1030	30/41	1170
4140	-	CHK1150N6A0	1150	26/36	NA

Table 5-17. Input choke dimensioning, 12-pulse supply

*Converter types written **bold italic** require two (2) chokes of the designated kind per unit (totally 4).*

*Inductances for different supply voltages; A = 400...480Vac, B = 500...690Vac. See page 54.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

5.4.1 Installation of input chokes

There are two types of input choke connection in Vacon NX Liquid-Cooled drives. The two smallest sizes (CH31, CH32; up to 61A) have terminal block connection whereas bigger sizes use busbar connection. Examples of both connections and the choke dimensions below.

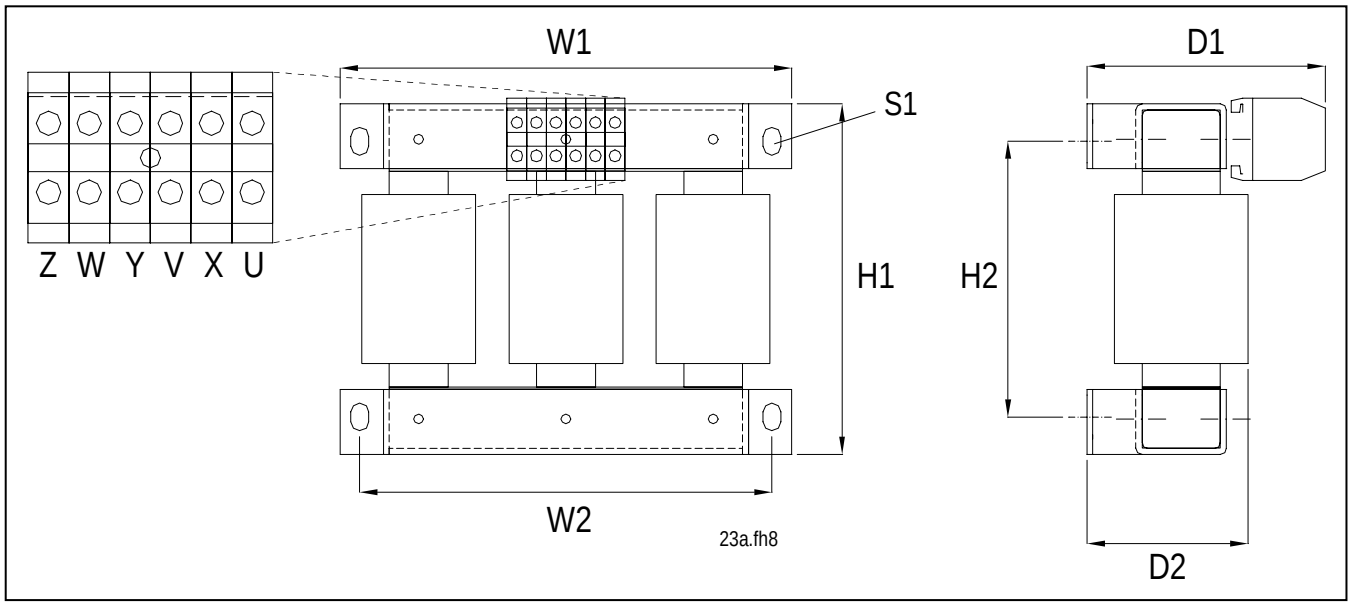


Figure 5-27. Example of input chokes for Vacon NX Liquid-Cooled. Sizes up to 62A

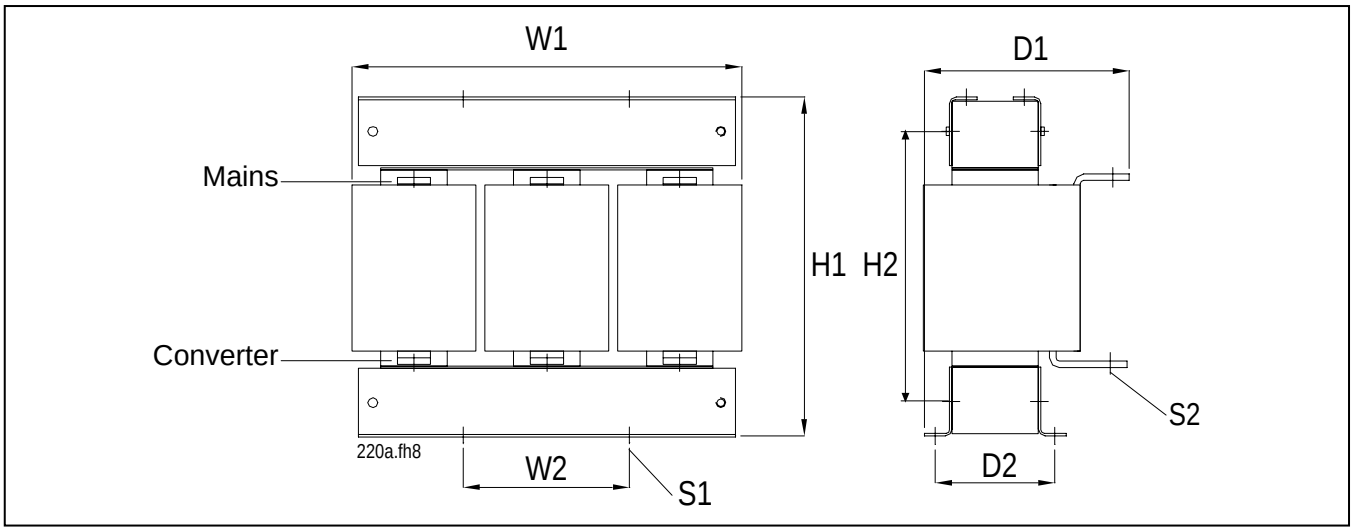
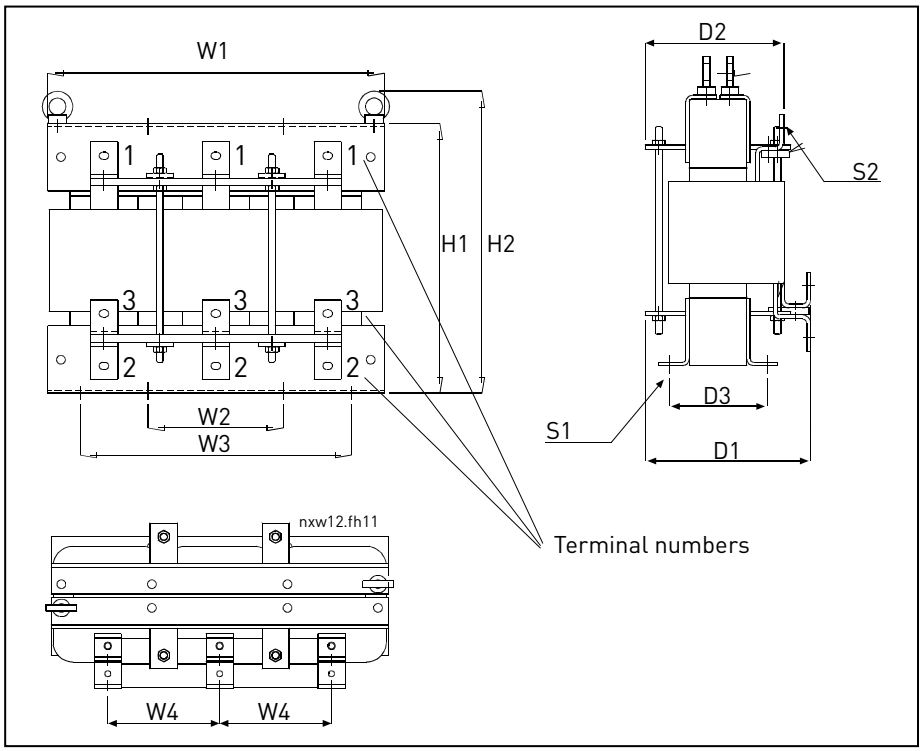


Figure 5-28. Example of input chokes for Vacon NX Liquid-Cooled. Sizes 87A…145A and 590A

Choke type	H1 [mm]	H2 [mm]	W1 [mm]	W2 [mm]	D1 [mm]	D2 [mm]	S1 [mm]	S2 [mm]	Weight [kg]
CHK0023N6A0	178	140	230	210	121	82	9*14 (4pcs)		10
CHK0038N6A0	209	163	270	250	NA	NA	9*14 (6pcs)		15
CHK0062N6A0	213	155	300	280	NA	NA	9*14 (4pcs)		20
CHK0087N6A0	232	174	300	280	170		9*14 (4pcs)	Ø9 (6 pcs)	26
CHK0145N6A0	292	234	300	280	185		9*14 (4pcs)	Ø9 (6 pcs)	37
CHK0590N6A0	519		394	316	272	165	10*35 (4pcs)	Ø11 (6 pcs)	125

Table 5-18. Choke dimensions; Sizes 23A…145A and 590A

Always connect the supply cables to the choke terminals marked with #1 (see Figure 5-29). Choose the converter connection according to the table below:



Supply voltage	Converter connection (terminal no.)
400-480Vac	2
500Vac	3
575-690Vac	3

Figure 5-29. Example of input chokes for Vacon NX Liquid-Cooled. Sizes 261A…1150A

Choke type	H1 [mm]	H2 [mm]	W1 [mm]	W2 [mm]	W3 [mm]	W4 [mm]	D1 [mm]	D2 [mm]	D3 [mm]	S1	S2 Ø	Weight [kg]
CHK0261N6A0	319	357	354	150	275	120	230	206	108	9*14 (8pcs)	9*14 (9 pcs)	53
CHK0400N6A0	383	421	350	150	275	120	262	238	140	9*14 (8pcs)	11*15 (9 pcs)	84
CHK0520N6A0	399	446	497	200	400	165	244	204	145	Ø13 (8pcs)	11*15 (9 pcs)	115
CHK0650N6A0	449	496	497	200	400	165	244	206	145	Ø13 (8pcs)	11*15 (9 pcs)	130
CHK0750N6A0	489	527	497	200	400	165	273	231	170	Ø13 (8pcs)	13*18 (9 pcs)	170
CHK0820N6A0	491	529	497	200	400	165	273	231	170	Ø13 (8pcs)	13*18 (9 pcs)	170
CHK1030N6A0	630	677	497	200	400	165	307	241	170	Ø13 (8pcs)	13*18 (36pcs)	213
CHK1150N6A0	630	677	497	200	400	165	307	241	170	Ø13 (8pcs)	13*18 (36pcs)	213

Table 5-19. Choke dimensions; Sizes 261A…1150A

If you have ordered the input chokes for Vacon NX Liquid-Cooled separately pay attention to the following instructions:

1. **Protect the chokes from dripping water.** You may even need to use plexiglass for protection because jets of water may occur when working with the connections.
2. **Connection of cables:**
   Types CHK0023N6A0, CHK0038N6A0, CHK0062N6A0 (chokes with terminal blocks)
   The terminals are marked with letters U,V,W and X,Y and Z in such an order, however, that terminals U and X, V and Y as well as W and Z form pairs of which one is an input and the other an output. Furthermore, terminals U,V and W must all be used as either input or output. The same applies to terminals X, Y and Z. See Figure 5-27.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

Example: If you connect the mains cable of one phase to terminal X, the other two phases must be connected to Y and Z. Accordingly, the choke output cables are connected to their corresponding input pairs: phase 1 → U, phase 2 → V and phase 3 → W.

Other types (chokes with busbar connection)
Connect the mains cables to the upper busbar connectors (see Figure 5-28 and Figure 5-29) with bolts. The cables to the frequency converter are bolted to the lower connectors. See and Table 5-19 for bolt sizes.

5.5 Inverter charging circuit

The charging circuit of **NX Liquid-Cooled inverters** can be controlled in two optional manners: 1) with a switch fuse or 2) with a contactor.

The resistor used for all charging circuits:

Type	Nominal rating T=350°; @25°C [W]	Max voltage [V]	R, ±10% [Ω]
Danotherm ZRF 30/165	165	1200	33

5.5.1 Control with switch fuse

As the DC main switch (OESL) is turned to position 1, the **main contacts** 1/2 and 3/4 as well as the **auxiliary contacts** 13/14 close causing the charging of the inverter through the resistor. After the inverter has fully charged the contact of the programmable relay output 25/26 (OPT-A3) close causing the relay in the switch fuse to operate and the last **main contacts** 5/6 to close. After a successful charging, all main contacts should be closed.

A principal drawing of a switch fuse-controlled (OESL) charging circuit below. For the principal drawing of charging with OETL2500, see APPENDICES.

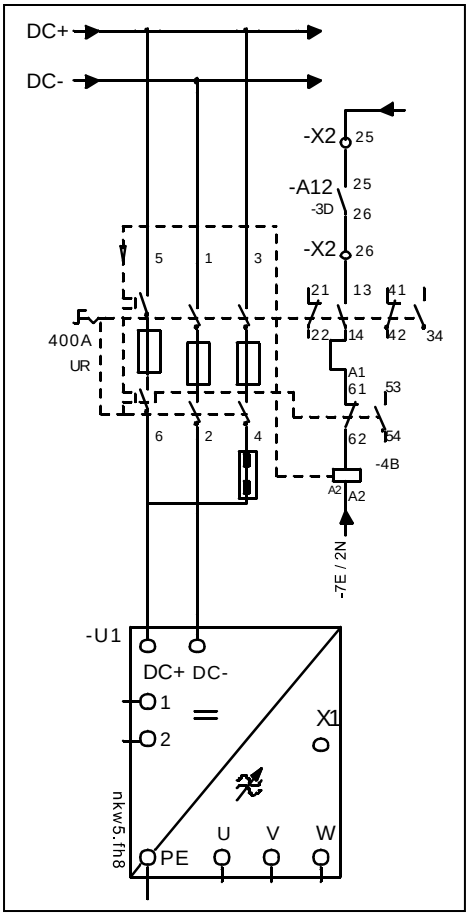


Figure 5-30. NX Liquid-Cooled inverter charging circuit controlled with switch fuse

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

5.5.2 Control with contactor

When the inverter charging circuit is controlled with a contactor an auxiliary voltage transformer must be used. Pay also attention to local conditions of the mains.
Choose the fuses according to the above.

6. ELECTRICAL CABLING AND CONNECTIONS

6.1 Power unit

How the power connections of Vacon NX Liquid-Cooled units are implemented depends on the size of the unit. The smallest NX Liquid-Cooled unit (CH3) has terminal blocks for the connections. In all other units, the connection is established using cables and cable clips or bolting the busbars together.

The main circuit diagrams of each NX Liquid-Cooled drive chassis you will find in Appendix 2 and Appendix 3.

6.1.1 Power connections

Use cables with heat resistance of at least +70°C. The cables and the fuses must be sized according to the drive nominal OUTPUT current that you can find on the rating plate. Sizing according to the output current is recommended because the drive input current never significantly exceeds the output current. Installation of cables according to UL regulations is presented in Chapter 6.1.8.

In chassis CH5 and greater, the field cables (both motor and mains) shall be connected to a specific **cable connection block** (optional equipment). However, inside a switchgear, the cable connection can be made directly to the drive.

Table 6-7 shows the minimum sizes of the Cu-cables and the corresponding aR fuse sizes.

If the motor temperature protection of the drive (see Vacon All in One Application Manual) is used as an overload protection, the cable shall be chosen accordingly. If three or more cables are used in parallel each cable requires a separate overload protection.

These instructions apply only to cases with one motor and one cable connection from the frequency converter or inverter to the motor. In any other case, ask the factory for more information.

6.1.1.1 Mains cable

The mains cables of the size CH31 are connected to terminal blocks (see Figure 5-4) whereas busbar connection is used for greater sizes, see drawings on pages 29 to 37. Mains cable type for EMC level N in Table 6-1.

6.1.1.2 Motor cable

In order to avoid current sharing disbalance **it is imperative to use symmetrical motor cables**. Vacon also recommends to always use shielded cable whenever possible.

The motor cables of the size CH31 are connected to terminal blocks (see Figure 5-4) whereas busbar connection is used for greater sizes, see drawings on pages 29 to 37. Motor cable type for EMC level N in Table 6-1.

Ask factory for more information on the use of ferrite cores with the motor cable in order to protect the motor bearings against motor bearing currents.

For information on control cables see Chapter 6.2.2.1 and Table 6-1.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

Cable type	Level N/T
Mains cable	1
Motor cable	1
Control cable	4

Table 6-1. Cable types required to meet standards.

1 = Power cable intended for fixed installation and the specific mains voltage. Symmetrical shielded cable recommended.
(NKCABLES/MCMK or similar recommended)

4 = Screened cable equipped with compact low-impedance shield (NKCABLES /JAMAK, SAB/ÖZCuY-O or similar).

6.1.1.3 Motor cable data

Chassis	Type	I_{th}	Motor cable Cu [mm²]	Terminal cable size		Max. number of cables/ Bolt size
				Main terminal [mm²], max.	Earth terminal [mm²]	
CH3	0016_5	16	3*2.5+2.5	50	1—10	(Terminal block)
CH3	0022_5	22	3*4+4	50	1—10	(Terminal block)
CH3	0031	31	3*6+6	50	1—10	(Terminal block)
CH3	0038_5 0045_5	38—45	3*10+10	50 Cu 50 Al	6—35	(Terminal block)
CH3	0061_5	61	3*16+16	50 Cu 50 Al	6—35	(Terminal block)
CH4	0072_5	72	3*25+16	50 Cu 50 Al	6—70	1/M8
CH4	0087_5	87	3*35+16	50 Cu 50 Al	6—70	1/M8
CH4	0105_5	105	3*50+25	50 Cu 50 Al	6—70	1/M8
CH4	0140_5	140	3*70+35	95 Cu/Al	25—95	1/M8
CH5	0168_5	168	3*95+50	185 Cu/Al	25—95	2/M10
CH5	0208_5	208	3*150+70	185 Cu/Al	25—95	2/M10
CH5	0261_5	261	3*185+95	185 Cu/Al	25—95	2/M10
CH61	0300_5	300	2*(3*120+70)	*	25—185	2/M12
CH61	0385_5	385	2*(3*120+70)	*	25—185	2/M12
CH62/72	0460_5	460	2*(3*150+70)	**	25—185	4/M12
CH62/72	0520_5	520	2*(3*185+95)	**	25—185	4/M12
CH62/72	0590_5 0650_5	590 650	3*(3*150+70)	**	25—185	4/M12
CH62/72	0730_5	730	3*(3*150+70)	**	25—185	4/M12
CH63	0820_5	820	3*(3*185+95)	**	****	8/M12
CH63	0920_5	920	4*(3*185+95)	**	****	8/M12
CH63	1030_5	1030	4*(3*185+95)	**	****	8/M12
CH63	1150_5	1150	5*(3*185+95)	**	****	8/M12
CH64	1370_5	1370	5*(3*185+95)	**	***	8/M12
CH64	1640_5	1640	6*(3*185+95)	**	***	8/M12
CH64	2060_5	2060	7*(3*185+95)	**	***	8/M12
CH64	2300_5	2300	8*(3*185+95)	**	***	8/M12
CH74[1)]	1370_5	1370	5*(3*185+95)	**	***	4/M12
CH74[1)]	1640_5	1640	6*(3*185+95)	**	***	4/M12
CH74[1)]	2060_5	2060	7*(3*185+95)	**	***	4/M12
CH74[1)]	2300_5	2300	8*(3*185+95)	**	***	4/M12

Table 6-2. Motor cable sizes, 400—500V

[1)]Due to insufficient number of terminal bolt connections for required amount of cables, the cabinet must be equipped with an external flexible cable connection block at both mains and motor ends if stiff cable type is used. See also chapter 6.1.3, step 5.

Units with 6-pulse supply:

Note that all other sizes have 3 input terminals except for size CH74, which has 9 input terminals.

Units with 12-pulse supply:

12-pulse supply can be used with drives of sizes CH72 and CH74. The number of input terminals for both is 6. If 12-pulse supply is used, pay also attention to the fuse selection, see pages 65 and 66.

See the tightening torques of bolts in Table 6-6.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

Chassis	Type	I_{th}	Motor cable Cu [mm²]	Terminal cable size		Max. number of cables/ Bolt size
				Main terminal [mm²], max.	Earth terminal [mm²]	
CH61	0170_6	170	3*95+50	185 Cu/Al	25—95	2/M12
CH61	0208_6	208	3*150+70	185 Cu/Al	25—95	2/M12
CH61	0261_6	261	3*185+95	185 Cu/Al 2	25—95	2/M12
CH62/72	0325_6	325	2*(3*95+50)	**	25—185	4/M12
CH62/72	0385_6	385	2*(3*120+70)	**	25—185	4/M12
CH62/72	0416_6	416	2*(3*150+70)	**	25—185	4/M12
CH62/72	0460_6	460	2*(3*185+95)	**	25—185	4/M12
CH62/72	0502_6	502	2*(3*185+95)	**	25—185	4/M12
CH63	0590_6	590	3*(3*150+70)	**	***	8/M12
CH63	0650_6	650	3*(3*150+70)	**	***	8/M12
CH63	0750_6	750	3*(3*185+95)	**	***	8/M12
CH74[1)]	0820_6	820	4*(3*150+70)	**	***	4/M12
CH74[1)]	0920_6	920	4*(3*185+95)	**	***	4/M12
CH74[1)]	1030_6	1030	4*(3*185+95)	**	***	4/M12
CH74[1)]	1180_6	1180	5*(3*185+95)	**	***	4/M12
CH74[1)]	1300_6	1300	5*(3*185+95)	**	***	4/M12
CH74[1)]	1500_6	1500	6*(3*185+95)	**	***	4/M12
CH74[1)]	1700_6	1700	Contact factory			

Table 6-3. Motor cable sizes, 525—690V

[1)]Due to insufficient number of terminal bolt connections for required amount of cables, the cabinet must be equipped with an external flexible cable connection block at both mains and motor ends if stiff cable type is used. See also chapter 6.1.3, step 5.

* = Number of bolt connections 2
** = Number of bolt connections 4
*** = Three earthing terminals per mounting plate, see chapter 6.1.6.
**** = Two earthing terminals per mounting plate, see chapter 6.1.6.

See the tightening torques of bolts in Table 6-6.

6.1.1.4 *Mains cable data for frequency converters*

Chassis	Type	I_{th}	Mains cable Cu [mm²]	Terminal cable size		Max. number of cables/ Bolt size
				Main terminal [mm²], max.	Earth terminal [mm²]	
CH3	0016_5	16	3*2.5+2.5	50	1—10	(Terminal block)
CH3	0022_5	22	3*4+4	50	1—10	(Terminal block)
CH3	0031	31	3*6+6	50	1—10	(Terminal block)
CH3	0038_5 0045_5	38 45	3*10+10	50 Cu 50 Al	6—35	(Terminal block)
CH3	0061_5	61	3*16+16	50 Cu 50 Al	6—35	(Terminal block)
CH4	0072_5	72	3*25+16	50 Cu 50 Al	6—70	1/M8
CH4	0087_5	87	3*35+16	50 Cu 50 Al	6—70	1/M8
CH4	0105_5	105	3*50+25	50 Cu 50 Al	6—70	1/M8
CH4	0140_5	140	3*70+35	95 Cu/Al	25—95	1/M8
CH5	0168_5	168	3*95+50	185 Cu/Al	25—95	2/M10
CH5	0208_5	208	3*150+70	185 Cu/Al	25—95	2/M10
CH5	0261_5	261	3*185+95	185 Cu/Al	25—95	2/M10
CH61	0300_5	300	2*(3*120+70)	300 Cu/Al	25—185	2/M12
CH61	0385_5	385	2*(3*120+70)	300 Cu/Al	25—185	2/M12
CH72/*CH72*	0460_5	460	2*(3*150+70)	300 Cu/Al	25—185	2 *(or 4)*/M12
CH72/*CH72*	0520_5	520	2*(3*185+95)	300 Cu/Al	25—185	2 *(or 4)*/M12
CH72	0590_5 0650_5	590 650	2*(3*240+120)	300 Cu/Al	25—185	2/M12
CH72	*0590_5* *0650_5* *0730_5*	*590* *650* *730*	*4*(3*95+50)*	300 Cu/Al	*25—185*	*4/M12*
CH72[1)]	0730_5	730	3*(3*150+70)	300 Cu/Al	25—185	2/M12
CH63[1)]	0820_5	820	3*(3*185+95)	300 Cu/Al	****	2/M12
CH63[1)]	0920_5 1030_5	920 1030	4*(3*185+95)	300 Cu/Al	****	2/M12
CH63[1)]	1150_5	1150	4*(3*240+120)	300 Cu/Al	****	2/M12
CH74/ *CH74*[1)]	1370_5	1370	6*(3*150+70)	300 Cu/Al	***	6 *(or 4)*/M12
CH74/ *CH74*[1)]	1640_5	1640	6*(3*185+95)	300 Cu/Al	***	6 *(or 4)*/M12
CH74[1)]	2060_5	2060	9*(3*150+70)	300 Cu/Al	***	6/M12
CH74[1)]	*2060_5*	*2060*	*8*(3*185+95)*	300 Cu/Al	***	*4/M12*
CH74[1)]	2300_5	2300	9*(3*185+95)	300 Cu/Al	***	6/M12

Table 6-4. Mains cable sizes for frequency converters, 400—500V

[1)]Due to insufficient number of terminal bolt connections for required amount of cables, the cabinet must be equipped with an external flexible cable connection block at both mains and motor ends if stiff cable type is used. See also chapter 6.1.3, step 5.

Data in Italic refer to drives with 12-pulse supply.

Units with 6-pulse supply:

Note that all other sizes have 3 input terminals except for size CH74, which has 9 input terminals. CH74 cables must be connected symmetrically between 3 parallel connected rectifiers in each phase.

Units with 12-pulse supply:

12-pulse supply can be used with drives of sizes CH72 and CH74. The number of input terminals for both is 6.
If 12-pulse supply is used, pay also attention to the fuse selection, see pages 65 and 66.

See the tightening torques of bolts in Table 6-6.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

Chassis	Type	I_{th}	Mains cable Cu [mm²]	Terminal cable size		Max. number of cables/ Bolt size
				Main terminal [mm²], max.	Earth terminal [mm²]	
CH61	0170_6	170	3*95+50	185 Cu/Al	25—95	2/M12
CH61	0208_6	208	3*150+70	185 Cu/Al	25—95	2/M12
CH61	0261_6	261	3*185+95	185 Cu/Al 2	25—95	2/M12
CH72/*CH72*	0325_6	325	2*(3*95+50)	300 Cu/Al	25—185	2 *(or 4)*/M12
CH72/*CH72*	0385_6	385	2*(3*120+70)	300 Cu/Al	25—185	2 *(or 4)*/M12
CH72/*CH72*	0416_6	416	2*(3*150+70)	300 Cu/Al	25—185	2 *(or 4)*/M12
CH72/*CH72*	0460_6	460	2*(3*185+95)	300 Cu/Al	25—185	2 *(or 4)*/M12
CH72/*CH72*	0502_6	502	2*(3*185+95)	300 Cu/Al	25—185	2 *(or 4)*/M12
CH63	0590_6 0650_6	590 650	2*(3*240+120)	300 Cu/Al	****	2/M12
CH63[1)]	0750_6	750	3*(3*185+95)	300 Cu/Al	****	2/M12
CH74	0820_6	820	3*(3*185+95)	300 Cu/Al	***	6/M12
CH74	*0820_6*	*820*	*4*(3*150+70)*	300 Cu/Al	***	*4/M12*
CH74	0920_6	920	3*(3*240+120)	300 Cu/Al	***	6/M12
CH74	*0920_6*	*920*	*4*(3*185+95)*	300 Cu/Al	***	*4/M12*
CH74	1030_6	1030	6*(3*95+50)	300 Cu/Al	***	6/M12
CH74	*1030_6*	*1030*	*4*(3*185+95)*	300 Cu/Al	***	*4/M12*
CH74	1180_6	1180	6*(3*120+95)	300 Cu/Al	***	6/M12
CH74	*1180_6* *1300_6*	*1180* *1300*	*4*(3*240+120)*	300 Cu/Al	***	*4/M12*
CH74	1300_6	1300	6*(3*150+95)	300 Cu/Al	***	6/M12
CH74	1500_6	1500	6*(3*185+95)	300 Cu/Al	***	6/M12
CH74[1)]	*1500_6*	*1500*	*6*(3*185+95)*	300 Cu/Al	***	*4/M12*
CH74[1)]	1700_6	1700	Contact factory			

Table 6-5. Mains cable sizes, 525—690V

[1)]Due to insufficient number of terminal bolt connections for required amount of cables, the cabinet must be equipped with an external flexible cable connection block at both mains and motor ends if stiff cable type is used. See also chapter 6.1.3, step 5.

Data in Italic refer to drives with 12-pulse supply.

Units with 6-pulse supply:

Note that all other sizes have 3 input terminals except for size CH74, which has 9 input terminals.

Units with 12-pulse supply:

12-pulse supply can be used with drives of sizes CH72 and CH74. The number of input terminals for both is 6.
If 12-pulse supply is used, pay also attention to the fuse selection, see pages 65 and 66.

See the tightening torques of bolts in Table 6-6.

Bolt	Tightening torque [Nm]	Max. inward thread length [mm]
M8	20	10
M10	40	22
M12	70	22

Table 6-6. Tightening torques of bolts

We recommend a low-impedance earthing of the motor cable shield for better performance.

Because of several possible cable installations and environmental conditions, it is very important to consider **local regulations** and the **IEC/EN standards**.

6.1.2 Drive protection – Fuses

In order to protect the drive from short-circuits and excessive loads, input line fuses are used. Depending on the drive configuration, the following types of fuse protection are recommended:

Frequency converter with AC supply:
Always protect the drive with fast-acting input line fuses for short-circuit protection. Also pay attention to protection of cables!

Common DC bus:

- Inverter units: Choose fuse protection according to Table 6-9 and Table 6-10.
- Active Front End (AFE) units: Choose DC fuses according to Table 6-9 and Table 6-10; Appropriate fuses for the AC supply are listed in Table 6-11 and Table 6-12.
- Inverter units connected to AFE units: Choose fuses for AC supply according to Table 6-11 and Table 6-12; NOTE: Protect each inverter unit with fuses according to Table 6-9 and Table 6-10.

DC links interconnected (e.g. 2*CH74)
In case interconnection of DC links is required please contact the manufacturer.

Brake chopper unit
See chapter 10.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

6.1.2.1 Fuse sizes, frequency converters

The fuse sizing in the tables below is based on Bussman aR fuses. We recommend you to use these fuses. Sufficient protection against short-circuit cannot be guaranteed if other fuse types are used. **Furthermore, equation of the fuse values given in the tables below with those of other fuse manufacturers is not allowed.** In case you wish to use fuses of other fuse manufacturers, contact Vacon.

Chas-sis	Type	I_{th} [A]	DIN43620		DIN43653 (80mm)		DIN43653 (110mm)		Fuse U_n [V]	Fuse I_n [A]	Qty. of fuses per phase 3~/6~
			aR fuse part nr.	Fuse size	aR fuse part nr.	Fuse size	aR fuse part nr.	Fuse size			
CH3	0016	16	170M1565	DIN000	170M1415	000T/80			690	63	1
CH3	0022	22	170M1565	DIN000	170M1415	000T/80			690	63	1
CH3	0031	31	170M1565	DIN000	170M1415	000T/80			690	63	1
CH3	0038	38	170M1565	DIN000	170M1415	000T/80			690	63	1
CH3	0045	45	170M1567	DIN000	170M1417	000T/80			690	100	1
CH3	0061	61	170M1567	DIN000	170M1417	000T/80			690	100	1
CH4	0072	72	170M3815	DIN1*	170M3065	1*TN/80	170M3215	1*TN/110	690	200	1
CH4	0087	87	170M3815	DIN1*	170M3065	1*TN/80	170M3215	1*TN/110	690	200	1
CH4	0105	105	170M3815	DIN1*	170M3065	1*TN/80	170M3215	1*TN/110	690	200	1
CH4	0140	140	170M3815	DIN1*	170M3065	1*TN/80	170M3215	1*TN/110	690	200	1
CH5	0168	168	170M3819	DIN1*	170M3069	1*TN/80	170M3219	1*TN/110	690	400	1
CH5	0208	208	170M3819	DIN1*	170M3069	1*TN/80	170M3219	1*TN/110	690	400	1
CH5	0261	261	170M3819	DIN1*	170M3069	1*TN/80	170M3219	1*TN/110	690	400	1
CH61	0300	300	170M5813	DIN2	170M5063	2TN/80	170M5213	2TN/110	690	700	1
CH61	0385	385	170M5813	DIN2	170M5063	2TN/80	170M5213	2TN/110	690	700	1
CH72	0460	460	170M6814	DIN3	170M6064	3TN/80	170M6214	3TN/110	690	1000	1
*CH72**	*0460*	*460*	*170M5813*	*DIN2*	*170M5063*	*2TN/80*	*170M5213*	*2TN/110*	*690*	*700*	*1*
CH72	0520	520	170M6814	DIN3	170M6064	3TN/80	170M6214	3TN/110	690	1000	1
*CH72**	*0520*	*520*	*170M5813*	*DIN2*	*170M5063*	*2TN/80*	*170M5213*	*2TN/110*	*690*	*700*	*1*
CH72	0590	590	170M6814	DIN3	170M6064	3TN/80	170M6214	3TN/110	690	1000	1
*CH72**	*0590*	*590*	*170M5813*	*DIN2*	*170M5063*	*2TN/80*	*170M5213*	*2TN/110*	*690*	*700*	*1*
CH72	0650	650	170M8547	3SHT**	170M6066	3TN/80	170M6216	3TN/110	690	1250	1
*CH72**	*0650*	*650*	*170M5813*	*DIN2*	*170M5063*	*2TN/80*	*170M5213*	*2TN/110*	*690*	*700*	*1*
CH72	0730	730	170M8547	3SHT**	170M6066	3TN/80	170M6216	3TN/110	690	1250	1
*CH72**	*0730*	*730*	*170M5813*	*DIN2*	*170M5063*	*2TN/80*	*170M5213*	*2TN/110*	*690*	*700*	*1*
CH63	0820	820	170M6812	DIN3	170M6062	3TN/80	170M6212	3TN/110	690	800	2
CH63	0920	920	170M6812	DIN3	170M6062	3TN/80	170M6212	3TN/110	690	800	2
CH63	1030	1030	170M6814	DIN3	170M6064	3TN/80	170M6214	3TN/110	690	1000	2
CH63	1150	1150	170M6814	DIN3	170M6064	3TN/80	170M6214	3TN/110	690	1000	2
CH74	1370	1370	170M6814	DIN3	170M6064	3TN/80	170M6214	3TN/110	690	1000	3
*CH74**	*1370*	*1370*	*170M6812*	*DIN3*	*170M6062*	3TN/80	*170M6212*	*3TN/110*	*690*	*800*	*2*
CH74	1640	1640	170M6814	DIN3	170M6064	3TN/80	170M6214	3TN/110	690	1000	3
*CH74**	*1640*	*1640*	*170M6812*	*DIN3*	*170M6062*	3TN/80	*170M6212*	*3TN/110*	*690*	*800*	*2*
CH74	2060	2060	170M8547	3SHT**	170M6066	3TN/80	170M6216	3TN/110	690	1250	3
*CH74**	*2060*	*2060*	*170M6814*	*DIN3*	*170M6064*	3TN/80	*170M6214*	*3TN/110*	*690*	*1000*	*2*
CH74	2300	2300	170M8547	3SHT**	170M6066	3TN/80	170M6216	3TN/110	690	1250	3
*CH74**	*2300*	*2300*	*170M6814*	*DIN3*	*170M6064*	3TN/80	*170M6214*	*3TN/110*	*690*	*1000*	*2*

Table 6-7. Fuse sizes for Vacon NX Liquid-Cooled (500V) frequency converters

**Data in Italic refer to drives with 12-pulse supply*

Chas-sis	Type	I_{th} [A]	DIN43620		DIN43653 (80mm)		DIN43653 (110mm)		Fuse U_n [V]	Fuse I_n [A]	Qty. of fuses per phase 3~/6~
			aR fuse part nr.	Fuse size	aR fuse part nr.	Fuse size	aR fuse part nr.	Fuse size			
CH61	0170	170	170M3819	DIN1*	170M3069	1*TN/80	170M3219	1*TN/110	690	400	1
CH61	0208	208	170M3819	DIN1*	170M3069	1*TN/80	170M3219	1*TN/110	690	400	1
CH61	0261	261	170M3819	DIN1*	170M3069	1*TN/80	170M3219	1*TN/110	690	400	1
CH72	0325	325	170M5813	DIN2	170M5063	2TN/80	170M5213	2TN/110	690	700	1
*CH72**	*0325*	*325*	*170M3819*	*DIN1**	*170M3069*	1*TN/80	*170M3219*	*1*TN/110*	*690*	*400*	*1*
CH72	0385	385	170M5813	DIN2	170M5063	2TN/80	170M5213	2TN/110	690	700	1
*CH72**	*0385*	*385*	*170M3819*	*DIN1**	*170M3069*	1*TN/80	*170M3219*	*1*TN/110*	*690*	*400*	*1*
CH72	0416	416	170M6812	DIN3	170M6062	3TN/80	170M6212	3TN/110	690	800	1
*CH72**	*0416*	*416*	*170M3819*	*DIN1**	*170M3069*	1*TN/80	*170M3219*	*1*TN/110*	*690*	*400*	*1*
CH72	0460	460	170M6812	DIN3	170M6062	3TN/80	170M6212	3TN/110	690	800	1
*CH72**	*0460*	*460*	*170M3819*	*DIN1**	*170M3069*	1*TN/80	*170M3219*	*1*TN/110*	*690*	*400*	*1*
CH72	0502	502	170M6812	DIN3	170M6062	3TN/80	170M6212	3TN/110	690	800	1
*CH72**	*0502*	*502*	*170M3819*	*DIN1**	*170M3069*	1*TN/80	*170M3219*	*1*TN/110*	*690*	*400*	*1*
CH63	0590	590	170M6814	DIN3	170M6064	3TN/80	170M6214	3TN/110	690	1100	1
CH63	0650	650	170M8547	3SHT**	170M6066	3TN/80	170M6216	3TN/110	690	1250	1
CH63	0750	750	170M8547	3SHT**	170M6066	3TN/80	170M6216	3TN/110	690	1250	1
CH74	0820	820	170M5813	DIN2	170M5063	2TN/80	170M5213	2TN/110	690	700	3
*CH74**	*0820*	*820*	*170M6812*	*DIN3*	*170M6062*	*3TN/80*	*170M6212*	*3TN/110*	*690*	*800*	*1*
CH74	0920	920	170M5813	DIN2	170M5063	2TN/80	170M5213	2TN/110	690	700	3
*CH74**	*0920*	*920*	*170M6812*	*DIN3*	*170M6062*	*3TN/80*	*170M6212*	*3TN/110*	*690*	*800*	*1*
CH74	1030	1030	170M5813	DIN2	170M5063	2TN/80	170M5213	2TN/110	690	700	3
*CH74**	*1030*	*1030*	*170M6814*	*DIN3*	*170M6064*	*3TN/80*	*170M6214*	*3TN/110*	*690*	*1000*	*1*
CH74	1180	1180	170M5813	DIN2	170M5063	2TN/80	170M5213	2TN/110	690	700	3
*CH74**	*1180*	*1180*	*170M6814*	*DIN3*	*170M6064*	*3TN/80*	*170M6214*	*3TN/110*	*690*	*1000*	*1*
CH74	1300	1300	170M6814	DIN3	170M6064	3TN/80	170M6214	3TN/110	690	1000	3
*CH74**	*1300*	*1300*	*170M8547*	*3SHT***	*170M6066*	*3TN/80*	*170M6216*	*3TN/110*	*690*	*1250*	*1*
CH74	1500	1500	170M6814	DIN3	170M6064	3TN/80	170M6214	3TN/110	690	1000	3
*CH74**	*1500*	*1500*	*170M8547*	*3SHT***	*170M6066*	*3TN/80*	*170M6216*	*3TN/110*	*690*	*1250*	*1*
CH74	1700	1700	170M6814	DIN3	170M6064	3TN/80	170M6214	3TN/110	690	1000	3
*CH74**	*1700*	*1700*	*170M6812*	*DIN3*	*170M6064*	*3TN/80*	*170M6212*	*3TN/110*	*690*	*800*	*1*

Table 6-8. Fuse sizes for Vacon NX Liquid-Cooled (690V) frequency converters

**Data in Italic refer to drives with 12-pulse supply.*
*** SHT fuses can be assembled into DIN fuse base of the corresponding size*

Fuse information

Max fuse ambient temperature +50°C.

Fuse sizes can differ in the same chassis. Fuses can be chosen according to the biggest current rating of the chassis to minimize fuse variants.

Check the current rating of the fuse bases according to the input current of the drive.

The physical size of the fuse is chosen on the basis of the fuse current: Current < 400 amps (size 2 fuse or smaller), current < 400 amps (size 3 fuse)

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

6.1.2.2 Fuse sizes, inverters

Each DC supply line must be equipped with an aR fuse according to the table below.

The fuse sizing in the tables below is based on Bussman aR fuses. We recommend you to use these fuses. Sufficient protection against short-circuit cannot be guaranteed if other fuse types are used. **Furthermore, equation of the fuse values given in the tables below with those of other fuse manufacturers is not allowed.** In case you wish to use fuses of other fuse manufacturers, contact Vacon.

