

COMPLETE THE 10 FOLLOWING STEPS OF THE *START-UP QUICK GUIDE* DURING INSTALLATION AND COMMISSIONING.

IF ANY PROBLEMS OCCUR, PLEASE CONTACT THE LOCAL DISTRIBUTOR.

Start-up Quick Guide

1. Check that the delivery corresponds to the order, see Chapter 3.
 2. Carefully read the safety instructions in Chapter 1 before commencing commissioning .
 3. Ensure the minimum clearances around the unit and check the ambient conditions in Chapter 5.2.
 4. Check the size of the motor cable, mains cable, mains fuses and check the cable connections, read Chapter 6.
 5. Follow the installation instructions, see Chapter 5.
 6. Control cable sizes and the grounding system are explained in Chapter 6.1.1.
 7. 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 P2.1. See Chapter 8.3.2.
 - nominal voltage of the motor, par. 2.1.6
 - nominal frequency of the motor, par. 2.1.7
 - nominal speed of the motor, par 2.1.8
 - nominal current of the motor, par. 2.1.9
 - & if possible motor $\cos\phi$, par. 2.1.10
- All parameters are explained in the Multi-Control Application Manual.
9. Follow the commissioning instructions, see Chapter 8.
 10. The NXL Frequency Converter is now ready for use.
 11. In the end of this manual, there is a quick help with the default I/O, control panel menus, monitoring values, fault codes and basic parameters

The Manufacturer is not responsible for the use of the frequency converters against the instructions.

CONTENTS

NXL USER'S MANUAL

INDEX

1	SAFETY
2	EU DIRECTIVE
3	RECEIPT OF DELIVERY
4	TECHNICAL DATA
5	INSTALLATION
6	CABLING AND CONNECTIONS
7	CONTROL KEYPAD
8	COMMISSIONING
9	FAULT TRACING
10	DESCRIPTION OF BOARD NXOPTAA

MULTI-CONTROL APPLICATION MANUAL

**ABOUT THE NXL USER'S MANUAL
AND THE MULTI-CONTROL APPLICATION MANUAL**

The User's Manual provides the necessary information about the installation, commissioning and operation of NXL Frequency Converter. Read these instructions carefully before powering up the frequency converter for the first time.

The Multi-Control Application Manual contains information about the application used in the NXL Drive.

This manual is available in both paper and electronic format. It is recommended to use the electronic version if possible as it contains links and cross-references to other locations in the manual, which makes it easier for the reader to navigate the manual, and refer to other areas.

NXL User's Manual

Index

1.			
SAFETY		6
1.1	WARNINGS.....		6
1.2	SAFETY INSTRUCTIONS.....		6
1.3	EARTHING AND EARTH FAULT PROTECTION.....		6
1.4	RUNNING THE MOTOR.....		7
2.	EU DIRECTIVE		8
2.1	CE MARKING.....		8
2.2	EMC DIRECTIVE.....		8
2.2.1	<i>General</i>		8
2.2.2	<i>Technical criteria</i>		8
2.2.3	<i>NXL frequency converter EMC classification</i>		8
2.2.4	<i>Manufacturer's declaration of conformity</i>		9
3.	RECEIPT OF DELIVERY		11
3.1	TYPE DESIGNATION CODE.....		11
3.2	STORAGE.....		11
3.3	MAINTENANCE.....		12
3.4	WARRANTY.....		12
4.	TECHNICAL DATA		13
4.1	INTRODUCTION.....		13
4.2	POWER RATINGS.....		15
4.2.1	<i>NXL – Mains voltage 208 – 240 V</i>		15
4.2.2	<i>NXL – Mains voltage 380 – 500 V</i>		15
4.3	TECHNICAL DATA.....		16
5.	INSTALLATION		18
5.1	MOUNTING.....		18
5.1.1	<i>MF2 and MF3</i>		18
5.1.2	<i>MF4 – MF6</i>		21
5.2	COOLING.....		22
5.3	CHANGING EMC PROTECTION CLASS FROM H TO T.....		23
6.	CABLING AND CONNECTIONS		24
6.1	POWER CONNECTIONS.....		24
6.1.1	<i>Cabling</i>		25
6.1.1.1	<i>Cable and fuse sizes</i>		25
6.1.2	<i>Installation instructions</i>		26
6.1.2.1	<i>Stripping lengths of motor and mains cables</i>		27
6.1.2.2	<i>Installation of cables to NXL</i>		28
6.1.3	<i>Cable installation and the UL standards</i>		34
6.1.4	<i>Cable and motor insulation checks</i>		34
6.2	CONTROL UNIT.....		35
6.2.1	<i>Control connections</i>		35
6.2.2	<i>Control I/O</i>		36
6.2.3	<i>Control terminal signals</i>		37
6.2.3.1	<i>Jumper selections on NXL basic board</i>		38
7.	CONTROL KEYPAD		41
7.1	INDICATIONS ON THE KEYPAD DISPLAY.....		41
7.1.1	<i>Drive status indications</i>		41
7.1.2	<i>Control place indications</i>		42
7.1.3	<i>Numeric indications</i>		42

7.2	KEYPAD PUSH-BUTTONS	43
7.2.1	<i>Button descriptions</i>	43
7.3	NAVIGATION ON THE CONTROL KEYPAD.....	44
7.3.1	<i>Monitoring menu (M1)</i>	48
7.3.2	<i>Parameter menu (P2)</i>	50
7.3.3	<i>Keypad control menu (K3)</i>	52
7.3.3.1	Selection of control place	52
7.3.3.2	Keypad reference.....	53
7.3.3.3	Keypad direction	53
7.3.3.4	Stop button activation.....	53
7.3.4	<i>Active faults menu (F4)</i>	54
7.3.4.1	Fault types	54
7.3.4.2	Fault codes	55
7.3.5	<i>Fault history menu (H5)</i>	57
7.3.6	<i>System menu (S6)</i>	58
7.3.6.1	Copy parameters.....	60
7.3.6.2	Security	60
7.3.6.3	Keypad settings.....	61
7.3.6.4	Hardware settings	62
7.3.6.5	System information	63
7.3.6.6	AI mode	66
7.3.6.7	Fieldbus parameters	66
7.3.7	<i>Expander board menu (E7)</i>	68
7.4	FURTHER KEYPAD FUNCTIONS.....	68
8.	COMMISSIONING	69
8.1	SAFETY	69
8.2	COMMISSIONING OF THE FREQUENCY CONVERTER	69
8.3	BASIC PARAMETERS	72
8.3.1	<i>Monitoring values (Control keypad: menu M1)</i>	72
8.3.2	<i>Basic parameters (Control keypad: Menu P2 → B2.1)</i>	73
9.	FAULT TRACING	75
10.	DESCRIPTION OF EXPANDER BOARD NXOPTAA	77



1. SAFETY




ONLY A COMPETENT ELECTRICIAN MAY CARRY OUT THE ELECTRICAL INSTALLATION




1.1 Warnings

 WARNING  HOT SURFACE	1	The components of the power unit of the frequency converter are live when the NXL 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 (T1, T2, T3) and the DC-link/brake resistor terminals -/+ (in NXL ≥ 1.1 kW) are live when NXL 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 NXL is disconnected from mains.
	4	The frequency converter has a large 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 Honeywell can be used.
	7	The heat sink of types MF2 and MF3 may be hot when the frequency converter is in use. Coming into contact with the heat sink may cause burns.

1.2 Safety instructions

	1	The NXL frequency converter is meant for fixed installations only.
	2	Do not perform any measurements when the frequency converter is connected to the mains.
	3	After disconnecting the frequency converter from the mains, wait until the fan stops and the indicators on the display go out. Wait 5 more minutes before doing any work on NXL connections.
	4	Do not perform any voltage withstand tests on any part of NXL. There is a certain procedure according to which the tests can be performed. Ignoring this procedure may result in damaged product.
	5	Prior to measurements on the motor or the motor cable, disconnect the motor cable from the frequency converter.
	6	Do not touch the IC-circuits on the circuit boards. Static voltage discharge may damage the components.

1.3 Earthing and earth fault protection

The NXL frequency converter must always be earthed with an earthing conductor connected to the earthing terminal .

The earth fault protection inside the frequency converter protects only the converter itself against earth faults in the motor or the motor cable.

Due to the high capacitive currents present in the frequency converter, fault current protective switches may not function properly. If fault current protective switches are used they must be tested with the drive with earth fault currents that are possible to arise in fault situations.

1.4 Running the motor

Warning symbols

For personal safety, please pay special attention to the instructions marked with the following symbols:



= **Dangerous voltage**



WARNING

= **General warning**



HOT SURFACE

= **Hot surface – Risk of burn**

MOTOR RUN CHECK LIST

 WARNING	1	Before starting the motor, check that the motor 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) according to the motor and the machine connected to it.
	3	Before reversing the motor shaft rotation direction ensure that this can be done safely.
	4	Ensure that no power factor correction capacitors are connected to the motor cable.
	5	Ensure that the motor terminals are not connected to mains potential.

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). It also guarantees that the product meets the various requirements placed upon it (such as the EMC Directive and possibly other directives according to the so-called new procedure).

NXL frequency converters carry the CE label as a proof of compliance with the Low Voltage Directive (LVD) and the Electro Magnetic Compatibility (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 they are used in, and, conversely, it shall have an adequate level of immunity toward other disturbances from the same environment.

The compliance of NXL frequency converters with the EMC directive is verified with Technical Construction Files (TCF) checked and approved by SGS FIMKO, which is a Competent Body.

2.2.2 Technical criteria

EMC compliance is a major consideration for NXL drives from the outset of the design. NXL frequency converters are marketed throughout the world, a fact which makes the EMC requirements of customers different. All NXL frequency converters are designed to fulfil even the strictest immunity requirements.

2.2.3 NXL frequency converter EMC classification

NXL frequency converters are divided into two classes according to the level of electromagnetic disturbances emitted. Later in this manual the division is made according to the mechanical sizes (MF2, MF3, etc.). The technical data of the different sizes can be found in Chapter 4:

Class N:

No EMC emission protection. NXL frames MF2 and MF3 are delivered from the factory without an external RFI filter as class N products.

Class H:

NXL frequency converters MF4 – MF6 **fulfil the requirements of the product standard EN 61800-3 + A11 for the 1st environment restricted distribution and the 2nd environment.**

The emission levels correspond to the requirements of EN 61000-6-4.

With an external optional **RFI filter** the NXL frequency converters MF2 and MF3 also fulfil these requirements.

All NX frequency converters fulfil all EMC immunity requirements (standards EN 61000-6-1, 61000-6-2 and EN 61800-3).

2.2.4 Manufacturer's declaration of conformity

The following page presents the photocopy of the Manufacturer's Declaration of Conformity assuring the compliance of NXL frequency converters with the EMC-directives.

EU DECLARATION OF CONFORMITY

We

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

hereby declare that the product

Product name: NXL Frequency converter
Model designation: NXL0001 5...to 0061 5...

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

Safety: EN 50178 (1997), EN 60204-1 (1996)
EN 60950 (3rd edition 2000, as relevant)

EMC: EN 61800-3 (1996)+A11(2000), EN
61000-6-2 (1999), EN 61000-6-4 (2001)

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.

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, 6th of September, 2002



Vesa Laisi
President

The year the CE marking was affixed: 2002

3. RECEIPT OF DELIVERY

NXL frequency converters have undergone stringent testing and quality checks during manufacture, 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, or the delivery does not correspond to the order please contact the supplier.

3.1 Type designation code

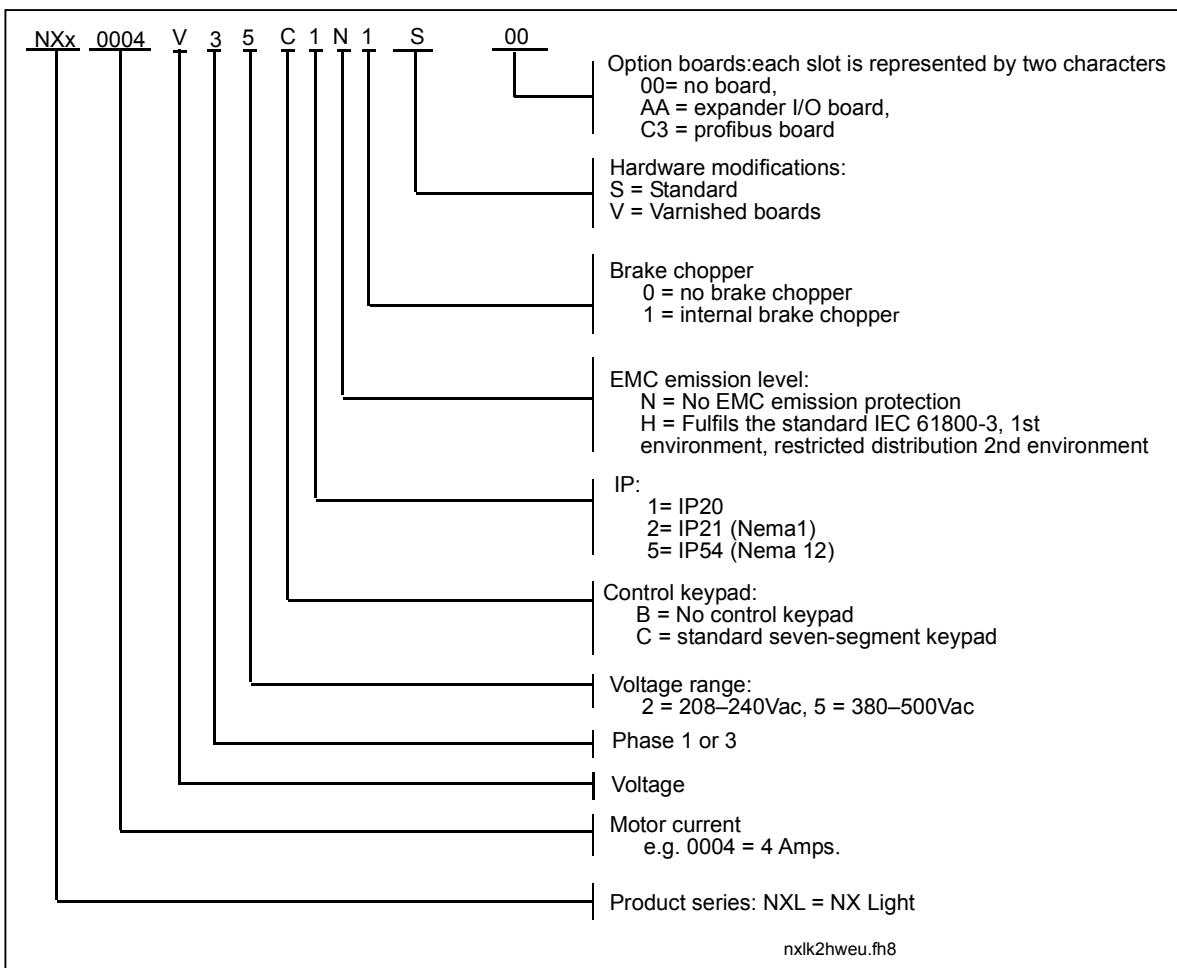


Figure 3-1. NXL type designation code

3.2 Storage

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
- Relative humidity <95%, no condensation

3.3 Maintenance

In normal conditions, NXL frequency converters are maintenance-free. However, we recommend to clean the heatsink (using e.g. a small brush) whenever necessary.

Most NXL drives are equipped with a cooling fan, which can easily be changed if necessary.

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, dust, corrosive substances or operation outside the rated specifications. Neither can the manufacturer be held responsible for consequential damages.

The Manufacturer's time of warranty is 36 months from the delivery or 24 months from the commissioning whichever expires first (General Conditions NL92/Orgalime S92).

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. The manufacturer assumes no responsibility for any other warranties granted by offers.

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

4. TECHNICAL DATA

4.1 Introduction

NXL is a compact, small-sized frequency converter with the output ranging from 220 W to 30 kW. It is well adapted for HVAC and OEM applications where its possibilities of use are almost unlimited.

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 IGBT Inverter Bridge produces a symmetrical, 3-phase PWM-modulated AC-voltage to the motor.

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. Instead of the control keypad, also a PC can be used to control the frequency converter if connected through a cable and a serial interface adapter (optional equipment).

NXL drive can be equipped with control I/O boards NXOPTAA, NXOPTB_ or NXOPTC_.

All other sizes but MF2 have an internal brake chopper. For closer information, contact the Manufacturer or the local distributor (see back cover). The input EMC filters are available as options externally for MF2 and MF3. In other sizes the filters are internal and included as standard.

The NXL frequency converters are professional drives intended to be connected to industrial networks. According to IEC 61000-5-2, drives up to 1kW must be equipped with an input EMC filter if they are directly connected to general distribution network.

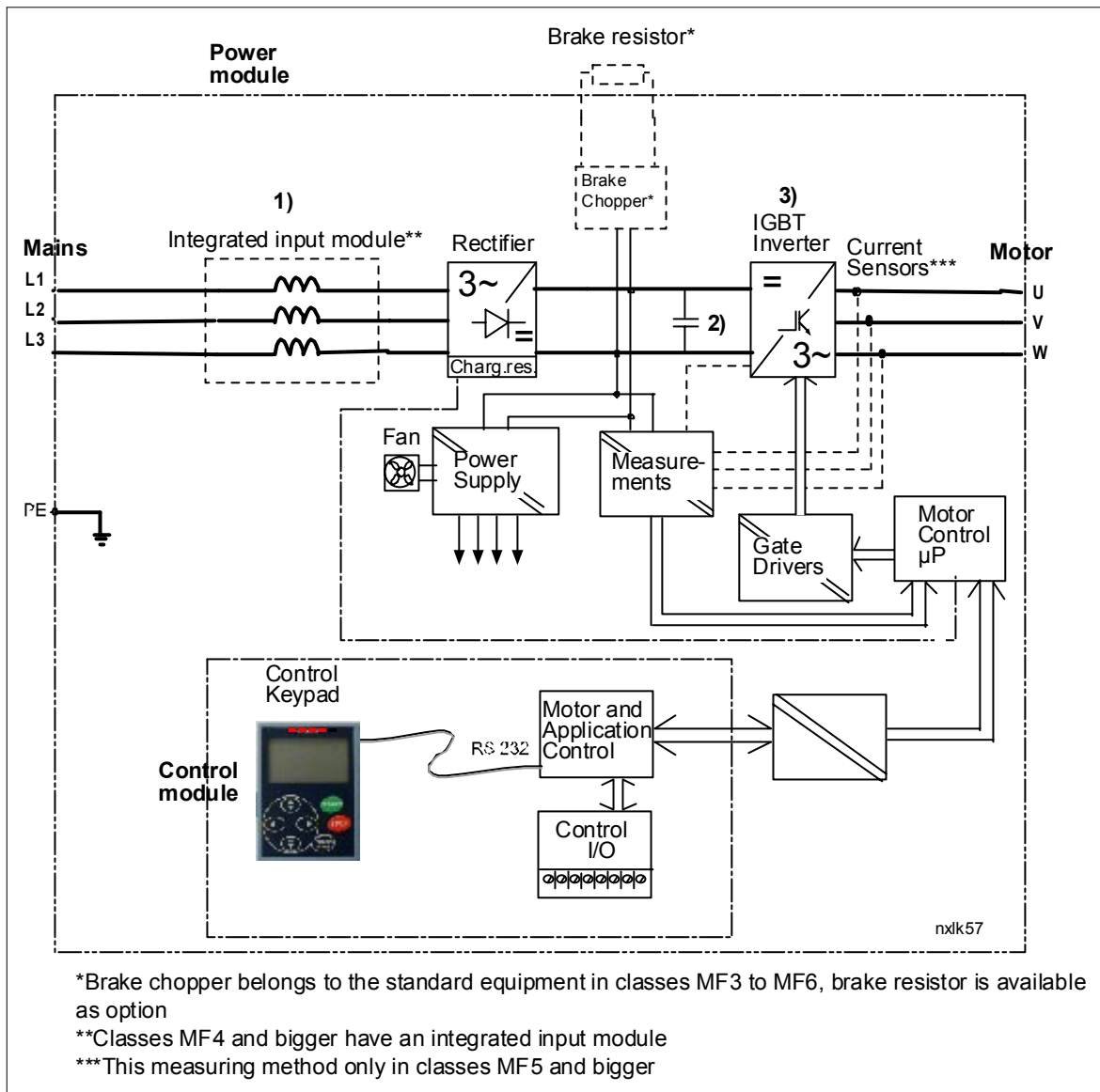


Figure 4-1. NXL block diagram

4.2 Power ratings

4.2.1 NXL – Mains voltage 208 – 240 V

Mains voltage 208-240 V, 50/60 Hz, 1~/3~ Series NXL												
Frequency converter type		Loadability				Motor shaft power		Nominal input current 1~/3~	Mechanical size Enclosure and protection class	Dimensions WxHxD	Weight (kg)	
		Low		High		Low	High					
		Rated continuous current I _L (A)	10% overload current (A)	Rated continuous current I _H (A)	50% overload current (A)	40°C P(kW)	50°C P(kW)					
EMC-level N	NXL 0002 2	2,4	2,6	1,7	2,6	0,37	0,25	4,8	MF2/IP20	60x130x150	1,0	
	NXL 0003 2	3,7	4,1	2,8	4,2	0,75	0,55	7,4/5,6	MF3/IP20	84x184x174	1,9	
	NXL 0004 2	4,8	5,3	3,7	5,6	1,1	0,75	9,6/7,2	MF3/IP20	84x184x174	1,9	
	NXL 0006 2	6,6	7,3	4,8	7,2	1,5	1,1	13,2/9,9	MF3/IP20	84x220x174	2,0	

Table 4-1. Power ratings and dimensions of NXL, supply voltage 208—240V.

