

## User's Manual



# NX series

**Constant and variable torque  
Variable Speed Drives  
for induction motors**

Subject to changes without notice

**REFER TO THE *START-UP QUICK GUIDE* BELOW DURING INSTALLATION AND COMMISSIONING.**

**IF ANY PROBLEMS OCCUR, PLEASE CONTACT YOUR LOCAL DISTRIBUTOR.**

### **Start-up Quick Guide**

1. Check that the product corresponds to your order, see Chapter 3.
2. Read the safety instructions carefully in Chapter 1, before commencing commissioning.
3. Before the mechanical installation, check the minimum clearances around the unit and check the ambient conditions in Chapter 5.
4. Check the size of the motor cable, mains cable, mains fuses and check the cable connections, read Chapters 6.1.1.1 – 6.1.1.4.
5. Follow the installation instructions, see Chapter 6.1.2.
6. Control cable sizes and the grounding system are explained in Chapter 6.2.1.
7. Select the most appropriate application from the Menu **M6**, page **6.1**. Instructions on using the keypad are given in Chapter 7.
8. Select the language of the keypad from the Menu **M6**, page **6.2**. Instructions on using the keypad are given in Chapter 7.
9. All parameters have factory default values. In order to ensure proper operation, check the rating plate data for the values below and the corresponding parameters of parameter group G2.1.
  - nominal voltage of the motor
  - nominal frequency of the motor
  - nominal speed of the motor
  - nominal current of the motor
  - motor  $\cos\phi$

All parameters are explained in the Application Manual.

10. Follow the commissioning instructions, see Chapter 8.
11. The NX\_ Frequency Converter is now ready for use.

**The Manufacturer is not responsible for the use of the frequency converters outside the instructions provided.**

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## **THE NX FREQUENCY CONVERTER USER'S MANUAL AND THE APPLICATION MANUAL**

The User's Manual will provide the necessary information about the installation, commissioning and operation of NX Frequency Converters. It is recommended that these instructions are studied, before powering up the frequency converter for the first time.

The Application Manual provides information about the different applications included in the standard frequency converter. Should these applications not meet the requirements of the process, contact Honeywell for information on special applications.

This manual is available in both paper and electronic editions. It is recommended that the electronic version be used where possible as it contains several links and cross-references to other locations in the manual which makes it easier for the reader to move around in the manual, to check and find things faster.

# NX User's Manual

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## 1. SAFETY



**ONLY A COMPETENT ELECTRICIAN SHOULD CARRY OUT THE ELECTRICAL INSTALLATION**



## 1.1 Warnings

 WARNING	<b>1</b>	The components of the power unit of the frequency converter are <b>live</b> when the NX is connected to mains potential. <b>Contact with this voltage is extremely dangerous and may cause death or severe injury.</b> The control unit is isolated from the potential.
	<b>2</b>	The motor terminals U, V, W and the DC-link/brake resistor terminals -/+ are <b>live</b> when the NX is connected to mains, <b>even if the motor is not running.</b>
	<b>3</b>	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 the NX is disconnected from mains.
	<b>4</b>	The frequency converter has a large capacitive leakage current.
	<b>5</b>	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).
	<b>6</b>	Only spare parts delivered by Honeywell can be used.

## 1.2 Safety instructions

	<b>1</b>	The NX frequency converter is meant for fixed installations only.
	<b>2</b>	Do not perform any measurements when the frequency converter is connected to the mains.
	<b>3</b>	After disconnecting the frequency converter from the mains, wait until the fan stops and the indicators on the keypad extinguish. (if no keypad is attached see the indicators on the cover). Wait 5 more minutes before doing any work on the NX connections. Do not even open the cover before this time has expired.
	<b>4</b>	Do not perform any voltage withstand tests on any part of the NX. There is a defined procedure for making this test. Ignoring this procedure may result in damage to the frequency converter.
	<b>5</b>	Prior to measurements on the motor or the motor cable, disconnect the motor cable from the frequency converter.
	<b>6</b>	Do not touch the IC-circuits on the circuit boards. Static voltage discharge may damage the components.
	<b>7</b>	Before connecting the frequency converter to mains, ensure that the frequency converter front and cable covers are closed.

### 1.3 Earthing and earth fault protection

The NX frequency converter must always be earthed via a 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.

If fault current protective switches (e.g. RCD or Earth Leakage devices) are to be used in conjunction with the frequency converter, they must be tested with earth fault currents that are possible to arise in fault situations.

### 1.4 Running the motor

#### **Warning symbols**

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



= **Dangerous voltage**



= **General warning**

#### MOTOR RUN CHECK LIST

 WARNING	<b>1</b>	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.
	<b>2</b>	Set the maximum motor speed (frequency) according to the motor and the machine connected to it.
	<b>3</b>	Before reversing the motor shaft rotation direction make sure that this can be done safely.
	<b>4</b>	Ensure that no power correction capacitors are connected to the motor cable.
	<b>5</b>	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 defined by the directive.

The NX 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 it is used in, and also, it shall have an adequate level of immunity toward other disturbances from the same environment.

The compliance of the NX frequency converters with the EMC directive is verified with Technical Construction Files (TCF) checked and approved by SGS FIMKO, which is a [Competent Body](#). The Technical Construction Files are used to authenticate the conformity of the NX frequency converters with the Directive due to the large product family & variety of installations possibilities.

#### 2.2.2 Technical criteria

The NX frequency converters are marketed throughout the world, a fact which makes the EMC requirements of customers different. As far as the immunity is concerned, all NX frequency converters are designed to fulfil even the strictest requirements, while as regards the emission level, the customer may want to upgrade the NX's already high ability to filter electro-magnetic disturbances.

#### 2.2.3 NX frequency converter EMC classification

The NX frequency converters are divided into three classes, according to the level of electromagnetic disturbances emitted. There is no difference in the functions or the control electronics between these classes but their EMC properties vary as follows:

##### **Class H:**

All Vacon NX frequency converters have been designed to **fulfil the requirements of the product standard EN61800-3 for the 1st environment restricted distribution and the 2nd environment.**

The emission levels correspond to the requirements of EN50081-2.

##### **Class L:**

The customer has the possibility to upgrade the EMC-disturbance filtering level of the product by ordering the frequency converter with external EMC filters. In such case, the frequency converter complies with the generic standards EN 50081-1, EN 50081-2 and EN 61800-3, **2nd environment (restricted distribution).**

**Class T:**

The T-class converters have a small earth current and can be used with IT supplies only. If they are used with other supplies no EMC requirements are complied with.

**Class N:**

The drives of this class do not provide EMC emission protection. This kind of drives are mounted in enclosures.

**All NX frequency converters fulfil all EMC immunity requirements (standards EN 50082-1, 50082-2 and EN 61800-3).**

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

**2.2.4 Manufacturer's declaration of conformity**

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

**EU DECLARATION OF CONFORMITY**

We

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

hereby declare that the product

**Product name:** NXS Frequency converter  
**Model designation:** NXS 0003.... to NXS 0205....

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

**Safety:** EN50178 (1995), EN60204-1 (1996)  
**EMC:** EN50082-2 (1995), EN61800-3 (1996)

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, 21st of May, 2001



Veijo Karppinen  
Managing Director

The year the CE marking was affixed: 2001

### 3. RECEIPT OF SHIPMENT

The NX frequency converters have undergone rigorous tests and quality checks at the factory before delivery. 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, contact the carrier and or distributor.

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

#### 3.1 Type designation code

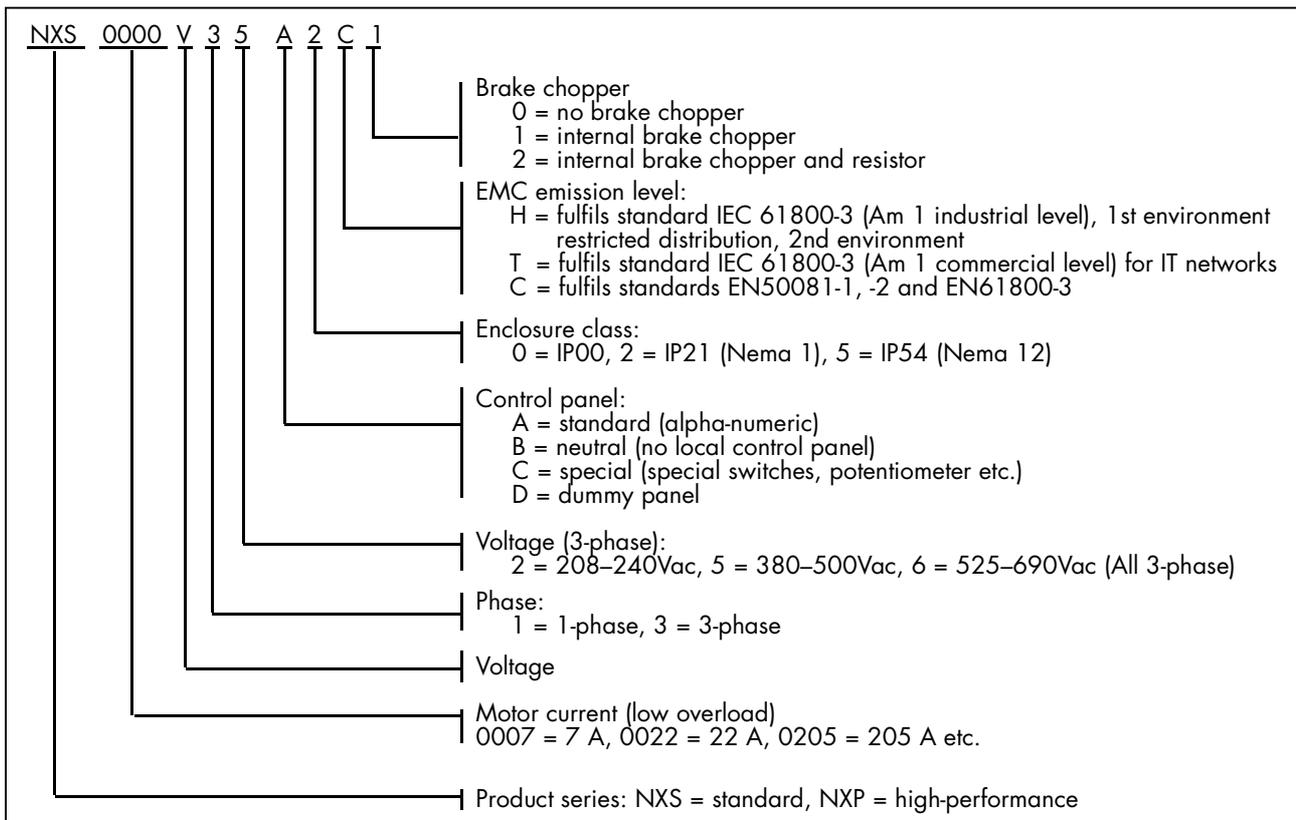


Figure 3-1. NX type designation code

#### 3.2 Storage

If the frequency converter is to be kept in store ensure that the ambient conditions are acceptable:

Storing temperature  $-40\dots+70^{\circ}\text{C}$

Relative humidity  $<95\%$ , no condensation

### 3.3 Maintenance

In normal conditions, the NX frequency converters are maintenance-free. However, it is recommended the heatsink be cleared periodically with compressed air. The cooling fan 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, incorrect 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 period 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 period shall be specified in the distributor's sales and warranty terms. The manufacturer assumes no responsibility for warranties offered by others. With all warranty issues, please contact the distributor first.

## 4. TECHNICAL DATA

### 4.1 Introduction

Figure 4-1 presents the block diagram of the NX frequency converter. The frequency converter consists of two units, the Power Unit and the Control Unit.

The three-phase AC-choke (1) at the mains end together with the DC-link capacitor (2) form an LC-filter, which, again, together with the diode bridge produce the DC-voltage supply to the IGBT Inverter Bridge (3) block. The AC-choke also functions as a filter against High Frequency disturbances from the mains as well as against those caused by the frequency converter to the mains. It, in addition, enhances the waveform of the input current to the frequency converter. The entire power drawn by the frequency converter from the mains is active power.

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

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

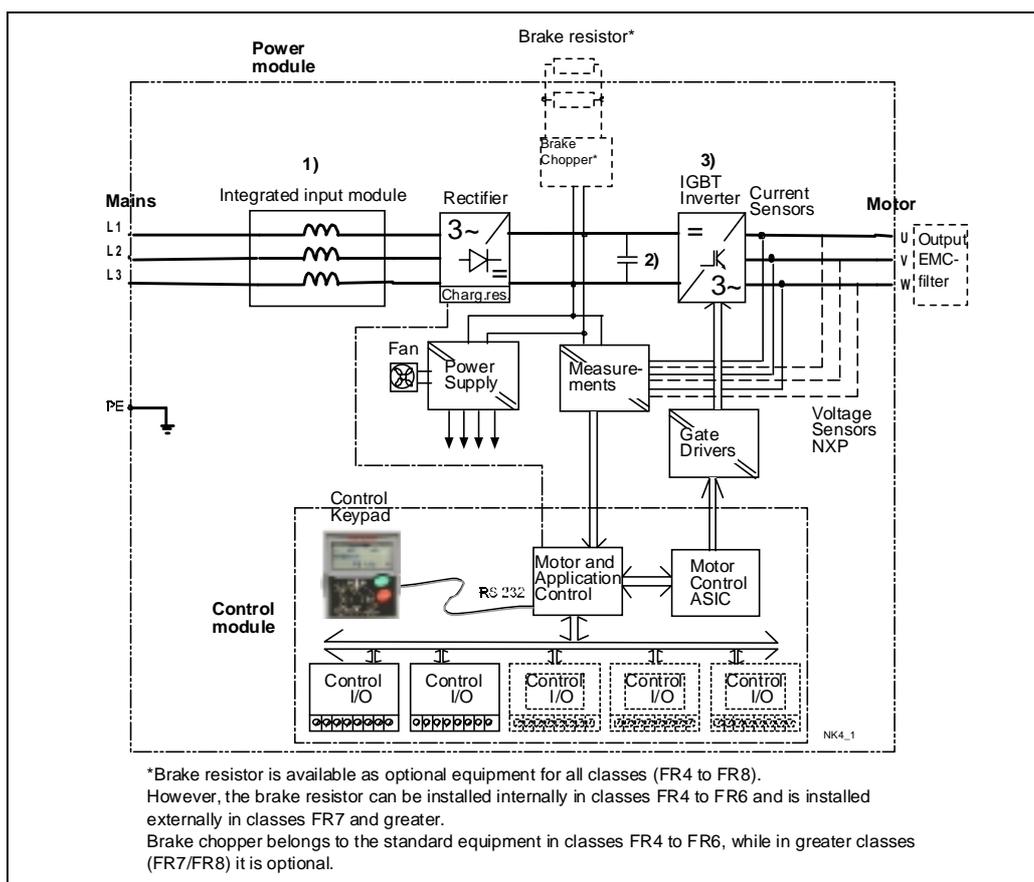


Figure 4-1. NX block diagram

The control keypad provides a link between the user and the frequency converter. The control keypad is used for parameter setting, reading status data and giving control commands. It is detachable and can be operated externally and connected via a cable to the frequency converter. Also a PC can be used instead of the control keypad, to control the frequency converter, if connected through a similar cable.

Control I/O boards which are either isolated (NXOPTA8) or not isolated (NXOPTA1) from the ground are available.

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

A brake resistor is available as external or internal option for sizes FR6 and smaller and as external option for FR7 and bigger. Optional I/O expander boards that increase the number of inputs and outputs to be used are also available. For details please contact your nearest Honeywell office or your local distributor (see back cover).

The input and output EMC filters have no influence on the basic functions of the frequency converter. They are, however, necessary for the fulfilment of the EMC directives.

## 4.2 Power ratings

### 4.2.1 NX5 – Mains voltage 380—500 V

High overload = 200% starting torque, 2 sec/20 sec, 150% overloadability, 1 min/10 min

Low overload = 150% starting torque, 2 sec/20 sec, 110% overloadability, 1 min/10 min

All sizes up to and including FR8 available with IP21 enclosure and IP54 as option.

Mains voltage 380-500 V, 50/60 Hz, 3~											
Frequency converter type	Loadability				Motor shaft power				Mechanical size Enclosure and protection class	Dimensions WxHxD	Weight
	Low		High		380V supply		500V supply				
	Rated continuous current I <sub>L</sub> (A)	10% overload current (A)	Rated Continuous current I <sub>H</sub> (A)	50% overload current (A)	10% overload 40 deg C P (kW)	50% overload 50 deg C P (kW)	10% overload 40 deg C P (kW)	50% overload 50 deg C P (kW)			
NXS 0003	3,1	3,5	2,2	3,5	1,1	0,75	1,5	1,1	FR4/IP21, IP54	128x292x190	5
NXS 0004	4,0	4,4	3,1	4,4	1,5	1,1	2,2	1,5	FR4/IP21, IP54	128x292x190	5
NXS 0005	5,4	6	4	6	2,2	1,5	3	2,2	FR4/IP21, IP54	128x292x190	5
NXS 0007	7	7,7	5,4	7,7	3	2,2	4	3	FR4/IP21, IP54	128x292x190	5
NXS 0009	9	10	7	10	4	3	5,5	4	FR4/IP21, IP54	128x292x190	5
NXS 0012	12	13,2	9	13,2	5,5	4	7,5	5,5	FR4/IP21, IP54	128x292x190	5
NXS 0016	16	18	12	18	7,5	5,5	11	7,5	FR5/IP21, IP54	144x391x214	8,1
NXS 0022	22	24	16	24	11	7,5	15	11	FR5/IP21, IP54	144x391x214	8,1
NXS 0031	31	35	22	35	15	11	18,5	15	FR5/IP21, IP54	144x391x214	8,1
NXS 0038	38	47	31	47	18,5	15	22	18,5	FR6/IP21, IP54	195x519x237	18,5
NXS 0045	45	54	38	54	22	18,5	30	22	FR6/IP21, IP54	195x519x237	18,5
NXS 0061	61	68	45	68	30	22	37	30	FR6/IP21, IP54	195x519x237	18,5
NXS 0072	72	92	61	92	37	30	45	37	FR7/IP21, IP54	237x591x257	35
NXS 0087	87	108	72	108	45	37	55	45	FR7/IP21, IP54	237x591x257	35
NXS 0105	105	131	87	131	55	45	75	55	FR7/IP21, IP54	237x591x257	35
NXS 0140	140	158	105	158	75	55	90	75	FR8/IP21, IP54	285x721x288	58
NXS 0168	168	210	140	210	90	75	110	90	FR8/IP21, IP54	285x721x288	58
NXS 0205	205	252	168	252	110	90	132	110	FR8/IP21, IP54	285x721x288	58

Table 4-1. Power ratings and dimensions of the NX, supply voltage 380—500V.

## 4.3 Technical data

<b>Mains connection</b>	Input voltage $U_{in}$	208...240 V; 380...500 V; 525...690 V; -15%...+10%
	Input frequency	45...66 Hz
	Connection to mains	Once per minute or less (normal case)
<b>Motor connection</b>	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	2.5 x $I_H$ 2 secs every 20 secs, if output frequency <30Hz and temperature of heatsink <+60°C (up to 400 kW)
	Output frequency	0...320 Hz (NXS); 7200 Hz (Special)
	Frequency resolution	0.01 Hz (NXS); Application dependent (NXP)
<b>Control characteristics</b>	Control method	Frequency Control U/f Open Loop Sensorless Vector Control Closed Loop Frequency Control Closed Loop Vector Control (NXP only)
	Switching frequency (See parameter 2.6.9)	Up to and including NX 0061: 1...16 kHz; Factory default 10 kHz From NX 0072: 1...10 kHz; Factory default 3.6 kHz
	<u>Frequency reference</u>	
	Analogue input	Resolution 0.1% (10bit), accuracy $\pm 1\%$
	Panel reference	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)
<b>Ambient conditions</b>	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 to 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 (IEC 721-3-3, EN50178/ EN60068-2-6, IEC68-2-6 (68-2-34, -35, -36)	5...200 Hz Displacement amplitude 3 mm at 5...10.7 Hz Max acceleration amplitude 0.7 G at 10.7...200 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	IP21/NEMA1 standard in entire kW/HP range IP54/NEMA12 option in entire kW/HP range <b>Note!</b> Keypad installation required for IP54

Table 4-2. Technical data (continues on next page)

<b>EMC</b>	Immunity	Fulfil all EMC immunity requirements
	Emissions	EMC level H: EN50082-2, EN61800-3 (1st environment, restricted use; 2nd environment)
<b>Safety</b>		EN50178, EN60204-1, CE, UL, cUL, FI, GOST R , IEC 61800-5 (see unit nameplate for more detailed approvals)
<b>Control connections</b>	Analogue input voltage	0...+10V, $R_i = 200k\Omega$ , (-10V...+10V joystick control) Resolution 0.1%, accuracy $\pm 1\%$
	Analogue input current	0(4)...20mA, $R_i = 250\Omega$ differential
	Digital inputs (6)	Positive or negative logic; 18...24 Vdc
	Auxiliary voltage	+24V, $\pm 15\%$ , max. 250mA
	Output reference voltage	+10 V, +3 %, max. load 10 mA
	Analogue output	0(4)...20mA; $R_L$ max 500 $\Omega$ , Resolution 10 bit, Accur. $\pm 2\%$
	Digital outputs	Open collector output, 50mA/48V
<b>Protections</b>	Relay outputs	2 programmable change over relay outputs Max. switching voltage 125Vdc/250Vac Max. switching current 6A/24Vdc, 0.4A/250 Vac Max. continuous current 2 A rms
	Overcurrent protection	Trip limit $4.0 * I_H$ instantaneously
	Overvoltage protection	<b>NX_2</b> : 437V; <b>NX_5</b> : 911V; <b>NX_6</b> : 1200V (all VDC)
	Undervoltage protection	<b>NX_2</b> : 183V; <b>NX_5</b> : 333V; <b>NX_6</b> : 461V (all VDC)
	Earth-fault protection	In case of earth fault in motor or motor cable, only the frequency converter is protected
	Mains supervision	Trips if any of the input phases is missing
	Motor phase supervision	Trips if any of the output phases is missing
	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	

Table 4-2. Technical data

## 5. INSTALLATION

### 5.1 Mounting

The frequency converter can be mounted in either vertical or horizontal position on the wall or on the back plane of a cubicle. Enough space shall be reserved around the frequency converter in order to ensure a sufficient cooling, see Figure 5-6, Table 5-6 and Table 5-7. For safe installation, ensure that the mounting surface is relatively even.

The frequency converter should be fixed with four screws (or bolts, depending on the unit size). The dimensions of installation are presented in Figure 5-6 and Table 5-6.