Chas-sis	Type	I_{th} [A]	DIN43620		DIN43653 (80mm)		DIN43653 (110mm)		Fuse U_n [V]	Fuse I_n [A]	Qty. of fuses/ pole
			aR fuse part nr.	Fuse size	aR fuse part nr.	Fuse size	aR fuse part nr.	Fuse size			
CH3	0016	16	170M3810	DIN1*	170M3060	1*TN/80	170M3210	1*TN/110	690	63	1
CH3	0022	22	170M3810	DIN1*	170M3060	1*TN/80	170M3210	1*TN/110	690	63	1
CH3	0031	31	170M3810	DIN1*	170M3060	1*TN/80	170M3210	1*TN/110	690	63	1
CH3	0038	38	170M3813	DIN1*	170M3063	1*TN/80	170M3213	1*TN/110	690	125	1
CH3	0045	45	170M3813	DIN1*	170M3063	1*TN/80	170M3213	1*TN/110	690	125	1
CH3	0061	61	170M3813	DIN1*	170M3063	1*TN/80	170M3213	1*TN/110	690	125	1
CH4	0072	72	170M3815	DIN1*	170M3063	1*TN/80	170M3213	1*TN/110	690	200	1
CH4	0087	87	170M3815	DIN1*	170M3065	1*TN/80	170M3215	1*TN/110	690	200	1
CH4	0105	105	170M3815	DIN1*	170M3065	1*TN/80	170M3215	1*TN/110	690	200	1
CH4	0140	140	170M3819	DIN1*	170M3069	1*TN/80	170M3219	1*TN/110	690	400	1
CH5	0168	168	170M3819	DIN1*	170M3069	1*TN/80	170M3219	1*TN/110	690	400	1
CH5	0208	208	170M3819	DIN1*	170M3069	1*TN/80	170M3219	1*TN/110	690	400	1
CH5	0261	261	170M6808	DIN3	170M6058	3TN/80	170M6208	3TN/110	690	500	1
CH61	0300	300	170M6812	DIN3	170M6062	3TN/80	170M6212	3TN/110	690	800	1
CH61	0385	385	170M6812	DIN3	170M6062	3TN/80	170M6212	3TN/110	690	800	1
CH62	0460	460	170M6814	DIN3	170M6064	3TN/80	170M6214	3TN/110	690	1000	1
CH62	0520	520	170M6814	DIN3	170M6064	3TN/80	170M6214	3TN/110	690	1000	1
CH62	0590	590	170M6812	DIN3	170M6062	3TN/80	170M6212	3TN/110	690	800	2
CH62	0650	650	170M6812	DIN3	170M6062	3TN/80	170M6212	3TN/110	690	800	2
CH62	0730	730	170M6812	DIN3	170M6062	3TN/80	170M6212	3TN/110	690	800	2
CH63	0820	820	170M6814	DIN3	170M6064	3TN/80	170M6214	3TN/110	690	1000	2
CH63	0920	920	170M6814	DIN3	170M6064	3TN/80	170M6214	3TN/110	690	1000	2
CH63	1030	1030	170M6812	DIN3	170M6062	3TN/80	170M6212	3TN/110	690	800	3
CH63	1150	1150	170M6812	DIN3	170M6062	3TN/80	170M6212	3TN/110	690	800	3
CH64	1370	1370	170M8547	3SHT**	170M6066	3TN/80	170M6216	3TN/110	690	1250	3
CH64	1640	1640	170M8547	3SHT**	170M6066	3TN/80	170M6216	3TN/110	690	1250	3
CH64	2060	2060	170M8550	3SHT**	170M6069	3TN/80	170M6219	3TN/110	690	1600	3
CH64	2300	2300	170M8550	3SHT**	170M6069	3TN/80	170M6219	3TN/110	690	1600	3

Table 6-9. Fuse sizes for Vacon NX Liquid-Cooled (450—800V) inverters

*Tj = 25C

*** SHT fuses can be assembled into DIN fuse base of the corresponding size*

Chas-sis	Type	I_{th} [A]	DIN43620		DIN43653 (110mm)		Fuse U_n [V]	Fuse I_n [A]	Qty. of fuses/ pole
			aR fuse part nr.	Fuse size*	aR fuse part nr.	Fuse size			
CH61	0170	170	170M4199	1SHT	170M4985	1TN/110	1250	400	1
CH61	0208	208	170M4199	1SHT	170M4985	1TN/110	1250	400	1
CH61	0261	261	170M6202	3SHT	170M8633	3TN/110	1250	500	1
CH62	0325	325	170M6305	3SHT	170M8636	3TN/110	1250	700	1
CH62	0385	385	170M6305	3SHT	170M8636	3TN/110	1250	700	1
CH62	0416	416	170M6277	3SHT	170M8639	3TN/110	1100	1000	1
CH62	0460	460	170M6277	3SHT	170M8639	3TN/110	1100	1000	1
CH62	0502	502	170M6277	3SHT	170M8639	3TN/110	1100	1000	1
CH63	0590	590	170M6305	3SHT	170M8636	3TN/110	1250	700	2
CH63	0650	650	170M6305	3SHT	170M8636	3TN/110	1250	700	2
CH63	0750	750	170M6305	3SHT	170M8636	3TN/110	1250	700	2
CH64	0820	820	170M6277	3SHT	170M8639	3TN/110	1100	1000	2
CH64	0920	920	170M6277	3SHT	170M8639	3TN/110	1100	1000	2
CH64	1030	1030	170M6277	3SHT	170M8639	3TN/110	1250	700	3
CH64	1180	1180	170M6277	3SHT	170M8639	3TN/110	1100	1000	3
CH64	1300	1300	170M6277	3SHT	170M8639	3TN/110	1100	1000	3
CH64	1500	1500	170M6277	3SHT	170M8639	3TN/110	1100	1000	3
CH64	1700	1700	170M6277	3SHT	170M8639	3TN/110	1100	1000	3

Table 6-10. Fuse sizes for Vacon NX Liquid-Cooled (640—1100V) inverters

** SHT fuses can be assembled into DIN fuse base of the corresponding size*

Fuse information

Max fuse ambient temperature +50ºC.

Fuse sizes can differ in the same chassis. Fuses can be chosen according to the biggest current rating of the chassis to minimize fuse variants.

Check the current rating of the fuse bases according to the input current of the drive.

The physical size of the fuse is chosen on the basis of the fuse current: Current < 250 amps (size 1 fuse), current > 250 amps (size 3 fuse)

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

6.1.2.3 Fuse sizes, Active Front End units (AC supply)

Chas-sis	Type	I_{th} [A]	DIN43620		DIN43653 (80mm)		DIN43653 (110mm)		Fuse U_n [V]	Fuse I_n [A]	Qty. of fuses /phase 3~
			aR fuse part nr.	Fuse size*	aR fuse part nr.	Fuse size*	aR fuse part nr.	Fuse size*			
CH3	0016	16	170M2679	DIN00	170M4828	00TN/80			1000	63	1
CH3	0022	22	170M2679	DIN00	170M4828	00TN/80			1000	63	1
CH3	0031	31	170M2679	DIN00	170M4828	00TN/80			1000	63	1
CH3	0038	38	170M2679	DIN00	170M4828	00TN/80			1000	63	1
CH3	0045	45	170M2683	DIN00	170M4832	00TN/80			1000	160	1
CH3	0061	61	170M2683	DIN00	170M4832	00TN/80			1000	160	1
CH4	0072	72	170M2683	DIN00	170M4832	00TN/80			1000	160	1
CH4	0087	87	170M2683	DIN00	170M4832	00TN/80			1000	160	1
CH4	0105	105	170M2683	DIN00	170M4832	00TN/80			1000	160	1
CH4	0140	140	170M4199	1SHT			170M4985	1TN/110	1250	400	1
CH5	0168	168	170M4199	1SHT			170M4985	1TN/110	1250	400	1
CH5	0208	208	170M4199	1SHT			170M4985	1TN/110	1250	400	1
CH5	0261	261	170M4199	1SHT			170M4985	1TN/110	1250	400	1
CH61	0300	300	170M6202	3SHT			170M8633	3TN/110	1250	500	1
CH61	0385	385	170M6305	3SHT			170M8636	3TN/110	1250	700	1
CH62	0460	460	170M6277	3SHT			170M8639	3TN/110	1100	1000	1
CH62	0520	520	170M6277	3SHT			170M8639	3TN/110	1100	1000	1
CH62	0590	590	170M6277	3SHT			170M8639	3TN/110	1100	1000	1
CH62	0650	650	170M6305	3SHT			170M8636	3TN/110	1250	700	2
CH62	0730	730	170M6305	3SHT			170M8636	3TN/110	1250	700	2
CH63	0820	820	170M6305	3SHT			170M8636	3TN/110	1250	700	2
CH63	0920	920	170M6277	3SHT			170M8639	3TN/110	1100	1000	2
CH63	1030	1030	170M6277	3SHT			170M8639	3TN/110	1100	1000	2
CH63	1150	1150	170M6277	3SHT			170M8639	3TN/110	1100	1000	2
CH64	1370	1370	170M6277	3SHT			170M8639	3TN/110	1100	1000	3
CH64	1640	1640	170M6277	3SHT			170M8639	3TN/110	1100	1000	3
CH64	2060	2060	170M6277	3SHT			170M8639	3TN/110	1100	1000	4
CH64	2300	2300	170M6277	3SHT			170M8639	3TN/110	1100	1000	4

Table 6-11. Fuse sizes for Vacon NX AFE units (380—500V)

Chas-sis	Type	I_{th} [A]	DIN43620		DIN43653 (110mm)		Fuse U_n [V]	Fuse I_n [A]	Qty. of fuses /phase 3~
			aR fuse part nr.	Fuse size*	aR fuse part nr.	Fuse size*			
CH61	0170	170	170M4199	1SHT	170M4985	1TN/110	1250	400	1
CH61	0208	208	170M4199	1SHT	170M4985	1TN/110	1250	400	1
CH61	0261	261	170M4199	1SHT	170M4985	1TN/110	1250	400	1
CH62	0325	325	170M6305	3SHT	170M8636	3TN/110	1250	700	1
CH62	0385	385	170M6305	3SHT	170M8636	3TN/110	1250	700	1
CH62	0416	416	170M6305	3SHT	170M8636	3TN/110	1250	700	1
CH62	0460	460	170M6277	3SHT	170M8639	3TN/110	1100	1000	1
CH62	0502	502	170M6277	3SHT	170M8639	3TN/110	1100	1000	1
CH63	0590	590	170M6277	3SHT	170M8639	3TN/110	1100	1000	1
CH63	0650	650	170M6305	3SHT	170M8636	3TN/110	1250	700	2
CH63	0750	750	170M6305	3SHT	170M8636	3TN/110	1250	700	2
CH64	0820	820	170M6305	3SHT	170M8636	3TN/110	1250	700	2
CH64	0920	920	170M6277	3SHT	170M8639	3TN/110	1100	1000	2
					170M8639	3TN/110	1100	1000	2
					170M8639	3TN/110	1100	1000	2
CH64	1300	1300	170M6305	3SHT	170M8636	3TN/110	1250	700	3
CH64	1500	1500	170M6277	3SHT	170M8639	3TN/110	1100	1000	3

Table 6-12. Fuse sizes for Vacon NX AFE units (525—690V)

**SHT fuses can be assembled into DIN fuse base of the corresponding size*

6.1.2.4 Recommended switch fuses

NX type	Switch fuse (type OS/OESA)
0016_5...0061_5	OS63
0072_5...0105_5	OESA250
00140_5	OESA250
0168_5...0208_5 0170_6...0208_6	OESA250
0261_5...0385_5 0261_6...0385_6	OESA400
0460_5...0590_5 0416_6...0502_6 0590_6	OESA630
0650_5...0730_5 0650_6...0750_6	OESA800

NX type	Switch fuse (type OS/OESA)
0325_6...0502_6 (12-p)	2*OESA250
0460_5...0730_5 (12-p)	2*OESA400
0820_6...1180_6	3*OESA400
0820_5...1150_5 *0820_6...1180_6 (12-p)*	2*OESA630
1300_6...1500_6 (12-p)	2*OESA800
1370_5...1640_5 1300_6...1500_6	3*OESA630
2060_5...2300_5	3*OESA800
1370_5...2060_5 (12-p)	4*OESA630
1640_5...2300_5 (12-p)	4*OESA630

Table 6-13. Recommended switch fuses for Vacon liquid-cooled frequency converters

Data in Italic refer to drives with 12-pulse supply.

NX type	Switch fuse (type OESL/OETL)
0016_5...0208_5 0170_6...0208_6	OESL250D 1MC1
0261_5...0520_5 0261_6...0502_6	OESL630D 1MC1
0590_5...0920_5 0590_6...0920_6	OESL630D 2MC1

NX type	Switch fuse (type OESL/OETL)
1030_5...1150_5 1030_6...1180_6	OESL630D 3MC1
1370_5...2060_5 1300_6...1500_6	OETL2500 + OFAX3 + Charging circuit
2300_5	OETL3150 + OFAX3 + Charging circuit

Table 6-14. Recommended switch fuses for Vacon liquid-cooled inverters

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

6.1.3 Cable installation instructions

<table>
<tr><td></td><td>1</td><td>Before starting the installation, check that none of the components of the frequency converter is live.</td></tr>
<tr><td></td><td>2</td><td>Vacon NX Liquid-Cooled drive must always be installed in an enclosure, a separate cubicle or an electrical room.
Always use a jib crane or similar lifting device to lift the drive. For safe and appropriate lifting, see chapter 5.1.1.</td></tr>
<tr><td></td><td>3</td><td>Place the motor cables far enough from other cables:
▪ Avoid placing the motor cables in long parallel lines with other cables
▪ If the motor cables run in parallel with other cables, note the minimum distances between the motor cables and other cables given in table below.
▪ The given distances also apply between the motor cables and signal cables of other systems.
<table><tr><th>Distance between parallelly running cables [m]</th><th>Shielded cable [m]</th></tr><tr><td>0.3</td><td>≤50</td></tr><tr><td>1.0</td><td>≤200</td></tr></table>▪ The maximum length of the motor cables is 300 m.
▪ The motor cables should cross other cables at an angle of 90 degrees.</td></tr>
<tr><td></td><td>4</td><td>If cable insulation checks are needed, see Chapter 6.1.9.</td></tr>
<tr><td></td><td>5</td><td>Connect the cables/busbars:
▪ For chassis CH5 and greater, an external flexible cable connection block must be used at both mains and motor ends if stiff cable type (EMCMK, MCMK) is used. See chapter 6.1.1.
▪ Strip the cables at a sufficient distance if needed
▪ Connect the mains, motor and control cables to their respective terminals (see chapter 5.1.2). If busbar connection is used, bolt the bars and the terminals together. See bolt sizes on pages 29 to 37.
▪ Take the maximum terminal stresses shown in Figure 6-2 into account
▪ For information on cable installation according to UL regulations see Chapter 6.1.8.
▪ Make sure that the control cable wires do not come in contact with the electronic components of the unit.
▪ If an external brake resistor (option) is used, connect its cable to the appropriate terminal (CH3 only).
▪ Check the connection of the earth cable to the motor and the frequency converter terminals marked with ⏚.
▪ Connect the separate shield of the power cable to the earth terminals of the frequency converter, motor and the supply centre.</td></tr>
<tr><td></td><td>6</td><td>For chassis CH74: Clamp the motor cables to the cabinet frame as instructed in Figure 6-1.</td></tr>
</table>

	7	**Liquid cooling connection:** The standard delivery of the Vacon NX Liquid-Cooled drive includes hoses on the cooling element 1.5m in length and 15mm in diameter. The hoses are inserted in 1400-mm UL94V0 approved conduits. Connect the line hose branch to its counterpart (screw or fast connector) on the of the Vacon Liquid-Cooled drive. Due to high pressure in the line hose, it is recommended to equip the liquid line with a shut-off valve, which makes the connection easier. In order to prevent water from spraying in the installation room we also recommend to wrap e.g. linters around the connection on installing. For more information on the liquid connection, see chapter 5.2.2. When the installation in the enclosure is completed the liquid pump can be started. See Commissioning of the frequency converter on page 127. **Note: Do not switch on the power before ensuring the proper functioning of the liquid cooling system.**

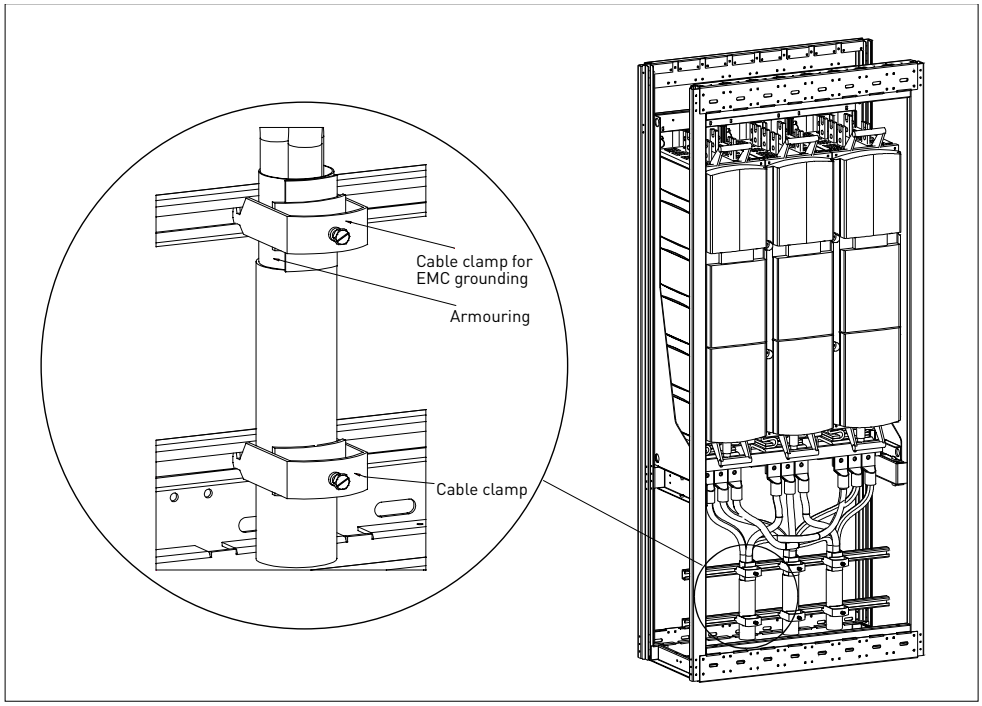


Figure 6-1. Clamping the motor cables to cabinet frame

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

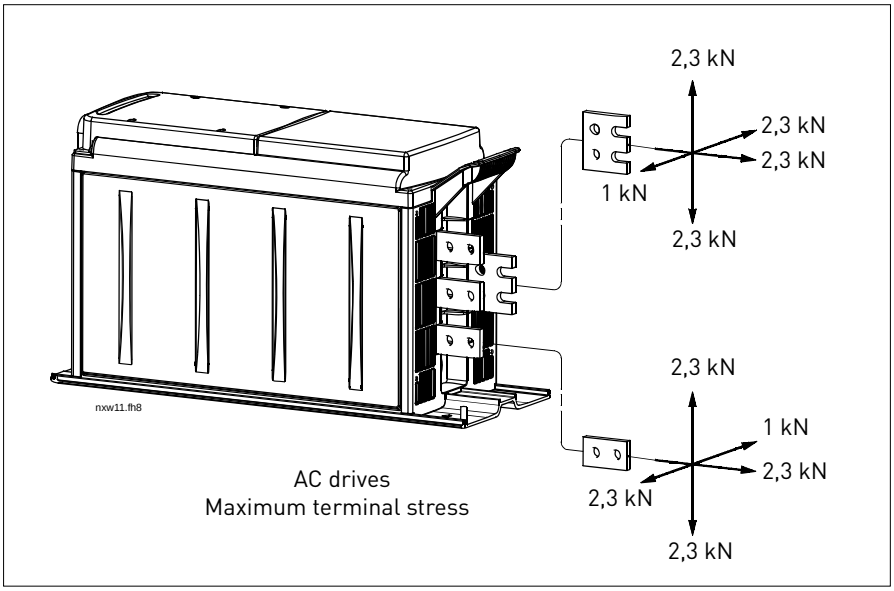


Figure 6-2. Maximum terminal stresses

6.1.4 Supply busbars for inverter units

In order to avoid excessive terminal stresses on busbar terminals on inverter units with DC-supply on top (CH61...CH64), use flexible busbar connection. See figure below. The maximum terminal stresses are shown in Figure 6-2.

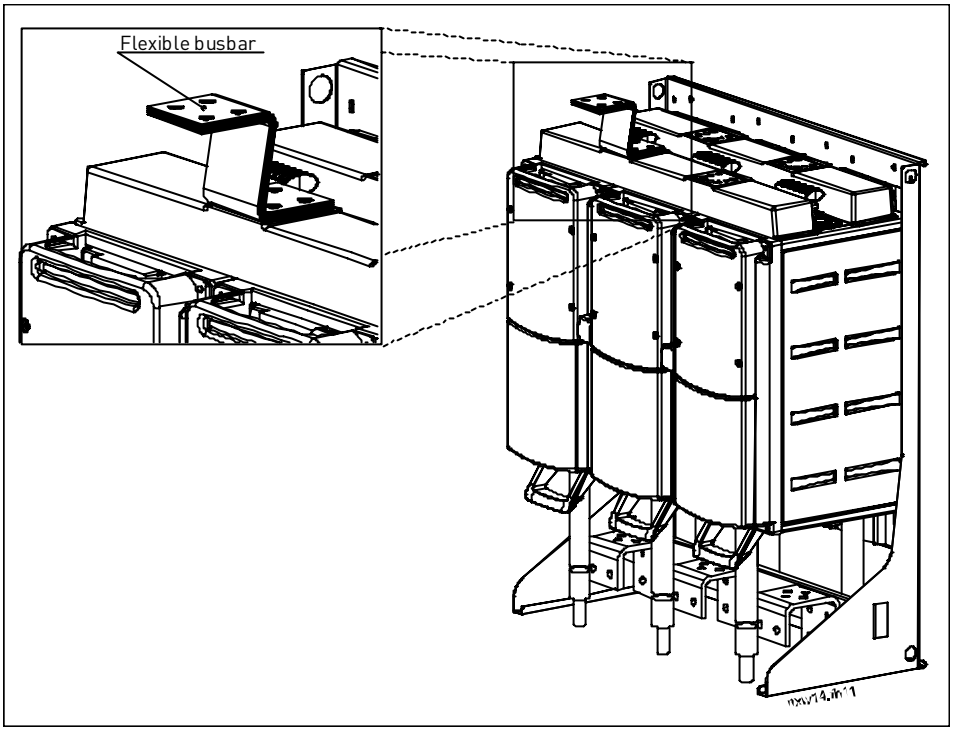
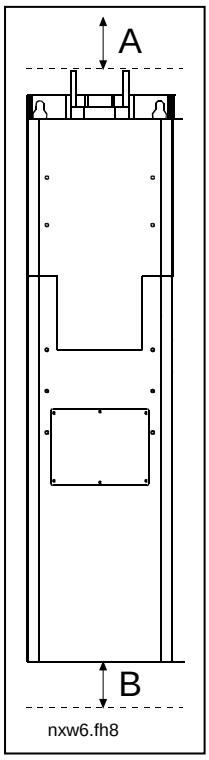


Figure 6-3. Mounting of flexible busbar

6.1.5 Installation space

Enough free space shall be left above and below the frequency converter/inverter to ensure practical and appropriate electrical and cooling connections. The minimum dimensions are given in the table below. The space left and right to the drive may be 0 mm.



Chassis	A [mm]	B [mm]
CH3	100	150
CH4	100	200
CH5	100	200
CH61	100	300
CH62	100	400*
CH63	200	400*
CH64	200	500*
CH72	200	400*
CH74	200	500*

Table 6-15. Installation space

*Distance to the cable connection block. Additional space must be reserved for possibly used ferrite rings. See chapter 6.1.1.2.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

6.1.6 *Earthing of power unit*

The mains cables are connected to the protective earth of the switchgear enclosure.

We recommend to connect the motor cables to the common PE of the cabinet/cabinet system.

For earthing of the drive itself, use the earthing terminal on the drive mounting plate (see Figure 6-4).

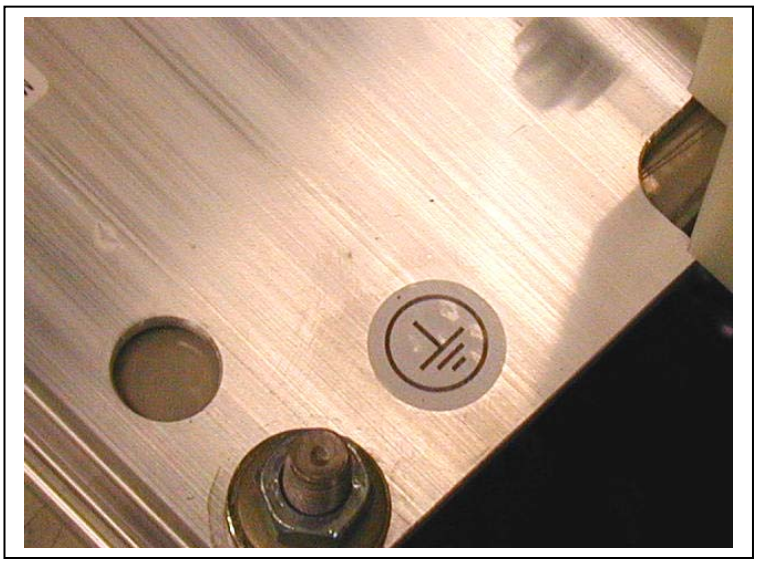


Figure 6-4. Earthing terminal on mounting plate

6.1.7 *Installation of ferrite rings (option) on the motor cable*

Slip only the phase conductors through the window; leave the cable screen below and outside the rings, see Figure 6-5. Separate the PE conductor. In case of parallel motor cables, reserve an equal amount of ferrite rings for each cable and feed all the phase conductors of one cable through one set of rings. The Vacon delivery includes fixed sets of ferrite rings. When ferrite rings are used to attenuate the risk of bearing damages, the number of ferrites has to be 6...10 for a single motor cable and 10 per cable when the motor is supplied with parallel cables.

Note! The ferrite rings are only additional protection. The basic protection against bearing currents is an insulated bearing.

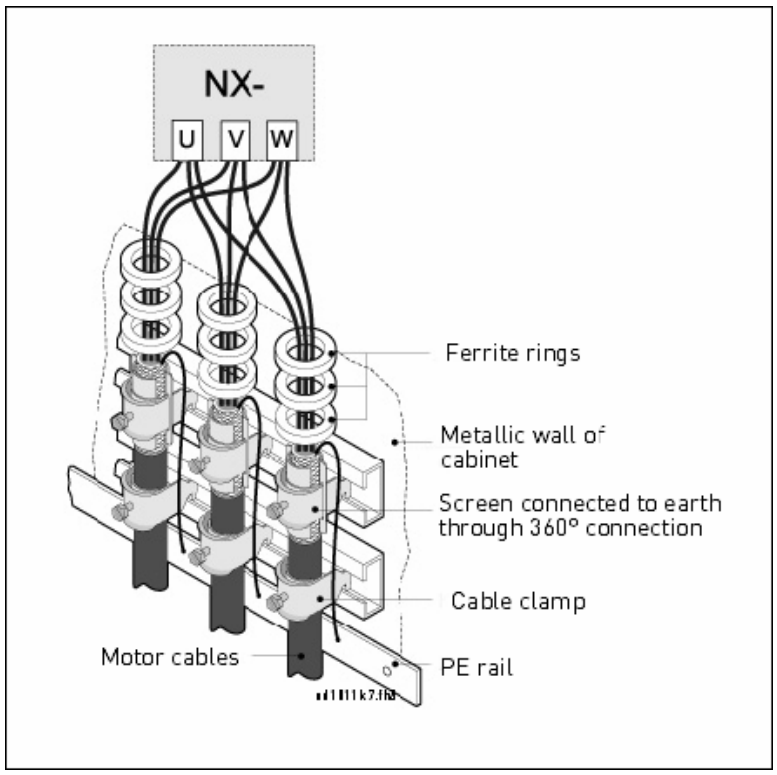


Figure 6-5. Installation of ferrite rings

6.1.8 Cable installation and the UL standards

To meet the UL (Underwriters Laboratories) regulations, a UL-approved copper cable with a minimum heat-resistance of +60/75°C must be used.

The tightening torques of the terminals are given in Table 6-6.

6.1.9 Cable and motor insulation checks

1. Motor cable insulation checks

   Disconnect the motor cable from terminals U, V and W of the frequency converter and from the motor. Measure the insulation resistance of the motor cable between each phase conductor as well as between each phase conductor and the protective ground conductor.

   The insulation resistance must be at least 1...2MΩ.

2. Mains cable insulation checks

   Disconnect the mains cable from terminals L1, L2 and L3 of the frequency converter and from the mains. Measure the insulation resistance of the mains cable between each phase conductor as well as between each phase conductor and the protective ground conductor.

   The insulation resistance must be at least 1...2MΩ.

3. Motor insulation checks

   Disconnect the motor cable from the motor and open the bridging connections in the motor connection box. Measure the insulation resistance of each motor winding. The measurement voltage must equal at least the motor nominal voltage but not exceed 1000V. The insulation resistance must be at least 1...2MΩ.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

6.2 Control unit

The control unit of Vacon NX Liquid-Cooled frequency converter/inverter is installed into a mounting box. It contains the control board and additional boards (see Figure 6-6 and Figure 6-7) connected to the five *slot connectors* (A to E) of the control board. The control unit and the ASIC of the power unit are connected through cables (and an adapter board). For more information, see page 88.

The mounting box with the control unit is mounted inside an enclosure. See the mounting instructions on page 84.

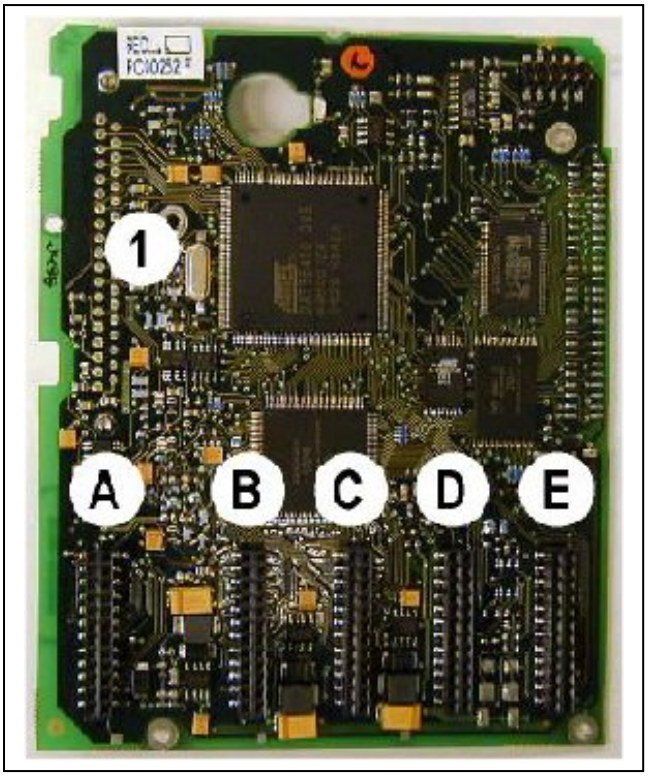


Figure 6-6. NX control board

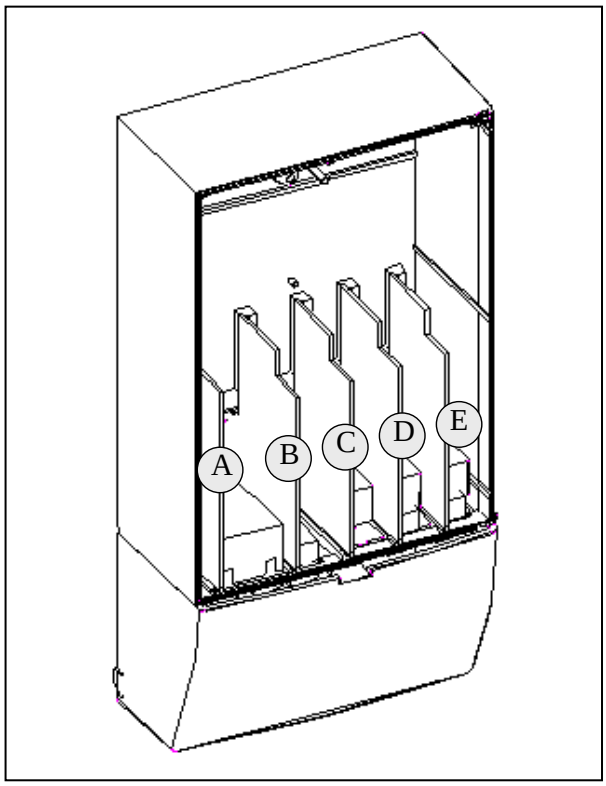
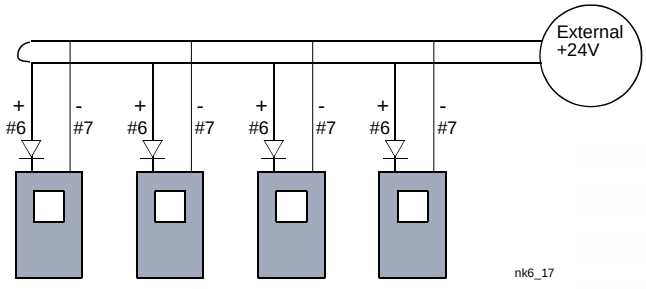


Figure 6-7. Basic and option board connections on the control board

Usually, when the frequency converter is delivered from the factory, the control unit includes at least the standard compilation of two basic boards (I/O board and relay board) which are normally installed in slots A and B. On the next pages you will find the arrangement of the control I/O and the relay terminals of the two basic boards, the general wiring diagram and the control signal descriptions. The I/O boards mounted at the factory are indicated in the type code.

The control board can be powered externally (+24V, ±10%) by connecting the external power source to either of the bidirectional terminal #6 or #12, see page 81. This voltage is sufficient for parameter setting and for keeping the fieldbus active.

Note! If the 24V inputs of several frequency converters are parallelly connected we recommend to use a diode in terminal #6 (or #12) in order to avoid the current to flow in opposite direction. This might damage the control board. See picture below.

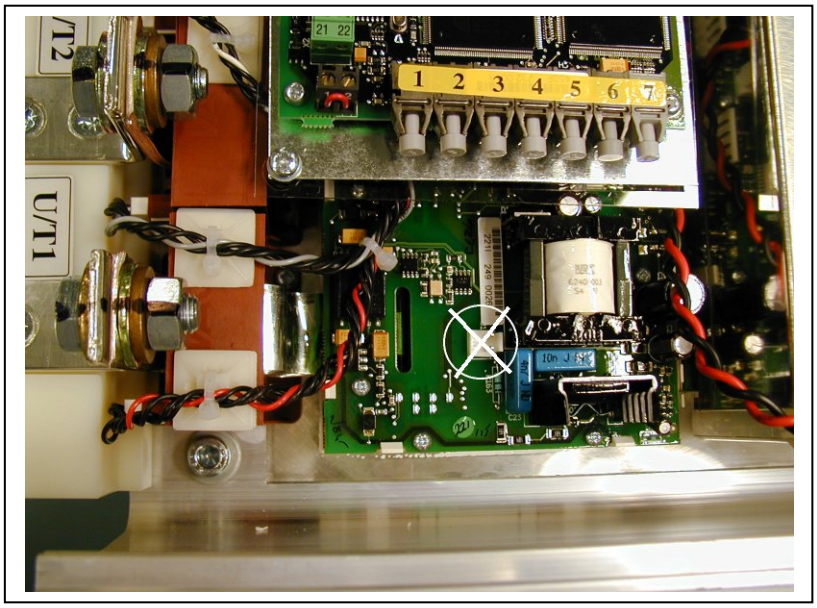


6.2.1 Control board power-up

The control board can be powered (+24V) in two different ways: either **1)** directly from the power board ASIC, terminal X10 or **2)** externally using the customer's own power source. This voltage is sufficient for parameter setting and for keeping the fieldbus active.

By factory default, the control unit is powered using the terminal X10 on the power board. However, if an external supply is used to power up the control unit, a **load resistor** must be connected to terminal X10 on the power board. This applies to all chassis **≥ CH61**.

IMPORTANT NOTE FOR CHASSIS CH3, CH4 and CH5: If you power the control board from the power board be sure to connect the cable to the correct terminal. Terminal **J2** on the power board is reserved for this purpose. **Do not connect the cable to terminal J1**. See pictures below.



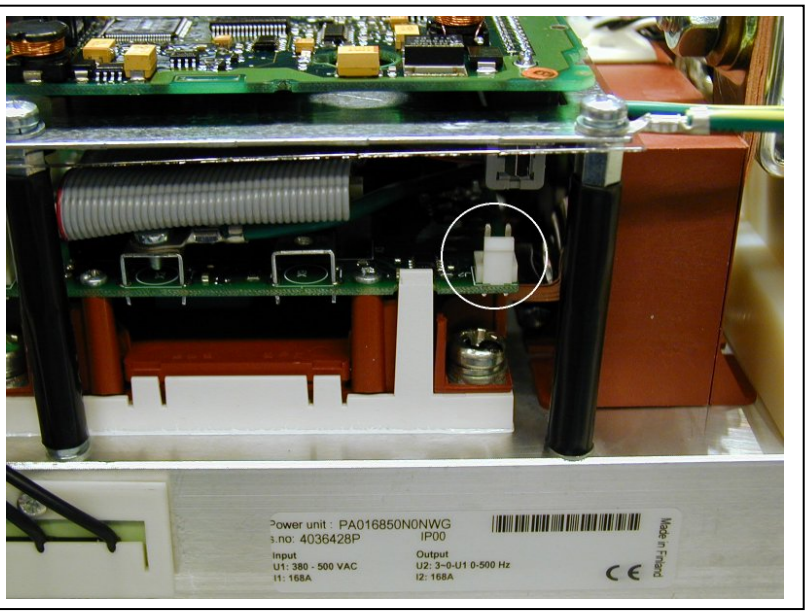


Figure 6-8. Connection of control board power cable from the power board. WRONG: terminal J1 (upper); CORRECT: terminal J2 (lower)

6.2.2 Control connections

The basic control connections for boards A1 and A2 are shown in Chapter 6.2.3.
The signal descriptions are presented in the All in One Application Manual.

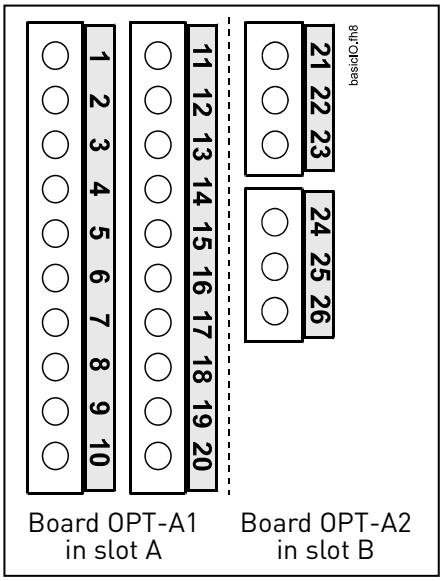


Figure 6-9. The I/O terminals of the two basic boards

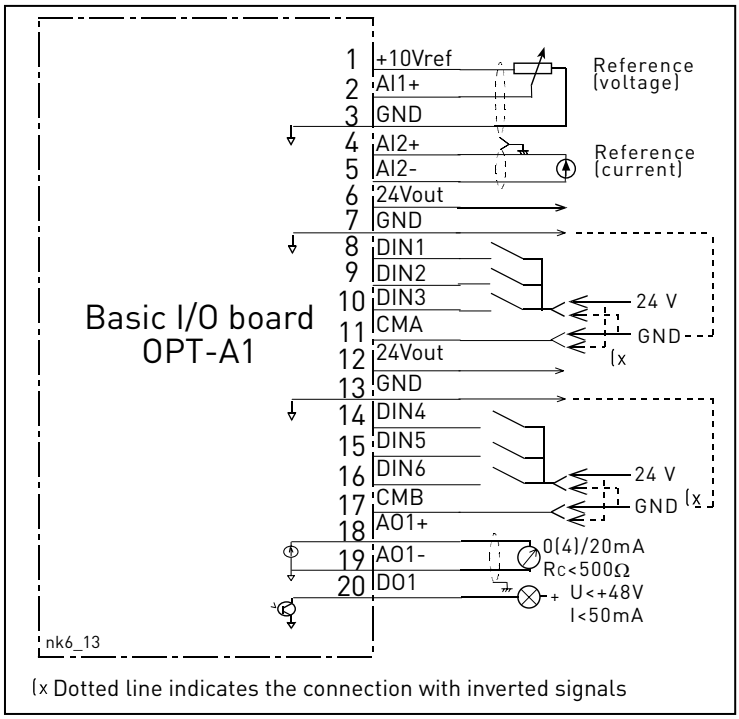


Figure 6-10. General wiring diagram of the basic I/O board (OPT-A1)

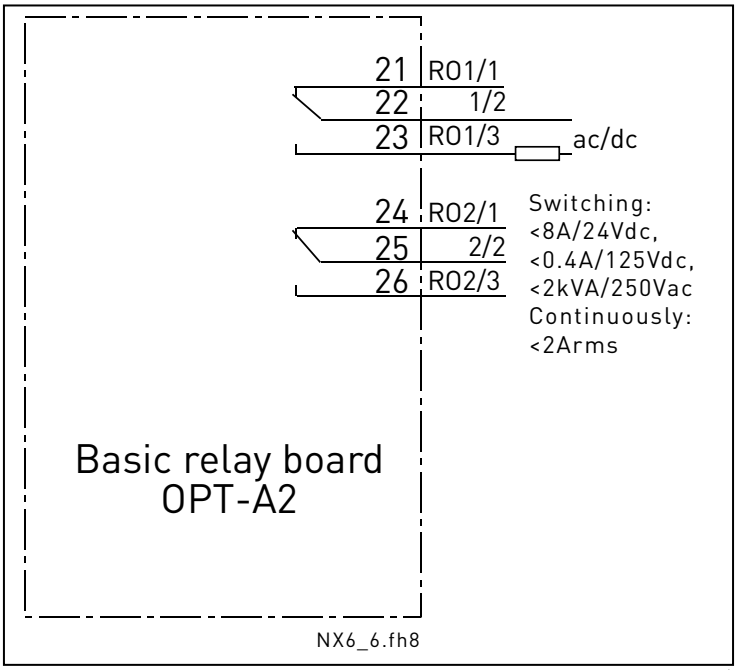


Figure 6-11. General wiring diagram of the basic relay board (OPT-A2)

6.2.2.1 Control cables

The control cables shall be at least 0.5 mm^2 screened multicore cables, see Table 6-1. The maximum terminal wire size is 2.5 mm^2 for the relay terminals and 1.5 mm^2 for other terminals.

6.2.2.2 Galvanic isolation barriers

The control connections are isolated from the mains potential and the GND terminals are permanently connected to ground. See Figure 6-12.
The digital inputs are galvanically isolated from the I/O ground. The relay outputs are additionally double-isolated from each other at 300VAC (EN-50178).