4.2.2 NXL – Mains voltage 380 – 500 V

Mains voltage 380-500 V, 50/60 Hz, 3~ Series NXL													
Frequency converter type		Loadability				Motor shaft power				Nominal input current	Mechanical size Enclosure and protection class	Dimensions WxHxD	Weight (kg)
		Low		High		380V supply		500V supply					
		Rated continuous current I _L (A)	10% overload current (A)	Rated continuous current I _H (A)	50% overload current (A)	10% overload 40°C P(kW)	50% overload 50°C P(kW)	10% overload 40°C P(kW)	50% overload 50°C P(kW)				
EMC-level N	NXL 0001 5	1,9	2,1	1,3	2	0,55	0,37	0,75	0,37	2,9	MF2/IP20	60x130x150	1,0
	NXL 0002 5	2,4	2,6	1,9	2,9	0,75	0,55	0,75	0,75	3,6	MF2/IP20	60x130x150	1,0
	NXL 0003 5	3,3	3,6	2,4	3,6	1,1	0,75	1,1	0,75	5,0	MF3/IP20	84x184x150	1,9
	NXL 0004 5	4,3	4,7	3,3	5	1,5	1,1	1,5	1,1	6,5	MF3/IP20	84x184x174	1,9
	NXL 0005 5	5,4	5,9	4,3	6,5	2,2	1,5	2,2	1,5	8,1	MF3/IP20	84x220x174	2,0

EMC-level H	NXL 0003 5	3,3	3,6	2,2	3,3	1,1	0,75	1,5	1,1	3,3	MF4/IP21,IP54	128x292x190	5
	NXL 0004 5	4,3	4,7	3,3	5,0	1,5	1,1	2,2	1,5	4,3	MF4/IP21,IP54	128x292x190	5
	NXL 0005 5	5,4	5,9	4,3	6,5	2,2	1,5	3	2,2	5,4	MF4/IP21,IP54	128x292x190	5
	NXL 0007 5	7,6	8,4	5,6	8,4	3	2,2	4	3	7,6	MF4/IP21,IP54	128x292x190	5
	NXL 0009 5	9	9,9	7,6	11,4	4	3	5,5	4	9	MF4/IP21,IP54	128x292x190	5
	NXL 0012 5	12	13,2	9	13,5	5,5	4	7,5	5,5	12	MF4/IP21,IP54	128x292x190	5
	NXL 0016 5	16	17,6	12	18	7,5	5,5	11	7,5	16	MF5/IP21,IP54	144x391x214	8,1
	NXL 0023 5	23	25,3	16	24	11	7,5	15	11	23	MF5/IP21,IP54	144x391x214	8,1
	NXL 0031 5	31	34	23	35	15	11	18,5	15	31	MF5/IP21,IP54	144x391x214	8,1
	NXL 0038 5	38	42	31	47	18,5	15	22	18,5	38	MF6/IP21, IP54	195x519x237	18,5
NXL 0045 5	45	51	38	57	22	18,5	30	22	45	MF6/IP21, IP54	195x519x237	18,5	
NXL 0061 5	61	67	46	69	30	22	37	30	61	MF6/IP21, IP54	195x519x237	18,5	

Table 4-2. Power ratings and dimensions of NXL, supply voltage 380 – 500V.

4.3 Technical data

Mains connection	Input voltage U_{in}	208...240V; 380...500V
	Input frequency	45...66 Hz
	Connection to mains	Once per minute or less (normal case)
Motor connection	Output voltage	0— U_{in}
	Continuous output current	I_H : Ambient temperature max. +50°C, overload 1.5 x I_H (1min/10min) I_L : Ambient temperature max. +40°C, overload 1.1 x I_L (1min/10min)
	Starting torque	150% (Low overload); 200% (High overload)
	Starting current	2 x I_H 2 secs every 20 secs, if output frequency <30Hz and temperature of heatsink <+60°C
	Output frequency	0...320 Hz
	Frequency resolution	0,01 Hz
Control characteristics	Control method	Frequency Control U/f Open Loop Sensorless Vector Control
	Switching frequency (See parameter 2.6.8)	1...16 kHz; Factory default 6 kHz
	<u>Frequency reference</u> Analogue input Keypad reference	Resolution 0.1% (10bit), accuracy ±1% Resolution 0.01 Hz
	Field weakening point	30...320 Hz
	Acceleration time	0...3000 sec
	Deceleration time	0...3000 sec
	Braking torque	DC-brake: 30%* T_N (without brake option)
Ambient conditions	Ambient operating temperature	-10°C (no frost)...+50°C: I_H -10°C (no frost)...+40°C: I_L
	Storage temperature	-40°C...+70°C
	Relative humidity	0...95% RH, non-condensing, non-corrosive, 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
	Altitude	100% load capacity (no derating) up to 1000m 1-% derating for each 100m above 1000m; max. 3000m
	Vibration: EN50178/EN60068-2-6	5...150 Hz Displacement amplitude 1(peak) mm at 5...15.8 Hz Max acceleration amplitude 1 G at 15.8...150 Hz
	Shock EN50178, IEC 68-2-27	UPS Drop Test (for applicable UPS weights) Storage and shipping: max 15 G, 11 ms (in package)
	Enclosure class	IP20; MF2 and MF3. IP21/IP54; MF4 – MF6
EMC	Immunity	Complies with EN50082-1, -2, EN61800-3
	Emissions	<u>MF2-MF3</u> : EMC level N; With an external RFI filter (option) attached EMC-level H (see Ch. 6.1.2.2) <u>MF4-MF6</u> : EMC-level H: EN 61800-3 (1996)+A11 (2000) 1. environment, restricted use; 2. environment); EN 61000-6-4

Technical data (continues on next page)

Safety		EN50178, EN60204-1, CE, UL, cUL, FI, GOST R, IEC 61800-5 (see unit nameplate for more detailed approvals)
Control connections	Analogue input voltage	0...+10V, $R_i = 200k\Omega$, Resolution 10 bit, accuracy $\pm 1\%$
	Analogue input current	0(4)...20 mA, $R_i = 250\Omega$ differential
	Digital inputs (3)	Positive logic; 18...24VDC
	Auxiliary voltage	+24V, $\pm 15\%$, max. 100mA
	Output reference voltage	+10V, $+3\%$, max. load 10mA
	Analogue output	0(4)...20mA; R_L max. 500 Ω ; resolution 16 bit; accuracy $\pm 1\%$
	Relay outputs	1 programmable change over relay output Switching capacity: 24VDC/8A, 250VAC/8A, 125VDC/0.4A
Protections	Overvoltage protection	NXL_2 : 437VDC; NXL_5 : 911VDC
	Undervoltage protection	NXL_2 : 183VDC; NXL_5 : 333VDC
	Earth-fault protection	In case of earth fault in motor or motor cable, only the frequency converter is protected
	Unit overtemperature protection	Yes
	Motor overload protection	Yes
	Motor stall protection	Yes
	Motor underload protection	Yes
	Short-circuit protection of +24V and +10V reference voltages	Yes
Overcurrent protection	Trip limit $4,0 \cdot I_H$ instantaneously	

Table 4- 3. Technical data

5. INSTALLATION

5.1 Mounting

5.1.1 MF2 and MF3

There are two possible positions in the wall mounting for the frames MF2 and MF3 (see Figure 5-1)

The NXL type **MF2** is mounted with two screws using the middle holes of the mounting plates. If an RFI filter is used, the upper mounting plate shall be attached with **two** screws. MF3 and bigger types are always mounted with **four** screws, see Figure 5-2.



Figure 5-1. The two possible mounting positions of NXL (MF2 and MF3)

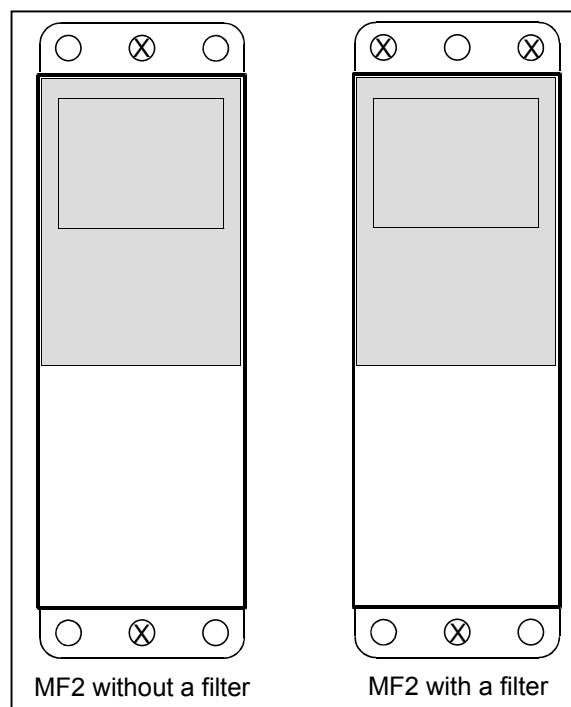


Figure 5-2. Mounting of NXL, MF2

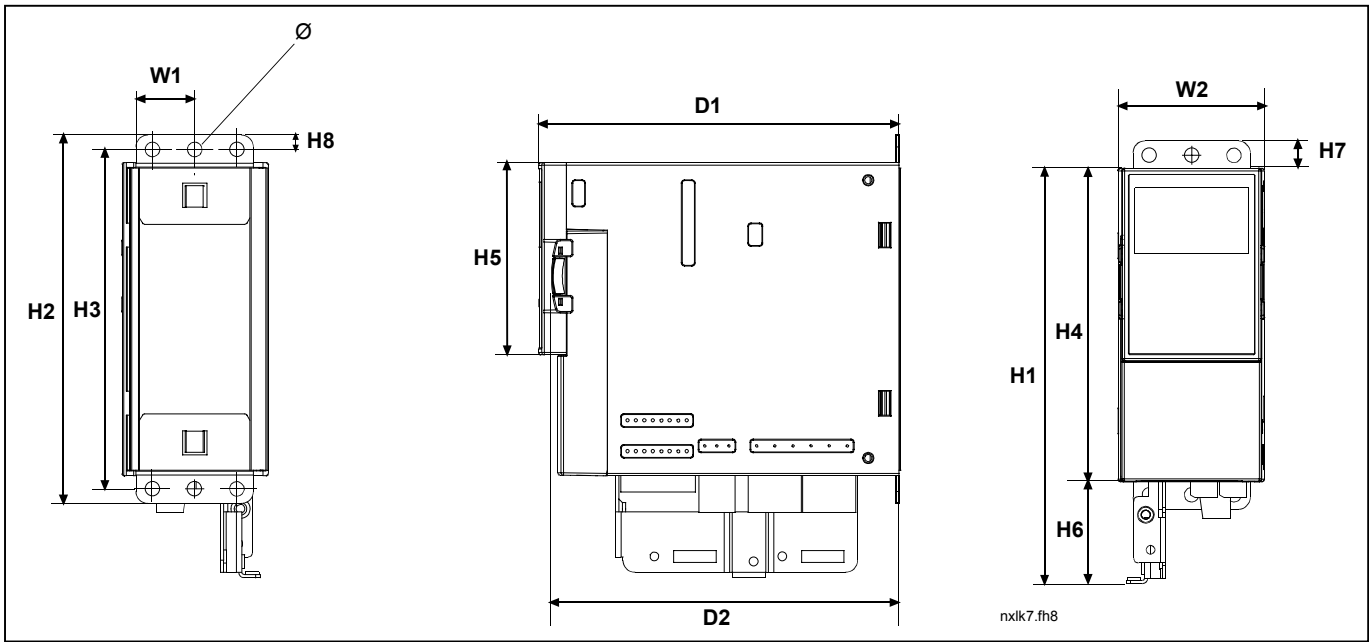


Figure 5-3. NXL dimensions, MF2

Type	Dimensions (mm)												
	W1	W2	H1	H2	H3	H4	H5	H6	H7	H8	D1	D2	Ø
MF2	30	60	172	152	140	130	80	42	11	6	150	144	6

Table 5-1. Dimensions of NXL, MF2

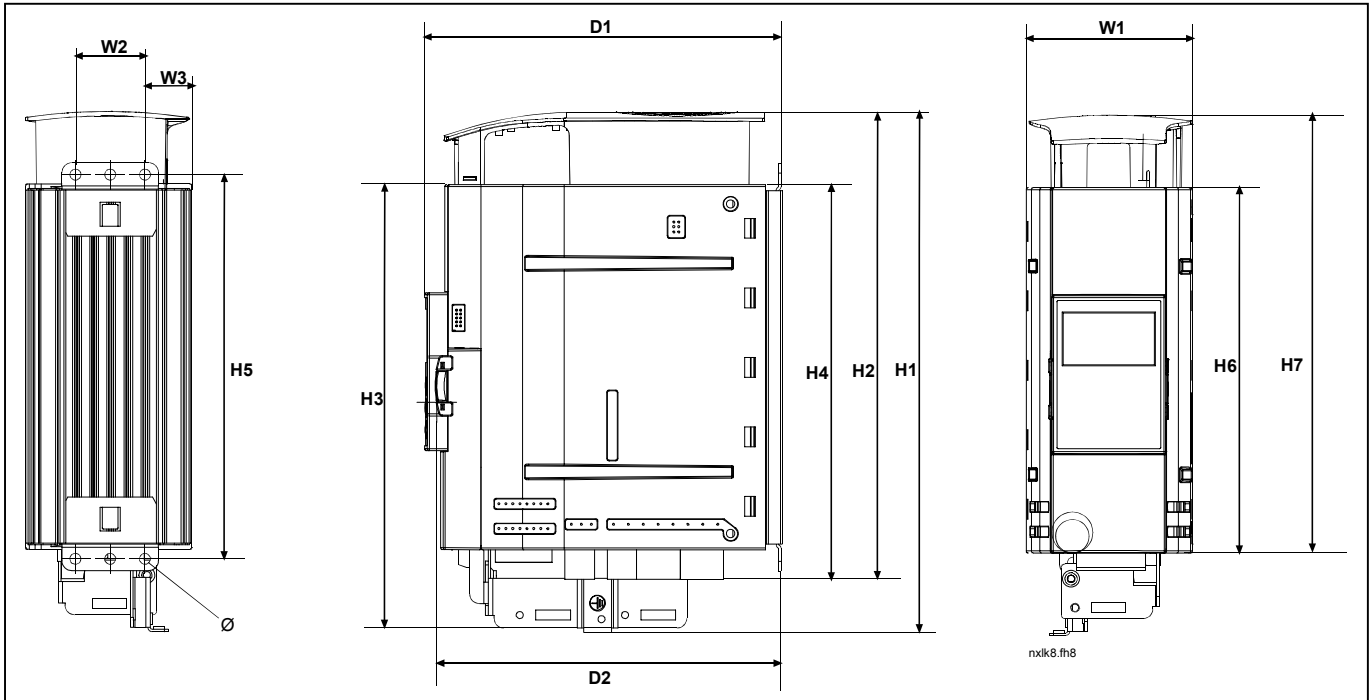


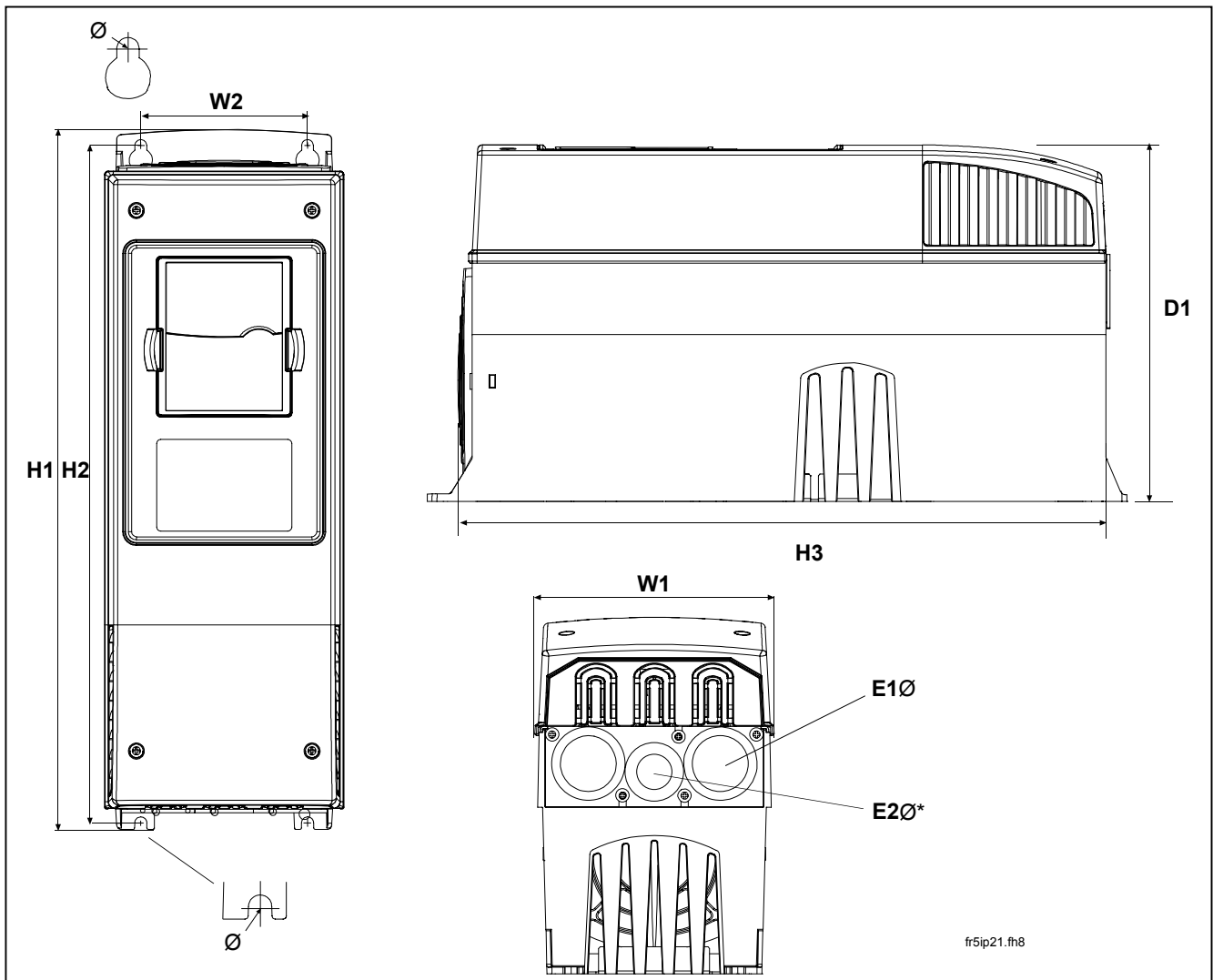
Figure 5-4. NXL dimensions, MF3

Type	Dimensions (mm)												
	W1	W2	W3	H1	H2	H3	H4	H5	H6	H7	D1	D2	Ø
MF3	84	35	23	262	235	223	199	193	184	220	172	166	6

Table 5-2. Dimensions of NXL, MF3

5.1.2 MF4 – MF6

The frequency converter shall be fixed with four screws (or bolts, depending on the unit size). Enough space shall be reserved around the frequency converter in order to ensure a sufficient cooling, see page 22.