Lift units bigger than FR7 out of the package using a jib crane. Ask the factory or your local distributor for information on how to lift the unit safely.

Below are the dimensions of the NX frequency converters with IP21 enclosure in Figure 5-1 and with IP21 for collar installation in Figure 5-2. The dimensions of the opening needed in collar installation are given in Table 5-3 and Table 5-5.

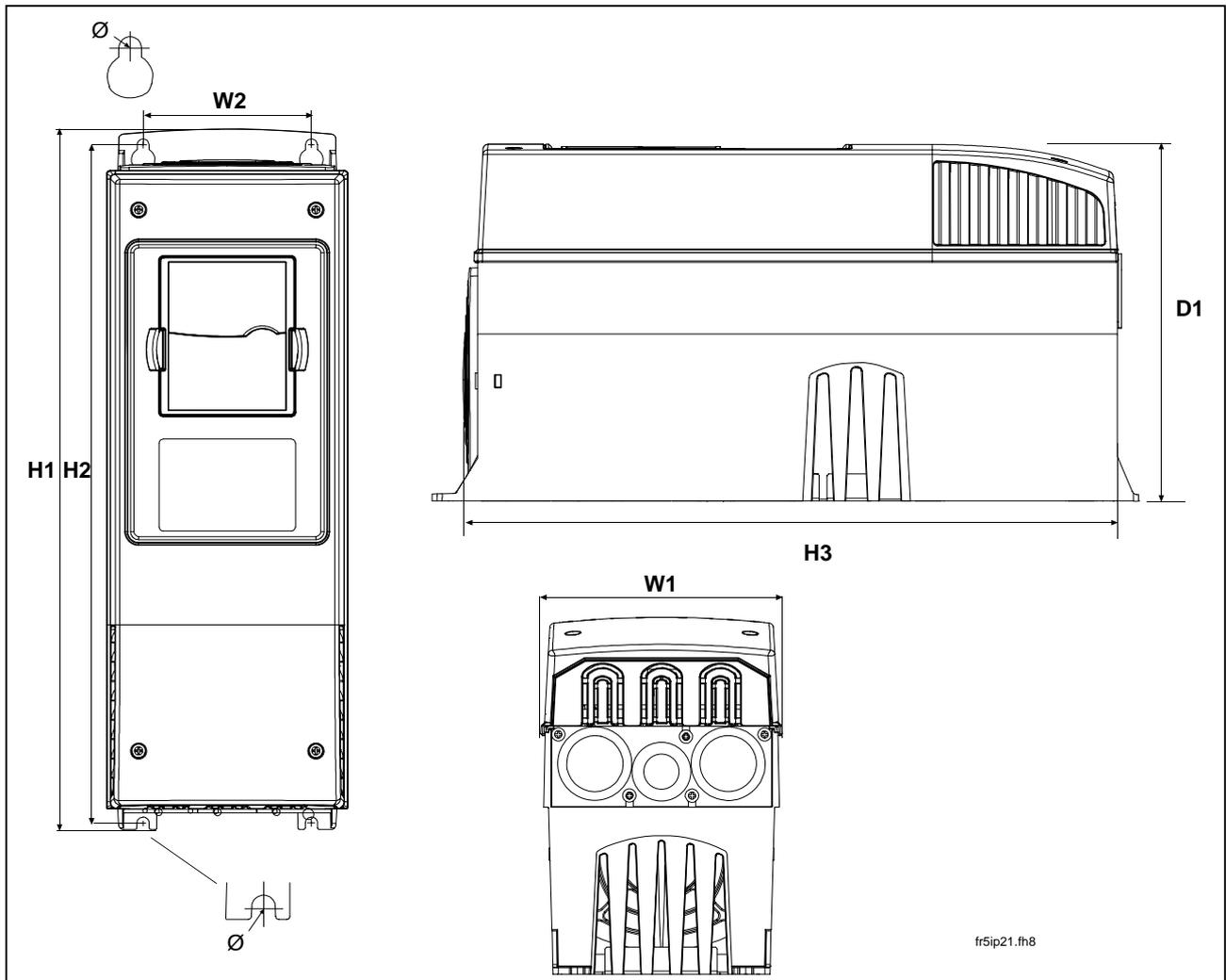


Figure 5-1. NX dimensions, IP21

Type	Dimensions								
	W1	W2	H1	H2	H3	D1	Ø	E1Ø	E2Ø*
0004—0015 NX2 0003—0012 NX5 0005—0019 NX6	128	100	327	313	292	190	7	3 x 28,3	
0018—0032 NX2 0016—0031 NX5 0022—0035 NX6	144	100	419	406	391	214	7	2 x 37	1 x 28,3
0048—0092 NX2 0038—0061 NX5 0042—0085 NX6	195	148	558	541	519	237	9	3 x 37	
0120—0150 NX2 0072—0105 NX5 0085—0122 NX6	237	190	630	614	591	257	9	3 x 47	
0140—0205 NX5	285	255	755	732	721	288	9	3 x 59	

Table 5-1. Dimensions for different frequency converter types, IP21

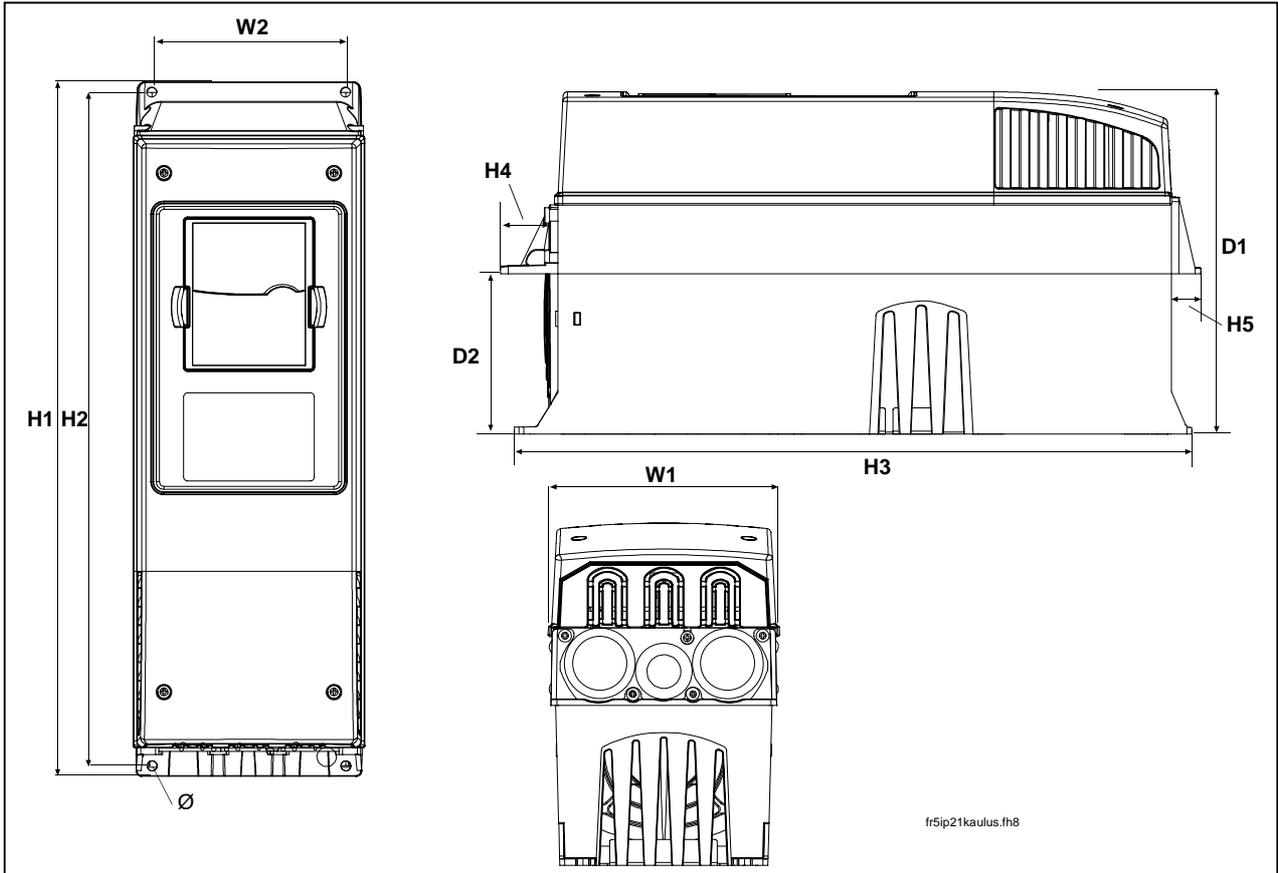


Figure 5-2. NX dimensions, IP21 with collar, FR4 to FR6

Type	Dimensions									
	W1	W2	H1	H2	H3	H4	H5	D1	D2	Ø
0004—0015 NX_2 0003—0012 NX_5 0005—0019 NX_6	128	113	337	325	327	30	22	190	77	7
0018—0032 NX_2 0016—0031 NX_5 0022—0035 NX_6	144	120	434	420	419	36	18	214	100	7
0048—0092 NX_2 0038—0061 NX_5 0042—0085 NX_6	195	170	560	549	558	30	20	237	106	6.5

Table 5-2. Dimensions for different frequency converter types FR4 to FR6, IP21 with collar

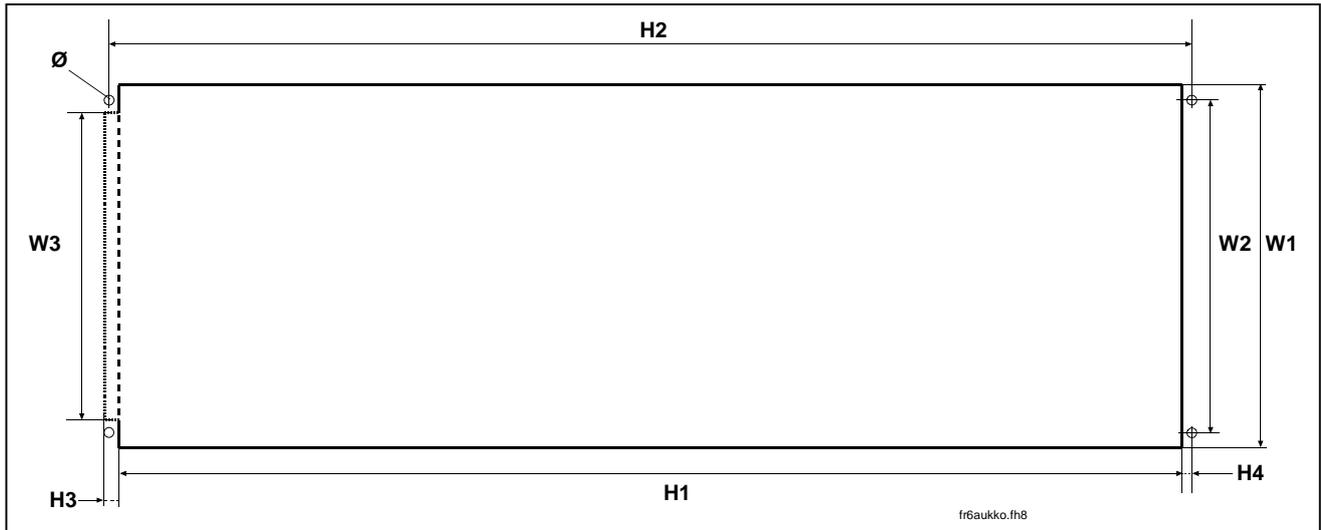


Figure 5-3. The opening needed for the collar installation, FR4 to FR6

Type	W1	W2	W3	H1	H2	H3	H4	Ø
	0004—0015 NX_2 0003—0012 NX_5 0005—0019 NX_6	123	113	—	315	325	—	5
0018—0032 NX_2 0016—0031 NX_5 0022—0035 NX_6	135	120	—	410	420	—	5	6.5
0048—0092 NX_2 0038—0061 NX_5 0042—0085 NX_6	185	170	157	539	549	7	5	6.5

Table 5-3. Dimensions for the collar opening, FR4/FR5

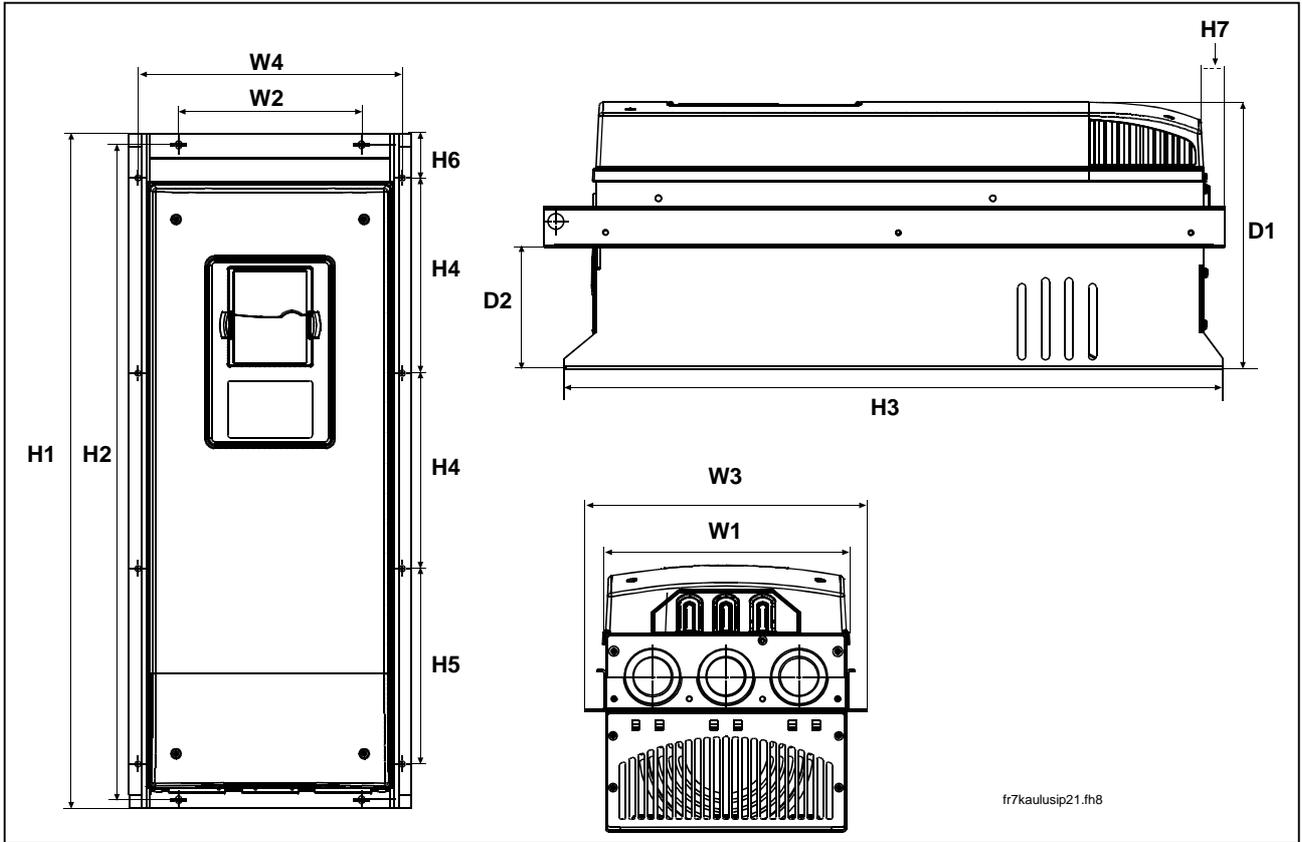


Figure 5-4. NX dimensions, IP21 with collar, FR7 and FR8

Type	W1	W2	W3	W4	H1	H2	H3	H4	H5	H6	H7	D1	D2	Ø
0120—0150 NX_2														
0072—0105 NX_5	237	175	270	253	652	632	630	188.5	188.5	23	20	257	117	5.5
0085—0122 NX_6														
0140—0205 NX_5	285	—	355	330	832	—	745	258	265	43	57	288	110	9

Table 5-4. Dimensions for different frequency converter types FR7 and FR8, IP21 with collar

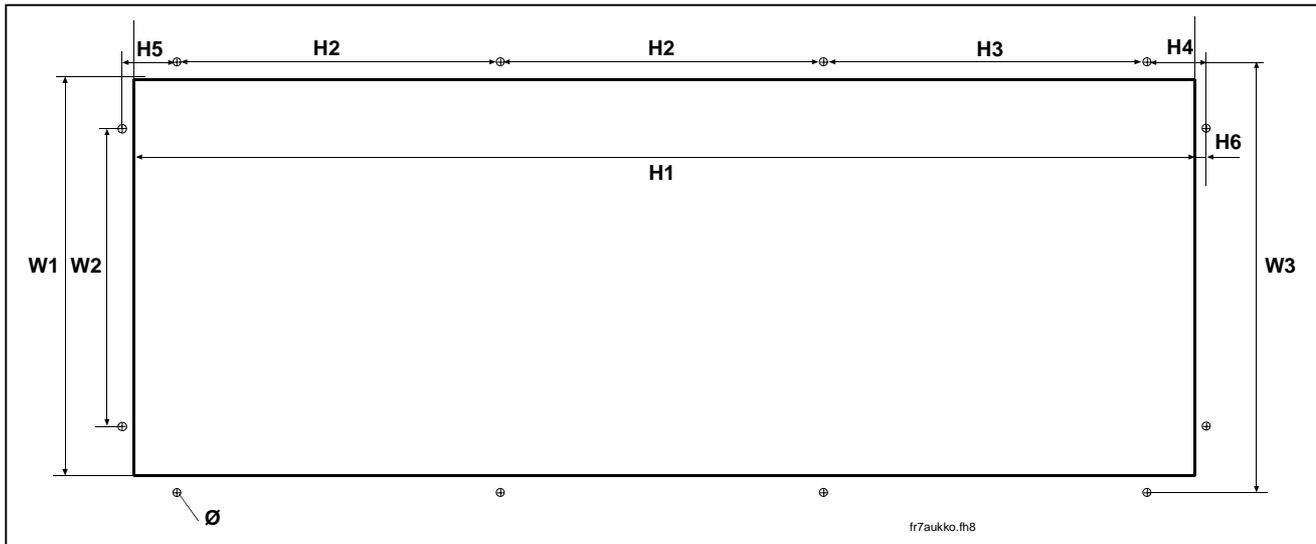


Figure 5-5. The opening needed for the collar installation, FR7/FR8

Type	W1	W2	W3	H1	H2	H3	H4	H5	H6	Ø
	0120—0150 NX_2 0072—0105 NX_5 0085—0122 NX_6	233	175	253	619	188.5	188.5	34.5	32	7
0140—0205 NX_5	301	—	330	810	258	265	—	—	—	9

Table 5-5. Dimensions for the collar opening, FR7/FR8

### 5.2 Cooling

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

If several units are mounted above each other the required free space equals C + D (see figure below). Moreover, the outlet air used for cooling by the lower unit must be directed away from the inlet air to be used by the upper unit.

Type	Dimensions				
	A	A <sub>2</sub>	B	C	D
0003—0012 NX_5	20		20	100	50
0016—0031 NX_5	20		20	120	60
0038—0061 NX_5	30		20	160	80
0072—0105 NX_5	80		80	300	100
0140—0205 NX_5	20	200 (150*)	80	300	200

Table 5-6. Mounting space dimensions

- A** = clearance around the freq. converter (see also **A<sub>2</sub>** and **B**)
- A<sub>2</sub>** = clearance needed on either side of the frequency converter for fan change (without disconnecting the motor cables)
- \*** = min. clearance for fan change (without disconnecting the motor cables) between two frequency converters
- 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

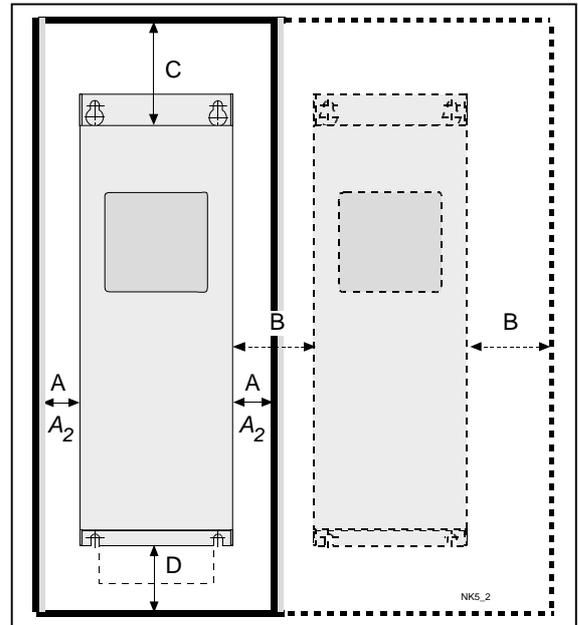


Figure 5-6. Installation space

Type	Cooling air required [m <sup>3</sup> /h]
0004—0015 NX_2 0003—0012 NX_5 0005—0019 NX_6	70
0018—0032 NX_2 0016—0031 NX_5 0022—0062 NX_6	190
0048—0078 NX_2 0038—0061 NX_5 0085 NX_6	425
0092—0150 NX_2 0072—0105 NX_5	425
0140—0205 NX_5 0100—0122 NX_6	650

Table 5-7. Required cooling air.

### 5.3 Power loss

#### 5.3.1 Power loss as function of switching frequency

If the operator wants to raise the switching frequency of the drive for some reason (typically e.g. in order to reduce the motor noise), this inevitably affects the output power reducing it according to the graphs below.