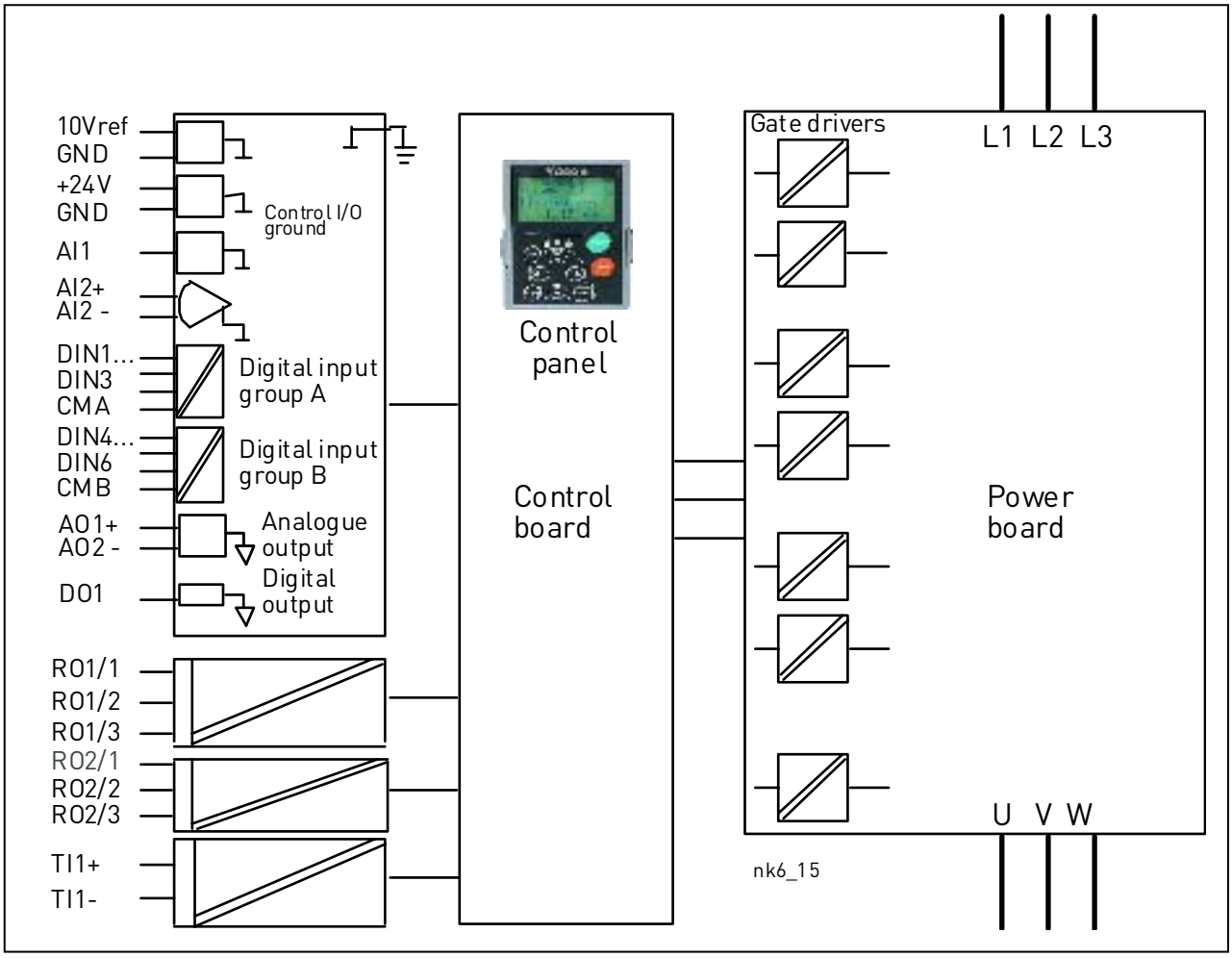


Figure 6-12. Galvanic isolation barriers

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

6.2.3 *Control terminal signals*

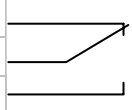
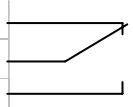
OPT-A1			
Terminal		Signal	Technical information
1	+10 Vref	Reference voltage	Maximum current 10 mA
2	AI1+	Analogue input, voltage or current	Selection V or mA with jumper block X1 (see page 83): Default: 0– +10V (Ri = 200 kΩ) (-10V.....+10V Joy-stick control, selected with a jumper) 0– 20mA (Ri = 250 Ω)
3	GND/AI1–	Analogue input common	Differential input if not connected to ground; Allows ±20V differential mode voltage to GND
4	AI2+	Analogue input, voltage or current	Selection V or mA with jumper block X2 (see page 83): Default: 0– 20mA (Ri = 250 Ω) 0– +10V (Ri = 200 kΩ) (-10V.....+10V Joy-stick control, selected with a jumper)
5	GND/AI2–	Analogue input common	Differential input if not connected to ground; Allows ±20V differential mode voltage to GND
6	24 Vout (bidirectional)	24V auxiliary voltage	±15%, maximum current 250 mA Can also be used as external power backup for the control unit (and fieldbus)
7	GND	I/O ground	Ground for reference and controls
8	DIN1	Digital input 1	R_i = min. 5kΩ 18...30V = "1"
9	DIN2	Digital input 2	
10	DIN3	Digital input 3	
11	CMA	Digital input common A for DIN1, DIN2 and DIN3.	Must be connected to GND or 24V of I/O terminal or to external 24V or GND Selection with jumper block X3 (see page 83):
12	24 Vout (bidirectional)	24V auxiliary voltage	Same as terminal #6
13	GND	I/O ground	Same as terminal #7
14	DIB4	Digital input 4	R_i = min. 5kΩ
15	DIB5	Digital input 5	
16	DIB6	Digital input 6	
17	CMB	Digital input common B for DIB4, DIB5 and DIB6	Must be connected to GND or 24V of I/O terminal or to external 24V or GND Selection with jumper block X3 (see page 83):
18	AO1+	Analogue signal (+output)	Output signal range: Current 0(4)–20mA, R_L max 500Ω or Voltage 0—10V, R_L >1kΩ Selection with jumper block X6 (see page 83):
19	AO1–	Analogue output common	
20	DO1	Open collector output	Maximum U_{in} = 48VDC Maximum current = 50 mA
OPT-A2			
21	RO1/1	 Relay output 1	Max. switching voltage 250VAC, 125VDC Max. switching current 8A/24VDC, 0.4A/250VDC Min. switching load 5V/10mA
22	RO1/2		
23	RO1/3		
24	RO2/1	 Relay output 2	Max. switching voltage 250VAC, 125VDC Max. switching current 8A/24VDC, 0.4A/250VDC Min. switching load 5V/10mA
25	RO2/2		
26	RO2/3		

Table 6-16. Control I/O terminal signals

6.2.3.1 Digital input signal inversions

The active signal level depends on which potential the common inputs CMA and CMB (terminals 11 and 17) are connected to. The alternatives are either +24V or ground (0 V). See Figure 6-13.

The 24-volt control voltage and the ground for the digital inputs and the common inputs (CMA, CMB) can be either internal or external.

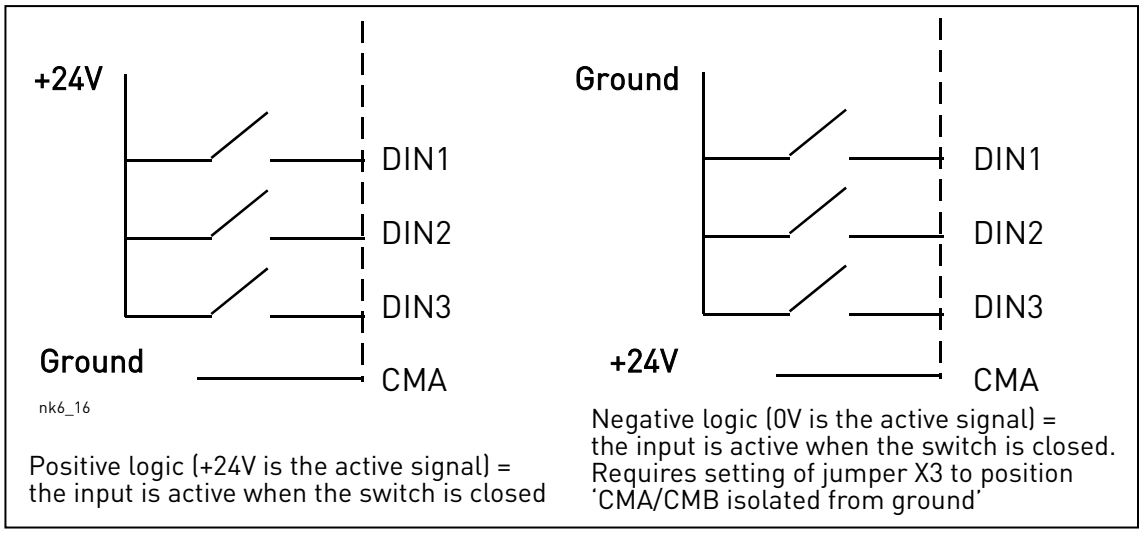


Figure 6-13. Positive/Negative logic

6.2.3.2 Jumper selections on the OPT-A1 basic board

The user is able to customise the functions of the frequency converter to better suit his needs by selecting certain positions for the jumpers on the OPT-A1 board. The positions of the jumpers determine the signal type of analogue and digital inputs.

On the A1 basic board, there are four jumper blocks X1, X2, X3 and X6 each containing eight pins and two jumpers. The selectable positions of the jumpers are shown in Figure 6-15.

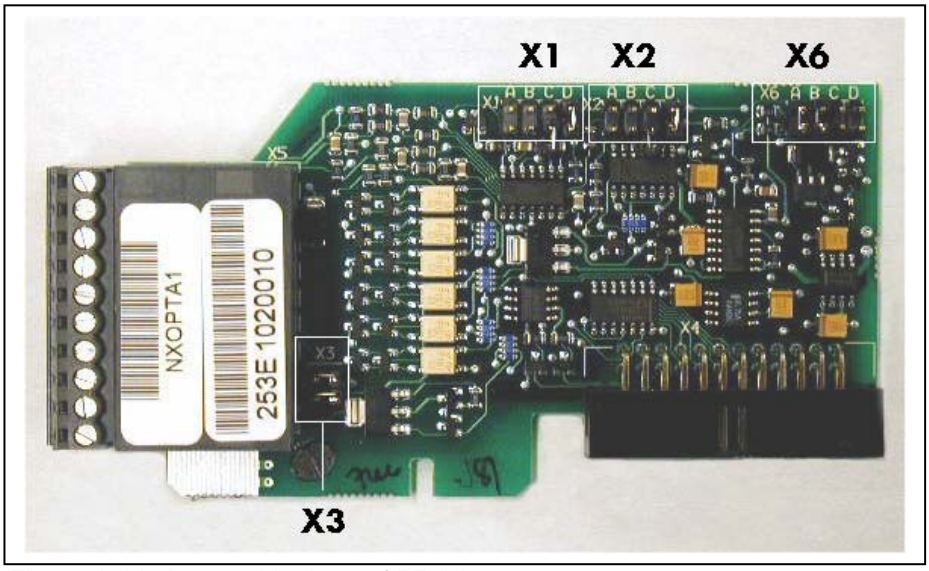


Figure 6-14. Jumper blocks on OPT-A1

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

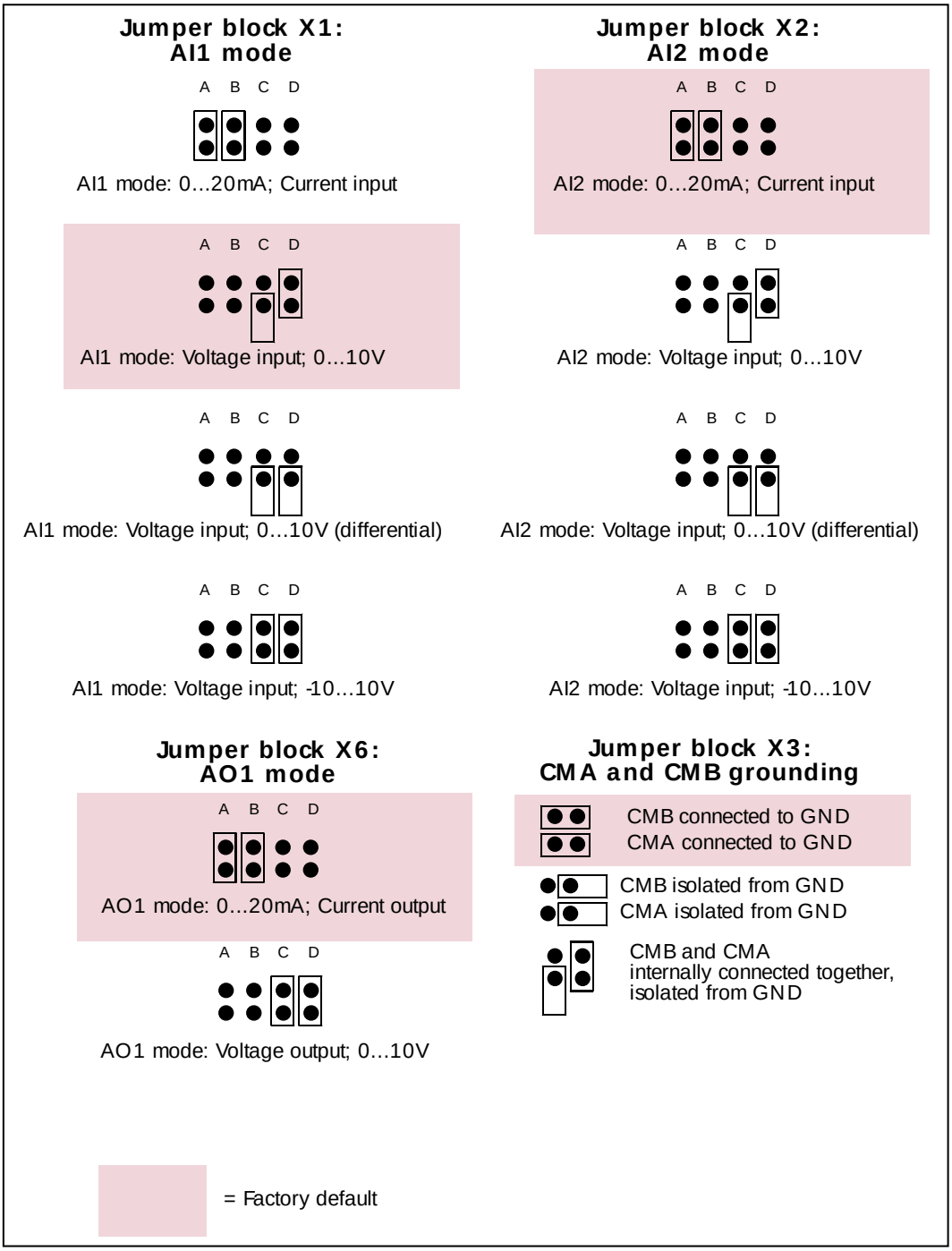


Figure 6-15. Jumper selection for OPT-A1

NOTE	If you change the AI signal content also remember to change the corresponding board parameter in menu M7.

6.2.4 Control unit mounting box

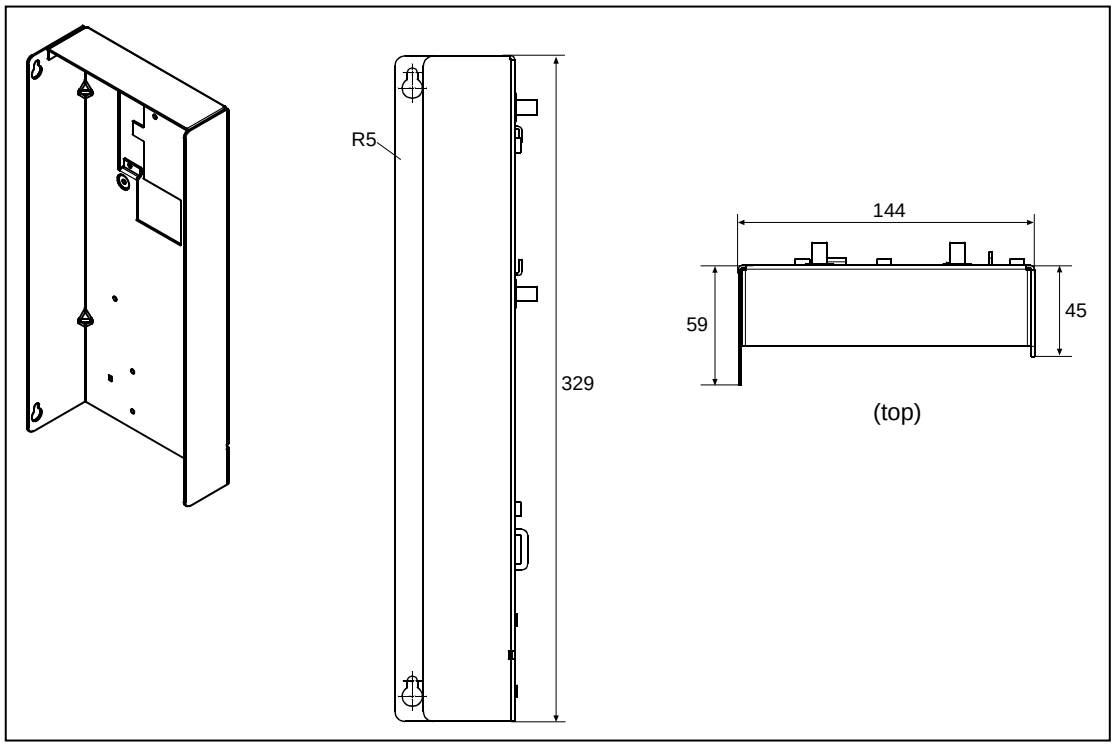


Figure 6-16. Control unit mounting box dimensions

6.2.4.1 Installing the control unit mounting box

The control unit of Vacon NX Liquid-Cooled drive is mounted into a metal box which then can be placed inside the enclosure. Vacon alpha-numeric or graphical keypad can be used to control the drive. The keypad is connected to the control unit with an RS232 cable and mounted on the enclosure door. Pay special attention to the earthing of the cable, see instructions below.

Figure 6-17. Control unit installed into the mounting box; Left: front; Right: back

1. If the keypad sits in its place on the control unit, remove the keypad.
2. Connect the male end of the keypad cable to the D-connector of the control unit. Use Vacon RS232 cable included in the delivery. Figure 1.
3. Run the cable over the top of the box and secure with plastic band on the backside. Figure 2.

4. Earthing of keypad cable: Earth the keypad cable in the mounting box frame by fixing the branch cable with a screw underneath the control unit. See figures 3 and 4.
5. Mount the control unit mounting box in the front-left corner of the enclosure using two screws as shown in Figure 5. **Note: Do not install the mounting box floating (with e.g. plastic screws).**
6. Connect the optical cables (or the flat cable) to the power unit. See chapter 6.3.2 and figures 6 and 7.
7. Connect the female end of the keypad cable to keypad on the enclosure door, figure 8. Use a cable channel for the cable run, figure 9.

Figure 1.

Figure 2.

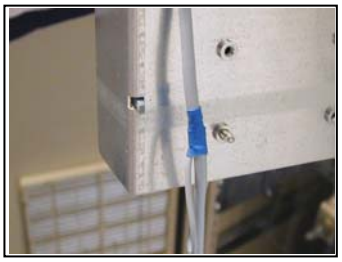


Figure 3.

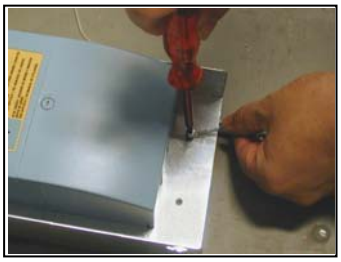


Figure 4.

Figure 5.

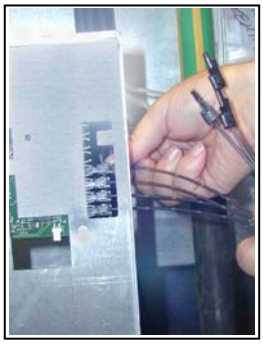


Figure 6.

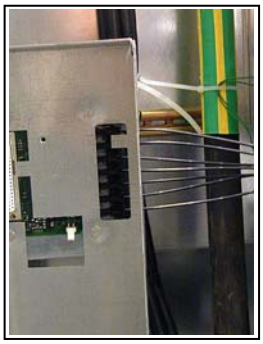


Figure 7.

Figure 8.

Figure 9.

6.3 Internal connections

As a general rule, all internal electrical and communications connections are made at the factory. However, if modules have to be moved, for example, and the connections therefore removed, you will have to re-establish the connections between 1) *the Power Unit ASIC* and *the Driver Board(s)* on the one hand and 2) the Power Unit ASIC and *the Optical Cable Adapter Board* on the other.

6.3.1 Connections between Power Unit ASIC and Driver Boards

See the figures and tables on the following pages for the correct connection of internal electrical and communications connections.

Note: The minimum optical cable bending radius is 50 mm.

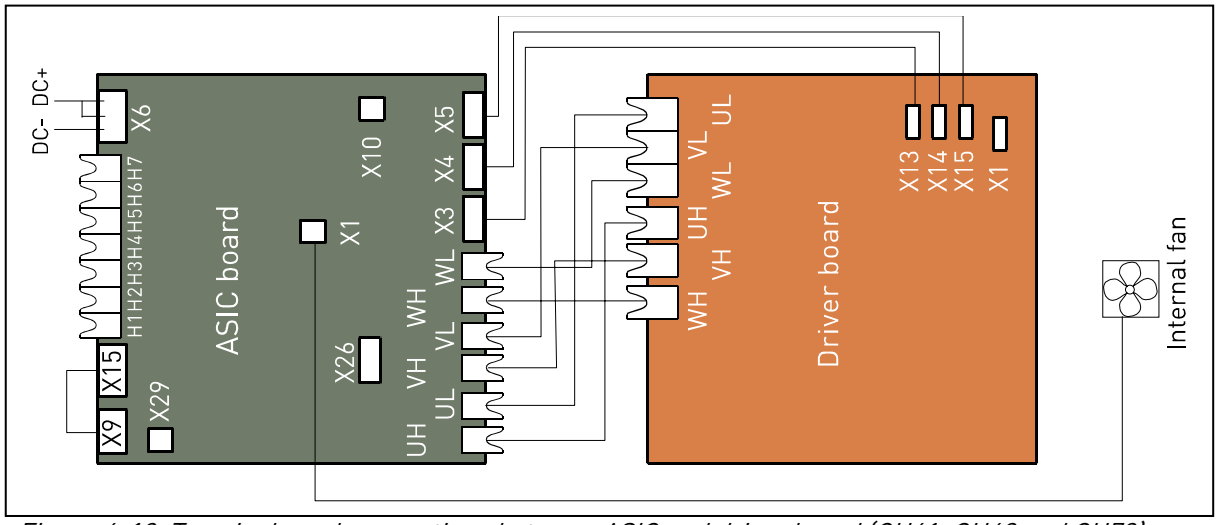


Figure 6-18. Terminals and connections between ASIC and driver board (CH61, CH62 and CH72)

Terminals on ASIC board	
X9	Charge feedback
X15	Charging relay output
X6	Connect to DC-link on freq. converter
X29	Flow supervision input
X26	Star Coupler terminal for drives greater than CH61
X10	+24V supply voltage to control board
X3	Connect to terminal X13 on driver board
X4	Connect to terminal X14 on driver board
X5	Connect to terminal X15 on driver board
X1	Driver board fan power connection

Gate driver signals from ASIC to driver board:	
UH	Connect to UH on driver board
UL	Connect to UL on driver board
VH	Connect to VH on driver board
VL	Connect to VL on driver board
WH	Connect to WH on driver board
WL	Connect to WL on driver board
Terminal X1 on driver board	
X1	Connect to DC-link on freq. converter

Note: Terminals X9 and X15 are connected by default. The cable can be removed if the signal is receved from other source.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

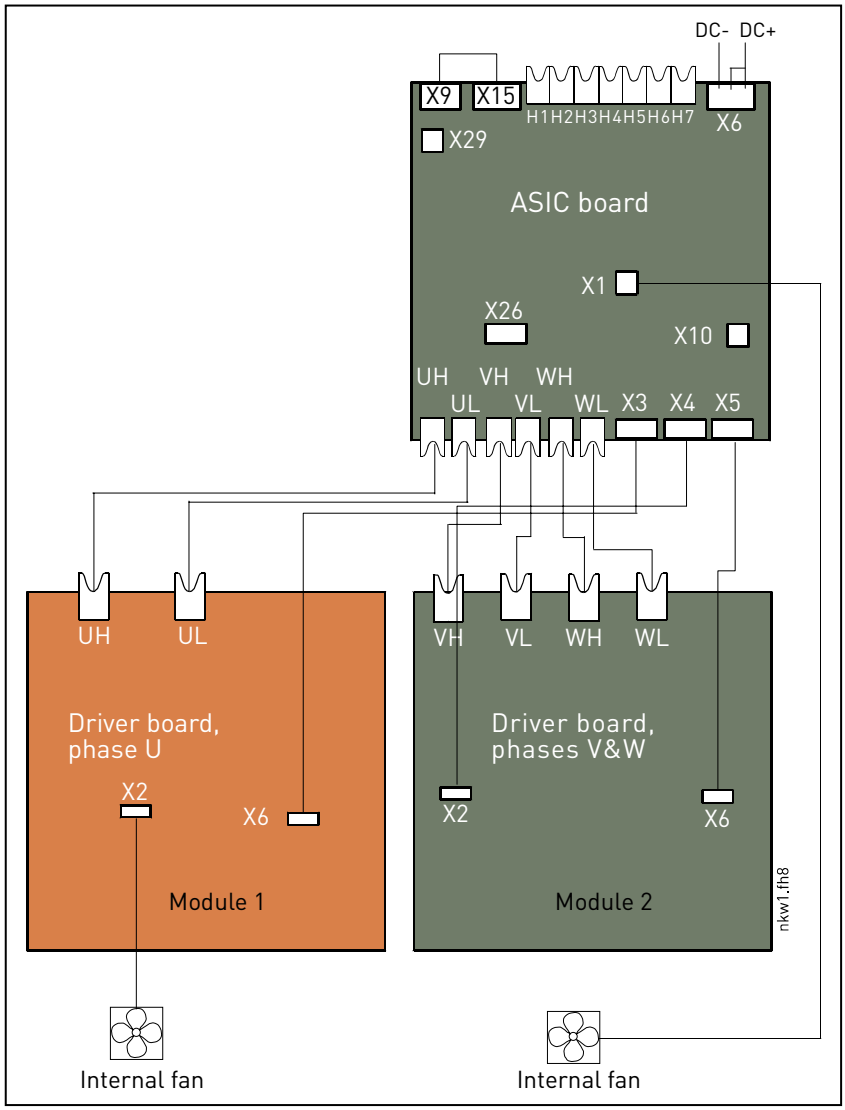


Figure 6-19. Terminals and connections between ASIC and driver boards (CH63)

Terminals on ASIC board	
X9	Charge feedback
X15	Charging relay output
X6	Connect to DC-link on freq. converter
X29	Flow supervision input
X26	Star Coupler terminal for drives greater than CH61
X10	+24V supply voltage to control board
X3	Connect to terminal X6 on phase U driver board
X4	Connect to terminal X2 on phase V/W driver board
X5	Connect to terminal X6 on phase V/W driver board
X1	Internal fan power connection for Mod. 2

Gate driver signals from ASIC to driver board:	
UH	Connect to UH on Phase U driver board
UL	Connect to UL on Phase U driver board
VH	Connect to VH on Phase V/W driver board
VL	Connect to VL on Phase V/W driver board
WH	Connect to WH on Phase V/W driver board
WL	Connect to WL on Phase V/W driver board
Terminal X2 on Phase U driver board	
X2	Internal fan power connection for Mod. 1

Note: Terminals X9 and X15 are connected by default. The cable can be removed if the signal is receved from other source.

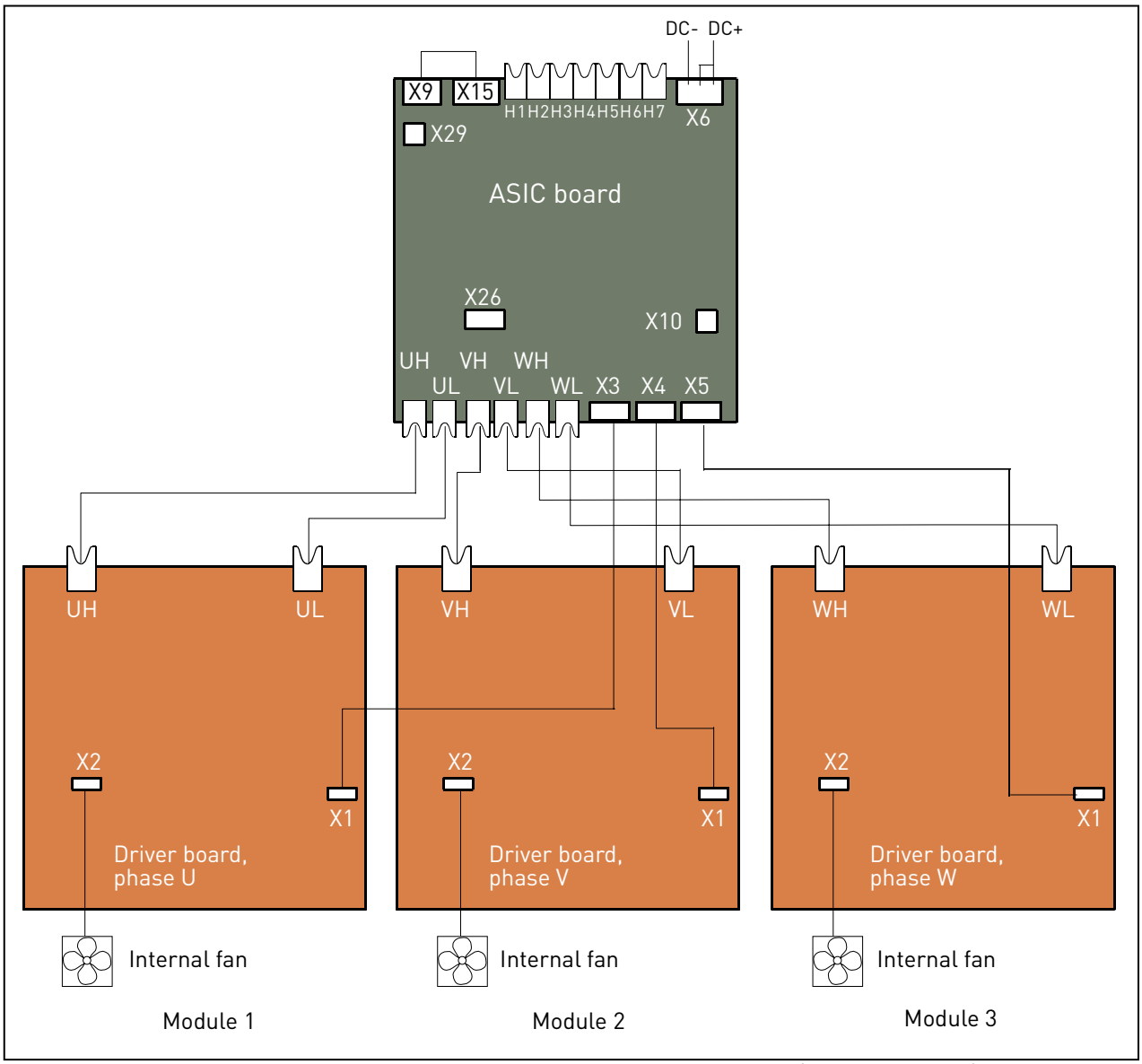


Figure 6-20. Terminals and connections between ASIC and driver boards (CH64 and CH74)

Terminals on ASIC board	
X9	Charge feedback
X15	Charging relay output
X6	Connect to DC-link on freq. converter
X29	Flow supervision input
X26	Star Coupler terminal for drives greater than CH61
X10	+24V supply voltage to control board
X3	Connect to terminal X1 on phase U driver board
X4	Connect to terminal X1 on phase V driver board
X5	Connect to terminal X1 on phase W driver board

Gate driver signals from ASIC to driver board:	
UH	Connect to UH on Phase U driver board
UL	Connect to UL on Phase U driver board
VH	Connect to VH on Phase V driver board
VL	Connect to VL on Phase V driver board
WH	Connect to WH on Phase W driver board
WL	Connect to WL on Phase W driver board

Terminal X2 on Phase driver boards	
X2	Internal fan power connection

Note: Terminals X9 and X15 are connected by default. The cable can be removed if the signal is receved from other source.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

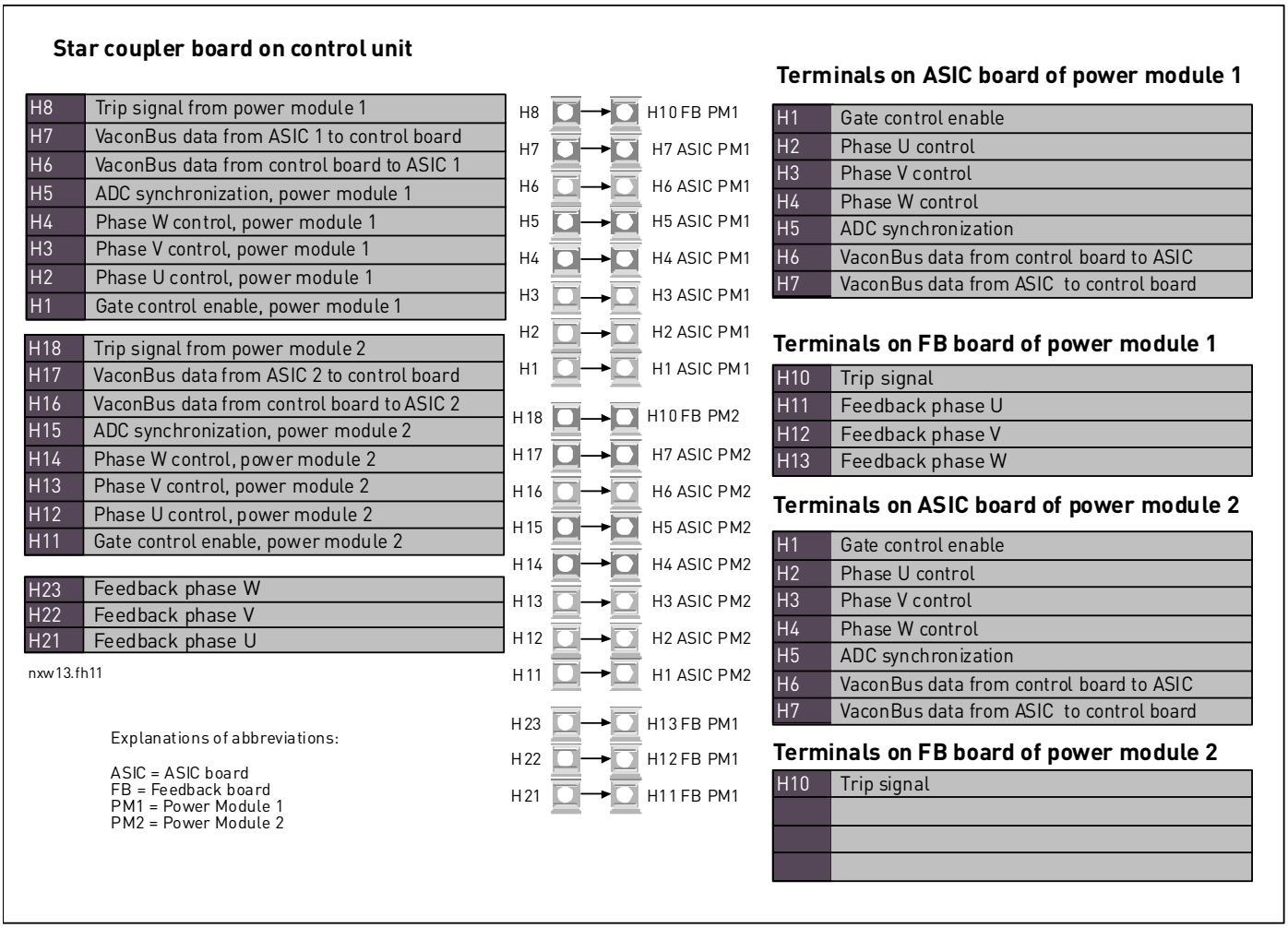


Figure 6-21. Terminals and connections between the star-coupler board, ASIC boards and feedback boards (CH64 and CH74)

6.3.2 Connections between power unit ASIC and the control unit

The communication connections between the NX Liquid-Cooled drive power unit and the *control unit* (see chapter 6.2) can be established using either the conventional round cable (standard in chassis CH3, CH4 and CH5) or optical cable (all chassis). Note that for chassis CH61 and greater, only optical cables can be used.

6.3.2.1 Connections with round cable

The communication connection between the drive power unit and the control unit in chassis CH3, CH4 and CH5 are primarily made with conventional round cable and D-connectors at both ends.

Remove the protective cover to reveal the D-connector on the power unit. Connect the one end of the communication cable to the D-connector of the power unit and the other end to the control unit. If the Optical Cable Adapter Board (see below) sits on the D-connector of the control unit you have to remove it first. See Figure 6-22 below.

6.3.2.2 Connections with optical cable

If optical cables are used to link the power unit and the control board, a special Optical Cable Adapter Board connected to the control board D-connector must be used. To connect the optical cables to the power unit, you will have to remove the protective cover first. See Figure 6-22. Connect the optical cables as shown in Figure 6-23. See also chapter 6.2.4, Control unit mounting box.
The maximum length of the optical cable is 10 m.

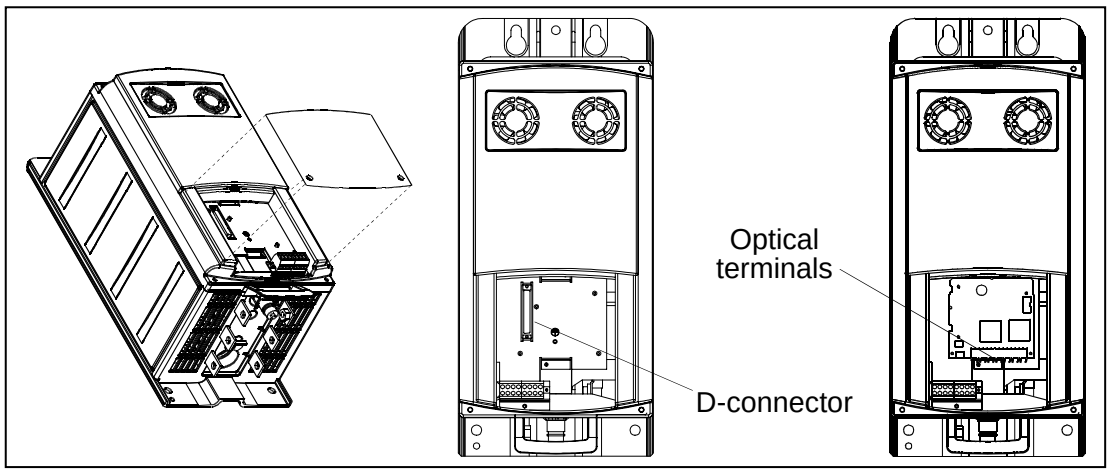


Figure 6-22.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

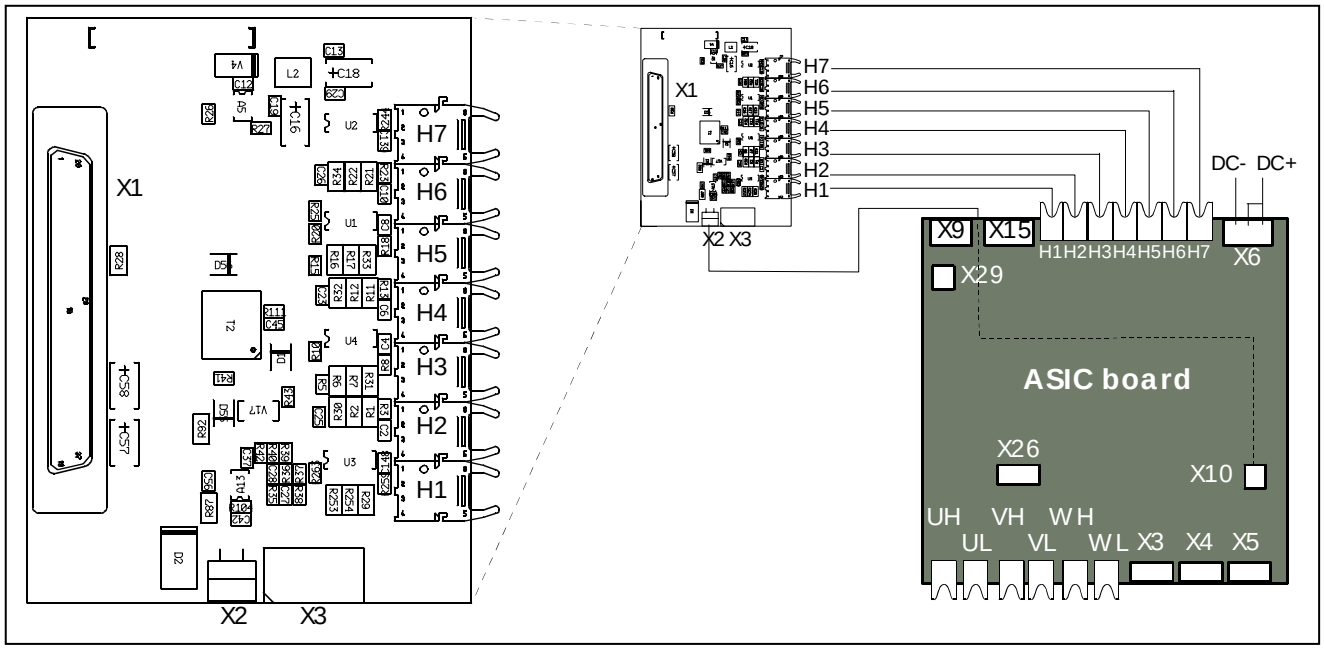


Figure 6-23. Optical cable adapter board

Optical terminals on Optical cable adapter board:

H1	Gate control enable
H2	Phase U control
H3	Phase V control
H4	Phase W control
H5	ADC synchronization
H6	VaconBus data from control board to ASIC
H7	VaconBus data from ASIC to control board

Other terminals on adapter board:

X1	Control board connection
X2	Supply voltage 24Vin (from power unit ASIC)
X3	Supply voltage 24Vin (customer); • Max. current 1A • Terminal #1: + • Terminal #2: –

Note: The minimum optical cable bending radius is 50 mm.