Also see to that the mounting plane is relatively even

Figure 5-5. NXL dimensions, MF4 and MF5

Type	Dimensions								
	W1	W2	H1	H2	H3	D1	Ø	E1Ø	E2Ø*
MF4	128	100	327	313	292	190	7	3 x 28,3	
MF5	144	100	419	406	391	214	7	2 x 37	1 x 28,3
MF6	195	148	558	541	519	237	9	3 x 37	

Table 5-3. Dimensions of NXL, MF4—MF5

* = MF5 only

5.2 Cooling

The cooling method in NXL drive is either convection or air cooling with a cooling fan. The cooling method for lower power ranges (frame MF2 and lower powers of MF3) is a convection type cooling. Forced air flow cooling is used for frames MF4, MF5, MF6 and higher powers of MF3.

Enough free space shall be left above and below the frequency converter to ensure sufficient air circulation and cooling. The required dimensions for free space are presented in the table below.

Type	Dimensions [mm]			
	A	B	C	D
0001-0005 NXL 5	10	10	100	50
0007-0012 NXL 5	20	20	100	50
0016-0032 NXL 5	20	20	120	60
0038-0061 NXL 5	30	20	160	80

Table 5-4. Mounting space dimensions

- A** = clearance around the freq. converter (see also **B**)
- B** = distance from one frequency converter to another or distance to cabinet wall
- C** = free space above the frequency converter
- D** = free space underneath the frequency converter

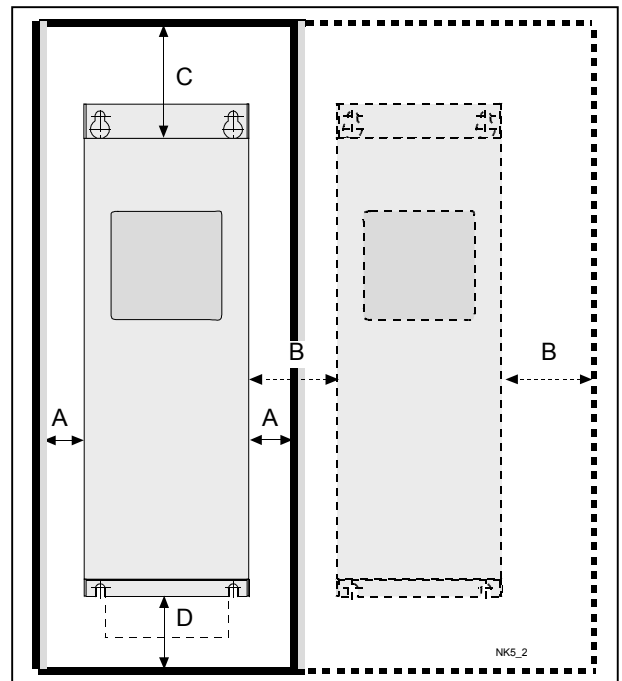


Figure 5-6. Installation space

5.3 Changing EMC protection class from H to T

The EMC protection class of NXL frequency converter types MF4 – MF6 can be changed from **class H** to **class T** with a simple procedure presented in the figures below.

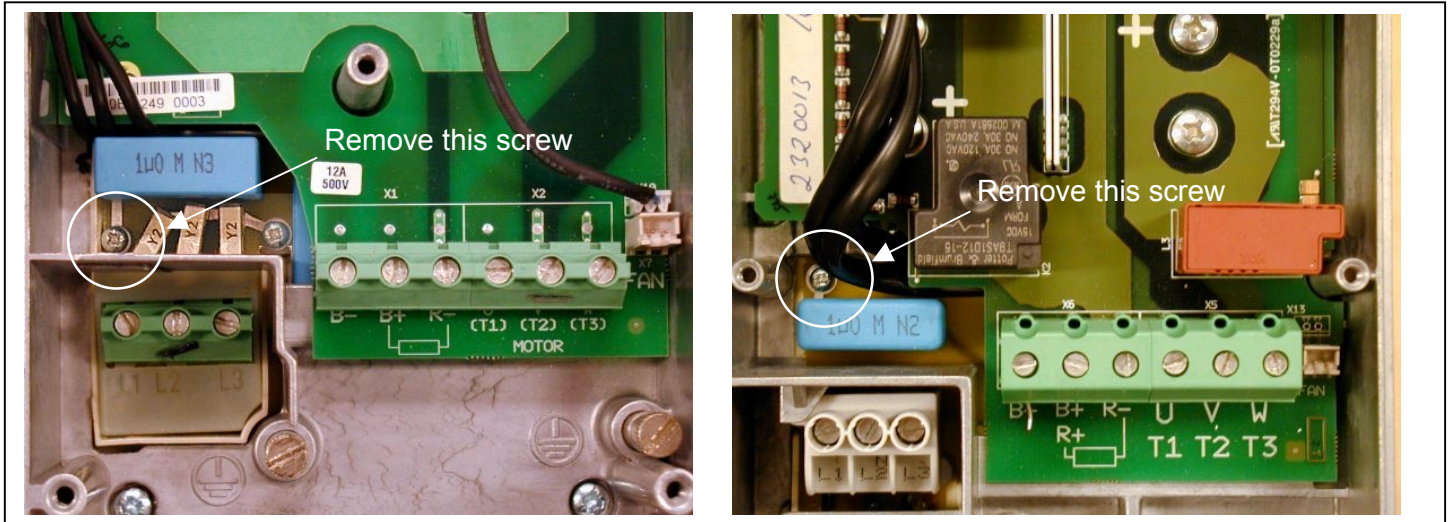


Figure 5-7. Changing of EMC protection class, MF4 (right) and MF5 (left).

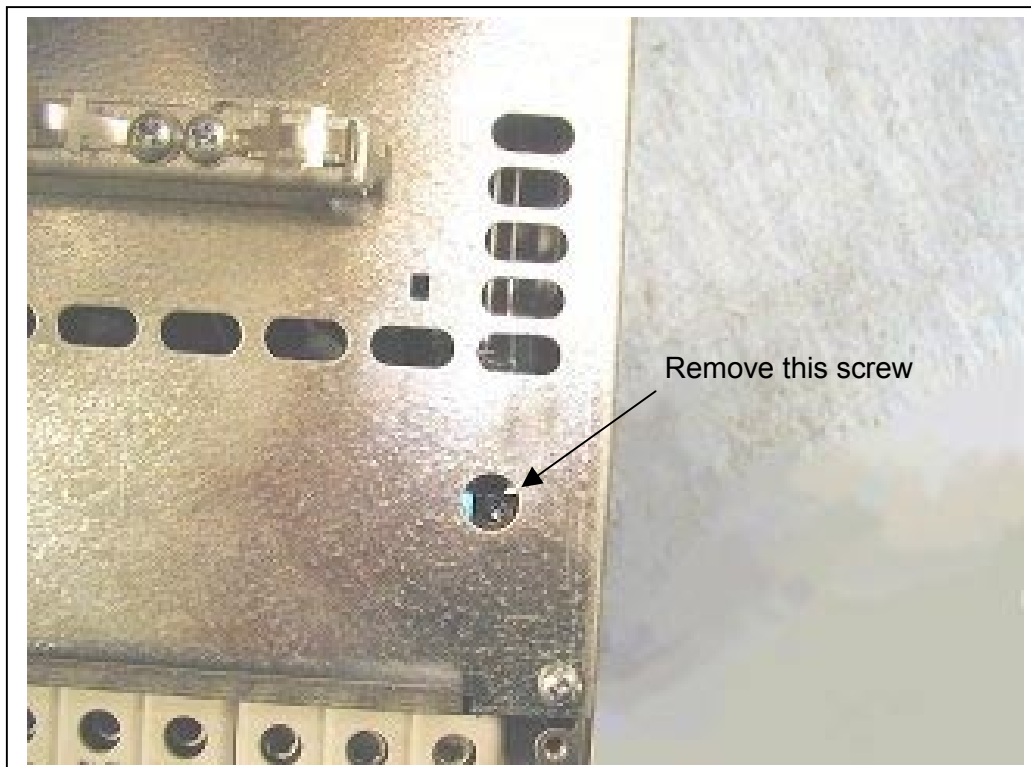


Figure 5-8. Changing of EMC protection class, MF6

6. CABLING AND CONNECTIONS

6.1 Power connections

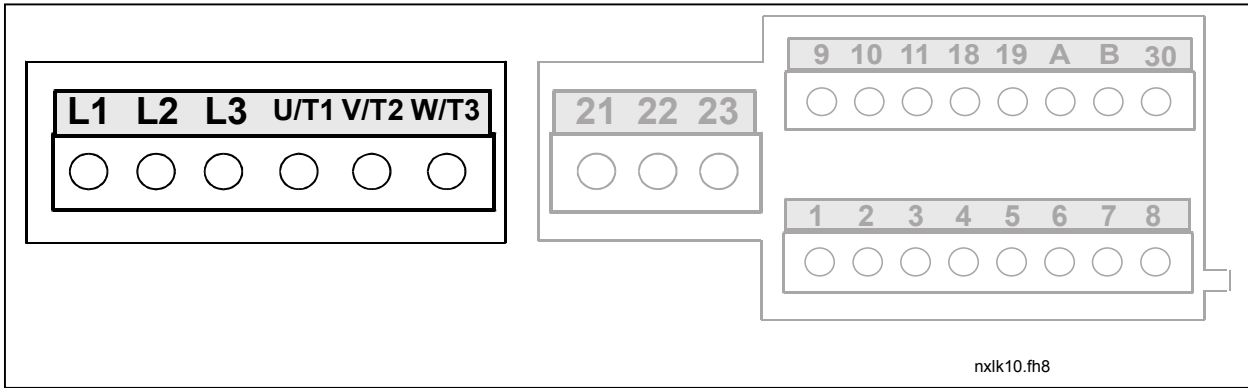


Figure 6-1. Power connections, MF2

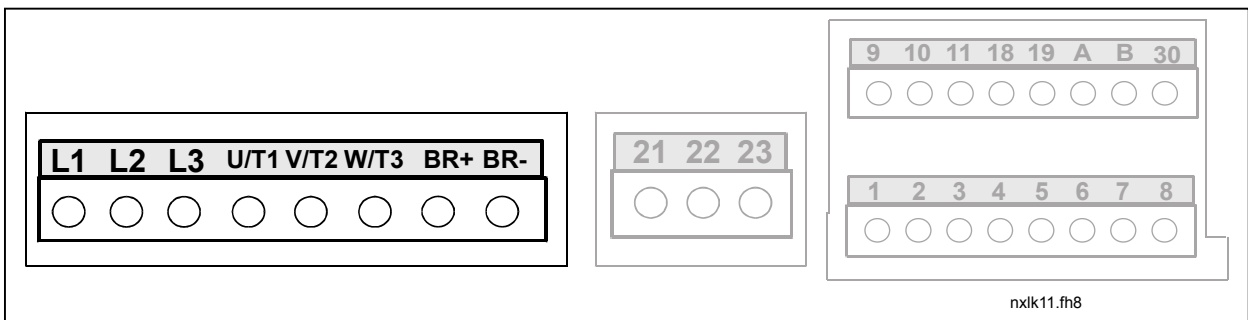


Figure 6-2. Power connections, MF3

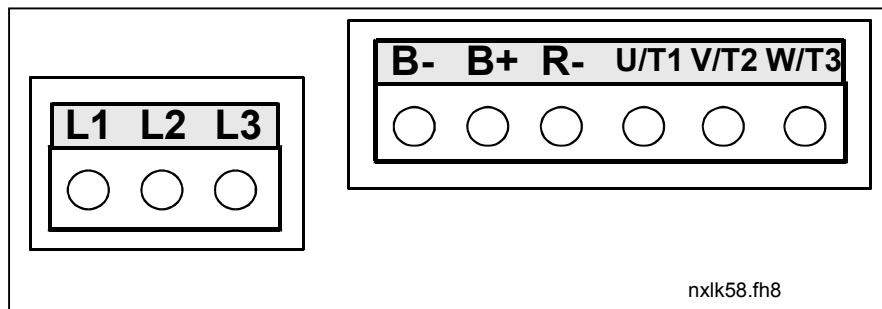


Figure 6-3. Power connections, MF4 to MF6

6.1.1 Cabling

Use cables with heat resistance of at least +60°C. The cables and the fuses must be dimensioned according to the tables below. Installation of cables according to UL regulations is presented in Chapter 6.1.3.

The fuses function also as cable overload protection.

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

<u>Mains cable</u>	Power cable intended for fixed installation and the specific mains voltage. Shielded cable not required. (NKCABLES/MCMK or similar recommended)
<u>Motor cable</u>	Power cable equipped with concentric protection wire and intended for the specific mains voltage. (NKCABLES /MCMK or similar recommended). OR: If EN61800-3 1 st environment is required, a cable with low-impedance shield.
<u>Control cable</u>	Screened cable equipped with compact low-impedance shield (NKCABLES /jamak, SAB/ÖZCuY-O or similar).

6.1.1.1 Cable and fuse sizes

The control cables shall be at least 0.5 mm² screened multicore cables. The maximum terminal wire size is 2.5 mm² for the relay terminals and 1.5 mm² for other terminals.


Frame	Type	I _L [A]	Fuse [A]	Mains cable Cu [mm ²]	Terminal cable size (max)	
					Main terminal [mm ²]	Earth terminal [mm ²]
MF2	0002	2	10	2*1.5+1.5	0.5—2.5	0.5—2.5
MF3	0003—0006	3-6	16	2*2.5+2.5	0.5—2.5	0.5—2.5

Table 6-1. Cable and fuse sizes for NXL, 208 - 240V

Frame	Type	I _L [A]	Fuse [A]	Mains cable Cu [mm ²]	Terminal cable size (max)	
					Main terminal [mm ²]	Earth terminal [mm ²]
MF2	0001—0002	1-2	10	3*1.5+1.5	0.5—2.5	0.5—2.5
MF3	0003—0005	1-5	10	3*1.5+1.5	0.5—2.5	0.5—2.5
MF4	0007—0009	7—9	10	3*1.5+1.5	1—4	1—2.5
MF4	0012	12	16	3*2.5+2.5	1—4	1—2.5
MF5	0016	16	20	3*4+4	1—10	1—10
MF5	0023	22	25	3*6+6	1—10	1—10
MF5	0031	31	35	3*10+10	1—10	1—10
MF6	0038—45	38—45	50	3*10+10	2.5—50 Cu 6—50 Al	6—35
MF6	0061	61	63	3*16+16	2.5—50 Cu 6—50 Al	6—35

Table 6-2. Cable and fuse sizes for NXL, 380 – 500V

6.1.2 Installation instructions

1	Before starting the installation, check that none of the components of the frequency converter is live.						
2	The frequency converter shall be installed inside a switchgear, separate cubicle or electrical room because of the protection class IP20 and the fact that the cable terminals are not protected.						
3	<p>Place the motor cables sufficiently far from other cables:</p> <ul style="list-style-type: none"> ▪ Avoid placing the motor cables in long parallel lines with other cables ▪ If the motor cables runs 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. ▪ The maximum length of the motor cables is 30 m (MF2-MF3), 50 m (MF4) and 300 m (MF5 – MF6). ▪ The motor cables should cross other cables at an angle of 90 degrees. <table style="margin-left: auto; margin-right: auto; border: none;"> <thead> <tr> <th style="text-align: center;">Distance between cables (m)</th> <th style="text-align: center;">Shielded cable (m)</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">0.3</td> <td style="text-align: center;">≤20</td> </tr> <tr> <td style="text-align: center;">1.0</td> <td style="text-align: center;"><50</td> </tr> </tbody> </table>	Distance between cables (m)	Shielded cable (m)	0.3	≤20	1.0	<50
Distance between cables (m)	Shielded cable (m)						
0.3	≤20						
1.0	<50						
4	If cable insulation checks are needed, see Chapter 6.1.4.						
5	<p>Connect the cables:</p> <ul style="list-style-type: none"> ▪ Strip the motor and mains cables as advised in Table 6-3 and Figure 6-4. ▪ Connect the mains, motor and control cables into their respective terminals (see e.g. Figure 6-6). ▪ For Information on cable installation according to UL regulations see Chapter 6.1.3. ▪ 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. ▪ Check the connection of the earth cable to the motor and the frequency converter terminals marked with . ▪ Connect the separate shield of the motor cable to the earth plate of the frequency converter, motor and the supply centre. ▪ Ensure that the control cables or the cables of the unit are not trapped between the frame and the protection plate. 						

6.1.2.1 Stripping lengths of motor and mains cables

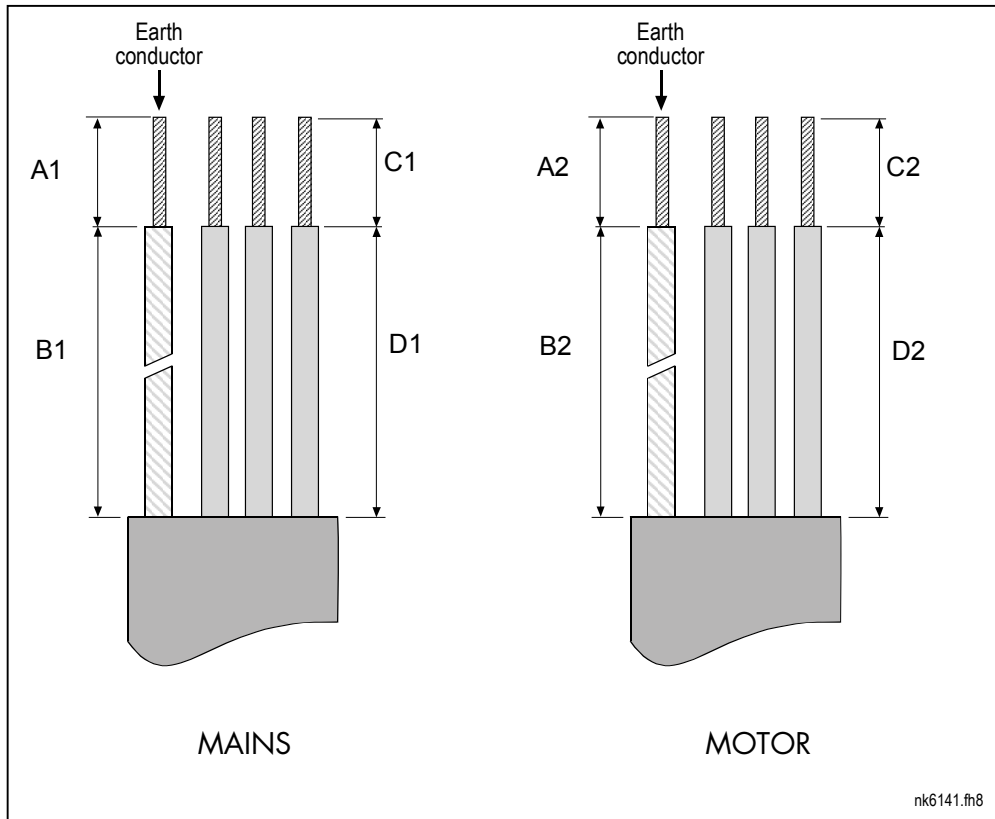


Figure 6-4. Stripping of cables

Frame	A1	B1	C1	D1	A2	B2	C2	D2
MF2	7	35	7	20	7	50	7	35
MF3	7	40	7	30	7	60	7	40
MF4	15	35	10	20	7	50	7	35
MF5	20	40	10	30	20	60	10	40
MF6	20	90	15	60	20	90	15	60

Table 6-3. Cables stripping lengths [mm]

6.1.2.2 Installation of cables to NXL

Note: In case of connecting an external brake resistor (MF3 and bigger sizes), see separate Brake Resistor Manual.