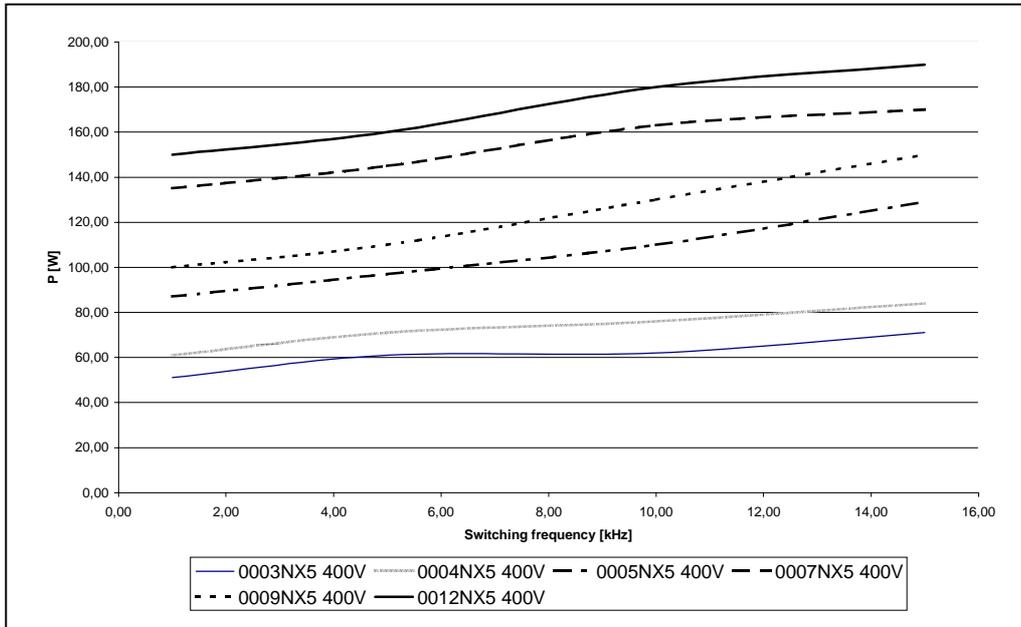


Figure 5-7. Power loss as function of switching frequency; 0003...0012NX5

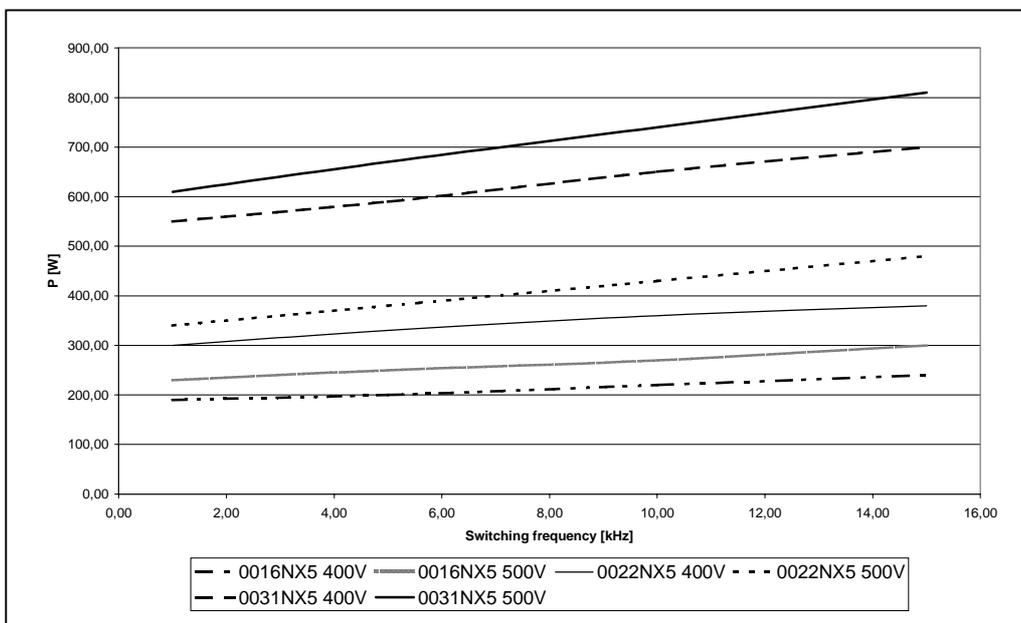


Figure 5-8. Power loss as function of switching frequency; 0016...0031NX5

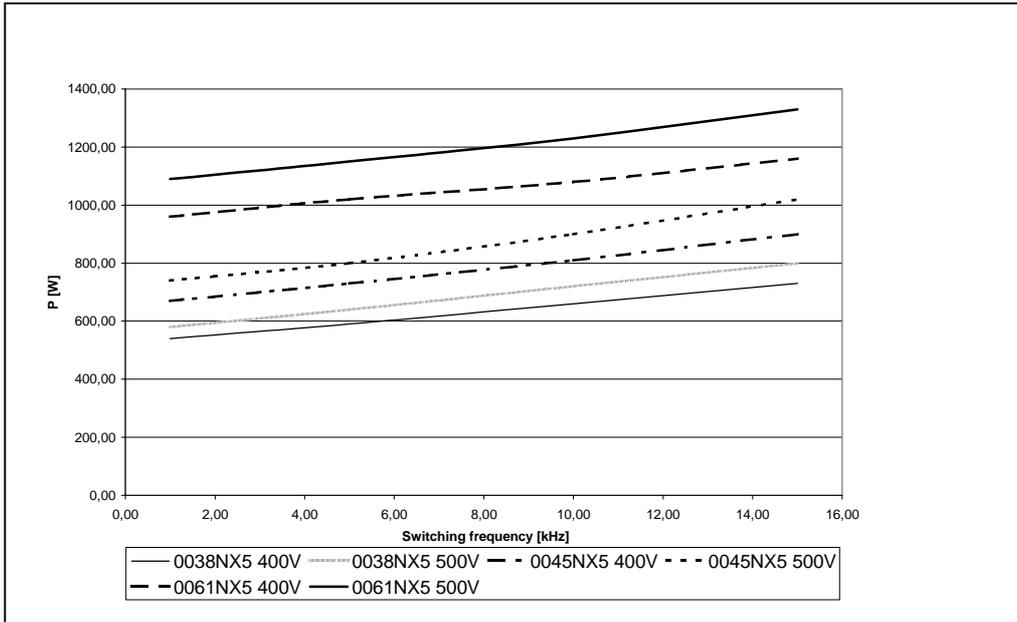


Figure 5-9. Power loss as function of switching frequency; 0038...0061NX5

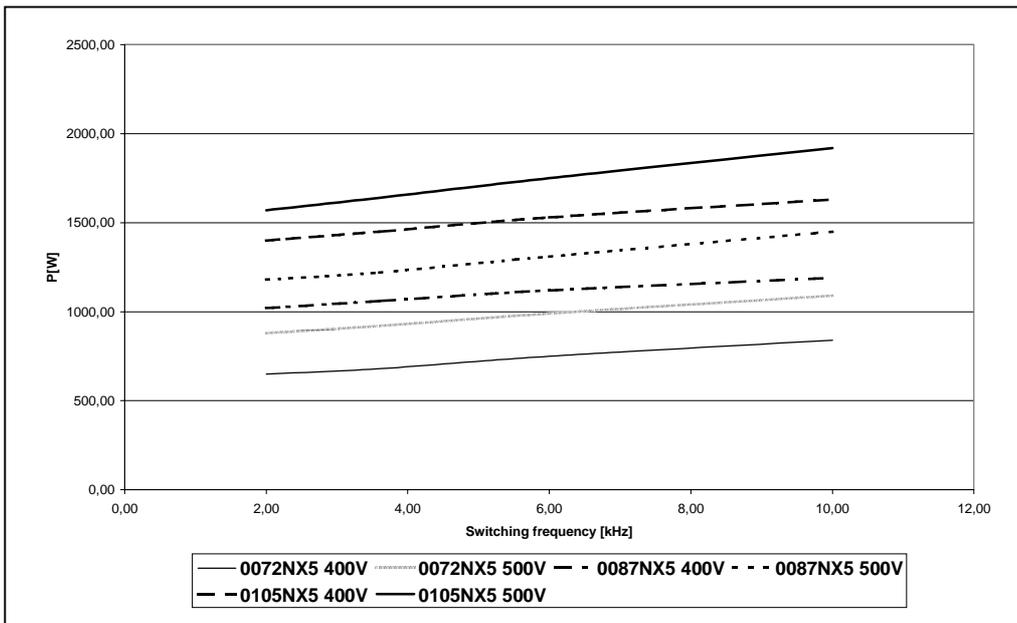


Figure 5-10. Power loss as function of switching frequency; 0072...0105NX5

6. CABLING AND CONNECTIONS

6.1 Power unit

The following wiring diagrams show the mains and motor connections of the frequency converter.

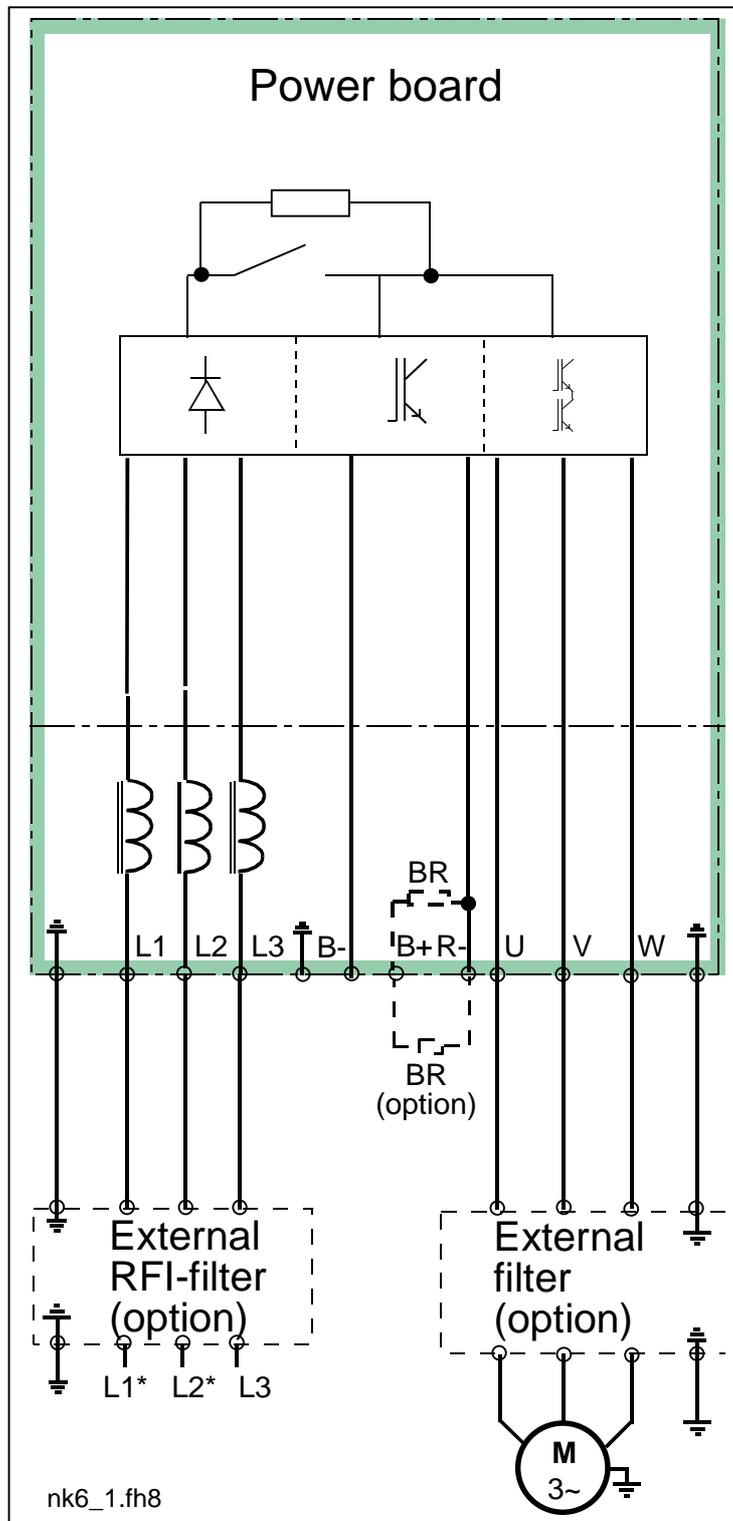


Figure 6-1. Principal wiring diagram of NX5 power unit, FR4 to FR6

\*When using 1-phase supply, connect the cables to terminals L1 and L2.

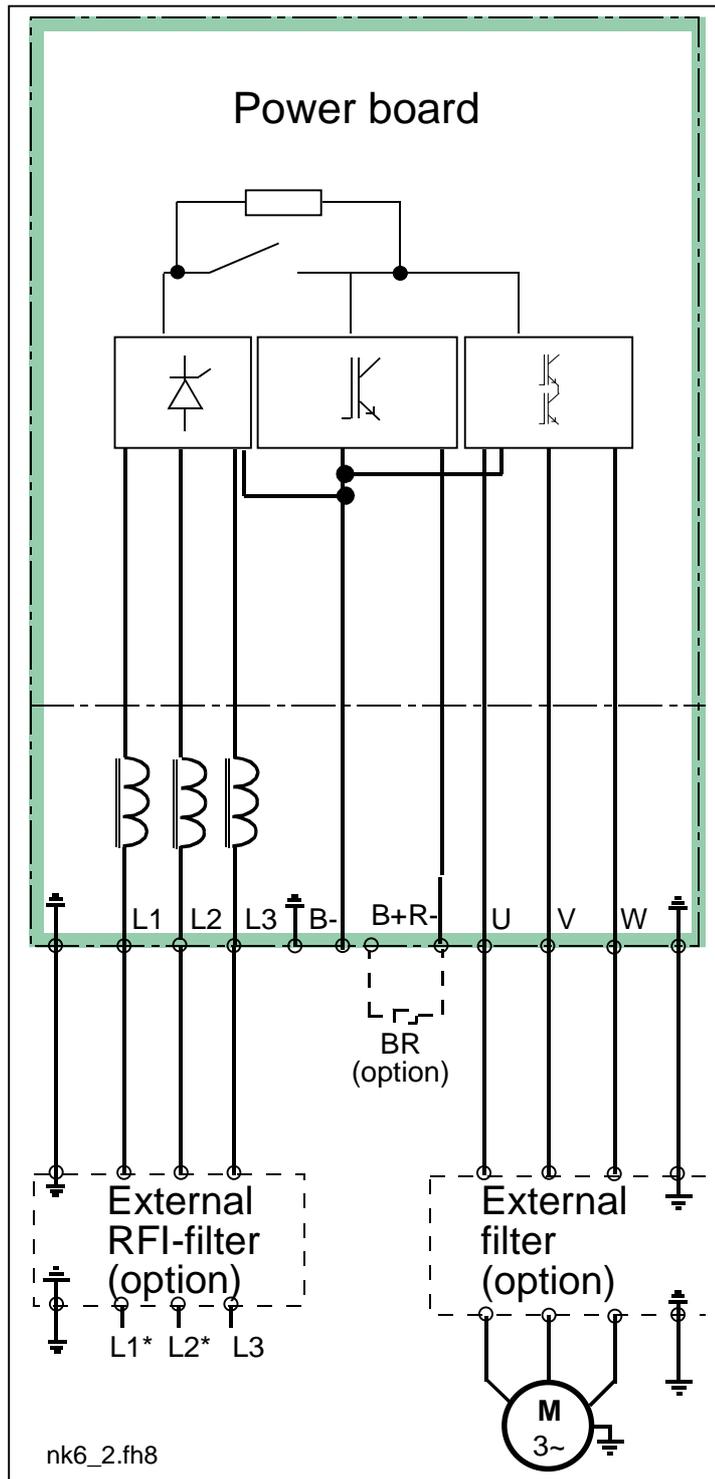


Figure 6-2. Principal wiring diagram of NX5 power unit, ≥FR7

\*When using 1-phase supply, connect the cables to terminals L1 and L2.

### 6.1.1 Power connections

Use cables with heat resistance of at least +60°C. The cables and the fuses must be dimensioned according to the frequency converter nominal OUTPUT current which can be found on the rating plate. Dimensioning according to the output current is recommended because the frequency converter input current never significantly exceeds the output current. Installation of cables according to UL regulations is presented in Chapter 6.1.3.

Table 6-2 shows the minimum dimensions of the Cu-cables and the corresponding GG/GL fuse sizes. The dimensions of the fuses in the table have been given taking their function as a cable overload protection into account.

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

#### 6.1.1.1 Mains cable

Mains cables for different EMC levels in Table 6-1.

#### 6.1.1.2 Motor cable

Motor cables for different EMC levels in Table 6-1.

#### 6.1.1.3 Control cable

For information on control cables see Chapter 6.2.1.1 and Table 6-1.

Cable type	Level H
Mains cable	1
Motor cable	2
Control cable	4

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

**Level H** = EN 61800-3, 1st environment  
EN 50081-2

- 1 = Power cable intended for fixed installation and the specific mains voltage. Shielded cable not required. (NNCABLES/MCMK or similar recommended)
- 2 = Power cable equipped with concentric protection wire and intended for the specific mains voltage. (NNCABLES /MCMK or similar recommended).
- 3 = Power cable equipped with compact low-impedance shield and intended for the specific mains voltage. (NNCABLES /MCCMK, SAB/ÖZCUY-J or similar recommended).
- 4 = Screened cable equipped with compact low-impedance shield (NNCABLES /jamak, SAB/ÖZCuY-O or similar).

## 6.1.1.4... Cable and fuse sizes

Frame	Type	I <sub>L</sub> [A]	Fuse [A]	Mains and motor cable Cu [mm <sup>2</sup> ]	Terminal cable size	
					Main terminal [mm <sup>2</sup> ]	Earth terminal [mm <sup>2</sup> ]
FR4	0003—0009	3—9	10	3*1.5+1.5	1—4	1—2.5
FR4	0012	12	16	3*2.5+2.5	1—4	1—2.5
FR5	0016	16	20	3*4+4	1—10	1—10
FR5	0022	22	25	3*6+6	1—10	1—10
FR5	0031	31	35	3*10+10	1—10	1—10
FR6	0038—45	38—45	50	3*10+10	2.5—50 Cu 6—50 Al	6—35
FR6	0061	61	63	3*16+16	2.5—50 Cu 6—50 Al	6—35
FR7	0072	72	80	3*25+16	2.5—50 Cu 6—50 Al	6—70
FR7	0087	87	100	3*35+16	2.5—50 Cu 6—50 Al	6—70
FR7	0105	105	125	3*50+25	2.5—50 Cu 6—50 Al	6—70
FR8	0140	140	160	3*70+35	25—95 Cu/Al	25—95
FR8	0168	168	200	3*95+50	95—185 Cu/Al	25—95
FR8	0205	205	250	3*150+70	95—185 Cu/Al	25—95

Table 6-2. Cable and fuse sizes for NX5

## 6.1.2 Installation instructions

	<b>1</b>	Before starting the installation, check that none of the components of the frequency converter are live.						
	<b>2</b>	If the frequency converter is installed outside either a switchgear, separate cubicle or electrical room, it must be equipped with a protection cover (see e.g. Figure 6-4) as provided by the regulations for IP21 protection class. For installations in a switchgear, separate cubicle or electrical room, the cable protection plate is normally not necessary.						
	<b>3</b>	<p>Place the motor cables sufficiently far from other cables:</p> <ul style="list-style-type: none"> <li>▪ <b>Avoid placing</b> the motor cables in long parallel lines with other cables</li> <li>▪ If the motor cables runs in parallel with other cables, note the <b>minimum distances</b> between the motor cables and other cables given in the table below.</li> <li>▪ The given distances also apply between the motor cables and signal cables of other systems.</li> <li>▪ <b>The maximum length of the motor cables is 300 m (level H, units with power greater than 1.5 kW) and 100 m (units with power from 0.75 to 1.5 kW).</b></li> <li>▪ The <b>motor cables should cross</b> other cables at an angle of 90 degrees.</li> </ul> <table border="1" style="margin-left: auto; margin-right: auto;"> <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;">≤50</td> </tr> <tr> <td style="text-align: center;">1.0</td> <td style="text-align: center;">≤200</td> </tr> </tbody> </table>	Distance between cables [m]	Shielded cable [m]	0.3	≤50	1.0	≤200
Distance between cables [m]	Shielded cable [m]							
0.3	≤50							
1.0	≤200							
	<b>4</b>	If <b>cable insulation checks</b> are needed, see Chapter 6.1.4.						

*Continues on the next page*

	<b>5</b>	<p>Connect the cables:</p> <ul style="list-style-type: none"><li>▪ <b>Strip the motor and mains cables</b> as advised in Table 6-3 and Figure 6-3.</li><li>▪ <b>Remove the screws</b> of the cable protection plate.</li><li>▪ Make holes into and <b>pass the cables</b> through the rubber grommets on the bottom of the power unit (see e.g. Figure 6-7).</li><li>▪ <b>Connect the mains, motor and control cables</b> into their respective terminals (see e.g. Figure 6-7).</li><li>▪ For information on the installation of <b>larger units</b>, please contact your local distributor.</li><li>▪ For Information on <b> cable installation according to UL regulations</b> see Chapter 6.1.3.</li><li>▪ <b>Ensure</b> that the control cable wires do not come in contact with the electronic components of the unit.</li><li>▪ If an <b>external brake resistor</b> (option) is used, connect its cable to the appropriate terminal.</li><li>▪ <b>Check the connection</b> of the earth cable to the motor and the frequency converter terminals marked with .</li><li>▪ Connect the <b>separate shield of the power cable</b> to the earth terminals of the frequency converter, motor and the supply centre.</li><li>▪ Attach the cable protection plate with the screws.</li><li>▪ <b>Ensure</b> that the control cables or the cables of the unit are <b>not trapped</b> between the frame and the protection plate.</li></ul>
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6.1.2.1 Stripping lengths of motor and mains cables

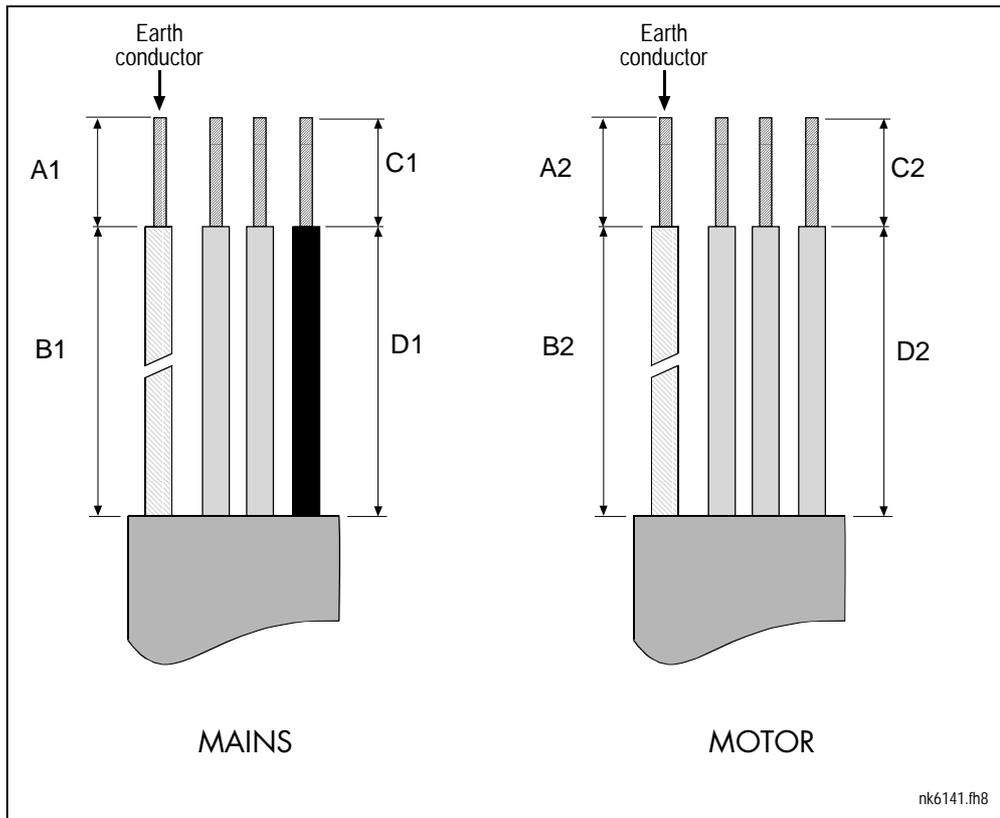


Figure 6-3. Stripping of cables

Frame	A1	B1	C1	D1	A2	B2	C2	D2
FR4	15	35	10	20	7	50	7	35
FR5	20	40	10	30	20	60	10	40
FR6	20	90	15	60	20	90	15	60
FR7	25	120	25	120	25	120	25	120
FR8								
0140	23	240	23	240	23	240	23	240
0168—0205	28	240	28	240	28	240	28	240

Table 6-3. Cables stripping lengths [mm]

### 6.1.2.2... NX frequency converter frames and installation of cables

**Note:** To connect an external brake resistor, see separate Brake Resistor Manual. See also Chapter Internal brake resistor connection (P6.3.3) on page 69 in this manual.