Note: Terminals *X2* and *X3* can be in use simultaneously. However, if the +24V supply from the control I/O terminals (e.g. from board OPT-A1) is used, this terminal must be protected with a diode.

6.3.3 Connections between mains device and inverter power module

The dimensions in the table below shall be taken into account if some kind of mains device (e.g. fuse, switch fuse, contactor) is used in the input line between the mains and the Vacon Liquid-Cooled inverter.

Chassis	Type	Connection		
		Conductor cross section [mm²]	Busbar size (flexible connection)	Busbar size (bright Cu)
CH3	0016_5	6		
	0022_5			
	0031_5			
CH3	0038_5	10		
	0045_5			
	0061_5			
CH4	0072_5	25		
	0087_5			
	0105_5			
CH4	0140_5	50		
CH5	0168_5	70	2*24*1	
CH5	0208_5	95		
CH5	0261_5	120		
CH61	0300_5	2*70	5*32*1	1*50*5
CH61	0385_5			
CH72	0460_5	2*95		
CH72	0520_5	2*120		
CH72	0590_5	2*150		1*80*5
CH72	0650_5		2*(6*40*1)	
CH72	0730_5			
CH63	0820_5			1*100*5
CH63	0920_5			
CH63	1030_5			
CH63	1150_5			
CH74	1370_5			2*100*5
CH74	1640_5			
CH74	2060_5			3*100*5
CH74	2300_5			

Table 6-17. Connections from mains device to drive

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

Chassis	Type	Connection		
		Conductor cross section [mm²]	Busbar size (flexible connection)	Busbar size (bright Cu)
CH61	0170_6	70	2*24*1	
	0208_6	95		
	0261_6	120		1*50*5
CH62	0325_6	2*70	5*32*1	
	0385_6			
	0416_6	2*95		
	0460_6			
	0502_6	2*120		
CH63	0590_6	2*150	2*(6*40*1)	1*80*5
	0650_6			
	0750_6			
CH64	0820_6			1*100*5
	0920_6			
	1030_6			
	1180_6			2*100*5
	1300_6			
	1500_6			

Table 6-18. Connections from mains device to drive

7. CONTROL KEYPAD

The control keypad is the link between the Vacon frequency converter and the user. The Vacon NX control keypad features an alphanumeric display with seven indicators for the Run status (RUN, , READY, STOP, ALARM, FAULT) and three indicators for the control place (I/O term/ Keypad/BusComm). There are also three Status Indicator LEDs (green - green - red), see Status LEDs (green – green – red) below.
The control information, i.e. the number of menu, description of menu or the displayed value and the numeric information are presented on three text lines.

The frequency converter is operable through the nine push-buttons of the control keypad. Furthermore, the buttons serve the purposes of parameter setting and value monitoring.

The keypad is detachable and isolated from the input line potential.

7.1 Indications on the Keypad display

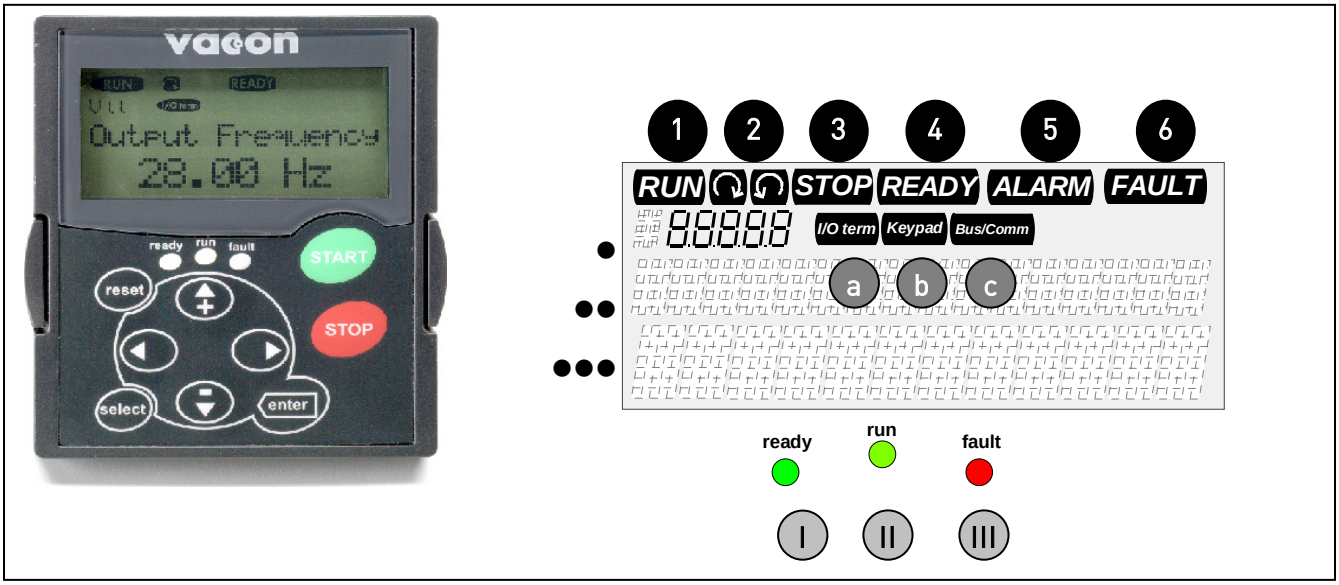


Figure 7-1. Vacon control keypad and drive status indications

7.1.1 Drive status indications (See control keypad)

The drive status indications tell the user what the status of the motor and the drive is and whether the motor control software has detected irregularities in motor or frequency converter functions.

1 RUN = Motor is running; Blinks when the stop command has been given but the frequency is still ramping down.

2 = Indicates the direction of motor rotation.

3 STOP = Indicates that the drive is not running.

4 READY = Lights when AC power is on. In case of a trip, the symbol will not light up.

5 ALARM = Indicates that the drive is running outside a certain limit and a warning is given.

6 FAULT = Indicates that unsafe operating conditions were encountered due to which the drive was stopped.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

7.1.2 Control place indications (See control keypad)

The symbols *I/O term, Keypad* and *Bus/Comm* (see Figure 7-1) indicate the choice of control place made in the Keypad control menu (M3) (see chapter 7.3.3).

a *I/O term* = I/O terminals are the selected control place; i.e. START/STOP commands or reference values etc. are given through the I/O terminals.

b *Keypad* = Control keypad is the selected control place; i.e. the motor can be started or stopped, or its reference values etc. altered from the keypad.

c *Bus/Comm* = The frequency converter is controlled through a fieldbus.

7.1.3 Status LEDs (green – green – red) (See control keypad)

The status LEDs light up in connection with the READY, RUN and FAULT drive status indicators.

I ● = Illuminates with the AC power connected to the drive and no faults are active. Simultaneously, the drive status indicator READY is lit up.

II ● = Illuminates when the drive is running. Blinks when the STOP button has been pushed and the drive is ramping down.

III ● = Blinks when unsafe operating conditions were encountered due to which the drive was stopped (Fault Trip). Simultaneously, the drive status indicator FAULT blinks on the display and the fault description can be seen, see chapter 7.3.4, Active Faults.

7.1.4 Text lines (See control keypad)

The three text lines (•, ••, •••) provide the user with information on his present location in the keypad menu structure as well as with information related to the operation of the drive.

• = Location indication; displays the symbol and number of menu, parameter etc. Example: M2 = Menu 2 (Parameters); P2.1.3 = Acceleration time

•• = Description line; Displays the description of menu, value or fault.

••• = Value line; Displays the numerical and textual values of references, parameters etc. and the number of submenus available in each menu.

7.2 Keypad push-buttons

The Vacon alphanumeric control keypad features 9 push-buttons that are used for the control of the frequency converter (and motor), parameter setting and value monitoring.

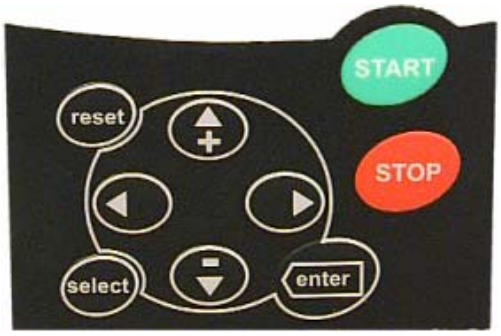


Figure 7-2. Keypad push-buttons

7.2.1 Button descriptions

reset = This button is used to reset active faults (see Chapter 7.3.4).

select = This button is used to switch between two latest displays. May be useful when you want to see how the changed new value influences some other value.

enter = The Enter button serves for:
1) confirmation of selections
2) fault history reset (2...3 seconds)

▲ + = Browser button up
Browse the main menu and the pages of different submenus.
Edit values.

- ▼ = Browser button down
Browse the main menu and the pages of different submenus.
Edit values.

◄ = Menu button left
Move backward in menu.
Move cursor left (in parameter menu).
Exit edit mode.
Hold down for 3 seconds to return to main menu.

► = Menu button right
Move forward in menu.
Move cursor right (in parameter menu).
Enter edit mode.

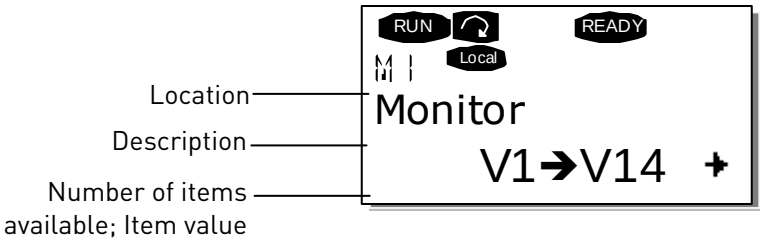
start = Start button.
Pressing this button starts the motor if the keypad is the active control place. See Chapter 7.3.3.

stop = Stop button. Pressing this button stops the motor (unless disabled by parameter R3.4/R3.6). See Chapter 7.3.3.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

7.3 Navigation on the control keypad

The data on the control keypad are arranged in menus and submenus. The menus are used for example for the display and editing of measurement and control signals, parameter settings (chapter 7.3.2), reference values and fault displays (chapter 7.3.4). Through the menus, you can also adjust the contrast of the display (page 121).



The first menu level consists of menus M1 to M7 and is called the *Main menu*. The user can navigate in the main menu using the *Browser buttons* up and down. The desired submenu can be entered from the main menu using the *Menu buttons*. When there still are pages to enter under the currently displayed menu or page, you can see an arrow (+) in the lower right corner of the display and by pressing the *Menu button right*, you can reach the next menu level.

The control keypad navigation chart is shown on the next page. Please note that the menu *M1* is located in the lower left corner. From there you will be able to navigate your way up to the desired menu using the menu and browser buttons.

More detailed descriptions of the menus you will find later in this Chapter.

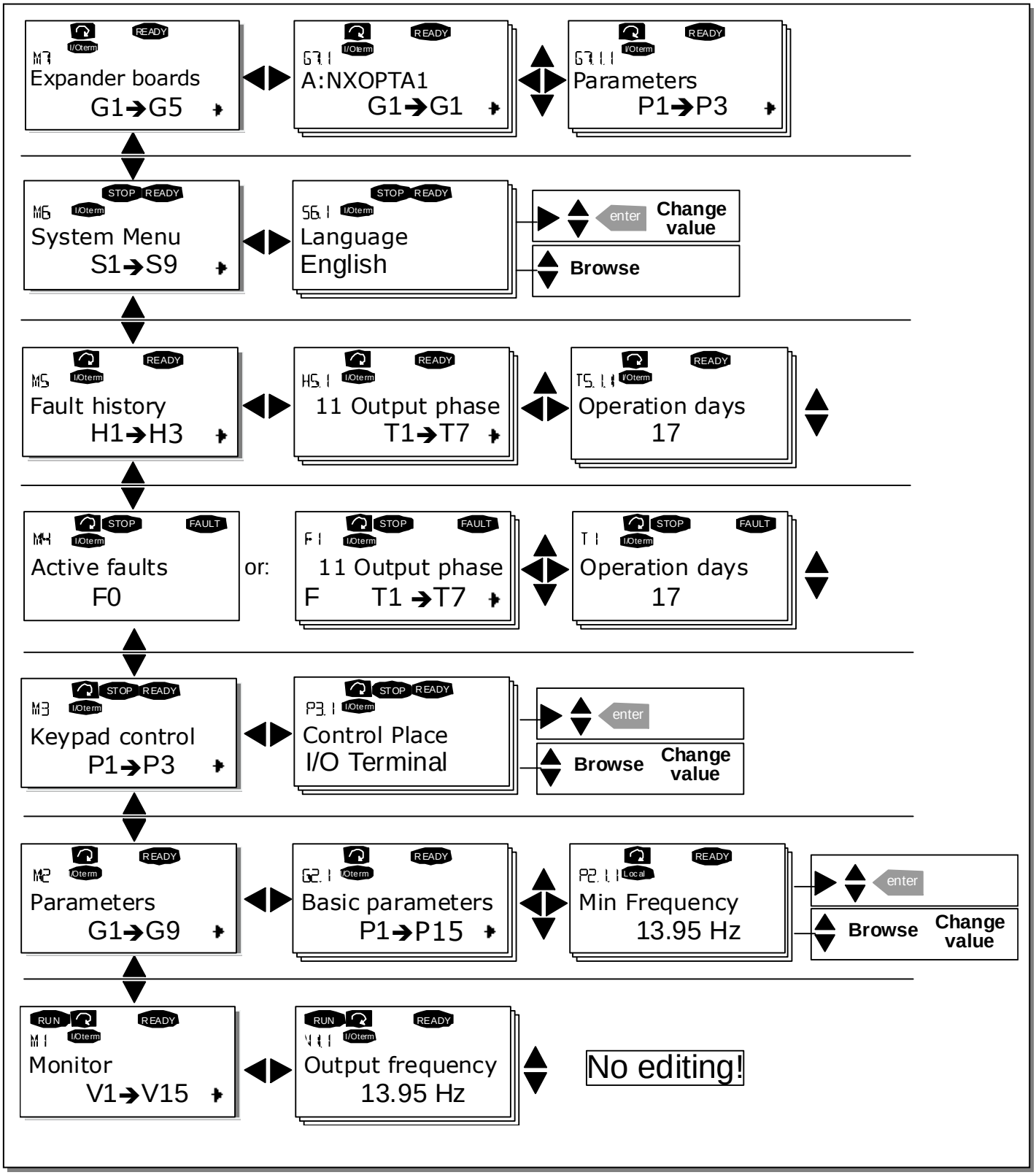


Figure 7-3. Keypad navigation chart

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

7.3.1 Monitoring menu (M1)

You can enter the Monitoring menu from the Main menu by pushing the *Menu button right* when the location indication **M1** is visible on the first line of the display. How to browse through the monitored values is presented in Figure 7-4.
The monitored signals carry the indication **V#.#** and they are listed in Table 7-1. The values are updated once every 0.3 seconds.

This menu is meant only for signal checking. The values cannot be altered here. For changing values of parameters see Chapter 7.3.2.

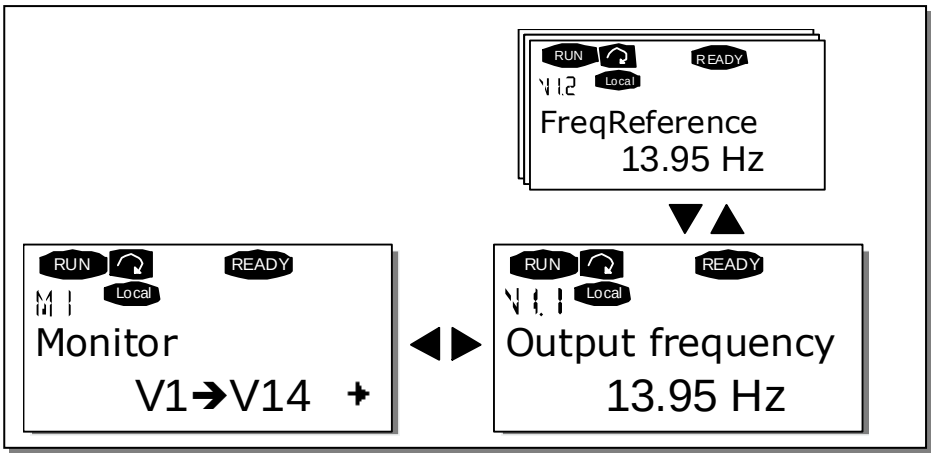


Figure 7-4. Monitoring menu

Code	Signal name	Unit	Description
V1.1	Output frequency	Hz	Frequency to the motor
V1.2	Frequency reference	Hz	
V1.3	Motor speed	rpm	Calculated motor speed
V1.4	Motor current	A	Measured motor current
V1.5	Motor torque	%	Calculated motor shaft torque
V1.6	Motor power	%	Calculated motor shaft power
V1.7	Motor voltage	V	Calculated motor voltage
V1.8	DC-link voltage	V	Measured DC-link voltage
V1.9	Unit temperature	°C	Heat sink temperature
V1.10	Motor temperature	%	Calculated motor temperature. See All in One application manual.
V1.11	Voltage input	V	AI1
V1.12	Current input	mA	AI2
V1.13	DIN1, DIN2, DIN3		Digital input statuses
V1.14	DIN4, DIN5, DIN6		Digital input statuses
V1.15	DO1, RO1, RO2		Digital and relay output statuses
V1.16	Analogue output cur-	mA	AO1
M1.17	Multimonitoring items		Displays three selectable monitoring values. See chapter 7.3.6.5.

Table 7-1. Monitored signals

Note: The All in One applications embody more monitoring values.

7.3.2 Parameter menu (M2)

Parameters are the way of conveying the commands of the user to the frequency converter. The parameter values can be edited by entering the *Parameter Menu* from the *Main Menu* when the location indication **M2** is visible on the first line of the display. The value editing procedure is presented in Figure 7-5.

Push the *Menu button right* once to move into the *Parameter Group Menu (G#)*. Locate the parameter group desired by using the *Browser buttons* and push the *Menu button right* again to enter the group and its parameters. Use again the *Browser buttons* to find the parameter *(P#)* you want to edit. From here you can proceed in two different ways: Pushing the *Menu button right* takes you to the edit mode. As a sign of this, the parameter value starts to blink. You can now change the value in two different manners:

1. Just set the new desired value with the *Browser buttons* and confirm the change with the *Enter button*. Consequently, the blinking stops and the new value is visible in the value field.
2. Push the *Menu button right* once again. Now you will be able to edit the value digit by digit. This editing manner may come in handy, when a relatively greater or smaller value than that on the display is desired. Confirm the change with the *Enter button*.

The value will not change unless the Enter button is pushed. Pressing the *Menu button left* takes you back to the previous menu.

Several parameters are locked, i.e. uneditable, when the drive is in RUN status. If you try to change the value of such a parameter the text **Locked** will appear on the display. The frequency converter must be stopped in order to edit these parameters.
The parameters values can also be locked using the function in menu **M6** (see Chapter Parameter lock (P6.5.2)).

You can return to the *Main menu* anytime by pressing the *Menu button left* for 3 seconds.

The basic application package "All in One+" includes seven applications with different sets of parameters.

Once in the last parameter of a parameter group, you can move directly to the first parameter of that group by pushing the *Browser button up*.

See the diagram for parameter value change procedure on page 101.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

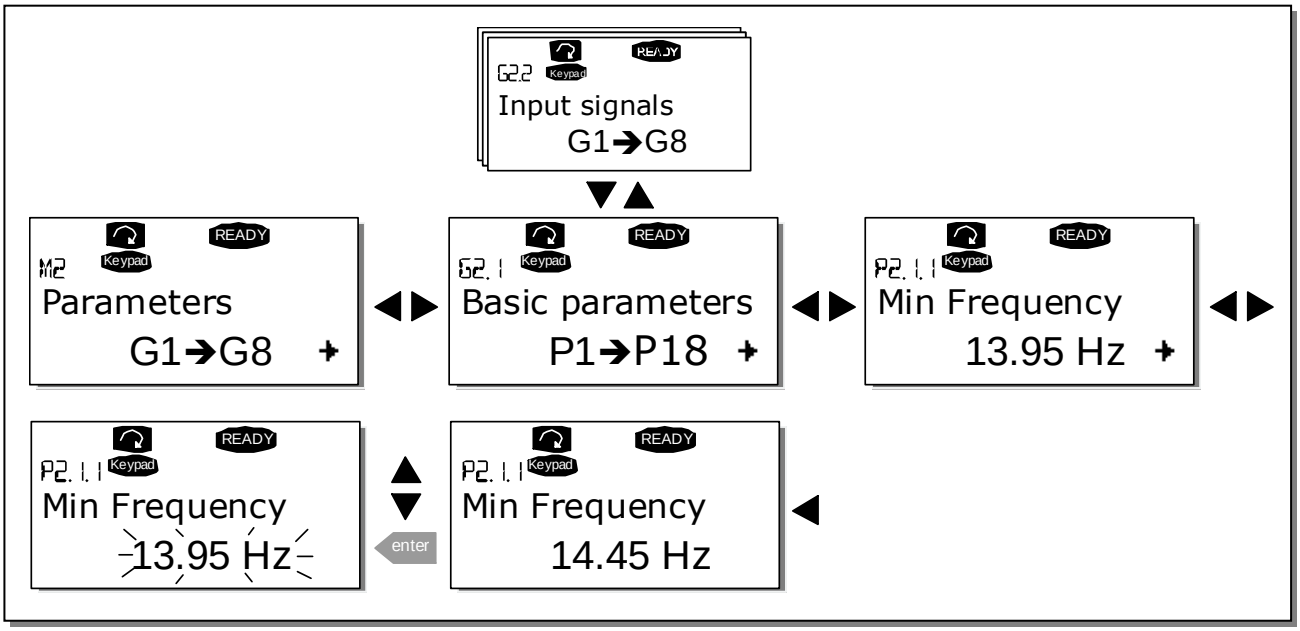


Figure 7-5. Parameter value change procedure

7.3.3 Keypad control menu (M3)

In the *Keypad Controls Menu*, you can choose the control place, edit the frequency reference and change the direction of the motor. Enter the submenu level with the *Menu button right*.

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P3.1	Control place	1	3		1		125	1=I/O terminal 2=Keypad 3=Fieldbus
R3.2	Keypad reference	Par. 2.1.1	Par. 2.1.2	Hz				
P3.3	Direction (on keypad)	0	1		0		123	0=Forward 1=Reverse
R3.4	Stop button	0	1		1		114	0=Limited function of Stop button 1=Stop button always enabled

Table 7-2. Keypad control parameters, M3

7.3.3.1 Selection of control place

There are three different places (sources) which the frequency converter can be controlled from. For each control place, a different symbol will appear on the alphanumeric display:

Control place	Symbol
I/O terminals	I/O term
Keypad (panel)	Keypad
Fieldbus	Bus/Comm

Change the control place by entering the edit mode with the *Menu button right*. The options can then be browsed through with the *Browser buttons*. Select the desired control place with the *Enter button*. See the diagram on the next page.

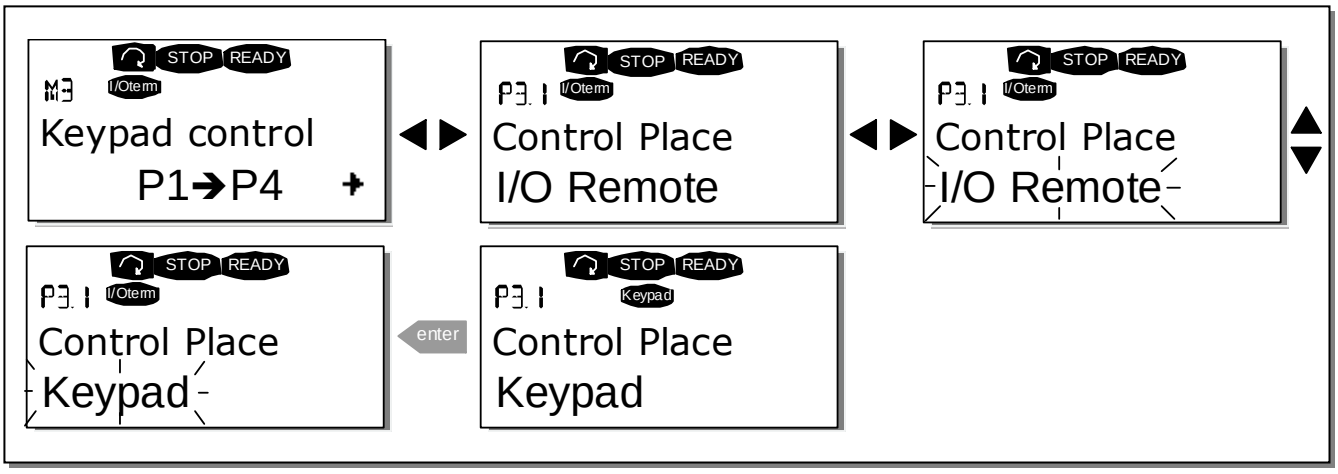


Figure 7-6. Selection of control place

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

7.3.3.2 *Keypad reference*

The keypad reference submenu **(P3.2)** displays and allows the operator to edit the frequency reference. The changes will take place immediately. **This reference value will not, however, influence the rotation speed of the motor unless the keypad has been selected as source of reference.**
NOTE: The maximum difference in RUN mode between the output frequency and the keypad reference is 6 Hz. See also 7.3.3.4 below.

See Figure 7-5 for how to edit the reference value (pressing the *Enter button* is not, however, necessary).

7.3.3.3 *Keypad direction*

The keypad direction submenu displays and allows the operator to change the rotating direction of the motor. **This setting will not, however, influence the rotation direction of the motor unless the keypad has been selected as the active control place.**
See also 7.3.3.4 below.

See Figure 7-6 for how to change the rotation direction.

Note: Additional Information on controlling the motor with the keypad is given in Chapters 7.2.1 and 8.2.

7.3.3.4 *Stop button activated*

By default, pushing the STOP button will **always** stop the motor regardless of the selected control place. You can disable this function by giving parameter 3.4 the value **0**. If the value of this parameter is **0**, the STOP button will stop the motor only **when the keypad has been selected as the active control place.**

NOTE! There are some special functions that can be performed when in the ***M3*** menu:

Select the keypad as the active control place by keeping the start button pushed down for 3 seconds **when the motor is running**. The keypad will become the active control place and the current frequency reference and direction will be copied to the keypad.

Select the keypad as the active control place by keeping the stop button pushed down for 3 seconds **when the motor is stopped**. The keypad will become the active control place and the current frequency reference and direction will be copied to the keypad.

Copy the frequency reference set elsewhere (I/O, fieldbus) **to the panel** by keeping the enter button pushed down for 3 seconds.

Note that if you are in any other than ***M3*** menu these functions will not work.
If you are in some other than ***M3*** menu and try to start the motor by pressing the START button when the keypad is not selected as the active control place you will get an error message *Keypad Control NOT ACTIVE*.

7.3.4 Active faults menu (M4)

The *Active faults menu* can be entered from the *Main menu* by pushing the *Menu button right* when the location indication **M4** is visible on the first line of the keypad display.

When a fault brings the frequency converter to a stop, the location indication F1, the fault code, a short description of the fault and the **fault type symbol** (see Chapter 7.3.4.1) will appear on the display. In addition, the indication FAULT or ALARM (see Figure 7-1 or Chapter 7.1.1) is displayed and, in case of a FAULT, the red led on the keypad starts to blink. If several faults occur simultaneously, the list of active faults can be browsed with the *Browser buttons*.

The memory of active faults can store the maximum of 10 faults in the order of appearance. The display can be cleared with the *Reset button* and the read-out will return to the same state it was before the fault trip. The fault remains active until it is cleared with the *Reset button* or with a reset signal from the I/O terminal or fieldbus.

Note! Remove external Start signal before resetting the fault to prevent unintentional restart of the drive.

Normal state, no faults:

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

7.3.4.1 Fault types

In the NX frequency converter, there are four different types of faults. These types differ from each other on the basis of the subsequent behaviour of the drive. See Table 7-3.

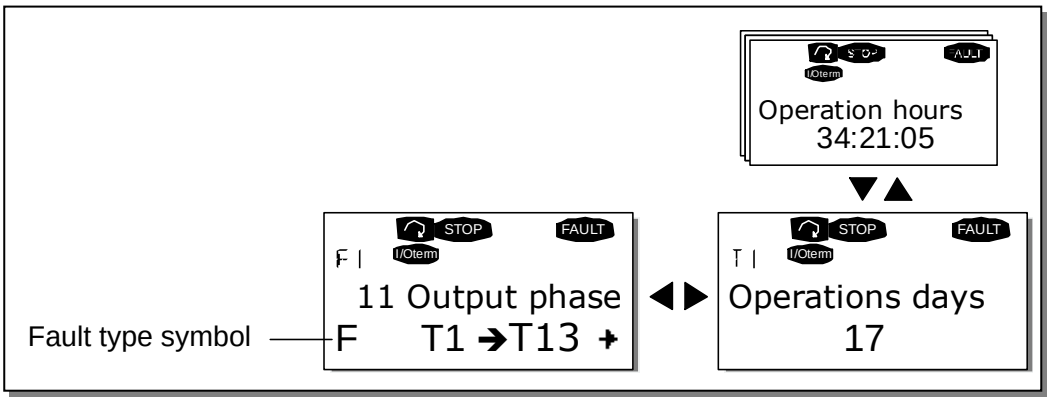


Figure 7-7. Fault display

Fault type symbol	Meaning
A (Alarm)	This type of fault is a sign of an unusual operating condition. It does not cause the drive to stop, nor does it require any special actions. The 'A fault' remains in the display for about 30 seconds.
F (Fault)	An 'F fault' is a kind of fault that makes the drive stop. Actions need to be taken in order to restart the drive.
AR (Fault Autoreset)	If an 'AR fault' occurs the drive will also stop immediately. The fault is reset automatically and the drive tries to restart the motor. Finally, if the restart is not successful, a fault trip (FT, see below) occurs.
FT (Fault Trip)	If the drive is unable to restart the motor after an AR fault an FT fault occurs. The effect of the 'FT fault' is basically the same as that of the F fault: the drive is stopped.

Table 7-3. Fault types

7.3.4.2 Fault codes

The fault codes, their causes and correcting actions are presented in the table below. The shadowed faults are A faults only. The items written in white on black background present faults for which you can program different responses in the application. See parameter group Protections.
Note: When contacting distributor or factory because of a fault condition, always write down all texts and codes on the keypad display.

Fault code	Fault	Possible cause	Correcting measures
1	Overcurrent	Frequency converter has detected too high a current in the motor cable: – sudden heavy load increase – short circuit in motor cables – unsuitable motor	Check loading. Check motor. Check cables.
2	Overvoltage	The DC-link voltage has exceeded the limits defined in . – too short a deceleration time – high overvoltage spikes in supply	Make the deceleration time longer. Use brake chopper or brake resistor (available for most chassis as options)
3	Earth fault	Current measurement has detected that the sum of motor phase current is not zero. – insulation failure in cables or motor	Check motor cables and motor.
5	Charging switch	The charging switch is open, when the START command has been given. – faulty operation – component failure	Reset the fault How? and restart. Should the fault re-occur, contact the distributor near to you. Please visit: http://www.vacon.com/wwcontacts.html
6	Emergency stop	Stop signal given from the option board.	
7	Saturation trip	Various causes: – defective component – brake resistor short-circuit or overload	Cannot be reset from the keypad. Switch off power. DO NOT RE-CONNECT POWER! Contact factory. If this fault appears simultaneously with Fault 1, check motor cables and motor
8	System fault	- component failure - faulty operation Note exceptional fault data record, see 7.3.4.3. Subcode in **T.14:** S1 = Feedback of motor voltage S2 = Reserved S3 = Reserved S4 = ASIC trip S5 = Disturbance in VaconBus S6 = Feedback of charging switch S7 = Charging switch S8 = No power to driver card S9 = Power unit communication (TX) S10 = Power unit communication (Trip) S11 = Power unit comm. (Measurement)	Reset the fault How? and restart. Should the fault re-occur, contact the distributor near to you. Please visit: http://www.vacon.com/wwcontacts.html

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

Fault code	Fault	Possible cause	Correcting measures
9	Undervoltage	DC-link voltage is under the voltage limits defined in . – most probable cause: too low a supply voltage – frequency converter internal fault	In case of temporary supply voltage break reset the fault How? and restart the frequency converter. Check the supply voltage. If it is adequate, an internal failure has occurred. Contact the distributor near to you. Please visit: http://www.vacon.com/wwcontacts.html
10	Input line supervision	Input line phase is missing.	Check supply voltage and cable. Check fuses.
11	Output phase supervision	Current measurement has detected that there is no current in one motor phase.	Check motor cable and motor.
12	Brake chopper supervision	– no brake resistor installed – brake resistor is broken – brake chopper failure	Check brake resistor. If the resistor is ok, the chopper is faulty. Contact the distributor near to you. Please visit: http://www.vacon.com/wwcontacts.html
13	Frequency converter undertemperature	Heatsink temperature is under –10°C	
14	Frequency converter overtemperature	1) Heatsink temperature is over 70°C. Overtemperature warning is issued when the heatsink temperature exceeds 65°C. 2) Circuit board temperature is over 85°C. Overtemperature warning is issued when the board temperature exceeds 70°C.	Cause 1): Check that values for I_{th} (chapter 4.2) are not exceeded Check the correct coolant flow and temperature. Also check the circulation for possible leaks. Check the ambient temperature. Make sure that the switching frequency is not too high in relation to ambient temperature and motor load. Cause 2): Circulation of air in the drive is blocked. The cooling fans are defect.
15	Motor stalled	Motor stall protection has tripped.	Check motor.
16	Motor overtemperature	Motor overheating has been detected by frequency converter motor temperature model. Motor is overloaded.	Decrease the motor load. If no motor overload exists, check the temperature model parameters.
17	Motor underload	Motor underload protection has tripped.	
22	EEPROM checksum fault	Parameter save fault – faulty operation – component failure	
24	Counter fault	Values displayed on counters are incorrect	
25	Microprocessor watchdog fault	– faulty operation – component failure	Reset the fault How? and restart. Should the fault re-occur, contact the distributor near to you. Please visit: http://www.vacon.com/wwcontacts.html
26	Startup prevented	Start-up of the drive has been prevented.	Cancel prevention of start-up.

Fault code	Fault	Possible cause	Correcting measures
29	Thermistor fault	The thermistor input of option board has detected increase of the motor temperature	Check motor cooling and loading Check thermistor connection (If thermistor input of the option board is not in use it has to be short circuited)
31	IGBT temperature (hardware)	IGBT Inverter Bridge overtemperature protection has detected too high a short-term overload current	Check loading. Check motor size.
34	CAN bus communication	Sent message not acknowledged.	Ensure that there is another device on the bus with the same configuration.
36	Control unit	NXS Control Unit can not control NXP Power Unit and vice versa	Change control unit
37	Device changed (same type)	Option board or control unit changed. Same type of board or same power rating of drive.	Reset **Note:** No fault time data record!
38	Device added (same type)	Option board or drive added. Drive of same power rating or same type of board added.	Reset **Note:** No fault time data record!
39	Device removed	Option board removed. Drive removed.	Reset **Note:** No fault time data record!
40	Device unknown	Unknown option board or drive.	Contact the distributor near to you. Please visit: http://www.vacon.com/wwcontacts.html
41	IGBT temperature	IGBT Inverter Bridge overtemperature protection has detected too high a short term overload current	Check loading. Check motor size.
42	Brake resistor overtemperature	Brake resistor overtemperature protection has detected too heavy braking	Set the deceleration time longer. Use external brake resistor.
43	Encoder fault	Note the exceptional Fault data record. See 7.3.4.3. Additional codes: 1 = Encoder 1 channel A is missing 2 = Encoder 1 channel B is missing 3 = Both encoder 1 channels are missing 4 = Encoder reversed	Check encoder channel connections. Check the encoder board.
44	Device changed (different type)	Option board or control unit changed. Option board of different type or different power rating of drive.	Reset **Note:** No fault time data record! **Note:** Application parameter values restored to default.
45	Device added (different type)	Option board or drive added. Option board of different type or drive of different power rating added.	Reset **Note:** No fault time data record! **Note:** Application parameter values restored to default.
50	Analogue input I_{in} < 4mA (sel. signal range 4 to 20 mA)	Current at the analogue input is < 4mA. – control cable is broken or loose – signal source has failed	Check the current loop circuitry.
51	External fault	Digital input fault.	
52	Keypad communication fault	The connection between the control keypad and the frequency converter is broken.	Check keypad connection and possible keypad cable.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

Fault code	Fault	Possible cause	Correcting measures
53	Fieldbus fault	The data connection between the fieldbus Master and the fieldbus board is broken	Check installation. If installation is correct contact the nearest Vacon distributor. Please visit: http://www.vacon.com/wwcontacts.html
54	Slot fault	Defective option board or slot	Check board and slot. Contact the nearest Vacon distributor. Please visit: http://www.vacon.com/wwcontacts.html
56	PT100 board temp. fault	Temperature limit values set for the PT100 board parameters have been exceeded	Find the cause of temperature rise

Table 7-4. Fault codes

7.3.4.3 Fault time data record

When a fault occurs the information described above in 7.3.4 is displayed. By pushing the *Menu button right* here you will enter the *Fault time data record menu* indicated by T.1→T.13. In this menu, some selected important data valid at the time of the fault are recorded. This feature is intended to help the user or the service person to determine the cause of fault.

The data available are:

T.1	Counted operation days *(Fault 43: Additional code)*	d
T.2	Counted operation hours *(Fault 43: Counted operation days)*	hh:mm:ss *(d)*
T.3	Output frequency *(Fault 43: Counted operation hours)*	Hz *(hh:mm:ss)*
T.4	Motor current	A
T.5	Motor voltage	V
T.6	Motor power	%
T.7	Motor torque	%
T.8	DC voltage	V
T.9	Unit temperature	°C
T.10	Run status	
T.11	Direction	
T.12	Warnings	
T.13	0-speed*	

Table 7-5. Fault time recorded data

* Tells the user if the drive was at zero speed (< 0.01 Hz) when the fault occurred

Real time record

If real time is set to run on the frequency converter the data items T1 and T2 will appear as follows:

T.1	Counted operation days	yyyy-mm-dd
T.2	Counted operation hours	hh:mm:ss,sss

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

7.3.5 Fault history menu (M5)

The *Fault history menu* can be entered from the *Main menu* by pushing the *Menu button right* when the location indication **M5** is visible on the first line of the keypad display. Find the fault codes in Table 7-4.

All faults are stored in the *Fault history menu* in which you can browse through them using the *Browser buttons*. Additionally, the *Fault time data record* pages (see Chapter 7.3.4.3) are accessible at each fault. You can return to the previous menu anytime by pushing the *Menu button left*.

The memory of the frequency converter can store a maximum of 30 faults in the order of appearance. The number of faults currently in the fault history is shown on the value line of the main page (**H1→H#**). The order of the faults is indicated by the location indication in the upper left corner of the display. The latest fault carries the indication F5.1, the second latest F5.2 etc. If there are 30 uncleared faults in the memory the next occurring fault will erase the oldest from the memory.

Pressing the *Enter button* for about 2 to 3 seconds resets the whole fault history. Then, the symbol **H#** will change to **0**.

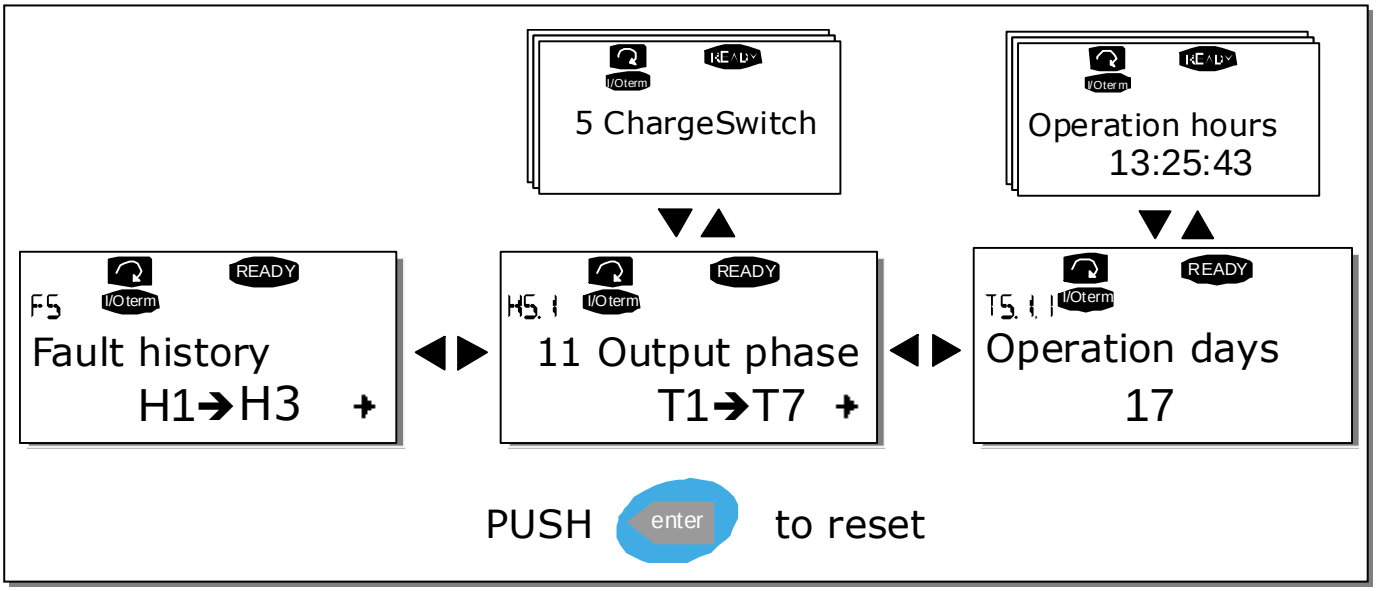


Figure 7-8. Fault history menu

7.3.6 System menu (M6)

The *System menu* can be entered from the main menu by pushing the *Menu button right* when the location indication **M6** is visible on the display.

The controls associated with the general use of the frequency converter, such as application selection, customised parameter sets or information about the hardware and software are located under the *System menu*. The number of submenus and subpages is shown with the symbol **S (or P)** on the value line.