Figure 6-5. NXL, MF2

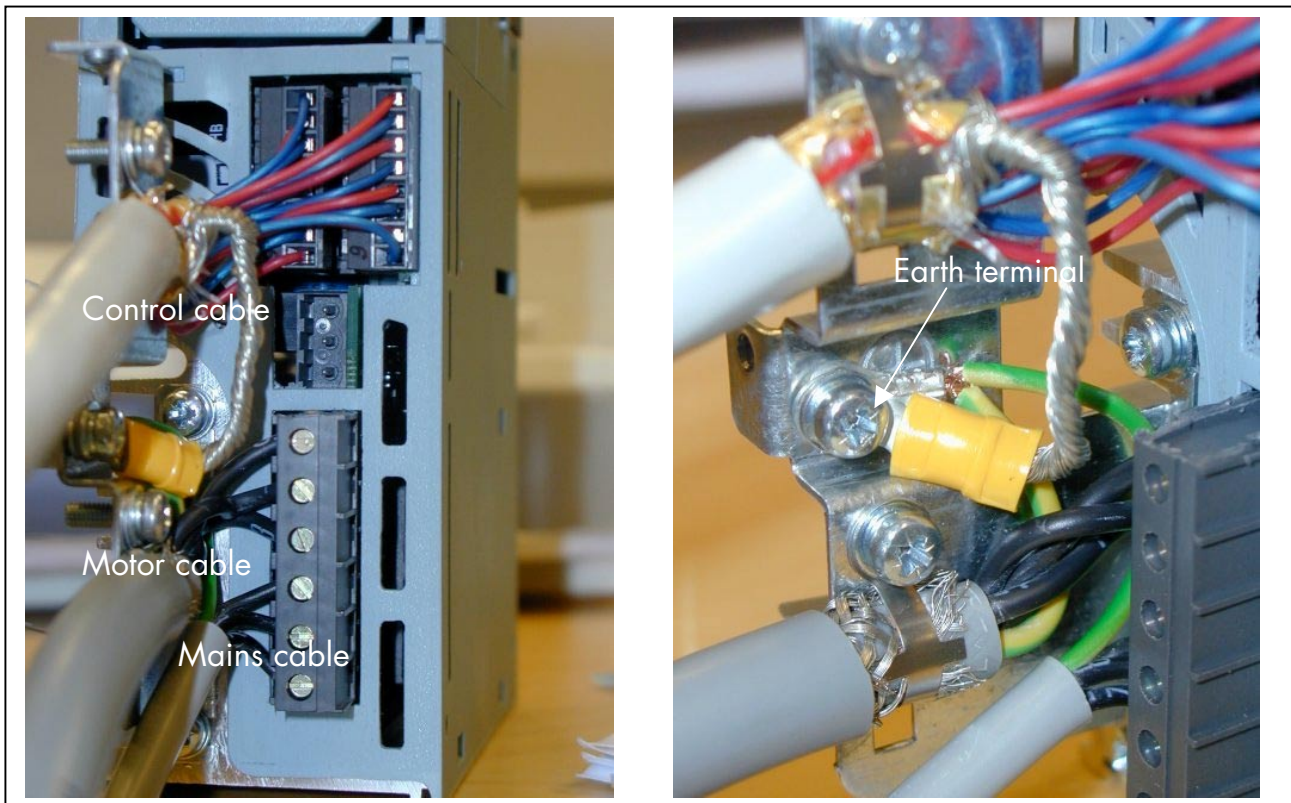


Figure 6-6. Cable installation in NXL, MF2



Figure 6-7. NXL, MF3

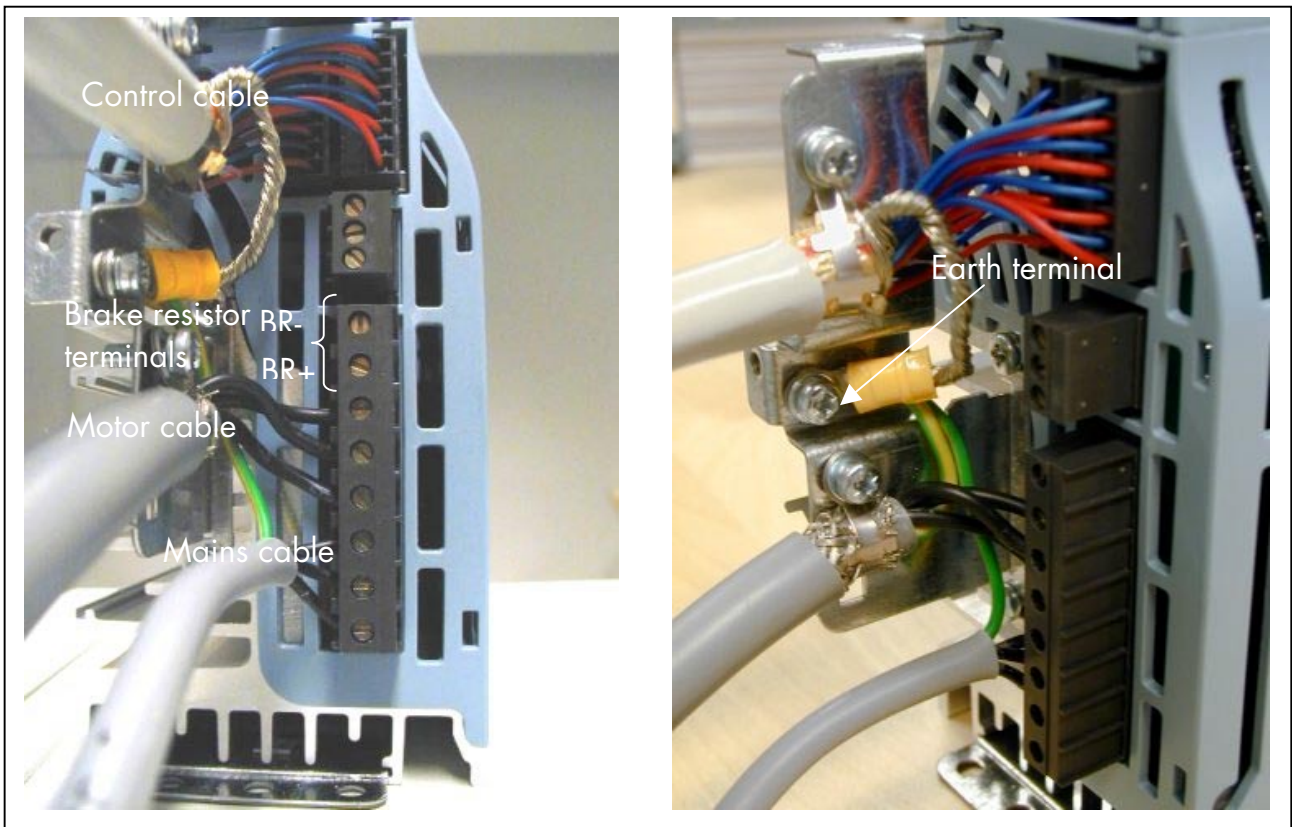


Figure 6-8. Cable installation in NXL, MF3

NOTE! MF2-MF3: It is advisable to connect the cables to the terminals and earthing plate first and then attach the terminals and earthing plate to the unit.

The installation of an external RFI filter

The EMC protection class of NXL frequency converters MF2 and MF3 can be changed from **N** to **H** with an optional external RFI filter. Install the power cables in terminals L1, L2 and L3 and the grounding cable in terminal PE of the filter. See figure below. See also mounting instructions of MF2 in Figure 5-2.



Figure 6-9. MF2 with a RFI-filter

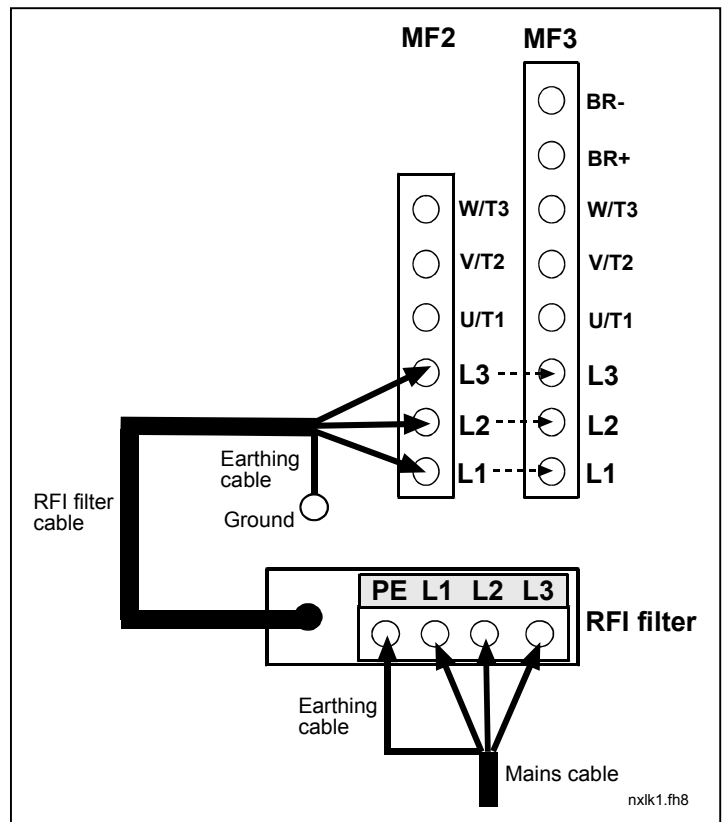


Figure 6-10. RFI filter cable installation in Vacon NXL



Figure 6-11. NXL, MF4

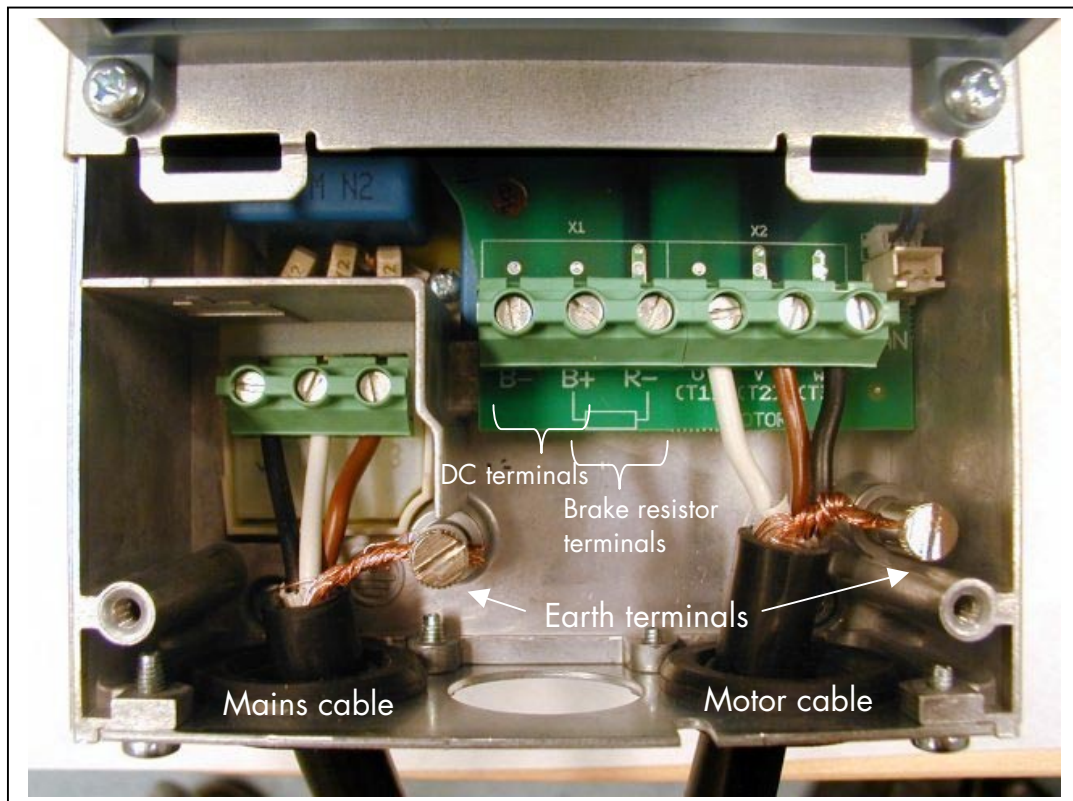


Figure 6-12. Cable installation in NXL, MF4



Figure 6-13. NXL, MF5

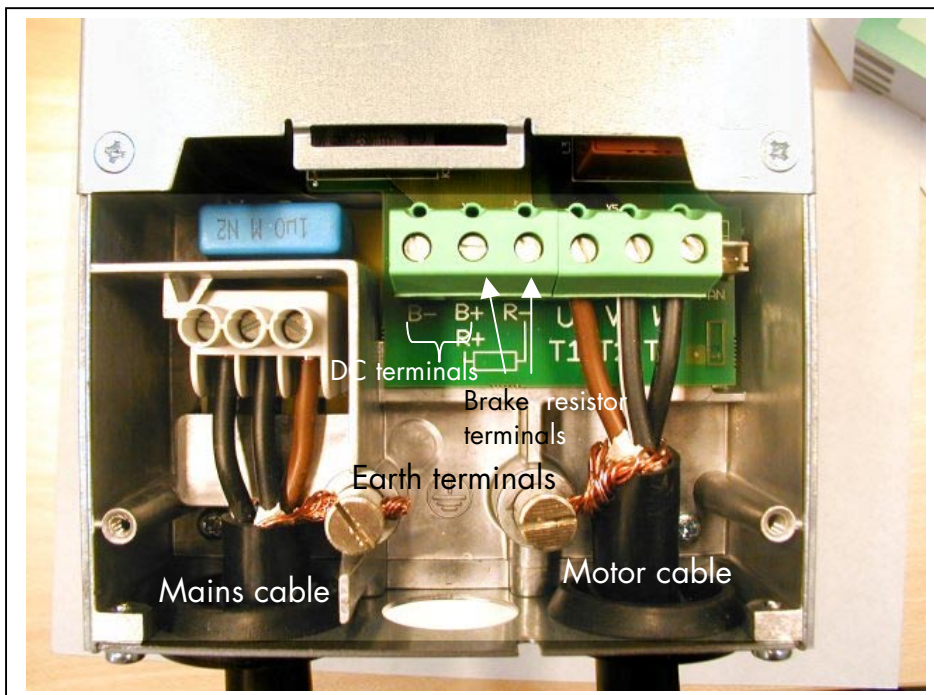


Figure 6-14. Cable installation in NXL, MF5

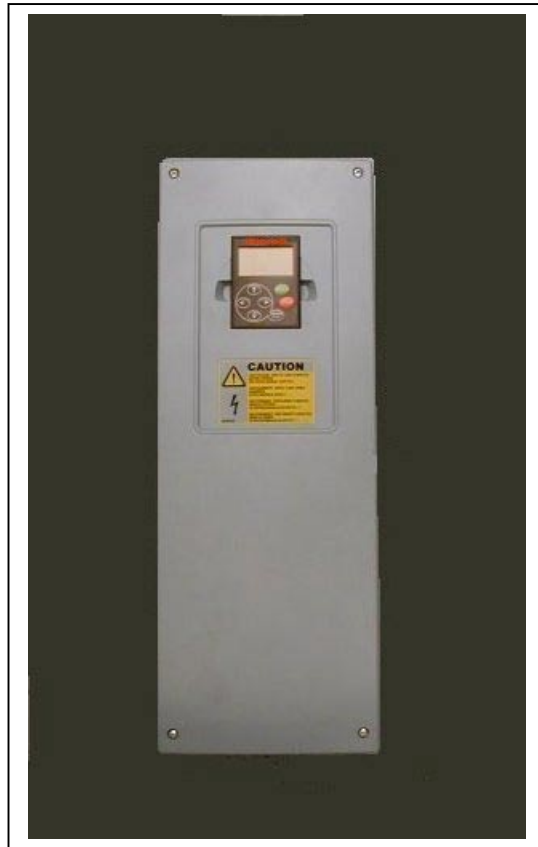


Figure 6-15. NXL, MF6

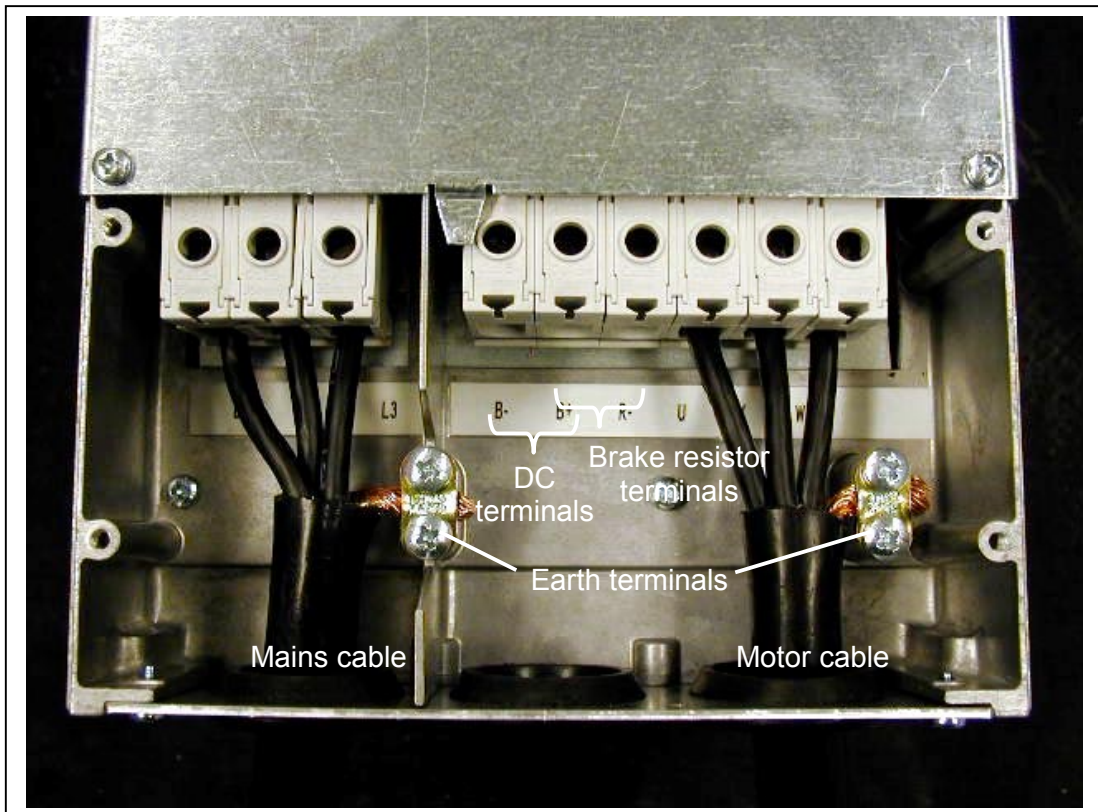


Figure 6-16. Cable installation in NXL, MF6

6.1.3 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 6-4.

Frame	Tightening torque [Nm]	Tightening torque in-lbs.
MF2	0.5—0.6	4—5
MF3	0.5—0.6	4—5
MF4	0.5—0.6	4—5
MF5	1.2—1.5	10—13
MF6	4	35

Table 6-4. Tightening torques of terminals

6.1.4 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 $>1\text{M}\Omega$.

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 $>1\text{M}\Omega$.

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 1000 V. The insulation resistance must be $>1\text{M}\Omega$.

6.2 Control unit

The control unit of the NXL frequency converter is integrated with the power unit and consists roughly of the control board and one optional board, which can be connected to the *slot connector* of the control board.

The frequency converter is delivered from the factory with the basic configuration without an option board.

6.2.1 Control connections

The basic control connections are shown in Chapter 6.2.1.

The signal descriptions of the Multicontrol Application are presented below and in Chapter 2 of the Application Manual.

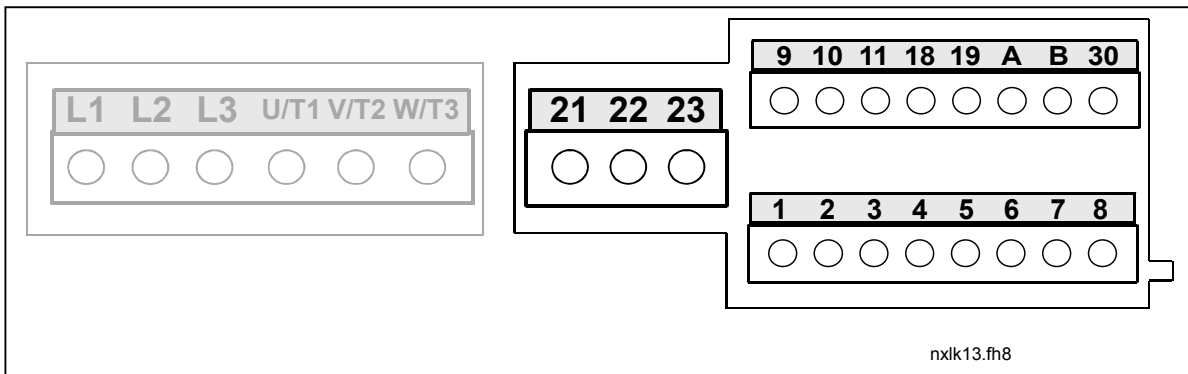


Figure 6-17. Control connections, MF2

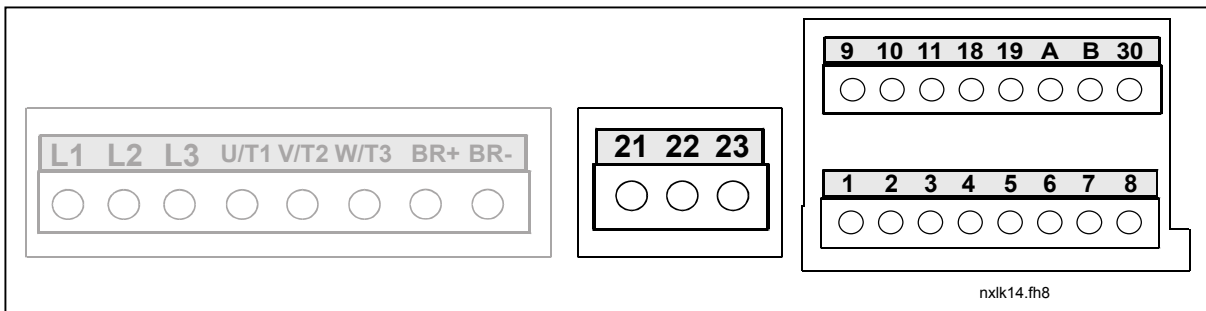


Figure 6-18. Control connections, MF3

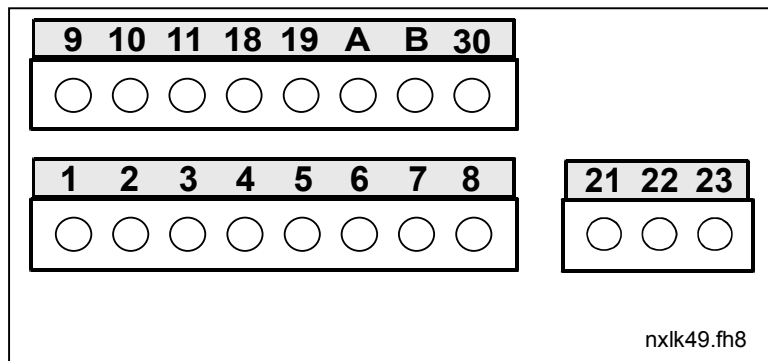
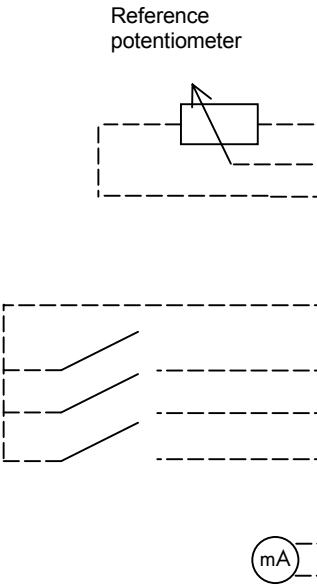


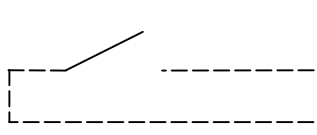
Figure 6-19. Control connections, MF4, MF5

6.2.2 Control I/O



Terminal	Signal	Description
1	+10V _{ref}	Reference output Voltage for potentiometer, etc.
2	AI1+	Analogue input, voltage range 0—10V DC. Voltage input frequency reference Can be programmed as DIN4
3	AI1-	I/O Ground Ground for reference and controls
4	AI2+	Analogue input, current range 0/4—20mA Current input frequency reference
5	AI2- /GND	
6	+24V	Control voltage output Voltage for switches, etc. max 0.1 A
7	GND	I/O ground Ground for reference and controls
8	DIN1	Start forward (programmable) Contact closed = start forward
9	DIN2	Start reverse (programmable) Contact closed = start reverse
10	DIN3	Multi-step speed selection 1 (programmable) Contact closed = multi-step speed
11	GND	I/O ground Ground for reference and controls
18	AO1+	Output frequency Analogue output Programmable Range 0—20 mA/R _L , max. 500Ω
19	AO1-	
A	RS 485	Serial bus Differential receiver/transmitter
B	RS 485	Serial bus Differential receiver/transmitter
21	RO1	Relay output 1 FAULT Programmable
22	RO1	
23	RO1	

Table 6-5. Multicontrol application default I/O configuration.



Terminal	Signal	Description
1	+10V _{ref}	Reference output Voltage for potentiometer, etc.
2	AI1+ or DIN 4	Analogue input, voltage range 0—10V DC Voltage input frequency reference (MF2-3) Voltage/current input frequency reference (MF4-MF6) Can be programmed as DIN4
3	AI1-	I/O Ground Ground for reference and controls
4	AI2+	Analogue input, voltage range 0—10V DC or current range 0—20mA Voltage or current input frequency reference
5	AI2- /GND	
6	+ 24 V	Control voltage output

Table 6-6. The programming of AI1 as DIN4

6.2.3 Control terminal signals

Terminal	Signal	Technical information
1	+10 Vref	Reference voltage Maximum current 10 mA
2	AI1+	Analogue input, voltage (MF4 and bigger: voltage or current) MF2-MF3: Voltage input MF4-MF6: <u>Selection V or mA with jumper block X8</u> (see page 39) Default: 0– +10V ($R_i = 200 \text{ k}\Omega$) 0– 20mA ($R_i = 250 \text{ }\Omega$)
3	AI1–	Analogue input common Differential input if not connected to ground; Allows $\pm 20\text{V}$ differential mode voltage to GND
4	AI2+	Analogue input, voltage or current <u>Selection V or mA with jumper block X4 (MF2-MF3) and X13 (MF4-MF6)</u> Default: 0– 20mA ($R_i = 250 \text{ }\Omega$) 0– +10V ($R_i = 200 \text{ k}\Omega$)
5	AI2–	Analogue input common Differential input; Allows $\pm 20\text{V}$ differential mode voltage to GND
6	24 Vout	24V auxiliary voltage $\pm 10\%$, maximum current 100 mA
7	GND	I/O ground Ground for reference and controls
8	DIN1	Digital input 1 $R_i = \text{min. } 5\text{k}\Omega$
9	DIN2	Digital input 2
10	DIN3	Digital input 3
11	GND	I/O ground Ground for reference and controls
18	AO1+	Analogue signal (+output)
19	AO1–	Analogue output common Output signal range: Current 0(4)–20mA, $R_L \text{ max } 500\Omega$ or Voltage 0–10V, $R_L > 1\text{k}\Omega$
A	RS 485	Serial bus
B	RS 485	Serial bus

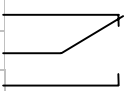
21	RO1/1	 Relay output 1 Switching capacity: 24VDC/8A 250VAC/8A 125VDC/0,4A Relay output terminals are galvanically isolated from the I/O ground
22	RO1/2	
23	RO1/3	

Table 6-7. Control I/O terminal signals

6.2.3.1 Jumper selections on NXL 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 NXL board. The positions of the jumpers determine the signal type of analogue input (terminal #2) and whether the termination resistor RS485 is used or not.

The following figures present the jumper selections of NXL frequency converters:

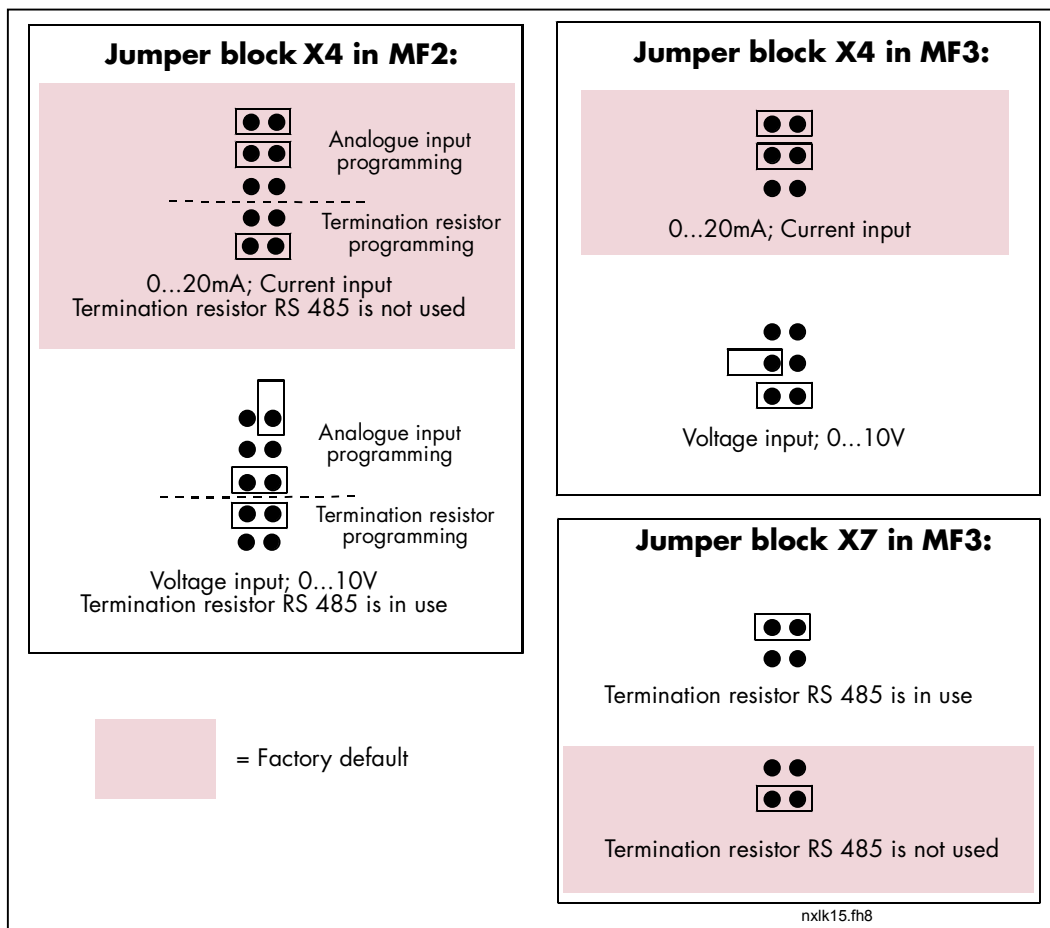


Figure 6-20. Jumper selection for NXL, MF2 and MF3

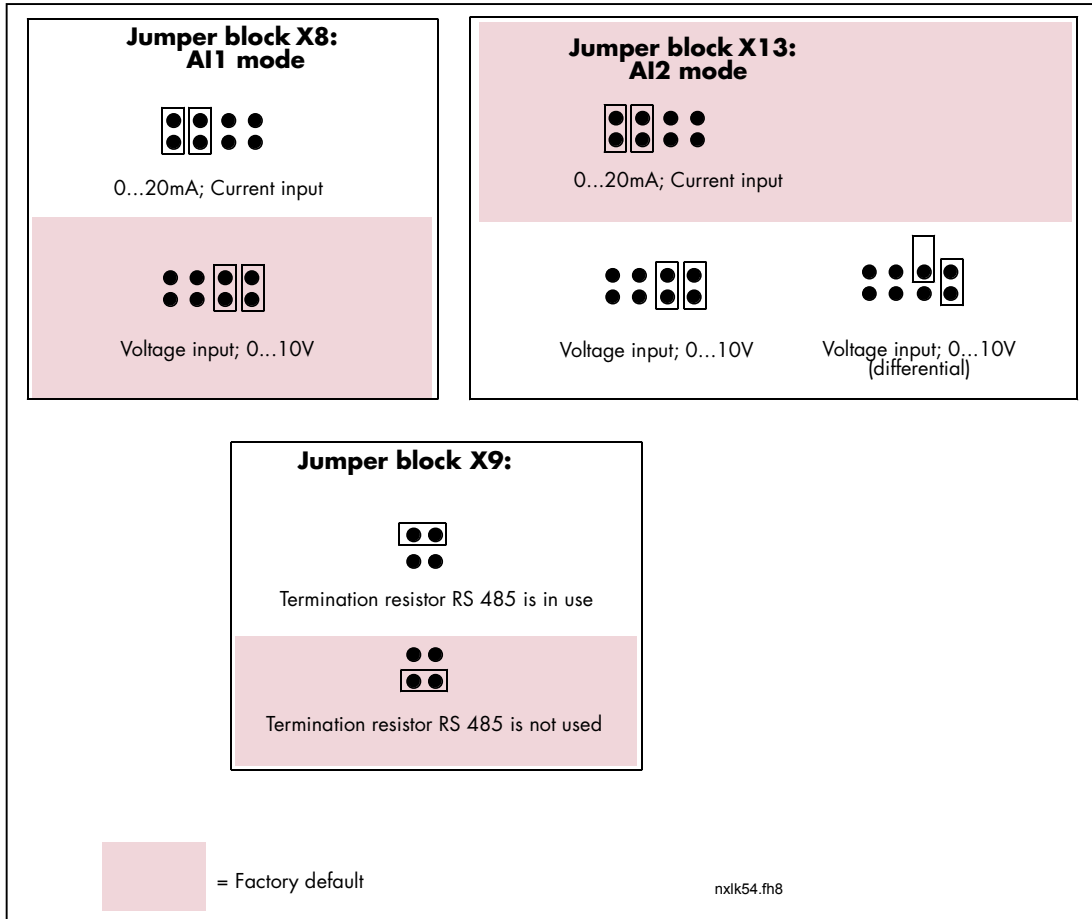




Figure 6-21. Jumper selection for NXL, MF4 – MF6

 WARNING	<p>Check the correct positions of the jumpers. Running the motor with signal settings different from the jumper positions will not harm the frequency converter but may damage the motor.</p>
 NOTE	<p>If the AI signal content is changed, also the corresponding parameters S6.9.1, 6.9.2 in System Menu must be changed.</p>

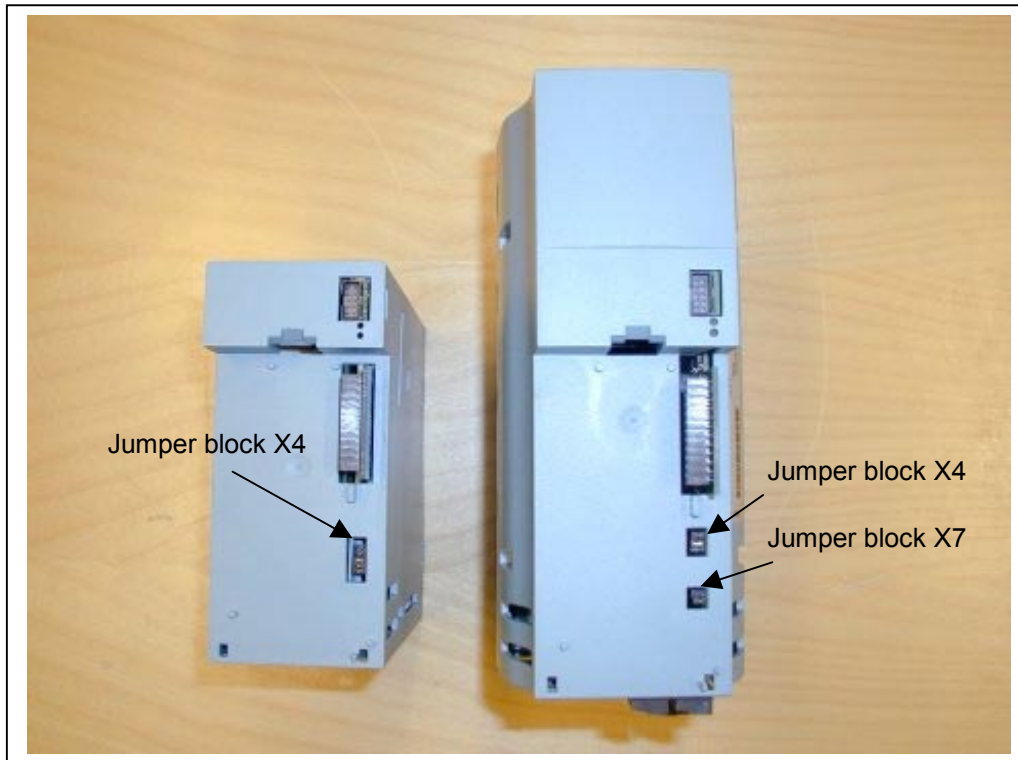


Figure 6-22. The location of jumper blocks in MF2 (left) and MF3 (right)

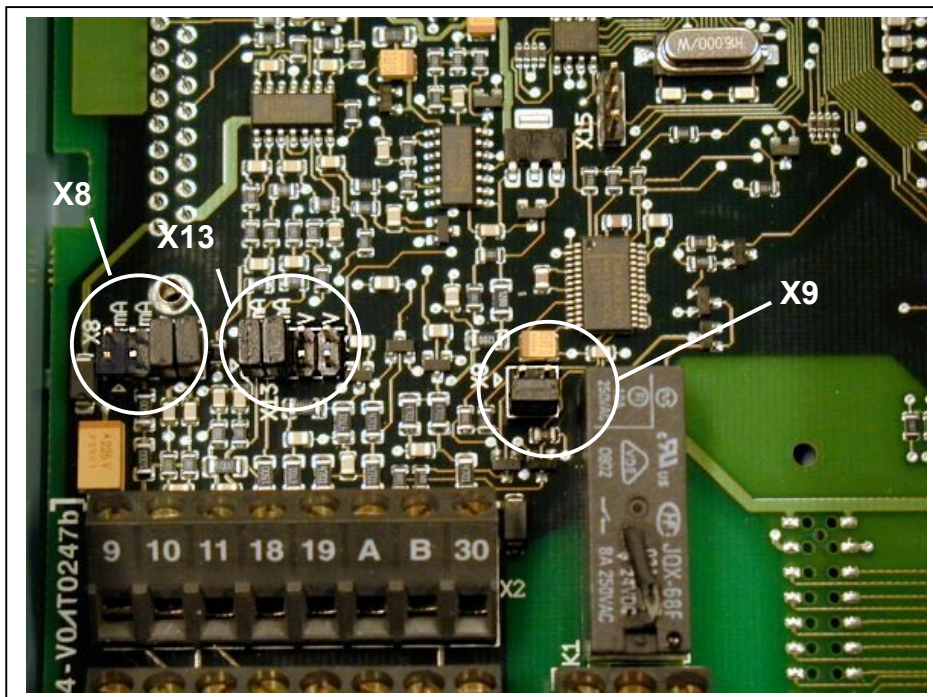



Figure 6-23. The location of jumper blocks in the control board of MF4 – MF6

7. CONTROL KEYPAD

The control keypad is the link between the NXL frequency converter and the user. The NXL control keypad features a seven-segment display with seven indicators for the Run status (RUN, , READY, STOP, ALARM, FAULT) and three indicators for the control place (I/O term, Keypad, Bus/Comm).

The control information, i.e. the number of menu, the displayed value and the numeric information are presented with numeric symbols.

The frequency converter is operable through the seven 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

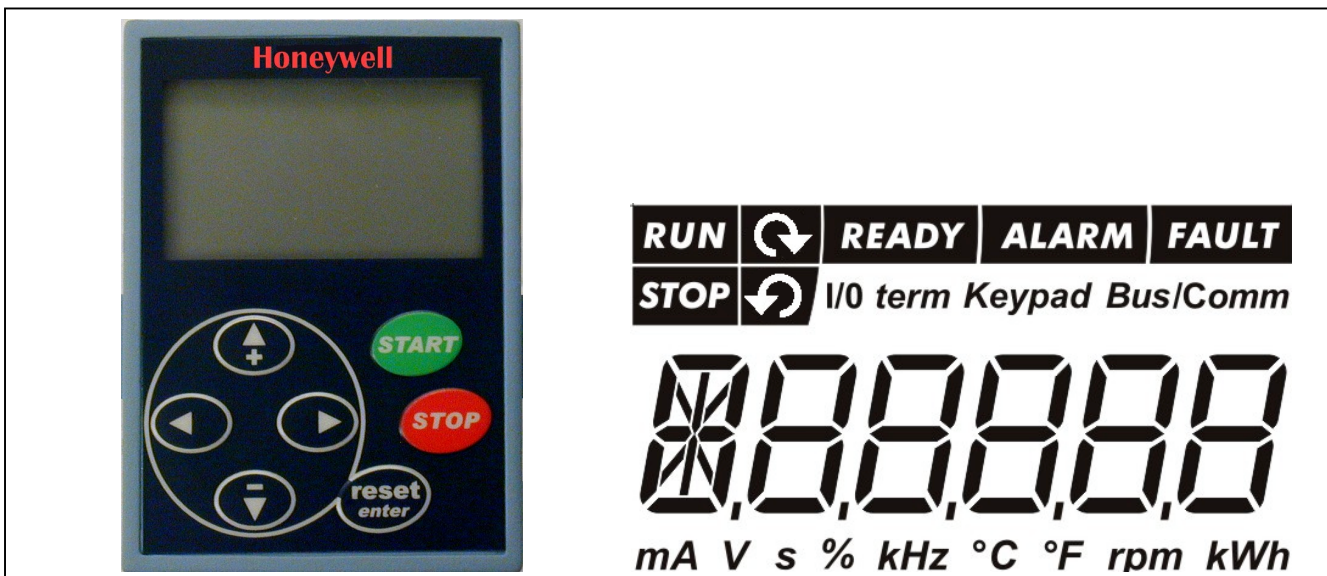



Figure 7-1. NXL control keypad and drive status indications

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 fault, 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.

7.1.2 Control place indications (See control keypad)

The symbols *I/O term*, *Keypad* and *Bus/Comm* (see chapter 7.3.3.1) indicate the choice of control place made in the Keypad control menu (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 Numeric indications (See control keypad)

The numeric indications 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.

7.2 Keypad push-buttons

The NXL seven-segment control keypad features 7 push-buttons that are used for the control of the frequency converter (and motor), parameter setting and value monitoring.

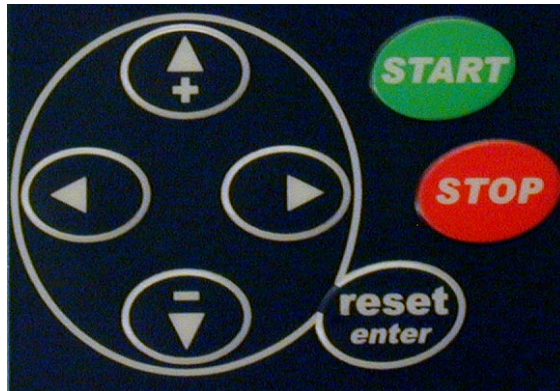





Figure 7-2. Keypad push-buttons

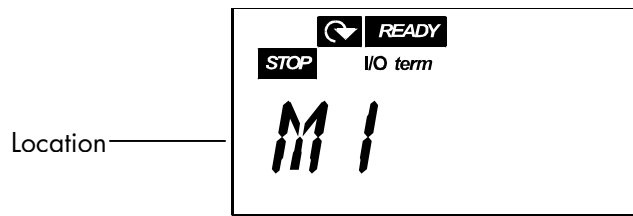
7.2.1 Button descriptions

- | | | |
|---|---|--|
|  | = | There are two operations integrated in this button. The button operates mainly as reset button except in the parameter edit mode. The button operation is shortly described below. |
| reset | = | This button is used to reset active faults.
Note! The motor may start immediately after resetting the faults |
| 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 edit mode).
Exit edit mode.
Hold down for 2...3 seconds to return to main menu.
- ▶ = Menu button right
Move forward in menu.
Move cursor right (in parameter edit mode).
Enter edit mode.
- = Start button.
Pressing this button starts the motor if the keypad is the active control place. See Chapter 7.3.3.1.
- start = Stop button.
Pressing this button stops the motor (unless disabled by parameter R3.4/R3.6).

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).



The first menu level consists of menus M1 to E7 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, the last digit of the figure on the display is blinking and by pressing the *Menu button right*, the next menu level can be reached.

The control keypad navigation chart is shown on [page 46](#). Please note that the menu **M1** is located in the lower left corner. From there the user will be able to navigate up to the desired menu using the menu and browser buttons.

More detailed descriptions of the menus are presented later in this Chapter.

NOTE!

By default the System Menu (**S6**) and Expander Board Menu (**E7**) are hidden. In order to browse these menus the value of **parameter 2.1.22** (Parameter conceal) must be set to **0**:

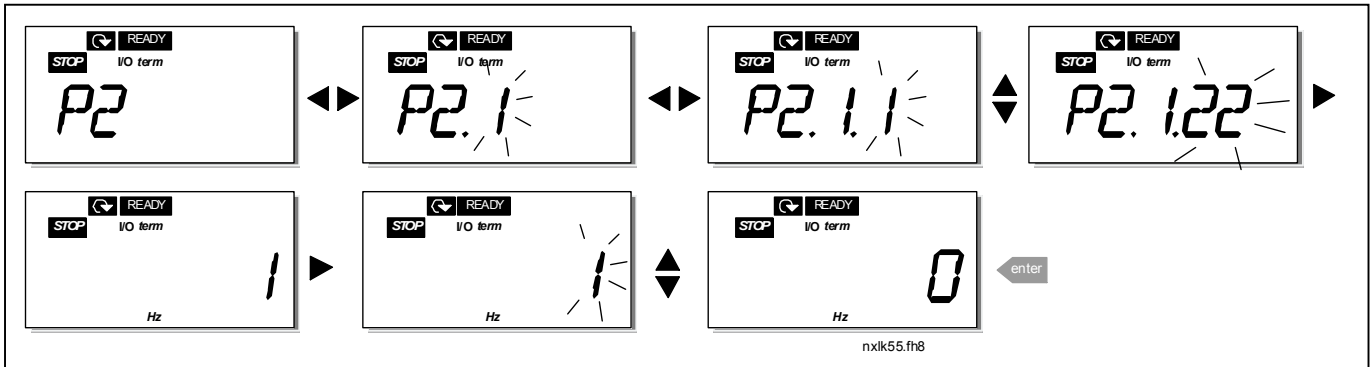


Figure 7-3. Changing the value of parameter 2.1.22

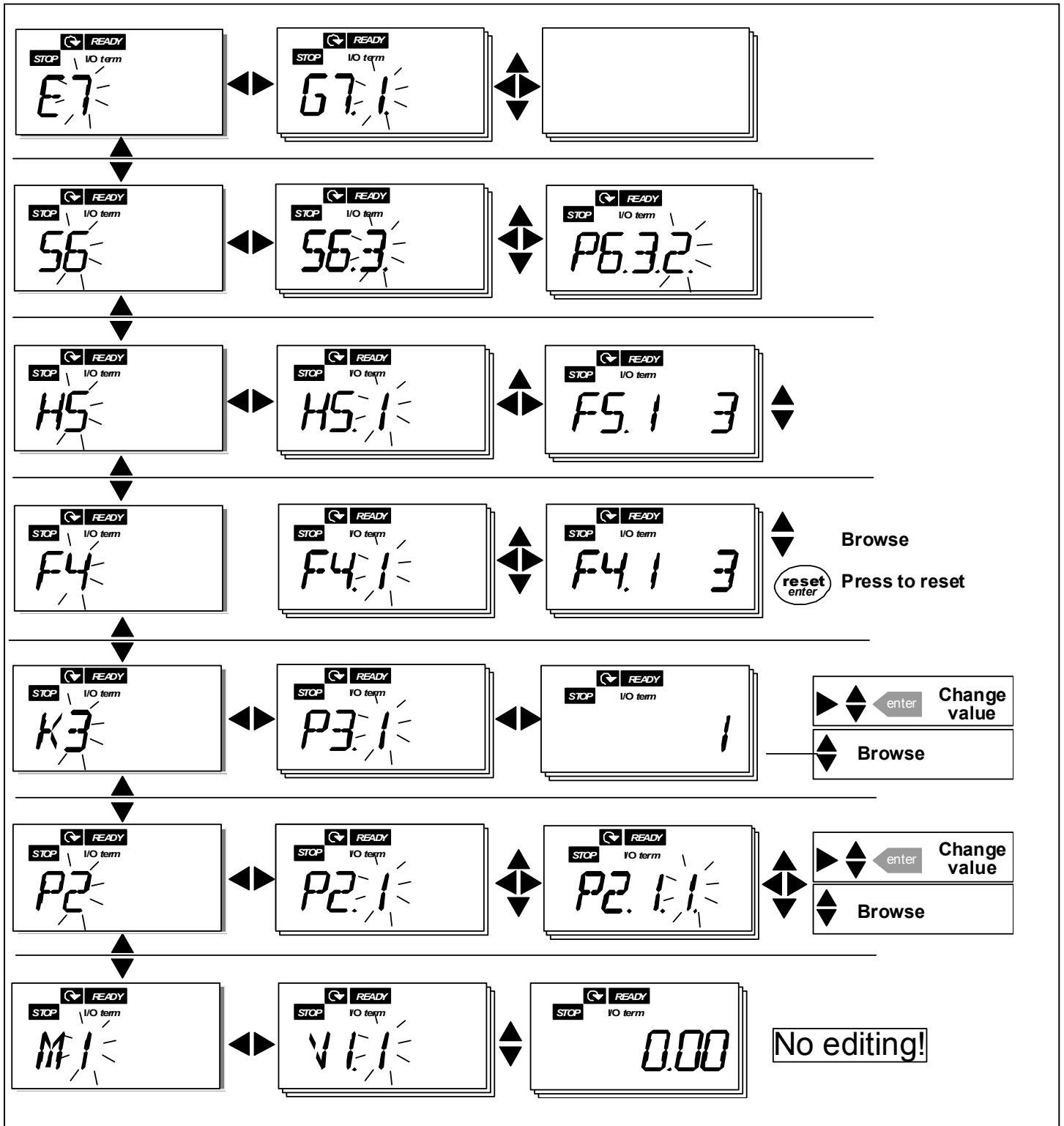


Figure 7-4. Keypad navigation chart

Menu functions

Code	Menu	Min	Max	Selections
M1	Monitoring menu	V1.1	V1.23	See chapter 7.3.1 for the monitoring values
P2	Parameter menu	P2.1	P2.9	P2.1 = Basic parameters P2.2 = Input signals P2.3 = Output signals P2.4 = Drive control P2.5 = Prohibit frequencies P2.6 = Motor control P2.7 = Protections P2.8 = Autorestart P2.9 = PID control P2.10=Pump and fan control See the Multi-control application manual for detailed parameter lists
K3	Keypad control menu	P3.1	R3.6	P3.1 = Selection of control place R3.2 = Keypad reference P3.3 = Keypad direction P3.4 = Stop button activation R3.5 = PID reference 1 R3.6 = PID reference 2
F4	Active faults menu			Shows the active faults and their types
H5	Fault history menu			Shows the fault history list
S6	System menu	S6.3	S6.10	S6.3 = Copy parameters S6.5 = Security S6.6 = Keypad settings S6.7 = Hardware settings S6.8 = System info S6.9 = AI mode S6.10 = Fieldbus parameters Parameters are described in chapter 7.3.6
E7	Expander board menu			

Table 7-1. Main menu functions

7.3.1 Monitoring menu (M1)

The Monitoring menu can be entered from the Main menu by pushing the *Menu button right* when the location indication **M1** is visible on the display. How to browse through the monitored values is presented in Figure 7-5.

The monitored signals carry the indication **V#.#** and they are listed in Table 7-2. 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.

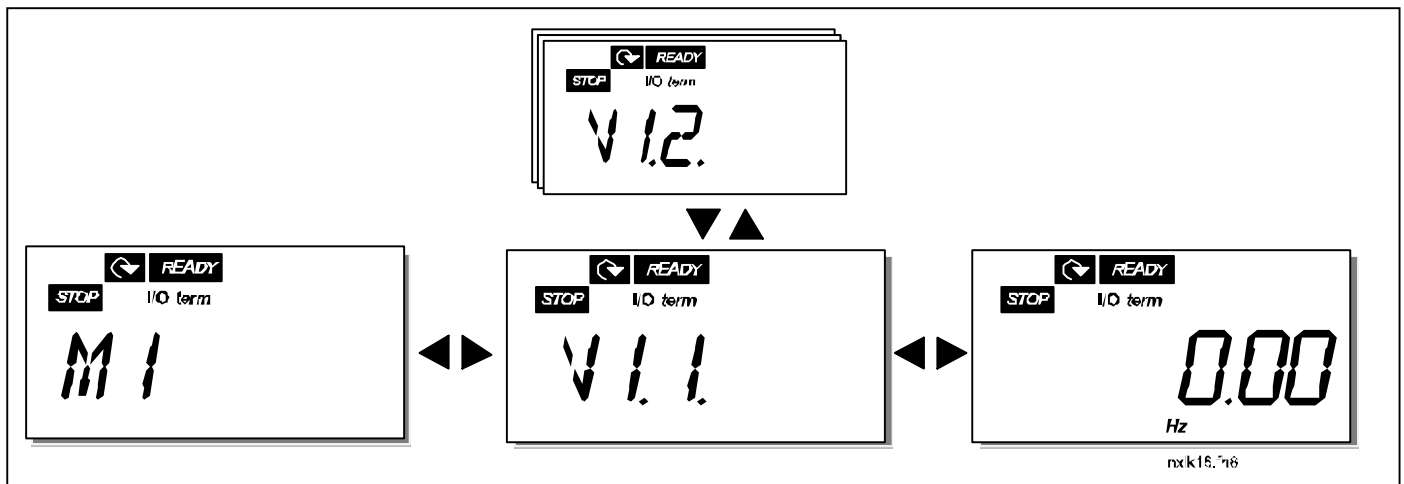


Figure 7-5. Monitoring menu

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 actual torque/nominal torque of the motor
V1.6	Motor power	%	Calculated actual power/nominal power of the motor
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	Analogue input 1		AI1
V1.11	Analogue input 2		AI2
V1.12	Analogue output current	mA	AO1
V1.13	Analogue output current 1, expander board	mA	
V1.14	Analogue output current 2, expander board	mA	
V1.15	DIN1, DIN2, DIN3		Digital input statuses
V1.16	DIE1, DIE2, DIE3		I/O expander board: Digital input statuses
V1.17	RO1		Relay output 1 status
V1.18	ROE1, ROE2, ROE3		I/O exp. board: Relay output statuses
V1.19	DOE 1		I/O exp. board: Digital output 1 status
V1.20	PID Reference	%	In percent of the maximum process reference
V1.21	PID Actual value	%	In percent of the maximum actual value
V1.22	PID Error value	%	In percent of the maximum error value
V1.23	PID Output	%	In percent of the maximum output value

Table 7-2. Monitored signals

7.3.2 Parameter menu (P2)

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 **P2** is visible on the display. The value editing procedure is presented in Figure 7-6.

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#*) to be edited. Pushing the *Menu button right* takes the user to the edit mode. As a sign of this, the parameter value starts to blink. The value can now be changed 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 the user 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 the user back to the previous menu.

Several parameters are locked, i.e. uneditable, when the drive is in RUN status. The frequency converter must be stopped in order to edit these parameters.

The parameters values can also be locked using the function in menu **S6** (see Chapter Parameter lock (P6.5.2)).

The user can return to the *Main menu* anytime by pressing the *Menu button left* for 1—2 seconds.

The Multi-Control Application includes several sets of parameters. The parameter lists are presented in the Application Section of this manual.

Once in the last parameter of a parameter group, the user 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 51.

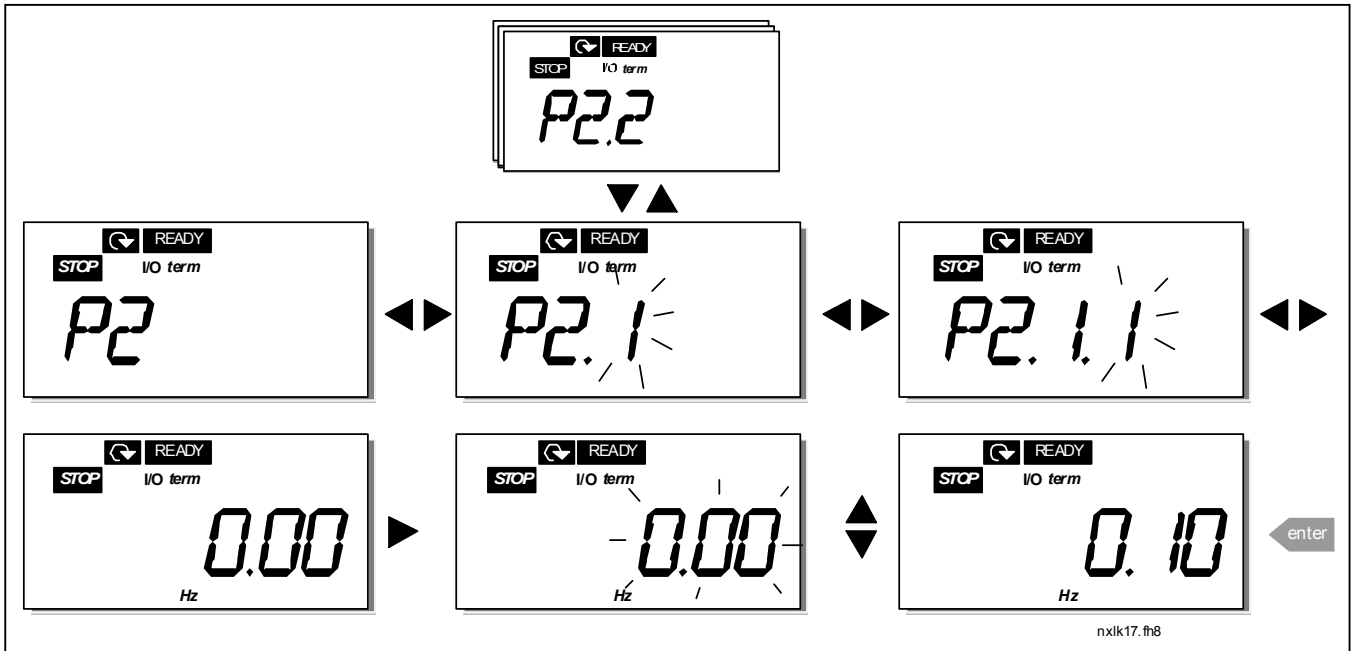


Figure 7-6. Parameter value change procedure

7.3.3 Keypad control menu (K3)

In the *Keypad Controls Menu*, the user 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*.

Parameters in Menu K3	Selections
P3.1 = Selection of control place	1 = I/O terminals 2 = Keypad 3 = Fieldbus
R3.2 = Keypad reference	
P3.3 = Keypad direction	0 = Forward 1 = Reverse
P3.4 = Stop button activation	0 = Limited function of Stop button 1 = Stop button always enabled
R3.5 = PID reference 1	
R3.6 = PID reference 2	

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>I/O term</i>
Keypad (panel)	<i>Keypad</i>
Fieldbus	<i>Bus/Comm</i>

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 below. See also 0 above.

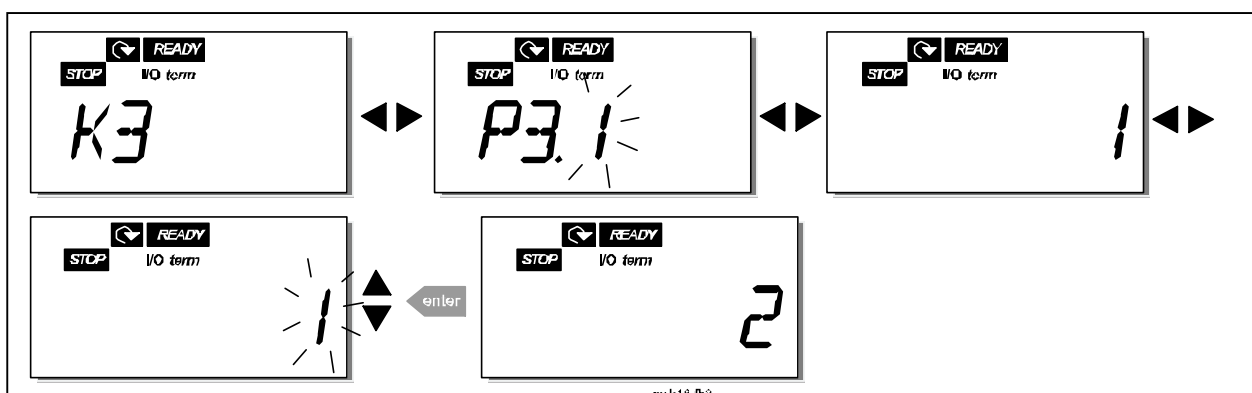


Figure 7-7. Selection of control place

7.3.3.2 Keypad reference

The keypad reference submenu (**R3.2**) 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 the active control place.**

NOTE: The maximum difference between the output frequency and the keypad reference is 6 Hz. The application software monitors the keypad frequency automatically.

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

7.3.3.4 Stop button activation

By default, pushing the STOP button will **always** stop the motor regardless of the selected control place. The user 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.**

See Figure 7-7 for how to change the value of this parameter.

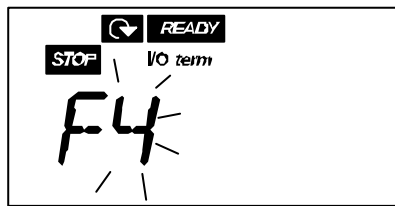
7.3.4 Active faults menu (F4)

The *Active faults menu* can be entered from the *Main menu* by pushing the *Menu button right* when the location indication **F4** is visible on the keypad display.

The memory of active faults can store the maximum of 5 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.

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

Normal state,
no faults:



7.3.4.1 Fault types

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

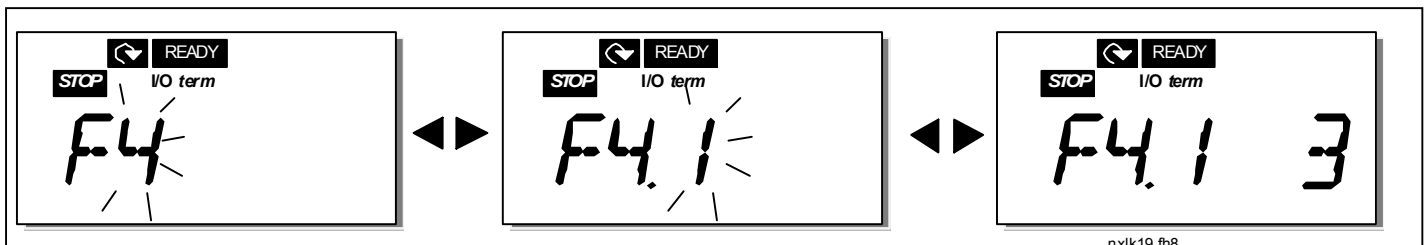


Figure 7-8. Fault display

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.

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 the user can program different responses in the application. See parameter group Protections.

Note! When contacting the factory or the distributor due to a fault, it is advisable to write down all fault texts and codes that appear on the keypad

Fault code	Fault	Possible cause	Correcting measures
1	Overcurrent	Frequency converter has detected too high a current ($>4 \cdot I_n$) in the motor cable: <ul style="list-style-type: none"> – sudden heavy load increase – short circuit in motor cables – unsuitable motor 	Check loading. Check motor size. Check cables.
2	Overvoltage	The DC-link voltage has exceeded the limits defined in Table 4-3. <ul style="list-style-type: none"> – too short a deceleration time – high overvoltage spikes in supply 	Make the deceleration time longer.
3	Earth fault	Current measurement has detected that the sum of motor phase current is not zero. <ul style="list-style-type: none"> – 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. <ul style="list-style-type: none"> – faulty operation – component failure 	Reset the fault How? and restart. Should the fault re-occur, contact the nearest distributor.
8	System fault	<ul style="list-style-type: none"> - component failure - faulty operation 	Reset the fault How? and restart. Should the fault re-occur, contact the nearest distributor.
9	Undervoltage	DC-link voltage is under the voltage limits defined in Table 4-3. <ul style="list-style-type: none"> – 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 nearest distributor.
11	Output phase supervision	Current measurement has detected that there is no current in one motor phase.	Check motor cable and motor.
13	Frequency converter under-temperature	Heatsink temperature is under -10°C	
14	Frequency converter overtemperature	Heatsink temperature is over 90°C . Overtemperature warning is issued when the heatsink temperature exceeds 85°C .	Check the correct amount and flow of cooling air. Check the heatsink for dust. Check the ambient temperature. Make sure that the switching frequency is not too high in relation to ambient temperature and motor load.
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	Contact the nearest distributor
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 nearest distributor.
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)
34	Internal bus communication	Ambient interference or defective hardware	Reset the fault How? and restart Should the fault re-occur, contact the nearest distributor.
39	Device removed	Option board removed. Drive removed.	Reset
40	Device unknown	Unknown option board or drive.	Contact the nearest distributor.
41	IGBT temperature	IGBT Inverter Bridge overtemperature protection has detected too high a short term overload current	Check loading. Check motor size.
44	Device change	Option board changed. Option board has default settings.	Reset Note: No fault time data record! Note: Application parameter values restored to default.
45	Device added	Option board added. Drive of different power rating added.	Reset Note: No fault time data record! Note: Application parameter values restored to default.
50	Analogue input $I_{in} < 4\text{mA}$ (selected signal range 4 to 20 mA)	Current at the analogue input is $< 4\text{mA}$. – 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 distributor
54	Slot fault	Defective option board or slot	Check board and slot. Contact the nearest distributor
55	Actual value supervision	Actual value has exceeded or fallen below (depending on par. 2.7.22) the actual value supervision limit (par. 2.7.23)	

Table 7-4. Fault codes

7.3.5 Fault history menu (H5)

The *Fault history menu* can be entered from the *Main menu* by pushing the *Menu button right* when the location indication **H5** is visible on the keypad display.

All faults are stored in the *Fault history menu* in which the user can browse through them using the *Browser buttons*. The user can return to the previous menu anytime by pushing the *Menu button left*.

The memory of the frequency converter can store a maximum of 5 faults in the order of appearance. The latest fault carries the indication H5.1, the second latest H5.2 etc. If there are 5 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.

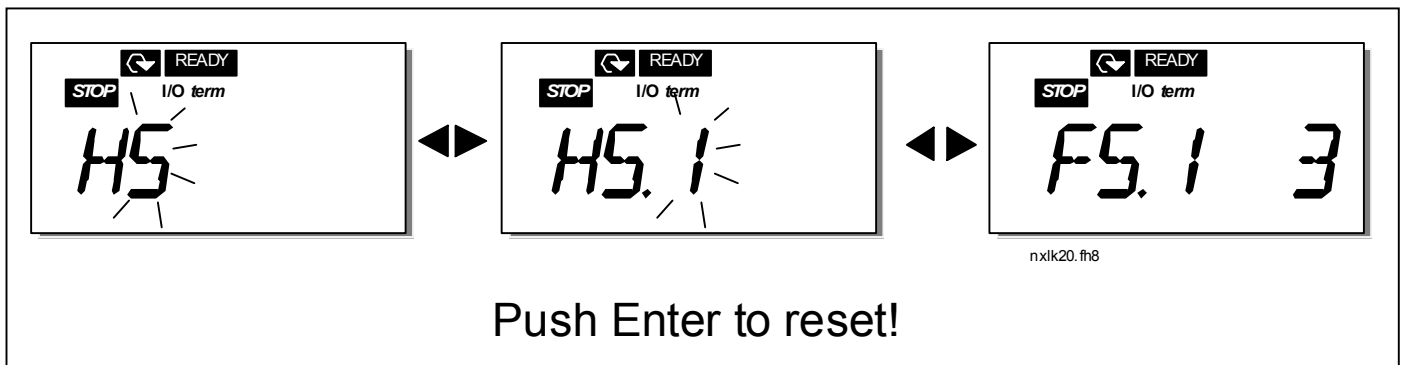


Figure 7-9. Fault history menu

7.3.6 System menu (S6)

The *System menu* can be entered from the main menu by pushing the *Menu button right* when the location indication **S6** is visible on the display.

The controls associated with the general use of the frequency converter, such as keypad settings, customised parameter sets or information about the hardware and software are located under the *System menu*.

Below there is a list of the functions available in the System menu.

Functions in the System menu

Code	Function	Min	Max	Unit	Default	Cust	Selections
S6.3	Copy parameters						
P6.3.1	Parameter sets						0 = Select 1 = Store set 1 2 = Load set 1 3 = Store set 2 4 = Load set 2 5 = Load factory defaults 6 = Fault 7 = Wait 8 = OK
S6.5	Security						
P6.5.2	Parameter lock				0		0 = Change Enabled 1 = Change Disabled
S6.6	Keypad settings						
P6.6.1	Default page				1.1		
P6.6.3	Timeout time	5	65535	s	30		
S6.7	Hardware settings						
P6.7.2	Fan control				0		0 = Continuous 1 = Temperature (only sizes MF4 and bigger)
P6.7.3	HMI acknowledg. timeout	200	5000	ms	200		
P6.7.4	HMI number of retries	1	10		5		
S6.8	System info						
S6.8.1	Counters menu						
C6.8.1.1	Mwh counter			KWh			
C6.8.1.2	Operating days counter			hh:mm:ss			
C6.8.1.3	Operating hours counter			hh:mm:ss			
S6.8.2	Trip counters						
T6.8.2.1	MWh trip counter			kWh			
P6.8.2.2	Clear MWh trip counter						
T6.8.2.3	Operating days trip counter						
T6.8.2.4	Operating hours trip counter			hh:mm:ss			
P6.8.2.5	Clear operating time counter						
S6.8.3	Software info						
I6.8.3.1	Software package						
I6.8.3.2	System SW version						
I6.8.3.3	Firmware interface						
I6.8.3.4	System load			%			
S6.8.4	Application info						
S6.8.4.1	Application						

A6.8.4.1.1	Application id						
A6.8.4.1.2	Application version						
A6.8.4.1.3	Firmware interface						
S6.8.5	Hardware info						
I6.8.5.2	Unit voltage			V			
I6.8.5.3	Brake chopper						
S6.8.6	Options						
S6.8.6.1	NXOPT						Note! the submenus are not showing if no option board is installed
I6.8.6.1.1	Status	1	5				1=Connection lost 2=Initializing 3=Run 5=Fault
I6.8.6.1.2	Program version						
S6.9	AI mode						
P6.9.1	AIA1 mode	0	1		0		0=Voltage input 1=Current input (Types MF4 – MF6)
P6.9.2	AIA2 mode	0					
S6.10	Fieldbus parameters						
I6.10.1	Communication status						
P6.10.2	Fieldbus protocol	1	1		1		1=Modbus protocol
P6.10.3	Slave address	1	255		1		Addresses 1 – 255
P6.10.4	Baud rate	0	8		5		0=300 baud 1=600 baud 2=1200 baud 3=2400 baud 4=4800 baud 5=9600 baud 6=19200 baud 7=38400 baud 8=57600 baud
P6.10.5	Stop bits	0	1		0		0=1 1=2
P6.10.6	Parity type	0	2		0		0=None 1=Odd 2=Even
P6.10.7	Communication timeout	0	300	s	0		0=Not used 1=1 second 2=2 seconds, etc

Table 7-5. System menu functions

7.3.6.1 Copy parameters

The Copy parameters submenu (**S6.3**) is located under the *System menu*.

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

Parameter sets (S6.3.1)

On *Parameter sets* page (**S6.3.1**), push the *Menu button right* to enter the *Edit menu*. The user can store or load two customised parameter sets or load back the factory defaults. Confirm with the *Enter button*. Wait, until **8 (=OK)** appears on the display.

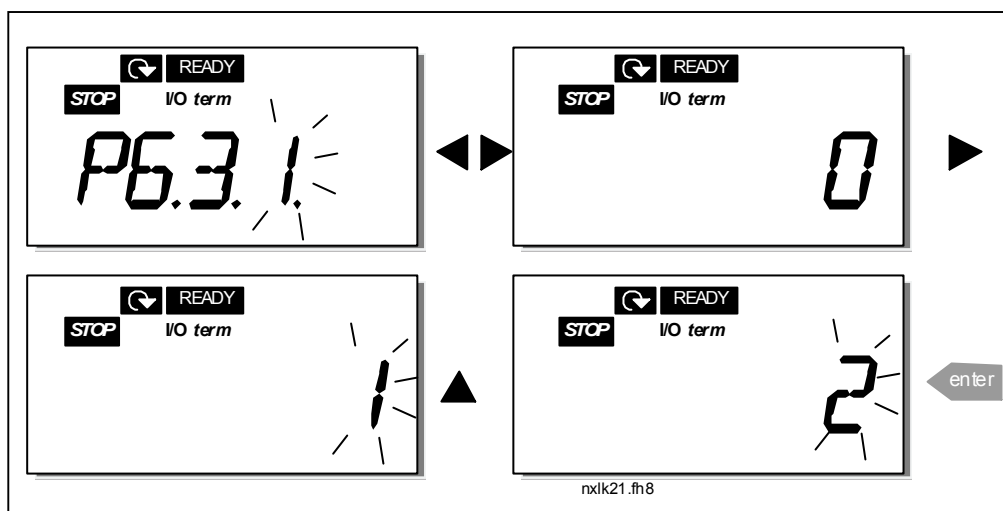


Figure 7-10. Storing and loading of parameter sets

7.3.6.2 Security

The Security submenu (**S6.5**) under the system menu has a function that allows the user to prohibit changes to the parameters.

Parameter lock (P6.5.2)

If the parameter lock is activated the parameter values cannot be edited.

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 (**0** = changes enabled, **1** = changes disabled). Accept the change with the *Enter button* or return to the previous level with the *Menu button left*.

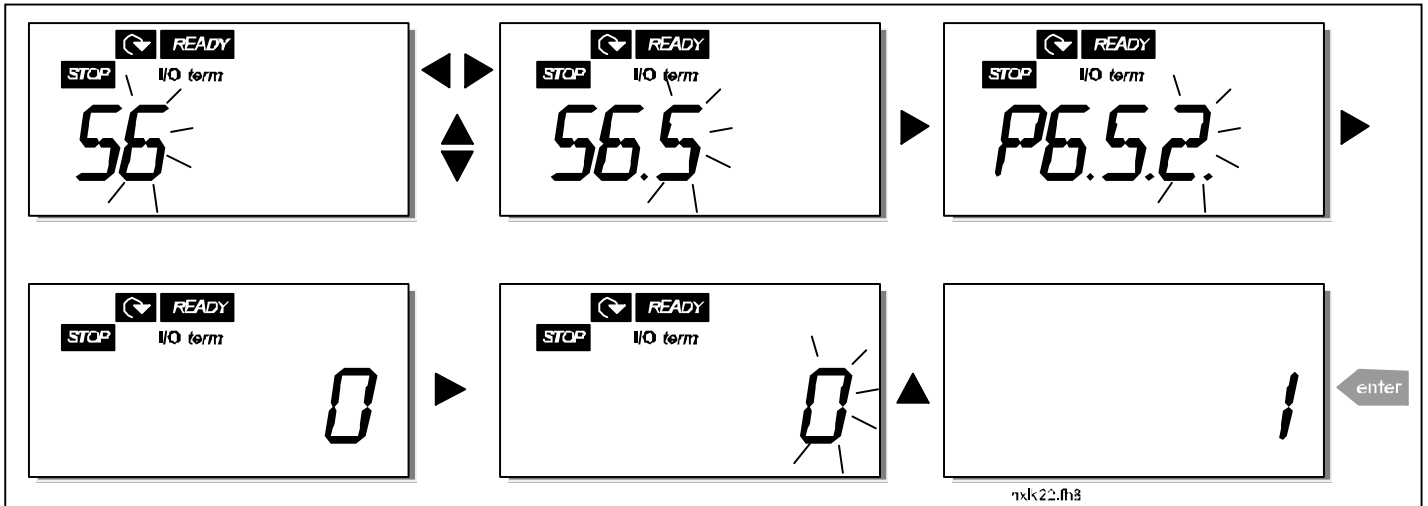


Figure 7-11. Parameter locking

7.3.6.3... Keypad settings

In the submenu **S6.6** under the *System menu* the user can further customise the frequency converter operator interface.

Locate the Keypad settings submenu (**S6.6**). Under the submenu, there are two pages (**P#**) associated with the keypad operation, *Default page (P6.6.1)* and *Timeout time (P6.6.3)*

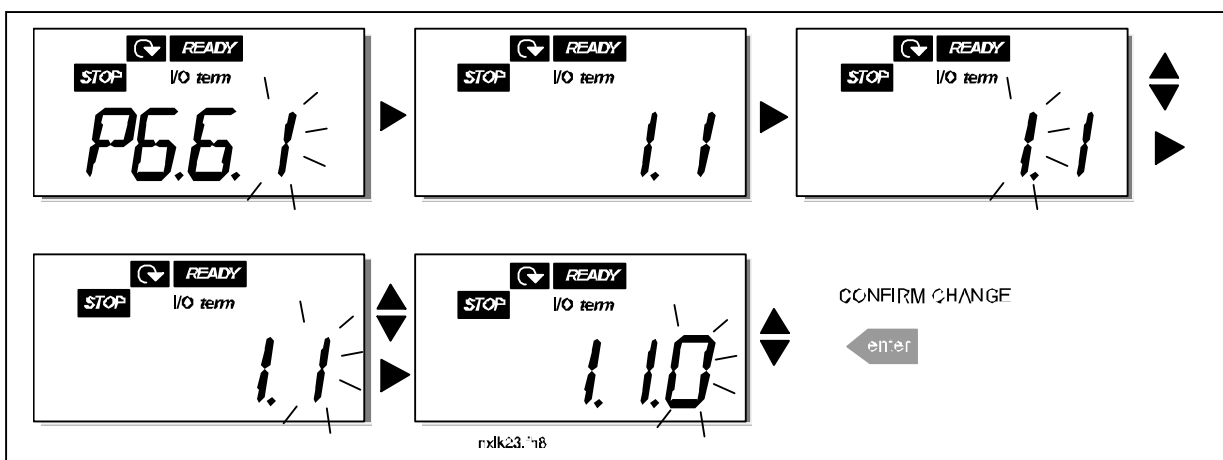
Default page (P6.6.1)

Here the user 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.

Press the *Menu button right* once to enter to the edit mode. Pressing the *Menu button right* once again allows the user to edit the number of the submenu/page digit by digit. Confirm the new default page value with the *Enter button*. The user can return to the previous step anytime by pushing the *Menu button left*.

Note! If the user set a page that does not exist in the menu, the display will automatically move to the last available page in the menu.

Figure 7-12. Default page function



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 desired timeout time and confirm the change with the *Enter button*. The user can return to the previous step anytime by pushing the *Menu button left*.

NOTE: This function cannot be disabled.

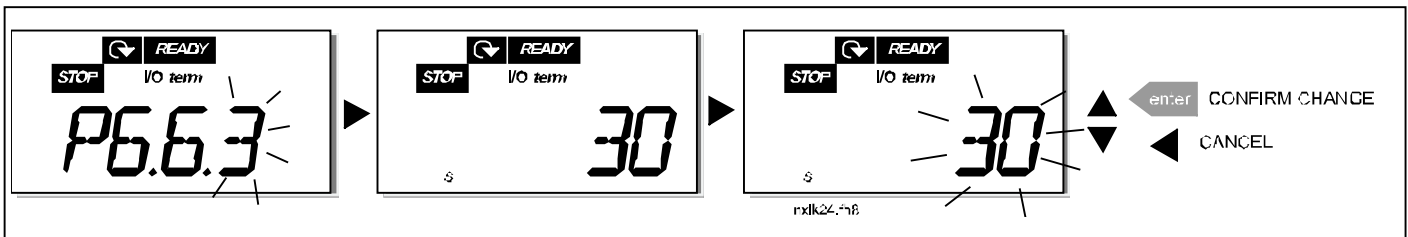


Figure 7-13. Timeout time setting

7.3.6.4 Hardware settings

In the Hardware settings submenu (**S6.7**) the user can further customise the settings of the frequency converter with four parameters: **Fan control**, **HMI acknowledgement timeout** and **HMI retry**.

Fan control (P6.7.2)

Note! Only the higher power modules of MF3 have been equipped with a cooling fan, in lower power modules of MF3 the cooling fan is available as option.

If the cooling fan has been installed in MF3 it runs continuously, when the power is switched on.

Sizes MF4 and bigger:

This function allows the user to control the frequency converter's cooling fan. The fan can be set to run continuously when the power is switched on or depending on the temperature of the unit. If the latter function has been selected the fan is switched on automatically when the heat sink temperature reaches 60°C. The fan receives a stop command when the heat sink temperature falls to 55°C. However the fan runs for about a minute after receiving the stop command, as well as after changing the value from **0** (*Continuous*) to **1** (*Temperature*).

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

See Figure 7-11 for how to change the fan control function.

HMI acknowledge timeout (P6.7.3)

This function allows the user to change the timeout of the HMI acknowledgement time.

Note! If the frequency converter has been connected to the PC with a **normal cable**, the default values of parameters 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 that are 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*. See Figure 7-14 for how to change the HMI acknowledgement timeout.

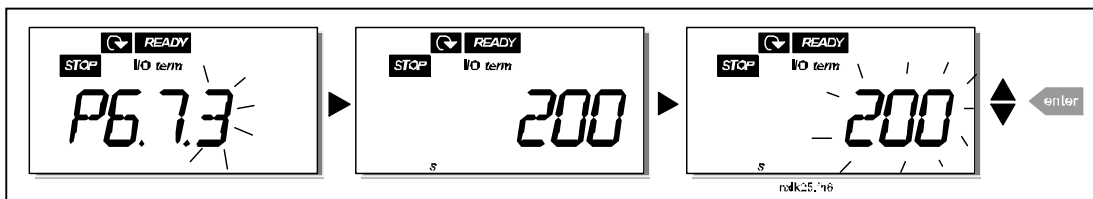


Figure 7-14. HMI acknowledge timeout

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

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

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*.

7.3.6.5 System information

In the submenu **S6.8** under the *System menu* the user can find frequency converter-related hardware and software information as well as operation-related information.

Enter the *Info menu* by pressing the *Menu button right*. Now it is possible to browse through the information pages with the *Browser buttons*.

Counters submenu (S6.8.1)

In the *Counters submenu (S6.8.1)* the user 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 menu*, these counters cannot be reset.

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

Page	Counter
C6.8.1.1	MWh counter
C6.8.1.2	Operation day counter
C6.8.1.3	Operation hour counter

Table 7-6. Counter pages

Trip counters submenu (S6.8.2)

Trip counters (menu **S6.8.2**) are counters, where the values can be reset i.e. restored to zero. The following resettable counters are at the user's disposal:

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

Page	Counter
T6.8.2.1	MWh counter
P6.8.2.2	Clear mWh counter
T6.8.2.3	Operation day counter
T6.8.2.4	Operation hour counter
P6.8.2.5	Clear operation time counter

Table 7-7. Trip counter pages

Example: When resetting the operation counters, do the following:

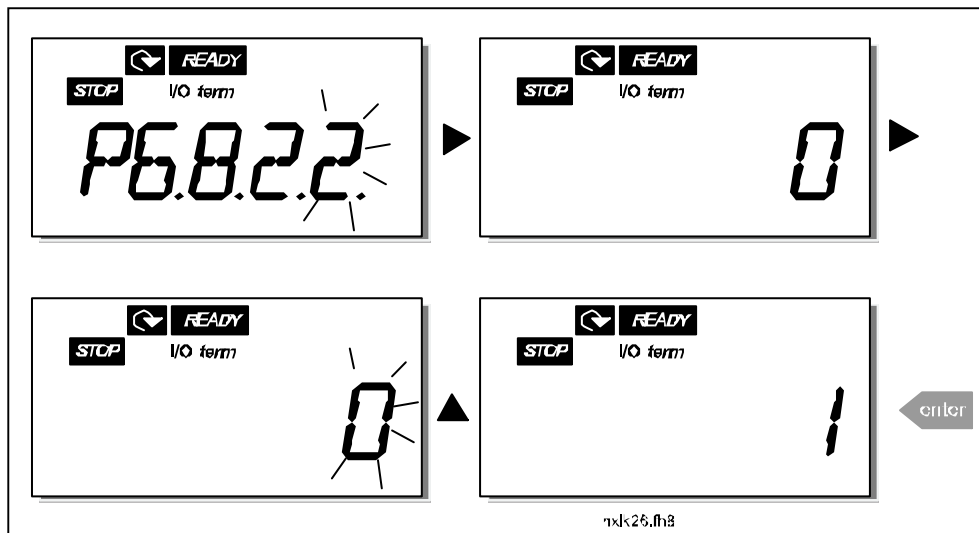


Figure 7-15. MWh counter reset

Software info submenu (S6.8.3)

The following information can be found under the Software info submenu (S6.8.3):

Page	Content
I6.8.3.1	Software package
I6.8.3.2	System software version
I6.8.3.3	Firmware interface
I6.8.3.4	System load

Table 7-8. Software information pages

Application information submenu (S6.8.4)

The user can find the following information from the Application info submenu (S6.8.4)

Page	Content
A6.8.4.1	Application
D6.8.4.1.1	Application id
D6.8.4.1.2	Version
D6.8.4.1.3	Firmware interface

Table 7-9. Application information pages

Hardware information submenu (S6.8.5)

The user can find the following information from the Hardware info submenu (S6.8.5)

Page	Content
I6.8.5.2	Unit voltage
I6.8.5.3	Brake chopper

Table 7-10. Hardware information pages

Connected options submenu (S6.8.6)

The Connected options submenu (S6.8.6) shows the following information on the option board connected to the frequency converter:

Page	Content
S6.8.6.1	Option board
I6.8.6.1.1	Option board status
I6.8.6.1.2	Program version

Table 7-11. Connected options submenu

In this submenu the user will find information about the option board connected to the control board (see chapter 6.2)

Check the status of the slot by entering the board submenu with the *Menu button right* and using the *Browser buttons*. 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 either one of the *Browser buttons* is pushed.

For more information on the expander board-related parameters, see Chapter 7.3.7.

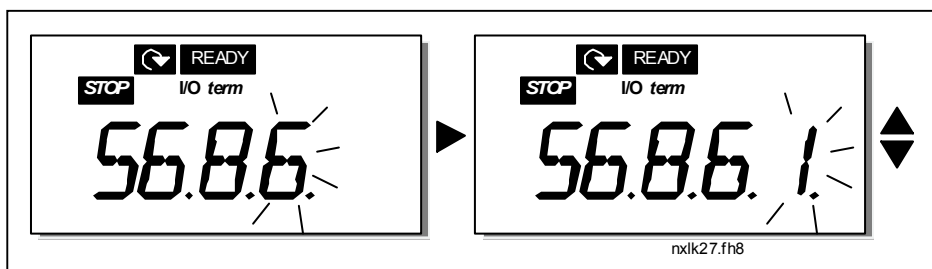


Figure 7-16. Expander board information menu

7.3.6.6 AI mode

The parameters P6.9.1 and P6.9.2 selects the analogue input mode. **P6.9.1** appears only in classes **MF4 – MF6**

- 0 = voltage input (par. 6.9.1 default)
- 1 = current input (par. 6.9.2 default)

Note! Make sure that the jumper selections correspond to the selections of this parameter. See Figure 6-20 and Figure 6-17.

7.3.6.7 Fieldbus parameters

The parameters of built-in Modbus protocol are only shortly described here. For further information, please refer to NX Modbus Option Board User's Manual.

Expander board communication status (I6.10.1)

With this function you can check the status of the RS 485 bus. If the bus is not in use, this value is **0**.

xx.yyy

- xx = 0 – 64 (Number of messages containing errors)
- yyy = 0 – 999 (Number of messages received correctly)

Fieldbus protocol (P6.10.2)

With this function the fieldbus communications protocol can be selected.

- 0 = Not used
- 1 = Modbus protocol

Slave address (P6.10.3)

Set here the slave address for the modbus protocol. Any address between 1 and 255 can be used.

Baud rate (P6.10.4)

Selects the baud rate used with the modbus communication.

- 0 = 300 baud
- 1 = 600 baud
- 2 = 1200 baud
- 3 = 2400 baud
- 4 = 4800 baud
- 5 = 9600 baud
- 6 = 19200 baud
- 7 = 38400 baud
- 8 = 57600 baud

Stop bits (P6.10.5)

Set the number of stop bits used in Modbus communication

- 0 = 1 stop bit
- 1 = 2 stop bits

Parity type (P6.10.6)

Here the user can select the type of parity checking used with the modbus communication.

- 0** = None
- 1** = Odd
- 2** = Even

Communication time-out (P6.10.7)

If communication between two messages is broken for a longer time than that defined by this parameter, a communication error is initiated. If the value of this parameter is **0**, the function is not used.

- 0** = Not used
- 1** = 1 second
- 2** = 2 seconds, etc

7.3.7 Expander board menu (E7)

The *Expander board menu* makes it possible for the user 1) to see which expander board is connected to the control board and 2) to reach and edit the parameters associated with the expander board.

Enter the following menu level (**E#**) with the *Menu button right*. The user can view and edit the parameter values in the same way as described in chapter 7.3.2.

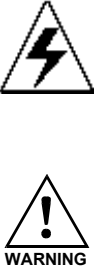
7.4 Further keypad functions

The NXL control keypad embodies additional application-related functions. See Multicontrol Application Manual for more information.


8. COMMISSIONING

8.1 Safety

Before commissioning, note the following directions and warnings:

	1	Internal components and circuit boards of the frequency converter (except for the galvanically isolated I/O terminals) are live when NXL 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 -/+ are live when NXL 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 NXL is disconnected from mains.
	4	Do not make any connections with the frequency converter connected to the mains.
	5	After having disconnected the frequency converter from the mains, wait until the fan stops and 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 NXL connections. Do not even open the cover before this time has expired.
	6	Before connecting the frequency converter to mains make sure that the NXL front cover 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 to:
 - 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 6.1.2, step 3) , the shields of the shielded cables are connected to protective earth . The wires may not touch the electrical components of the frequency converter.
 - **For option boards only:** make sure that the common ends of digital input groups are connected to +24V or ground of the I/O terminal or the external supply.
- 3** Check the quality and quantity of cooling air (Chapter 5.2).
- 4** Check the inside of the frequency converter for condensation.
- 5** Check that all Start/Stop switches connected to the I/O terminals are in **Stop**-position.
- 6** Connect the frequency converter to mains.
- 7** Set the parameters of group 1 according to the requirements of the application. At least the following parameters should be set:
 - motor nominal voltage

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

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





8 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 (K3) and Keypad Reference submenu (Chapter 7.3.3) 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  .

- 9** 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 the 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.*
 - c) *See to that all Start/Stop switches are in Stop positions.*
 - d) *Switch the mains ON*
 - e) *Repeat test **8A** or **8B.***


- 10** 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 the co-workers of the tests.*
 - c) *Repeat test **8A** or **8B.***

8.3 Basic parameters

On the next pages there is the list of parameters that are essential for the commissioning of the frequency converter. More details of these and other special parameters can be found in the Multi-Control Application manual.

Note! If the special parameters are to be edited, the value of [par. 2.1.22](#) must be set to 0.

Column explanations:

Code	= Location indication on the keypad; Shows the operator the present param. number
Parameter	= Name of parameter
Min	= Minimum value of parameter
Max	= Maximum value of parameter
Unit	= Unit of parameter value; Given if available
Default	= Value preset by factory
Cust	= Customer's own setting
ID	= ID number of the parameter (used with PC tools)
	= On the parameter code: parameter value can only be changed after the FC has been stopped.

8.3.1 Monitoring values (Control keypad: menu M1)

The monitoring values are the actual values of parameters and signals as well as statuses and measurements. Monitoring values cannot be edited. See Chapter 7.3.1 for more information.

Code	Parameter	Unit	ID	Description
V1.1	Output frequency	Hz	1	Frequency to the motor
V1.2	Frequency reference	Hz	25	
V1.3	Motor speed	rpm	2	Calculated motor speed
V1.4	Motor current	A	3	Measured motor current
V1.5	Motor torque	%	4	Calculated actual torque/nominal torque of the motor
V1.6	Motor power	%	5	Calculated actual power/nominal power of the motor
V1.7	Motor voltage	V	6	Calculated motor voltage
V1.8	DC-link voltage	V	7	Measured DC-link voltage
V1.9	Unit temperature	°C	8	Heat sink temperature
V1.10	Analogue input 1		13	AI1
V1.11	Analogue input 2		14	AI2
V1.12	Analogue output current	mA	26	AO1
V1.13	Analogue output current 1, expander board	mA	31	
V1.14	Analogue output current 2, expander board	mA	32	
V1.15	DIN1, DIN2, DIN3		15	Digital input statuses
V1.16	DIE1, DIE2, DIE3		33	I/O expander board: Digital input statuses
V1.17	RO1		34	Relay output 1 status
V1.18	ROE1, ROE2, ROE3		35	I/O exp. board: Relay output statuses
V1.19	DOE 1		36	I/O exp. board: Digital output 1 status
V1.20	PID Reference	%	20	In percent of the maximum frequency
V1.21	PID Actual value	%	21	In percent of the maximum actual value
V1.22	PID Error value	%	22	In percent of the maximum error value
V1.23	PID Output	%	23	In percent of the maximum output value

Table 8-1. Monitoring values

8.3.2 Basic parameters (Control keypad: Menu P2 → B2.1)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.1.1	Min frequency	0,00	Par. 2.1.2	Hz	0,00		101	
P2.1.2	Max frequency	Par. 2.1.1	320,00	Hz	50,00		102	NOTE: If f_{max} > than the motor synchronous speed, check suitability for motor and drive system
P2.1.3	Acceleration time 1	0,1	3000,0	s	1,0		103	
P2.1.4	Deceleration time 1	0,1	3000,0	s	1,0		104	
P2.1.5	Current limit	$0,1 \times I_L$	$2,5 \times I_L$	A	I_L		107	NOTE: Formulas apply approximately for frequency converters up to MF3. For greater sizes, consult the factory.
P2.1.6	Nominal voltage of the motor	180	690	V	NXL2:230V NXL5:400V		110	
P2.1.7	Nominal frequency of the motor	30,00	320,00	Hz	50,00		111	Check the rating plate of the motor
P2.1.8	Nominal speed of the motor	300	20 000	rpm	1440		112	The default applies for a 4-pole motor and a nominal size frequency converter.
P2.1.9	Nominal current of the motor	$1 \times I_L$	$2,5 \times I_L$	A	I_L		113	Check the rating plate of the motor
P2.1.10	Motor $\cos\phi$	0,30	1,00		0,85		120	Check the rating plate of the motor
P2.1.11	Start function	0	1		0		505	0=Ramp 1=Flying start
P2.1.12	Stop function	0	1		0		506	0=Coasting 1=Ramp
P2.1.13	U/f optimisation	0	1		0		109	0=Not used 1=Automatic torque boost
P2.1.14	I/O reference	0	4		0		117	0=AI1 1=AI2 2=Keypad reference 3=Fieldbus reference (FBSpeedReference) 4=Motor potentiometer
P2.1.15	AI2 signal range	1	2		2		390	Not used if AI2 Custom min > 0% or AI2 custom max. < 100% 1=0mA – 20mA 2=4mA – 20mA 3=0V – 10V 4=2V – 10V
P2.1.16	Analogue output function	0	12		1		307	0=Not used 1=Output freq. ($0-f_{max}$) 2=Freq. reference ($0-f_{max}$) 3=Motor speed (0 —Motor nominal speed) 4=Output current ($0-I_{nMotor}$) 5=Motor torque ($0-T_{nMotor}$) 6=Motor power ($0-P_{nMotor}$) 7=Motor voltage ($0-U_{nMotor}$) 8=DC-link volt ($0-U_{nMotor}$) 9=PI controller ref. value 10=PI contr. act. value 1 11=PI contr. error value 12=PI controller output

P2.1.17	DIN2 function	0	10		1	319	<ul style="list-style-type: none"> 0=Not used 1=Start Reverse 2=Reverse 3=Stop pulse 4=External fault, cc 5=External fault, oc 6=Run enable 7=Preset speed 2 8= Motor pot. UP (cc) 9= Disable PID (Direct freq. reference) 10=Interlock 2
P2.1.18	DIN3 function	0	13		6	301	<ul style="list-style-type: none"> 0=Not used 1=Reverse 2=External fault, cc 3=External fault, oc 4=Fault reset 5=Run enable 6=Preset speed 1 7=Preset speed 2 8=DC-braking command 9=Motor pot. UP (cc) 10=Motor pot. DOWN (cc) 11=Disable PID (PID control selection) 12=PID Keypad ref. 2 selection 13=Interlock 3
P2.1.19	Preset speed 1	0,00	Par. 2.1.2	Hz	10,00	105	
P2.1.20	Preset speed 2	0,00	Par. 2.1.2	Hz	50,00	106	
P2.1.21	Automatic restart	0	1		0	731	<ul style="list-style-type: none"> 0=Not used 1=Used
P2.1.22	Parameter conceal	0	1		1	115	<ul style="list-style-type: none"> 0=All parameters and menus visible 1=Only group P2.1 and menus M1 – H5 visible

Table 8-2. Basic parameters B2.1

9. FAULT TRACING

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 and the fault code 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 (H5) which can be browsed. The different fault codes are presented in the table below.

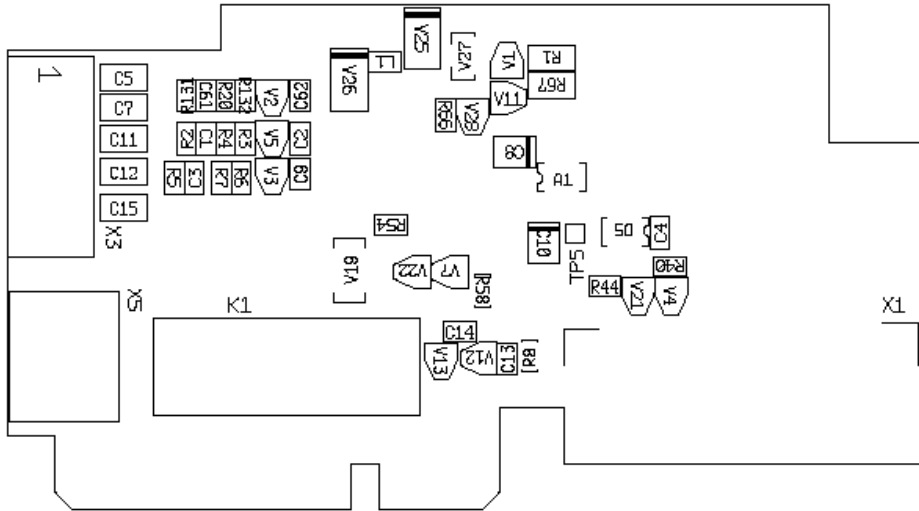
The fault codes, their causes and correcting actions are presented in the table below. The shadowed faults are A faults only. The items written in white on black background present faults for which the user can program different responses in the application. See parameter group Protections.

Fault code	Fault	Possible cause	Correcting measures
1	Overcurrent	Frequency converter has detected too high a current ($>4 \cdot I_n$) in the motor cable: <ul style="list-style-type: none"> – sudden heavy load increase – short circuit in motor cables – unsuitable motor 	Check loading. Check motor size. Check cables.
2	Overvoltage	The DC-link voltage has exceeded the limits defined in. <ul style="list-style-type: none"> – too short a deceleration time – high overvoltage spikes in utility 	Make the deceleration time longer.
3	Earth fault	Current measurement has detected that the sum of motor phase current is not zero. <ul style="list-style-type: none"> – 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. <ul style="list-style-type: none"> – faulty operation – component failure 	Reset the fault How? and restart. Should the fault re-occur, contact the nearest distributor.
8	System fault	<ul style="list-style-type: none"> - component failure - faulty operation 	Reset the fault How? and restart. Should the fault re-occur, contact the nearest distributor.
9	Undervoltage	DC-link voltage is under the voltage limits defined in. <ul style="list-style-type: none"> – 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 nearest distributor.
11	Output phase supervision	Current measurement has detected that there is no current in one motor phase.	Check motor cable and motor.
13	Frequency converter under-temperature	Heatsink temperature is under -10°C	
14	Frequency converter overtemperature	Heatsink temperature is over 90°C . Overtemperature warning is issued when the heatsink temperature exceeds 85°C .	Check the correct amount and flow of cooling air. Check the heatsink for dust. Check the ambient temperature. Make sure that the switching frequency is not too high in relation to ambient temperature and motor load.

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	Contact the nearest distributor
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 nearest distributor.
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)
34	Internal bus communication	Ambient interference or defective hardware	Should the fault re-occur, contact the nearest distributor.
39	Device removed	Option board removed. Drive removed.	Reset
40	Device unknown	Unknown option board or drive.	Contact the nearest distributor.
41	IGBT temperature	IGBT Inverter Bridge overtemperature protection has detected too high a short term overload current	Check loading. Check motor size.
44	Device change	Option board changed. Option board has default settings.	Reset Note: No fault time data record! Note: Application parameter values restored to default.
45	Device added	Option board added. Drive of different power rating added.	Reset Note: No fault time data record! Note: Application parameter values restored to default.
50	Analogue input $I_{in} < 4\text{mA}$ (selected signal range 4 to 20 mA)	Current at the analogue input is $< 4\text{mA}$. – 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 distributor.
54	Slot fault	Defective option board or slot	Check board and slot. Contact the nearest distributor.
55	Actual value supervision	Actual value has exceeded or fallen below (depending on par. 2.7.22) the actual value supervision limit (par. 2.7.23)	

Table 9-1. Fault codes

10. DESCRIPTION OF EXPANDER BOARD NXOPTAA



Description: I/O expander board with one relay output, one open collector output and three digital inputs.

- Allowed slots: **NXL** board slot
- Type ID: 16705
- Terminals: Two terminal blocks; Screw terminals (M2.6 and M3); No coding
- Jumpers: None
- Board parameters: None

I/O terminals on NXOPTAA

Terminal	Parameter setting	Description	
X3			
1	+24V	Control voltage output; voltage for switches etc, max. 150 mA	
2	GND	Ground for controls, e.g for +24 V and DO	
3	DIN1	DIGIN:x.1	Digital input 1
4	DIN2	DIGIN:x.2	Digital input 2
5	DIN3	DIGIN:x.3	Digital input 3
6	DO1	DIOUT:x.1	Open collector output, 50mA/48V
X5			
24	RO1/NC	DIOUT:x.2	Relay output 1 (NO) Switching capacity: 24VDC/8A 250VAC/8A 125VDC/0,4A
25	RO1/C		
26	RO1/NO		

Table 10-1. I/O terminals of board NXOPTAA

Note! The +24 V control voltage terminal can also be used to power the control module (but not the power module).