Figure 6-4. NX, FR4

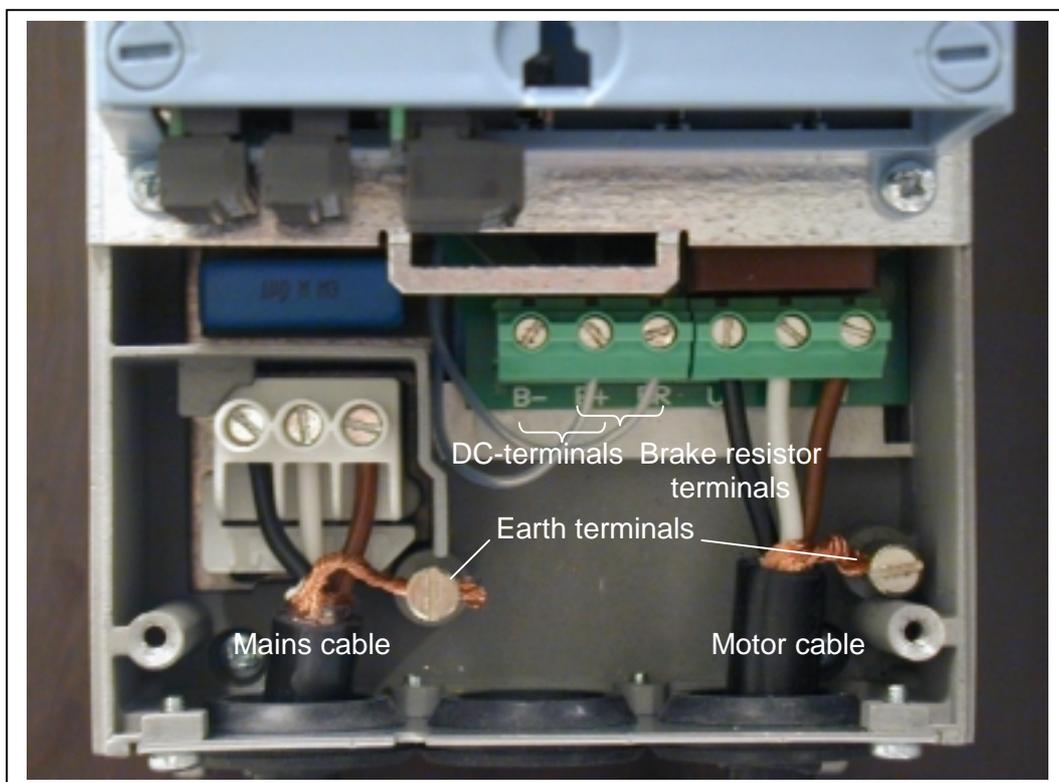


Figure 6-5. Cable installation in NX, FR4



Figure 6-6. NX, FR5. Protection class IP21

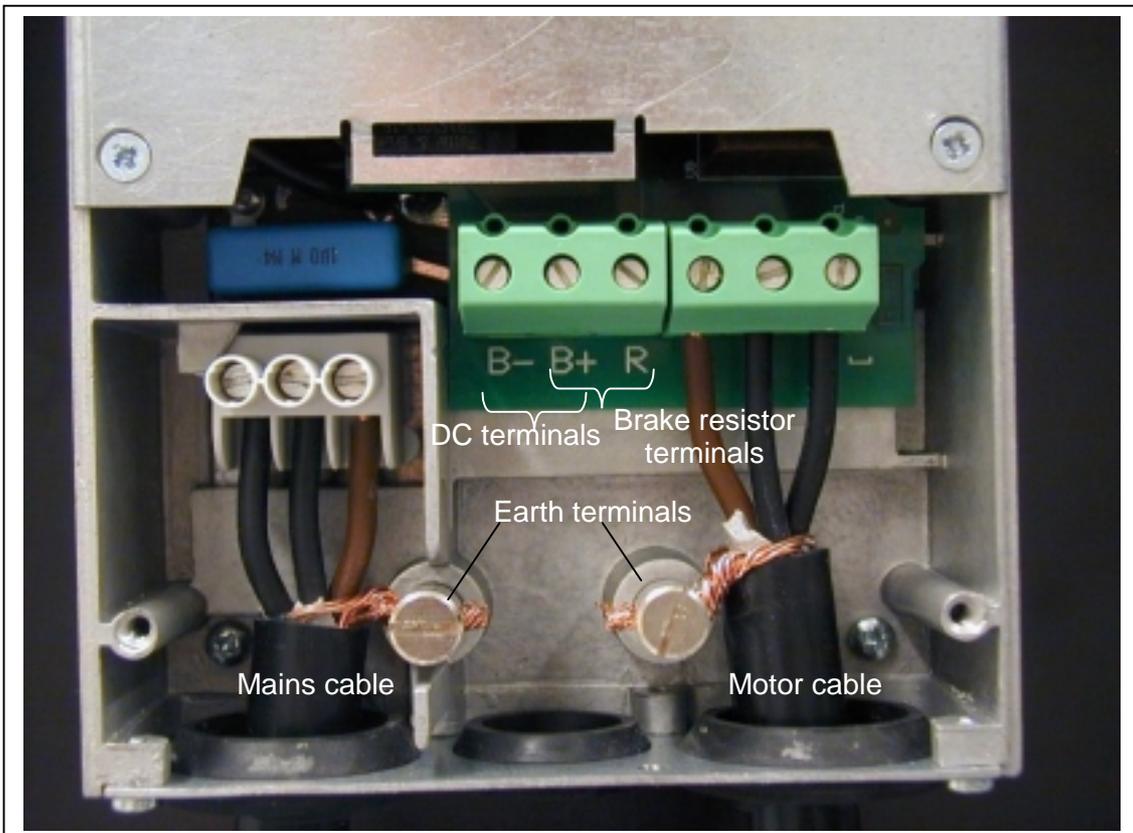


Figure 6-7. Cable installation in NX, FR5



Figure 6-8. NX, FR6. Protection class IP21.

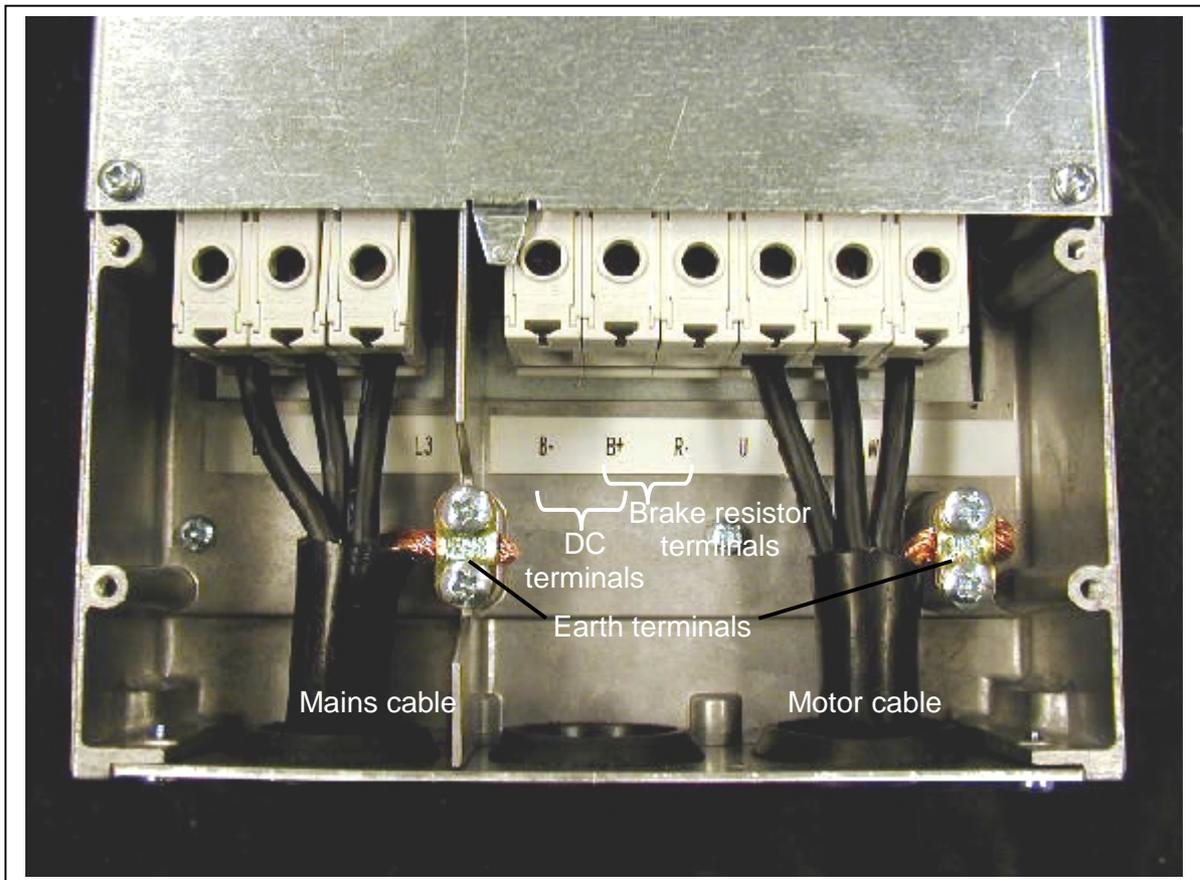


Figure 6-9. Cable installation in NX, FR6



Figure 6-10. NX, FR7. Protection class IP21.

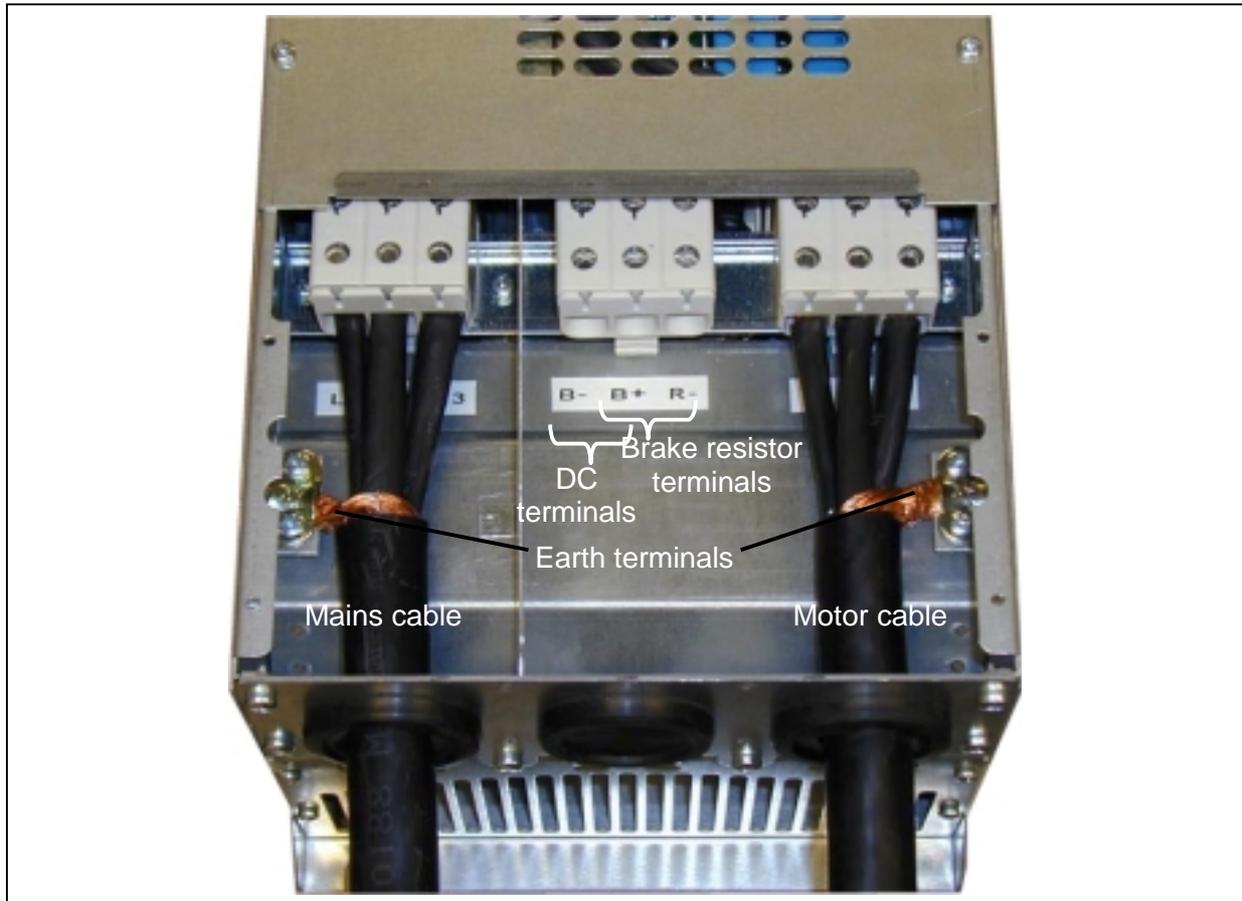


Figure 6-11. Cable installation in NX, FR7

### 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.

Type	Frame	Tightening torque [Nm]	Tightening torque in-lbs.
NX5 0003—0012	FR4	0.5—0.6	4—5
NX5 0016—0031	FR5	1.2—1.5	10—13
NX5 0038—0061	FR6	4	35
NX5 0072—0105	FR7	10	85
NX5 0140	FR8	20/9*	170/76*
NX5 0168—0205	FR8	40/22*	340/187*

Table 6-4. Tightening torques of terminals

\* Tightening torque of terminal connection to the isolative base in Nm/in-lbs.

### 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  $>1M\Omega$ .

#### 2. Mains cable insulation checks

Disconnect the motor cable from terminals L1, L2 and L3 of the frequency converter and from the mains. 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  $>1M\Omega$ .

#### 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  $>1M\Omega$ .

## 6.2 Control unit

The control unit of the frequency converter consists roughly of the control board and additional boards (see Figure 6-12 and Figure 6-13) connected to the five *slot connectors* (A to E) of the control board. The control board is connected to the power unit through a D-connector (1).

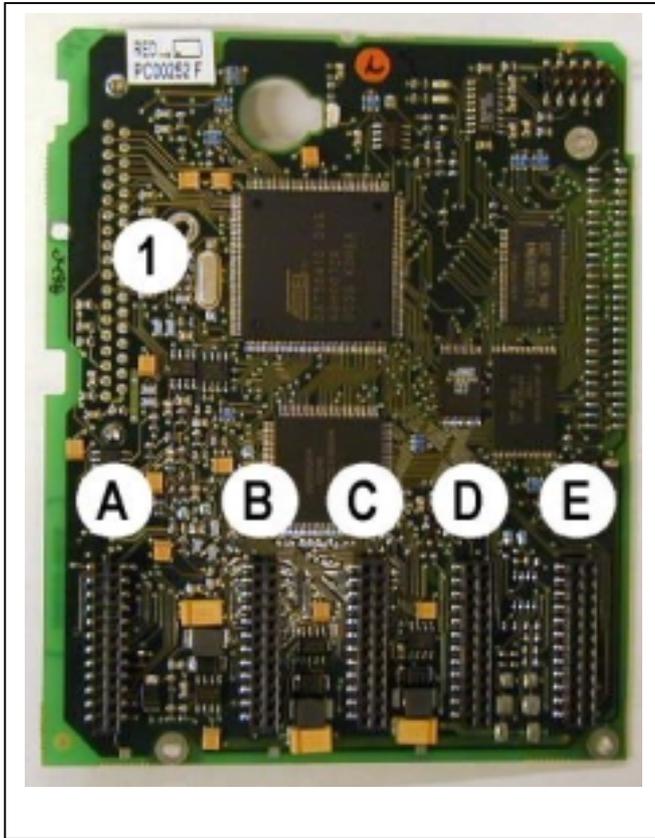


Figure 6-12. NX control board

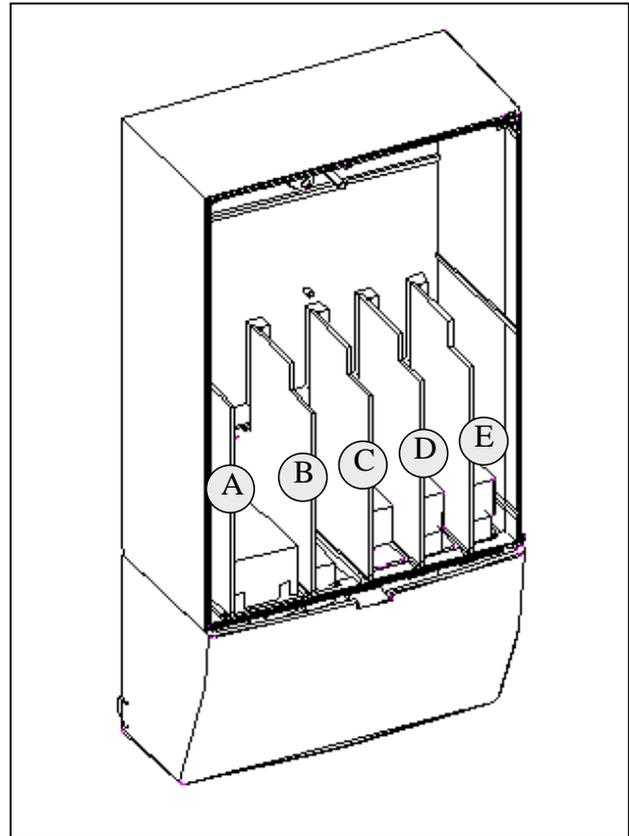


Figure 6-13. Basic and option board connections on the control board

When the frequency converter is delivered from the factory, the control unit includes at least the standard compilation of two basic boards (I/O board and thermistor board) which are normally installed in slots A and B. The next pages show the arrangement of the [control I/O and the relay terminals](#) of the two basic boards, the [general wiring diagram](#) and the [control signal descriptions](#).

The control board can be powered externally (+24V) by connecting the external power source to the bidirectional terminal #6, see page 43. This voltage is sufficient for parameter setting and for keeping the fieldbus active.

### 6.2.1 Control connections

The basic control connections for boards A1 and A3 are shown in Chapter 6.2.2.

The signal descriptions of the Standard Application are presented in Chapter 2 of the Application Manual. If some other **application** is used, check the Application Manual for the signal descriptions of the respective application.

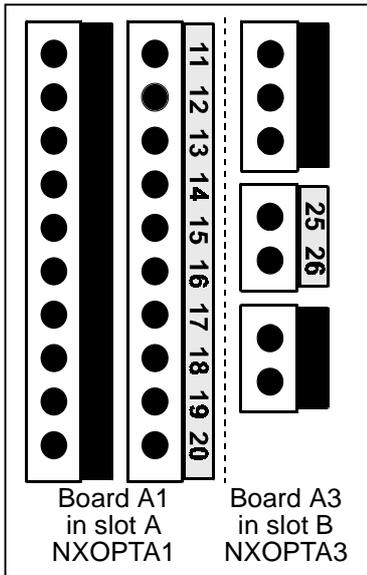


Figure 6-14. The I/O terminals of the two basic boards

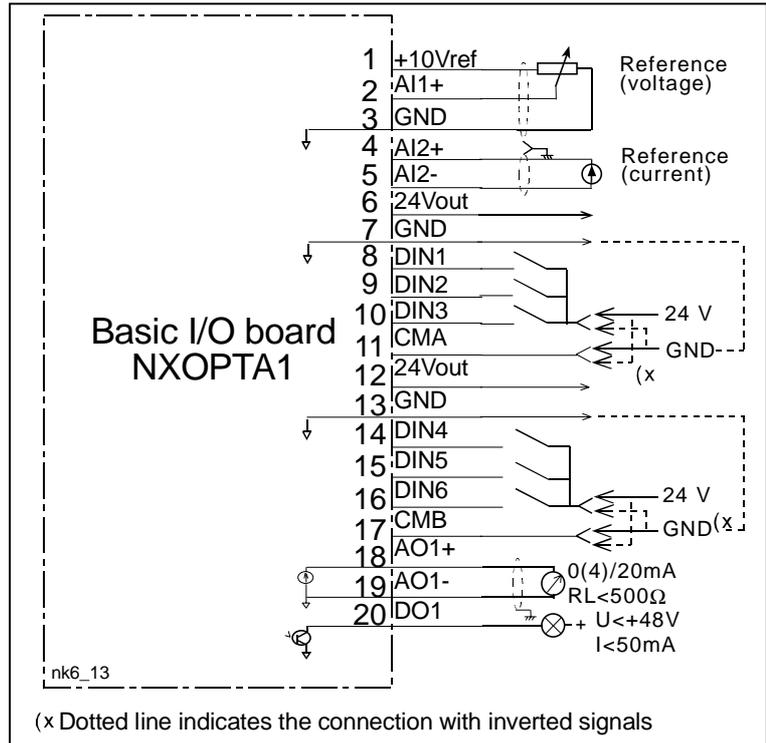


Figure 6-15. General wiring diagram of the basic I/O board (NXOPTA1)

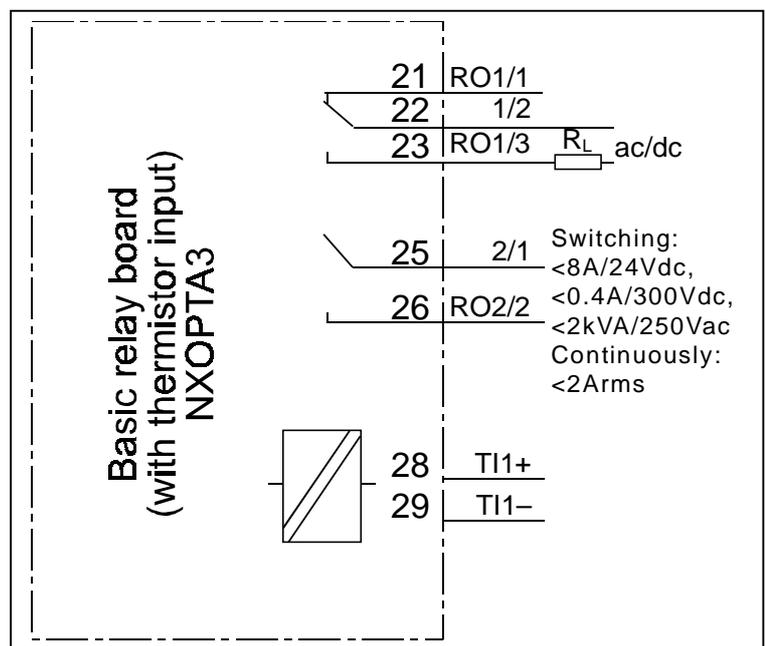


Figure 6-16. General wiring diagram of the basic relay board (NXOPTA3)

6.2.1.1 Control cables

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

6.2.1.2 Galvanic isolation barriers

The control connections are isolated from the mains potential and the GND terminals are permanently connected to ground. See Figure 6-17.