On page 112 you will find a list of the functions available in the System menu.

Functions in the System menu

Code	Function	Min	Max	Unit	Default	Cust	Selections
S6.1	Language selection				English		Available selections depend on the language package.
S6.2	Application selection				Basic Application		Basic Application Standard Application Local/Remote control Appl. Multi-Step Application PID Control Application Multi-Purpose Control Appl. Pump and Fan Control Appl.
S6.3	Copy parameters						
S6.3.1	Parameter sets						Store set 1 Load set 1 Store set 2 Load set 2 Load factory defaults
S6.3.2	Load up to keypad						All parameters
S6.3.3	Load down from keypad						All parameters All but motor parameters Application parameters
P6.3.4	Parameter backup				Yes		Yes No
S6.4	Compare parameters						
S6.4.1	Set1				Not used		
S6.4.2	Set2				Not used		
S6.4.3	Factory settings						
S6.4.4	Keypad set						
S6.5	Security						
S6.5.1	Password				Not used		**0**=Not used
P6.5.2	Parameter lock				Change Enabled		Change Enabled Change Disabled
S6.5.3	Start-up wizard						No Yes
S6.5.4	Multimonitoring items						Change Enabled Change Disabled
S6.6	Keypad settings						
P6.6.1	Default page						
P6.6.2	Default page/ Operating menu						
P6.6.3	Timeout time	0	65535	s	30		
P6.6.4	Contrast	0	31		18		
P6.6.5	Backlight time	Always	65535	min	10		

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

S6.7	Hardware settings						
P6.7.3	HMI acknowledg. timeout	200	5000	ms	200		
P6.7.4	HMI number of re-tries	1	10		5		
S6.8	System information						
S6.8.1	Total counters						
C6.8.1.1	MWh counter			kWh			
C6.8.1.2	Power On day counter						
C6.8.1.3	Power On hours counter			hh:mm:ss			
S6.8.2	Trip counters						
T6.8.2.1	MWh counter			kWh			
T6.8.2.2	Clear MWh trip counter						
T6.8.2.3	Operating days trip counter						
T6.8.2.4	Operating hours trip counter			hh:mm:ss			
T6.8.2.5	Clear operating time counter						
S6.8.3	Software info						
S6.8.3.1	Software package						
S6.8.3.2	System software version						
S6.8.3.3	Firmware interface						
S6.8.3.4	System load						
S6.8.4	Applications						
S6.8.4.#	*Name of application*						
D6.8.4.#.1	Application ID						
D6.8.4.#.2	Applications: Version						
D6.8.4.#.3	Applications: Firmware interface						
S6.8.5	Hardware						
I6.8.5.1	Info: Power unit type code						
I6.8.5.2	Info: Unit voltage			V			
I6.8.5.3	Info: Brake chopper						
I6.8.5.4	Info: Brake resistor						
S6.8.6	Expander boards						
S6.8.7	Debug menu						For Application programming only. Contact factory for more details

Table 7-6. System menu functions

7.3.6.1 Language selection

The Vacon control keypad offers you the possibility to control the frequency converter through the keypad in the language of your choice.

Locate the language selection page under the *System menu*. Its location indication is S6.1. Press the *Menu button right* once to enter the edit mode. As the name of the language starts to blink you are able to choose another language for the keypad texts. Confirm the selection by pushing the *Enter button* The blinking stops and all textual information on the keypad is presented in the language you chose.

You can return to the previous menu anytime by pushing the *Menu button left*.

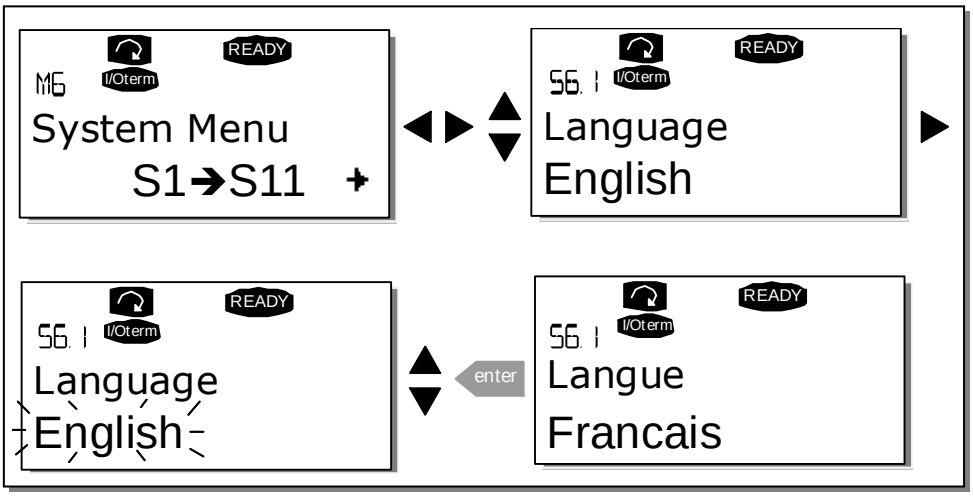


Figure 7-9. Selection of language

7.3.6.2 Application selection

The user can select the application desired by entering the *Application selection page (S6.2)*. This is done by pushing the *Menu button right* when on the first page of the *System menu*. Change then the application by pushing the *Menu button right* once again. The name of the application starts to blink. Now you can browse through the applications with the *Browser buttons* and select another application with the *Enter button*.

Changing application will reset all parameters. After application change, you will be asked if you want the parameters of the **new** application to be uploaded to the keypad. If you wish this to happen push the *Enter button* Pushing any other button leaves the parameters of the **previously used** application saved in the keypad. For more information, see Chapter 7.3.6.3.

For more information about the Application Package, see Vacon NX Application Manual.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

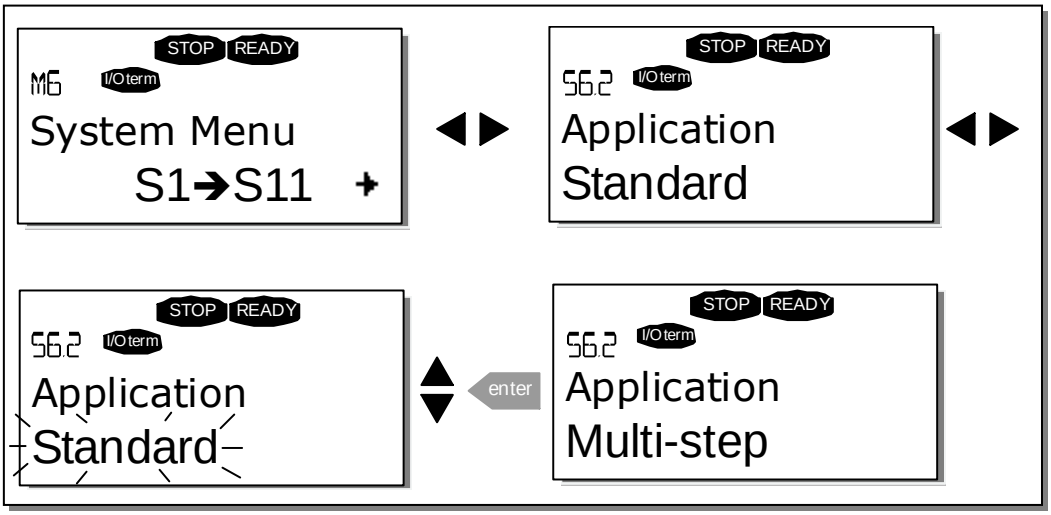


Figure 7-10. Change of application

7.3.6.3 Copy parameters

The parameter copy function is used when the operator wants to copy one or all parameter groups from one drive to another or to store parameter sets in the internal memory of the converter. All the parameter groups are first *uploaded* to the keypad, then the keypad is connected to another drive and then the parameter groups are *downloaded* to it (or possibly back to the same drive).

Before any parameters can successfully be copied from one drive to another the **drive** has to be **stopped** when the parameters are downloaded to it:

The parameter copy menu **(S6.3)** embodies four functions:

Parameter sets (S6.3.1)

The Vacon NX frequency converter features a possibility for the user to load back the factory default parameter values and to store and load two customised parameter sets (all parameters included in the application).

On *Parameter sets* page **(S6.3.1)**, push the *Menu button right* to enter the *Edit menu*. The text *LoadFactDef* begins to blink and you can confirm the loading of factory defaults by pushing the *Enter button*. The drive resets automatically.
Alternatively you can choose any other of the storing or loading functions with the *Browser buttons*. Confirm with the *Enter button*. Wait until 'OK' appears on the display.

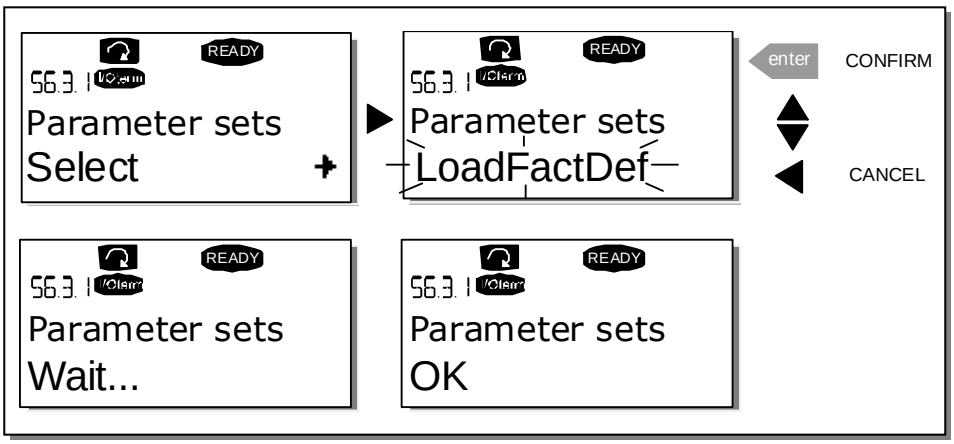


Figure 7-11. Storing and loading of parameter sets

Upload parameters to keypad (To keypad, S6.3.2)

This function uploads **all** existing parameter groups to the keypad provided that the drive is stopped.

Enter the *To keypad* page (S6.3.2) from the *Parameter copy menu*. Push the *Menu button right* to enter the edit mode. Use the *Browser buttons* to select the option *All parameters* and press the *Enter button*. Wait until 'OK' appears on the display.

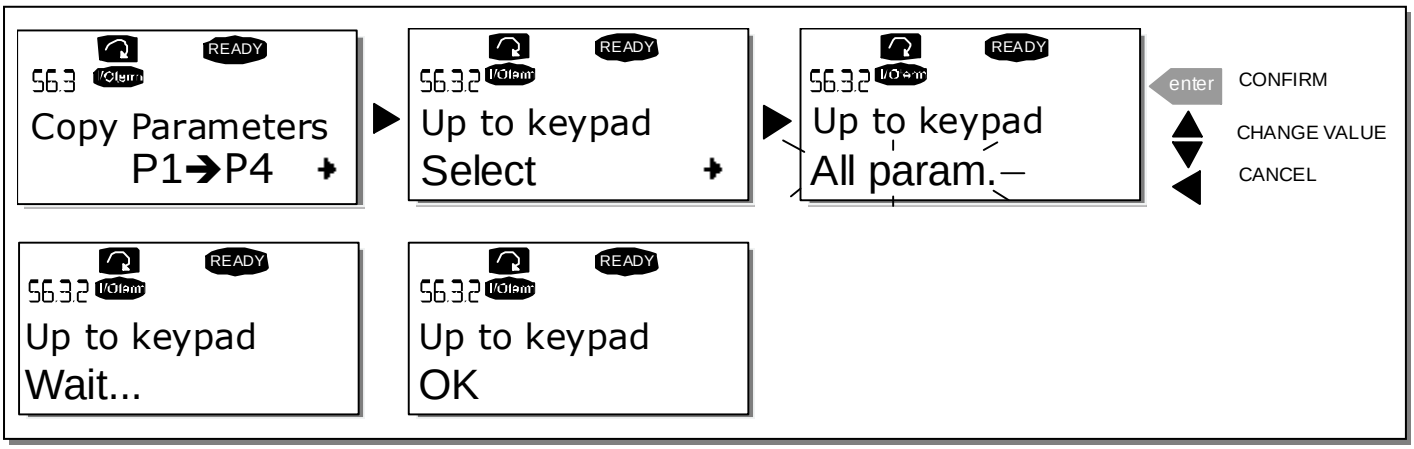


Figure 7-12. Parameter copy to keypad

Download parameters to drive (From keypad, S6.3.3)

This function downloads **one** or **all parameter** groups uploaded to the keypad to a drive provided that the drive is in STOP status.

Enter the *From keypad* page (S6.3.3) from the *Parameter copy menu*. Push the *Menu button right* to enter the edit mode. Use the *Browser buttons* to select either the option *All parameters* or *Application parameters* and press the *Enter button*. Wait until 'OK' appears on the display.

The procedure to download the parameters from keypad to drive is similar to that of from drive to keypad. See above.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

Automatic parameter backup (P6.3.4)

On this page you can activate or inactivate the parameter backup function. Enter the edit mode by pressing the *Menu button right*. Choose *Yes* or *No* with the *Browser buttons*.

When the Parameter backup function is activated Vacon NX control keypad makes a copy of the parameters of the presently used application. Every time a parameter is changed the keypad backup is automatically updated.

When applications are changed, you will be asked if you wish the parameters of the **new** application to be uploaded to the keypad. For this to happen, push the *Enter button*. If you wish to keep the copy of the parameters of the **previously used** application saved in the keypad push any other button. Now you will be able to download these parameters to the drive following the instructions given in chapter 7.3.6.3.

If you want the parameters of the new application to be automatically uploaded to the keypad you have to do this for the parameters of the new application once on page 6.3.2 as instructed. **Otherwise the panel will always ask for the permission to upload the parameters.**

Note: Parameters saved in the parameter settings on page **S6.3.1** will be deleted when applications are changed. If you want to transfer the parameters from one application to another you have to upload them first to the keypad.

7.3.6.4 Parameter comparison

In the *Parameter comparison* submenu **(S6.4)**, you can compare the **actual parameter values** to the values of your customised parameter sets and those loaded to the control keypad.

The comparison is performed by pushing the *Menu button right* when in the *Compare parameters submenu*. The actual parameter values are first compared to those of the customised parameter Set1. If no differences are detected a '0' is displayed on the lowermost line. But if any of the parameter values differ from those of the Set1 the number of the deviations is displayed together with symbol **P** (e.g. P1→P5 = five deviating values). By pressing the *Menu button right* once again you can still enter the pages where you can see both the actual value and the value it was compared to. In this display, the value on the Description line (in the middle) is the default value and the one on the value line (lowermost) is the edited value. Furthermore, you can also edit the actual value with the *Browser buttons* in the *edit mode* that you can reach by pushing the *Menu button right* once again.
In the same way, you can perform the comparison of the actual values to *Set2*, *Factory Settings* and *Keypad Set*.

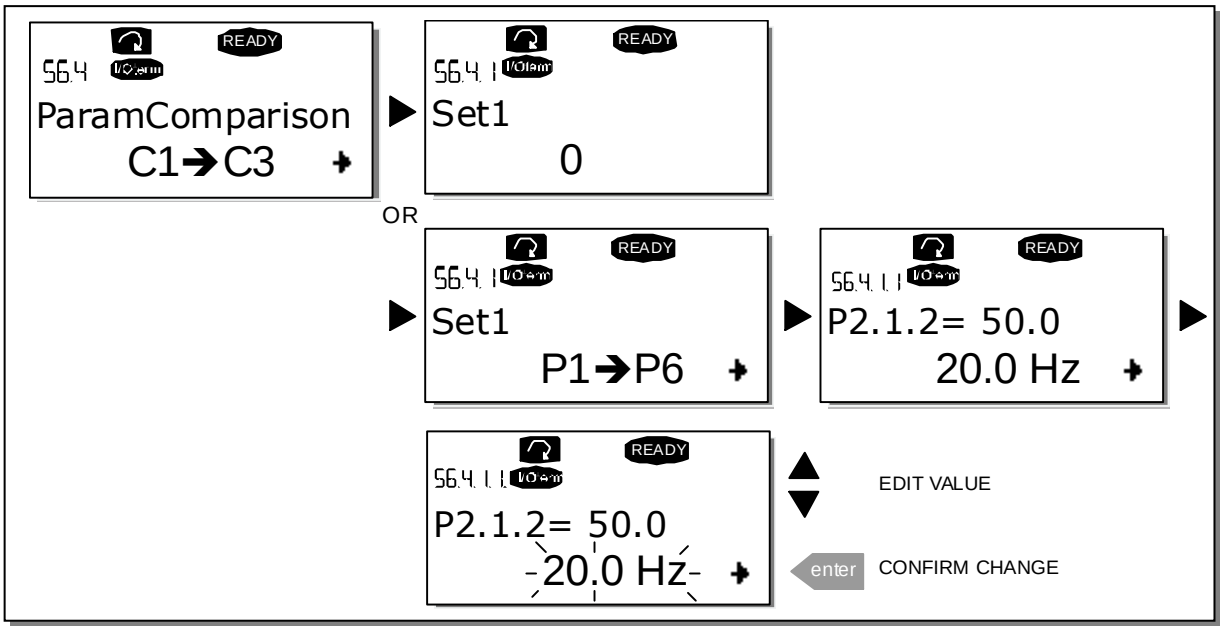


Figure 7-13. Parameter comparison

7.3.6.5 Security

NOTE: The *Security submenu* is protected with a password. Store the password in a safe place!

Password (S6.5.1)

The application selection can be protected against unauthorised changes with the Password function (S6.5.1).
By default, the password function is not in use. If you want to activate the function, enter the edit mode by pushing the *Menu button right*. A blinking zero appears in the display and now you can set a password with the *Browser buttons*. The password can be any number between 1 and 65535.

Note that you can also set the password by digits. In the edit mode, push the *Menu button right* once again and another zero appears on the display. Now set first the units. Then push the Menu button left and you can set the tens etc. Finally, confirm the password setting with the *Enter button*. After this, you have to wait until the *Timeout time (P6.6.3)* (see page 121) has expired before the password function is activated.
If you now try to change applications or the password itself you will be prompted for the current password. The password will be entered with the *Browser buttons*.
Deactivate the password function by entering the value **0**.

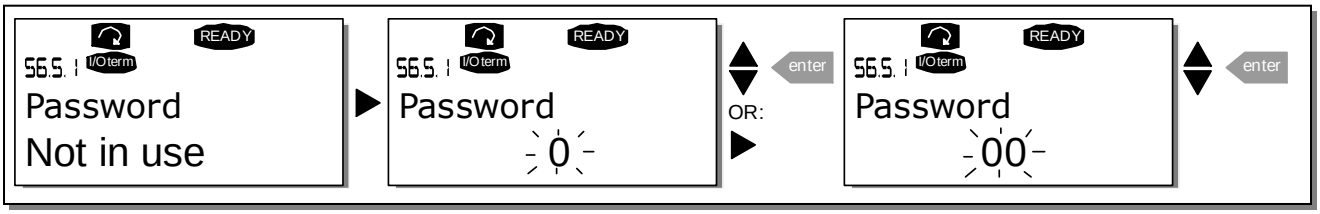


Figure 7-14. Password setting

Note! Store the password in a secure location! No changes can be made unless a valid password is entered!

Parameter lock (P6.5.2)

This function allows the user to prohibit changes to the parameters.

If the parameter lock is activated the text **locked** will appear on the display if you try to edit a parameter value.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

NOTE: This function does not prevent unauthorised editing of parameter values.

Enter the edit mode by pushing the *Menu button right*. Use the *Browser buttons* to change the parameter lock status. Accept the change with the *Enter button* or return to the previous level with the *Menu button left*.

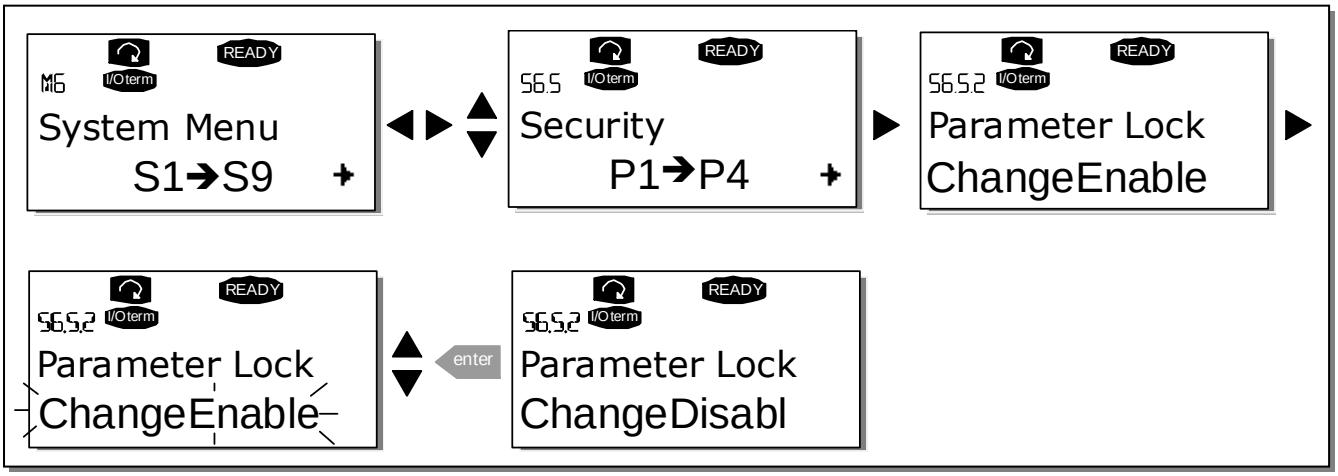


Figure 7-15. Parameter locking

Start-up Wizard (P6.5.3)

The **Start-up Wizard** is a feature on the control keypad to facilitate the commissioning of the frequency converter. If selected active (default), the Start-up Wizard prompts the operator for the **language** and **application** of his/her choice plus for **the values for a set of parameters** common to all applications as well as **for a set of application-dependent** parameters.

Always accept the value with the *Enter button*, scroll options or change values with the *Browser buttons* (up and down arrows).

Set the Start-up Wizard active in the following way: In the System Menu, find page P6.5.3. Press the *Menu button right* once to reach the edit mode. Use the *Browser buttons* to set value *Yes* and confirm the selection with the *Enter button*. If you want to deactivate the function follow the same procedure and give the parameter value *No*.

Figure 7-16. Activation of Start-up wizard

Multimonitoring items (P6.5.4)

Vacon alpha-numeric keypad features a display where you can monitor even three actual values at the same time (see chapter 7.3.1 and chapter *Monitoring values* in the manual of the application you are using). On page P6.5.4 of the System Menu you can define if it is possible for the operator to replace the values monitored with other values. See below.

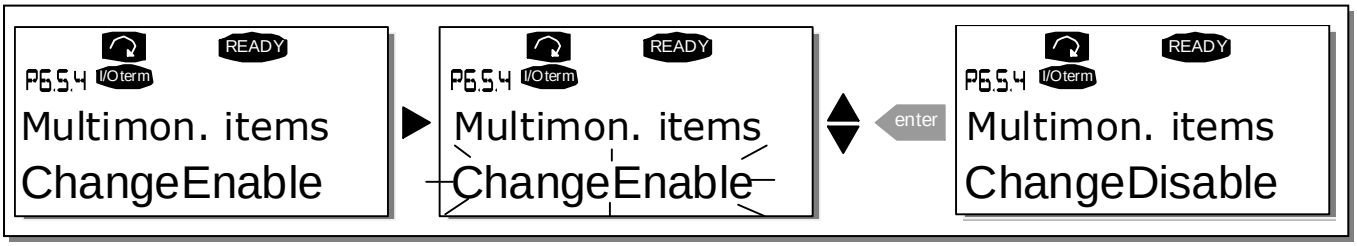


Figure 7-17. Enabling the change of multimonitoring items

7.3.6.6 Keypad settings

In the Keypad settings submenu under the *System menu* you can further customise your frequency converter operator interface.
Locate the Keypad settings submenu **(S6.6)**. Under the submenu, there are four pages **(P#)** associated with the keypad operation:

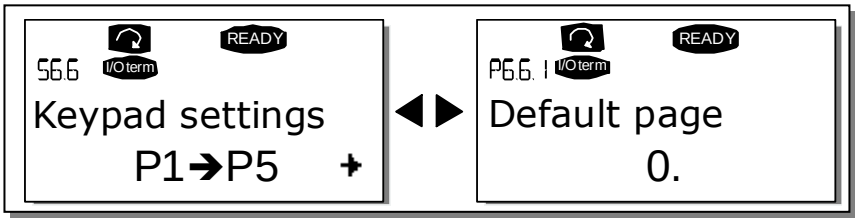


Figure 7-18. Keypad settings submenu

Default page (P6.6.1)

Here you can set the location (page) to which the display automatically moves as the *Timeout time* (see below) has expired or as the power is switched on to the keypad.

If the *Default Page* value is **0** the function is not activated, i.e. the last displayed page remains on the keypad display. Press the *Menu button right* once to enter the edit mode. Change the number of the Main menu with the *Browser buttons*. Pressing the *Menu button right* once again makes you able to edit the number of the submenu/page. If the page you want to move to by default is at the third level repeat the procedure. Confirm the new default page value with the *Enter button*. You can return to the previous step anytime by pushing the *Menu button left*.

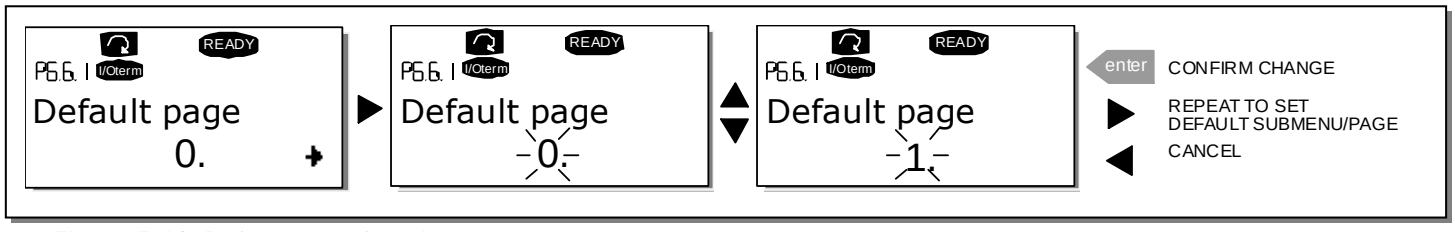


Figure 7-19. Default page function

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

Default page in the operating menu (P6.6.2)

Here you can set the location (page) in the *Operating menu* (in special applications only) to which the display automatically moves as the set *Timeout time* (see below) has expired or as the power is switched on to the keypad. See setting of Default page above.

Timeout time (P6.6.3)

The Timeout time setting defines the time after which the keypad display returns to the Default page (P6.6.1) see above.
Move to the Edit menu by pressing the *Menu button right*. Set the timeout time you want and confirm the change with the *Enter button*. You can return to the previous step anytime by pushing the *Menu button left*.

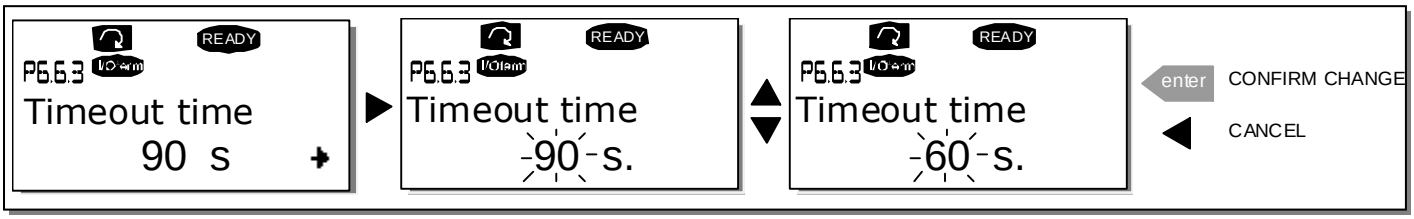


Figure 7-20. Timeout time setting

Note: If the *Default page* value is 0 the *Timeout time* setting has no effect.

Contrast adjustment (P6.6.4)

In case the display is unclear you can adjust its contrast through the same procedure as that for the timeout time setting (see above).

Backlight time (P6.6.5)

Giving a value for the *Backlight time*, you can determine how long the backlight stays on before going out. You can select here any time between 1 and 65535 minutes or *'Forever'*. For the value setting procedure see Timeout time (P6.6.3).

7.3.6.7 Hardware settings

NOTE: The *Hardware settings submenu* is protected with a password (see chapter Password (S6.5.1). Store the password in a safe place!

In the *Hardware settings submenu* **(S6.7)** under the *System menu* you can further control some functions of the hardware in your frequency converter. The functions available in this menu are ***HMI acknowledge timeout*** *and* ***HMI retry.***

HMI acknowledge timeout (P6.7.3)

This function allows the user to change the timeout of the HMI acknowledgement time in cases where there is an additional delay in the RS-232 transmission due to use of modems for communication over longer distances, for example.

Note! If the frequency converter has been connected to the PC with a **normal cable**, the default values of parametres 6.7.3 and 6.7.4 (200 and 5) **must not be changed.**
If the frequency converter has been connected to the PC via a modem and there is delay in transferring messages, the value of par. 6.7.3 must be set according to the delay as follows:

Example:

- Transfer delay between the frequency converter and the PC = 600 ms
- The value of par. 6.7.3 is set to 1200 ms (2 x 600, sending delay + receiving delay)
- The corresponding setting shall be entered in the [Misc]-part of the file NCDrive.ini:
  Retries = 5
  AckTimeOut = 1200
  TimeOut = 6000

It must also be considered that intervals shorter than the AckTimeOut-time cannot be used in NC-Drive monitoring.

Enter the edit mode by pushing the *Menu button right*. Use the *Browser buttons* to change the acknowledgement time. Accept the change with the *Enter button* or return to the previous level with the *Menu button left*.

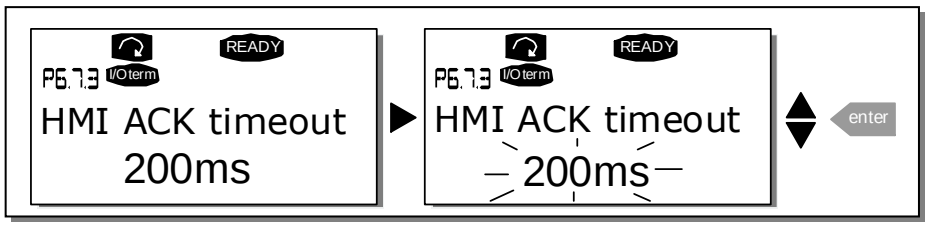


Figure 7-21. HMI acknowledge timeout

Number of retries to receive HMI acknowledgement (P6.7.4)

With this parameter you can set the number of times the drive will try receive acknowledgement if this does not succeed within the acknowledgement time (P6.7.3) or if the received acknowledgement is faulty.

Enter the edit mode by pushing the *Menu button right*. The present value shown starts to blink. Use the *Browser buttons* to change the amount of retries. Accept the change with the *Enter button* or return to the previous level with the *Menu button left*.

See Figure 7-21 for the procedure of changing the value.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

7.3.6.8 System info

In the *System info submenu* (S6.8) you can find frequency converter-related hardware and software information as well as operation-related information.

Total counters (S6.8.1)

In the *Total counters* page (S6.8.1) you can find information related to the frequency converter operation times, i.e. the total numbers of MWh, operation days and operation hours passed so far. Unlike the counters in the Trip counters , these counters cannot be reset.

Note! The Power On time counter (days and hours) runs always, when the power is on.

Page	Counter	Example
C6.8.1.1.	MWh counter	
C6.8.1.2.	Power On day counter	Value on display is *1.013*. The drive has operated for 1 year and 13 days.
C6.8.1.3.	Power On hour counter	Value on display is 7:05:16. The drive has operated for 7 hours 5 minutes and 16 seconds.

Table 7-7. Counter pages

Trip counters (S6.8.2)

Trip counters (menu S6.8.2) are counters the values of which can be reset i.e. restored to zero. You have the following resettable counters at your disposal. See Table 7-7 for examples.

Note! The trip counters run only when the motor is running.

Page	Counter
T6.8.2.1	MWh counter
T6.8.2.3	Operation day counter
T6.8.2.4	Operation hour counter

Table 7-8. Resettable counters

The counters can be reset on pages 6.8.2.2 *(Clear MWh counter)* and 6.8.2.5 *(Clear Operation time counter)*.
Example: When you want to reset the operation counters you should do the following:

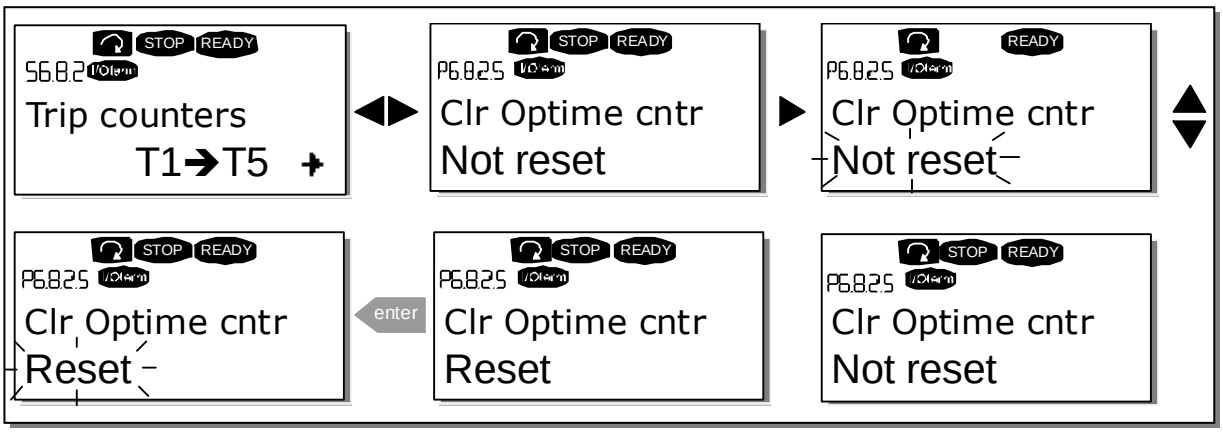


Figure 7-22. Counter reset

Software (S6.8.3)

The *Software* information page includes information on the following frequency converter software related topics:

Page	Content
6.8.3.1	Software package
6.8.3.2	System software version
6.8.3.3	Firmware interface
6.8.3.4	System load

Table 7-9. Software information pages

Applications (S6.8.4)

At location S6.8.4 you can find the *Applications submenu* containing information about not only the application currently in use but also all other applications loaded into the frequency converter. The information available is:

Page	Content
6.8.4.#	*Name of application*
6.8.4.#.1	Application ID
6.8.4.#.2	Version
6.8.4.#.3	Firmware interface

Table 7-10. Applications information pages

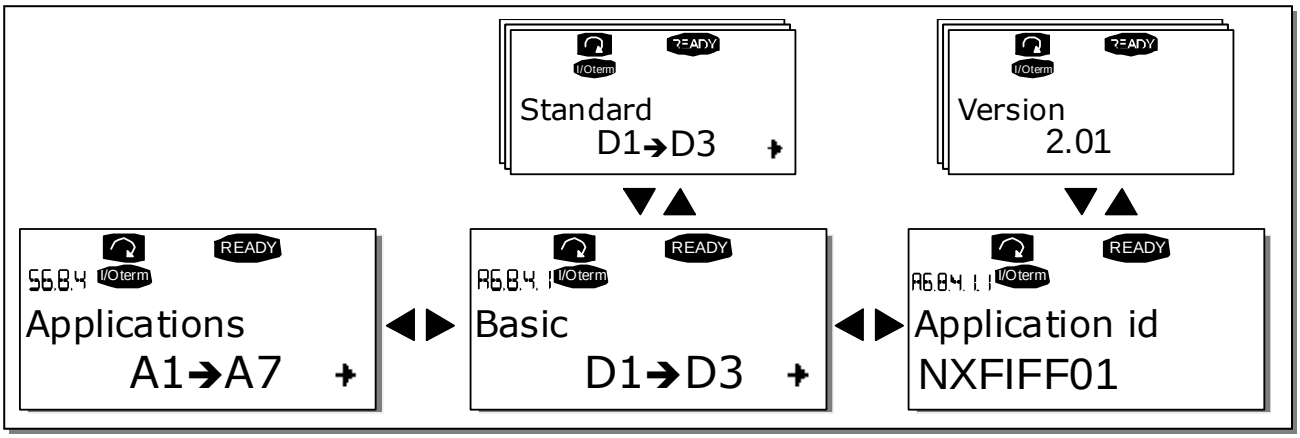


Figure 7-23. Applications info page

In the *Applications* information page, push the *Menu button right* to enter the Application pages of which there are as many as there are applications loaded into the frequency converter. Locate the application you want information about with the *Browser buttons* and then enter the *Information pages* with the *Menu button right*. Use again the *Browser buttons* to see the different pages.

Hardware (S6.8.5)

The *Hardware* information page provides information on the following hardware-related topics:

Page	Content
6.8.5.1	Power unit type code
6.8.5.2	Nominal voltage of the unit
6.8.5.3	Brake chopper
6.8.5.4	Brake resistor

Table 7-11. Hardware information pages

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

Expander boards (S6.8.6)

In the *Expander boards* pages you find information about the basic and option boards connected to the control board (see Chapter 6.2).

You can check the status of each board slot by entering the *Expander boards* page with the *Menu button right* and using the *Browser buttons* to choose the board whose status you wish to check. Push the *Menu button right* again to display the status of the board. The keypad will also display the program version of the respective board when you push either one of the *Browser buttons*.
If no board is connected to the slot the text *'no board'* will be shown. If a board is connected to a slot but the connection is somehow lost the text *'no conn.'* is displayed. See Chapter 6.2 and Figure 6-6 and 6-16 for more information.
For more information on the expander board-related parameters, see Chapter 7.3.7.

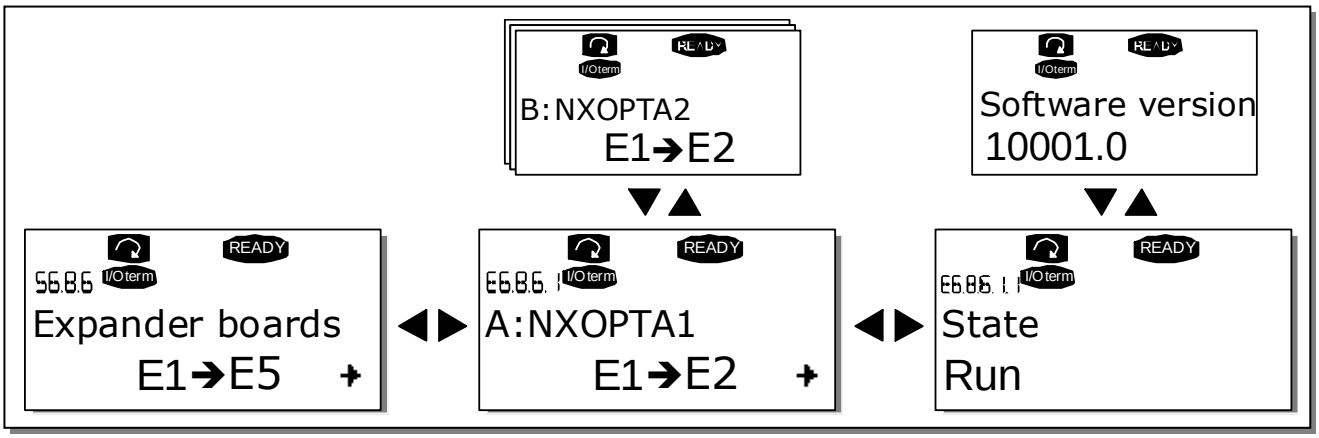


Figure 7-24. Expander board information menus

Debug menu (S6.8.7)

This menu is meant for advanced users and application designers. Contact factory for any assistance needed.

7.3.7 *Expander board menu (M7)*

The *Expander board menu* makes it possible for the user 1) to see what expander boards are connected to the control board and 2) to reach and edit the parameters associated with the expander board.
Enter the following menu level **(G#)** with the *Menu button right*. At this level, you can browse through slots (see page 77) A to E with the *Browser buttons* to see what expander boards are connected. On the lower-most line of the display you also see the number of parameters associated with the board. You can view and edit the parameter values in the same way as described in chapter 7.3.2. See Table 7-12 and Figure 7-25.

Expander board parameters

Code	Parameter	Min	Max	Default	Cust	Selections
P7.1.1.1	AI1 mode	1	5	3		**1**=0...20 mA **2**=4...20 mA **3**=0...10 V **4**=2...10 V **5**=–10...+10 V
P7.1.1.2	AI2 mode	1	5	1		See P7.1.1.1
P7.1.1.3	AO1 mode	1	4	1		**1**=0...20 mA **2**=4...20 mA **3**=0...10 V **4**=2...10 V

Table 7-12. Expander board parameters (board OPT-A1)

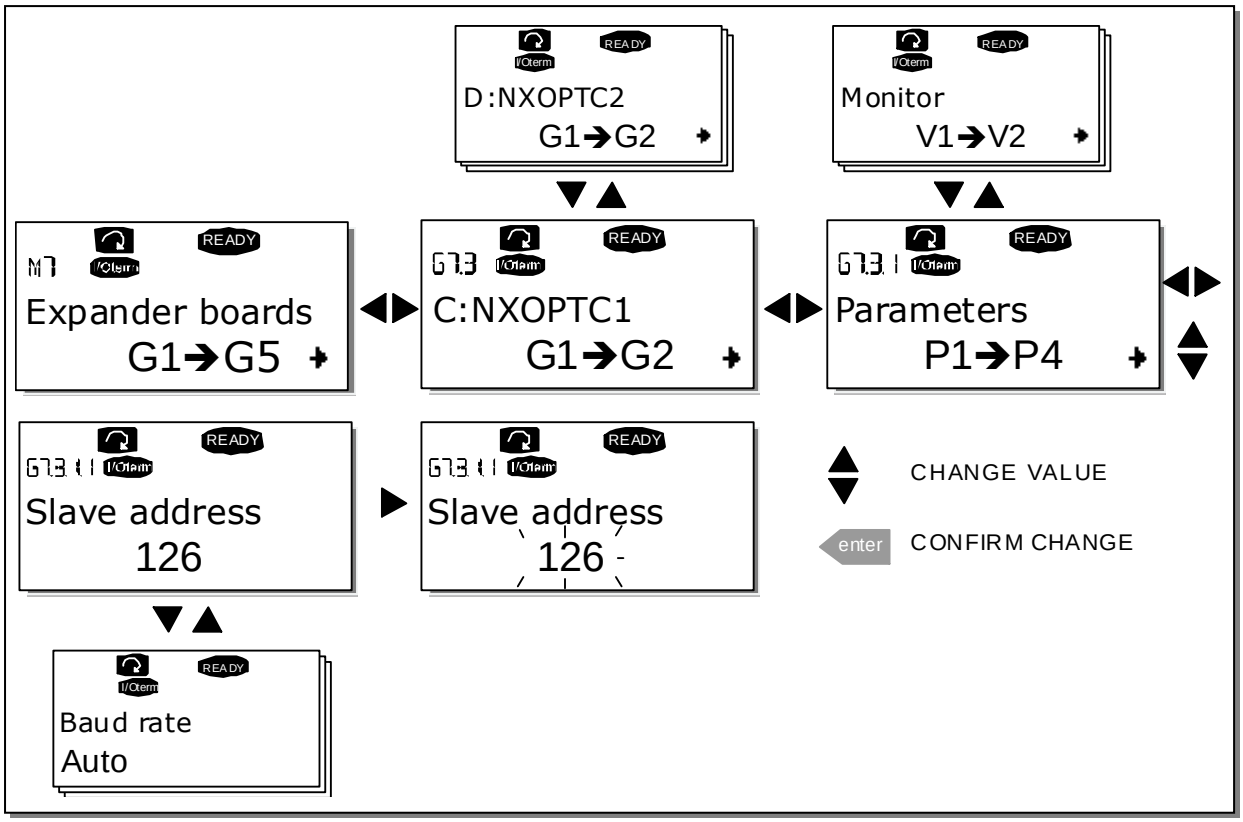


Figure 7-25. Expander board information menu

7.4 Further keypad functions

The Vacon NX control keypad embodies additional application-related functions. See Vacon NX Application Package for more information.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

8. COMMISSIONING

8.1 Safety

Before commissioning, note the following directions and warnings:

DANGER	1	Internal components and circuit boards of the frequency converter are **live** when Vacon NX Liquid-Cooled drive is connected to mains potential. **Coming into contact with this voltage is extremely dangerous and may cause death or severe injury**.
	2	The motor terminals U, V, W and the DC-link/brake resistor terminals B–, B+/R+, R– are **live** when Vacon NX Liquid-Cooled drive is connected to mains, **even if the motor is not running**.
	3	The control I/O-terminals are isolated from the mains potential. However, the relay outputs and other I/O-terminals may have a dangerous control voltage present even when Vacon NX Liquid-Cooled drive is disconnected from mains.
	4	Do not make any connections with the frequency converter connected to the mains.
WARNING	5	After having disconnected the frequency converter from the mains, wait until the indicators on the keypad go out (if no keypad is attached see the indicator through the keypad base). Wait 5 more minutes before doing any work on Vacon NX Liquid-Cooled drive connections. Do not even open the cover before this time has expired.
	6	Before connecting the NX Liquid-Cooled drive to mains, ensure the functionality of the coolant circulation and check the circulation for possible leaks.
	7	Before connecting the drive to mains make sure that the switchgear enclosure door is closed.

8.2 Commissioning of the frequency converter

1 Read carefully the safety instructions in Chapter 1 and above and follow them.

2 After the installation, pay attention:

- that both the frequency converter and the motor are grounded.
- that the mains and motor cables comply with the requirements given in Chapter 6.1.1.
- that the control cables are located as far as possible from the power cables (see Chapter 6.1.3, step 3) and the shields of the shielded cables are connected to protective earth ⏚. The wires may not touch the electrical components of the frequency converter.
- that the common inputs of digital input groups are connected to +24V or ground of the I/O terminal or the external supply.

3 Check liquid cooling connections and system operation.

- open the shut-off valves
- check the quality and quantity of the cooling liquid (chapter 5.2)
- ensure the proper operation of liquid circulation system

4 Perform the cable and motor insulation checks, see chapter 6.1.9.

5 **Check the frequency converter for condensation.**

6 Check that all Start/Stop switches connected to the I/O terminals are in **Stop**-position.

7 Connect the frequency converter to mains.

8 Set the parameters of group 1 (See Vacon All in One Application Manual) according to the requirements of your application. At least the following parameters should be set:

- motor nominal voltage
- motor nominal frequency
- motor nominal speed
- motor nominal current

You will find the values needed for the parameters on the motor rating plate.

9 Perform run test **without motor**

Perform either Test A or Test B:

A Controls from the I/O terminals:

a) Turn the Start/Stop switch to ON position.

b) Change the frequency reference (potentiometer)

*c) Check in the Monitoring menu **M1** that the value of Output frequency changes according to the change of frequency reference.*

d) Turn the Start/Stop switch to OFF position.

B Control from the control keypad:

a) Change the control from the I/O terminals to the keypad as advised in Chapter 7.3.3.1.

b) Push the Start button on the keypad

.

*c) Move over to the Keypad control menu **(M3)** and Keypad Reference submenu (Chapter 7.3.3.2) and change the frequency reference using the Browser buttons*

.

*d) Check in the Monitoring menu **M1** that the value of Output frequency changes according to the change of frequency reference.*

e) Push the Stop button on the keypad

.

10 Run the start-up tests without the motor being connected to the process, if possible. If this is not possible, secure the safety of each test prior to running it. Inform your co-workers of the tests.

a) Switch off the supply voltage and wait up until the drive has stopped as advised at Chapter 8.1, step 5.

b) Connect the motor cable to the motor and to the motor cable terminals of the frequency converter.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

c) See to that all Start/Stop switches are in Stop positions.

d) Switch the mains ON

*e) Repeat test **9A** or **9B**.*

11 Connect the motor to the process (if the startup test was run without the motor being connected)

a) Before running the tests, make sure that this can be done safely.

b) Inform your co-workers of the tests.

*c) Repeat test **9A** or **9B**.*

9. FAULT TRACING

9.1 Fault codes

When a fault is detected by the frequency converter control electronics, the drive is stopped and the symbol F together with the ordinal number of the fault, the fault code and a short fault description appear on the display. The fault can be reset with the *Reset button* on the control keypad or via the I/O terminal. The faults are stored in the Fault history menu (M5) which can be browsed. The different fault codes you will find in the table below.

The fault codes, their causes and correcting actions are presented in the table below. The shadowed faults are A faults only. The faults written in white on black background may appear as both A and F fault.

Fault code	Fault	Possible cause	Correcting measures
1	Overcurrent	Frequency converter has detected too high a current in the motor cable: – sudden heavy load increase – short circuit in motor cables – unsuitable motor	Check loading. Check motor. Check cables.
2	Overvoltage	The DC-link voltage has exceeded the limits defined in . – too short a deceleration time – high overvoltage spikes in supply	Make the deceleration time longer. Use brake chopper or brake resistor (available for most chassis as options)
3	Earth fault	Current measurement has detected that the sum of motor phase current is not zero. – insulation failure in cables or motor	Check motor cables and motor.
5	Charging switch	The charging switch is open, when the START command has been given. – faulty operation – component failure	Reset the fault and restart. Should the fault re-occur, contact the distributor near to you. Please visit: http://www.vacon.com/wwcontacts.html
6	Emergency stop	Stop signal given from the option board.	
7	Saturation trip	Various causes: – defective component – brake resistor short-circuit or overload	Cannot be reset from the keypad. Switch off power. DO NOT RE-CONNECT POWER! Contact factory. If this fault appears simultaneously with Fault 1, check motor cables and motor
8	System fault	- component failure - faulty operation Note exceptional fault data record, see 7.3.4.3.	Reset the fault and restart. Should the fault re-occur, contact the distributor near to you. Please visit: http://www.vacon.com/wwcontacts.html
9	Undervoltage	DC-link voltage is under the voltage limits defined in . – most probable cause: too low a supply voltage – frequency converter internal fault	In case of temporary supply voltage break reset the fault and restart the frequency converter. Check the supply voltage. If it is adequate, an internal failure has occurred. Contact the distributor near to you. Please visit: http://www.vacon.com/wwcontacts.html
10	Input line supervision	Input line phase is missing.	Check supply voltage and cable. Check fuses.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

Fault code	Fault	Possible cause	Correcting measures
11	Output phase supervision	Current measurement has detected that there is no current in one motor phase.	Check motor cable and motor.
12	Brake chopper supervision	– no brake resistor installed – brake resistor is broken – brake chopper failure	Check brake resistor. If the resistor is ok, the chopper is faulty. Contact the distributor near to you. Please visit: http://www.vacon.com/wwcontacts.html
13	Frequency converter under-temperature	Heatsink temperature is under –10°C	
14	Frequency converter over-temperature	3) Heatsink temperature is over 70°C. Overtemperature warning is issued when the heatsink temperature exceeds 65°C. 4) Circuit board temperature is over 85°C. Overtemperature warning is issued when the board temperature exceeds 70°C.	Cause 1): Check that values for I_{th} (chapter 4.2) are not exceeded Check the correct coolant flow and temperature. Also check the circulation for possible leaks. Check the ambient temperature. Make sure that the switching frequency is not too high in relation to ambient temperature and motor load. Cause 2): Circulation of air in the drive is blocked. The cooling fans are defect.
15	Motor stalled	Motor stall protection has tripped.	Check motor.
16	Motor over-temperature	Motor overheating has been detected by frequency converter motor temperature model. Motor is overloaded.	Decrease the motor load. If no motor overload exists, check the temperature model parameters.
17	Motor under-load	Motor underload protection has tripped.	
22	EEPROM checksum fault	Parameter save fault – faulty operation – component failure	
24	Counter fault	Values displayed on counters are incorrect	
25	Microprocessor watchdog fault	– faulty operation – component failure	Reset the fault and restart. Should the fault re-occur, contact the distributor near to you. Please visit: http://www.vacon.com/wwcontacts.html
26	Startup prevented	Start-up of the drive has been prevented.	Cancel prevention of start-up.
29	Thermistor fault	The thermistor input of option board has detected increase of the motor temperature	Check motor cooling and loading Check thermistor connection (If thermistor input of the option board is not in use it has to be short circuited)
31	IGBT temperature (hardware)	IGBT Inverter Bridge overtemperature protection has detected too high a short-term overload current	Check loading. Check motor size.
34	CAN bus communication	Sent message not acknowledged.	Ensure that there is another device on the bus with the same configuration.
36	Control unit	NXS Control Unit can not control NXP Power Unit and vice versa	Change control unit

Fault code	Fault	Possible cause	Correcting measures
37	Device changed (same type)	Option board or control unit changed. Same type of board or same power rating of drive.	Reset **Note:** No fault time data record!
38	Device added (same type)	Option board or drive added. Drive of same power rating or same type of board added.	Reset **Note:** No fault time data record!
39	Device removed	Option board removed. Drive removed.	Reset **Note:** No fault time data record!
40	Device unknown	Unknown option board or drive.	Contact the distributor near to you. Please visit: http://www.vacon.com/wwcontacts.html
41	IGBT temperature	IGBT Inverter Bridge overtemperature protection has detected too high a short term overload current	Check loading. Check motor size.
42	Brake resistor overtemperature	Brake resistor overtemperature protection has detected too heavy braking	Set the deceleration time longer. Use external brake resistor.
43	Encoder fault	Note the exceptional Fault data record. See 7.3.4.3. Additional codes: 1 = Encoder 1 channel A is missing 2 = Encoder 1 channel B is missing 3 = Both encoder 1 channels are missing 4 = Encoder reversed	Check encoder channel connections. Check the encoder board.
44	Device changed (different type)	Option board or control unit changed. Option board of different type or different power rating of drive.	Reset **Note:** No fault time data record! **Note:** Application parameter values restored to default.
45	Device added (different type)	Option board or drive added. Option board of different type or drive of different power rating added.	Reset **Note:** No fault time data record! **Note:** Application parameter values restored to default.
50	Analogue input I_{in} < 4mA (sel. signal range 4 to 20 mA)	Current at the analogue input is < 4mA. – control cable is broken or loose – signal source has failed	Check the current loop circuitry.
51	External fault	Digital input fault.	
52	Keypad communication fault	The connection between the control keypad and the frequency converter is broken.	Check keypad connection and possible keypad cable.
53	Fieldbus fault	The data connection between the fieldbus Master and the fieldbus board is broken	Check installation. If installation is correct contact the nearest Vacon distributor. Please visit: http://www.vacon.com/wwcontacts.html
54	Slot fault	Defective option board or slot	Check board and slot. Contact the nearest Vacon distributor. Please visit: http://www.vacon.com/wwcontacts.html
56	PT100 board temp. fault	Temperature limit values set for the PT100 board parameters have been exceeded	Find the cause of temperature rise

Table 9-1. Fault codes

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

9.2 Load test with motor

1. Connect the motor cables and check the right phase order. Also check that the motor rotates freely.
2. Check liquid cooling system operation
3. Turn on the supply voltage and ensure that all input phases are connected to the unit.
4. Check DC link voltage by measuring with multimeter and compare the value to the one on monitoring page *V1.8*.
5. Select the application of your choice and set the needed parameters (see Start-up Quick Guide, step 8 on page 2.
6. Start the operation with lower Current Limit value and long Acceleration/Deceleration times.
7. If Closed Loop control mode is used, check direction of encoder and make necessary Closed Loop parameter settings. Check the correct operation of the encoder by running the system in open loop and check the signals in the expander board menu.
8. Run the motor without load between minimum and maximum frequencies and check the unit output current with a current clamp. Compare the value to the one on monitoring page *V1.4*.
9. Load the motor to nominal value if possible and repeat the current measurement. Follow the Unit Temperature value on page *V1.9*.

9.3 DC link test (without motor)

NOTE: There will be dangerous voltages present during this test!

1. Read carefully the safety instructions in Chapter 1 and above and follow them.
2. Connect a variable DC power supply to DC+ and DC– terminals. Make sure that all polarities are correct.
3. Slowly charge up the DC link to nominal voltage. Allow the system to remain at this level for at least one minute and check current.
4. If possible, continue increasing the DC link voltage up to the trip limit. Fault F2 (see chapter 9) should occur at 911 VDC (400...500-volt units) and at 1200 VDC (525...690-volt units). Do not increase the voltage over the trip limit.
5. Bring the power supply voltage back to zero. Allow sufficient time for the capacitors to discharge.
6. Check the DC bus voltage with a multimeter. When you read zero volts disconnect the power supply and reconnect all wires to the phase module.
7. If the phase module has been de-energized for an extended period of time (six months or longer) allow this voltage to remain for a minimum of 30 minutes – even 4 hours if time permits.

Through the above test procedure, two things are achieved: 1) It allows the caps to partially reform due to storage and shipping; 2) It allows any device failures to evidence themselves with a low power failure.

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

10. BRAKE CHOPPER UNIT (NXB)

10.1 Introduction

The Vacon NXB (Brake chopper unit) is a unidirectional power converter for the supply of excessive energy from a common DC bus drive line-up to resistors where the energy is dissipated as heat. External resistors are needed. The NXB improves the DC-link voltage controllability as well as enhances the motor drives performance in dynamic applications.

Mechanically, the NXB module is based on inverter unit construction. The dynamic DC energy brake function is achieved through a specific NXB system software. Several NXB modules can be installed parallelly in order to increase the braking capacity, however, the modules require mutual synchronization.

10.2 Type designation code

In Vacon type designation code, the Brake Chopper Unit is characterized by number **8**, for example:

NXP	0300	5	A	0	T	0	8WF	A1A2000000

10.3 Diagrams

10.3.1 NXB Brake Chopper Unit block diagram

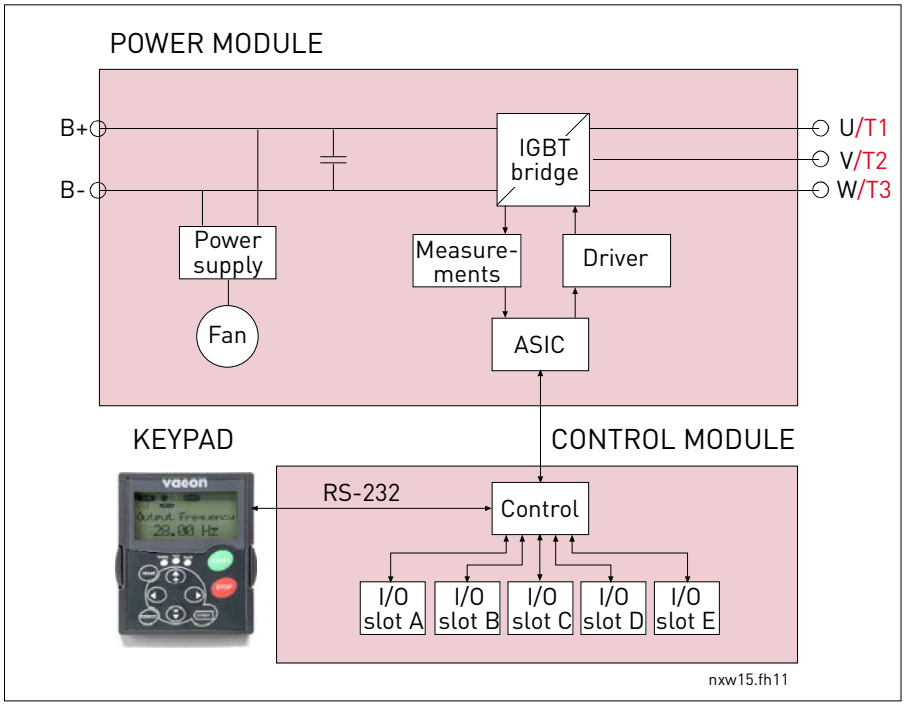


Figure 10-1. BCU block diagram

10.3.2 NXB topologies and connection

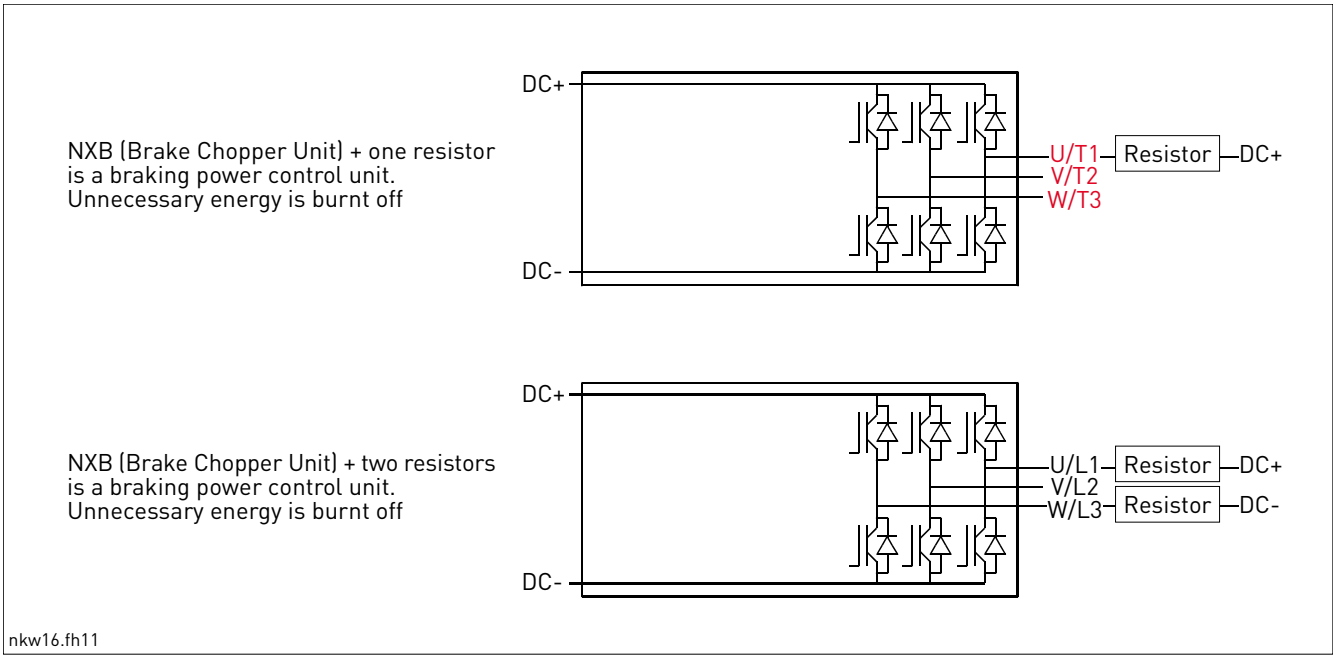


Figure 10-2. Brake chopper unit topology

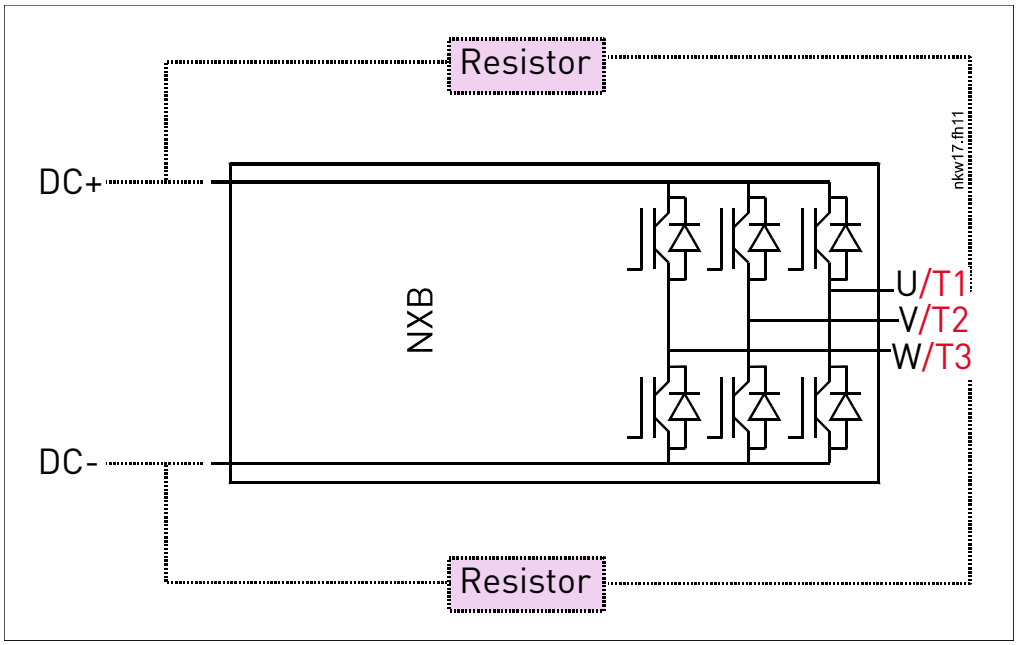


Figure 10-3. Vacon Brake Chopper Unit connections

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

10.4 Brake chopper unit technical data

Supply connection	Input voltage U_{in}	465...800Vdc (380...500Vac); (–0%...+0%) 640...1100Vdc (525...690Vdc); (–0%...+0%)
	Input current	DC I_{in} ~ I_{out}
	DC bank capacitance	Voltage class 500V: CH3 (1): 410 µF CH3 (2): 600 µF CH4 (1): 2400 µF CH4 (2): 5400 µF CH5: 7200 µF CH61: 10800 µF CH62: 10800 µF Voltage class 690V: CH61: 4800 µF CH62: 4800 µF
	Starting delay	2...5 s
Resistor connection	Output voltage	U_{in} ~ U_{out}
	Continuous output current	I_{br}: Max ambient temperature +50°C
	Connection order	R1 U – DC+ R2 W – DC-
Control characteristics	Control method	Voltage level control, default U_n+18%
	Parallel BCU	Requires synchronization
Ambient conditions	Ambient operating temperature	–10°C (no frost)...+50°C (at I_H) –10°C (no frost)...+50°C (at I_L)
	Storage temperature	–40°C...+70°C; No liquid in heatsink under 0°C
	Relative humidity	5 to 96% RH, non-condensing, no dripping water
	Air quality: - chemical vapours - mechanical particles	 IEC 721-3-3, unit in operation, class 3C2 IEC 721-3-3, unit in operation, class 3S2 • No conductive dust allowed • No corrosive gases
	Altitude	100% load capacity (no derating) up to 1,000 m; above 1,000 m derating of 1% per each 100 m required; Max altitude 3,000 m
	Vibration EN50178/EN60068-2-6	5...150Hz Displacement amplitude 0.25 mm (peak) at 3...31 Hz Max acceleration amplitude 1 G at 31...150 Hz
	Shock EN50178, EN60068-2-27	UPS Drop Test (for applicable UPS weights) Storage and shipping: max 15 G, 11 ms (in package)
	Cooling capacity required	See Table 5-6 and
	Cooling air required	Contact factory
	Unit enclosure class	IP00/Open Frame standard in entire kW/HP range
EMC	Immunity	Fulfils all EMC immunity requirements
Safety		CE, UL, EN61800-5-1 (2003) (see unit nameplate for more detailed approvals)

Control connections	Analogue input voltage	0...+10V, Ri = 200kΩ, (–10V...+10V joystick control) Resolution 0.1%, accuracy ±1%
	Analogue input current	0(4)...20 mA, Ri = 250Ω differential
	Digital inputs (6)	Positive or negative logic; 18...30VDC
	Auxiliary voltage	+24V, ±10%, max. 250mA
	Output reference voltage	+10V, +3%, max. load 10mA
	Analogue output	0(4)...20mA; RL max. 500Ω; Resolution 10 bit; Accuracy ±2%
	Digital outputs	Open collector output, 50mA/48V
	Relay outputs	2 programmable change-over relay outputs Switching capacity: 24VDC/8A, 250VAC/8A, 125VDC/0.4A Min. switching load: 5V/10mA
Protections	Overvoltage trip limit Undervoltage trip limit	NX_W5: 911VDC; NX_W6: 1200VDC NX_W5: 333VDC; NX_W6: 461VDC
	Overcurrent protection	Yes
	Unit overtemperature protection	Yes
	Resistor overtemperature protection	Yes
	Wrong connection protection	Yes
	Short-circuit protection of +24V and +10V reference voltages	Yes
Liquid cooling	Allowed cooling agents	Drinking water (see specification on page 39) Water-glycol mixture See derating specifications, chapter 5.3
	Volume	See page 41.
	Temperature of cooling agent	0...35°C (I_{br})(input); 35...65°C: derating required, see Chapter 5.3 Max. temperature rise during circulation 5°C No condensation allowed. See Chapter 5.2.1.
	Cooling agent flow rates	See Table 5-6.
	System max. working pressure	6 bar
	System max. peak pressure	40 bar
	Pressure loss (at nominal flow)	Varies according to size. See Table 5-8.

Table 10-1. Technical specification for Vacon NXB liquid-cooled brake chopper unit

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

10.5 BCU power ratings

10.5.1 Vacon NXB; DC voltage 460–800V

Braking voltage 460-800 Vdc							
NXB type	Loadability				Braking capacity		Chassis
	BCU rated cont. braking current, I_{br} [A]	Rated min resistance @800VDC [Ω]	Rated min resistance @600VDC [Ω]	Rated max input current [Adc]	Rated cont. braking power 2*R@ 800VDC [kW]	Rated cont. braking power 2*R@ 600VDC [kW]	
NXB_0031 5	2*31	25,7	19,5	62	49	37	CH3
NXB_0061 5	2*61	13,1	9,9	122	97	73	CH3
NXB_0087 5	2*87	9,2	7,0	174	138	105	CH4
NXB_0105 5	2*105	7,6	5,8	210	167	127	CH4
NXB_0140 5	2*140	5,7	4,3	280	223	169	CH4
NXB_0168 5	2*168	4,7	3,6	336	267	203	CH5
NXB_0208 5	2*208	3,9	3,0	410	326	248	CH5
NXB_0261 5	2*261	3,1	2,3	522	415	316	CH5
NXB_0300 5	2*300	2,7	2,0	600	477	363	CH61
NXB_0385 5	2*385	2,1	1,6	770	613	466	CH61
NXB_0460 5	2*460	1,7	1,3	920	732	556	CH62
NXB_0520 5	2*520	1,5	1,2	1040	828	629	CH62
NXB_0590 5	2*590	1,4	1,1	1180	939	714	CH62
NXB_0650 5	2*650	1,2	1,0	1300	1035	786	CH62
NXB_0730 5	2*730	1,1	0,9	1460	1162	883	CH62

Table 10-2. Power ratings of Vacon NXB, supply voltage 460–800Vdc

For dimensions of BCU units, see Table 5-1.

Note: The rated currents in given ambient (+50°C) and coolant (+30°) temperatures are achieved only when the switching frequency is equal to or less than the factory default.

Note: Braking power: $P_{brake} = 2*U_{brake}^2 / R_{brake}$

Note: Max input DC current: $I_{in_max} = P_{brake_max} / U_{brake}$

10.5.2 Vacon NXB; DC voltage 640–1100V

Braking voltage 640-1100 Vdc							
NXB type	Loadability				Braking capacity		Chassis
	BCU rated cont. braking current, I_{br} [A]	Rated min resistance @1100VDC [Ω]	Rated min resistance @840VDC [Ω]	Rated max input current [Adc]	Rated cont. braking power 2*R@ 1100VDC [kW]	Rated cont. braking power 2*R@ 840VDC [kW]	
NXB_0170 6	2*170	6,5	4,9	340	372	282	CH61
NXB_0208 6	2*208	5,3	4,0	416	456	346	CH61
NXB_0261 6	2*261	4,2	3,2	522	572	435	CH61
NXB_0325 6	2*325	3,4	2,6	650	713	542	CH62
NXB_0385 6	2*385	2,9	2,2	770	845	643	CH62
NXB_0416 6	2*416	2,6	2,0	832	913	693	CH62
NXB_0460 6	2*460	2,4	1,8	920	1010	767	CH62
NXB_0502 6	2*502	2,2	1,7	1004	1100	838	CH62

Table 10-3. Power ratings of Vacon NXB, supply voltage 640–1100Vdc

For dimensions of BCU units, see Table 5-1.

Note: The rated currents in given ambient (+50°C) and coolant (+30°) temperatures are achieved only when the switching frequency is equal to or less than the factory default.

Note: Braking power: $P_{brake} = 2*U_{brake}^2 / R_{brake}$

Note: Max input DC current: $I_{in_max} = P_{brake_max} / U_{brake}$

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

10.6 Vacon brake resistors and brake chopper dimensioning

10.6.1 Braking energy and losses

Mains voltage 465-800 VDC					
BCU type	BCU output			BCU Power loss @ full braking	Chassis
	Resistor	Brake energy			
	Resistor type & R(Ω)	Light duty 5 sec (kJ)	High Duty 10 sec (kJ)	c/a/**T***) [kW]	
NXB 0031 5	BRR0031 / 63	82	220	0,7/0,2/**0,9**	CH3
NXB 0061 5	BRR0061 / 14	254	660	1,3/0,3/**1,5**	CH3
NXB 0087 5	BRR0061 / 14	254	660	1,5/0,3/**1,8**	CH4
NXB 0105 5	BRR0105 / 6,5	546	1420	1,8/0,3/**2,1**	CH4
NXB 0140 5	BRR0105 / 6,5	546	1420	2,3/0,3/**2,6**	CH4
NXB 0168 5	BRR0105 / 6,5	546	1420	2,5/0,3/**2,8**	CH5
NXB 0208 5	BRR0105 / 6,5	546	1420	3,0/0,4/**3,4**	CH5
NXB 0261 5	BRR0105 / 6,5	546	1420	4,0/0,4/**4,4**	CH5
NXB 0300 5	BRR0300 / 3,3	1094	2842	4,5/0,4/**4,9**	CH61
NXB 0385 5	BRR0300 / 3,3	1094	2842	5,5/0,5/**6,0**	CH61
NXB 0460 5	BRR0300 / 3,3	1094	2842	5,5/0,5/**6,0**	CH62
NXB 0520 5	BRR0520 / 1,4	2520	6600	6,5/0,5/**7,0**	CH62
NXB 0590 5	BRR0520 / 1,4	2520	6600	7,5/0,6/**8,1**	CH62
NXB 0650 5	BRR0520 / 1,4	2520	6600	8,5/0,6/**9,1**	CH62
NXB 0730 5	BRR0730 / 0,9	3950	10264	10,0/0,7/**10,7**	CH62

Table 10-4. Vacon standard brake resistors and NXB energy, mains voltage 465–800Vdc

Mains voltage 640-1100 VDC					
BCU type	BCU output			BCU Power loss @ full braking	Chassis
	Resistor	Brake energy			
	Resistor type & R(Ω)	Light Duty 5 sec (kJ)	High Duty 10 sec (kJ)	c/a/**T***) [kW]	
NXB 0170_6	BRR0208 / 7	968	2516	0,7/0,2/**0,9**	Ch61
NXB 0208_6	BRR0208 / 7	968	2516	1,3/0,3/**1,5**	Ch61
NXB 0261_6	BRR0208 / 7	968	2516	1,5/0,3/**1,8**	Ch61
NXB 0325_6	BRR0208 / 7	968	2516	1,8/0,3/**2,1**	Ch62
NXB 0385_6	BRR0208 / 7	968	2516	2,3/0,3/**2,6**	Ch62
NXB 0416_6	BRR0416 / 2,5	2710	7046	2,5/0,3/**2,8**	Ch62
NXB 0460_6	BRR0416 / 2,5	2710	7046	3,0/0,4/**3,4**	Ch62
NXB 0502_6	BRR0416 / 1,7	3986	10362	4,0/0,4/**4,4**	Ch62

Table 10-5. Vacon standard brake resistors and NXB energy, mains voltage 640–1100Vdc

*) c = power loss into coolant; a = power loss into air; **T = total power loss**; power losses of input chokes not included, see chapter 5.4. All power losses obtained using max. supply voltage and switching frequency of 3.6 kHz and ClosedLoop control mode. All power losses are worst case losses.

Heavy duty braking: 3 s 100%, followed by 7 s decreasing to zero
Light duty braking: 5 s 100%

Note: The rated currents in given ambient (+50°C) and coolant (+30°) temperatures are achieved only when the switching frequency is equal to or less than the factory default.

Note: Braking power: $P_{brake} = 2*U_{brake}^2 / R_{brake}$
Note: Max input DC current: $I_{in_max} = P_{brake_max} / U_{brake}$

10.6.2 Braking power and resistance, mains voltage 380–500Vac/600–800Vdc

Voltage	Default +18% DC-link voltage level for braking							
	Vac	380	400	420	440	460	480	500
	Vdc	513	540	567	594	621	648	675
	U_{br} +18%	605	637	669	701	733	765	797

Table 10-6. Voltage levels

Chas-sis	NXB unit	Thermal current [Ith]	Max braking power at DC-link voltages [kW]						
			605	637	669	701	733	765	797
Ch3	NXB 0031_5	31	37,5	39,5	41,5	43,5	45,4	47,4	49,4
Ch3	NXB 0061_5	61	73,9	77,7	81,6	85,5	89,4	93,3	97,2
Ch4	NXB 0087_5	87	105,3	110,9	116,4	122,0	127,5	133,0	138,6
Ch4	NXB 0105_5	105	127,1	133,8	140,5	147,2	153,9	160,6	167,3
Ch4	NXB 0140_5	140	169,5	178,4	187,3	196,3	205,2	214,1	223,0
Ch5	NXB 0168_5	168	203,4	214,1	224,8	235,5	246,2	256,9	267,6
Ch5	NXB 0208_5	208	248,2	261,3	274,3	287,4	300,4	313,5	326,6
Ch5	NXB 0261_5	261	316,0	332,6	349,2	365,9	382,5	399,1	415,8
Ch61	NXB 0300_5	300	363,2	382,3	401,4	420,6	439,7	458,8	477,9
Ch61	NXB 0385_5	385	466,1	490,6	515,2	539,7	564,2	588,8	613,3
Ch62	NXB 0460_5	460	556,9	586,2	615,5	644,8	674,2	703,5	732,8
Ch62	NXB 0520_5	520	629,6	662,7	695,8	729,0	762,1	795,2	828,4
Ch62	NXB 0590_5	590	714,3	751,9	789,5	827,1	864,7	902,3	939,9
Ch62	NXB 0650_5	650	786,9	828,4	869,8	911,2	952,6	994,0	1035,5
Ch62	NXB 0730_5	730	883,8	930,3	976,8	1023,3	1069,9	1116,4	1162,9

Table 10-7. Maximum braking power

NOTE: The braking powers indicated in Table 10-7 above can only be achieved with minimum resistance.

Chas-sis	NXB unit	Thermal current [Ith]	Minimum resistance at DC-link voltages [ohm]						
			605	637	669	701	733	765	797
Ch3	NXB 0031_5	31	19,5	20,6	21,6	22,6	23,6	24,7	25,7
Ch3	NXB 0061_5	61	9,9	10,4	11,0	11,5	12,0	12,5	13,1
Ch4	NXB 0087_5	87	7,0	7,3	7,7	8,1	8,4	8,8	9,2
Ch4	NXB 0105_5	105	5,8	6,1	6,4	6,7	7,0	7,3	7,6
Ch4	NXB 0140_5	140	4,3	4,6	4,8	5,0	5,2	5,5	5,7
Ch5	NXB 0168_5	168	3,6	3,8	4,0	4,2	4,4	4,6	4,7
Ch5	NXB 0208_5	208	3,0	3,1	3,3	3,4	3,6	3,7	3,9
Ch5	NXB 0261_5	261	2,3	2,4	2,6	2,7	2,8	2,9	3,1
Ch61	NXB 0300_5	300	2,0	2,1	2,2	2,3	2,4	2,5	2,7
Ch61	NXB 0385_5	385	1,6	1,7	1,7	1,8	1,9	2,0	2,1
Ch62	NXB 0460_5	460	1,3	1,4	1,5	1,5	1,6	1,7	1,7
Ch62	NXB 0520_5	520	1,2	1,2	1,3	1,3	1,4	1,5	1,5
Ch62	NXB 0590_5	590	1,0	1,1	1,1	1,2	1,2	1,3	1,4
Ch62	NXB 0650_5	650	0,9	1,0	1,0	1,1	1,1	1,2	1,2
Ch62	NXB 0730_5	730	0,8	0,9	0,9	1,0	1,0	1,0	1,1

Table 10-8. Minimum resistance

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

Chas-sis	NXB unit	Thermal current [Ith]	Maximum resistance at DC-link voltages [ohm]						
			605	637	669	701	733	765	797
Ch3	NXB 0031_5	31	97,6	102,8	107,9	113,1	118,2	123,3	128,5
Ch3	NXB 0061_5	61	49,6	52,2	54,8	57,5	60,1	62,7	65,3
Ch4	NXB 0087_5	87	34,8	36,6	38,5	40,3	42,1	43,9	45,8
Ch4	NXB 0105_5	105	28,8	30,3	31,9	33,4	34,9	36,4	37,9
Ch4	NXB 0140_5	140	21,6	22,8	23,9	25,0	26,2	27,3	28,4
Ch5	NXB 0168_5	168	18,0	19,0	19,9	20,9	21,8	22,8	23,7
Ch5	NXB 0208_5	208	14,8	15,5	16,3	17,1	17,9	18,6	19,4
Ch5	NXB 0261_5	261	11,6	12,2	12,8	13,4	14,0	14,6	15,3
Ch61	NXB 0300_5	300	10,1	10,6	11,2	11,7	12,2	12,7	13,3
Ch61	NXB 0385_5	385	7,9	8,3	8,7	9,1	9,5	9,9	10,3
Ch62	NXB 0460_5	460	6,6	6,9	7,3	7,6	8,0	8,3	8,7
Ch62	NXB 0520_5	520	5,8	6,1	6,4	6,7	7,0	7,4	7,7
Ch62	NXB 0590_5	590	5,1	5,4	5,7	5,9	6,2	6,5	6,8
Ch62	NXB 0650_5	650	4,7	4,9	5,1	5,4	5,6	5,9	6,1
Ch62	NXB 0730_5	730	4,1	4,4	4,6	4,8	5,0	5,2	5,5

Table 10-9. Maximum resistance

10.6.3 Braking power and resistance, mains voltage 525–690Vac/840–1100Vdc

Voltage	Default +18% DC-link voltage level for braking							
	Vac	525	550	575	600	630	660	690
	Vdc	708,8	742,5	776,3	810	850,5	891	931,5
	Ubr +18%	836	876	916	956	1004	1051	1099

Table 10-10. Voltage levels

Chas-sis	NXB unit	Thermal current [Ith]	Max braking power at DC-link voltages [kW]						
			836	876	916	956	1004	1051	1099
Ch61	NXB 0170_6	170	284,4	297,9	311,4	325,0	341,2	357,5	373,7
Ch61	NXB 0208_6	208	347,9	364,5	381,0	397,6	417,5	437,4	457,3
Ch62	NXB 0261_6	261	436,6	457,4	478,1	498,9	523,9	548,8	573,8
Ch62	NXB 0325_6	325	543,6	569,5	595,4	621,3	652,3	683,4	714,5
Ch62	NXB 0385_6	385	644,0	674,6	705,3	736,0	772,8	809,6	846,4
Ch62	NXB 0416_6	416	695,8	729,0	762,1	795,2	835,0	874,7	914,5
Ch62	NXB 0460_6	460	769,4	806,1	842,7	879,3	923,3	967,3	1011,2
Ch62	NXB 0502_6	502	839,7	879,7	919,6	959,6	1007,6	1055,6	1103,6

Table 10-11. Maximum braking power

NOTE: The braking powers indicated in Table 10-11 above can only be achieved with minimum resistance.