The digital inputs are galvanically isolated from the I/O ground. The relay outputs are additionally double-isolated from each other at 300VAC (EN-50178).

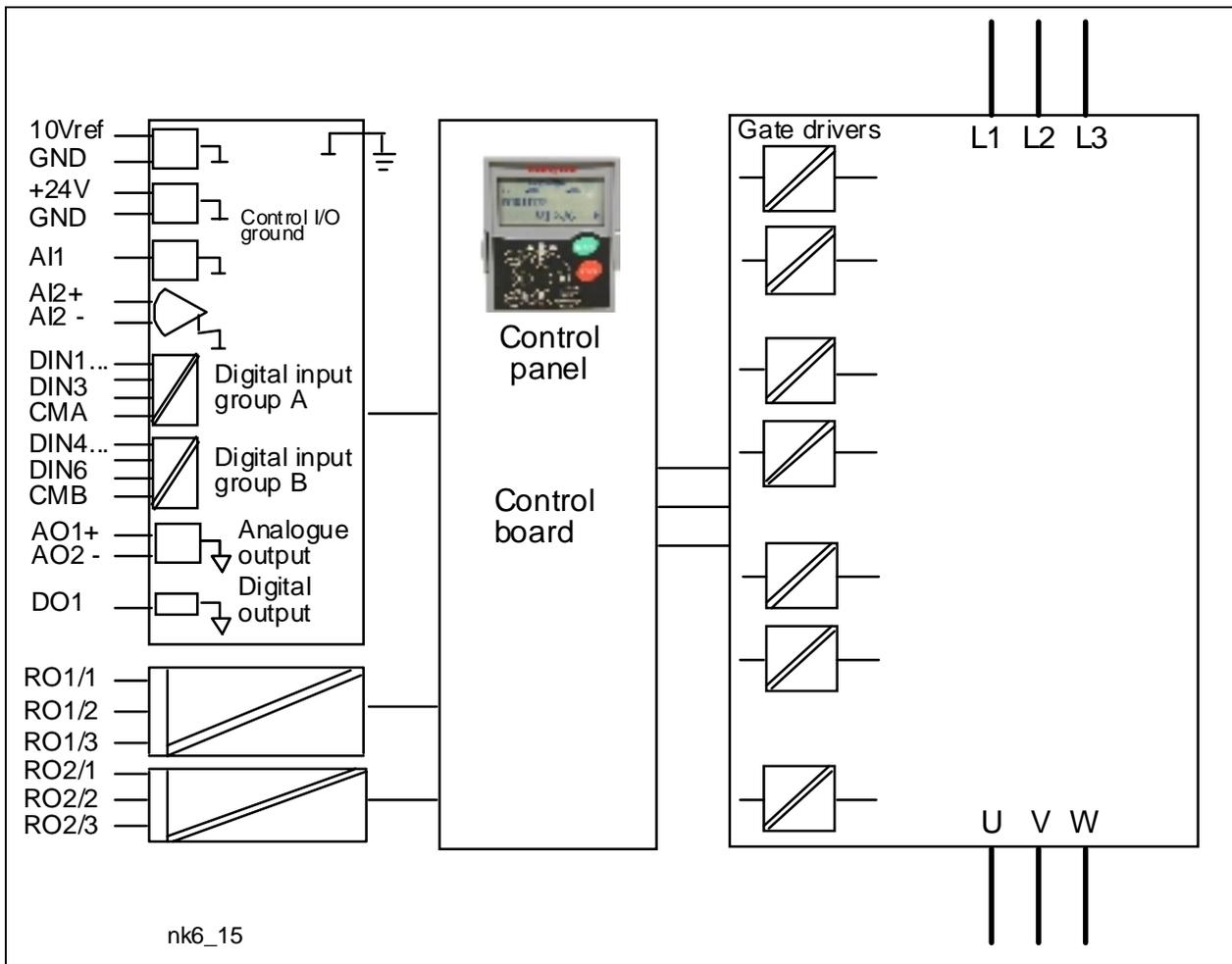


Figure 6-17. Galvanic isolation barriers

### 6.2.2 Control terminal signals

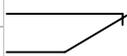
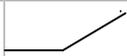
Terminal	Signal	Technical information
1	+10 Vref	Reference voltage Maximum current 10 mA
2	AI1+	Analogue input, voltage or current <a href="#">Selection V or mA with jumper block X1</a> (see page 45): Default: 0– +10V ( $R_i = 200\text{ k}\Omega$ ) (-10V.....+10V Joy-stick control, selected with a jumper) 0– 20mA ( $R_i = 250\ \Omega$ )
3	GND/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 <a href="#">Selection V or mA with jumper block X2</a> (see page 45): Default: 0– 20mA ( $R_i = 250\ \Omega$ ) 0– +10V ( $R_i = 200\text{ k}\Omega$ ) (-10V.....+10V Joy-stick control, selected with a jumper)
5	GND/AI2–	Analogue input common Differential input if not connected to ground; Allows $\pm 20\text{V}$ differential mode voltage to GND
6	24 Vout (bidirectional)	24V auxiliary voltage $\pm 15\%$ , maximum current 250mA (all boards total); 150mA (from single board); Can also be used as external power backup for the control unit (and fieldbus)
7	GND	I/O ground Ground for reference and controls
8	DIN1	Digital input 1 $R_i = \text{min. } 5\text{ k}\Omega$
9	DIN2	Digital input 2
10	DIN3	Digital input 3
11	CMA	Digital input common A for DIN1, DIN2 and DIN3. Must be connected to GND or 24V of I/O terminal or to external 24V or GND <a href="#">Selection with jumper block X3</a> (see page 45):
12	24 Vout (bidirectional)	24V auxiliary voltage Same as terminal #6
13	GND	I/O ground Same as terminal #7
14	DIB4	Digital input 4 $R_i = \text{min. } 5\text{ k}\Omega$
15	DIB5	Digital input 5
16	DIB6	Digital input 6
17	CMB	Digital input common B for DIB4, DIB5 and DIB6 Must be connected to GND or 24V of I/O terminal or to external 24V or GND <a href="#">Selection with jumper block X3</a> (see page 45):
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 href="#">Selection with jumper block X6</a> (see page 45):
20	DO1	Open collector output Maximum $U_{in} = 48\text{VDC}$ Maximum current = 50 mA
<b>NXOPTA3</b>		
21	RO1/1	 Relay output 1 Maximum switching voltage 250VAC, 125VDC Maximum switching current 8A/24VDC, 0.4A/250VDC Min. switching load 5V/10mA
22	RO1/2	
23	RO1/3	
25	RO2/1	 Relay output 2 Maximum switching voltage 250VAC, 125VDC Maximum switching current 8A/24VDC, 0.4A/250VDC Min. switching load 5V/10mA
26	RO2/2	
28	TI1/1	 Thermistor input 1 Basic galvanic isolation Double isolation when connected to thermistor
29	TI1/2	

Table 6-5. Control I/O terminal signals

### 6.2.2.1 Digital input signal inversions

The active signal level depends on which potential the common inputs CMA and CMB (terminals 11 and 17) are connected to. The alternatives are either +24V or ground (0 V). See Figure 6-18.

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

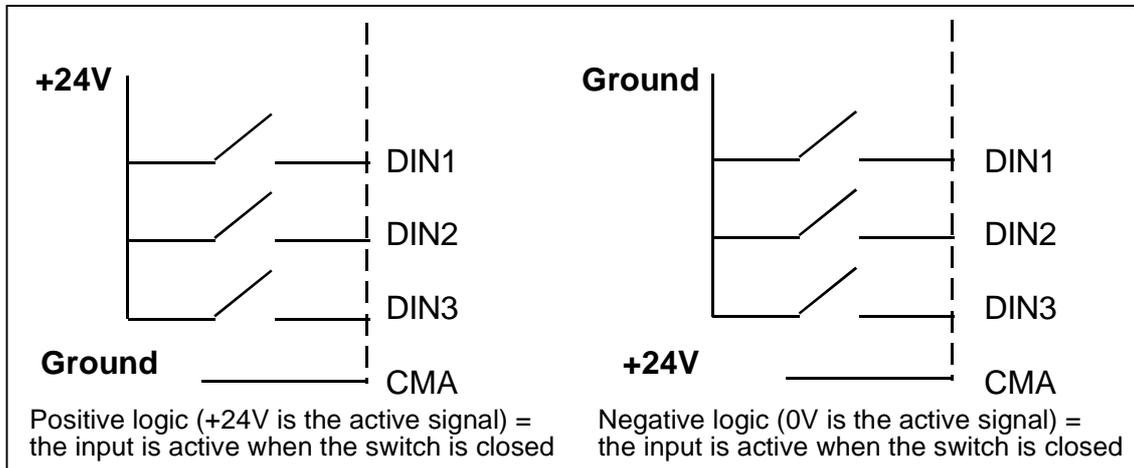


Figure 6-18. Positive/Negative logic

### 6.2.2.2 Jumper selections on the NXOPTA1 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 NXOPTA1 board. The positions of the jumpers determine the signal type of analogue and digital inputs.

On the A1 basic board, there are four jumper blocks X1, X2, X3 and X6 each containing eight pins and two jumpers. The selectable positions of the jumpers are shown in Figure 6-20.

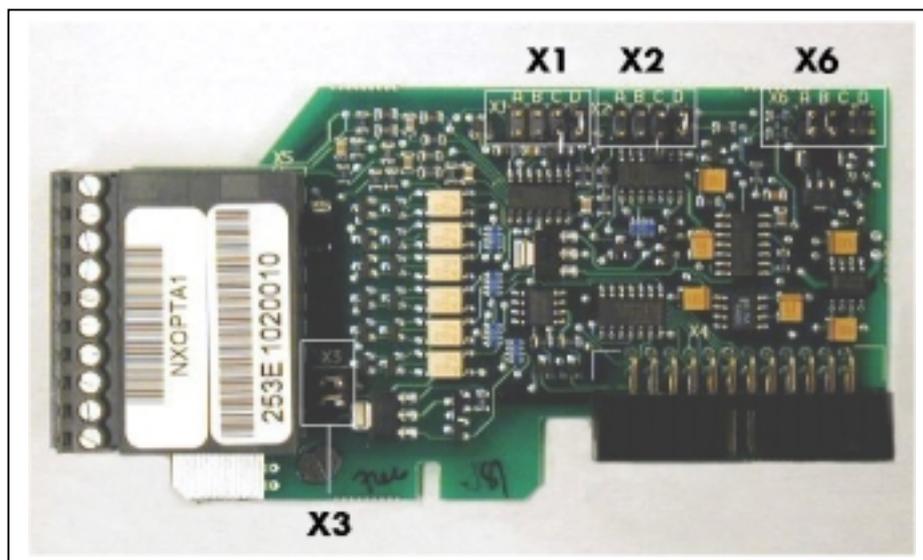


Figure 6-19. Jumper blocks on NXOPTA1

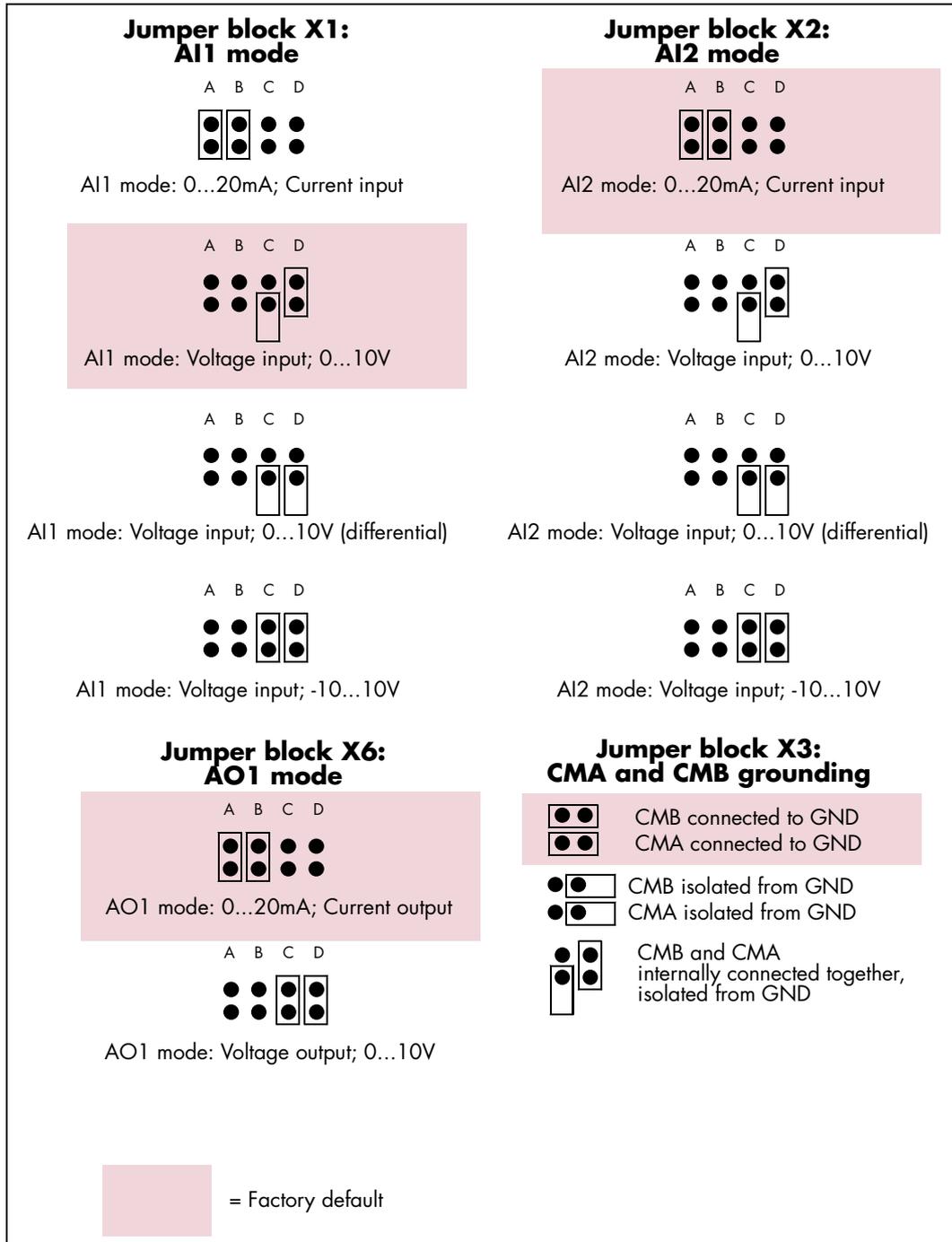


Figure 6-20. Jumper selection for NXOPTA1

 <b>WARNING</b>	<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>
 <b>NOTE</b>	<p>If the AI signal content is changed the corresponding board parameter in <b>menu M7</b> must also be changed.</p>

## 7. CONTROL KEYPAD

The control keypad is the link between the frequency converter and the user. The NX control keypad features an alphanumeric display with seven indicators for the Run status (RUN, , , READY, STOP, ALARM, FAULT) and three indicators for the control place (I/O term/Keypad/BusComm). There are also three Status Indicator LEDs (green - green - red), see Status LEDs (green – green – red) below.

The control information, i.e. the number of menu, description of menu or the displayed value and the numeric information are presented on three text lines.

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

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

### 7.1 Indications on the Keypad display

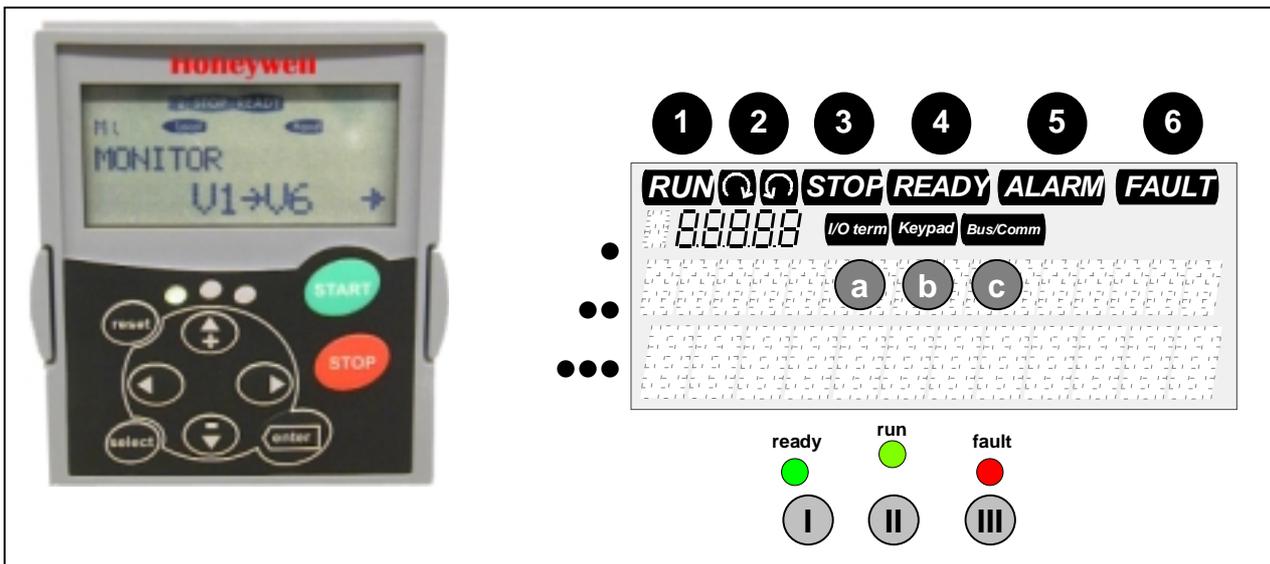


Figure 7-1. The control keypad and drive status indications

#### 7.1.1 Drive status indications (See control keypad)

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

- 1 RUN = Motor is running; Blinks when the stop command has been given but the frequency is still ramping down.
- 2   = Indicates the direction of motor rotation.
- 3 STOP = Indicates that the drive is not running.

- 4 READY = Lights when AC power is on. In case of a trip, the symbol will not light up.
- 5 ALARM = Indicates that the drive is running outside a certain limit and a warning is given.
- 6 FAULT = Indicates that unsafe operating conditions were encountered due to which the drive was stopped.

### 7.1.2 Control place indications (See control keypad)

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

- a *I/O term* = I/O terminals are the selected control place; i.e. START/STOP commands or reference values etc. are given through the I/O terminals.
- b *Keypad* = Control keypad is the selected control place; i.e. the motor can be started or stopped, or its reference values etc. altered from the keypad.
- c *Bus/Comm* = The frequency converter is controlled through a fieldbus.

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

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

- I ● = Illuminates with the AC power connected to the drive. Simultaneously, the drive status indicator READY is lit up.
- II ● = Illuminates when the drive is running. Blinks when the STOP button has been pushed and the drive is ramping down.
- III ● = Illuminates when unsafe operating conditions were encountered due to which the drive was stopped (Fault Trip). Simultaneously, the drive status indicator FAULT blinks on the display and the fault description can be seen, see chapter 7.3.4, Active Faults.

#### 7.1.4 Text lines (See control keypad)

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

- = Location indication; displays the symbol and number of menu, parameter etc.  
Example: **M3** = Menu 3 (References); **R1** = Reference no. 1 (Freq. reference)
- = Description line; Displays the description of menu, value or fault.
- = Value line; Displays the numerical and textual values of references, parameters etc. and the number of submenus available in each menu.

## 7.2 Keypad push-buttons

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

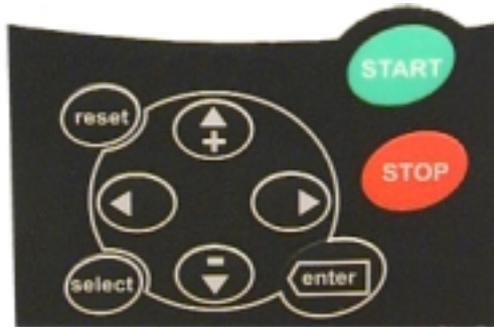


Figure 7-2. Keypad push-buttons

### 7.2.1 Button descriptions

- reset = This button is used to reset active faults (see Chapter 7.3.4).
- select = This button is used to switch between two latest displays. May be useful to see how the changed new value influences some other value.
- enter = The Enter button serves for:
  - 1) confirmation of selections
  - 2) fault history reset (2...3 seconds)
- ▲  
+ = Browser button up  
 Browse the main menu and the pages of different submenus.  
 Edit values.
- ▼ = Browser button down  
 Browse the main menu and the pages of different submenus.  
 Edit values.
- ◀ = Left arrow menu button  
 Move backward in menu.  
 Move cursor left (in [parameter menu](#)).  
 Exit edit mode.  
 Hold down for 2...3 seconds to return to main menu.
- ▶ = Right arrow menu button  
 Move forward in menu.  
 Move cursor right (in [parameter menu](#)).  
 Enter edit mode.

start

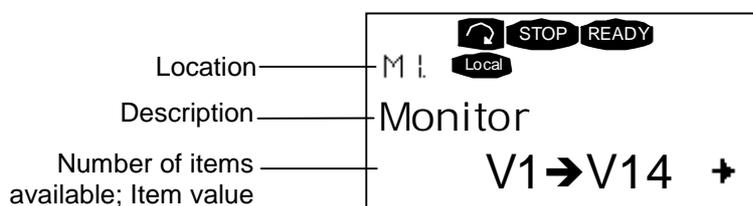
= Start button.  
Pressing this button starts the motor if the keypad is the active control place. See Chapter 7.3.3.1.

stop

= 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). Through the menus, the contrast of the display (page 73) can be adjusted.



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

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

More detailed descriptions of the menus can be found later in this Chapter.

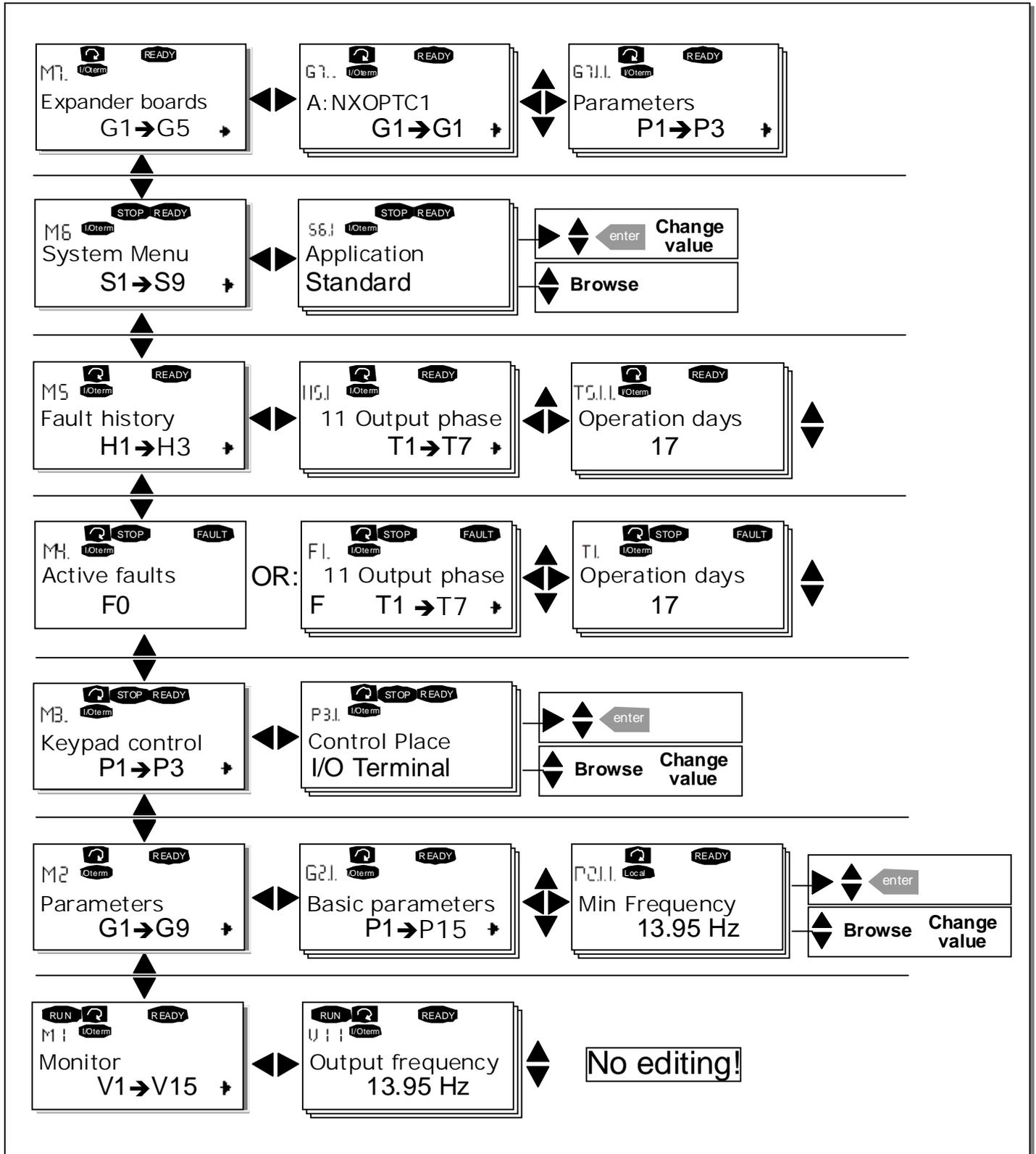


Figure 7-3. Keypad navigation chart

### 7.3.1 Monitoring menu (M1)

The monitoring menu can be entered from the main menu by pushing the *Right arrow menu button* when the location indication **M1** is visible on the first line of the display. How to browse through the monitored values is presented in Figure 7-4.

The monitored signals carry the indication **V#.#** and they are listed in Table 7-1. The values are updated once every 0.3 seconds.

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

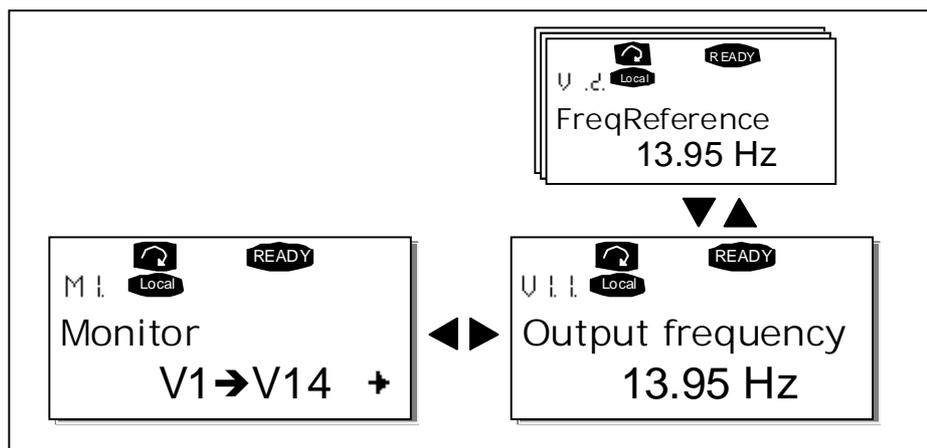


Figure 7-4. Monitoring menu

Code	Signal name	Unit	Description
<b>V1.1</b>	Output frequency	Hz	Frequency to the motor
<b>V1.2</b>	Frequency reference	Hz	
<b>V1.3</b>	Motor speed	rpm	Calculated motor speed
<b>V1.4</b>	Motor current	A	Measured motor current
<b>V1.5</b>	Motor torque	%	Calculated actual torque/nominal torque of the unit
<b>V1.6</b>	Motor power	%	Calculated actual power/nominal power of the unit
<b>V1.7</b>	Motor voltage	V	Calculated motor voltage
<b>V1.8</b>	DC-link voltage	V	Measured DC-link voltage
<b>V1.9</b>	Unit temperature	°C	Heat sink temperature
<b>V1.10</b>	Voltage input	V	AI1
<b>V1.11</b>	Current input	mA	AI2
<b>V1.12</b>	DIN1, DIN2, DIN3		Digital input statuses
<b>V1.13</b>	DIN4, DIN5, DIN6		Digital input statuses
<b>V1.14</b>	DO1, RO1, RO2		Digital and relay output statuses
<b>V1.15</b>	Analogue output current	mA	AO1

Table 7-1. Monitored signals

**Note:** Other applications may embody more monitoring values.

### 7.3.2 Parameter menu (M2)

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

Push the *right arrow menu button* once to move into the *Parameter Group Menu (G#)*. Locate the parameter group desired by using the *Browser buttons* and push the *HYPERLINK V "menubuttonright" right arrow menu button* again to enter the group and its parameters. Use the *Browser buttons* to find the parameter (*P#*) to edit. From here it is possible to, proceed in two different ways: Pushing the *right arrow menu button* goes to the edit mode. As a sign of this, the parameter value starts to blink. The value can now be changed in two different ways.:

- 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 *right arrow menu button* once again. Now it is possible to 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 *left arrow menu button* returns to the previous menu.

Several parameters are locked, i.e. uneditable, when the drive is in RUN status. If an attempt is made to edit the value of such a parameter the text *\*Locked\** will appear on the display. The frequency converter must be stopped in order to edit these parameters.

The parameters values can also be locked using the function in menu **M6** (see Chapter

Parameter lock (P6.3.2)).

Return to the *Main menu* anytime by pressing the *left arrow menu button* for 1—2 seconds.

The basic application package includes seven applications with different sets of parameters. The parameter lists are in the Application Section of this manual.

Once in the last parameter of a parameter group, To move directly to the first parameter of that group press the *Browser button up*.

See the diagram for parameter value change procedure on page 55.

**Note:** Instead of connecting power to the frequency converter, it is possible to power up the control board from an external power source by connecting the external power source to bidirectional terminal #6 of the NXOPTA1 board (see page 43) or to the corresponding +24V terminal on any other option board. This voltage is high enough to set parameter values or to keep the fieldbus active.

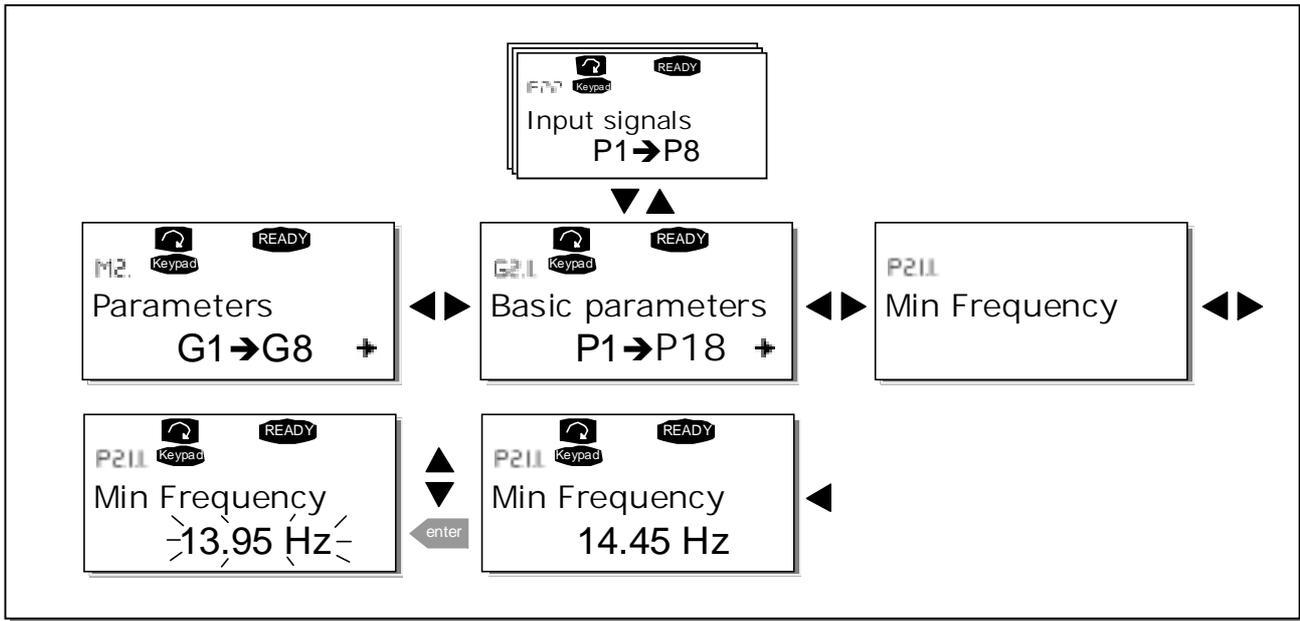


Figure 7-5. Parameter value change procedure

### 7.3.3 Keypad control menu (M3)

In the *Keypad Controls Menu*, it is possible to choose the control place, edit the frequency reference and change the direction of the motor. Enter the submenu level with the *right arrow menu button*.

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

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

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

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

**Note that** Whilst in any other than **M3** menu these functions will not work.

If in a different menu other than **M3** menu and try to start the motor by pressing the START button when the keypad is not selected as the active control place an error message *Keypad Control NOT ACTIVE* will be displayed.

#### 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	
Keypad (panel)	
Fieldbus	

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

See also 7.3.3 above.

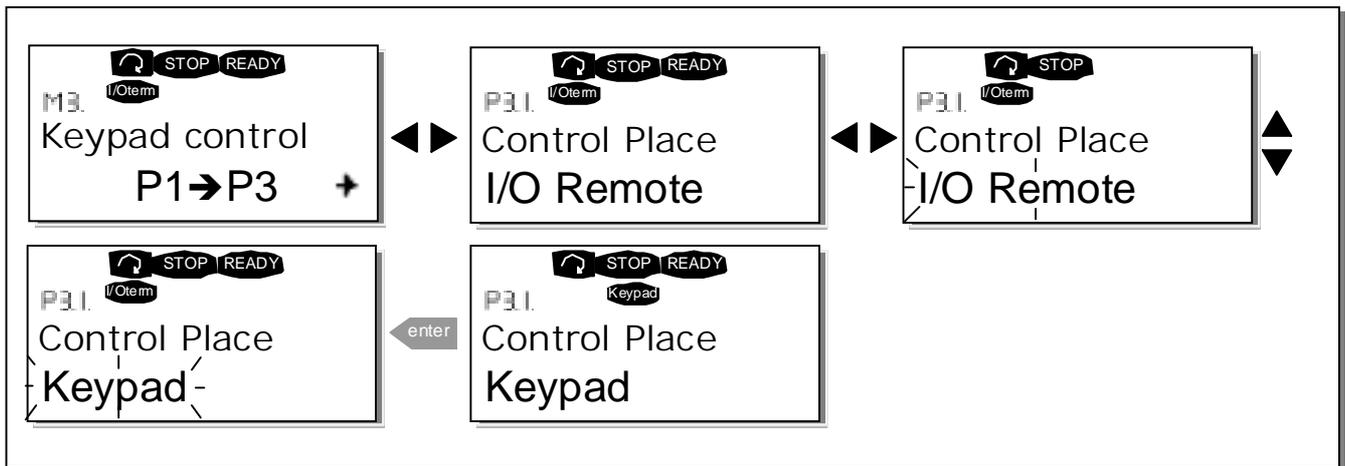


Figure 7-6. Selection of control place

### 7.3.3.2. Keypad reference

The keypad reference submenu (**P3.2**) displays and allows the operator to edit the frequency reference. The changes will take place immediately. **This reference value will not, however, influence the rotation speed of the motor unless the keypad has been selected as 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 also 7.3.3 above.

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

### 7.3.3.3 Keypad direction

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

See also 7.3.3 above

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

**Note:** Information on controlling the motor with the keypad is given in Chapters 7.2.1, 7.3.3 and 8.2.

### 7.3.4 Active faults menu (M4)

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

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

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

**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 NX frequency converter, there are four different types of faults. These types differ from each other on the basis of the subsequent behaviour of the drive. See Table 7-2.

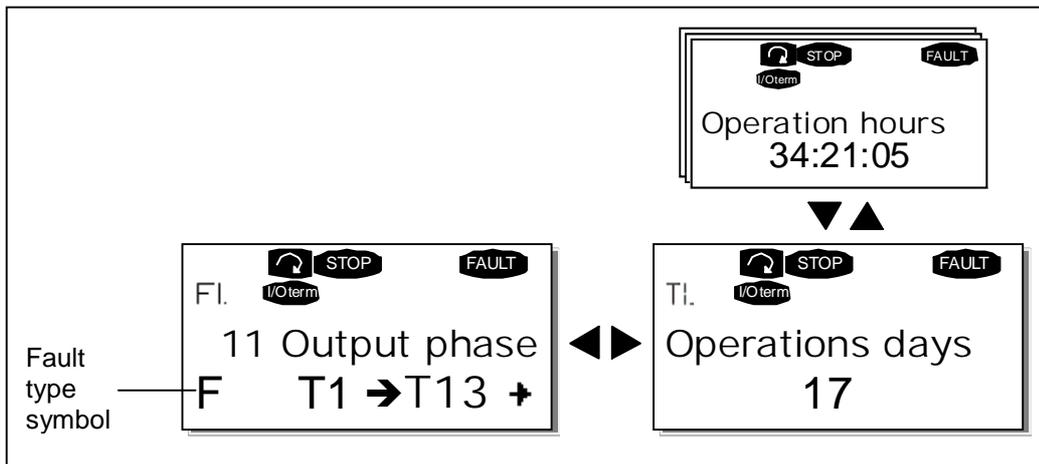


Figure 7-7. Fault display

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

Table 7-2. Fault types

### 7.3.4.2 Fault codes

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

Fault code	Fault	Possible cause	Correcting measures
1	Overcurrent	Frequency converter has detected too high a current ( $>4 \cdot I_n$ ) in the motor cable: <ul style="list-style-type: none"> <li>– sudden heavy load increase</li> <li>– short circuit in motor cables</li> <li>– unsuitable motor</li> </ul>	Check loading. Check motor. Check cables.
2	Overvoltage	The DC-link voltage has exceeded the limits defined in Table 4-1. <ul style="list-style-type: none"> <li>– too short a deceleration time</li> <li>– high overvoltage spikes in supply</li> </ul>	Make the deceleration time longer. Use brake chopper or brake resistor (available as options)
3	Earth fault	Current measurement has detected that the sum of motor phase current is not zero. <ul style="list-style-type: none"> <li>– insulation failure in cables or motor</li> </ul>	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"> <li>– faulty operation</li> <li>– component failure</li> </ul>	Reset the fault <b>How?</b> and restart. Should the fault re-occur, contact your nearest distributor..
6	Emergency stop	Stop signal has been given from the option board.	
7	Saturation trip	Very high overload Defective component	Cannot be reset from the keypad. Switch off power. If this does not help contact your nearest distributor.
8	System fault	The frequency converter troubleshooting system is unable to locate the fault.	Reset the fault <b>How?</b> and restart. Should the fault re-occur, contact your nearest distributor.
9	Undervoltage	DC-link voltage is under the voltage limits defined in. <ul style="list-style-type: none"> <li>– most probable cause: too low a supply voltage</li> <li>– frequency converter internal fault</li> </ul>	In case of temporary supply voltage break reset the fault <b>How?</b> and restart the frequency converter. Check the supply voltage. If it is adequate, an internal failure has occurred. Contact your nearest distributor.
10	Input line supervision	Input line phase is missing.	Check supply voltage and cable.
11	Output phase supervision	Current measurement has detected that there is no current in one motor phase.	Check motor cable and motor.
12	Brake chopper supervision	<ul style="list-style-type: none"> <li>– no brake resistor installed</li> <li>– brake resistor is broken</li> <li>– brake chopper failure</li> </ul>	Check brake resistor. If the resistor is ok, the chopper is faulty. Contact your nearest distributor..
13	Frequency converter under-temperature	Heatsink temperature is under $-10^\circ\text{C}$	
14	Frequency converter over temperature	Heatsink temperature is over $90^\circ\text{C}$ .  Over temperature warning is issued when the heatsink temperature exceeds $85^\circ\text{C}$ .	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.

Fault code	Fault	Possible cause	Correcting measures
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 23	EEPROM checksum fault	Parameter save fault – faulty operation – component failure	
24	Changed data warning	Changes may have occurred in the different counter data due to mains interruption	No special actions required. Take a critical attitude to the counter data.
25	Microprocessor watchdog fault	– faulty operation – component failure	Reset the fault <b>How?</b> and restart. Should the fault re-occur, contact your nearest distributor..
32	Fan cooling	Cooling fan of the frequency converter does not start, when ON command is given	Contact your nearest distributor..
34	CAN bus communication	Sent message not acknowledged.	Ensure that there is another device on the bus with the same configuration.
36	Control unit	NXS Control Unit can not control NXP Power Unit and vice versa	Change control units
37	Device change	Option board changed. Different power rating of drive.	Reset
38	Device added	Option board added. Drive of different power rating added.	Reset
39	Device removed	Option board removed. Drive removed.	Reset
40	Device unknown	Unknown option board or drive.	
41	IGBT temperature	IGBT Inverter Bridge overtemperature protection has detected too high a short term overload current	Check loading. Check motor size.
42	Brake resistor overtemperature	Brake resistor overtemperature protection has detected too heavy braking	Set the deceleration time longer. Use external brake resistor.
43	Encoder fault	Note the exceptional Fault data record. See 7.3.4.3. Additional codes: 1 = Encoder 1 channel A is missing 2 = Encoder 1 channel B is missing 3 = Both encoder 1 channels are missing 4 = Encoder reversed	Check encoder channel connections. Check the encoder board.
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.

Table 7-3. Fault codes

### 7.3.4.3... *Fault time data record*

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

The data available are:

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

Table 7-4. *Fault time recorded data*

### 7.3.5 Fault history menu (M5)

The *Fault history menu* can be entered from the *Main menu* by pushing the *right arrow menu button Menu button right* when the location indication **M5** is visible on the first line of the keypad display.

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

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

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

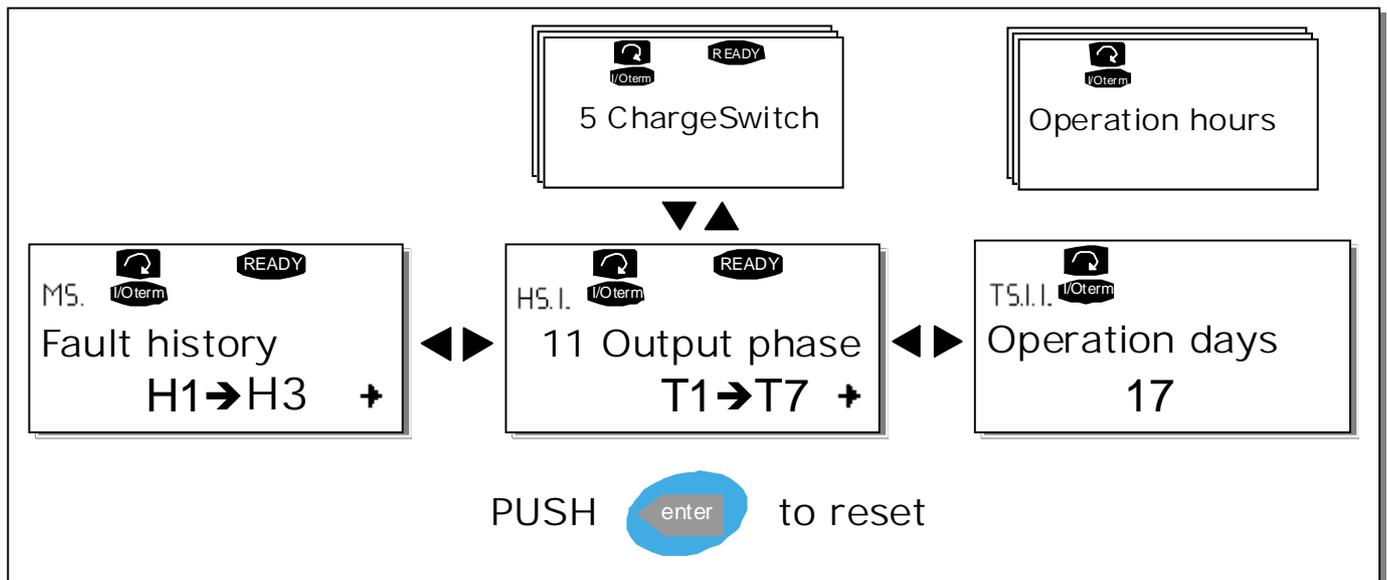


Figure 7-8. Fault history menu

### 7.3.6 System menu (M6)

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

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

On page 65 is a list of the functions available in the System menu.

## Functions in the System menu

Code	Function	Min	Max	Unit	Default	Cust	Selections
S6.1	Application selection				Basic Application		Basic Application Standard Application Local/Remote control Appl. Multi-Step Application PID Control Application Multi-Purpose Control Appl. Pump and Fan Control Appl.
S6.2	Language selection				English		English Deutsch Suomi Svenska Italiano
S6.3.1	Password				Not used		0=Not used
P6.3.2	Parameter lock				Change Enabled		Change Enabled Change Disabled
P6.3.3	Internal brake resistor				Connected		Not connected Connected
P6.3.4	Fan control				Continuous		Continuous Temperature
P6.3.5	Multimonitoring page				Change enabled		Change enabled Change disabled
P6.3.6	HMI acknowledg. timeout	200	5000	ms	200		
P6.3.7	HMI number of retries	1	10		5		
P6.4.1	Default page						
P6.4.2	Default page/ Operating menu						
P6.4.3	Timeout time	0	65535	s	30		
P6.4.4	Contrast	0	31		18		
P6.4.5	Backlight time	Always	65535	min	10		
S6.5.1	Load up to keypad						All parameters
S6.5.2	Load down from keypad						All parameters Application parameters
S6.5.3	Parameter sets						Store set 1 Load set 1 Store set 2 Load set 2 Load factory defaults
P6.5.4	Parameter backup				No		Yes No
S6.6	Parameter comparison						
I6.7.1	Info: Unit power						
I6.7.2	Info: Unit voltage			V			
I6.7.3	Info: Software version						
I6.7.4	Info: Firmware interface						
S6.7.5	Info: Expander boards						
D6.7.6.1.1	Info: Applications: Application ID						
D6.7.6.1.2	Info: Applications: Version						

Code	Function	Min	Max	Unit	Default	Cust	Selections
D6.7.6.1.3	Info: Applications: Firmware interface						
C6.8.1	MWh counter			kWh			
C6.8.2	Operating days counter						
C6.8.3	Operating hours counter			hh:mm:ss			
T6.9.1	MWh trip counter			kWh			
T6.9.2	Clear MWh trip counter						
T6.9.3	Operating days trip counter						
T6.9.4	Operating hours trip counter			hh:mm:ss			
T6.9.5	Clear operating time counter						

Table 7-5. System menu functions

### 7.3.6.1...Application selection

The user can select the application desired by entering the *Application selection page (S6.1)*. This is done by pushing the *right arrow menu button* when on the first page of the *System menu*. Change the application by pushing the *right arrow menu button* once again. The name of the application starts to blink. Browse through the applications with the *Browser buttons* and select another application with the *Enter button*.

In this phase, the display requests whether the parameters of the **new** application are to be uploaded to the keypad. If so press the *Enter button*. Pushing any other button leaves the parameters of the **previously used** application saved in the keypad. For more information, see Chapter 7.3.6.5.

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

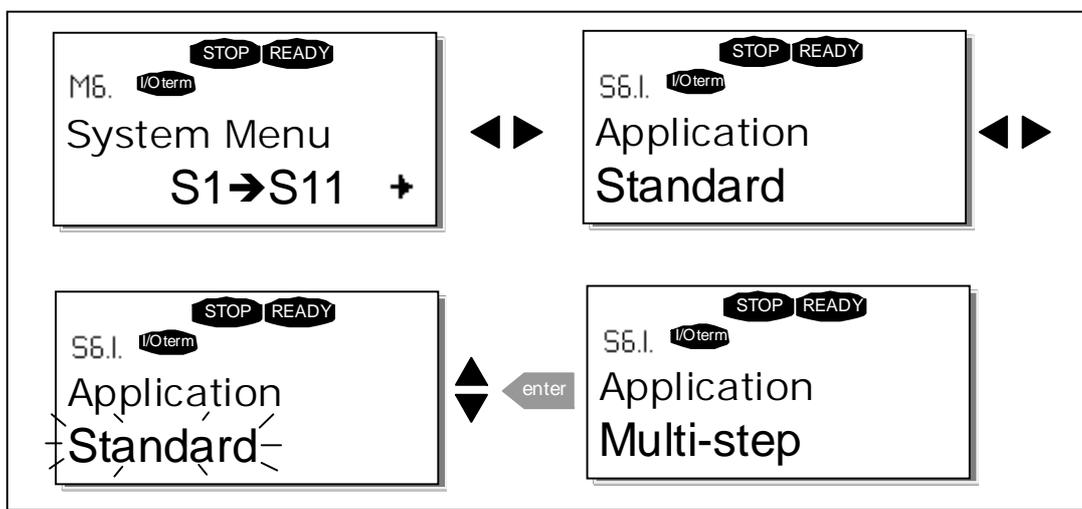


Figure 7-9. Change of application

### 7.3.6.2...Language selection

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

Locate the language selection page under the *System menu*. Its location indication is **S6.2**. Press the *right arrow menu button* once to enter the edit mode. As the name of the language starts to blink choose another language for the keypad texts. Confirm the selection by pushing the *Enter button*. The blinking stops and all textual information on the keypad is presented in the language chosen.

Return to the previous menu anytime by pushing the *left arrow menu button*.

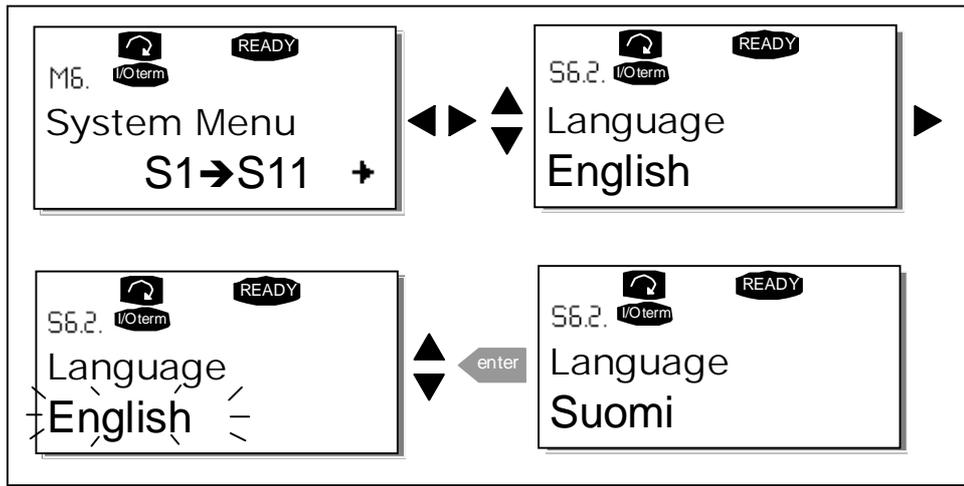


Figure 7-10. Selection of language

### 7.3.6.3 System settings

In the System settings submenu (**S6.3**) under the *System menu* it is possible to further customise the frequency converter operator interface. The functions available in this menu are **Password**, **Parameter lock**, **Internal brake resistor connection**, **Fan control**, **HMI acknowledge timeout** and **HMI retry**.

#### Password (S6.3.1)

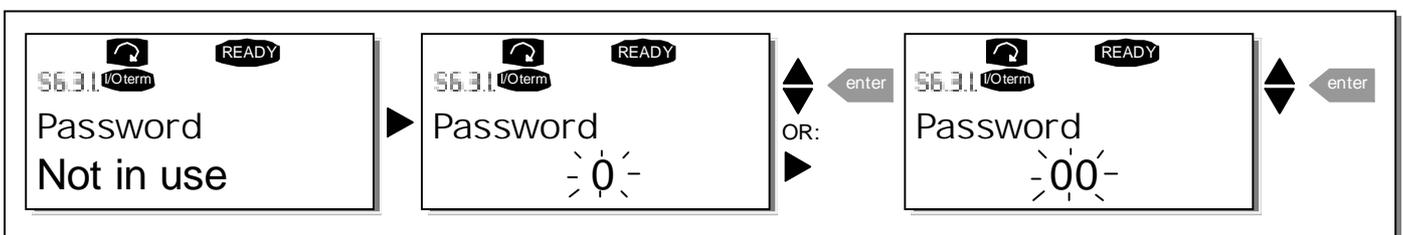
The application selection can be protected against unauthorised changes with the Password function (**S6.3.1**).

By default, the password function is not in use. To activate the function, enter the edit mode by pushing the **right arrow menu button**. A blinking zero appears in the display and a password can be set with the **Browser buttons**. The password can be any number between 1 and 65535.

**Note** The password can be set by digits. In the edit mode, push the **right arrow menu button** once again and another zero appears on the display. First set the units. Push the **left arrow menu button** and set the tens etc. Finally, confirm the password setting with the **Enter button**. After this, wait until the *Timeout time (P6.4.3)* (see page 72) has expired before the password function is activated.

If the applications or the password itself are changed the system will request the current password. The password will be entered with the **Browser buttons**.

Figure 7-11. Password setting



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

**Parameter lock (P6.3.2)**

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

If the parameter lock is activated the text *\*locked\** will appear on the display when the parameter value is edited.

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

Enter the edit mode by pushing the [right arrow menu button](#) HYPERLINK `V "menubuttonright"`. Use the [Browser buttons](#) to change the parameter lock status. Accept the change with the [Enter button](#) or return to the previous level with the [left arrow menu button](#) `Menu button left`.

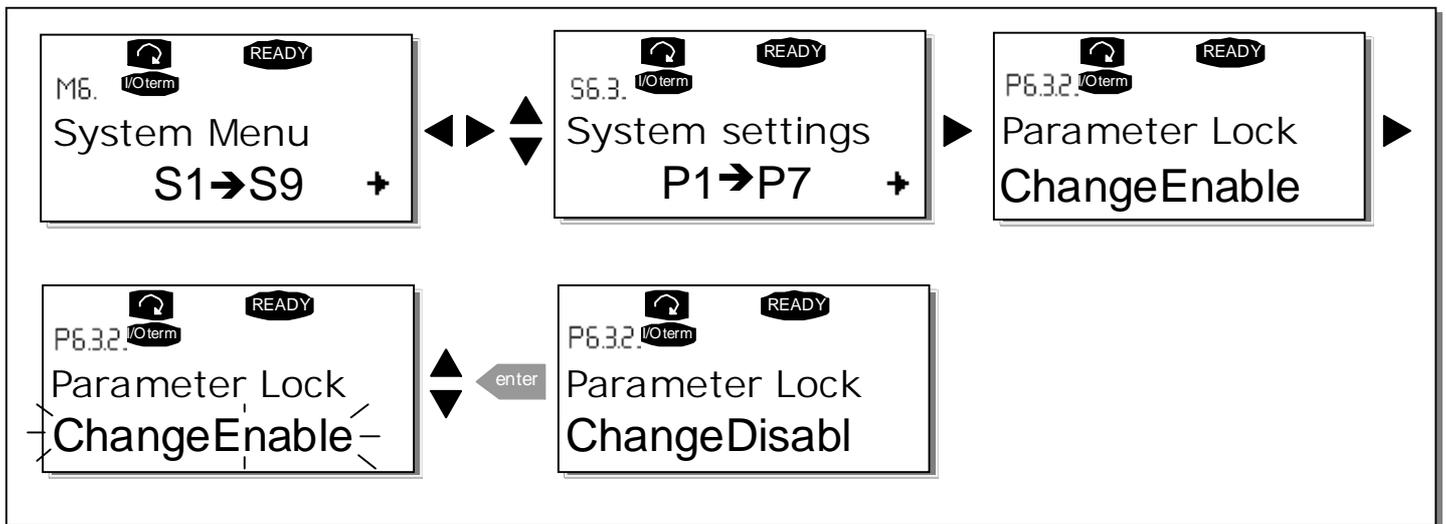


Figure 7-12. Parameter locking

**Internal brake resistor connection (P6.3.3)**

With this function it is possible to tell the frequency converter, whether the internal brake resistor is connected or not. If the frequency converter has been ordered with an internal brake resistor, the default value of this parameter is *Connected*. However, if it is necessary to increase braking capacity by installing an external brake resistor, or if the internal brake resistor is disconnected for another reason, it is advisable to change the value of this function to *Not conn.* in order to avoid unnecessary fault trips.

Enter the edit mode by pushing the [right arrow menu button](#) . Use the [Browser buttons](#) to change the internal brake resistor status. Accept the change with the [Enter button](#) or return to the previous level with the [left arrow menu button](#).

**Note!** The brake resistor is available as optional equipment for all classes. It can be installed internally in classes FR4 – FR6.

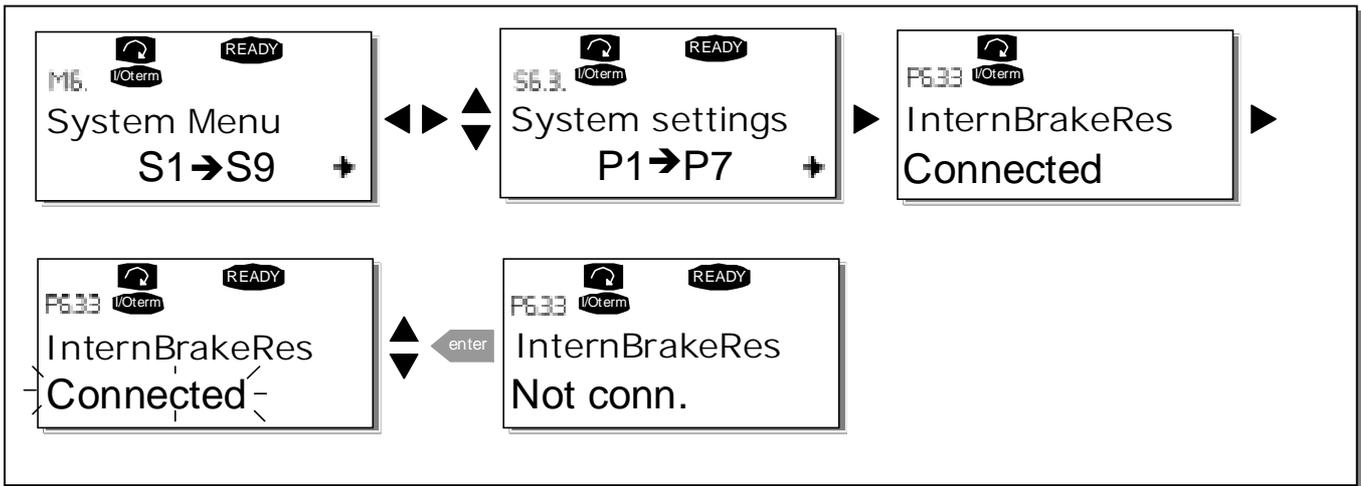


Figure 7-13. Internal brake resistor connection

#### Fan control (P6.3.4)

This function allows the control of the frequency converter's cooling fan. When the power is switched on the fan can be set to run continuously or dependant 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 *Continuous* to *Temperature*.

Enter the edit mode by pushing the *right arrow menu button*. 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 *left arrow menu button*.

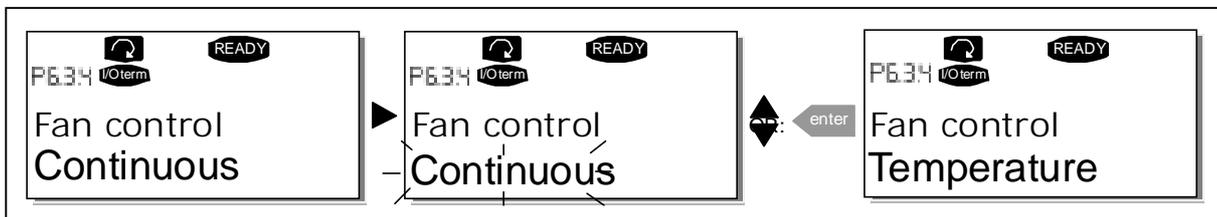


Figure 7-14. Fan control function

#### HMI acknowledge timeout (P6.3.6)

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 parametres 6.3.6 and 6.3.7 (200 and 5) **must not be changed**.

If the frequency converter has been connected to the PC via a modem and there is a delay in transferring messages, the value of par. 6.3.6 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. 6.3.6 is set to 1200 ms (2 x 600, sending delay + receiving delay)
- The corresponding setting shall be entered to the [Misc]-part of the NCDriver.ini – file:  
Retries = 5  
AckTimeOut = 1200  
TimeOut = 6000

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

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



Figure 7-15. HMI acknowledge timeout

**Number of retries to receive HMI acknowledgement (P6.3.7)**

With this parameter it is possible to set the number of times the drive will try to receive acknowledgement if this does not happen within the acknowledgement time (P6.3.6) or if the received acknowledgement is faulty.

Enter the edit mode by pushing the *right arrow menu button*. 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 *left arrow menu button*.

See Figure 7-15 for the procedure of changing the value.

**7.3.6.4 Keypad settings**

Further customisation of the frequency converter operator interface can be undertaken in the Keypad settings submenu under the *System menu*.

Locate the Keypad settings submenu (**S6.4**). Under the submenu, there are four pages (**P#**) associated with the keypad operation:

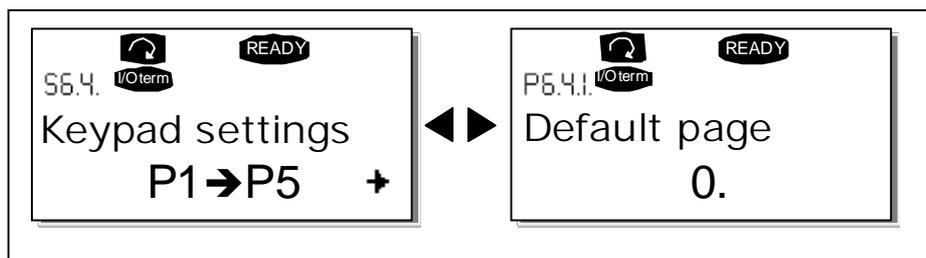


Figure 7-16. Keypad settings submenu

#### Default page (P6.4.1)

This menu allows the user to set the location (page) to which the display automatically moves as the *Timeout time* (see below) has expired or as the power is switched on to the keypad.

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

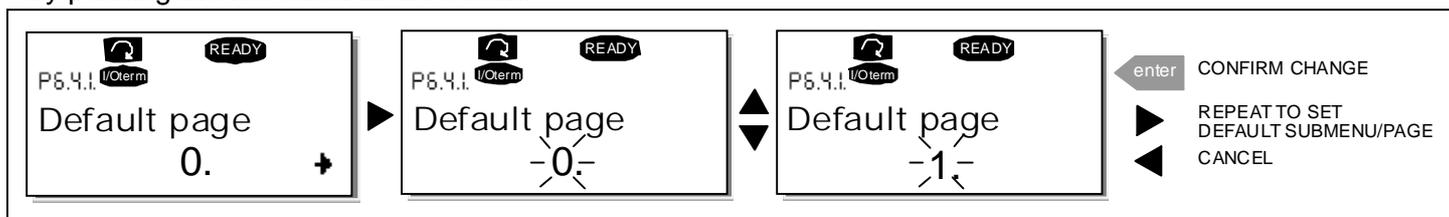


Figure 7-17. Default page function

#### Default page in the operating menu (P6.4.2)

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

#### Timeout time (P6.4.3)

The Timeout time setting defines the time after which the keypad display returns to the Default page (P6.4.1) see above.

Move to the Edit menu by pressing the **right arrow menu button**. Set the timeout time required and confirm the change with the *Enter button*. Return to the previous step anytime by pushing the **left arrow menu button**.

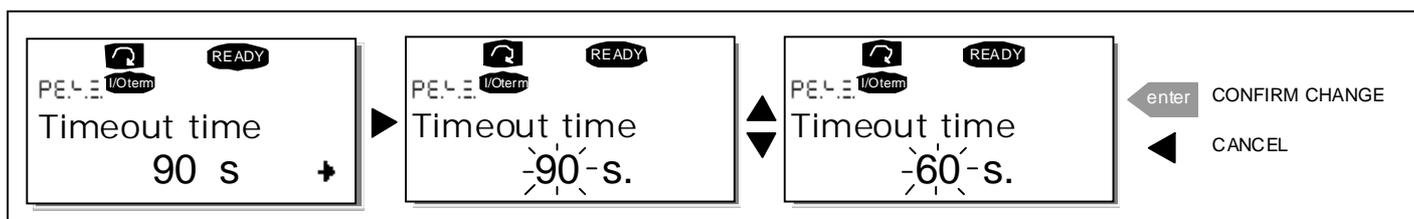


Figure 7-18. Timeout time setting

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

**Contrast adjustment (P6.4.4)**

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

**Backlight time (P6.4.5)**

Giving a value for the *Backlight time*, can determine how long the backlight stays on before going out. Select here any time between 1 and 65535 minutes or 'Forever'. For the value setting procedure see Timeout time (P6.4.3).

**7.3.6.5... Parameter copy**

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

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

The parameter copy menu (**S6.5**) embodies two functions:

**Upload parameters to keypad (To keypad, S6.5.1)**

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

Enter the *To keypad* page (S6.5.1) from the *Parameter copy menu*. Push the *right arrow menu button* to enter the edit mode. Use the *Browser buttons* to select the option *All parameters* and press the *Enter button*. Wait until 'OK' appears on the display.

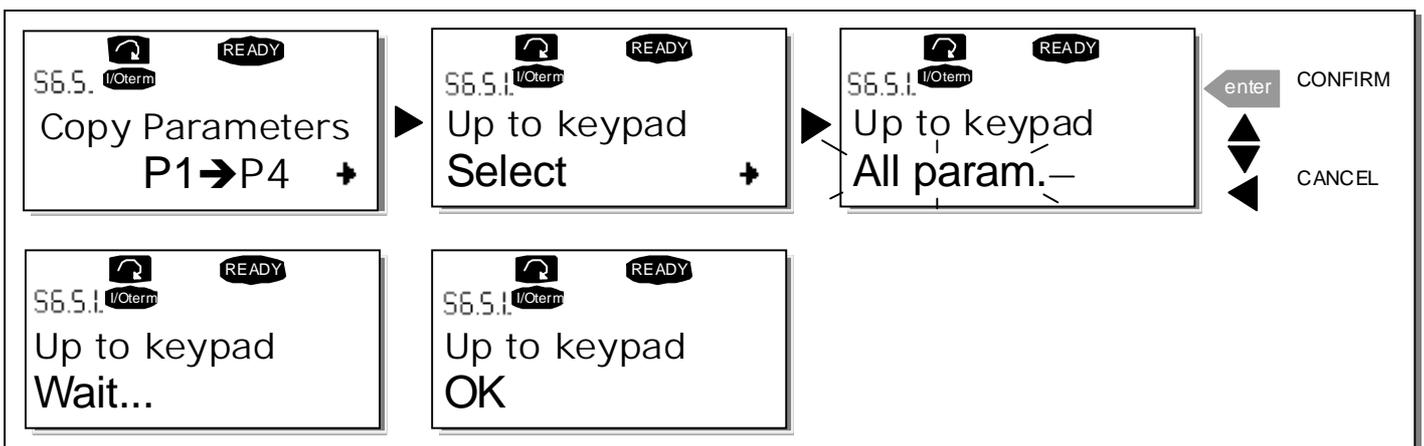


Figure 7-19. Parameter copy to keypad

**Download parameters to drive (From keypad, S6.5.2)**

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

Enter the *From keypad* page (S6.5.2) from the *Parameter copy menu*. Push the *right arrow menu button* to enter the edit mode. Use the *Browser buttons* to select either the option *All parameters* or *Application parameters* and press the *Enter button*. Wait until 'OK' appears on the display.

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

**Parameter sets (S6.5.3)**

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

On *Parameter sets* page (**S6.7**), push the *right arrow menu button* to enter the *Edit menu*. The text *Select* begins to blink allowing you to choose any of the storing or loading functions with the *Browser buttons*. You can store or load two customised parameter sets or load back the factory defaults. Confirm with the *Enter button*. Wait until 'OK' appears on the display.



Figure 7-20. Storing and loading of parameter sets

**Parameter backup (P6.5.4)**

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

When the Parameter backup function is activated the NX control keypad makes a copy of the parameters of the presently used application. When applications are changed, the user will be asked if they wish the parameters of the **new** application to be uploaded to the keypad. For this to happen, push the *Enter button*. If a copy is required of the parameters of the **previously used** application saved in the keypad push any other button. The user will be able to download these parameters to the drive following the instructions given in chapter 7.3.6.5.

If the user wants the parameters of the new application to be automatically uploaded to the keypad this will have to be done for the parameters of the new application once on page 6.5.1 as instructed. **Otherwise the panel will always ask for the permission to upload the parameters.**

**Note:** Parameters saved in the parameter settings on page **S6.5.3** will be deleted when applications are changed. If transfer of the parameters from one application to another is required, they must be uploaded first to the keypad.

### 7.3.6.6 Parameter comparison

In the *Parameter comparison* submenu (**S6.6**), the **actual parameter values** to the values of the customised parameter sets and those loaded to the control keypad can be compared.

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

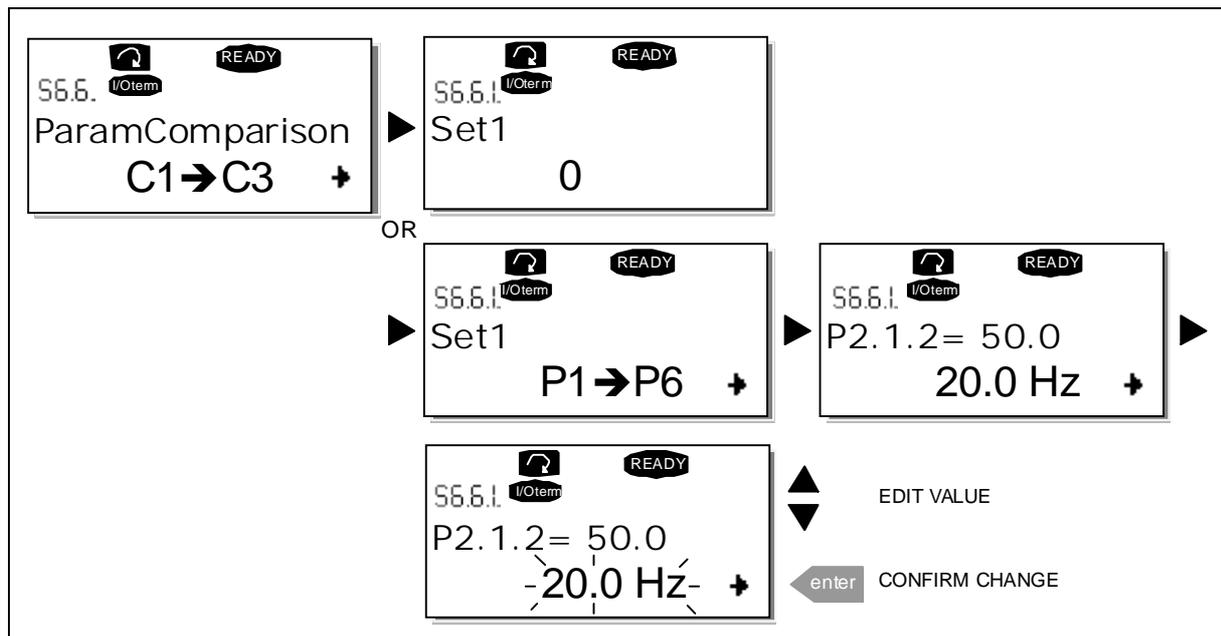


Figure 7-21. Parameter comparison

### 7.3.6.7... Information submenu

In the *Information submenu (S6.7)* frequency converter-related hardware and software information as well as operation-related information, can be found.

Enter the *Info menu* by pressing the *right arrow menu button*. The user can now browse through the information pages with the *Browser buttons*.

Page	Content
6.7.1	Nominal power of the unit (constant torque)
6.7.2	Nominal voltage of the unit
6.7.3	Control board software version
6.7.4	Application interface version of the software
6.7.5	Expander board statuses and program versions
6.7.6	Application-related software information
6.7.7	Debug menu (for advanced users)

Table 7-6. Information pages

### Expander board information (S6.7.5)

Information about the basic and option boards connected to the control board can be found in the *Expanders submenu* (see Chapter 6.2).

You can check the status of each slot by entering the board submenu with the *right arrow menu button* and using the *Browser buttons* to choose the board whose status you wish to check. Push the *right arrow menu button* 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. If no board is connected to the slot the text 'no board' will be shown. If a board is connected to a slot but the connection is somehow lost the text 'no conn.' is displayed. See Chapter 6.2 and Figure 6-12 and 6-11 for more information.

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

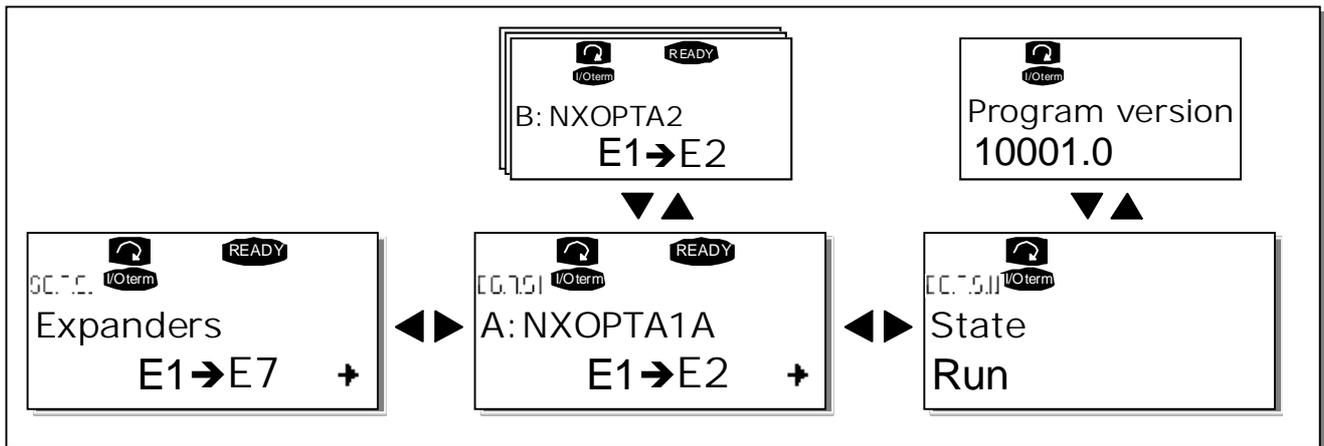


Figure 7-22. Expander board information menus

**Applications info submenu (S6.7.6)**

At location **S6.7.6** is the *Applications submenu* containing information about not only the application currently in use but also all other applications loaded into the frequency converter. The information available is:

1. Application identification number
2. Application version number
3. Firmware interface number

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

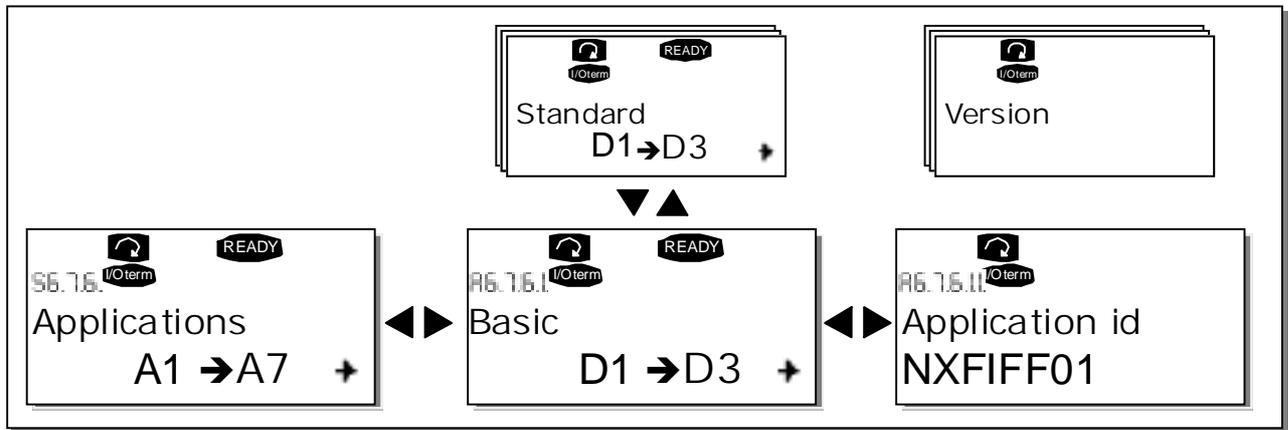


Figure 7-23. Applications info submenu

**7.3.6.8 Counters menu**

In the *Counters menu (S6.8)* is 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 submenu, 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.	MWh counter
C6.8.2.	Operation day counter
C6.8.3.	Operation hour counter

Table 7-7. Counter pages

### 7.3.6.9.....Trip counters submenu

Trip counters (menu **S6.9**) are counters the values of which can be reset i.e. restored to zero. The following resettable counters are available:

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

Page	Counter
T6.9.1.	MWh counter
T6.9.3.	Operation day counter
T6.9.4.	Operation hour counter

Table 7-8. Resettable counters

The counters can be reset on pages 6.9.2. (*MWh counter reset*) and 6.9.5. (*Operation time reset*).

**Example:** To reset the operation counters::

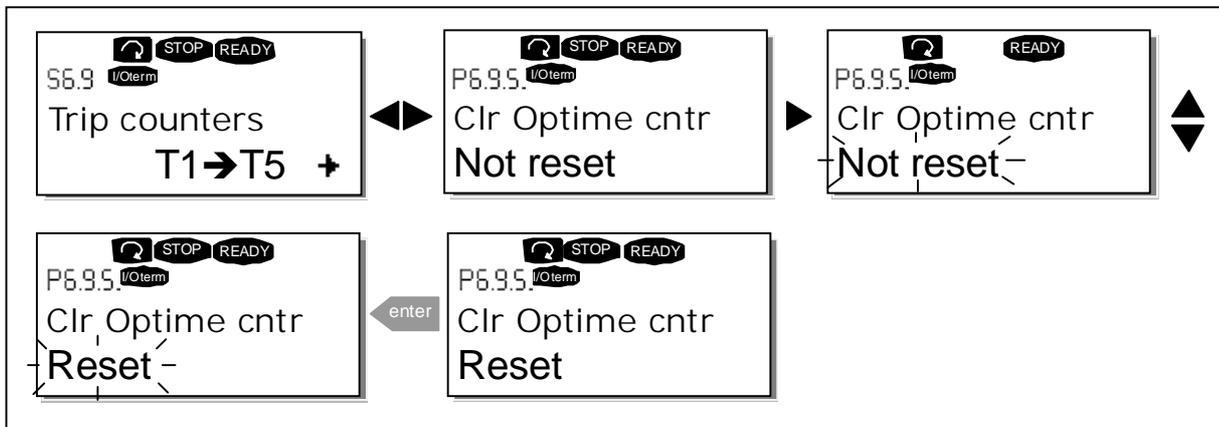


Figure 7-24. Counter reset

**7.3.7 Expander board menu (M7)**

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

Enter the following menu level (**G#**) with the *right arrow menu button*. At this level, the user can browse through slots (see page 40) A to E with the *Browser buttons* to see what expander boards are connected. The lowermost line of the display shows the number of parameters associated with the board. It is possible to view and edit the parameter values in the same way as described in chapter 7.3.2. See Table 7-9 and Figure 7-25.

**Expander board parameters**

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

Table 7-9. Expander board parameters (board NXOPTA1)

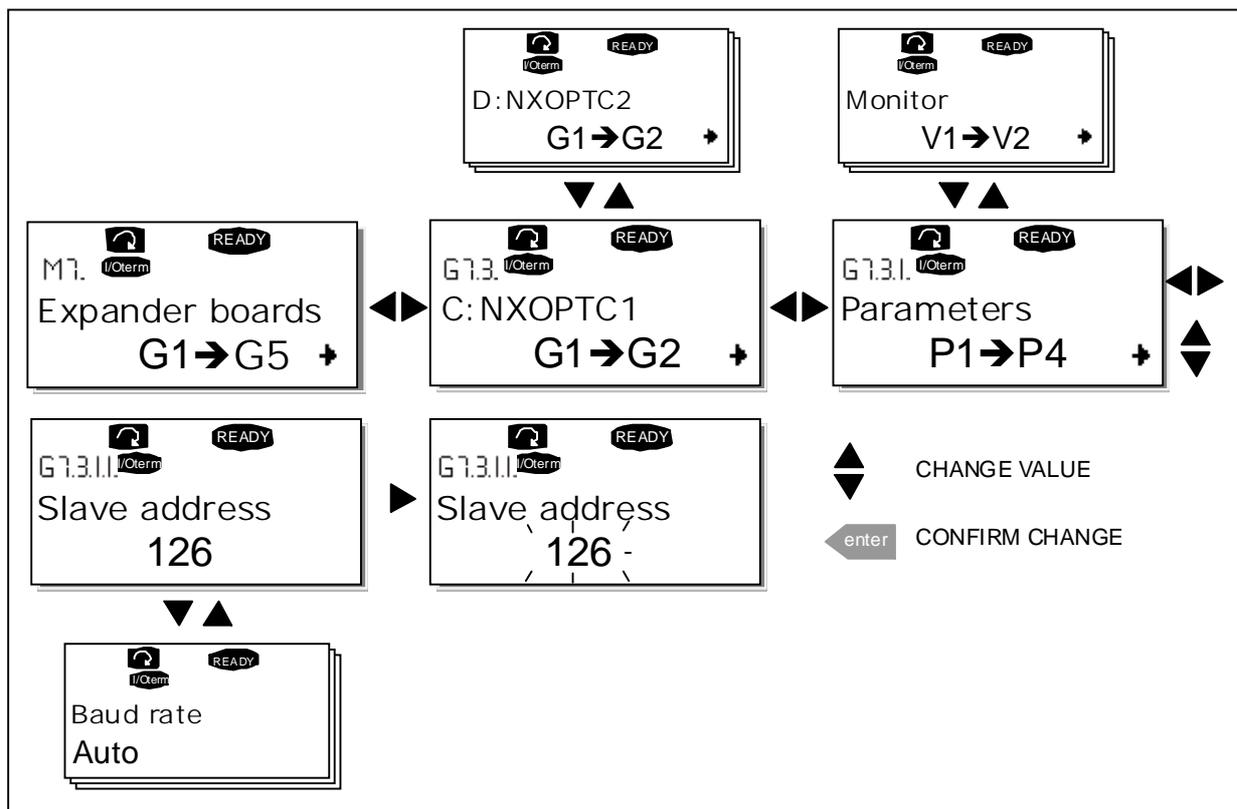


Figure 7-25. Expander board information menu

#### **7.4 Further keypad functions**

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

## 8. COMMISSIONING

### 8.1 Safety

Before commissioning, note the following directions and warnings:

  	<b>1</b>	Internal components and circuit boards of the frequency converter (except for the galvanically isolated I/O terminals) are <b>live</b> when the NX is connected to mains potential. <b>Coming into contact with this voltage is extremely dangerous and may cause death or severe injury.</b>
	<b>2</b>	The motor terminals U, V, W and the DC-link/brake resistor terminals –/+ are <b>live</b> when the NX is connected to mains, <b>even if the motor is not running.</b>
	<b>3</b>	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 the NX is disconnected from mains.
	<b>4</b>	Do not make any connections with the frequency converter connected to the mains.
	<b>5</b>	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 the NX connections. Do not even open the cover before this time has expired.
	<b>6</b>	Before connecting the frequency converter to mains make sure that the NX front cover is closed.

### 8.2 Commissioning of the frequency converter

- 1** Read 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.
  - that the common inputs of digital input groups are connected to +24V or ground of the I/O terminal or the external supply.
- 3** Check the quality and quantity of cooling air (Chapter 5.2, and Table 5-7).
- 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 (See the Application Manual) 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 values needed for the parameters are 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 (**M3**) and Keypad Reference submenu (Chapter 7.3.3.2) and change the frequency reference using the **Browser buttons**



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

- e) Push the **Stop button** on the keypad  .

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

## 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, the fault code and a short fault description appear on the display. The fault can be reset with the [Reset button](#) on the control keypad or via the I/O terminal. The faults are stored in the Fault history menu (M5) which can be browsed. The different fault codes can be found in the table below.

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

Fault code	Fault	Possible cause	Correcting measures
1	Overcurrent	Frequency converter has detected too high a current ( $>4 \cdot I_n$ ) in the motor cable: <ul style="list-style-type: none"> <li>– sudden heavy load increase</li> <li>– short circuit in motor cables</li> <li>– unsuitable motor</li> </ul>	Check loading. Check motor size. Check cables.
2	Overvoltage	The DC-link voltage has exceeded the limits defined in Table 4-1. <ul style="list-style-type: none"> <li>– too short a deceleration time</li> <li>– high overvoltage spikes in utility</li> </ul>	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"> <li>– insulation failure in cables or motor</li> </ul>	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"> <li>– faulty operation</li> <li>– component failure</li> </ul>	Reset the fault <b>How?</b> and restart. Should the fault re-occur, contact your nearest distributor.
6	Emergency stop	Stop signal has been given from the option board.	
7	Saturation trip	Very high overload Defective component	Cannot be reset from the keypad. Switch off power. If this does not help contact your nearest distributor.
8	System fault	The frequency converter troubleshooting system is unable to locate the fault.	Reset the fault <b>How?</b> and restart. Should the fault re-occur, contact your nearest distributor,
9	Undervoltage	DC-link voltage is under the voltage limits defined in. <ul style="list-style-type: none"> <li>– most probable cause: too low a supply voltage</li> <li>– frequency converter internal fault</li> </ul>	In case of temporary supply voltage break reset the fault <b>How?</b> and restart the frequency converter. Check the supply voltage. If it is adequate, an internal failure has occurred. Contact your nearest distributor..
10	Input line supervision	Input line phase is missing.	Check supply voltage and cable.
11	Output phase supervision	Current measurement has detected that there is no current in one motor phase.	Check motor cable and motor.
12	Brake chopper supervision	<ul style="list-style-type: none"> <li>– no brake resistor installed</li> <li>– brake resistor is broken</li> <li>– brake chopper failure</li> </ul>	Check brake resistor. If the resistor is ok, the chopper is faulty. Contact your nearest distributor.
13	Frequency converter under-temperature	Heatsink temperature is under $-10^{\circ}\text{C}$	

14	Frequency converter over temperature	Heatsink temperature is over 90°C.  Over temperature 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 23	EEPROM checksum fault	Parameter save fault – faulty operation – component failure	
24	Changed data warning	Changes may have occurred in the different counter data due to mains interruption	No special actions required. Take a critical attitude to the counter data.
25	Microprocessor watchdog fault	– faulty operation – component failure	Reset the fault <b>How?</b> and restart. Should the fault re-occur, contact your nearest distributor.
32	Fan cooling	Cooling fan of the frequency converter does not start, when ON command is given	Contact your nearest distributor.
34	CAN bus communication	Sent message not acknowledged.	Ensure that there is another device on the bus with the same configuration.
36	Control unit	NXS Control Unit can not control NXP Power Unit and vice versa	Change control units
37	Device change	Option board changed. Different power rating of drive.	Reset
38	Device added	Option board added. Drive of different power rating added.	Reset
39	Device removed	Option board removed. Drive removed.	Reset
40	Device unknown	Unknown option board or drive.	
41	IGBT temperature	IGBT Inverter Bridge overtemperature protection has detected too high a short term overload current	Check loading. Check motor size.
42	Brake resistor overtemperature	Brake resistor overtemperature protection has detected too heavy braking	Set the deceleration time longer. Use external brake resistor.
43	Encoder fault	Note the exceptional Fault data record. See 7.3.4.3. Additional codes: 1 = Encoder 1 channel A is missing 2 = Encoder 1 channel B is missing 3 = Both encoder 1 channels are missing 4 = Encoder reversed	Check encoder channel connections. Check the encoder board.
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.

Table 9-1. Fault codes

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