Chas-sis	NXB unit	Thermal current [Ith]	Minimum resistance at DC-link voltages [ohm]						
			836	876	916	956	1004	1051	1099
Ch61	NXB 0170_6	170	4,9	5,2	5,4	5,6	5,9	6,2	6,5
Ch61	NXB 0208_6	208	4,0	4,2	4,4	4,6	4,8	5,1	5,3
Ch62	NXB 0261_6	261	3,2	3,4	3,5	3,7	3,8	4,0	4,2
Ch62	NXB 0325_6	325	2,6	2,7	2,8	2,9	3,1	3,2	3,4
Ch62	NXB 0385_6	385	2,2	2,3	2,4	2,5	2,6	2,7	2,9
Ch62	NXB 0416_6	416	2,0	2,1	2,2	2,3	2,4	2,5	2,6
Ch62	NXB 0460_6	460	1,8	1,9	2,0	2,1	2,2	2,3	2,4
Ch62	NXB 0502_6	502	1,7	1,7	1,8	1,9	2,0	2,1	2,2

Table 10-12. Minimum resistance

Chas-sis	NXB unit	Thermal current [Ith]	Maximum resistance at DC-link voltages [ohm]						
			836	876	916	956	1004	1051	1099
Ch61	NXB 0170_6	170	24,6	25,8	26,9	28,1	29,5	30,9	32,3
Ch61	NXB 0208_6	208	20,1	21,1	22,0	23,0	24,1	25,3	26,4
Ch62	NXB 0261_6	261	16,0	16,8	17,5	18,3	19,2	20,1	21,1
Ch62	NXB 0325_6	325	12,9	13,5	14,1	14,7	15,4	16,2	16,9
Ch62	NXB 0385_6	385	10,9	11,4	11,9	12,4	13,0	13,7	14,3
Ch62	NXB 0416_6	416	10,1	10,5	11,0	11,5	12,1	12,6	13,2
Ch62	NXB 0460_6	460	9,1	9,5	10,0	10,4	10,9	11,4	11,9
Ch62	NXB 0502_6	502	8,3	8,7	9,1	9,5	10,0	10,5	10,9

Table 10-13. Maximum resistance

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

10.7 Brake chopper unit – Fuse selection

Chassis	Type	Min resistor value, 2* [ohm]	Braking current	DIN43620		Fuse U_n [V]	Fuse I_n [A]	Qty. of fuses
				aR fuse part nr.	Fuse size*			
CH3	0016	52,55	32	170M2679	DIN00	690	63	1
CH3	0022	38,22	44	170M2679	DIN00	690	63	1
CH3	0031	27,12	62	170M2679	DIN00	690	63	1
CH3	0038	22,13	76	170M2679	DIN00	690	63	1
CH3	0045	18,68	90	170M2683	DIN00	690	160	1
CH3	0061	13,78	122	170M2683	DIN00	690	160	1
CH4	0072	11,68	144	170M2683	DIN00	690	160	1
CH4	0087	9,66	174	170M2683	DIN00	690	160	1
CH4	0105	8,01	210	170M2683	DIN00	690	160	1
CH4	0140	6,01	280	170M4199	1SHT	690	400	1
CH5	0168	5,00	336	170M4199	1SHT	690	400	1
CH5	0208	4,10	410	170M4199	1SHT	690	400	1
CH5	0261	3,22	522	170M4199	1SHT	690	400	1
CH61	0300	2,80	600	170M6202	3SHT	690	500	1
CH61	0385	2,18	770	170M6305	3SHT	690	700	2
CH62	0460	1,83	920	170M6277	3SHT	690	1000	2
CH62	0520	1,62	1040	170M6277	3SHT	690	1000	2
CH62	0590	1,43	1180	170M6277	3SHT	690	1000	2
CH62	0650	1,29	1300	170M6305	3SHT	690	700	3
CH62	0730	1,15	1460	170M6305	3SHT	690	700	3

Table 10-14. BCU fuse selection, mains voltage 465–800Vdc

Chassis	Type	Min resistor value, 2* [ohm]	Braking current	DIN43620		Fuse U_n [V]	Fuse I_n [A]	Qty. of fuses
				aR fuse part nr.	Fuse size*			
CH61	0170	6,51	340	170M6305	3SHT	1250	700	1
CH61	0170*	80	27	170M2679	DIN00	1000	63	1
CH61	0208	5,32	416	170M6277	3SHT	1250	1000	1
CH61	0208*	30	73	170M2683	DIN00	1000	160	1
CH61	0261	4,24	522	170M6277	3SHT	1250	1000	1
CH61	0261*	12	183	170M4199	1SHT	1250	400	1
CH62	0310	3,41	650	170M6305	3SHT	1250	700	2
CH62	0385	2,88	770	170M6277	3SHT	1250	1000	2
CH62	0416	2,66	832	170M6277	3SHT	1250	1000	2
CH62	0460	2,41	920	170M6277	3SHT	1250	1000	2
CH62	0502	2,21	1004	170M6277	3SHT	1250	1000	2

Table 10-15. BCU fuse selection, mains voltage 640–1100Vdc

11. APPENDICES

Appendix 1

Drive type designation code

"Hardware modifications" – Explanation of letters

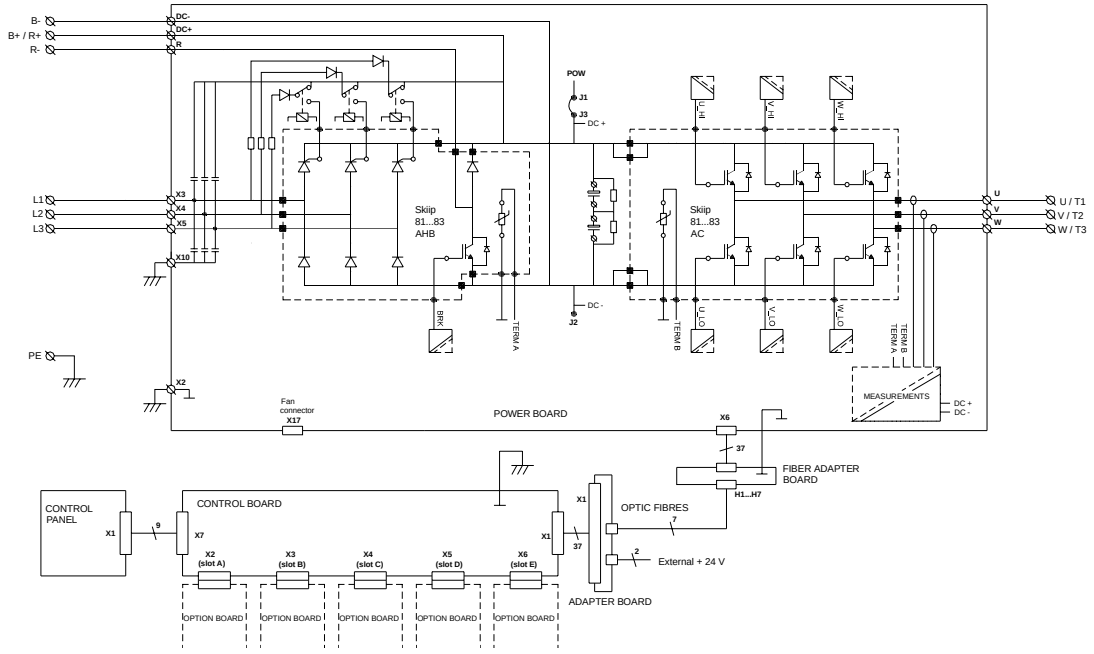
	1. letter	2. letter	3. Letter
A			
B	DC connection (> FR7) (in addition to normal AC)		
C		Switchgear version, air cooled drives– type of connections, components etc to be specified separately	
D	Demo case drive - modified. For internal use only	DIN rail mounting (NXL)	
E	Multipulse connection		
F	Double INU		Fiber connection/standard
G	Double FC		Fiber connection/varnished
H			Prevention of false start - direct connection - standard
I	INU		Prevention of false start - direct connection - varnished
J			Prevention of false start - fiber connection - standard
K			Prevention of false start - fiber connection - varnished
L		Switchgear version, liquid cooled drives– type of connections, components etc to be specified separately	
M		Air cooled - marine modifications (to be specified separately)	
N	Standard 6 -pulse - no chokes	Liquid cooled - marine modifications (to be specified separately)	
O			
P			
Q			
R	Full regenerative drive		
S	Standard 6 –pulse connection with chokes	Standard air cooled drive	Direct connection/standard
T	12- pulse connection	Through hole mounting (flange mounting)	
U			
V			Direct connection/varnished
W		Liquid cooled drive	
X	Special		
Y			
Z			

Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

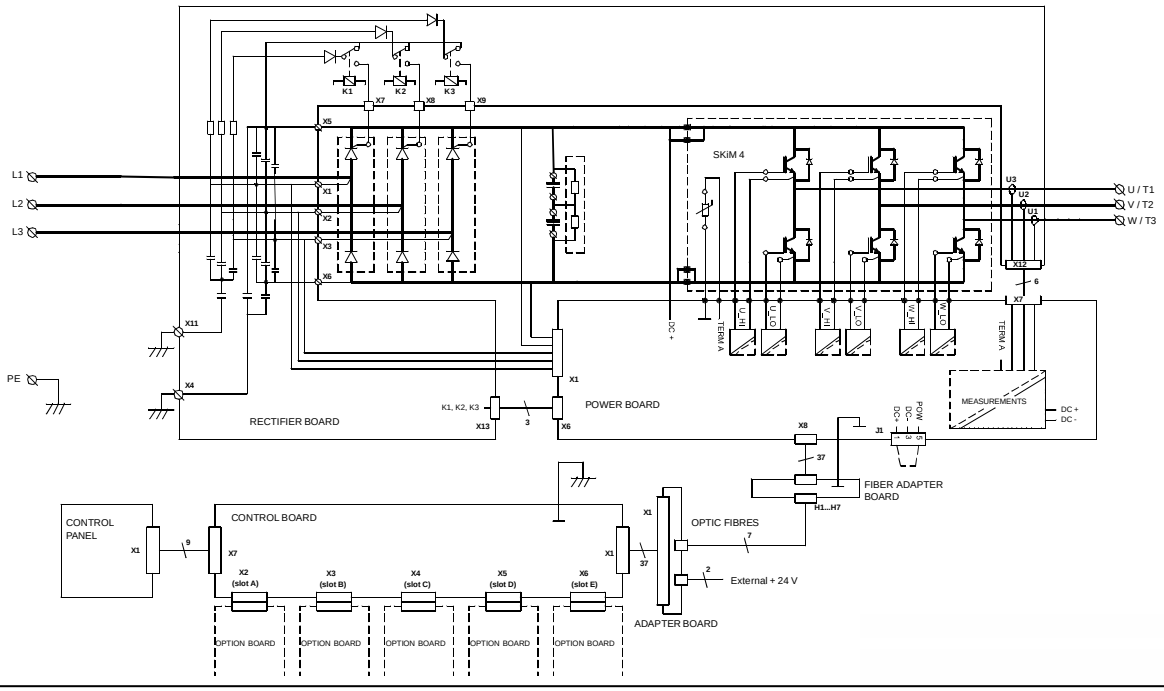
Appendix 2

Vacon NXW frequency converter and inverter main circuit and control diagrams

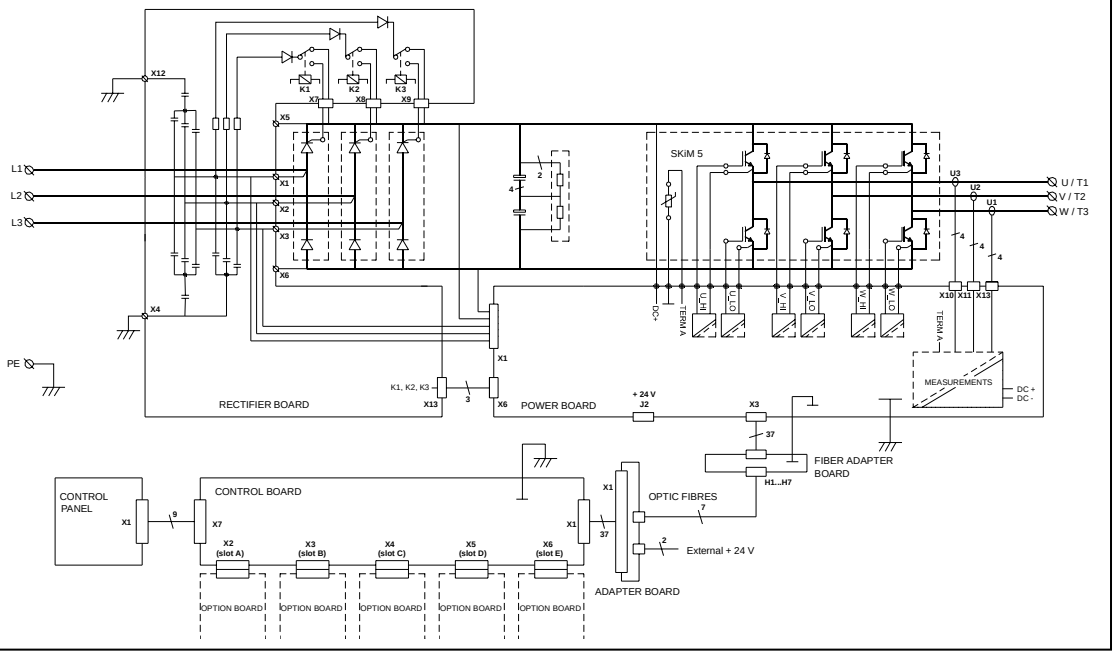
CH3, FC



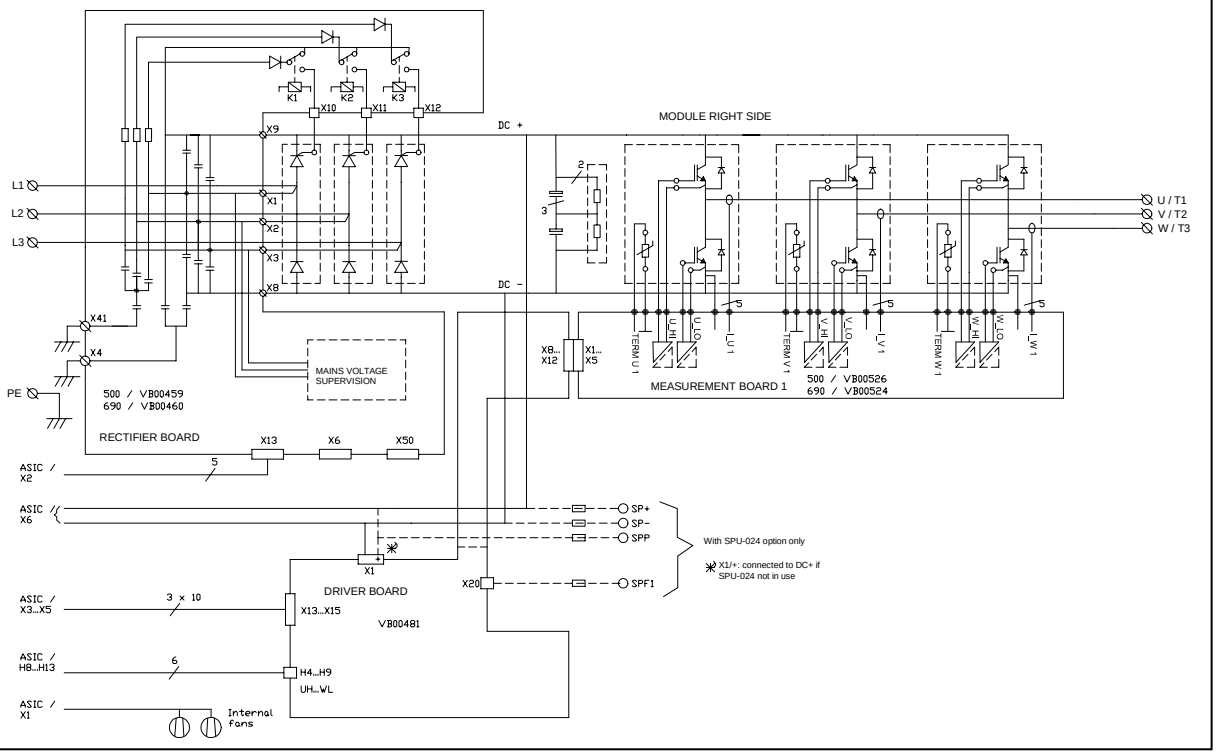
CH4, FC



CH5, FC

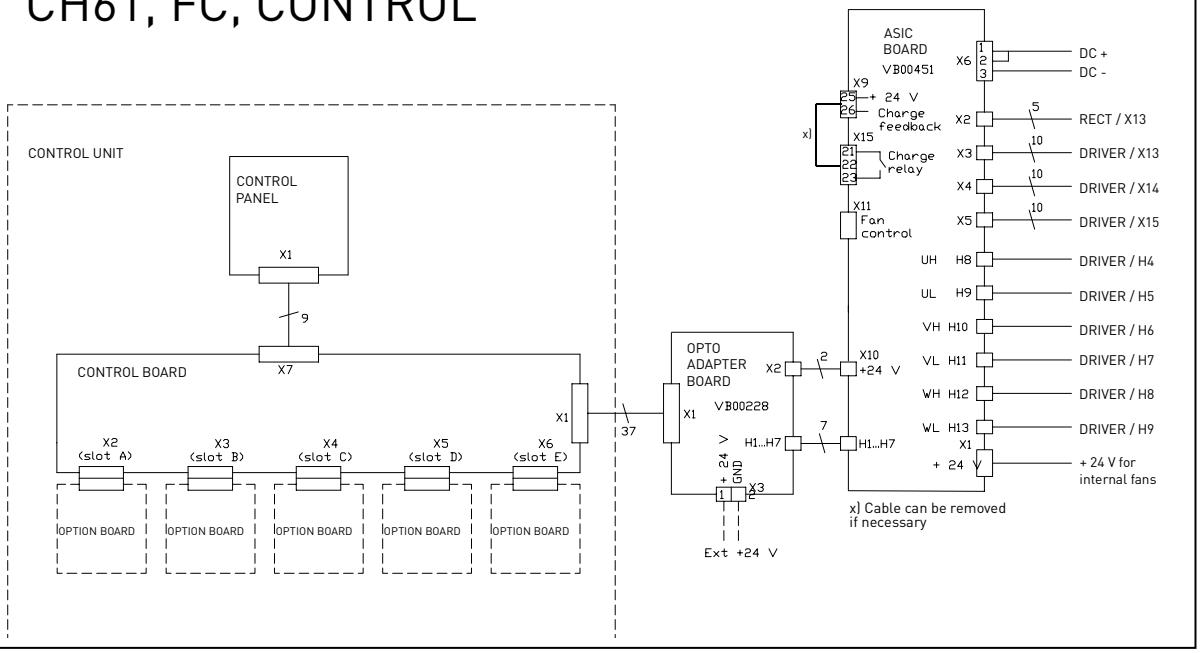


CH61, FC

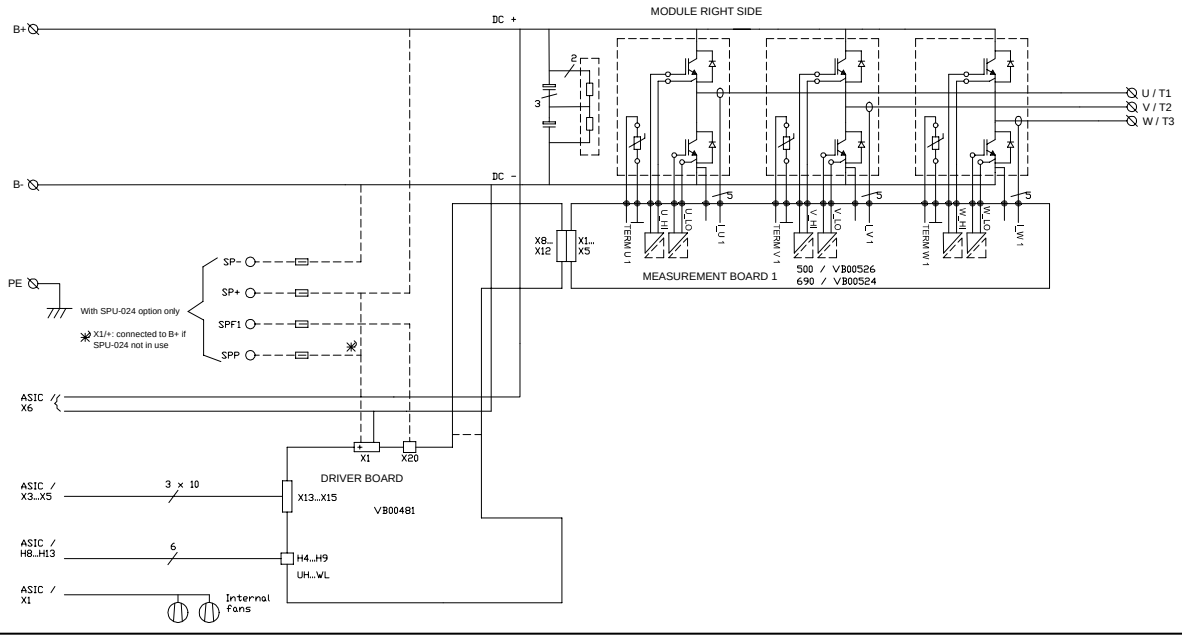


Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

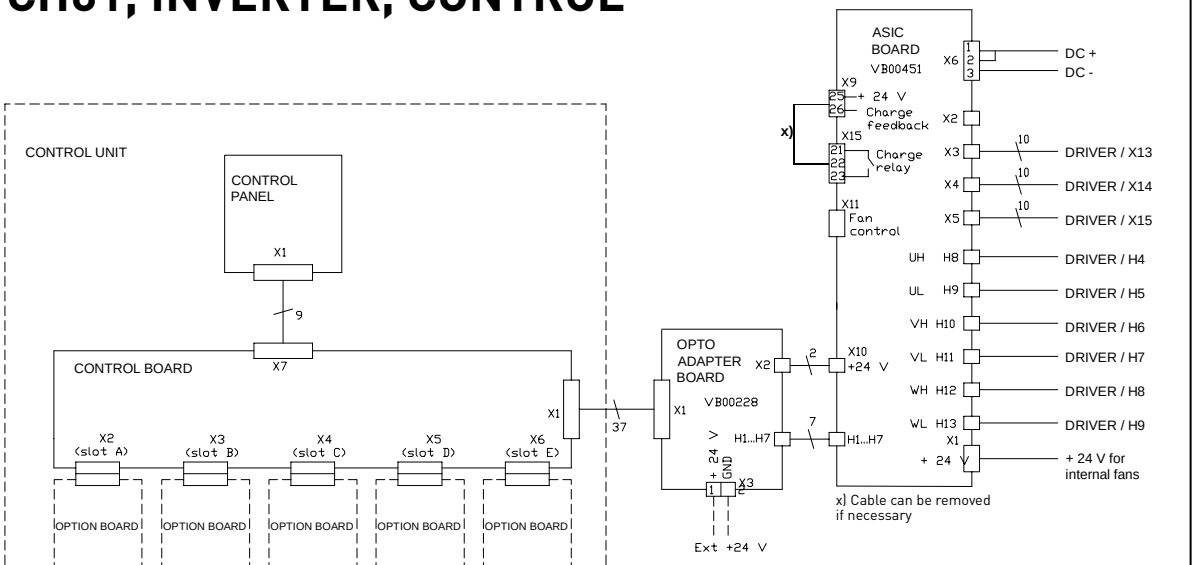
CH61, FC, CONTROL



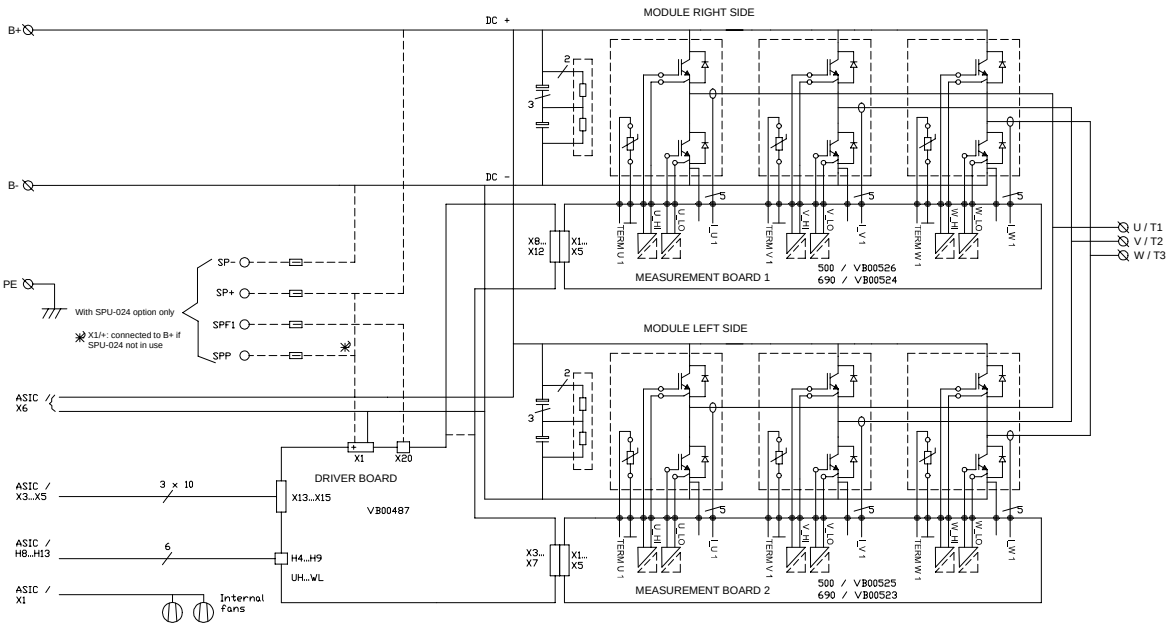
CH61, INVERTER



CH61, INVERTER, CONTROL

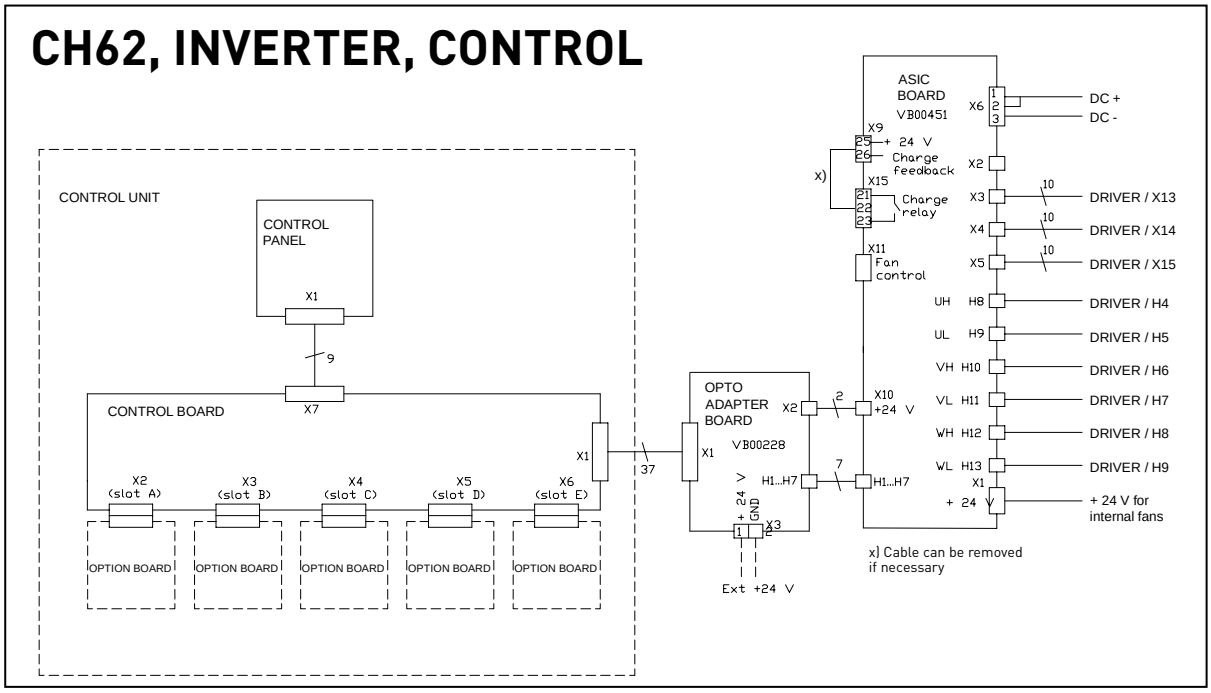


CH62, INVERTER

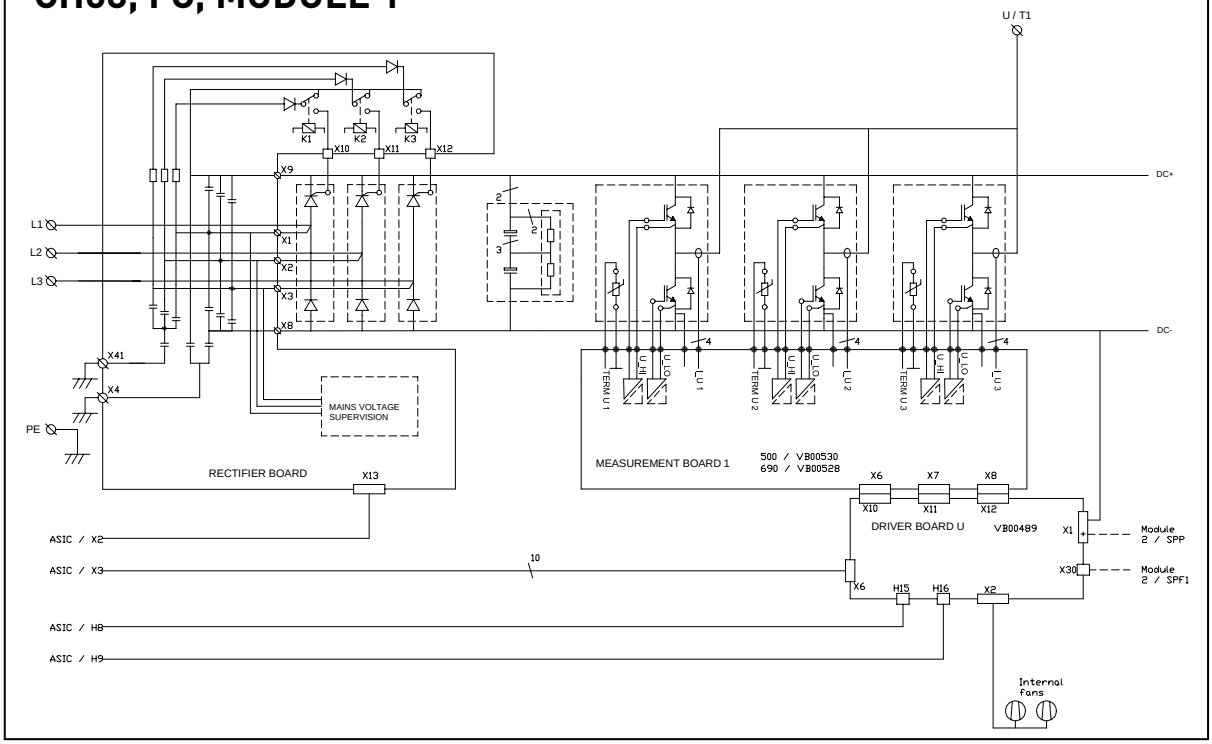


Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

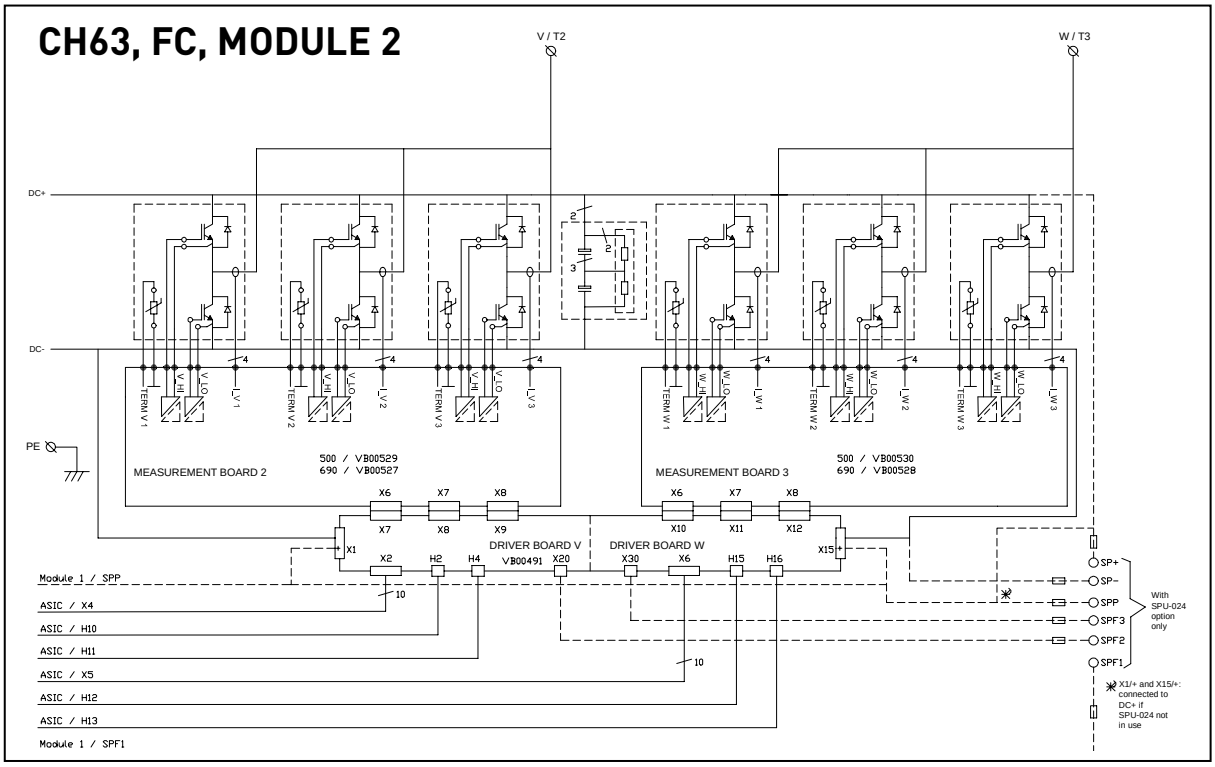
CH62, INVERTER, CONTROL



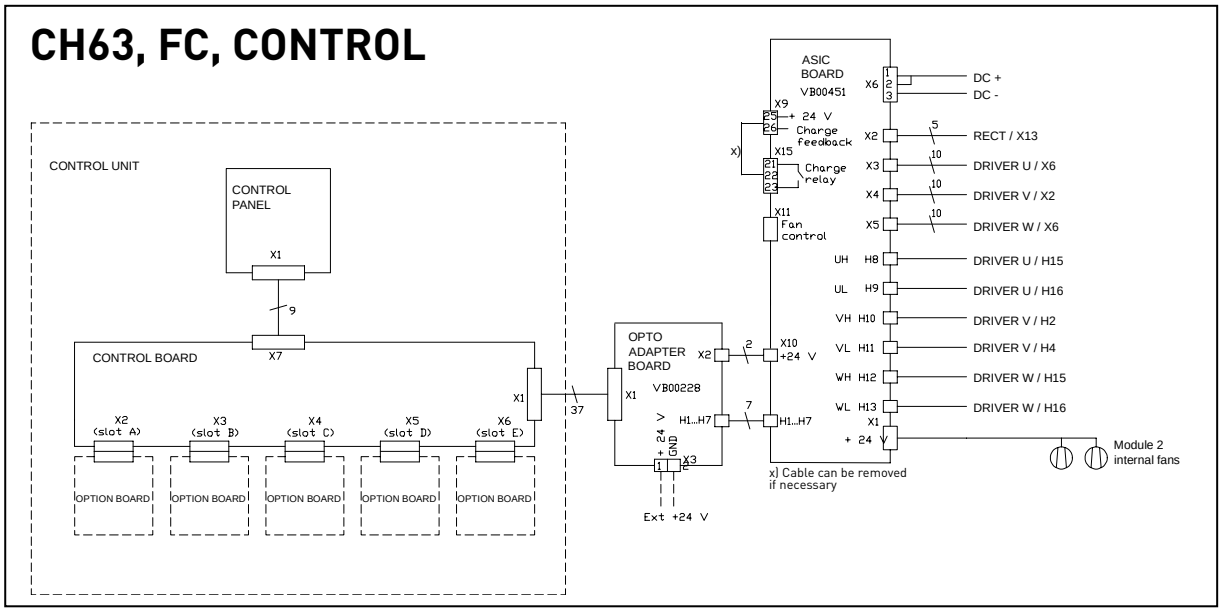
CH63, FC, MODULE 1



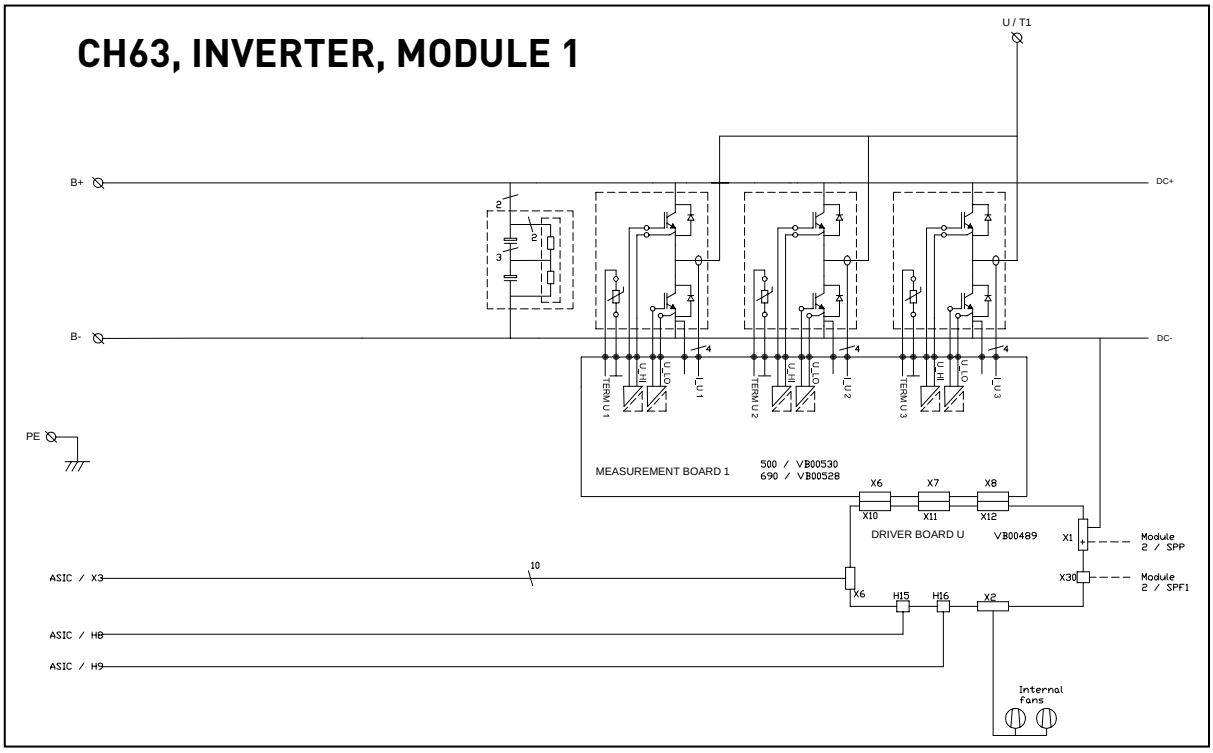
CH63, FC, MODULE 2

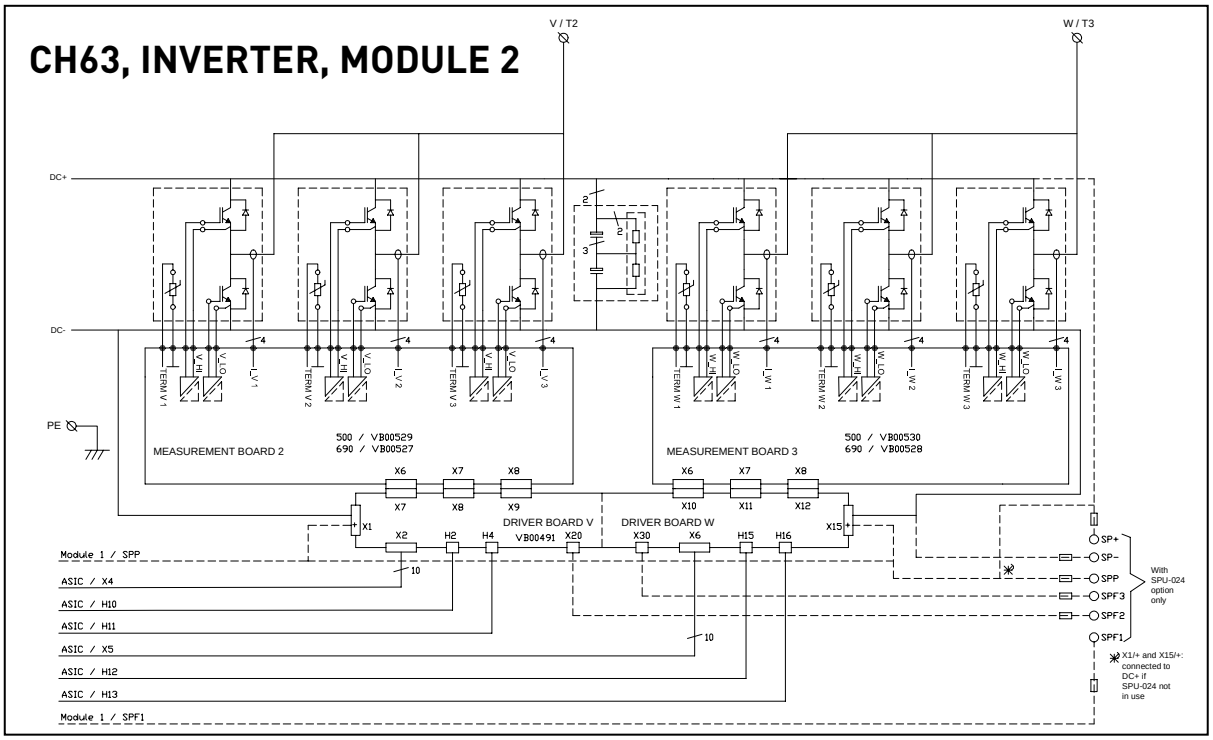


CH63, FC, CONTROL

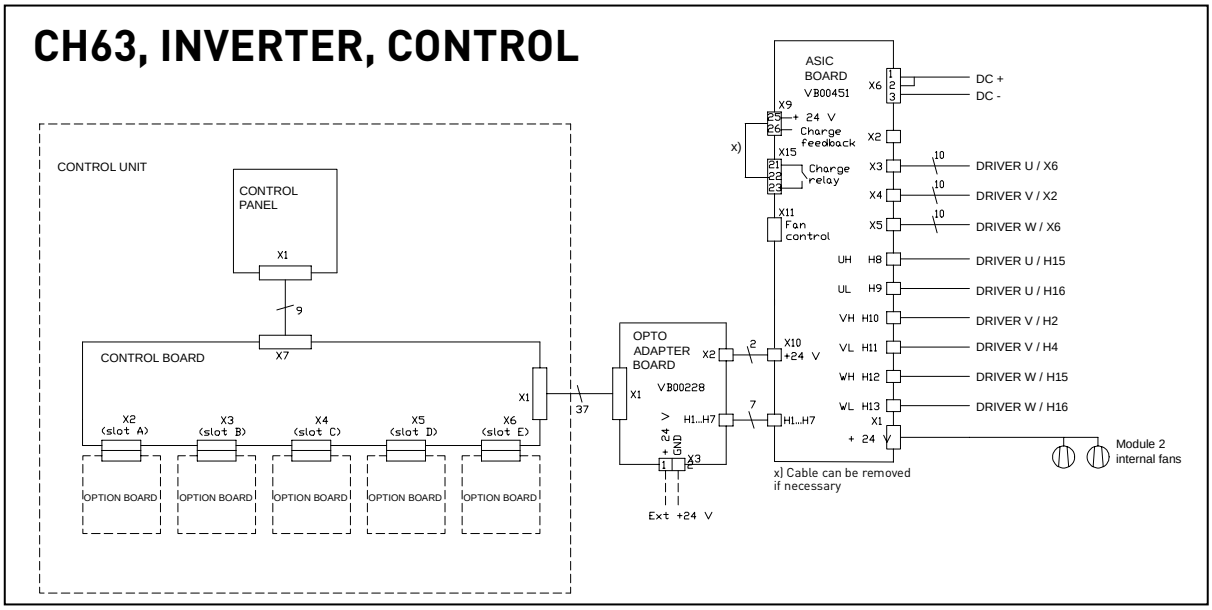


Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

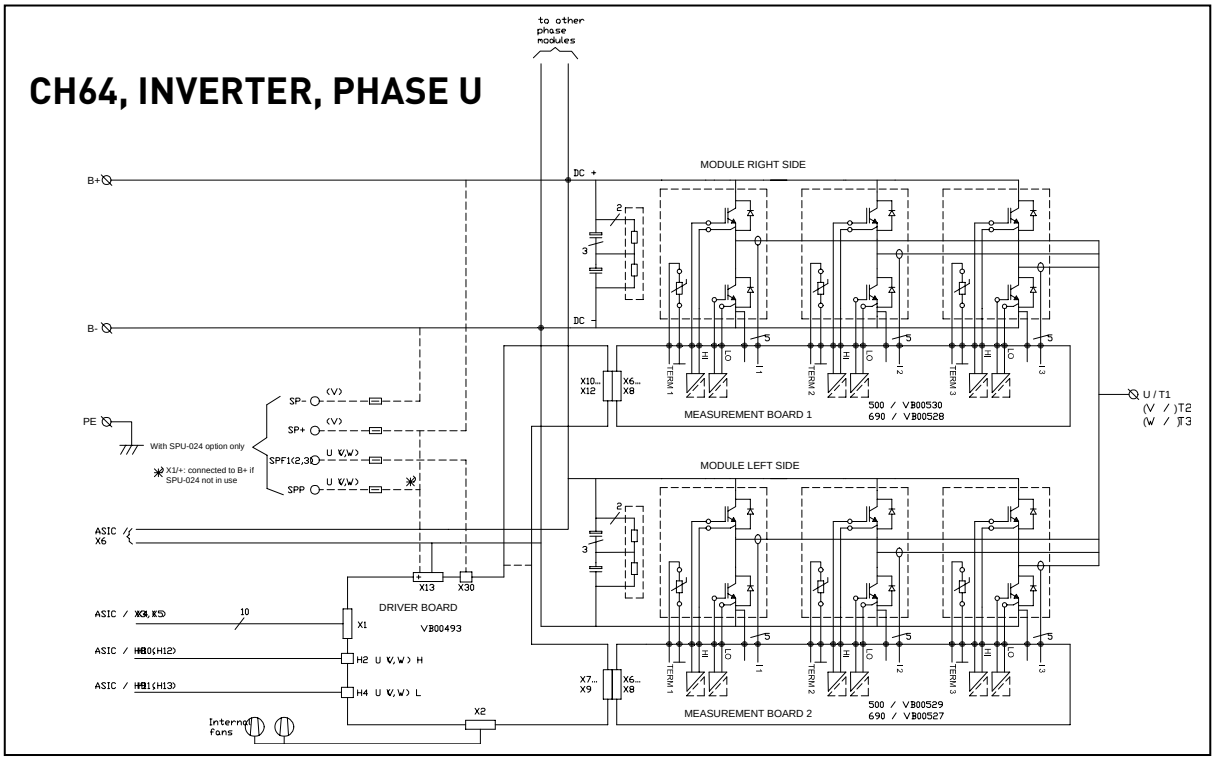

CH63, INVERTER, MODULE 1
U / T1
B+
DC+
B-
DC-
PE
MEASUREMENT BOARD 1
500 / VB00530
690 / VB00528
DRIVER BOARD U
VB00489
Module 2 / SPP
Module 2 / SPF1
ASIC / X3
ASIC / H8
ASIC / H9
Internal fans


CH63, INVERTER, MODULE 2
V / T2
W / T3
DC+
DC-
PE
MEASUREMENT BOARD 2
500 / VB00529
690 / VB00527
MEASUREMENT BOARD 3
500 / VB00530
690 / VB00528
DRIVER BOARD V
VB00491
DRIVER BOARD W
Module 1 / SPP
Module 1 / SPF1
ASIC / X4
ASIC / H10
ASIC / H11
ASIC / X5
ASIC / H12
ASIC / H13
SP+
SP-
SPP
SPF3
SPF2
SPF1
With SPU-024 option only
X1/+ and X15/+: connected to DC+ if SPU-024 not in use

CH63, INVERTER, CONTROL

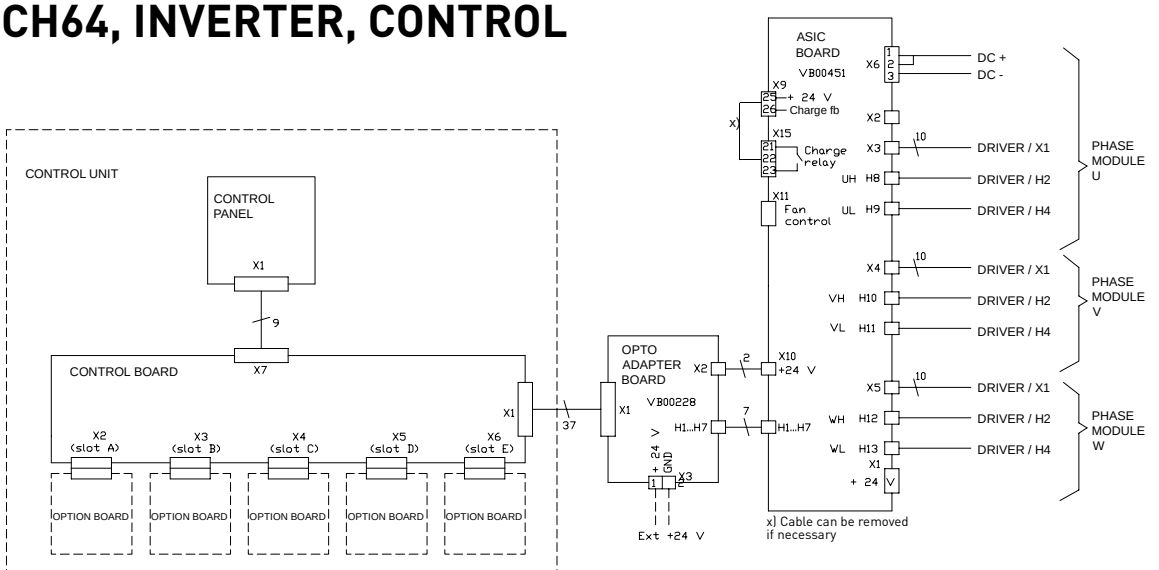


CH64, INVERTER, PHASE U

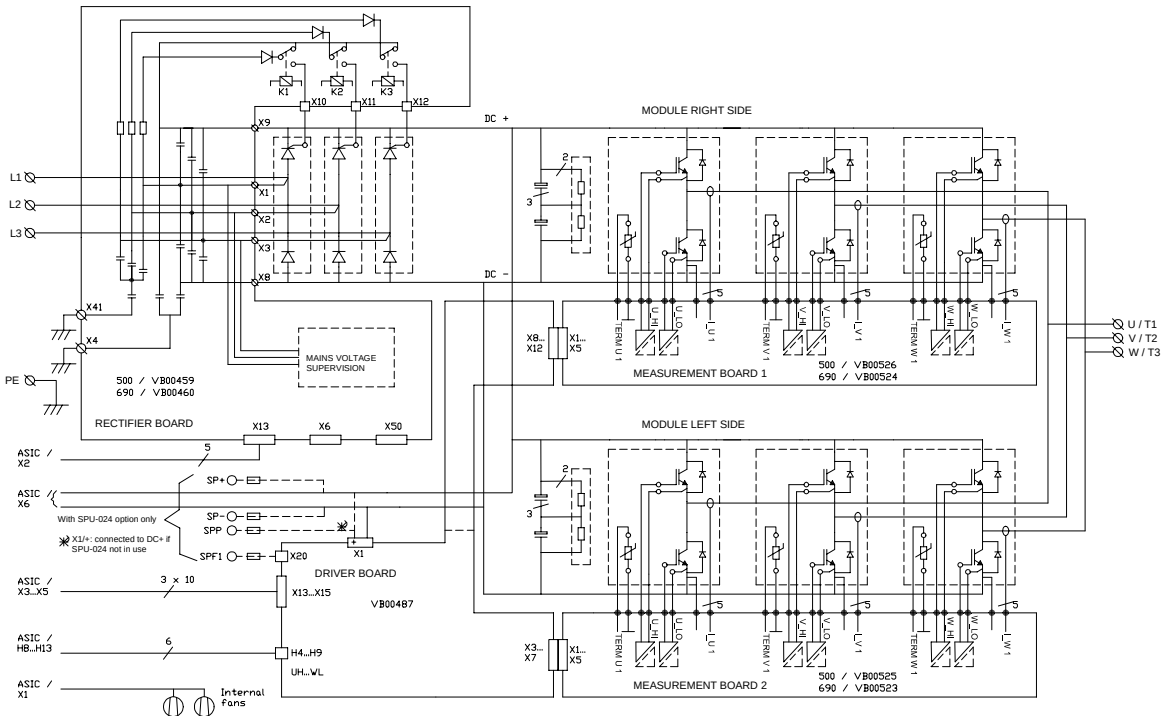


Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

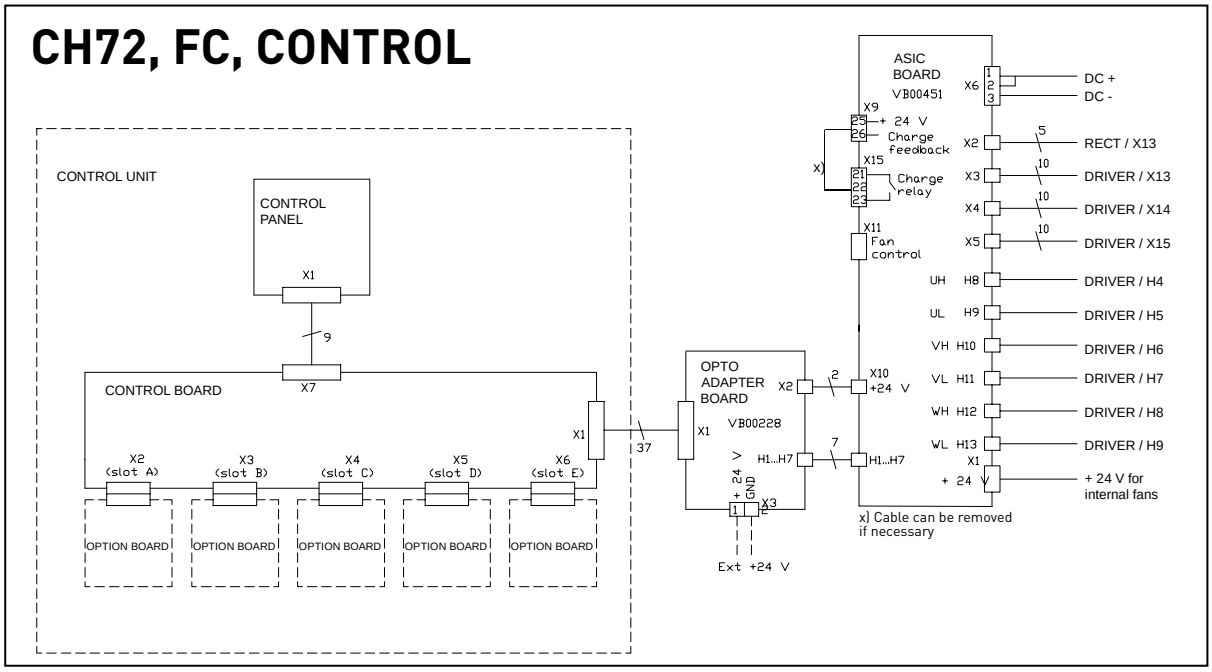
CH64, INVERTER, CONTROL



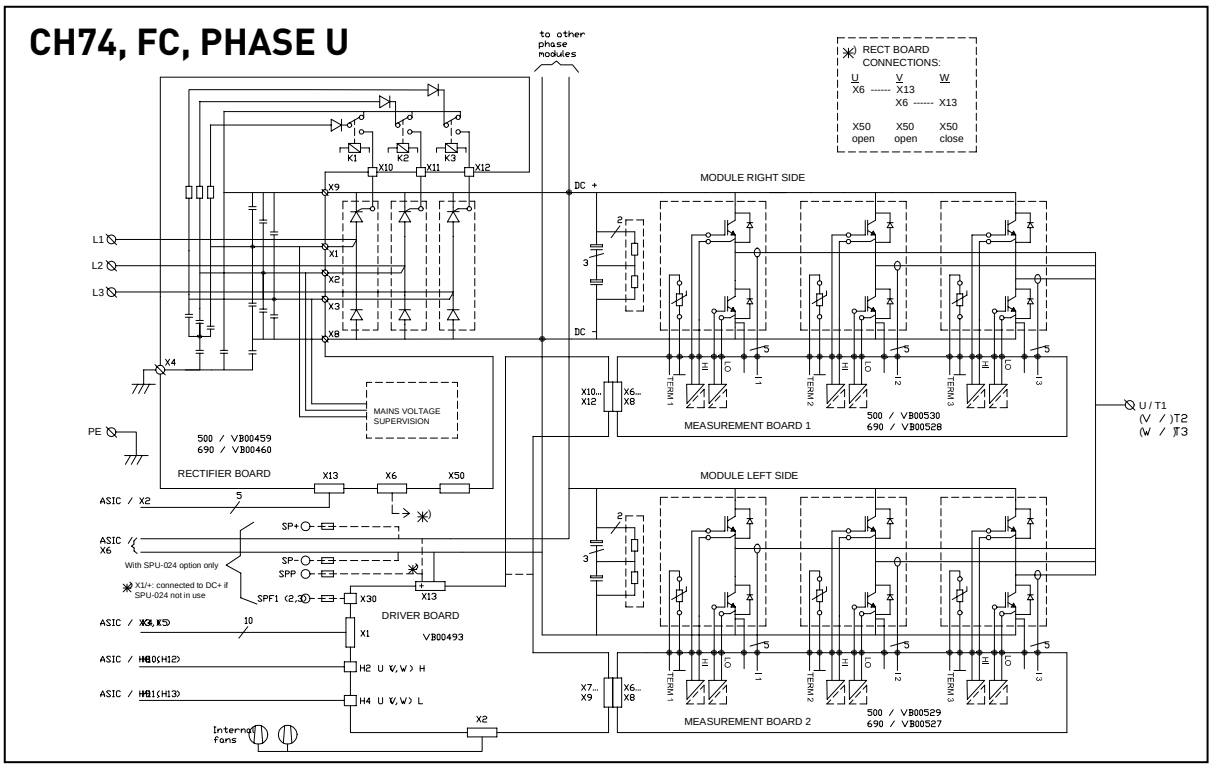
CH72, FC



CH72, FC, CONTROL

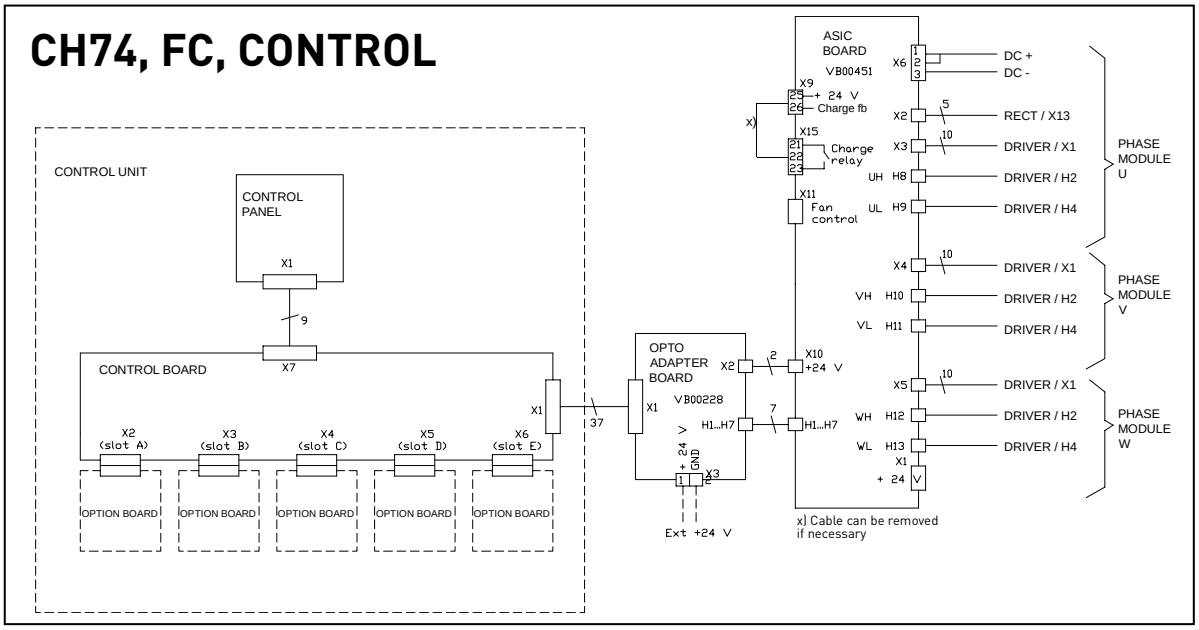


CH74, FC, PHASE U



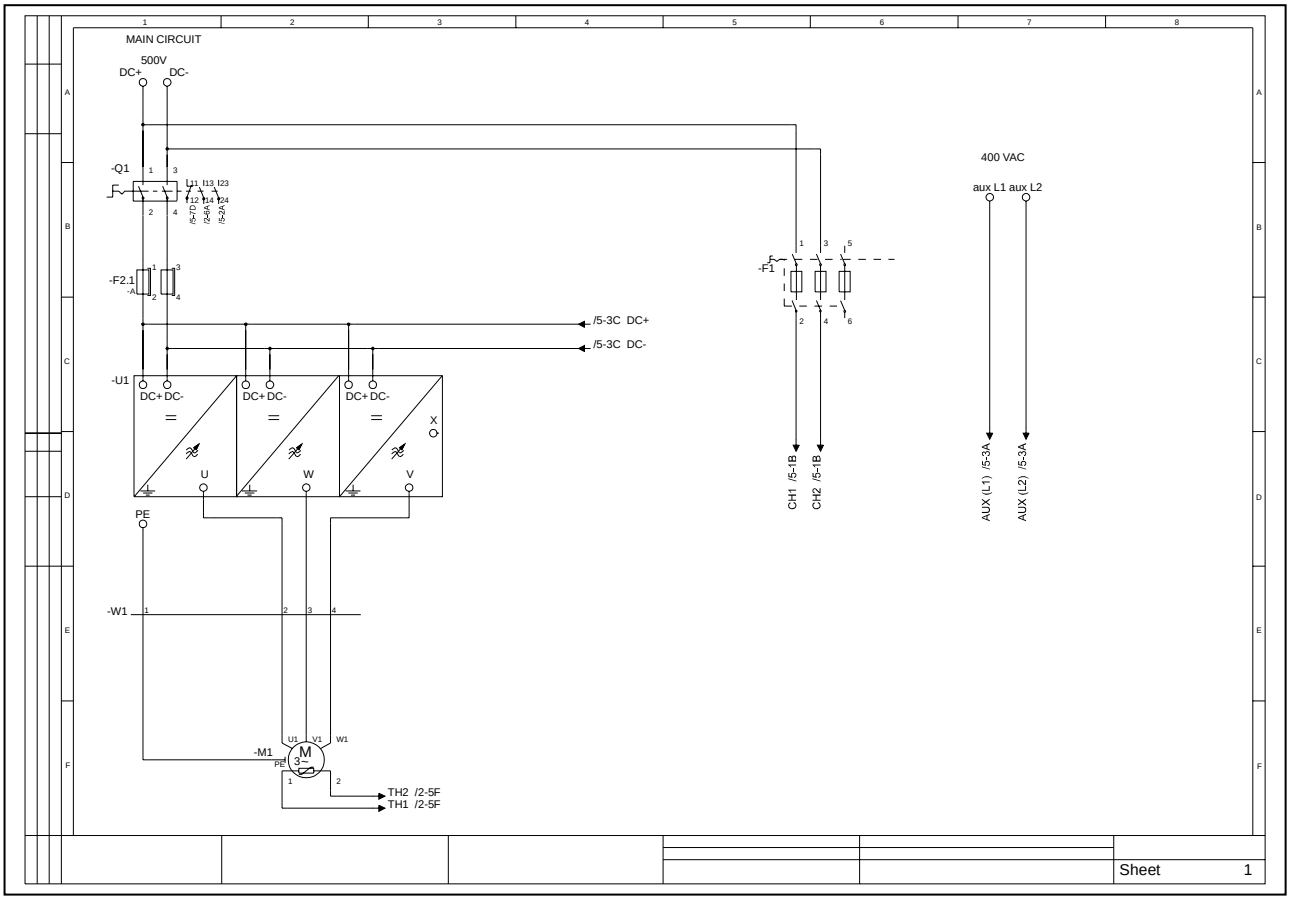
Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

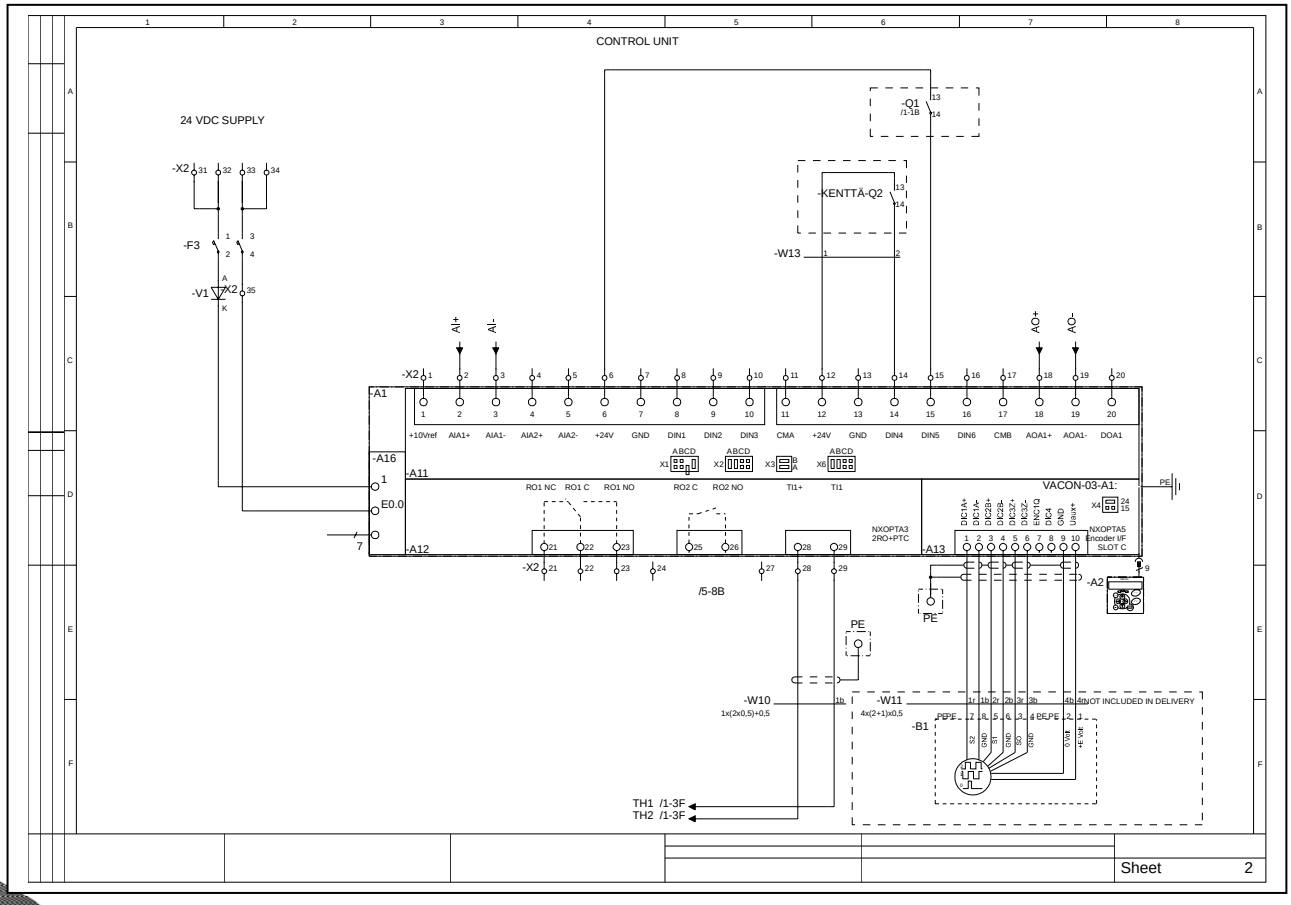
CH74, FC, CONTROL



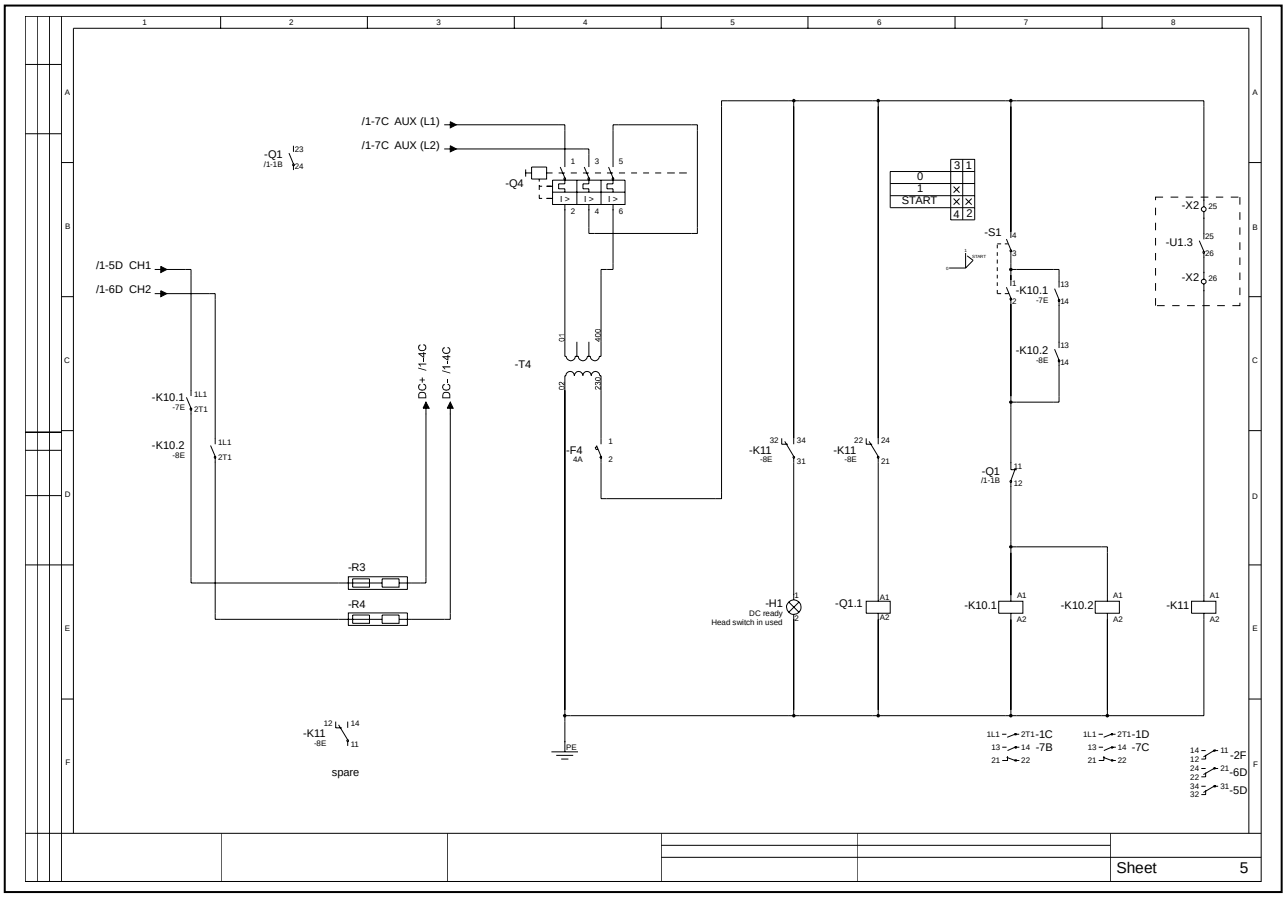
Appendix 3

OETL2500 + OFAX3 + Charging circuit for NX liquid-cooled inverters 1640_5 to 2300_5 (3 diagrams)





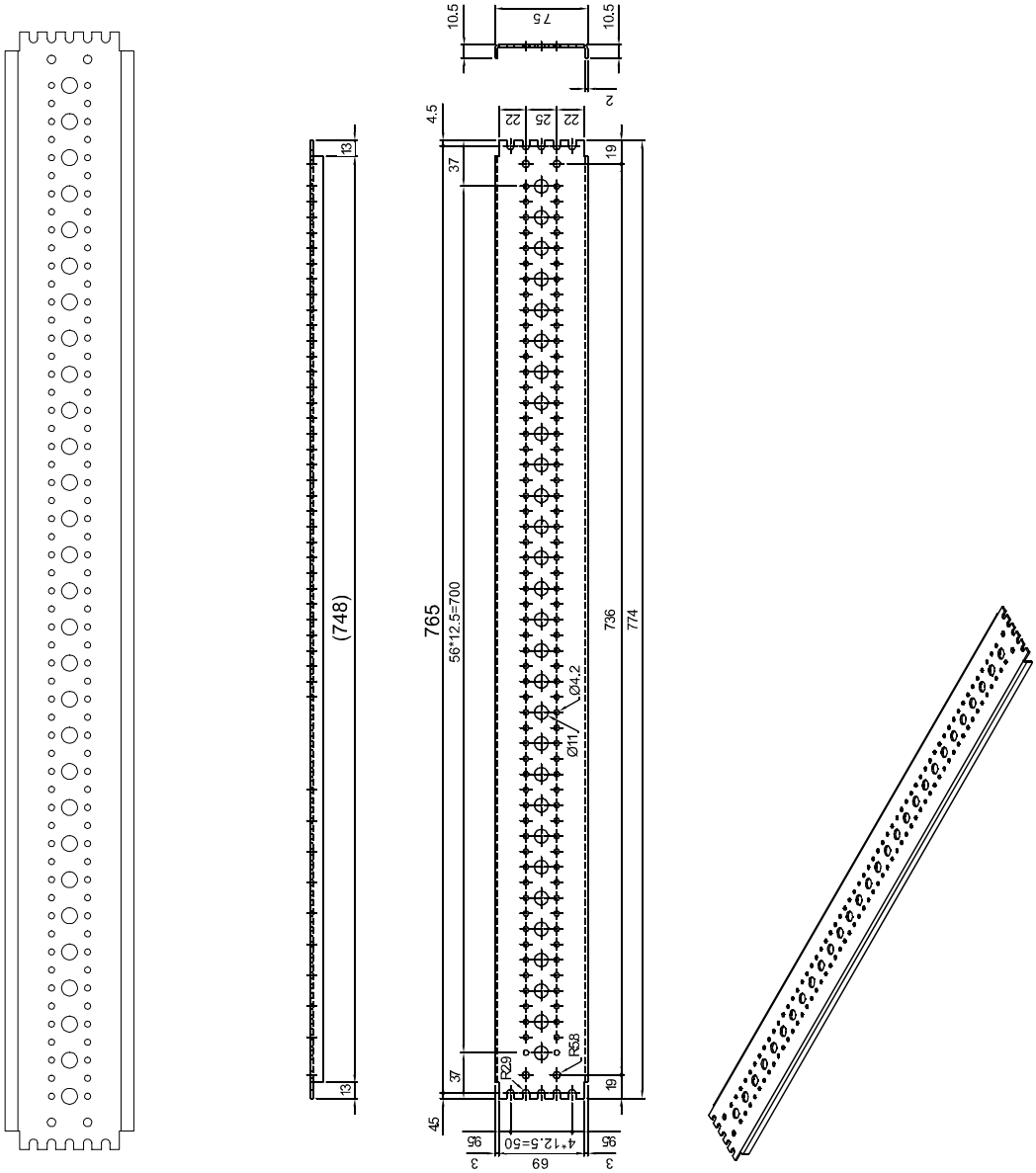
Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205


/1-7C AUX (L1)
/1-7C AUX (L2)
-Q1
/1-1B
-Q4
/1-5D CH1
/1-6D CH2
-K10.1
-7E
-K10.2
-8E
DC+ /1-4C
DC- /1-4C
-T4
-F4
4A
-R3
-R4
-K11
-8E
spare
PE
-H1
DC ready
Head switch in used
-Q1.1
-K10.1
-K10.2
-K11
START
-S1
-U1.3
-X2
1L1 2T1 -1C
13 14 -7B
21 22
1L1 2T1 -1D
13 14 -7C
21 22
-2F
-6D
-5D
Sheet 5

Appendix 4

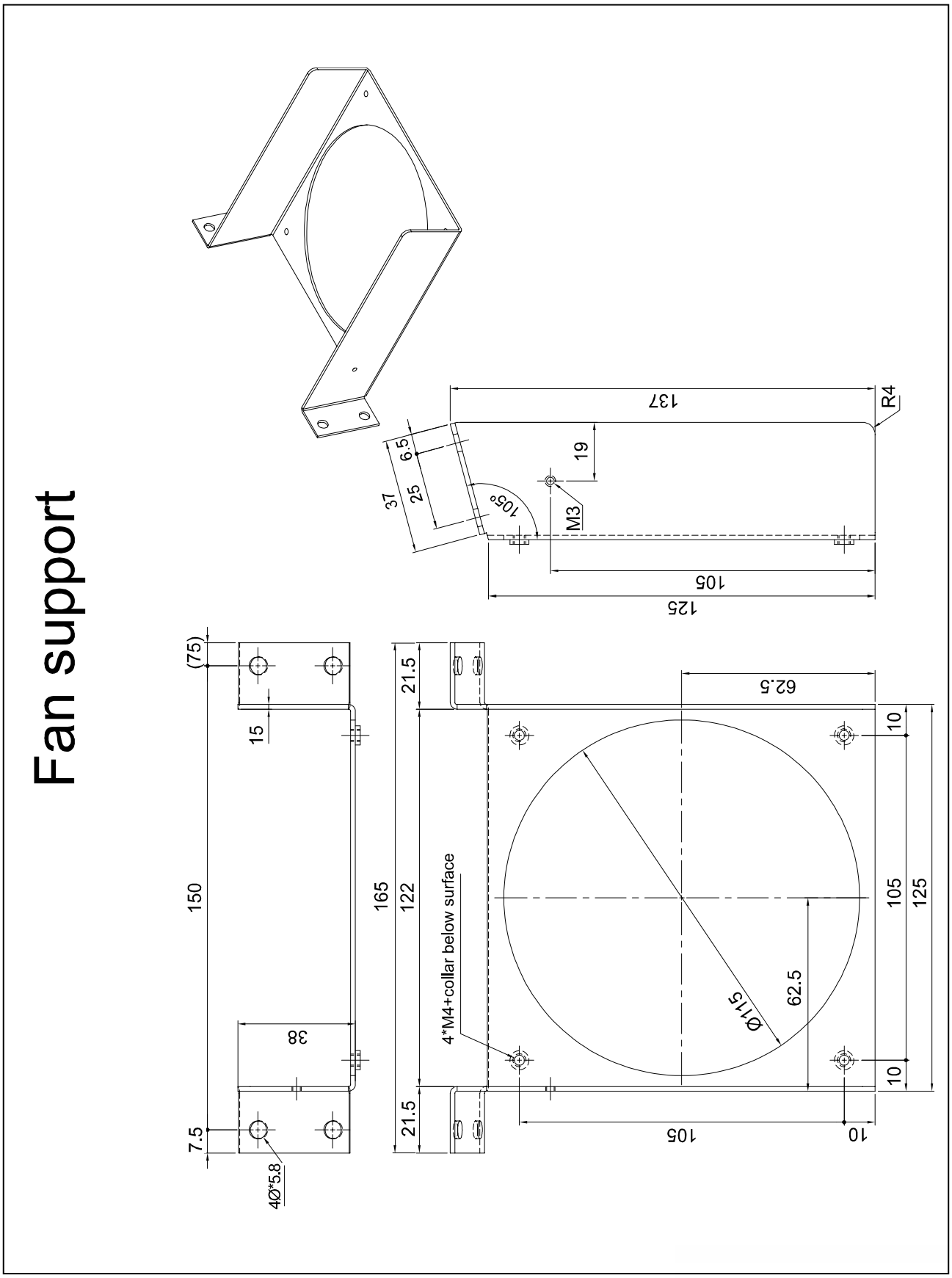
Fan mounting pallet

Hot dip zinc coated



Tel. +358 (0)201 2121 • Fax +358 (0)201 212 205

Fan support


137
R4
6.5
19
37
25
105°
M3
105
125
(75)
15
150
38
7.5
4Ø*5.8
21.5
165
122
21.5
4*M4+collar below surface
62.5
10
105
125
62.5
Ø115
10
105
10

Vaasa
Vacon Plc (Head office and production)
Runsorintie 7
65380 Vaasa
firstname.lastname@vacon.com
telephone: +358 (0)201 2121
fax: +358 (0)201 212 205

Helsinki
Vacon Plc
Äyritie 12
01510 Vantaa
telephone: +358 (0)201 212 600
fax: +358 (0)201 212 699

Tampere
Vacon Plc
Vehnämyllynkatu 18
33700 Tampere
telephone: +358 (0)201 2121
fax: +358 (0)201 212 750

Vacon Traction Oy
Vehnämyllynkatu 18
33700 Tampere
telephone: +358 (0)201 2121
fax: +358 (0)201 212 710

SALES COMPANIES AND REPRESENTATIVE OFFICES:

Austria
Vacon AT Antriebssysteme GmbH
Aumühlweg 21
2544 Leobersdorf
telephone: +43 2256 651 66
fax: +43 2256 651 66 66

Belgium
Vacon Benelux NV/SA
Interleuvenlaan 62
3001 Heverlee (Leuven)
telephone: +32 (0)16 394 825
fax: +32 (0)16 394 827

France
Vacon France s.a.s.
1 Rue Jacquard – BP72
91280 Saint Pierre du Perray CDIS
telephone: +33 (0)1 69 89 60 30
fax: +33 (0)1 69 89 60 40

Germany
Vacon GmbH
Gladbecker Strasse 425
45329 Essen
telephone: +49 (0)201 806 700
fax: +49 (0)201 806 7099

Great Britain
Vacon Drives (UK) Ltd.
18, Maizefield
Hinckley Fields Industrial Estate
Hinckley
LE10 1YF Leicestershire
telephone: +44 (0)1455 611 515
fax: +44 (0)1455 611 517

Italy
Vacon S.p.A.
Via F.lli Guerra, 35
42100 Reggio Emilia
telephone: +39 0522 276811
fax: +39 0522 276890

The Netherlands
Vacon Benelux BV
Weide 40
4206 CJ Gorinchem
telephone: +31 (0)183 642 970
fax: +31 (0)183 642 971

Norway
Vacon AS
Langgata 2
3080 Holmestrand
telephone: +47 330 96120
fax: +47 330 96130

PR China
Vacon Suzhou Drives Co. Ltd.
Blk 11A
428 Xinglong Street
Suchun Industrial Square
Suzhou 215126
telephone: +86 512 6283 6630
fax: +86 512 6283 6618

Vacon Suzhou Drives Co. Ltd.
Beijing Office
A205, Grand Pacific Garden Mansion
8A Guanhua Road
Beijing 100026
telephone: +86 10 6581 3734
fax: +86 10 6581 3754

Russia
ZAO Vacon Drives
Bolshaja Jakimanka 31,
stroenie 18
109180 Moscow
telephone: +7 (095) 974 14 47
fax: +7 (095) 974 15 54

ZAO Vacon Drives
2ya Sovetskaya 7, office 210A
191036 St. Petersburg
telephone: +7 (812) 332 1114
fax: +7 (812) 279 9053

Singapore
Vacon Plc
Singapore Representative Office
102F Pasir Panjang Road
#02-06 Citilink Warehouse Complex
Singapore 118530
telephone: +65 6278 8533
fax: +65 6278 1066

Spain
Vacon Drives Ibérica S.A.
Miquel Servet, 2. P.I. Bufalvent
08243 Manresa
telephone: +34 93 877 45 06
fax: +34 93 877 00 09

Sweden
Vacon AB
Torget 1
172 67 Sundbyberg
telephone: +46 (0)8 293 055
fax: +46 (0)8 290 755

Vacon distributor: