NX Series

Honeywell

Constant and Variable Torque Variable Speed Drives for Induction Motors

63-2600—1

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 delivery corresponds to your order, see Chapter 3.

2. Before taking any commissioning actions read carefully the safety instructions in Chapter 1.

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 to 6.1.1.5..

5. Follow the installation instructions, see Chapter 6.1.5.

6. Control connections are explained in Chapter 6.2.1.

7. If the Start-Up wizard is active, select the language of the keypad and the application you want to use and confirm by pressing the *Enter button*. If the Start-Up wizard is not active, follow the instructions 7a and 7b.

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

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

8. All parameters have factory default values. In order to ensure proper operation, check the rating plate data for the values below and the corresponding parameters of parameter group G2.1.

   - nominal voltage of the motor
   - nominal frequency of the motor
   - nominal speed of the motor
   - nominal current of the motor
   - motor cosφ

   All parameters are explained in the All in One Application Manual.

9. Follow the commissioning instructions, see Chapter 8.

10. NX_ Frequency Drive is now ready for use.

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

CONTENTS

NX USER'S MANUAL

THE NX FREQUENCY DRIVE 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 Drives. It is recommended that these instructions are studied, before powering up the frequency drive for the first time.

The Application Manual provides information about the different applications included in the standard frequency drive. 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

Index

1. SAFETY

ONLY A COMPETENT ELECTRICIAN SHOULD CARRY OUT THE ELECTRICAL INSTALLATION

1.1 Warnings

	1	The NX frequency drive is meant for fixed installations only.
	2	Do not perform any measurements when the frequency drive is connected to the mains. The motor terminals U, V, W and the DC-link/brake resistor terminals –/+ are **live** when the NX is connected to mains, **even if the motor is not running**.
	3	Do not perform any voltage withstand tests on any part of the NX.
	4	The frequency drive has a large capacitive leakage current.
WARNING	**5**	If the frequency drive is used as a part of a machine, the machine manufacturer is responsible for providing the machine with a main switch (EN 60204-1).
	6	Only spare parts delivered by Honeywell can be used.
	7	The motor starts at power-up if the start command is 'ON'. Furthermore, the I/O functionalities (including start inputs) may change if parameters, applications or software are changed. Disconnect, therefore, the motor if an unexpected start can cause danger.
	8	Prior to measurements on the motor or the motor cable, disconnect the motor cable from the frequency drive.
	9	Do not touch the IC-circuits on the circuit boards. Static voltage discharge may damage the components.

1.2 Safety instructions

	1	The components of the power unit of the frequency drive are **live** when the NX is connected to mains potential. **ontact with this voltage is extremely dangerous and may cause death or severe injury.** The control unit is isolated from the potential.
	2	The motor terminals U, V, W and the DC-link/brake resistor terminals –/+ are **live** when the NX is connected to mains, **even if the motor is not running**.
	3	After disconnecting the frequency drive 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.
	4	The control I/O-terminals are isolated from the mains potential. However, the relay outputs and other I/O-terminals may have a dangerous control voltage present even when the NX is disconnected from mains.
	5	Before connecting the frequency drive to mains, ensure that the frequency drive front and cable covers are closed.

1.3 Grounding and ground fault protection

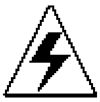
The NX frequency drive must always be grounded via a conductor connected to the grounding terminal ⏚ .

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

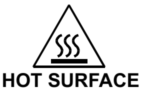
If fault current protective switches (e.g. RCD or Ground Leakage devices) are to be used in conjunction with the frequency drive, they must be tested with ground fault currents that are possible to arise in fault situations.

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***



= ***Hot surface – Risk of burn***

MOTOR RUN CHECK LIST

	**1**	Before starting the motor, check that the motor is mounted properly and ensure that the machine connected to the motor allows the motor to be started.
	2	Set the maximum motor speed (frequency) according to the motor and the machine connected to it.
	3	Before reversing the motor shaft rotation direction make sure that this can be done safely.
	4	Ensure that no power correction capacitors are connected to the motor cable.
	5	Ensure that the motor terminals are not connected to mains potential.

2. DIRECTIVES

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 drives 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 drives 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 comformity of the NX frequency drives with the Directive due to the large product family & variety of installations possibilities.

2.2.2 Technical criteria

The NX frequency drives 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 drives 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 drive EMC classification

The NX frequency drives 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:
NX_5 frequency drives (FR4 to FR9) and NX_2 frequency drives (FR4 to FR6) have been designed to **fulfil the requirements of the product standard IEC 61800-3+A11 for the 1st environment restricted distribution and the 2nd environment**.
The emission levels correspond to the requirements of IEC 61000-6-4.

Class L (NX_5, FR10 only)**:**
Provides filtering for the 2nd environment, restricted distribution **according to IEC 61800-3+A11**.

Class T:
The T-class drives have a small ground 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 drives fulfil all EMC immunity requirements (standards IEC 61000-6-1, 61000-6-2 and IEC 61800-3+A11).

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.

Note: For changing the EMC protection class of your NX frequency drive from class H to class T, please refer to the instructions given in Chapter 6.3.1.

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 drives with the EMC-directives.

2.3 UL-label

The NX frequency drives are UL-listed according to the standards, based on the needed voltage and power range. For more information contact you local Honeywell distributor. More information of cable selection and installation can be found from chapter 5 and 6.

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/P Frequency converter

Model designation: NXS/P 0003 5…. to 0520 5….

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

Safety: EN50178 (1997), EN60204-1 (1996)
EN 60950 (3rd edition 2000, as relevant)

EMC: EN61800-3 (1996)+A11(2000), EN 61000-6-2 (1999), EN 61000-6-4 (2001)

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

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

In Vaasa, 5th of May, 2003

Vesa Laisi
President

The year the CE marking was affixed: 2002

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/P Frequency converter
Model designation:	NXS/P 0004 6…. to 0416 6….

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

Safety:	EN50178 (1997), EN60204-1 (1996) EN 60950 (3rd edition 2000, as relevant)
EMC:	EN61800-3 (1996)+A11(2000), EN 61000-6-2 (1999), EN 61000-6-4 (2001)

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

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

In Vaasa, 17th of November, 2003

Vesa Laisi
President

The year the CE marking was affixed: 2003

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/P Frequency converter
Model designation:	NXS/P 0003 2…. to 0114 2….

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

Safety:	EN50178 (1997), EN60204-1 (1996) EN 60950 (3rd edition 2000, as relevant)
EMC:	EN61800-3 (1996)+A11(2000), EN 61000-6-2 (1999), EN 61000-6-4 (2001)

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

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

In Vaasa, 10th of November, 2003

Vesa Laisi
President

The year the CE marking was affixed: 2003

Note: Ask factory for other possible installation combinations.

3. RECEIPT OF SHIPMENT

The NX frequency drives 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.
In the small plastic bag included in the delivery you will find a silver *Drive modified* sticker. The purpose of the sticker is to notify the service personnel about the modifications made in the frequency drive. Attach the sticker on the side of the frequency drive to avoid losing it. Should the frequency drive be later modified (option board added, IP or EMC protection level changed), mark the change in the sticker.

3.1 Type designation code

NXS 0050 B 12

Enclosure
- 00 Open chassis
- 10 Nema 1
- 12 Nema 12

Voltage range
- B 208-240 Vac 3 phase
- A 380-500 Vac 3 phase
- C 525-690 Vac 3 phase

Motor Power (HP)
Low overloadability:
10% overload at
104 deg F
- 0005 1/2 HP
- 0050 5 HP
- 0400 40 HP etc

Product Series
- NXS
- NXL

Figure 3-1. NX type designation code

3.2 Storage

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

Storing temperature	-40…+158°F (-40…70° C)
Relative humidity	<95%, no condensation

3.3 Maintenance

In normal conditions, the NX frequency drives are maintenance-free. However, it is recommended the heatsink be cleared periodically with compressed air. The cooling fan can easily be changed if necessary.

It may also be necessary to check the tightening torques of terminals at regular intervals.

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 18 months from the delivery or 12 months from the commissioning whichever expires first.

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.

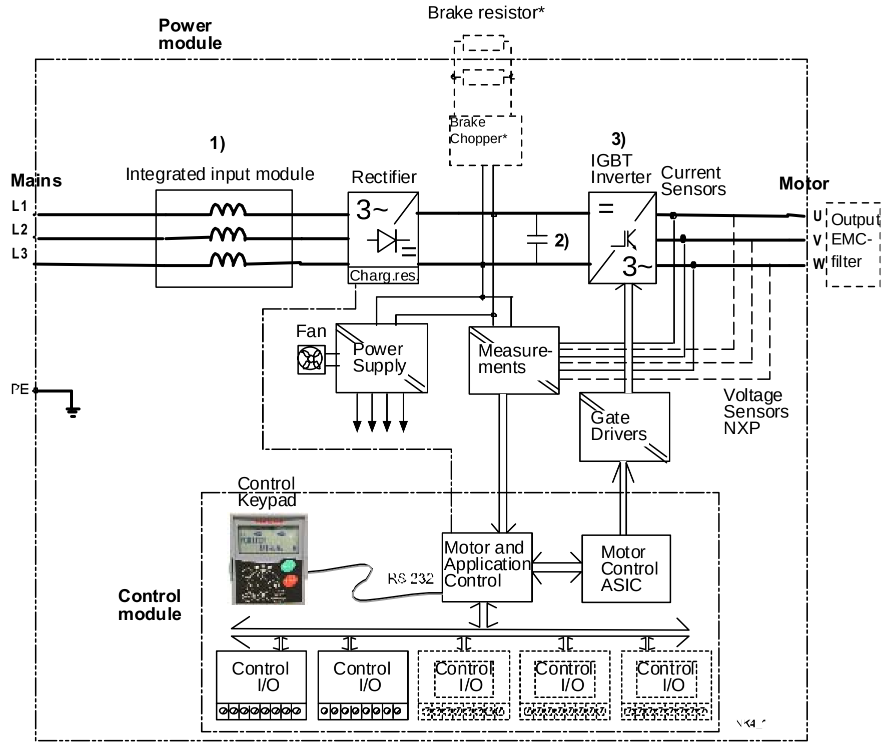
4. TECHNICAL DATA

4.1 Introduction

Figure 4-1 presents the block diagram of the NX frequency drive. The frequency drive 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 drive to the mains. It, in addition, enhances the waveform of the input current to the frequency drive. The entire power drawn by the frequency drive 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.



*The brake resistor can be installed internally in classes FR4 to FR6 (NX_2 and NX_5). In all other frames of voltage classes NX_2 and NX_5, as well as in all frames of all other voltage classes, the brake resistor is available as option and installed externally.
Brake chopper belongs to the standard equipment in classes FR4 to FR6, while in greater classes (FR7 to FR9) it is optional.

Figure 4-1. NX block diagram

The control keypad provides a link between the user and the frequency drive. 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 drive. Also a PC can be used instead of the control keypad, to control the frequency drive, if connected through a similar cable.

Control I/O boards which are either isolated (OPT-A8) or not isolated (OPT-A1) from the ground are available.

The default application (Basic Application) is preferred when speed control will be dictated by a separate automation system. 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 internal option for frames FR4 to FR6 of voltage classes NX_2 and NX_5. In all other frames of voltage classes NX_2 and NX_5, as well as in all frames of all other voltage classes, the brake resistor is available as option and installed externally.

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 drives and significantly enhance the protection of the drive from external interference as well as protecting other sensitive equipment from harmonics generated by the frequency drive. They are also necessary for the fulfillment of the EMC directives.

4.2 Power ratings

4.2.1 NX_5 – Mains voltage 380—500 V

Low overload = 150% starting torque, 2 sec/20 sec, 110% overloadability, 1 min/10 min
Following continuous operation at rated output current, 110% rated output current (IL) for 1 min, followed by a period of load current less than rated current, and of such duration that the r.m.s output current, over the duty cycle, does not exceed rated output current (IL)

High overload = 200% starting torque, 2 sec/20 sec, 150% overloadability, 1 min/10 min
Following continuous operation at rated output current, 150 % rated output current (IH) for 1 min, followed by a period of load current less than rated current, and of such duration that the r.m.s output current, over the duty cycle, does not exceed rated output current (IH)

All sizes up to and including FR9 are wall mounted available with NEMA1 enclosure and NEMA12 as option. All sizes above and including FR10 are standalone NEMA 1 NXP units.

For **single phase input connections**, ratings and wiring instructions can be found in 6.2.1

Mains voltage 380-500 V, NEMA 1/12, EMC-level H								
Frequency drive type	**Motor shaft power (500V) and current**					Size / prot. FR/IP	Dimensions WxHxD (in)	Weight (lb)
	Low overload		High overload					
	P [Hp] (500V)	I(L)	P [Hp] (500V)	I(H)	I(max)			
NX_ 0015 A	1.5	3.3	1	2.2	4.4	FR4/NEMA 1/12	5.0x11.5x7.5	11.02
NX_ 0020 A	2	4.3	1.5	3.3	6.2	FR4/NEMA 1/12	5.0x11.5x7.5	11.02
NX_ 0030 A	3	5.6	2	4.3	8.6	FR4/NEMA 1/12	5.0x11.5x7.5	11.02
NX_ 0040 A	4	7.6	3	5.6	10.8	FR4/NEMA 1/12	5.0x11.5x7.5	11.02
NX_ 0050 A	5	9	4	7.6	14	FR4/NEMA 1/12	5.0x11.5x7.5	11.02
NX_ 0075 A	7.5	12	5	9	18	FR4/NEMA 1/12	5.0x11.5x7.5	11.02
NX_ 0100 A	10	16	7.5	12	24	FR5/NEMA 1/12	5.7x15.4x8.4	17.86
NX_ 0150 A	15	23	10	16	32	FR5/NEMA 1/12	5.7x15.4x8.4	17.86
NX_ 0200 A	20	31	15	23	46	FR5/NEMA 1/12	5.7x15.4x8.4	17.86
NX_ 0250 A	25	38	20	31	62	FR6/NEMA 1/12	7.7x20.4x9.3	40.8
NX_ 0300 A	30	46	25	38	76	FR6/NEMA 1/12	7.7x20.4x9.3	40.8
NX_ 0400 A	40	61	30	46	92	FR6/NEMA 1/12	7.7x20.4x9.3	40.8
NX_ 0500 A	50	72	40	61	122	FR7/NEMA 1/12	9.3x23.3x10.1	77.2
NX_ 0600 A	60	87	50	72	144	FR7/NEMA 1/12	9.3x23.3x10.1	77.2
NX_ 0750 A	75	105	60	87	174	FR7/NEMA 1/12	9.3x23.3x10.1	77.2
NX_ 1000 A	100	140	75	105	210	FR8/NEMA 1/12	11.2x28.4x11.3	127.9
NX_ 1250 A	125	170	100	140	280	FR8/NEMA 1/12	11.2x28.4x11.3	127.9
NX_ 1500 A	150	205	125	170	336	FR8/NEMA 1/12	11.2x28.4x11.3	127.9
NX_ 2000 A	200	261	150	205	349	FR9/NEMA 1/12	18.9x45.3x14.3	321.9
NX_ 2500 A	250	300	200	245	444	FR9/NEMA 1/12	18.9x45.3x14.3	321.9
NXP 3000 A	300	385	250	300	540	FR10/NEMA1	23.6x89.6x23.6	661.1
NXP 3500 A	350	460	300	385	693	FR10/NEMA1	23.6x89.6x23.6	661.1
NXP 4500 A	450	520	350	460	828	FR10/NEMA1	23.6x89.6x23.6	661.1
NXP 5000 A	500	590	450	520	936	FR11/NEMA1	31.6x79.4x23.6	815.7
NXP 5500 A	550	650	500	590	1062	FR11/NEMA1	31.6x79.4x23.6	815.7
NXP 6000 A	600	730	550	650	1170	FR11/NEMA1	31.6x79.4x23.6	815.7
NXP 6500 A	650	820	600	730	1314	FR12/NEMA1	47.6x 79.4x 23.6	1322.8
NXP 7000 A	700	920	650	820	1476	FR12/NEMA1	47.6x 79.4x 23.6	1322.8
NXP 8000 A	800	1030	700	920	1654	FR12/NEMA1	47.6x 79.4x 23.6	1322.8

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

Note: The rated currents in given ambient temperatures are achieved only when the switching frequency is equal to or less than the factory default.
Note: The rated currents for FR10 to FR12 are all valid at an ambient temperature of 104 °F.

4.2.2 NX_6 – Mains voltage 525—690 V

High overload = Max current IS, 2 sec/20 sec, 150% overloadability, 1 min/10 min
Following continuous operation at rated output current, 150 % rated output current (IH) for 1 min, followed by a period of load current less than rated current, and of such duration that the r.m.s output current, over the duty cycle, does not exceed rated output current (IH)

Low overload = Max current IS, 2 sec/20 sec, 110% overloadability, 1 min/10 min
Following continuous operation at rated output current, 110% rated output current (IL) for 1 min, followed by a period of load current less than rated current, and of such duration that the r.m.s output current, over the duty cycle, does not exceed rated output current (IL)

All sizes up to and including FR9 are wall mounted available with NEMA1 enclosure and NEMA12 as option. All sizes above and including Fr10 are standalone NEMA 1 NXP units.

Mains voltage 525-690 V, NEMA 1/12, EMC-level H								
Frequency drive type	Motor shaft power (575V) and current					Size / prot. FR/IP	Dimensions WxHxD (in)	Weight (lb)
	Low overload		High overload					
	P [Hp] (575V)	I(L)	P [Hp] (575V)	I(H)	I(max)			
NX_ 0030 C	3	4.5	2	3.2	6.4	FR6/NEMA 1/12	7.7x20.4x9.3	39.7
NX_ 0040 C	4	5.5	3	4.5	9.0	FR6/NEMA 1/12	7.7x20.4x9.3	39.7
NX_ 0050 C	5	7.5	4	5.5	11.0	FR6/NEMA 1/12	7.7x20.4x9.3	39.7
NX_ 0075 C	7,5	10	5	7.5	15.0	FR6/NEMA 1/12	7.7x20.4x9.3	39.7
NX_ 0100 C	10	13.5	7,5	10	20.0	FR6/NEMA 1/12	7.7x20.4x9.3	39.7
NX_ 0150 C	15	18	10	13.5	27	FR6/NEMA 1/12	7.7x20.4x9.3	39.7
NX_ 0200 C	20	22	15	18	36	FR6/NEMA 1/12	7.7x20.4x9.3	39.7
NX_ 0250 C	25	27	20	22	44	FR6/NEMA 1/12	7.7x20.4x9.3	39.7
NX_ 0300 C	30	34	25	27	54	FR6/NEMA 1/12	7.7x20.4x9.3	39.7
NX_ 0400 C	40	41	30	34	68	FR7/NEMA 1/12	9.33x23.3x10.1	77.16
NX_ 0500 C	50	52	40	41	82	FR7/NEMA 1/12	9.33x23.3x10.1	77.16
NX_ 0600 C	60	62	50	52	104	FR8/NEMA1/12	11.4x29.9x13.5	127.9
NX_ 0750 C	75	80	60	62	124	FR8/NEMA1/12	11.4x29.9x13.5	127.9
NX_ 1000 C	100	100	75	80	160	FR8/NEMA1/12	11.4x29.9x13.5	127.9
NX_ 1250 C	125	125	100	100	200	FR9/NEMA 1/12	18.9x45.3x14.3	321.9
NX_ 1500 C	150	144	125	125	213	FR9/NEMA 1/12	18.9x45.3x14.3	321.9
NX_ 2000 C	200	208	150	170	289	FR9/NEMA 1/12	18.9x45.3x14.3	321.9
NXP 2500 C	250	261	200	208	375	FR10/NEMA 1	23.4x79.4x23.7	661.4
NXP 3500 C	350	325	250	261	470	FR10/NEMA 1	23.4x79.4x23.7	661.4
NXP 4000 C	400	385	350	325	585	FR10/NEMA 1	23.4x79.4x23.7	661.4
NXP 4600 C	450	460	400	385	693	FR11/NEMA 1	31.3x79.4x23.7	815.7
NXP 5000 C	500	502	450	460	828	FR11/NEMA 1	31.3x79.4x23.7	815.7
NXP 5500 C	550	590	500	502	904	FR11/NEMA 1	31.3x79.4x23.7	815.7
NXP 6000 C	600	650	550	590	375	FR12/NEMA 1	47.6x79.4x23.7	1322.8
NXP 7000 C	700	750	600	650	470	FR12/NEMA 1	47.6x79.4x23.7	1322.8
NXP 8000 C	800	820*	600	650	585	FR12/NEMA 1	47.6x79.4x23.7	1322.8

Table 4-2. Power ratings and dimensions of the NX, supply voltage 525—690V

Note: The rated currents for FR10 to FR12 are all valid at an ambient temperature of 104 °F (40°C).

* Maximum ambient temperature 95 °F (35°C)

Note: The rated currents in given ambient temperatures are achieved only when the switching frequency is equal to or less than the factory default.

4.2.3 NX_2 – Mains voltage 208—240 V

High overload = Max current IS, 2 sec/20 sec, 150% overloadability, 1 min/10 min
Following continuous operation at rated output current, 150 % rated output current (IH) for 1 min, followed by a period of load current less than rated current, and of such duration that the r.m.s output current, over the duty cycle, does not exceed rated output current (IH)

Low overload = Max current IS, 2 sec/20 sec, 110% overloadability, 1 min/10 min
Following continuous operation at rated output current, 110% rated output current (IL) for 1 min, followed by a period of load current less than rated current, and of such duration that the r.m.s output current, over the duty cycle, does not exceed rated output current (IL)

All sizes are available as wall mounted NEMA1 or NEMA12.

Mains voltage 208-240 V, NEMA 1/12, EMC-level H										
Frequency drive type	**Motor shaft power (208 and 230V) and current**							Size / prot. FR/NEMA	Dimensions WxHxD (in)	Weight (lb)
	Low overload			High overload						
	P [Hp] (230V)	P [Hp] (208V)	I(L)	P [Hp] (230V)	P [Hp] (208V)	I(H)	I(max)			
NX_ 0010 B	1	1	4.8	0.75	0.75	3.7	6.4	FR4/NEMA 1/12	5.0x11.5x7.5	11.0
NX_ 0015 B	1.5	1.5	6.6	1	1	4.8	9.0	FR4/NEMA 1/12	5.0x11.5x7.5	11.0
NX_ 0020 B	2	2	7.8	1.5	1.5	6.6	11.0	FR4/NEMA 1/12	5.0x11.5x7.5	11.0
NX_ 0030 B	3	3	11	2	2	7.8	15.0	FR4/NEMA 1/12	5.0x11.5x7.5	11.0
NX_ 0040 B	4	4	12.5	3	3	11	20.0	FR4/NEMA 1/12	5.0x11.5x7.5	11.0
NX_ 0050 B	5	5	17.5	4	4	12.5	27	FR5/NEMA 1/12	5.7x15.4x8.4	17.9
NX_ 0075 B	7.5	7.5	25	5	5	17.5	36	FR5/NEMA 1/12	5.7x15.4x8.4	17.9
NX_ 0100 B	10	10	31	7.5	7.5	25	44	FR5/NEMA 1/12	5.7x15.4x8.4	17.9
NX_ 0150 B	15	15	48	10	10	31	54	FR6/NEMA 1/12	7.8x20.4x9.3	40.8
NX_ 0200 B	20	20	61	15	15	48	68	FR6/NEMA 1/12	7.8x20.4x9.3	40.8
NX_ 0250 B	25	25	75	20	20	61	82	FR7/NEMA 1/12	9.3x23.3x10.1	77.2
NX_ 0300 B	30	30	88	25	25	75	104	FR7/NEMA 1/12	9.3x23.3x10.1	77.2
NX_ 0400 B	40	40	114	30	30	88	124	FR7/NEMA 1/12	9.3x23.3x10.1	77.2
NX_ 0500 B	50	50	140	40	40	105	160	FR8/NEMA 1/12	11.4x29.9x13.5	127.9
NX_ 0600 B	60	60	170	50	50	140	200	FR8/NEMA 1/12	11.4x29.9x13.5	127.9
NX_ 0750 B	75	60	205	60	60	170	213	FR8/NEMA 1/12	11.4x29.9x13.5	127.9
NX_ 1000 B	100	75	261	75	60	205	245	FR9/NEMA 1/12	18.9x45.3x14.3	321.9
NX_ 1250 B	125	100	300	100	75	245	289	FR9/NEMA 1/12	18.9x45.3x14.3	321.9

Table 4-3. Power ratings and dimensions of NX, supply voltage 208—240V.

Note: The rated currents in given ambient temperatures are achieved only when the switching frequency is equal to or less than the factory default.

4.3 Brake resistor ratings

Mains voltage 380-500 V, 50/60 Hz, 3~					
Drive type	Max. brake current [I]	Resistor nom [ohm]	Drive type	Max. brake current [I]	Resistor nom. [ohm]
NX 0003 A	12	63	NX 0105 A	111	6.5
NX 0004 A	12	63	NX 0140 A	222	3.3
NX 0005 A	12	63	NX 0168 A	222	3.3
NX 0007 A	12	63	NX 0205 A	222	3.3
NX 0009 A	12	63	NX 0261 A	222	3.3
NX 0012 A	12	63	NX 0300 A	222	3.3
NX 0016 A	12	63	NX 0385 A	570	1,4
NX 0022 A	12	63	NX 0460 A	570	1,4
NX 0031 A	17	42	NX 0520 A	570	1,4
NX 0038 A	35	21	NX 0590 A	855	0,9
NX 0045 A	35	21	NX 0650 A	855	0,9
NX 0061 A	51	14	NX 0730 A	855	0,9
NX 0072 A	111	6.5	NX 0820 A	2 x 570	2 x 1,4
NX 0087 A	111	6.5	NX 0920 A	2 x 570	2 x 1,4

Table 4-4. Brake resistor ratings, NX, supply voltage 380–500V

Mains voltage 525-690 V, 50/60 Hz, 3~					
Drive type	Max. brake current [I]	Resistor nom [ohm]	Drive type	Max. brake current [I]	Resistor nom. [ohm]
NX 0004 C	11	100	NX 0125 C	157.1	7
NX 0005 C	11	100	NX 0144 C	157.1	7
NX 0007 C	11	100	NX 0170 C	157.1	7
NX 0010 C	11	100	NX 0208 C	157.1	7
NX 0013 C	11	100	NX 0261 C	440.0	2.5
NX 0018 C	36.7	30	NX 0325 C	440.0	2.5
NX 0022 C	36.7	30	NX 0385 C	440.0	2.5
NX 0027 C	36.7	30	NX 0416 C	440.0	2.5
NX 0034 C	36.7	30	NX 0460 C	647.1	1.7
NX 0041 C	61.1	18	NX 0502 C	647.1	1.7
NX 0052 C	61.1	18	NX 0590 C	647.1	1.7
NX 0062 C	122.2	9	NX 0650 C	2 x 440	2 x 2.5
NX 0080 C	122.2	9	NX 0750 C	2 x 440	2 x 2.5
NX 0100 C	122.2	9	NX 0820 C	2 x 440	2 x 2.5

Table 4-5. Brake resistor ratings, NX, supply voltage 525–690V

Automation and Control Solutions
Honeywell
1985 Douglas Drive North
Golden Valley, MIN 55422

Honeywell Limited-Honeywell Limitée
35 Dynamic Drive
Scarborough, Ontario
MIV 4Z9

Mains voltage 208-240 V, 50/60 Hz, 3~					
Drive type	Max. brake current [I]	Resistor nom [ohm]	Drive type	Max. brake current [I]	Resistor nom. [ohm]
NX 0004 B	15	30	NX 0061 B	46	10
NX 0007 B	15	30	NX 0075 B	148	3.3
NX 0008 B	15	30	NX 0088 B	148	3.3
NX 0011 B	15	30	NX 0114 B	148	3.3
NX 0012 B	15	30	NX 0140 B	296	1.4
NX 0017 B	15	30	NX 0170 B	296	1.4
NX 0025 B	15	30	NX 0205 B	296	1.4
NX 0032 B	23	20	NX 0261 B	296	1.4
NX 0048 B	46	10	NX 0300 B	296	1.4

Table 4-6. Brake resistor ratings, NX, supply voltage 208–240V

4.4 Technical data

Mains connection	Input voltage U_{in}	208…240V; 380…500V; 525…690V; –10%…+10%
	Input frequency	45…66 Hz
	Connection to mains	Once per minute or less (normal case)
Motor connection	Output voltage	0—U_{in}
	Continuous output current	I_H: Ambient temperature max. +122ºF (50°C), overload 1.5 x I_H (1 min./10 min.) I_L: Ambient temperature max. +104°F (40°C), overload 1.1 x I_L (1 min./10 min.)
	Starting torque	I_S for two seconds, torque motor dependent
	Peak current	I_S for 2 s every 20 s
	Output frequency	0…320 Hz (NXS); 7200 Hz (Special)
	Frequency resolution	0.01 Hz (NXS); Application dependent (NXP)
Control characteristics	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)	**NX B/ NX A:** Up to and including NX_0061: 1…16 kHz; Factory default 10 kHz From NX_0072: 1…10 kHz; Factory default 3.6 kHz **NX C:** 1…6 kHz; Factory default 1.5 kHz
	Frequency reference Analogue input Panel reference	 Resolution 0.1% (10-bit), accuracy ±1% Resolution 0.01 Hz
	Field weakening point	8…320 Hz
	Acceleration time	0.1…3000 sec
	Deceleration time	0.1…3000 sec
	Braking torque	DC brake: 30% * T_N (without brake option)
Ambient conditions	Ambient operating temperature	–14°F (-10°C) (no frost)…+122°F (50°C): I_H –14°F (-10°C) (no frost)…+104°F (40°C): I_L
	Storage temperature	–104°F…+158°F
	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 3147 feet 1-% derating for each 327 ft above 3147 ft.; max. 9843 ft
	Vibration EN50178/EN60068-2-6	5…150 Hz Displacement amplitude 0,04 in (peak) at 3…15.8 Hz Max acceleration amplitude 1 G at 15.8…150 Hz
	Shock IEC50178, IEC60068-2-27	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 **Note!** Keypad installation required for IP54

Table 4-3. Technical data (continues on next page)

EMC (at default settings)	Immunity	Fulfil all EMC immunity requirements
	Emissions	EMC level H: IEC 61800-3 (1996)+A11 (2000)(1st environment, restricted use); IEC 61000-6-4 EMC level L: IEC 61800-3 (1996)+A11 (2000)(2nd environment)
Safety		EN 50178 (1997), IEC 60204-1 (1996), IEC 60950 (2000, 3rd edition) (as relevant), CE, UL, CUL, FI, GOST R, IEC 61800-5; (see unit nameplate for more detailed approvals)
Control connections	Analogue input voltage	0…+10V, R_i = 200kΩ, (–10V…+10V joystick control) Resolution 0.1%, accuracy ±1%
	Analogue input current	0(4)…20 mA, R_i = 250Ω differential
	Digital inputs (6)	Positive or negative logic; 18…30VDC
	Auxiliary voltage	+24V, ±15%, max. 250mA
	Output reference voltage	+10V, +3%, max. load 10mA
	Analogue output	0(4)…20mA; R_L max. 500Ω; Resolution 10 bit; Accuracy ±2%
	Digital outputs	Open collector output, 50mA/48V
	Relay outputs	2 programmable change-over relay outputs Switching capacity: 24VDC/8A, 250VAC/8A, 125VDC/0.4A Min.switching load: 5V/10mA
Protections	Overcurrent protection	Trip limit 4.0*I_H instantaneously
	Overvoltage protection Undervoltage protection	**NX_2**: 437VDC; **NX_5**: 911VDC; **NX_6**: 1200VDC **NX_2**: 183VDC; **NX_5**: 333VDC; **NX_6**: 460 VDC
	Ground fault protection	In case of ground fault in motor or motor cable, only the frequency drive 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 4-3. Technical data

5. INSTALLATION

5.1 Mounting

The frequency drive should be fixed with four fasteners sized appropriately to support the full weight of the unit and all approved accessories. Enough space shall be reserved around the frequency drive in order to ensure a sufficient cooling, see Figure 5-10, Table 5-9 and Table 5-10. For safe installation, ensure that the mounting surface is relatively even.

The frequency drive should be fixed with four screws (or bolts, depending on the unit size). The dimensions of installation are presented in Figure 5-10 and Table 5-9.

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 drives with NEMA1 enclosure in Figure 5-1 and with NEMA1 for collar installation in Figure 5-2 and Figure 5-4. The dimensions of the opening needed in collar installation are given in Table 5-3 and Table 5-5.

The sizes FR10 to FR12 are floorstanding units. The enclosures are equipped with fixing holes. For dimensions see below.

See also chapter 5.2 Cooling.

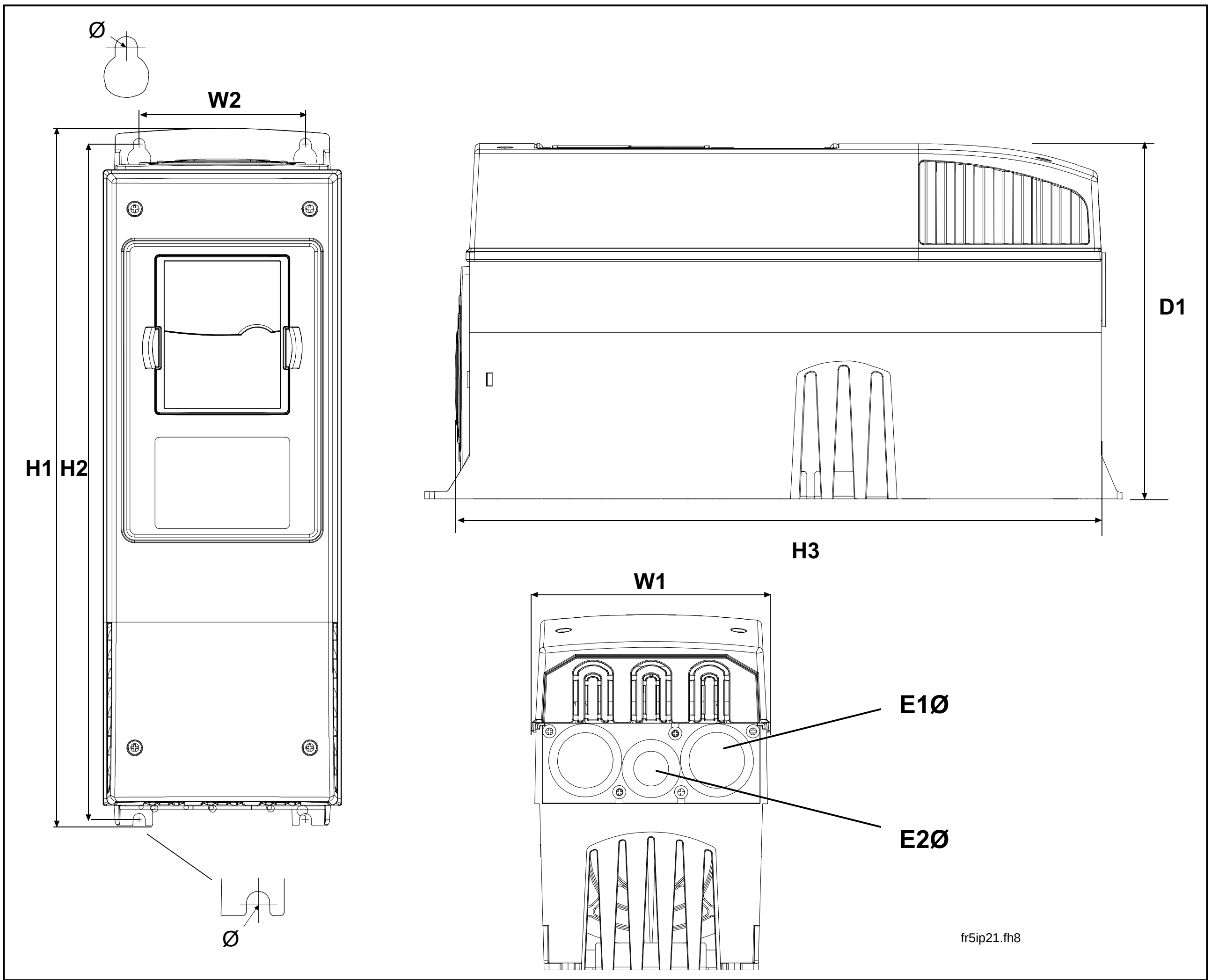


Figure 5-1. NX dimensions, NEMA1

Type	Dimensions (inch)								
	W1	W2	H1	H2	H3	D1	∅	E1∅	E2∅*
NXS 0010—0040 B NXS 0015—0075 A	5.04	3.94	12.87	12.32	11.5	7.48	7	3 x 1.11	
NXS 0050—0100 B NXS 0100—0200 A	5.67	3.94	16.5	15.98	15.39	8.43	7	2 x 1.46	1 x 1.11
NXS 0150—0200 B NXS 0250—0400 A	7.68	5.83	21.97	21.3	20.43	9.33	9	3 x 1.46	
NXS 0250—0400 B NXS 0500—0750 A NXS 0041—0062 C	9.33	7.48	24.8	24.17	23.27	10.12	9	3 x 1.85	
NXS 1000—1500 A	11.22	10.04	29.72	28.82	28.39	12.28	9	3 x 2.32	

Table 5-1. Dimensions for different frequency drive types, NEMA1

*FR5 only

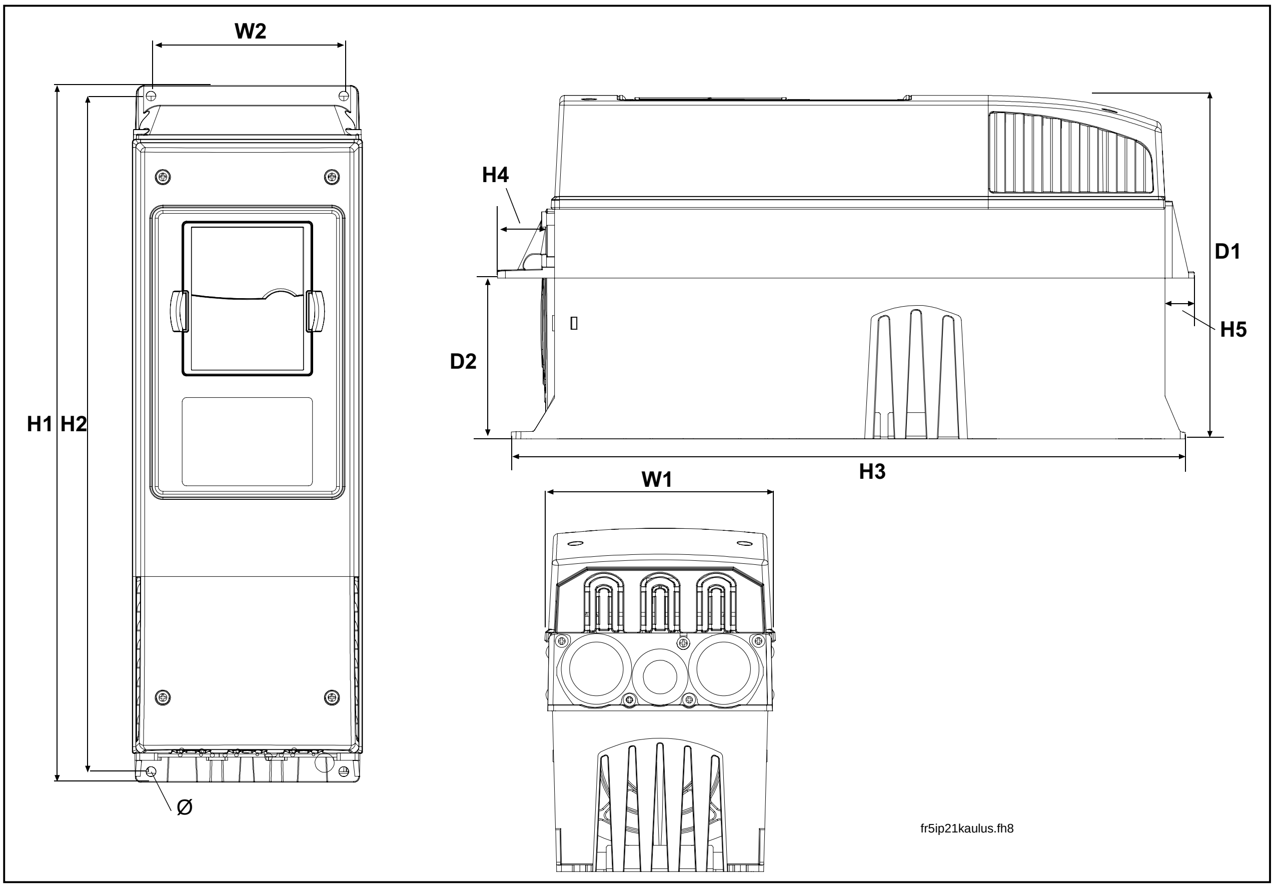


Figure 5-2. NX dimensions, NEMA1 with collar, FR4 to FR6

Type	Dimensions (inch)									
	W1	W2	H1	H2	H3	H4	H5	D1	D2	∅
NXS 0010—0040 B NXS 0015—0075 A	5.04	4.45	13.3	12.8	12.9	1.18	0.87	7.48	3.03	0.3
NXS 0050—0100 B NXS 0100—0200 A	5.67	4.72	17.1	16.5	16.5	1.42	0.71	8.43	3.94	0.3
NXS 0150—0200 B NXS 0250—0400 A	7.68	6.69	22	21.6	22	1.18	0.79	9.33	4.17	0.3

Table 5-2. Dimensions for different frequency drive types FR4 to FR6, NEMA1 with collar

Automation and Control Solutions
Honeywell
1985 Douglas Drive North
Golden Valley, MIN 55422

Honeywell Limited-Honeywell Limitée
35 Dynamic Drive
Scarborough, Ontario
MIV 4Z9

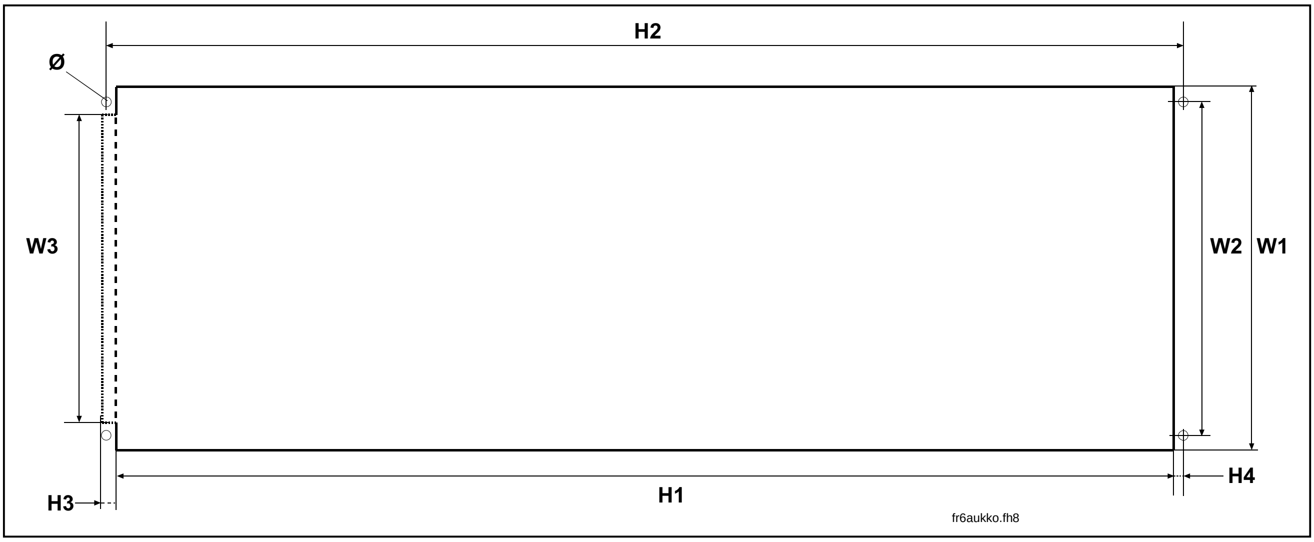


Figure 5-3. The opening needed for the collar installation, FR4 to FR6

Type	Dimensions (inch)							
	W1	W2	W3	H1	H2	H3	H4	∅
NXS 0010—0040 B NXS 0015—0075 A	5.04	4.45	–	12.4	12.8	–	0.16	0.3
NXS 0050—0100 B NXS 0100—0200 A	5.31	4.72	–	16.1	16.5	–	0.16	0.3
NXS 0150—0200 B NXS 0250—0400 A	7.28	6.69	6.18	21.2	21.6	0.28	0.16	0.3

Table 5-3. Dimensions for the collar opening, FR4 to FR6

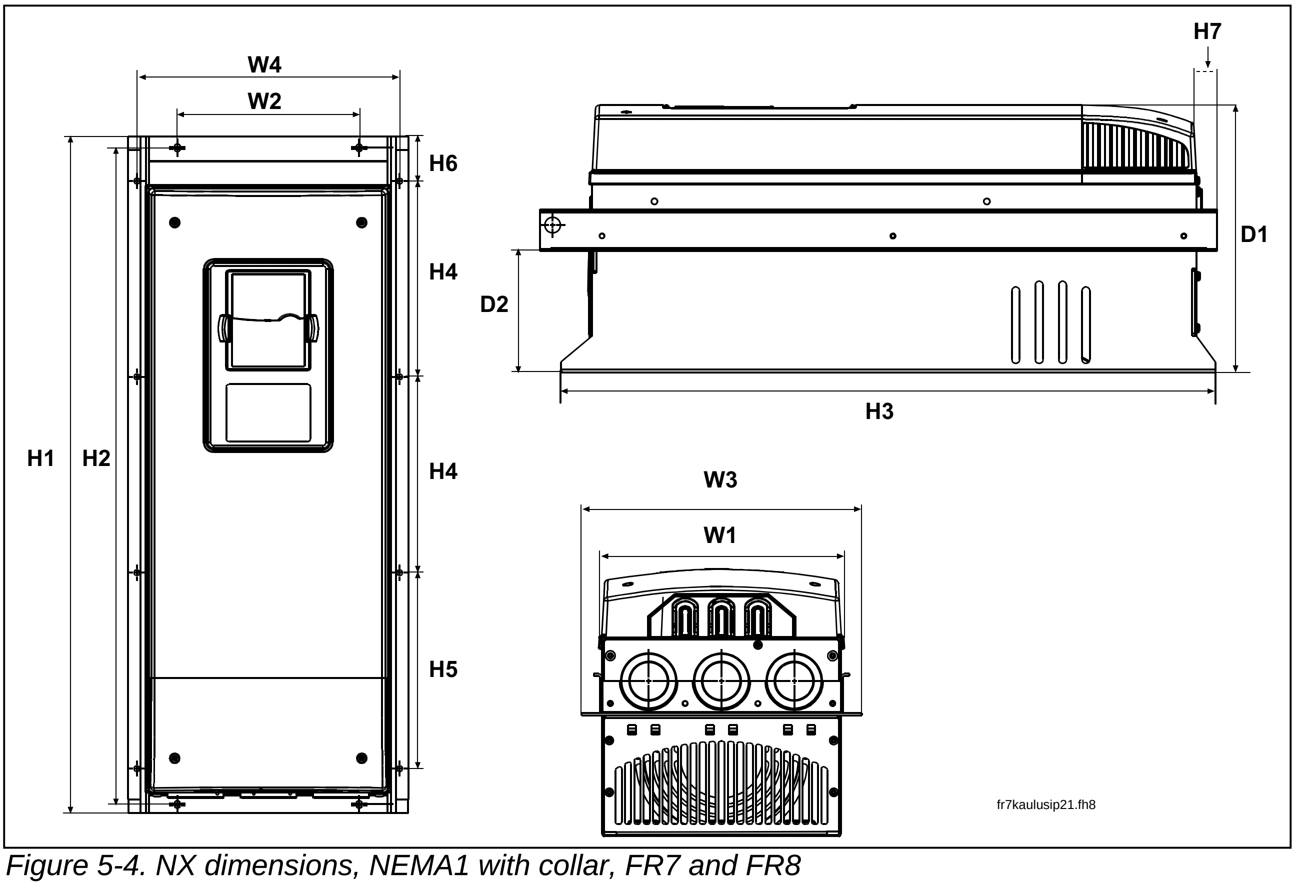


Figure 5-4. NX dimensions, NEMA1 with collar, FR7 and FR8

Type	Dimensions (inch)												
	W1	W2	W3	W4	H1	H2	H3	H4	H5	H6	H7	D1	D2	∅
NXS 0250—0400 B NXS 0500—0750 A NXS 0041—0062 C	9.33	6.89	10.6	9.96	25.7	24.9	24.8	7.42	7.42	0.91	0.91	10.1	4.6	0.2
NXS 1000—1500 A	11.2	–	14	13	32.8*	–	29.3	10.2	10.4	1.69	2.24	11.3	4.3	0.4

Table 5-4. Dimensions for different frequency drive types FR7 and FR8, NEMA1 with collar

*Excluding the height of the brake resistor terminal box (7.953 in). See page 56.

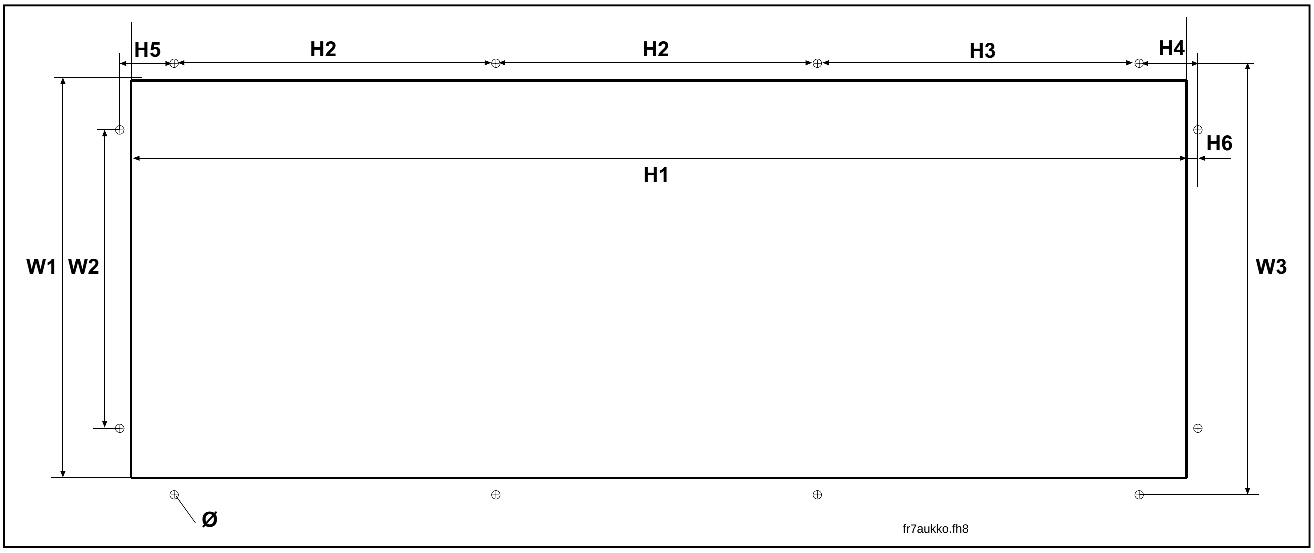


Figure 5-5. The opening needed for the collar installation, FR7/FR8

Type	Dimensions (inch)									
	W1	W2	W3	H1	H2	H3	H4	H5	H6	∅
NXS 0250—0400 B NXS 0500—0750 A NXS 0041—0062 C	9.17	6.89	9.96	24.4	7.42	7.42	1.36	1.26	0.28	0.2
NXS 1000—1500 A	11.9	–	13	31.9	10.2	10.4	–	–	–	0.4

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

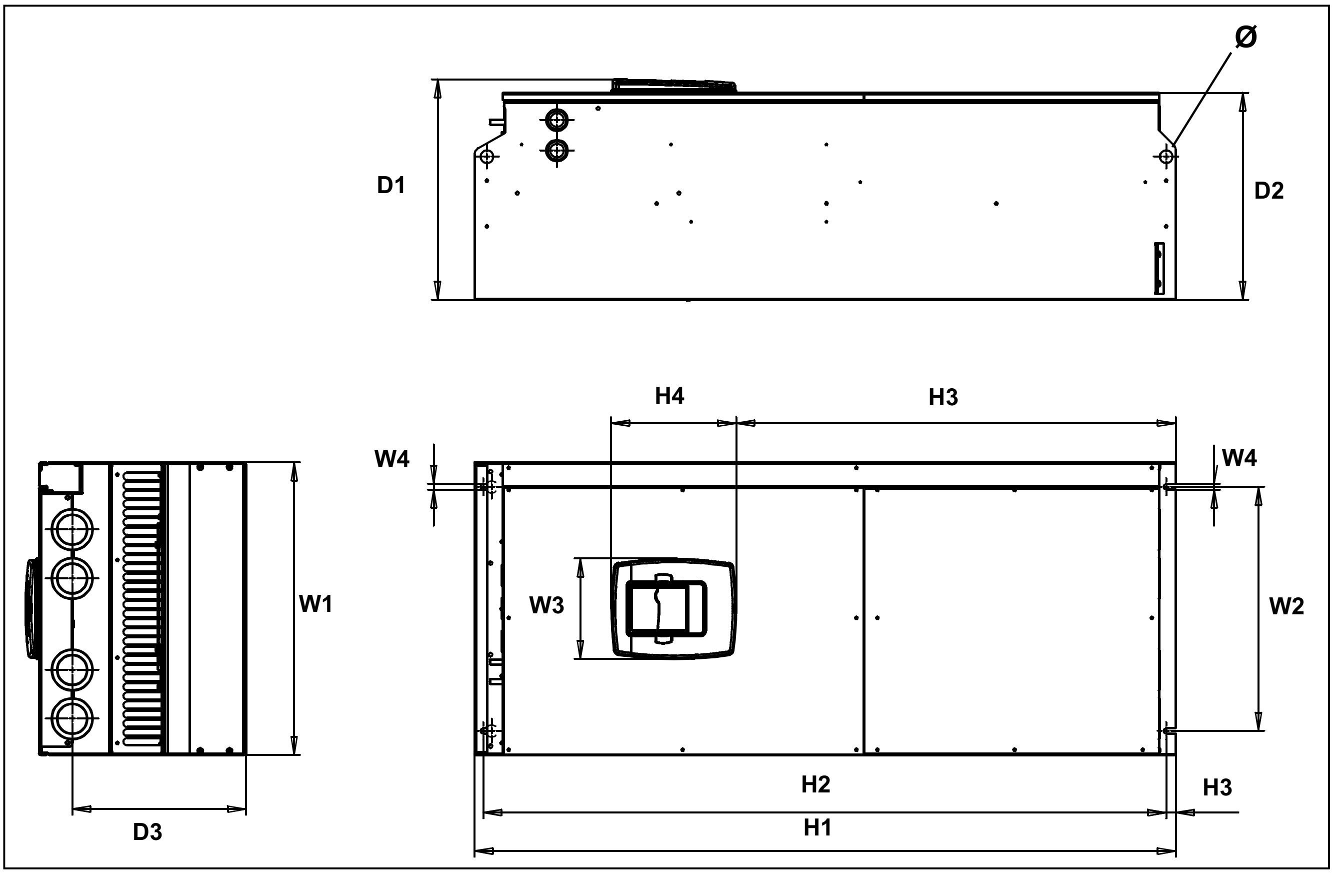


Figure 5-6. NX dimensions, FR9

Type	Dimensions (inch)											
	W1	W2	W3	W4	H1	H2	H3	H4	D1	D2	D3	∅
NXS 1750—2000 A NXS 0144—0208 C	18.9	15.7	6.5	0.35	45.3	44.1	28.4	8.07	14.3	13.4	11.2	0.8

Table 5-6. NX dimensions, FR9

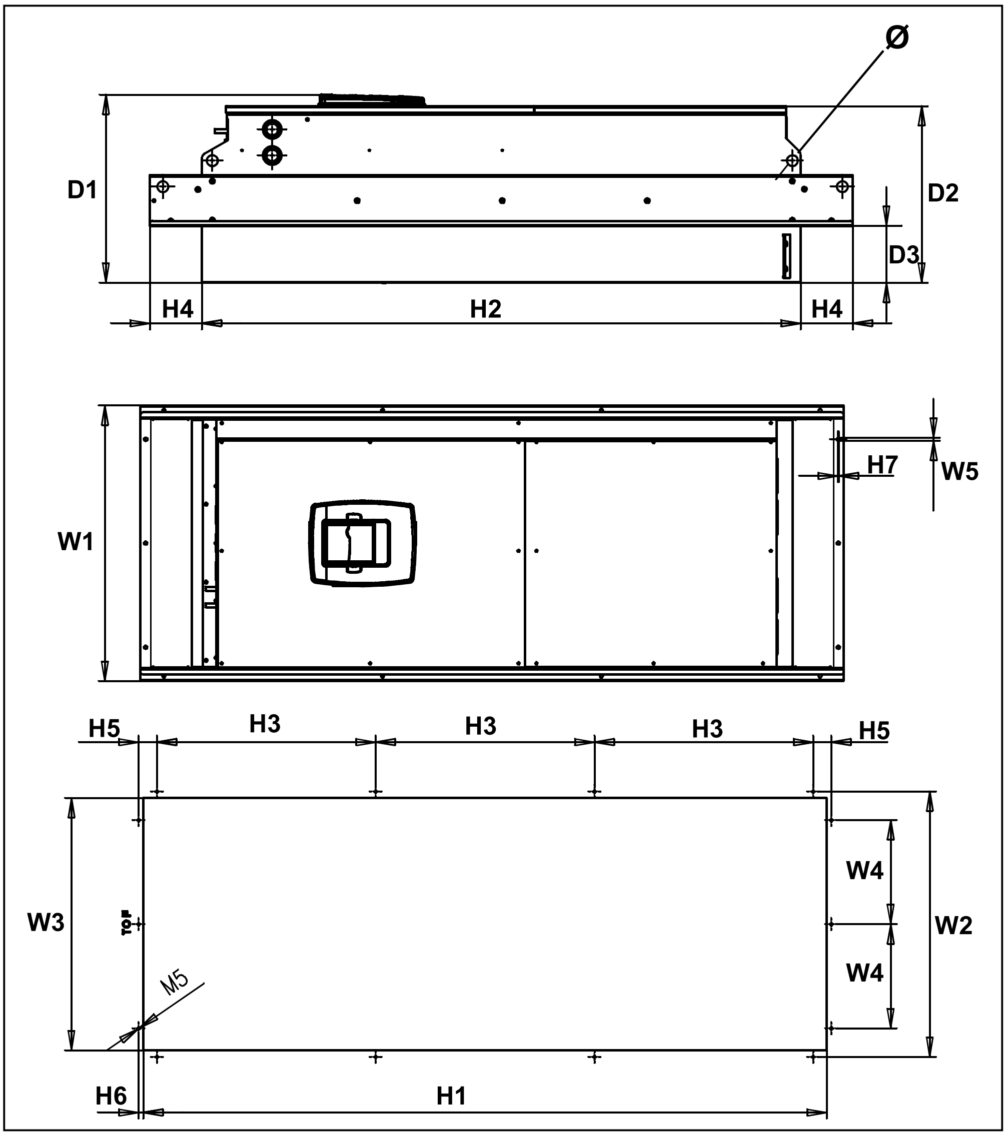


Figure 5-7. NX dimensions. FR9 collar installation

Type	Dimensions														
	W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	H6	H7	D1	D2	D3	∅
NXS 1750—2000 A NXS 0144—0208 C	20.9	20.1	18	7.87	0.22	51.7	45.3	16.5	3.94	1.38	0.24	0.08	14.3	13.4	4.29	0.8

Table 5-7. NX dimensions. FR9 with collar

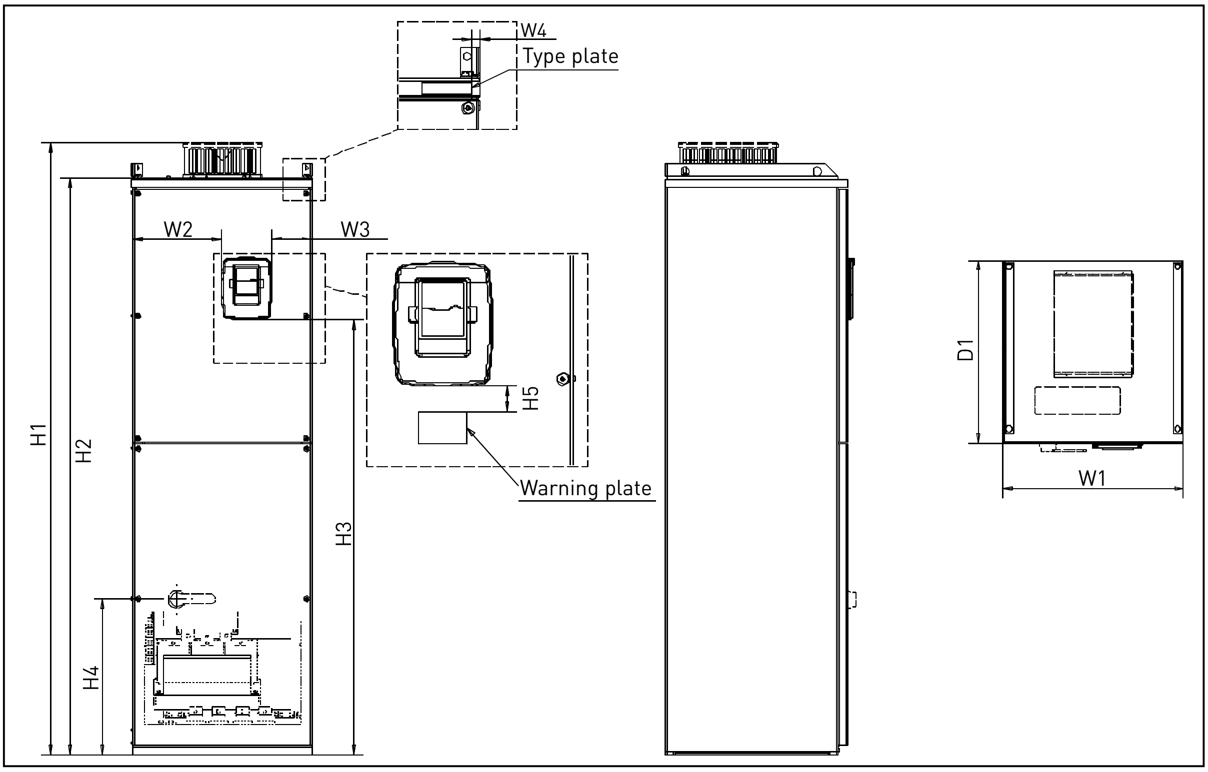


Figure 5-8. NX dimensions, FR10 and FR11 (floorstanding units)

Type	Dimensions [mm]									
	W1	W2	W3	W4	H1	H2	H3	H4	H5	D1
0385…0520 NX A 0261…0416 NX C	23.4	11.5	5.2	0.6	79.4	74.8	56.5	20.2	1.6	23.7
0590…0730 NX A 0460…0590 NX C	31.3	15.4	9.1	0.6	79.4	74.8	56.6	20.2	1.6	23.7

Table 5-8. NX dimensions, FR10 and FR11 (floorstanding units)

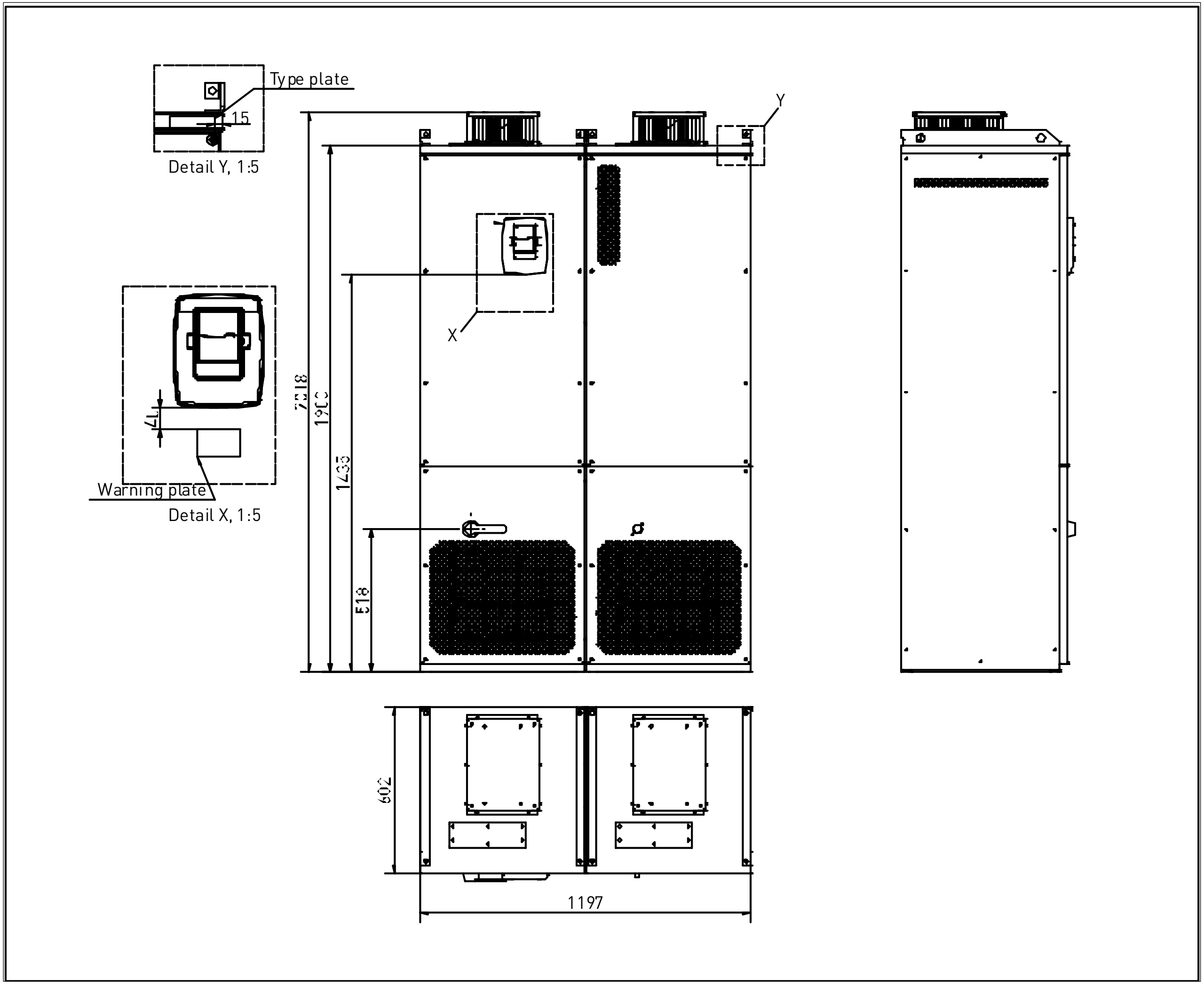


Figure 5-9. NX dimensions, FR12 (floorstanding units)

5.2 Cooling

Enough free space should be left around the frequency drive 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 the required free space between the stacked units 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.

5.2.1 FR4 to FR9

Type	Dimensions (inch)				
	A	A_2	B	C	D
NXS 0010—0040 B NXS 0015—0075 A	0.79		0.79	3.94	1.97
NXS 0050—0100 B NXS 0100—0200 A	0.79		0.79	4.72	2.36
NXS 0150—0200 B NXS 0250—0400 A	1.18		0.79	6.3	3.15
NXS 0250—0400 B NXS 0500—0750 A	3.15		3.15	11.8	3.94
NXS 1000—1500 A	0.79	7.87 (5.91*)	3.15	11.8	7.87

Table 5-9. Mounting space dimensions

A = clearance around the freq. converter (see also ***A₂*** and **B**)
A_2 = clearance needed on either side of the frequency converter for fan change (without disconneting 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

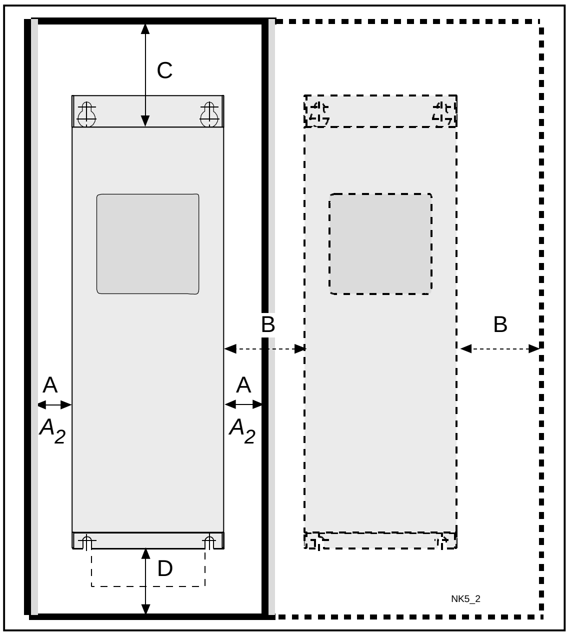


Figure 5-10. Installation space

Type	**Cooling air required** [CFM]
NXS 0010—0040 B NXS 0015—0075 A	42
NXS 0050—0100 B NXS 0100—0200 A	112
NXS 0150—0200 B NXS 0250—0400 A	251
NXS 0250—0400 B NXS 0500—0750 A NXS 0041—0062 C	251
NXS 0500—0750 B NXS 1000—1500 A	383
NXS 1750—2000 A NXS 0144—0208 C	766

Table 5-10. Required cooling air.

5.2.2 Standalone units (FR10 to FR12)

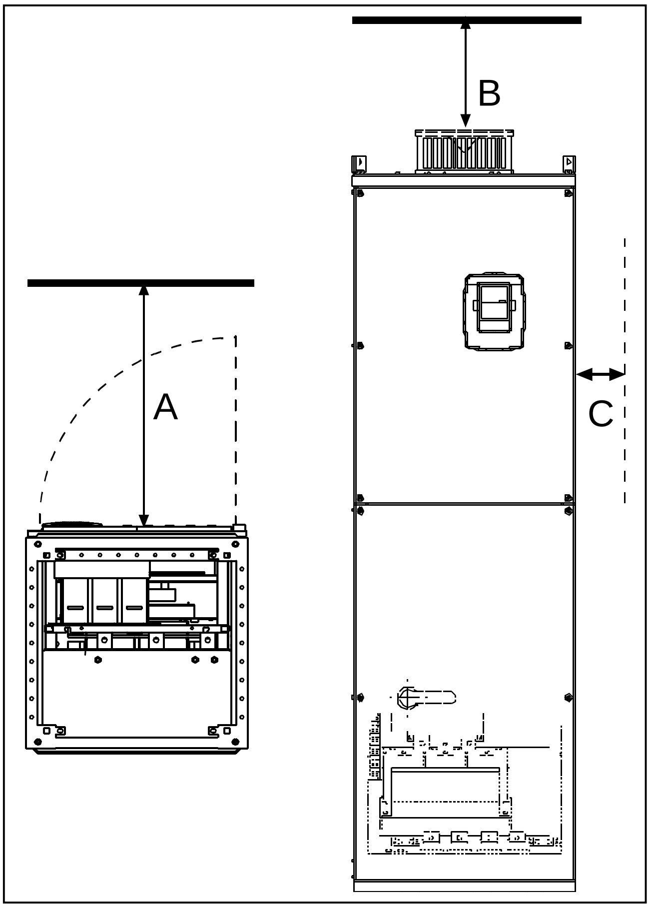


Figure 5-11. Installation space

Mounting space dimensions [in]		
A	**B**	**C**
31.5	7.9	0.8

Type	**Cooling air required** [cubic yards/h)
0385—0520 5 0261—0416 6	3400.7
0650—0730 5 0460—0590 6	5101
0820—1030 5 0650—0820 6	6801

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 power losses and cooling requirements according to the graphs below.

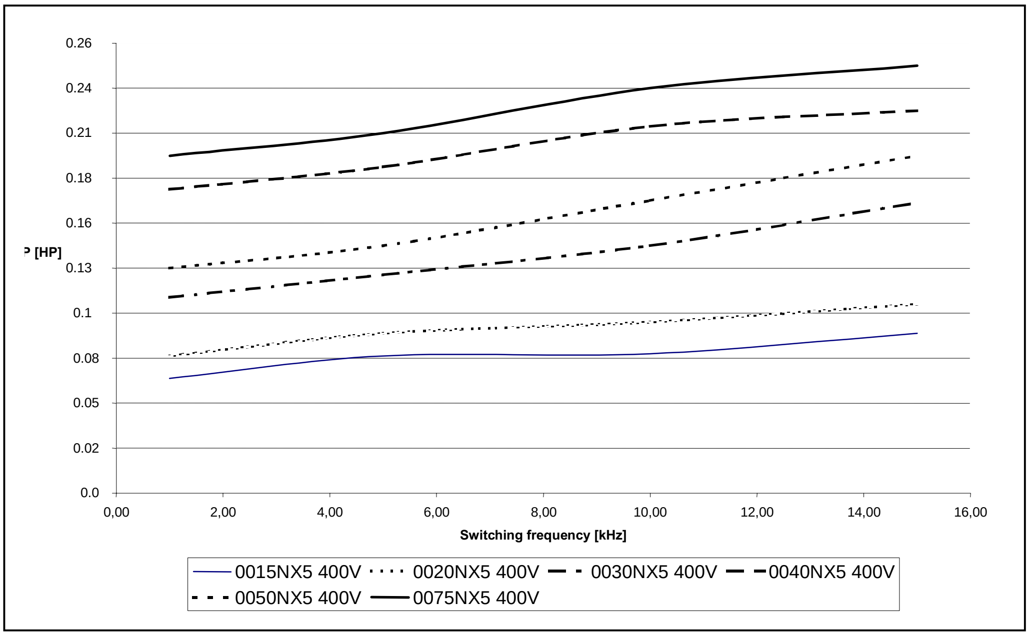


Figure 5-12. Power loss as function of switching frequency; NXS 0015…0075 A

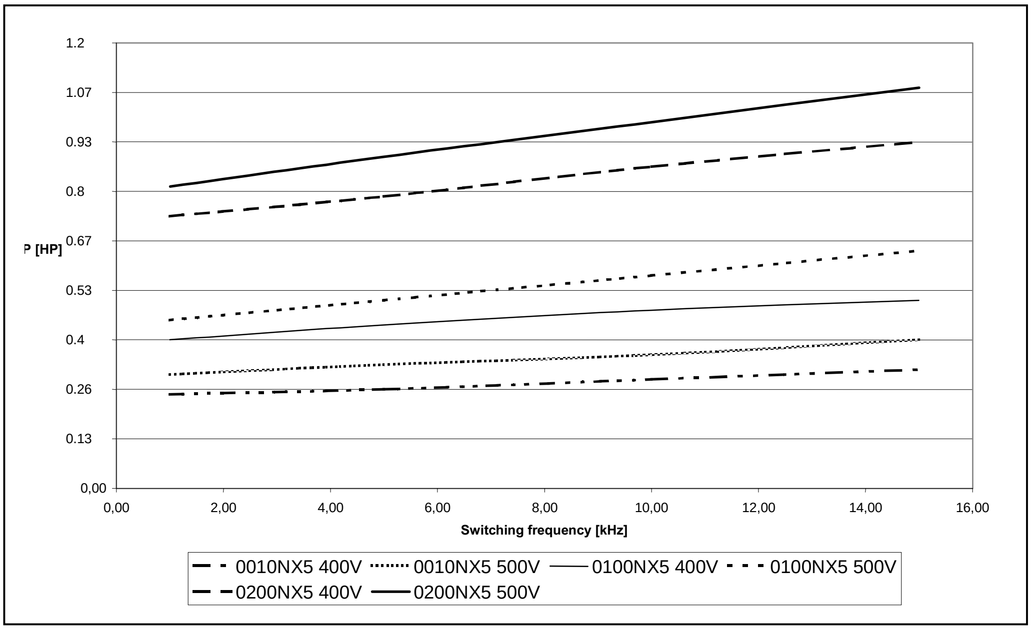


Figure 5-13. Power loss as function of switching frequency; NXS 0100…0200 A

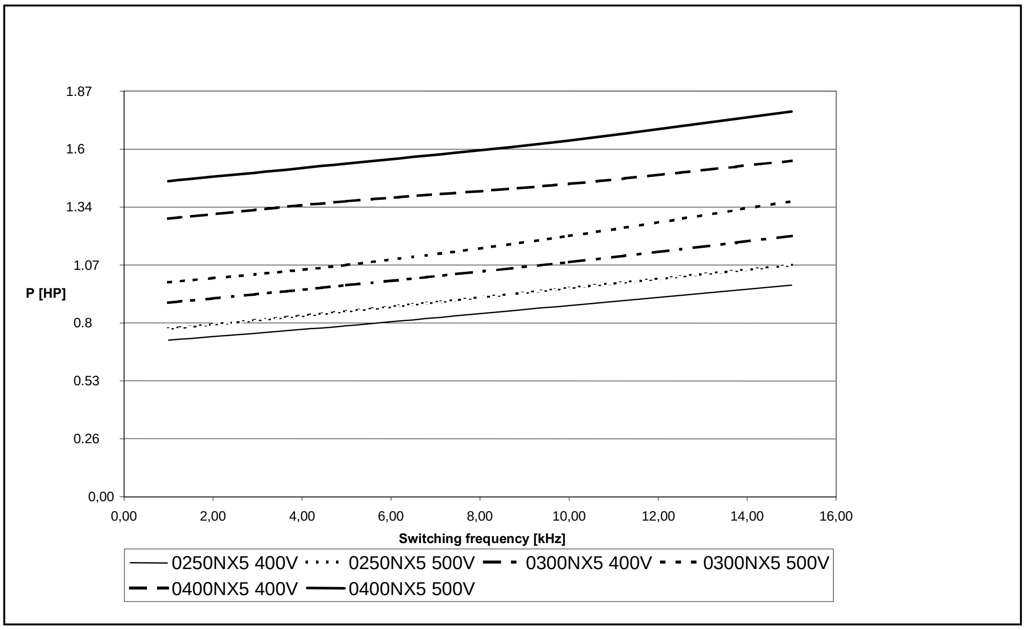


Figure 5-14. Power loss as function of switching frequency; NXS 0250…0400 A

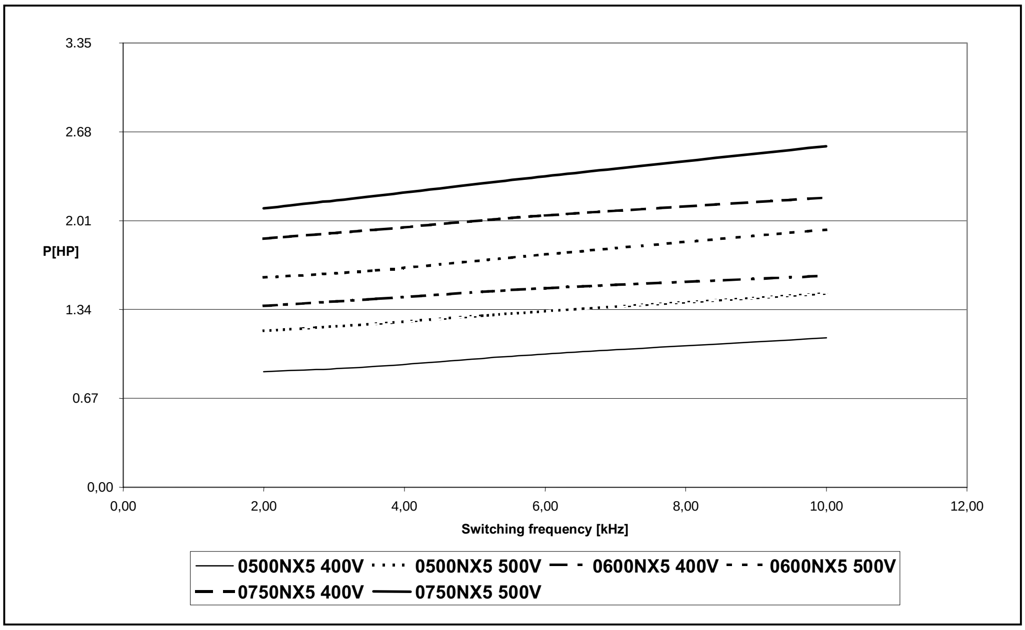


Figure 5-15. Power loss as function of switching frequency; NXS 0500…0750 A

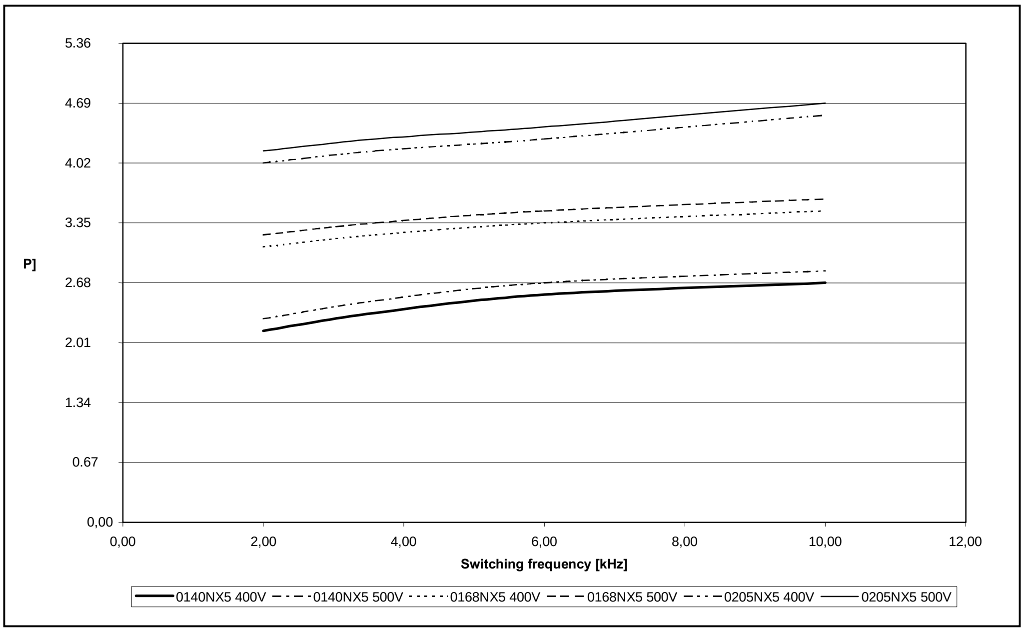


Figure 5-16. Power loss as function of switching frequency; NXS 1000…1500 A

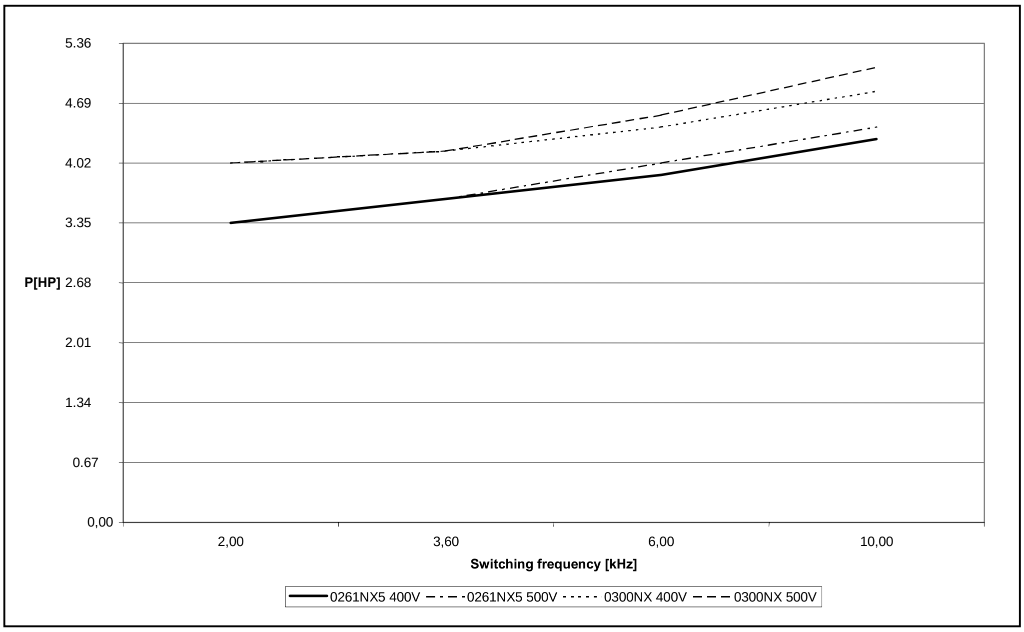


Figure 5-17. Power loss as function of switching frequency; NXS 1750…2000 A

Automation and Control Solutions
Honeywell
1985 Douglas Drive North
Golden Valley, MIN 55422

Honeywell Limited-Honeywell Limitée
35 Dynamic Drive
Scarborough, Ontario
MIV 4Z9

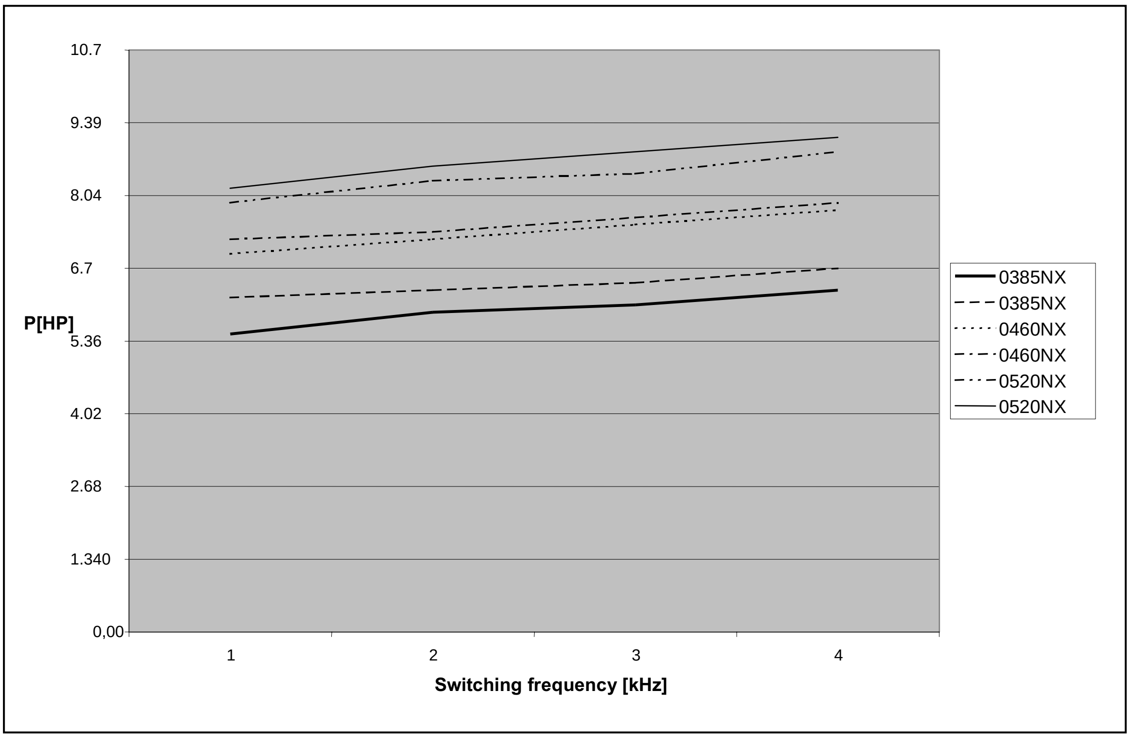


Figure 5-18. Power loss as function of switching frequency; 0385…0520 NX_5

6. CABLING AND CONNECTIONS

6.1 Power unit

6.1.1 Power connections

6.1.1.1 Mains and motor cables

The mains cables are connected to terminals **L1**, **L2** and **L3** (to L1 and L2, if 1-phase supply is used) and the motor cables to terminals marked with **U**, **V** and **W**. See Figures 6-1 to 6-4. A cable entry flange should be used when installing the motor cable at both ends in order to reach the EMC levels. See Table 6-1 for the cable recommmendations for EMC level H.

Use cables with heat resistance of at least +70°C. The cables and the fuses must be dimensioned according to the frequency drive nominal OUTPUT current which you can find on the rating plate. Dimensioning according to the output current is recommended because the frequency drive input current never significantly exceeds the output current. Installation of cables according to UL regulations is presented in Chapter 6.1.6.

Table 6-2 shows the minimum dimensions of the Cu-cables and the corresponding 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 All in One Application Manual) is used as an overload protection, the cable shall be chosen accordingly. If three or more cables are used in parallel 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 drive to the motor. In any other case, ask the factory for more information.

	1st environment (restricted distribution)	2nd environment		
Cable type	**Level H**	**Level L**	**Level T**	**Level N**
Mains cable	1	1	1	1
Motor cable	3*	2	1	1
Control cable	4	4	4	4

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

Level C = IEC 61800-3+A11, 1st environment, unrestricted distribution
IEC 61000-6-4

Level H = IEC 61800-3+A11, 1st environment, restricted distribution
IEC 61000-6-4

Level L = IEC 61800-3, 2nd environment

Level T: See page 8.

Level N: See page 8.

1 = Power cable intended for fixed installation and the specific mains voltage. Shielded cable not required. (NKCABLES/MCMK or similar recommended)

2 = Power cable equipped with concentric protection wire and intended for the specific mains voltage. (NKCABLES /MCMK or similar recommended).

3 = Power cable equipped with compact low-impedance shield and intended for the specific mains voltage.
(NKCABLES /MCCMK, SAB/ÖZCUY-J or similar recommended).
*360º grounding of both motor and FC connection required to meet the standard

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

Note: The EMC requirements are fulfilled at factory defaults of switching frequencies (all frames).

6.1.1.2 DC supply and brake resistor cables

NX frequency drives are equipped with terminals for the DC supply and an optional external brake resistor. These terminals are marked with **B–**, **B+/R+** and **R–**. The DC bus connection is made to terminals B– and B+ and the brake resistor connection to R+ and R–. See Figures 6-1 to 6-4.

6.1.1.3 Control cable

For information on control cables see Chapter 6.2.2.1 and .

6.1.1.4 Cable and fuse sizes, NXS B and NXS A

Frame	Type	I_L [A]	Fuse [A]	Mains and motor cable Cu (AWG)	Terminal cable size (AWG) Main terminal	Terminal cable size (AWG) Ground terminal
FR4	NXS 0010 B—0020 B NXS 0015 A—0050 A	3—8 3—9	10	3*15+15	17 — 11	17 — 13
	NXS 0030 B—0040 B NXS 0075 A	11—12 12	16	3*13+13	17 — 11	17 — 13
FR5	NXS 0050 B NXS 0100 A	17 16	20	3*11+11	17 — 7	17 — 7
	NXS 0075 B NXS 0150 A	25 22	25	3*10+10	17 — 7	17 — 7
	NXS 0100 B NXS 0200 A	32 31	35	3*7+7	17 — 7	17 — 7
FR6	NXS 0150 B NXS 0250 A—0300 A	48 38—45	50	3*7+7	13 — 1 Cu 9— 1 Al	13 — 2
	NXS 0200 B NXS 0400 A	61	63	3*5+5	13 — 1 Cu 9 — 1 Al	13 — 2
FR7	NXS 0500 A	72	80	3*3+5	13 — 1 Cu 9 — 1 Al	13 — 70 mm^2
	NXS 0600 A	87	100	3*2+5	13 — 1 Cu 9 — 1 Al	13 — 70 mm^2
	NXS 0750 A	105	125	3*1+3	13 — 1 Cu 9 — 1 Al	13 — 70 mm^2
FR8	NXS 1000 A	140	160	3*70+35 (mm^2)	3 — 95 mm^2 Cu/Al	3 — 95 mm^2
	NXS 1250 A	168	200	3*95+50 (mm^2)	95 — 185 Cu/Al (mm^2)	3 — 95 mm^2
	NXS 1500 A	205	250	3*150+70 (mm^2)	95 — 185 Cu/Al (mm^2)	3 — 95 mm^2
FR9	NXS 1750 A	261	315	3*185+95 or 2*(3*120+70) (mm^2)	95 — 185 Cu/Al 2 (mm^2)	10 — 95 mm^2
	NXS 2000 A	300	315	2*(3*120+70) (mm^2)	95 — 185 Cu/Al 2 (mm^2)	10 — 95 mm^2

Table 6-2. Cable and fuse sizes for NXS B and NXS A (FR4 to FR9)

6.1.1.5 Cable and fuse sizes, NXS C

Frame	Type	I_L [A]	Fuse [A]	Mains and motor cable Cu AWG	Terminal cable size: Main terminal	Terminal cable size: Ground terminal
FR6	NXS 0018 C	18	20	3*11+11	13 — 1	13 — 1
	NXS 0022 C	22	25	3*9+9	13 — 1	13 — 1
	NXS 0027 C NXS 0034 C	27 34	35	3*7+7	13 — 1	13 — 1
FR7	NXS 0041 C	41	50	3*7+7	13 — 1 Cu 9—1 Al	9—1
	NXS 0052 C NXS 0062 C	52 62	63	3*5+5	13 — 1 Cu 9—1 Al	9—1
FR8	NXS 0080 C	80	80	3*3+5	12—95 mm^2 Cu/Al	12—95 mm^2
	NXS 0100 C	100	100	3*2+5		
	NXS 0125 C	125	125	3*1+3		
FR9	NXS 0144 C NXS 0170 C	144 170	160 200	3*95+50 (mm^2)	95-185 Cu/Al2 (mm^2)	10—95 mm^2
	NXS 0208 C	208	250	3*150+70 (mm^2)		

Table 6-3. Cable and fuse sizes for NXS C.

6.1.1.6 Cable and fuse sizes, NX_A, FR10 to FR12

The table below shows typical cable sizes and types that can be used with the drive. The final selection should be made according to local regulations, cable installation conditions and cable specification.

Frame	Type	I_L [A]	Fuse I_n [A]	Mains and motor cable[1)] [mm^2]	No. of supply cables	No. of motor cables
FR10	NX0385 A	385	400	Cu: 2*(3*120+70) Al: 2*(3*185Al+57Cu)	Even/Odd	Even/Odd
	NX0460 A	460	500	Cu: 2*(3*150+70) Al: 2*(3*240Al+72Cu)	Even/Odd	Even/Odd
	NX0520 A	520	630	Cu: 2*(3*185+95) Al: 2*(3*300Al+88Cu)	Even/Odd	Even/Odd
FR11	NX0590 A	590	630	Cu: 2*(3*240+120) Al: 4*(3*120Al+41Cu)	Even	Even/Odd
	NX0650 A	650	800	Cu: 4*(3*95+50) Al: 4*(3*150Al+41Cu)	Even	Even/Odd
	NX0730 A	730	800	Cu: 4*(3*120+70) Al: 4*(3*185Al+57Cu)	Even	Even/Odd
FR12	NX0820 A	820	1000	Cu: 4*(3*150+70) Al: 4*(3*185Al+57Cu)	Even	Even
	NX0920 A	920	1000	Cu: 4*(3*150+70) Al: 4*(3*240Al+72Cu)	Even	Even
	NX1030 A	1030	1250	Cu: 4*(3*185+95) Al: 4*(3*300Al+88Cu)	Even	Even

Table 6-4. Cable and fuse sizes for NX A (FR10 to FR12)

[1)]based on correction factor 0.7

6.1.1.7 Cable and fuse sizes, NX_C, FR10 to FR12

The table below shows typical cable sizes and types that can be used with the drive. The final selection should be made according to local regulations, cable installation conditions and cable specification.

Frame	Type	I_L [A]	Fuse I_n [A]	Mains and motor cable[1)] [mm^2]	No of supply cables	No of motor cables
FR10	NX0261 C	261	400	Cu: 3*185+95 Al: 2*(3*95Al+29Cu)	Even/Odd	Even/Odd
	NX0325 C	325	500	Cu: 2*(3*95+50) Al: 2*(3*150Al+41Cu)	Even/Odd	Even/Odd
	NX0385 C	385	630	Cu: 2*(3*120+70) Al: 2*(3*185Al+57Cu)	Even/Odd	Even/Odd
	NX0416 C	416	630	Cu: 2*(3*150+70) Al: 2*(3*185Al+57Cu)	Even/Odd	Even/Odd
FR11	NX0460 C	460	800	Cu: 2*(3*150+70) Al: 2*(3*240Al+72Cu)	Even	Even/Odd
	NX0502 C	502	800	Cu: 2*(3*185+95) Al: 2*(3*300Al+88 Cu)	Even	Even/Odd
	NX0590 C	590	1000	Cu: 2*(3*240+120) Al: 4*(3*120Al+41Cu)	Even	Even/Odd
FR12	NX0650 C	650	1000	Cu: 4*(3*95+50) Al: 4*(3*150Al+41Cu)	Even	Even
	NX0750 C	750	1250	Cu: 4*(3*120+70) Al: 4*(3*150Al+41Cu)	Even	Even
	NX0820 C	820	1250	Cu: 4*(3*150+70) Al: 4*(3*185Al+57Cu)	Even	Even

Table 6-5. Cable and fuse sizes for NX C (FR10 to FR12)

[1)]based on correction factor 0.7

6.1.2 Understanding the power unit topology

Figure 6-1 shows the principles for mains and motor connections of the basic 6-pulse drive in frame sizes FR4 to FR12.

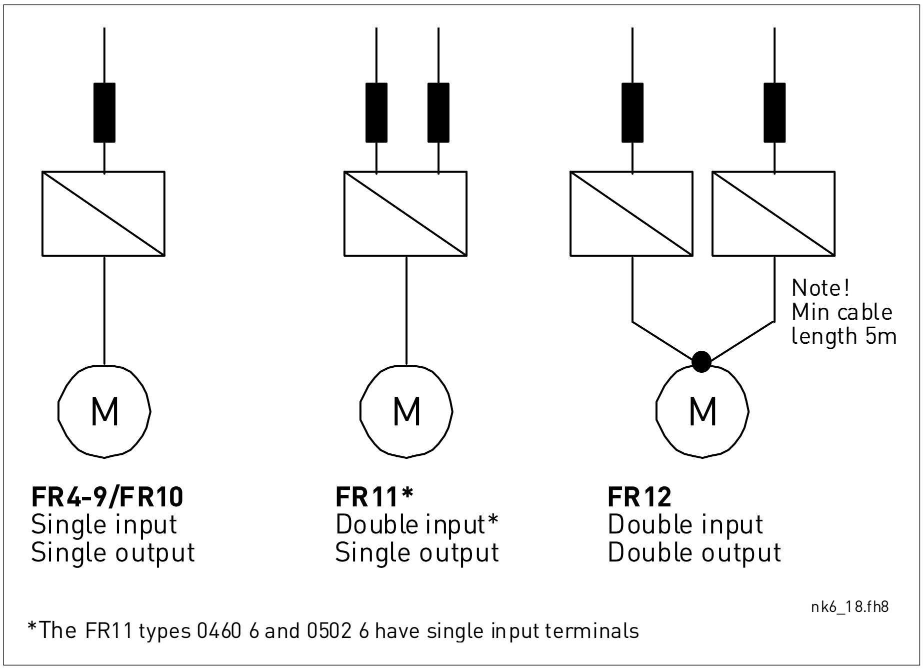


Figure 6-1. Topology of mechanical sizes FR4 – FR12

6.1.3 *Changing EMC protection class from H to T*

The EMC protection level of NX frequency drives can be changed from **class H** to **class T** with a simple procedure presented in the following figures.

Note! After having performed the change check *EMC Level modified* on the sticker included in the NX delivery (see below) and note the date. Unless already done, attach the sticker on the side of the frequency drive.

Drive modified:
☐ Option board: OPT............... Date:..................
in slot: A B C D E
☐ IP54 upgrade/Collar Date:..................
☐ EMC level modified: H → T / T → H Date:..................

FR4 and FR5:

Figure 6-2. Changing of EMC protection class, FR4 (left) and FR5 (right).

FR6:

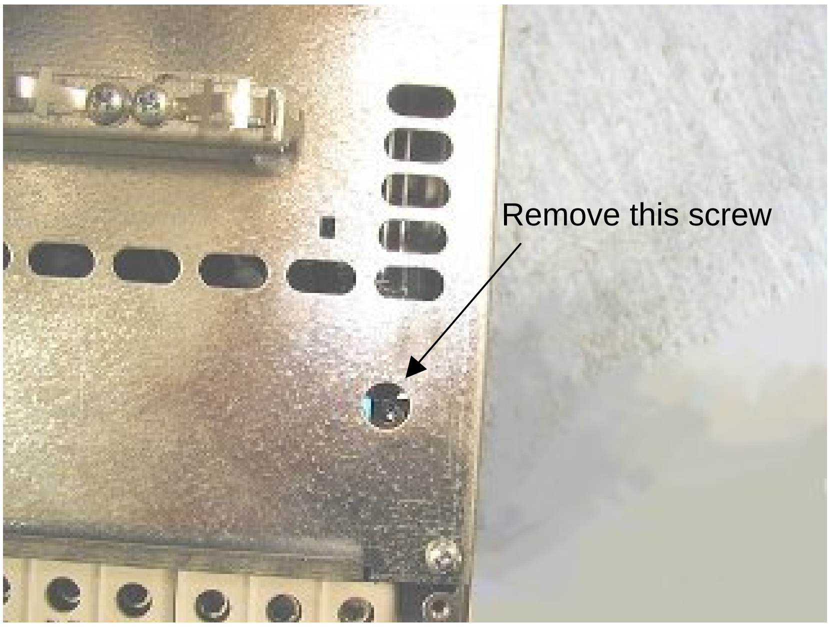


Figure 6-3. Changing of EMC protection class, FR6

FR7:

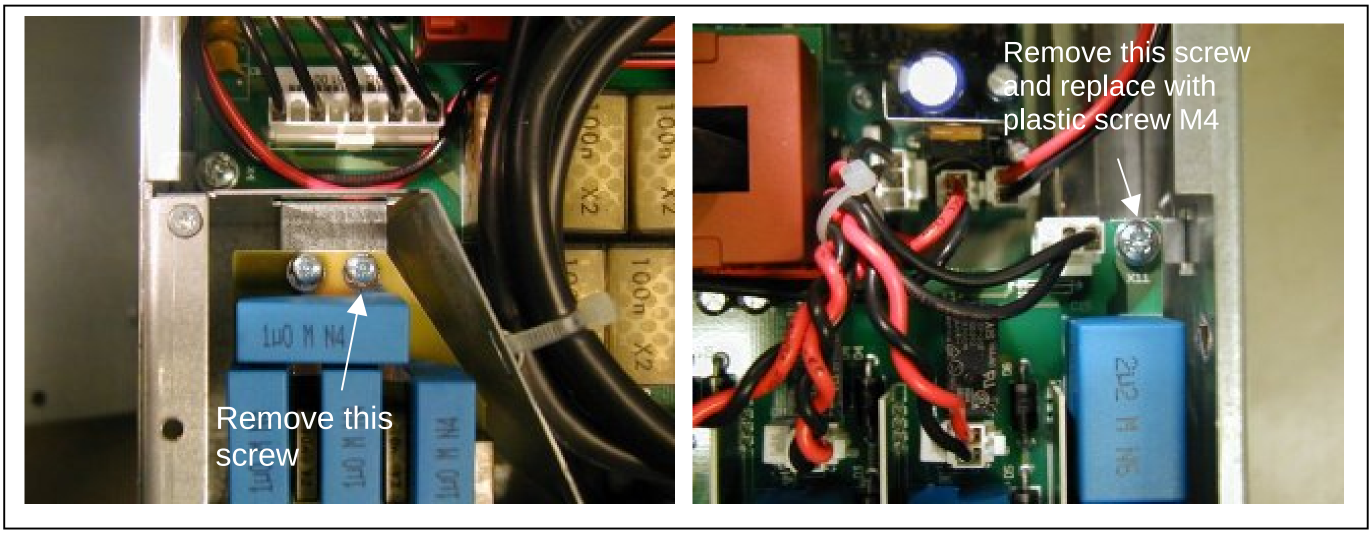


Figure 6-4. Changing of EMC protection class, FR7

NOTE! Only a qualified service person may change the EMC protection class of NX, FR9 and larger frames.

6.1.4 Mounting of cable accessories

Enclosed to your NX or NXL frequency drive is a plastic bag containing components that are needed for the installation of the mains and motor cables in the frequency drive.

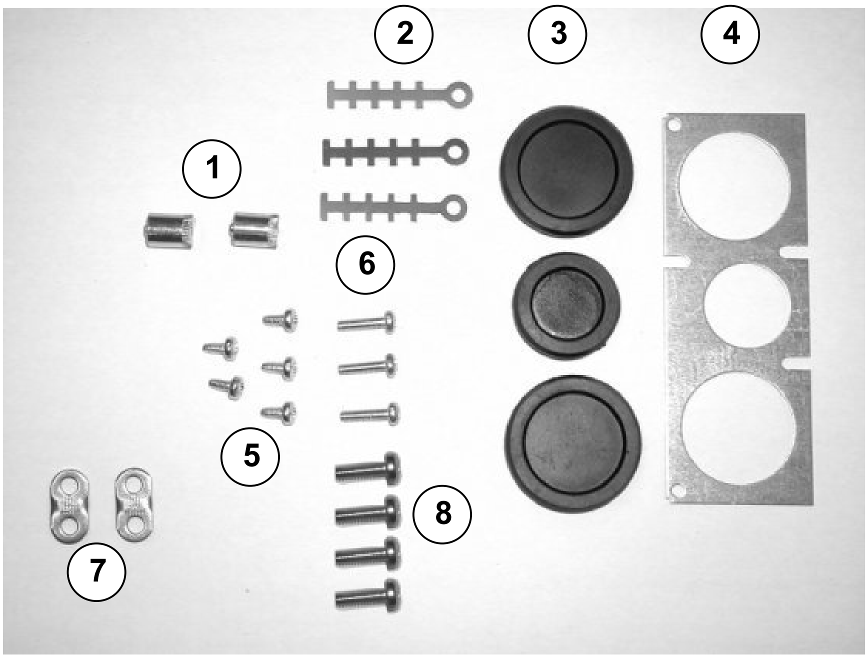


Figure 6-5. Cable accessories

Components:

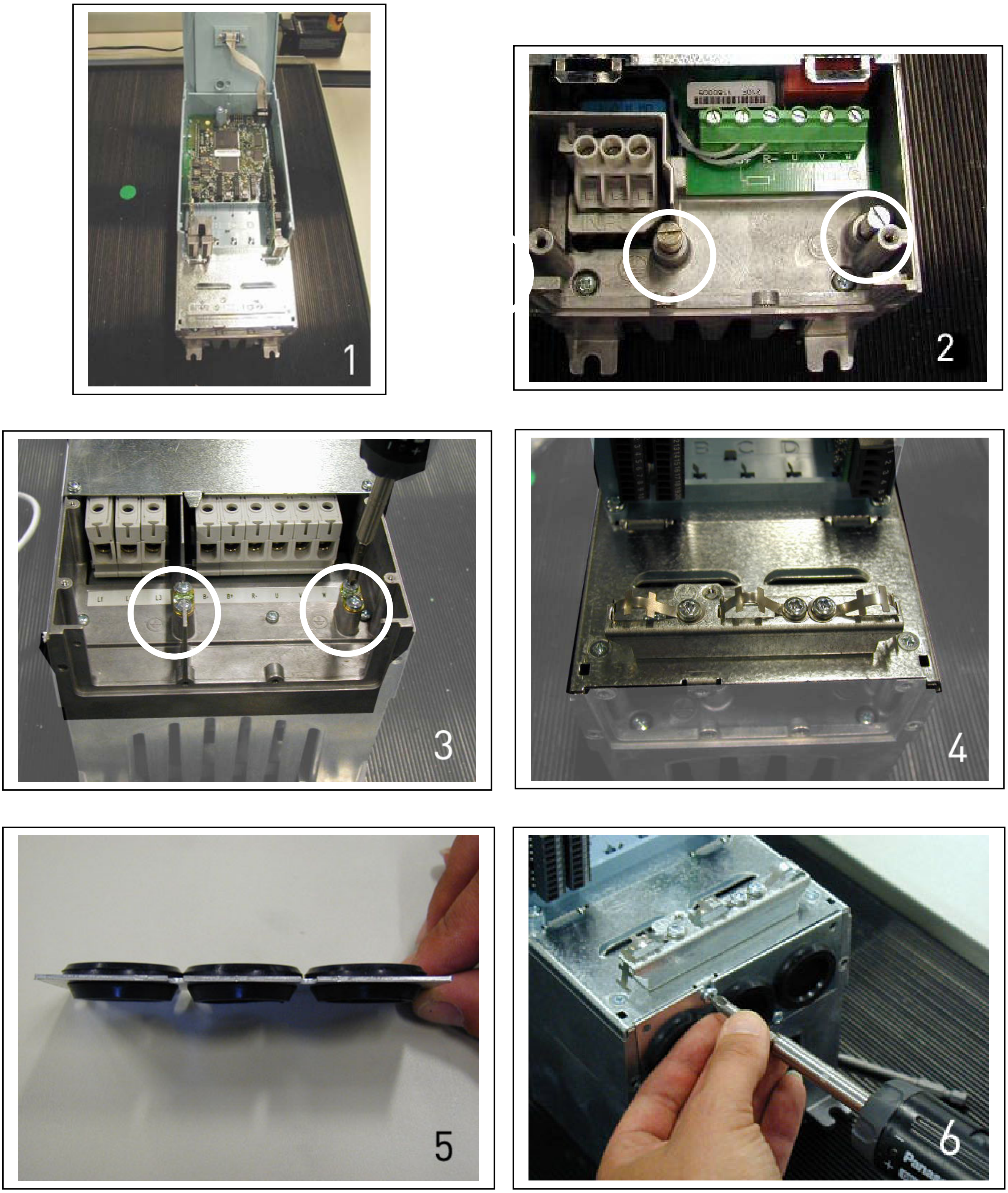
1 Grounding terminals (FR4, FR5/MF4, MF5) (2)
2 Cable clamps (3)
3 Rubber grommets (sizes vary from class to class) (3)
4 Cable entry gland (1)
5 Screws, M4x10 (5)
6 Screws, M4x16 (3)
7 Grounding cable clamps (FR6, MF6) (2)
8 Grounding screws M5x16 (FR6, MF6) (4)

NOTE: The cable accessories installation kit for frequency drives of protection class **IP54** includes all components except **4** and **5**.

Mounting procedure

1. Make sure that the plastic bag you have received contains all necessary components.
2. Open the cover of the frequency drive (**Figure 1**).
3. Remove the cable cover. Observe the places for
   a) the grounding terminals (FR4/FR5; MF4/MF6) (**Figure 2**).
   b) the grounding cable clamps (FR6/MF6) (**Figure 3**).
4. Re-install the cable cover. Mount the cable clamps with the three M4x16 screws as shown in **Figure 4**. Note that the location of the grounding bar in FR6/MF6 is different from what is shown in the picture.
5. Place the rubber grommets in the openings as shown in **Figure 5**.

6. Fix the cable entry gland to the frame of the frequency drive with the five M4x10 screws (**Figure 6**). Close the cover of the frequency drive.



6.1.5 Installation instructions

	1	Before starting the installation, check that none of the components of the frequency drive are live.
	2	Place the motor cables sufficiently far from other cables: ▪ **Avoid placing** the motor cables in long parallel lines with other cables ▪ If the motor cables runs in parallel with other cables, note the **minimum distances** between the motor cables and other cables given in the table below. ▪ The given distances also apply between the motor cables and signal cables of other systems. ▪ **The maximum length of the motor cables is 984 ft** (**,** units with power greater than 2.01 HP) **and 327 ft** (units with power from 1 to 2.01 HP)**.** ▪ The **motor cables should cross** other cables at an angle of 90 degrees.
	3	If **cable insulation checks** are needed, see Chapter 6.1.7.

Continues on the next page

	4	Connect the cables: ▪ **Strip the motor and mains cables** as advised in Figure 6-6 and Table 6-6. ▪ **Remove the screws** of the cable protection plate. Do not open the cover of the power unit! ▪ Make holes into and **pass the cables** through the rubber grommets on the bottom of the power unit (see e.g.). ▪ **Connect the mains, motor and control cables** into their respective terminals (see e.g.). ▪ For information on the installation of **larger units**, please contact your local distributor. ▪ For Information on **cable installation according to UL regulations** see Chapter 6.1.6. ▪ **Ensure** that the control cable wires do not come in contact with the electronic components of the unit. ▪ If an **external brake resistor** (option) is used, connect its cable to the appropriate terminal. ▪ **Check the connection** of the ground cable to the motor and the frequency drive terminals marked with ⏚. ▪ Connect the **separate shield of the power cable** to the ground terminals of the frequency drive, motor and the supply centre. ▪ Attach the cable protection plate with the screws. ▪ **Ensure** that the control cables or the cables of the unit are **not trapped** between the frame and the protection plate.

6.1.5.1 Stripping lengths of motor and mains cables

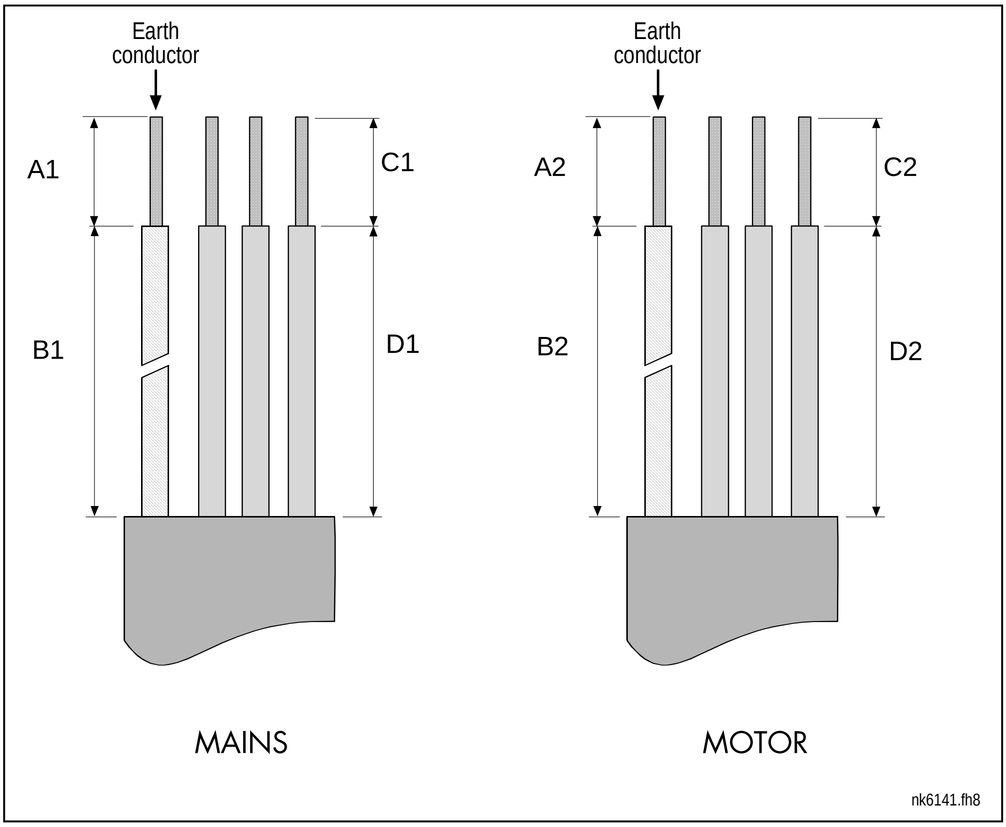


Figure 6-6. Stripping of cables

Frame	A1	B1	C1	D1	A2	B2	C2	D2
FR4	0.59	1.38	0.39	0.79	0.28	1.97	0.28	1.38
FR5	0.79	1.57	0.39	1.18	0.79	2.36	0.39	1.57
FR6	0.79	3.54	0.59	2.36	0.79	3.54	0.59	2.36
FR7	0.98	4.72	0.98	4.72	0.98	4.72	0.98	4.72
FR8								
0140	0.90	9.45	0.90	9.45	0.90	9.45	0.90	9.45
0168—0205	1.1	9.45	1.1	9.45	1.1	9.45	1.1	9.45
FR9	1.1	11.6	1.1	11.6	1.1	11.6	1.1	11.6

Table 6-6. Cables stripping lengths [in]

6.1.5.2 NX frequency drive frames and installation of cables

Note: To connect an external brake resistor, see separate Brake Resistor Manual. See also Chapter Internal brake resistor connection (P6.7.1) on page 97 in this manual.

Figure 6-7. NX, FR4

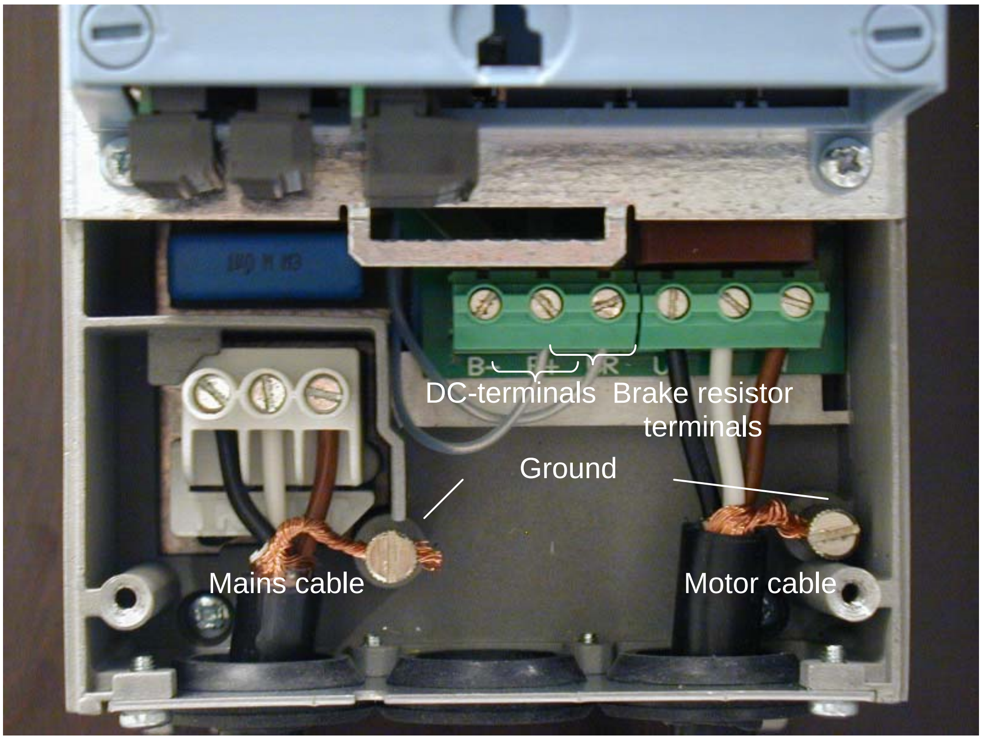


Figure 6-8. Cable installation in NX, FR4

Figure 6-9. NX, FR5. Protection class NEMA1

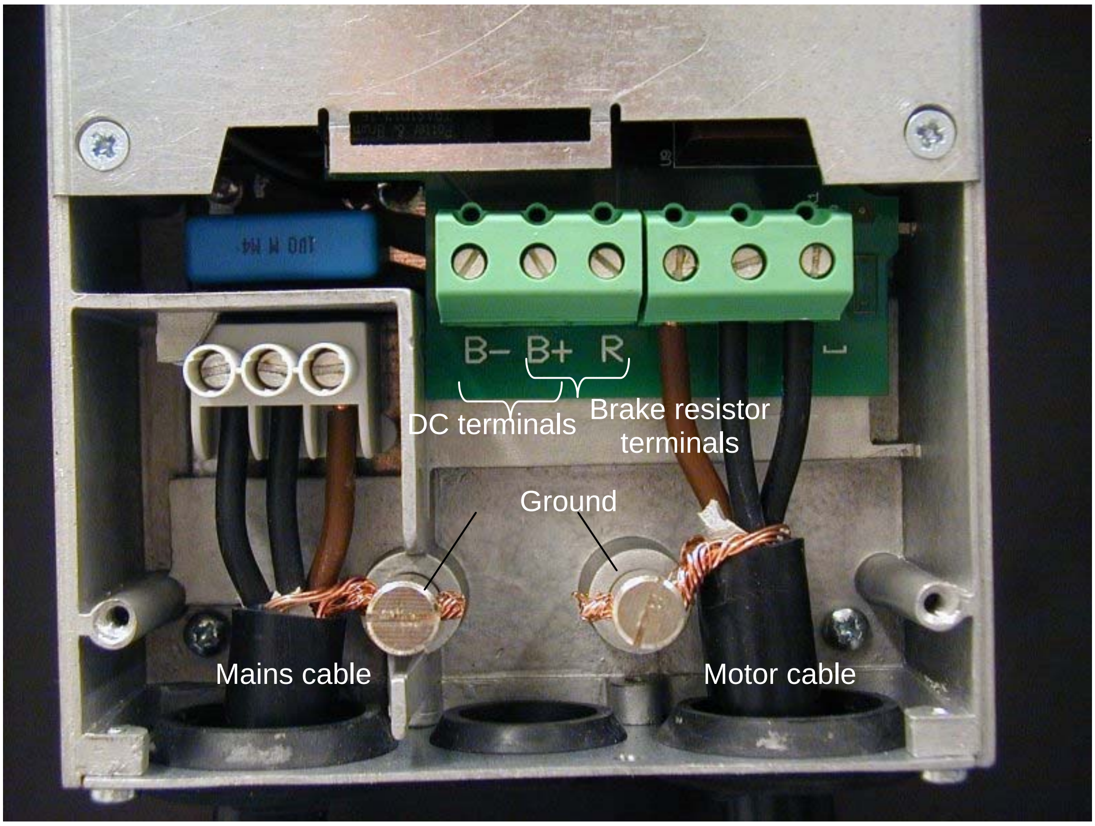


Figure 6-10. Cable installation in NX, FR5

Figure 6-11. NX, FR6. Protection class NEMA1.

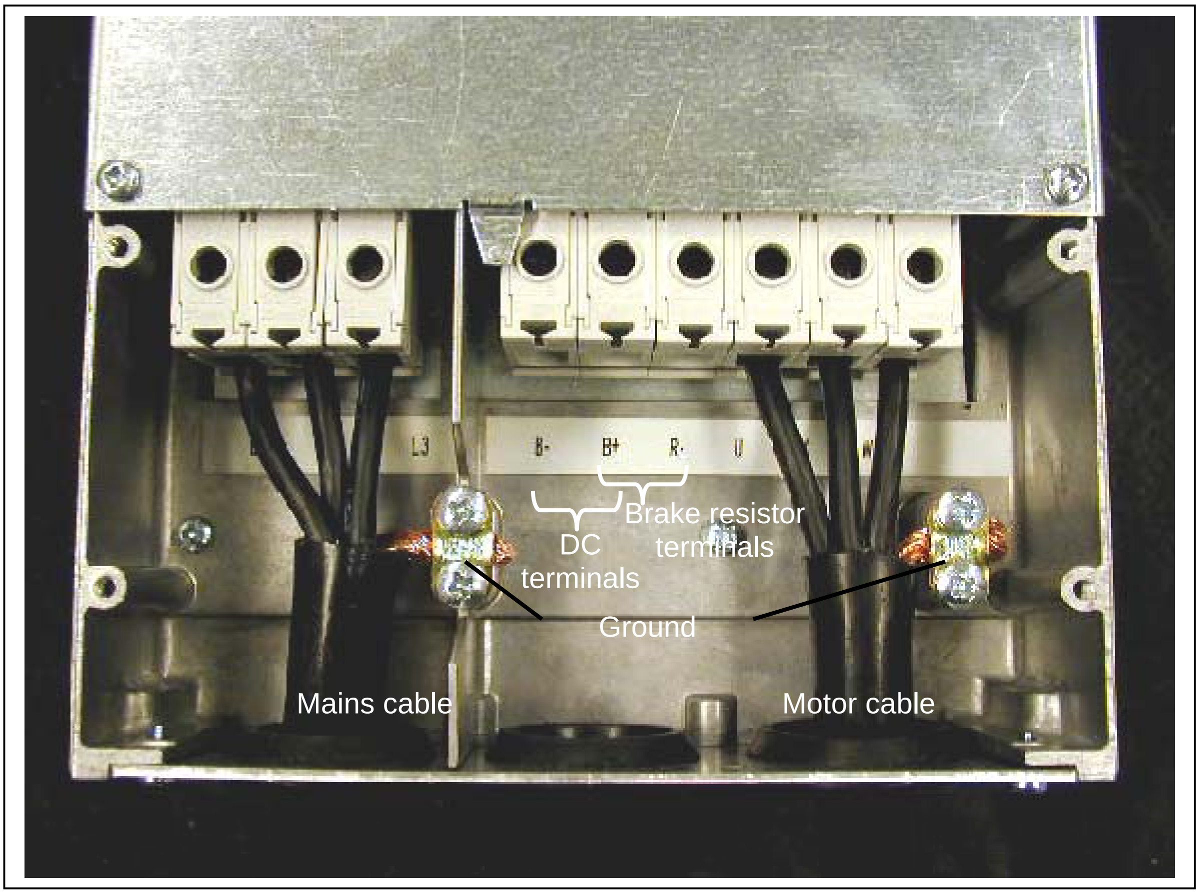


Figure 6-12. Cable installation in NX, FR6

Figure 6-13. NX, FR7. Protection class NEMA1.

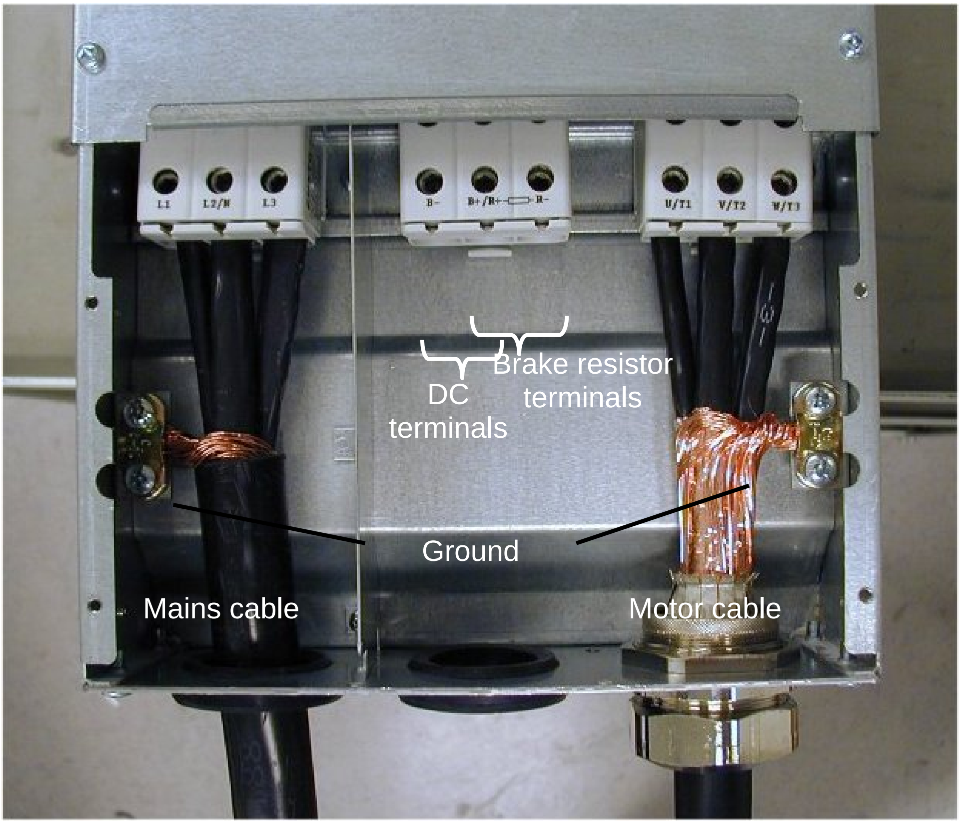


Figure 6-14. Cable installation in NX, FR7

Figure 6-15. NX, FR8. Protection class NEMA12 ((with optional DC/brake resistor connection box on top)

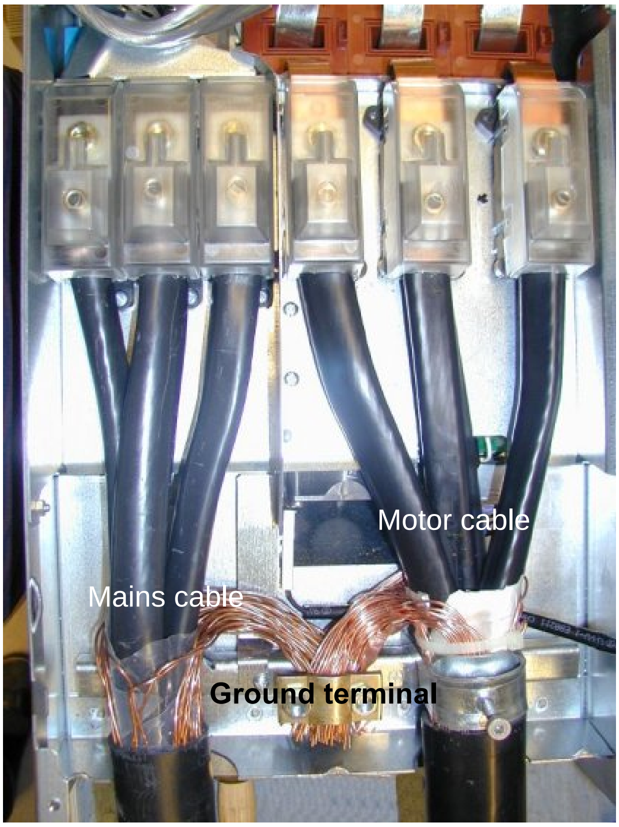


Figure 6-16. Cable installation in NX, FR8

Figure 6-17. Brake resistor terminal box on top of FR8

Figure 6-18. NX, FR9. Protection class NEMA1

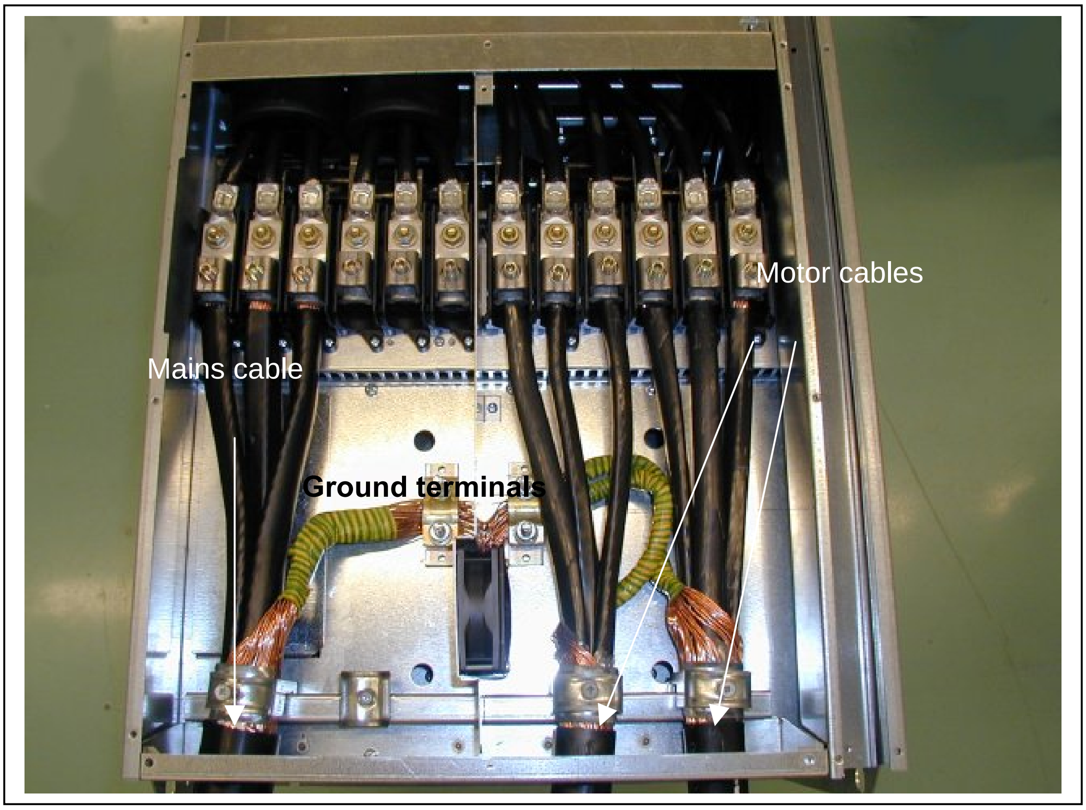


Figure 6-19. Cable installation in NX, FR9

Figure 6-20. DC and brake resistor terminals on FR9; DC terminals marked with B– and B+, brake resistor terminals marked with R+ and R–

6.1.6 Cable installation and the UL standards

To meet the UL (Underwriters Laboratories) regulations, a UL-approved copper cable with a minimum heat-resistance of +140/167°F (+60/75°C) must be used.

The tightening torques of the terminals are given in Table 6-7.

Type	Frame	Tightening torque [Nm]	Tightening torque in-lbs.
NXS 0015—0075 A	FR4	0.5—0.6	4—5
NXS 0100—0200 A	FR5	1.2—1.5	10—13
NXS 0250—0400 A	FR6	4	35
NXS 0500—0750 A	FR7	10	85
NXS 1000 A	FR8	20/9*	170/76*
NXS 1250—1500 A	FR8	40/22*	340/187*
NX 0261—0300 B NX 0261—0300 A NX 0125—0208 C	FR9	40/22*	340/187*
NX 0385—1030 A	FR10…12	40*	340
NX 0261—820 C	FR10…12	40*	340

Table 6-7. Tightening torques of terminals

* Tightening torque of terminal connection to the isolative base in Nm/in-lbs.
** Apply counter torque to the nut on the other side of the terminal when tightening/loosening the terminal screw in order to avoid damage to the terminal.

6.1.7 Cable and motor insulation checks

1. Motor cable insulation checks

   Disconnect the motor cable from terminals U, V and W of the frequency drive 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 >1MΩ.

2. Mains cable insulation checks

   Disconnect the motor cable from terminals L1, L2 and L3 of the frequency drive 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 >1MΩ.

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 >1MΩ.

6.2 Control unit

The control unit of the frequency drive consists roughly of the control board and additional boards (see Figures below) 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).

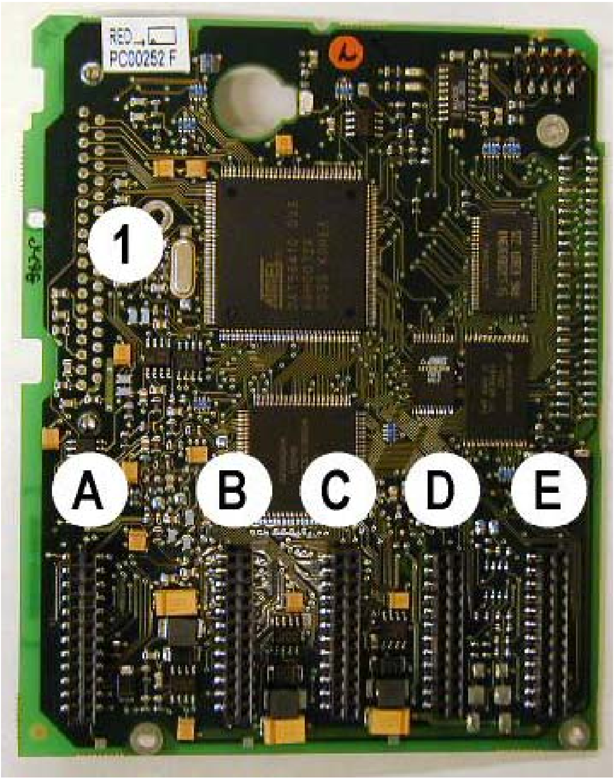


Figure 6-21. NX control board

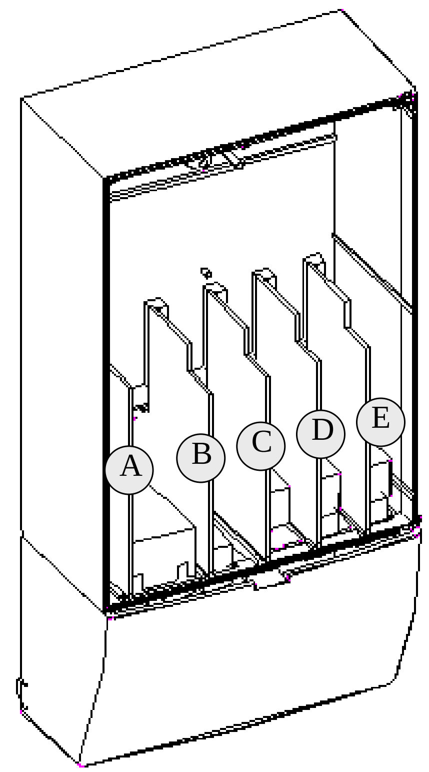
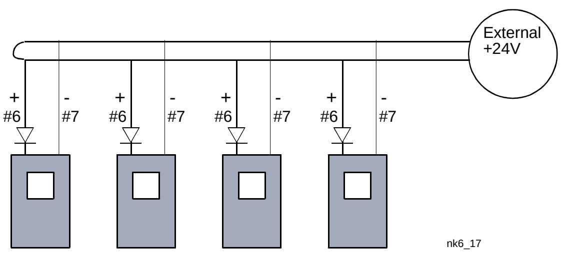


Figure 6-22. Basic and option board connections on the control board

When the frequency drive is delivered from the factory, the control unit includes at least the standard compilation of two basic boards (I/O board and relay board) which are normally installed in slots A and B. 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 65. This voltage is sufficient for parameter setting and for keeping the fieldbus active.

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



6.2.1 NXS and NXP single phase input applications 380-500 VAC

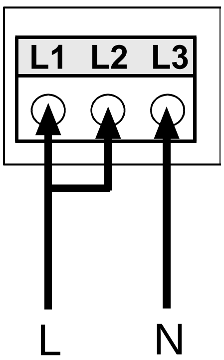
Power Ratings

Overload = 200% starting torque, 2 sec/20 sec, 150% overloadability, 1 min/10 min
Following continuous operation at rated output current, 150 % rated output current for 1 min, followed by a period of load current less than rated current, and of such duration that the r.m.s output current, over the duty cycle, does not exceed rated output current

Mains voltage 380-500 V, NEMA 1/12, Single Phase Input					
Frequency converter type	MOTOR SHAFT POWER (480V) AND CURRENT				
	P [Hp] (480V)	I [A]	Size / prot.	Dimensions W x H x D (in)	Weight (lb)
NX_ 0015 A	0,5	1,1	FR4/NEMA 1/12	5.04x11.5x7.48	11.02
NX_ 0020 A	0,75	1,7	FR4/NEMA 1/12	5.04x11.5x7.48	11.02
NX_ 0030 A	1	2,2	FR4/NEMA 1/12	5.04x11.5x7.48	11.02
NX_ 0040 A	1,5	3	FR4/NEMA 1/12	5.04x11.5x7.48	11.02
NX_ 0050 A	2	3,8	FR4/NEMA 1/12	5.04x11.5x7.48	11.02
NX_ 0075 A	2	4,5	FR4/NEMA 1/12	5.04x11.5x7.48	11.02
NX_ 0100 A	4	6	FR5/NEMA 1/12	5.67x15.4x8.43	17.86
NX_ 0150 A	5	8	FR5/NEMA 1/12	5.67x15.4x8.43	17.86
NX_ 0200 A	7,5	11	FR5/NEMA 1/12	5.67x15.4x8.43	17.86
NX_ 0250 A	10	16	FR6/NEMA 1/12	7.68x20.4x9.33	40.79
NX_ 0300 A	15	21	FR6/NEMA 1/12	7.68x20.4x9.33	40.79
NX_ 0400 A	15	23	FR6/NEMA 1/12	7.68x20.4x9.33	40.79
NX_ 0500 A	20	31	FR7/NEMA 1/12	9.33x23.3x10.1	77.16
NX_ 0600 A	25	36	FR7/NEMA 1/12	9.33x23.3x10.1	77.16
NX_ 0750 A	30	40	FR7/NEMA 1/12	9.33x23.3x10.1	77.16
NX_ 1000 A	40	53	FR8/NEMA 1/12	11.2x28.4x11.3	127.9
NX_ 1250 A	50	70	FR8/NEMA 1/12	11.2x28.4x11.3	127.9
NX_ 1500 A	60	85	FR8/NEMA 1/12	11.2x28.4x11.3	127.9
NX_ 2000 A	75	103	FR9/NEMA 1/12	18.9x45.3x14.3	321.9
NX_ 2500 A	100	124	FR9/NEMA 1/12	18.9x45.3x14.3	321.9
NXP 3000 A	125	156	FR10/NEMA 1	23.6x89.6x23.6	661.1
NXP 3500 A	150	193	FR10/NEMA 1	23.6x89.6x23.6	661.1
NXP 4500 A	150	230	FR10/NEMA 1	23.6x89.6x23.6	661.1
NXP 5000 A	200	260	FR11/NEMA 1	31.6x79.4x23.6	815.7
NXP 5500 A	250	302	FR11/NEMA 1	31.6x79.4x23.6	815.7
NXP 6000 A	250	325	FR11/NEMA 1	31.6x79.4x23.6	815.7
NXP 6500 A	300	365	FR12/NEMA 1	47.6x 79.4x 23.6	1322.8
NXP 7000 A	350	414	FR12/NEMA 1	47.6x 79.4x 23.6	1322.8
NXP 8000 A	350	460	FR12/NEMA 1	47.6x 79.4x 23.6	1322.8

Note: The rated currents in given ambient temperatures are achieved only when the switching frequency is equal to or less than the factory default.

Input connections in single phase application



6.2.2 Control connections

The basic control connections for boards A1 and A3 are shown in Chapter 6.2.3.
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.

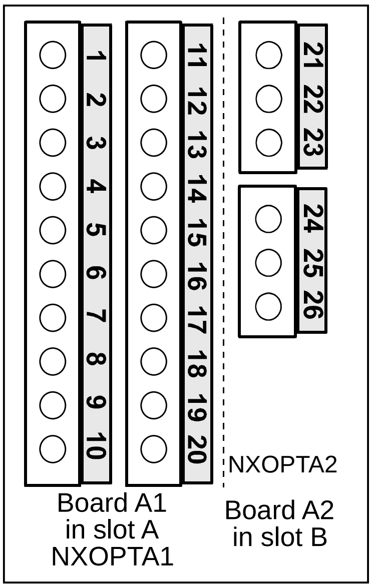


Figure 6-23. The I/O terminals of the two basic boards

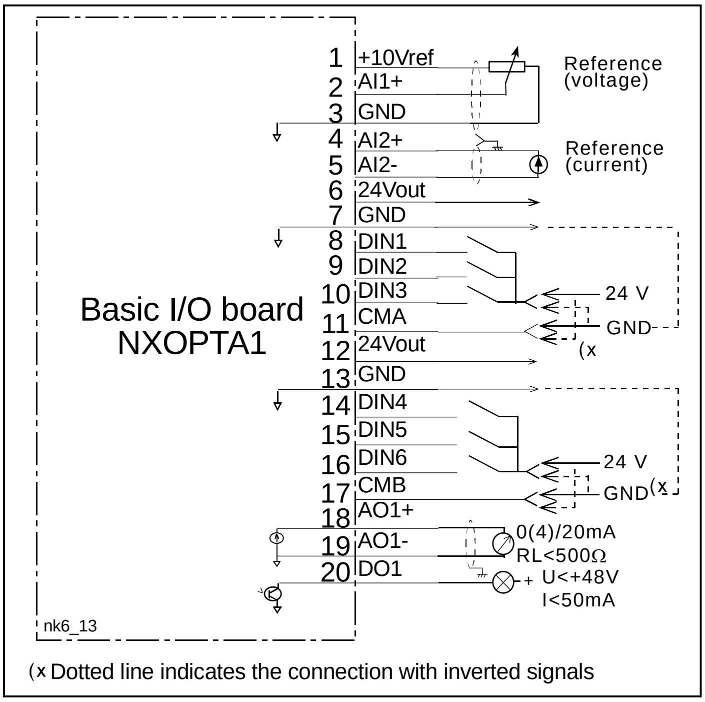


Figure 6-24. General wiring diagram of the I/O board (OPT-A1)

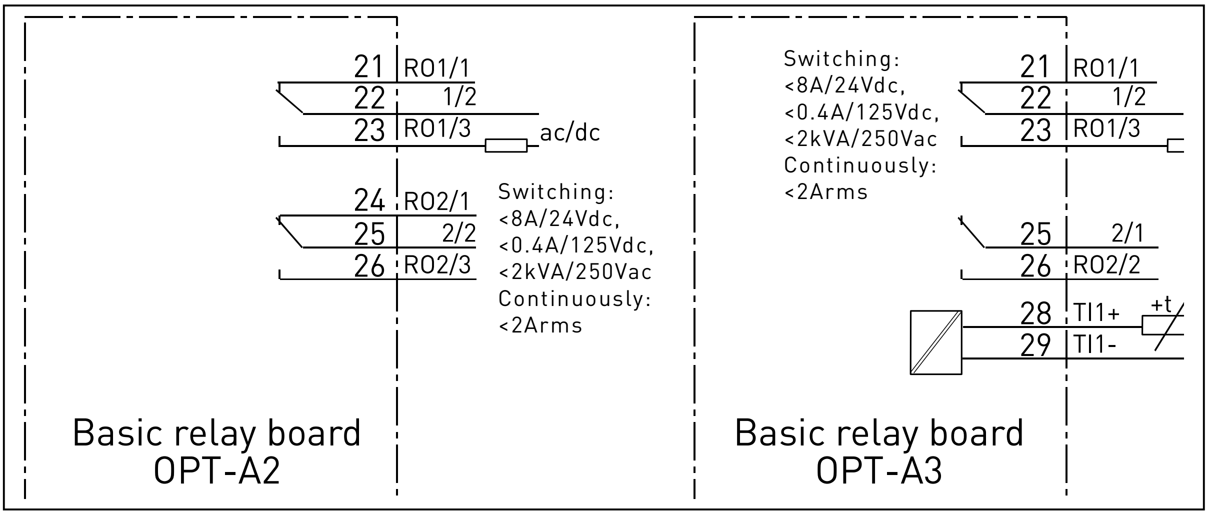


Figure 6-25. General wiring diagram of the relay board (OPT-A2)

6.2.2.1 Control cables

The control cables shall be at least 0.0008 in^2 screened multicore cables, see Table 6-1. The maximum terminal wire size is 0.004 in^2 for the relay terminals and 0.002 in^2 for other terminals.

Find the tightening torques of the option board terminals in Table below.

Terminal screw	**Tightening torque**	
	Nm	lb-in.
Relay and thermistor terminals (screw M3)	0.5	4.5
Other terminals (screw M2.6)	0.2	1.8

Table 6-8. Tightening torques of terminals

6.2.2.2 Galvanic isolation barriers

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

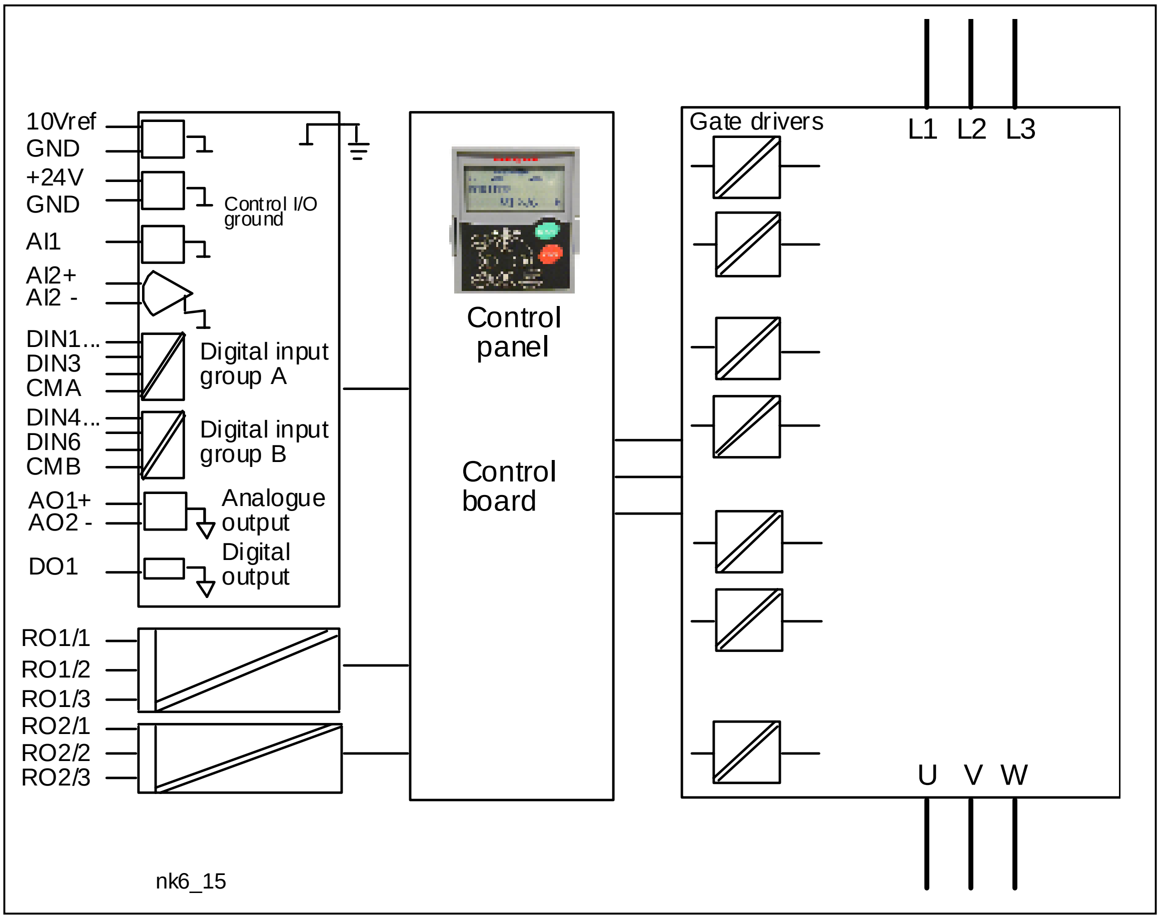


Figure 6-26. Galvanic isolation barriers

6.2.3 Control terminal signals

Terminal		Signal	Technical information
1	+10 Vref	Reference voltage	Maximum current 10 mA
2	AI1+	Analogue input, voltage or current	Selection V or mA with jumper block X1 (see page 68): Default: 0– +10V (Ri = 200 kΩ) (-10V…..+10V Joy-stick control, selected with a jumper) 0– 20mA (Ri = 250 Ω)
3	GND/AI1–	Analogue input common	Differential input if not connected to ground; Allows ±20V differential mode voltage to GND
4	AI2+	Analogue input, voltage or current	Selection V or mA with jumper block X2 (see page 68): Default: 0– 20mA (Ri = 250 Ω) 0– +10V (Ri = 200 kΩ) (-10V…..+10V Joy-stick control, selected with a jumper)
5	GND/AI2–	Analogue input common	Differential input if not connected to ground; Allows ±20V differential mode voltage to GND
6	24 Vout (bidirectional)	24V auxiliary voltage	±15%, maximum current 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 = min. 5kΩ
9	DIN2	Digital input 2	
10	DIN3	Digital input 3	
11	CMA	Digital input common A for DIN1, DIN2 and DIN3.	Must be connected to GND or 24V of I/O terminal or to external 24V or GND Selection with jumper block X3 (see page 68):
12	24 Vout (bidirectional)	24V auxiliary voltage	Same as terminal #6
13	GND	I/O ground	Same as terminal #7
14	DIN4	Digital input 4	R_i = min. 5kΩ
15	DIN5	Digital input 5	
16	DIN6	Digital input 6	
17	CMB	Digital input common B for DIB4, DIB5 and DIB6	Must be connected to GND or 24V of I/O terminal or to external 24V or GND Selection with jumper block X3 (see page 68):
18	AO1+	Analogue signal (+output)	Output signal range: Current 0(4)–20mA, R_L max 500Ω or Voltage 0—10V, R_L >1kΩ Selection with jumper block X6 (see page 68):
19	AO1–	Analogue output common	
20	DO1	Open collector output	Maximum U_{in} = 48VDC Maximum current = 50 mA
OPT-A2			
21	RO1/1	Relay output 1	Switching capacity 24VDC/8A 250VAC/8A 125VDC/0.4A Min.switching load 5V/10mA
22	RO1/2		
23	RO1/3		
24	RO2/1	Relay output 2	Switching capacity 24VDC/8A 250VAC/8A 125VDC/0.4A Min.switching load 5V/10mA
25	RO2/2		
26	RO2/3		

Table 6-9. Control I/O terminal signals

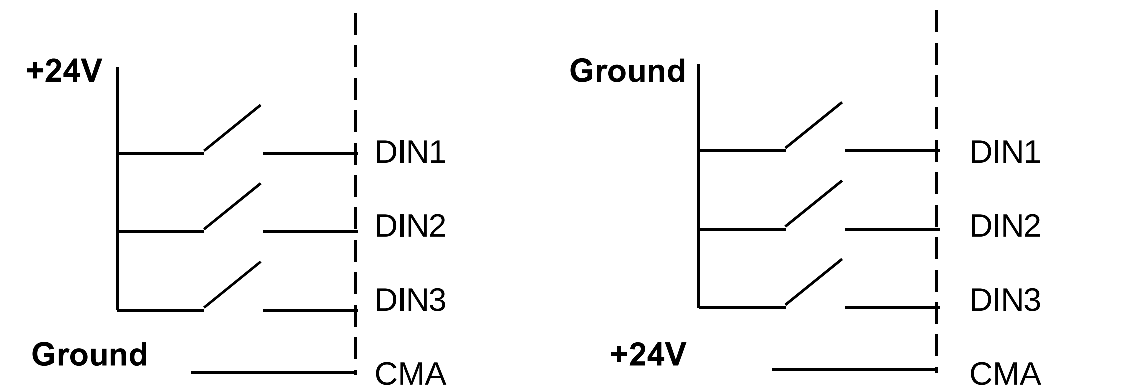
OPTA-3				
Terminal		**Signal**	**Technical information**	
21	RO1/1	Relay output 1	Switching capacity	24VDC/8A 250VAC/8A 125VDC/0.4A
22	RO1/2			
23	RO1/3		Min.switching load	5V/10mA
25	RO2/1	Relay output 2	Switching capacity	24VDC/8A 250VAC/8A 125VDC/0.4A
26	RO2/2		Min.switching load	5V/10mA
28	TI1+	Thermistor input		
29	TI1–			

Table 6-10. Control I/O terminal signals on basic relay board OPT-A3

6.2.3.1 Digital input signal inversions

The active signal level depends on which potential the common inputs CMA and CMB (terminals 11 and 17) are connected to. The alternatives are either +24V or ground (0 V). See Figure 6-27.

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



Positive logic (+24V is the active signal) = the input is active when the switch is closed

Negative logic (0V is the active signal) = the input is active when the switch is closed

Figure 6-27. Positive/Negative logic

6.2.3.2 Jumper selections on the OPT-A1 basic board

The user is able to customise the functions of the frequency drive 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 6-29.

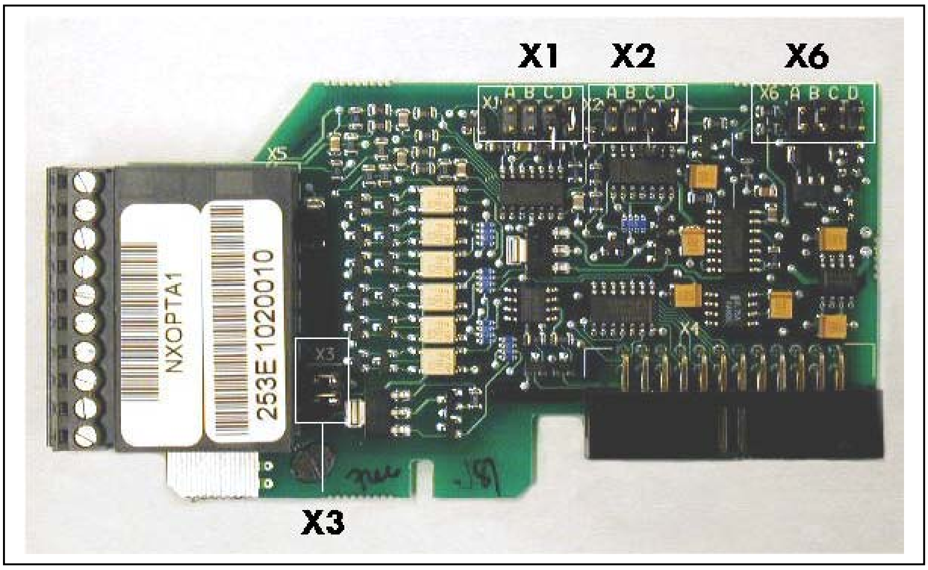


Figure 6-28. Jumper blocks on OPT-A1

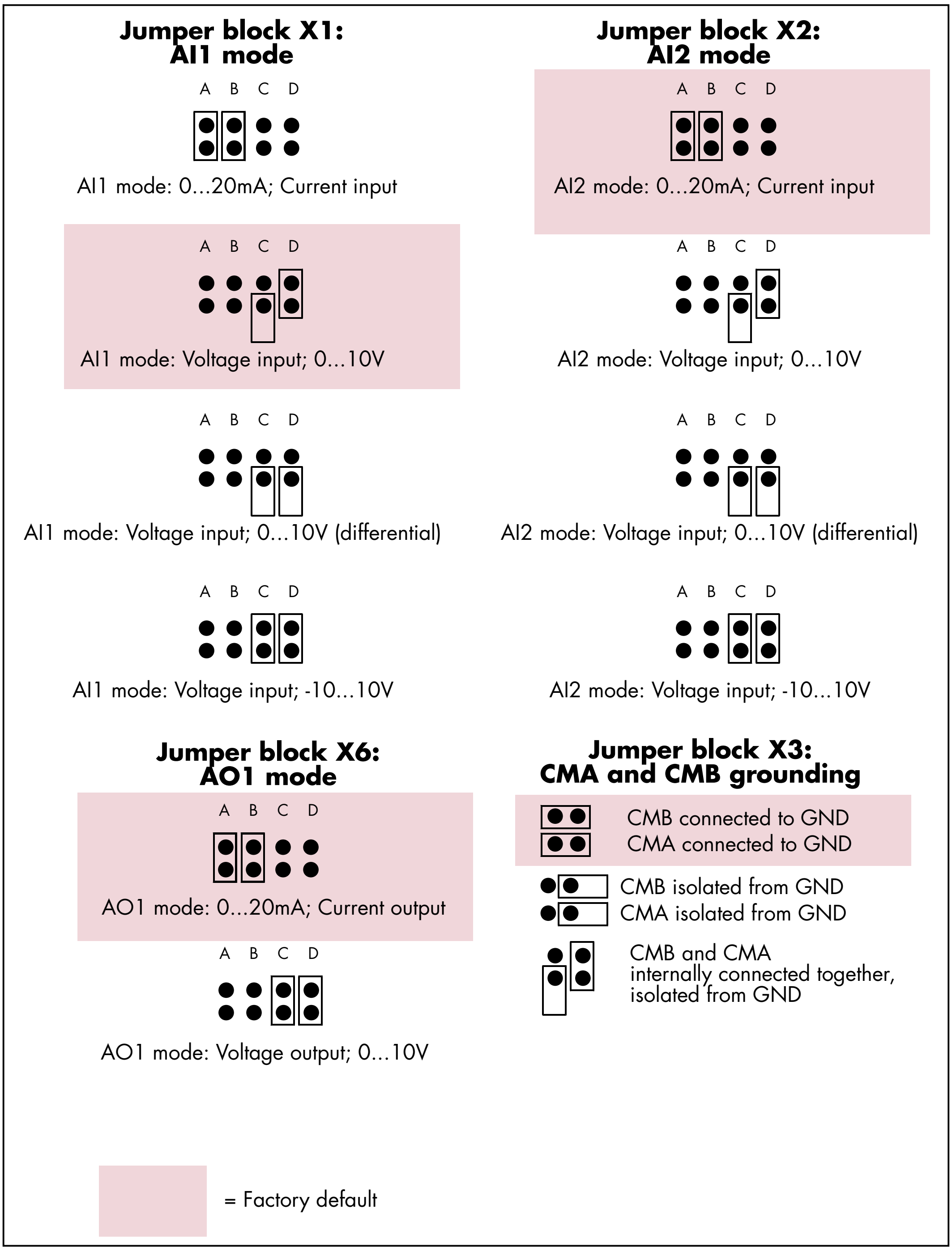


Figure 6-29. Jumper selection for OPT-A1

WARNING	Check the correct positions of the jumpers. Running the motor with signal settings different from the jumper positions will not harm the frequency drive but may damage the motor.
NOTE	**If the AI signal content is changed the corresponding board parameter in menu M7 must also be changed.**

7. CONTROL KEYPAD

The control keypad is the link between the frequency drive 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 drive 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

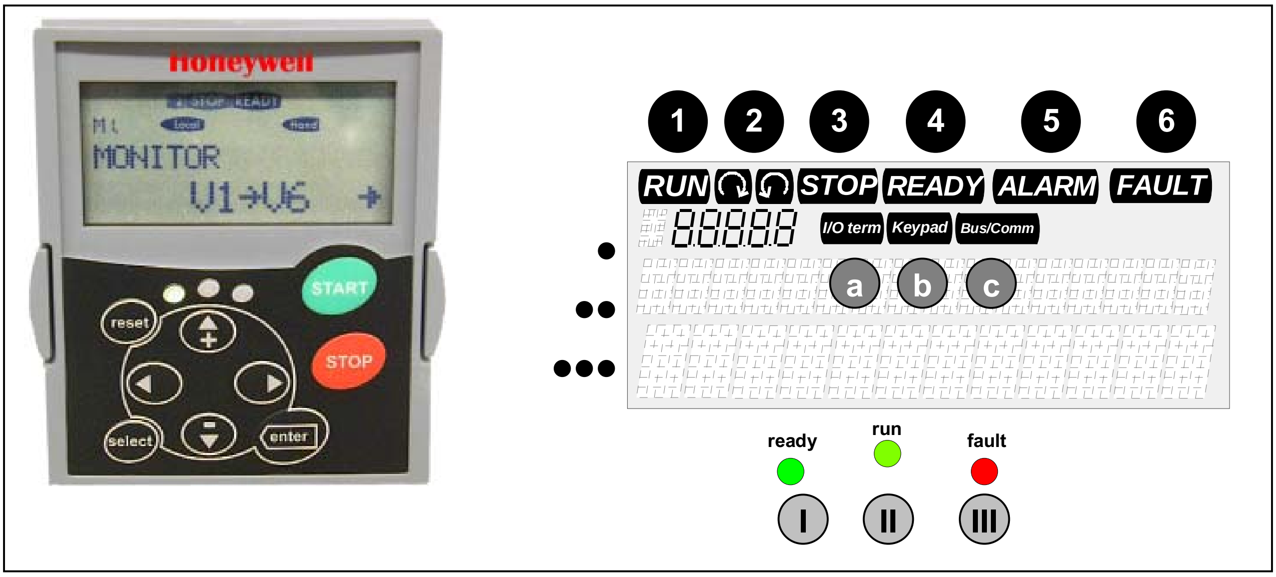


Figure 7-1. The control keypad and drive status indications

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 drive 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 drive 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 drive (and motor), parameter setting and value monitoring.

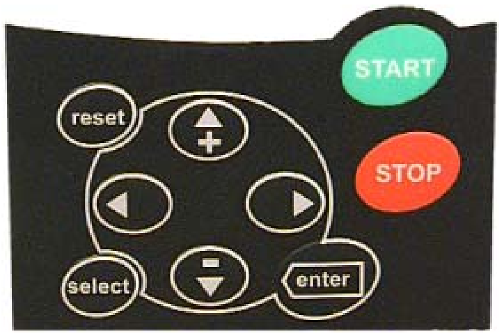
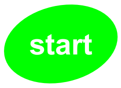


Figure 7-2. Keypad push-buttons

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.

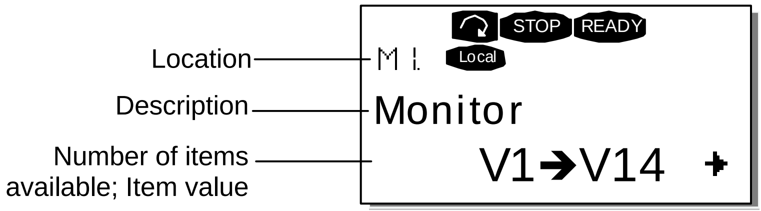


= Start button.
Pressing this button starts the motor if the keypad is the active control place. See Chapter 7.3.3.1.

= 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 96) 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.

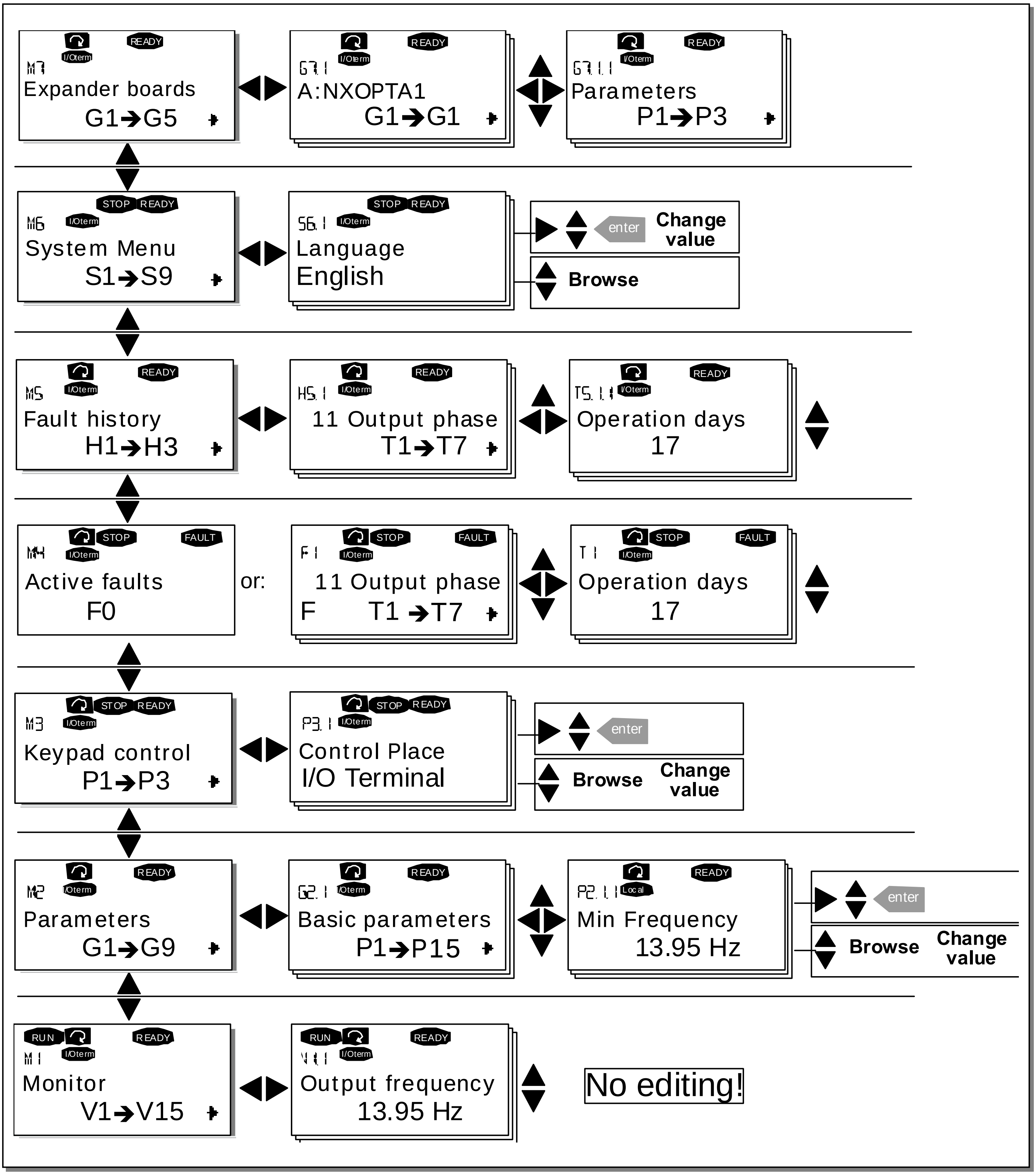


Figure 7-3. Keypad navigation chart

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.

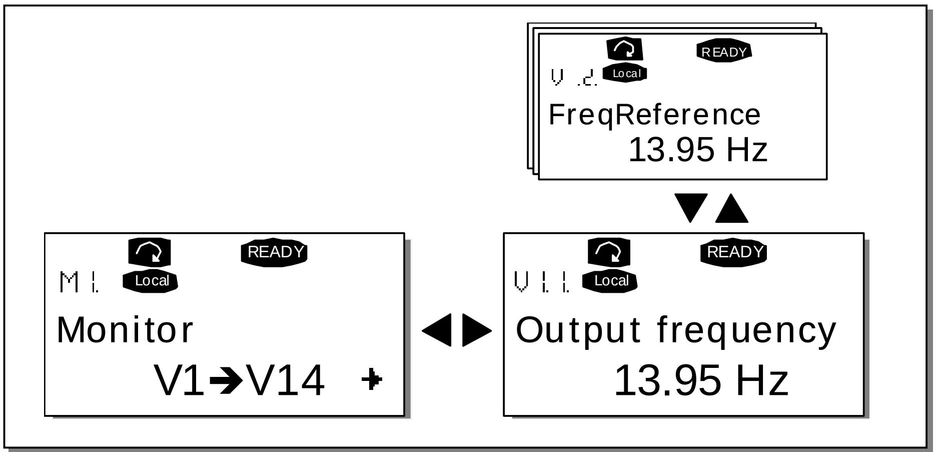


Figure 7-4. Monitoring menu

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

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 drive. 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 *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 drive must be stopped in order to edit these parameters.
The parameters values can also be locked using the function in menu **M6** (see Chapter 7.3.6.5).

Return to the *Main menu* anytime by pressing the *left arrow menu button* for 3 seconds.

The pre-loaded 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 77.

Note: Instead of connecting power to the frequency drive, 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 65) 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.

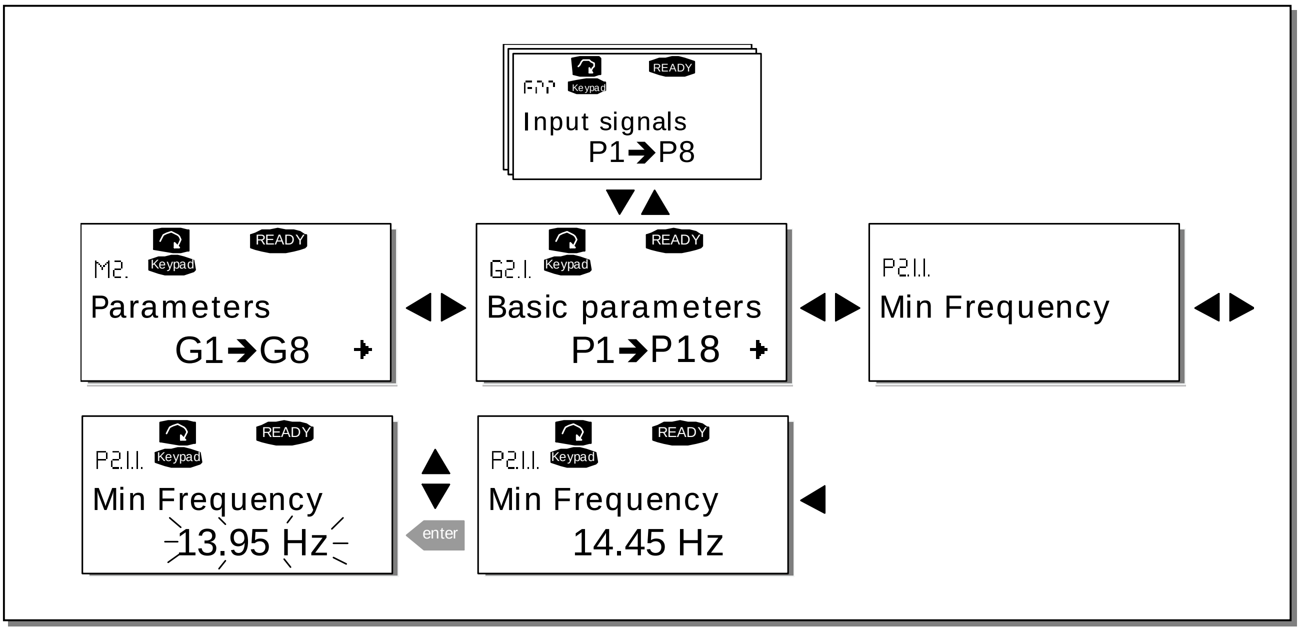


Figure 7-5. Parameter value change procedure

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*.

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

Table 7-2. Keypad control parameters, M3

7.3.3.1 Selection of control place

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

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

Change the control place by entering the edit mode with the *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.

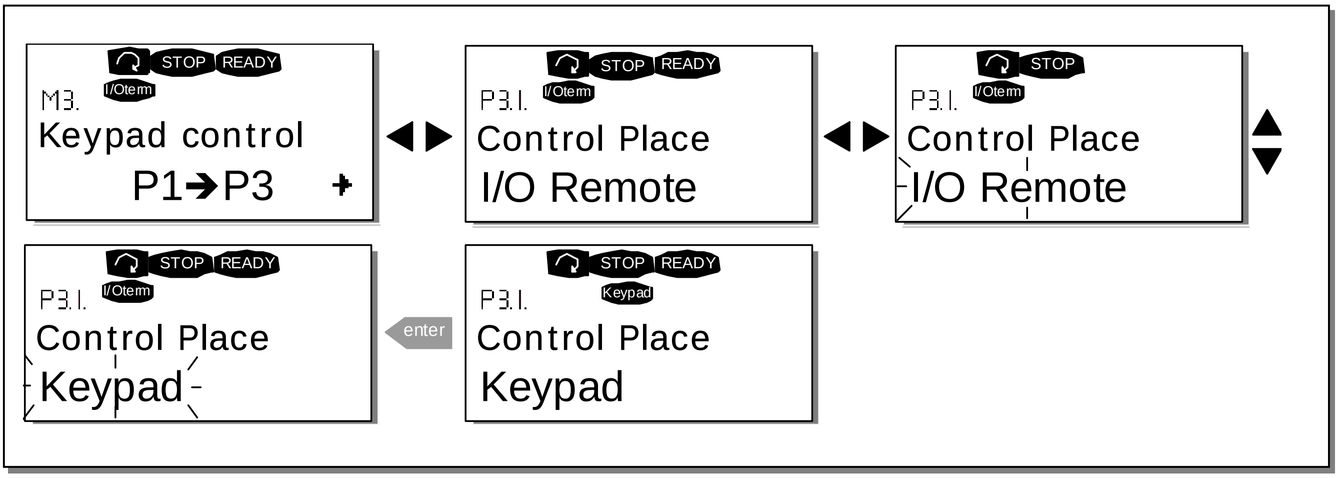


Figure 7-6. Selection of control place

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.

7.3.3.4 Stop button activated

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

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

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

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

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

Note that While 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*.

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

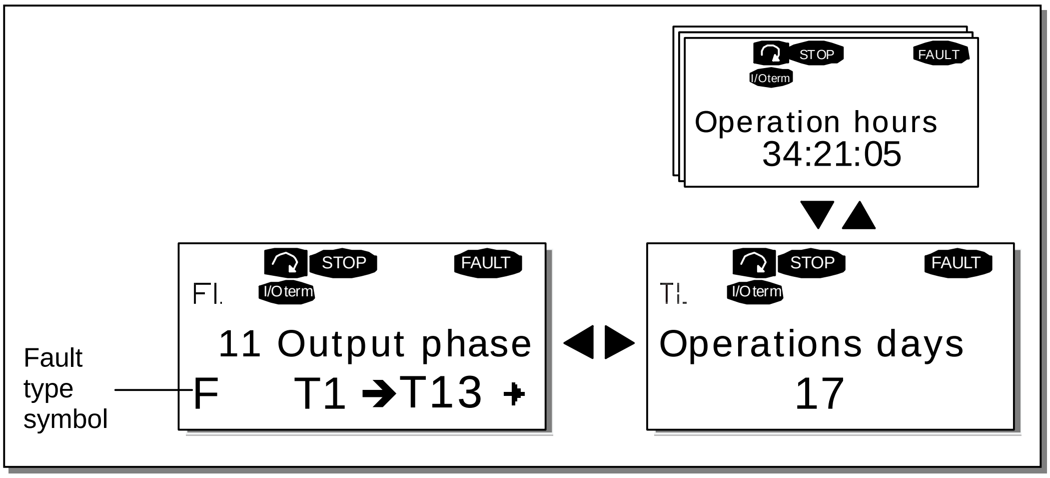


Figure 7-7. Fault display

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

Table 7-3. Fault types

7.3.4.2 Fault codes

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

Note: When contacting distributor because of a fault condition, always write down all text and codes on the keypad display.

Fault code	Fault	Possible cause	Correcting measures
1	Overcurrent	Frequency drive has detected too high a current (>4*I_n) in the motor cable: – sudden heavy load increase – short circuit in motor cables – unsuitable motor	Check loading. Check motor. Check cables.
2	Overvoltage	The DC-link voltage has exceeded the limits defined in Table 4-2. – too short a deceleration time – high overvoltage spikes in supply	Make the deceleration time longer. Use brake chopper or brake resistor (available as options)
3	Ground fault	Current measurement has detected that the sum of motor phase current is not zero. – insulation failure in cables or motor	Check motor cables and motor.
5	Charging switch	The charging switch is open, when the START command has been given. – faulty operation – component failure	Reset the fault How? and restart. Should the fault re-occur, contact your nearest distributor..
6	Emergency stop	Stop signal has been given from the option board.	
7	Saturation trip	Various causes, e.g. defective component	Cannot be reset from the keypad. Switch off power. DO NOT RE-CONNECT POWER! Contact factory. If this fault appears simultaneously with Fault 1, check motor cables and motor
8	System fault	- component failure - faulty operation Note exceptional fault data record, see 7.3.4.3.	Reset the fault How? and restart. Should the fault re-occur, contact your nearest distributor.
9	Undervoltage	DC-link voltage is under the voltage limits defined in. – most probable cause: too low a supply voltage – frequency drive internal fault	In case of temporary supply voltage break reset the fault How? and restart the frequency drive. 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	– no brake resistor installed – brake resistor is broken – brake chopper failure	Check brake resistor. If the resistor is ok, the chopper is faulty. Contact your nearest distributor..

13	Frequency drive under-temperature	Heatsink temperature is under 14°F (–10°C)	
14	Frequency drive over-temperature	Heatsink temperature is over 194°F (90°C). Overtemperature warning is issued when the heatsink temperature exceeds 185°F (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 drive 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	
25	Microprocessor watchdog fault	– faulty operation – component failure	Reset the fault How? and restart. Should the fault re-occur, contact your nearest distributor.
26	Start-up prevented	Start-up of the drive has been prevented.	Cancel prevention of start-up.
29	Thermistor fault	The thermistor input of option board has detected increase of the motor temperature	Check motor cooling and loading Check thermistor connection (If thermistor input of the option board is not in use it has to be short circuited)
32	Fan cooling	Cooling fan of the frequency drive 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 changed (same type)	Option board or control unit changed. Same type of board or same power rating of drive.	Reset **Note:** No fault time data record!
38	Device added (same type)	Option board or drive added. Drive of same power rating or same type of board added.	Reset **Note:** No fault time data record!
39	Device removed	Option board removed. Drive removed.	Reset **Note:** No fault time data record!
40	Device unknown	Unknown option board or drive.	Contact your nearest distributor.
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	Analog input I_{in} < 4mA (selected signal range 4 to 20 mA)	Current at the analogue input is < 4mA. – control cable is broken or loose – signal source has failed	Check the current loop circuitry.
51	External fault	Digital input fault.	
52	Keypad communication fault	The connection between the control keypad and the freq. drive is broken.	Check keypad connection and possible keypad cable.
53	Fieldbus fault	The data connection between the fieldbus Master and the fieldbus board is broken.	Check installation. If installation is correct contact your nearest distributor.
54	Slot fault	Defective option board or slot	Check board and slot. Contact your nearest distributor.
56	PT100 board temp. fault	Temperature limit values set for the PT100 board parameters have been exceeded	Find the cause of temperature rise

Table 7-4. Fault codes

7.3.4.3 Fault time data record

When a fault occurs the information described above in 7.3.4 is displayed. By pushing the *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:

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

Table 7-5. Fault time recorded data

Real time record

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

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

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* menubuttonright 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 drive 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**.

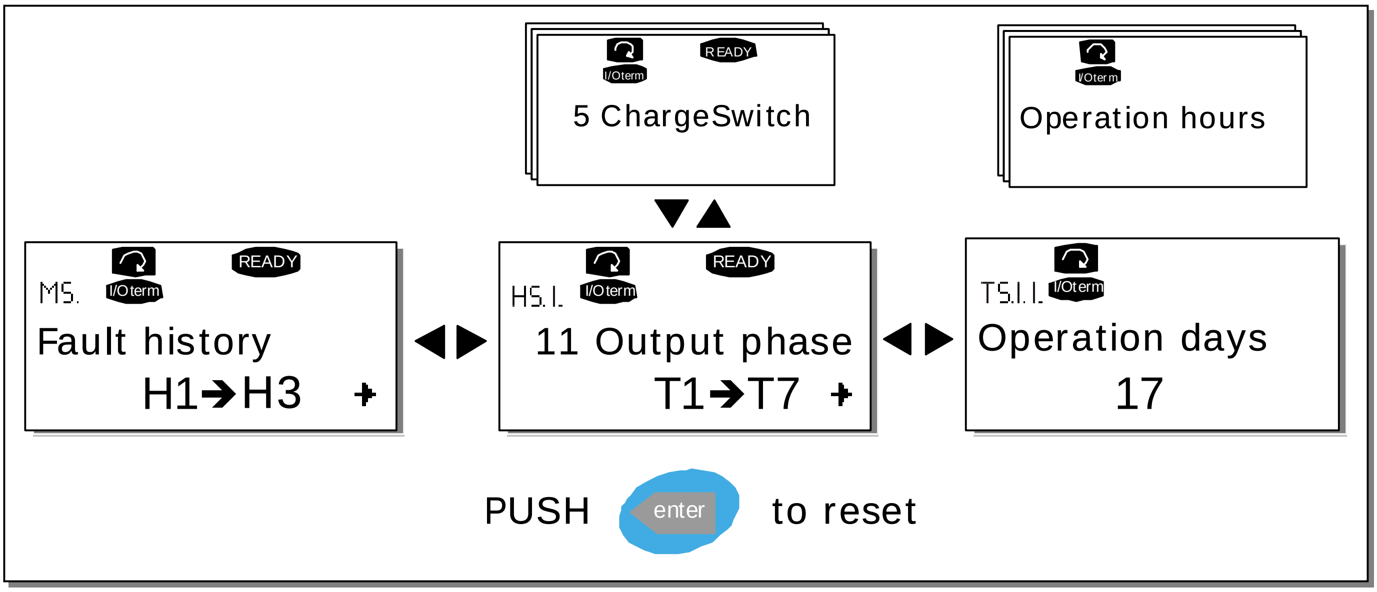


Figure 7-8. Fault history menu

7.3.6 System menu (M6)

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

The controls associated with the general use of the frequency drive, 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 87 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	Language selection				English		English Deutsch Suomi Svenska Italiano
S6.2	Application selection				Basic Application		Basic Application Standard Application Local/Remote control Appl. Multi-Step Application PID Control Application Multi-Purpose Control Appl. Pump and Fan Control Appl.
S6.3	Copy parameters						
S6.3.1	Parameter sets						Store set 1 Load set 1 Store set 2 Load set 2 Load factory defaults
S6.3.2	Load up to keypad						All parameters
S6.3.3	Load down from keypad						All parameters All but motor parameters Application parameters
P6.3.4	Parameter backup				No		Yes No
S6.4	Compare parameters						
S6.5	Security						
S6.5.1	Password				Not used		**0**=Not used
P6.5.2	Parameter lock				Change Enabled		Change Enabled Change Disabled
S6.5.3	Start-up wizard						No Yes
S6.5.4	Multimonitoring items						Change Enabled Change Disabled
S6.6	Keypad settings						
P6.6.1	Default page						
P6.6.2	Default page/ Operating menu						
P6.6.3	Timeout time	0	65535	s	30		
P6.6.4	Contrast	0	31		18		
P6.6.5	Backlight time	Always	65535	min	10		
S6.7	Hardware settings						
P6.7.1	Internal brake resistor				Connected		Not connected Connected
P6.7.2	Fan control				Continuou s		Continuous Temperature
P6.7.3	HMI acknowledg. timeout	200	5000	ms	200		
P6.7.4	HMI number of retries	1	10		5		
S6.8	System information						
S6.8.1	Total counters						
C6.8.1.1	MWh counter			kWh			
C6.8.1.2	Power On day counter						
C6.8.1.3	Power On hours counter			hh:mm:s s			
S6.8.2	Trip counters						
T6.8.2.1	MWh counter			kWh			

T6.8.2.2	Clear MWh trip counter						
T6.8.2.3	Operating days trip counter						
T6.8.2.4	Operating hours trip counter			hh:mm:ss			
T6.8.2.5	Clear operating time counter						
S6.8.3	Software info						
S6.8.3.1	Software package						
S6.8.3.2	System software version						
S6.8.3.3	Firmware interface						
S6.8.3.4	System load						
S6.8.4	Applications						
S6.8.4.#	*Name of application*						
D6.8.4.#.1	Application ID						
D6.8.4.#.2	Applications: Version						
D6.8.4.#.3	Applications: Firmware interface						
S6.8.5	Hardware						
I6.8.5.1	Info: Unit power			kW			
I6.8.5.2	Info: Unit voltage			V			
I6.8.5.3	Info: Brake chopper						
I6.8.5.4	Info: Brake resistor						
S6.8.6	Expander boards						

Table 7-6. System menu functions

7.3.6.1 Language selection

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

Locate the language selection page under the *System menu*. Its location indication is **S6.1**. Press the 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

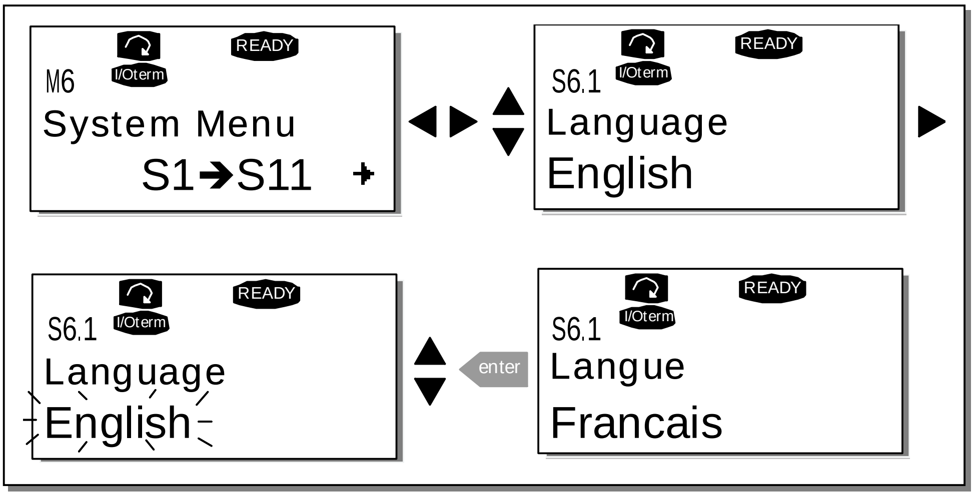


Figure 7-9. Selection of language

7.3.6.2 Application selection

The user can select the application desired by entering the *Application selection page (S6.2)*. This is done by pushing the *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 7.3.6.3.

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

Automation and Control Solutions
Honeywell
1985 Douglas Drive North
Golden Valley, MIN 55422

Honeywell Limited-Honeywell Limitée
35 Dynamic Drive
Scarborough, Ontario
MIV 4Z9

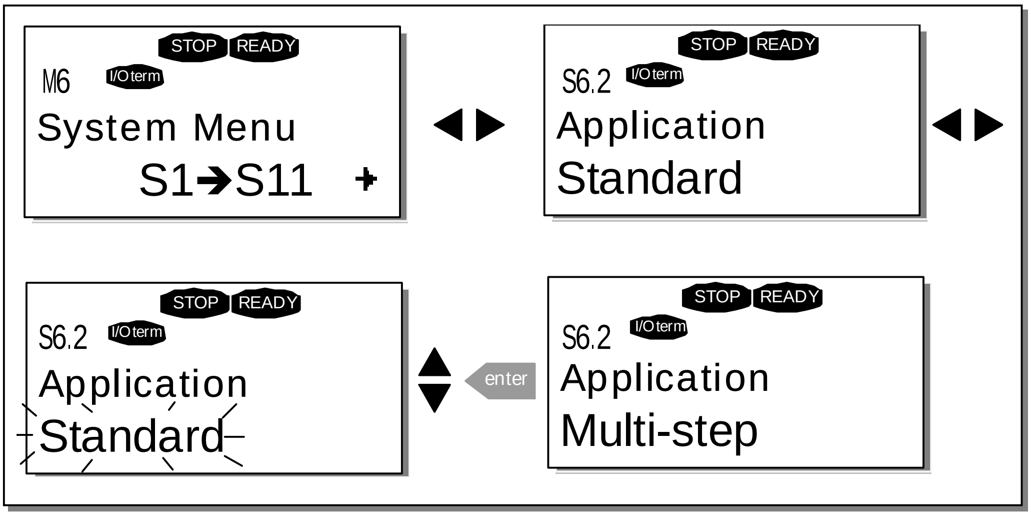


Figure 7-10. Change of application

7.3.6.3 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 **(S6.3)** embodies four functions:

Parameter sets (S6.3.1)

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

On *Parameter sets* page **(S6.3.1)**, 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.

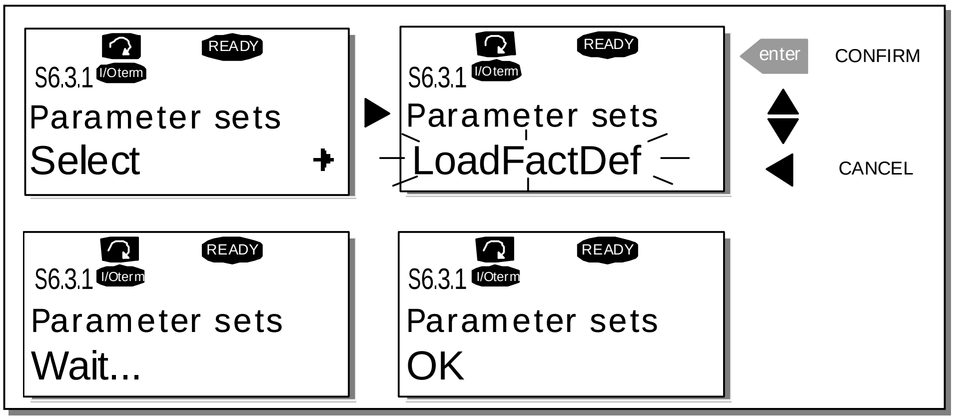


Figure 7-11. Storing and loading of parameter sets

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

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

Enter the *To keypad* page (S6.3.2) from the *Parameter copy menu*. Push the *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.

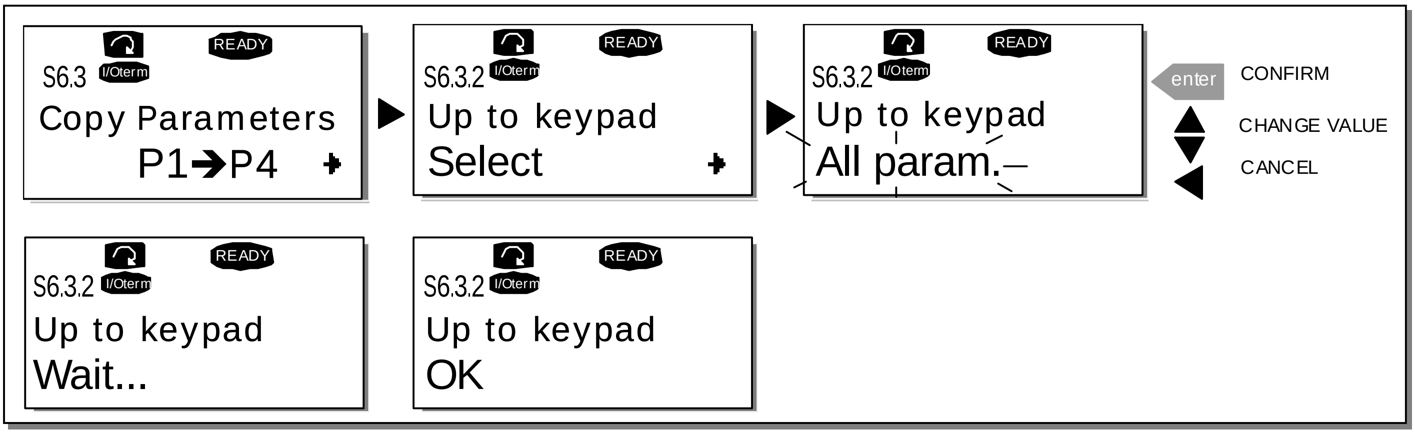


Figure 7-12. Parameter copy to keypad

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

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

Enter the *From keypad* page (S6.3.3) from the *Parameter copy menu*. Push the *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.

Automatic parameter backup (P6.3.4)

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 7.3.6.3.

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 6.3.2 as instructed. **Otherwise the panel will always ask for the permission to upload the parameters.**

Note: Parameters saved in the parameter settings on page **S6.3.1** will be deleted when applications are changed If transfer of the parameters from one application to another is required, they must be uploaded first to the keypad

7.3.6.4 Parameter comparison

In the *Parameter comparison* submenu **(S6.4)**, 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.

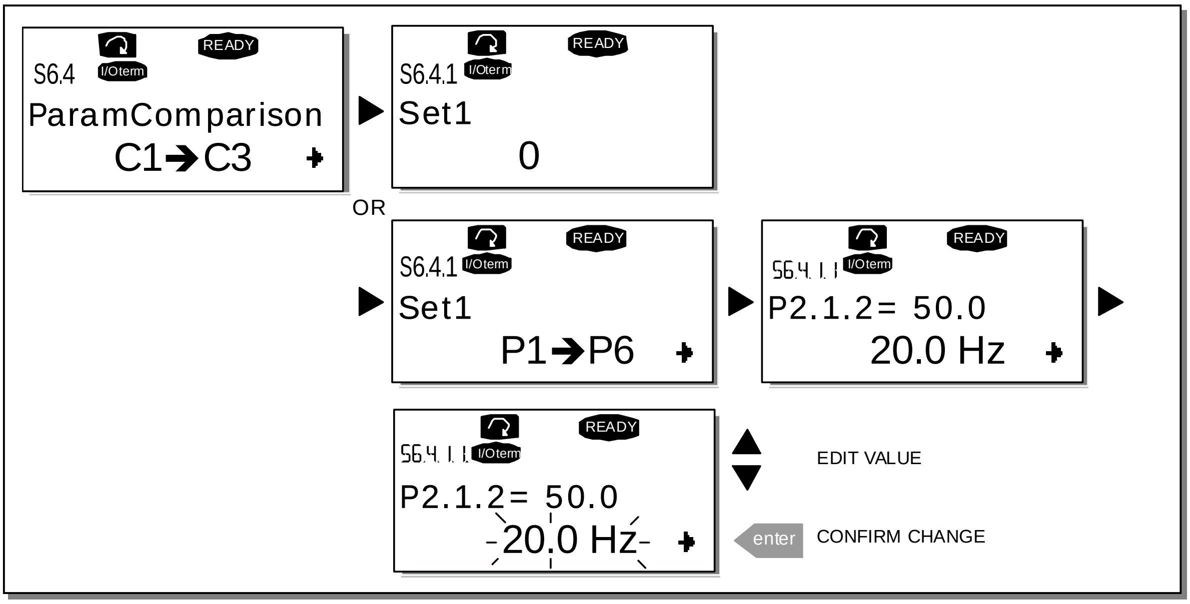


Figure 7-13. Parameter comparison

7.3.6.5 Security

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

Password (S6.5.1)

The application selection can be protected against unauthorised changes with the Password function **(S6.5.1)**.
By default, the password function is not in use. 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 (P6.6.3)* (see page 96) 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*.

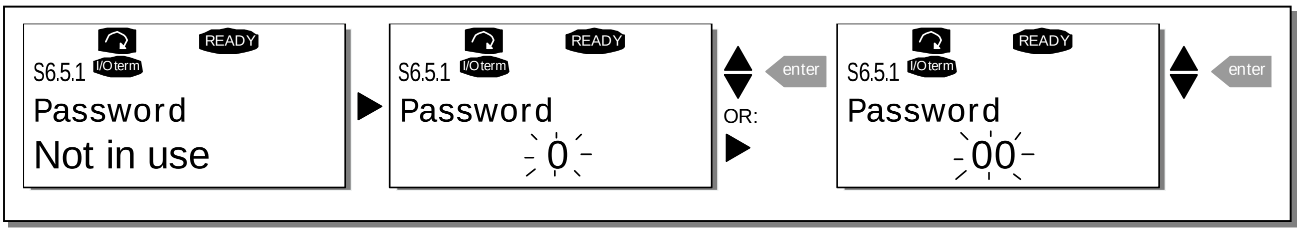


Figure 7-14. Password setting

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

Parameter lock (P6.5.2)

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

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

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

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

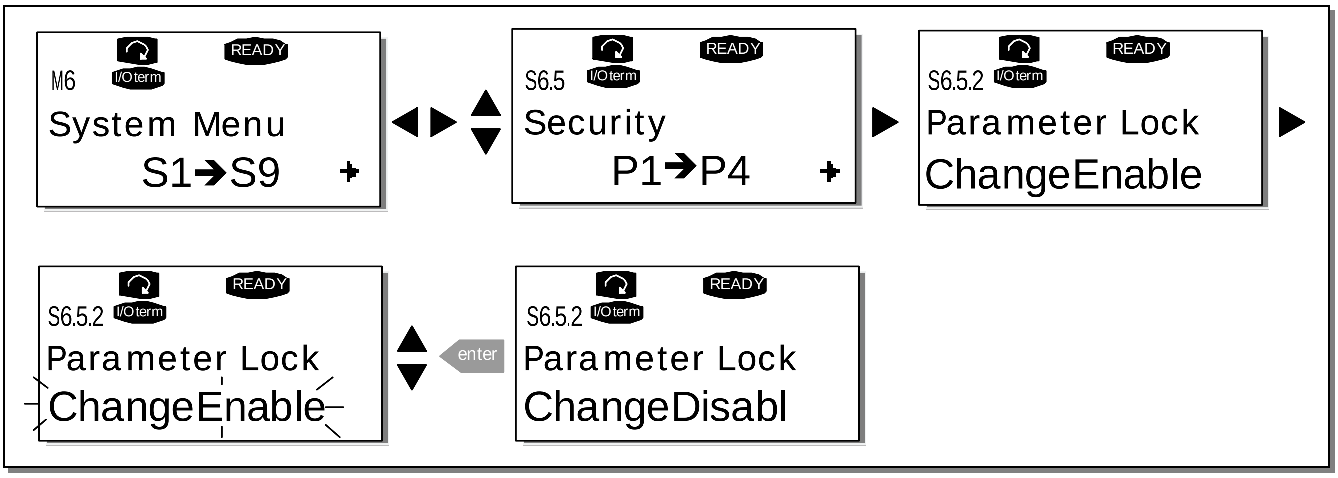


Figure 7-15. Parameter locking

Start-up Wizard (P6.5.3)

The Start-up Wizard is a feature of the control keypad to facilitate the commissioning of the frequency drive. If selected active, the Start-up Wizard prompts the operator for the language and application of his/her choice and then returns to the starting menu or page.

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

Figure 7-16. Activation of Start-up wizard

Multimonitoring items (P6.5.4)

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

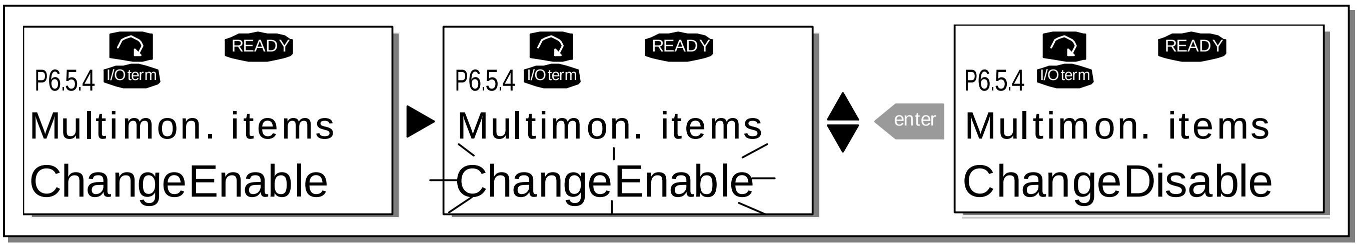


Figure 7-17. Enabling the change of multimonitoring items

7.3.6.6 Keypad settings

Further customization of the frequency drive operator interface can be undertaken in the Keypad settings submenu under the *System menu.*
Locate the Keypad settings submenu **(S6.6)**. Under the submenu, there are four pages **(P#)** associated with the keypad operation:

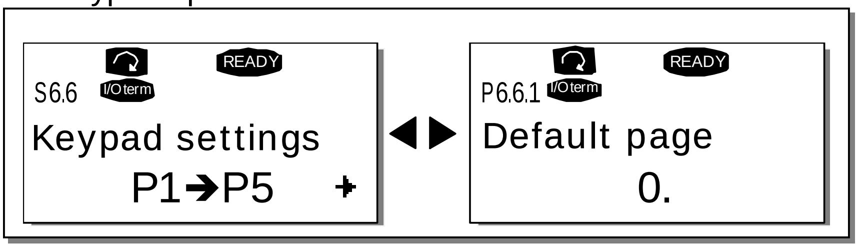


Figure 7-18. Keypad settings submenu

Default page (P6.6.1)

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.*

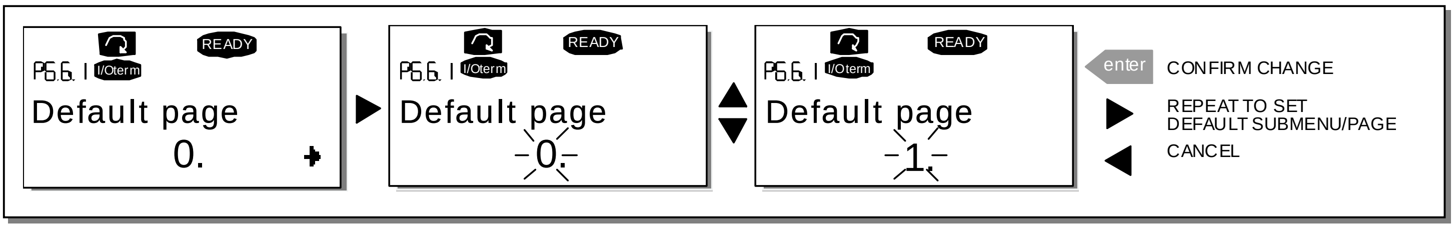


Figure 7-19. Default page function

Default page in the operating menu (P6.6.2)

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 (P6.6.3)

The Timeout time setting defines the time after which the keypad display returns to the Default page (P6.6.1) see above.
Move to the Edit menu by pressing the *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.*

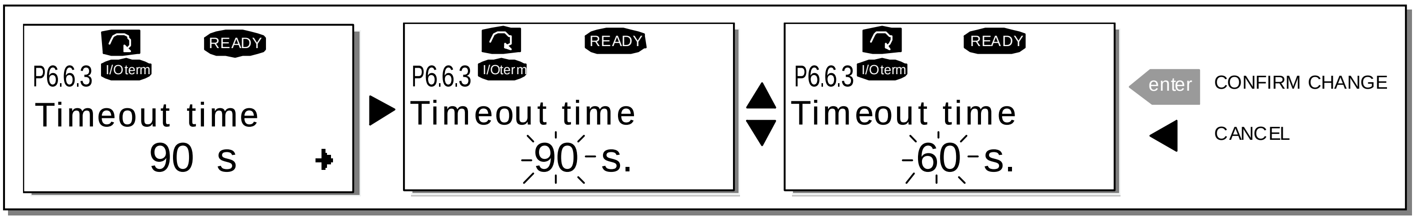


Figure 7-20. Timeout time setting

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

Contrast adjustment (P6.6.4)

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

Backlight time (P6.6.5)

Giving a value for the *Backlight time*, 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 (P6.6.3).

7.3.6.7 Hardware settings

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

In the Hardware settings submenu **(S6.7)** under the *System menu* it is possible to further control some functions of the hardware in the frequency drive. The functions available in this menu are ***Internal brake resistor connection, Fan control, HMI acknowledge timeout and HMI retry.***

Internal brake resistor connection (P6.7.1)

With this function it is possible to tell the frequency drive whether the internal brake resistor is connected or not. If the frequency drive 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.

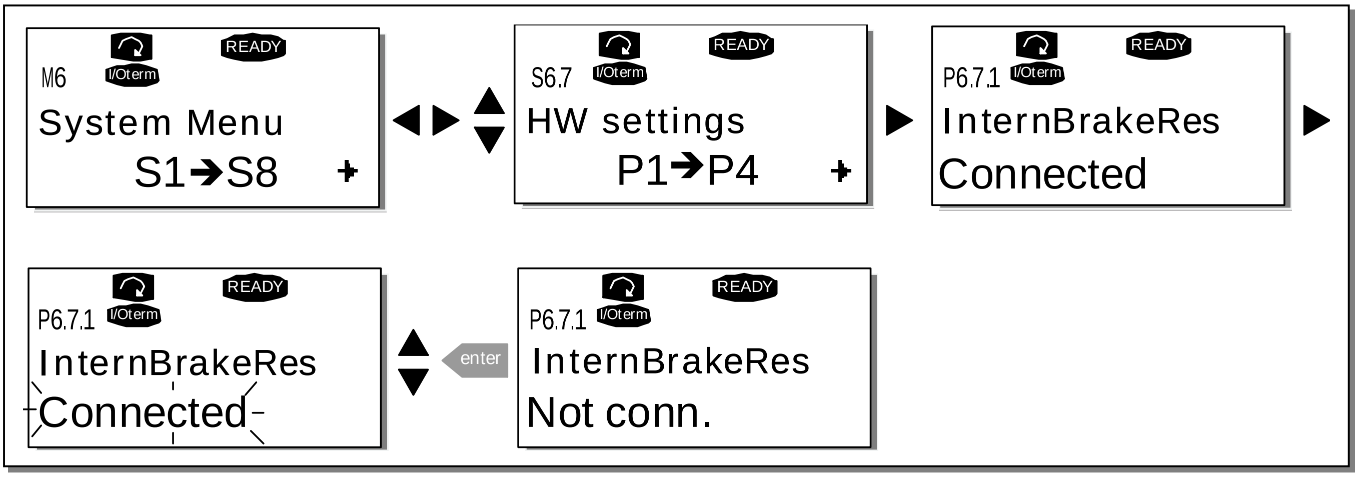


Figure 7-21. Internal brake resistor connection

Fan control (P6.7.2)

This function allows the control of the frequency drive's cooling fan. When the power is switched on the fan can be set to run continuously or dependent upon the temperature of the unit. If the latter function has been selected the fan is switched on automatically when the heat sink temperature reaches 140°F (60°C). The fan receives a stop command when the heat sink temperature falls to 131°F (55°C). However, the fan runs for about a minute after receiving the stop command or switching on the power, as well as after changing the value from *Continuous* to *Temperature.*

Note! The fan runs always when the drive is in RUN state

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*.

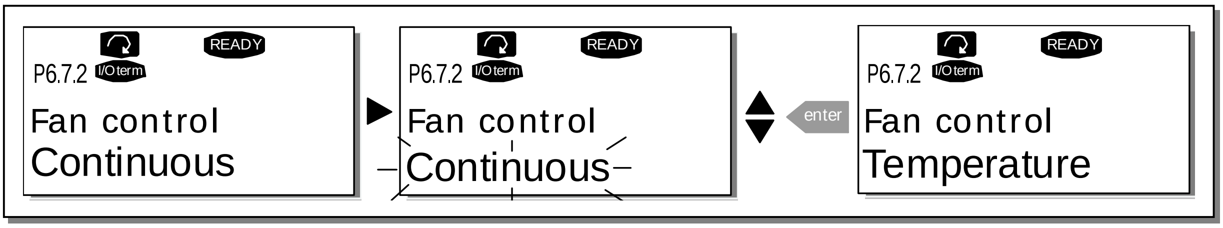


Figure 7-22. Fan control function

HMI acknowledge timeout (P6.7.3)

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

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

Example:

- Transfer delay between the frequency drive and the PC = 600 ms
- The value of par. 6.7.3 is set to <u>1200 ms</u> (2 x 600, sending delay + receiving delay)
- The corresponding setting shall be entered to the [Misc]-part of the NCDrive.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 NCDrive 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* .

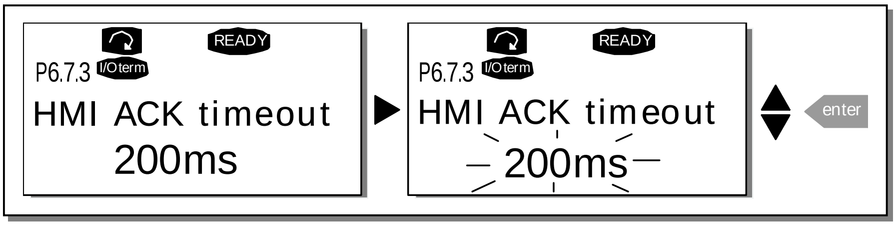


Figure 7-23. HMI acknowledge timeout

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

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 (P6.7.3) or if the received acknowledgement is faulty.

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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 7-23 for the procedure of changing the value.

7.3.6.8 System info

In the *System info submenu* **(S6.8)** frequency drive-related hardware and software information as well as operation-related information, can be found.

Total counters (S6.8.1)

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

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

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

Table 7-7. Counter pages

Trip counters (S6.8.2)

Trip counters (menu **S6.8.2)** are counters the values of which can be reset i.e. restored to zero. The following resettable counters are available:

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

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

Table 7-8. Resettable counters

The counters can be reset on pages 6.8.2.2 *(MWh counter reset)* and 6.8.2.5 *(Operation time reset)*.

Example: To reset the operation counters:

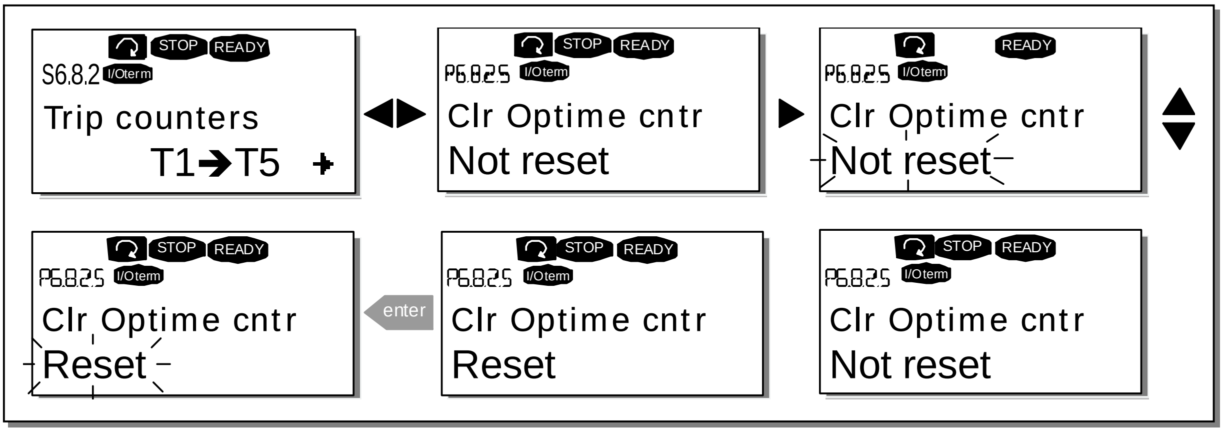

Figure 7-24. Counter reset

Software (S6.8.3)

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

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

Table 7-9. Software information pages

Applications (S6.8.4)

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

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

Table 7-10. Applications information pages

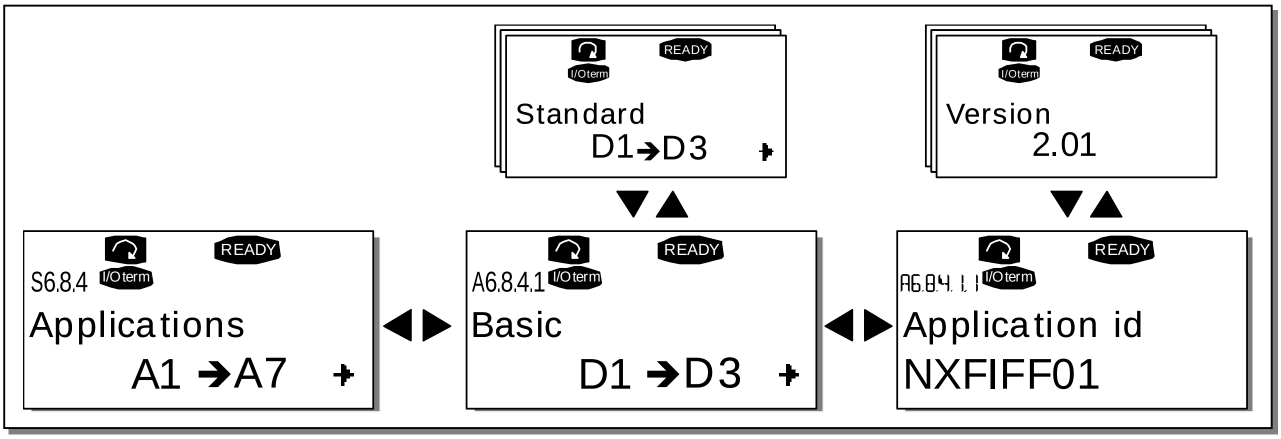

Figure 7-25. Applications info page

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

Hardware (S6.8.5)

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

Page	Content
6.8.5.1	Nominal power of the unit
6.8.5.2	Nominal voltage of the unit
6.8.5.3	Brake chopper
6.8.5.4	Brake resistor

Table 7-11. Hardware information pages

Expander boards (S6.8.6)

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 for more information.

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

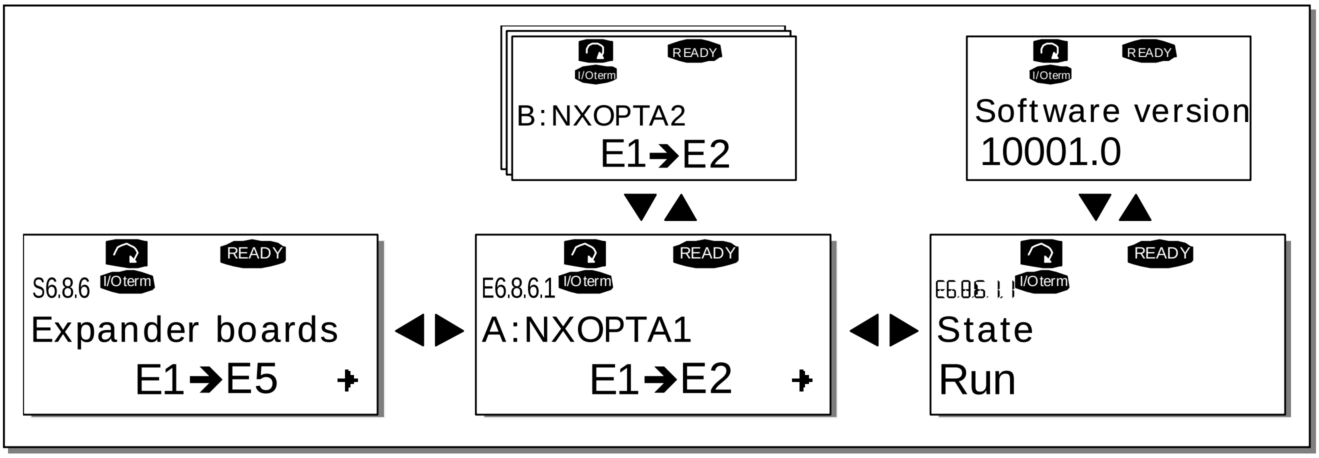

Figure 7-26. Expander board information menus

Debug menu (S6.8.7)

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

7.3.7 *Expander board menu (M7)*

The *Expander board menu* makes it possible for the user 1) to see what expander boards are connected to the control board and 2) to reach and edit the parameters associated with the expander board.
Enter the following menu level **(G#)** with the *right arrow menu button* At this level, the user can browse through slots (see page 60) 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 7-12 and Figure 7-27.

Expander board parameters

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

Table 7-12. Expander board parameters (board NXOPTA1)

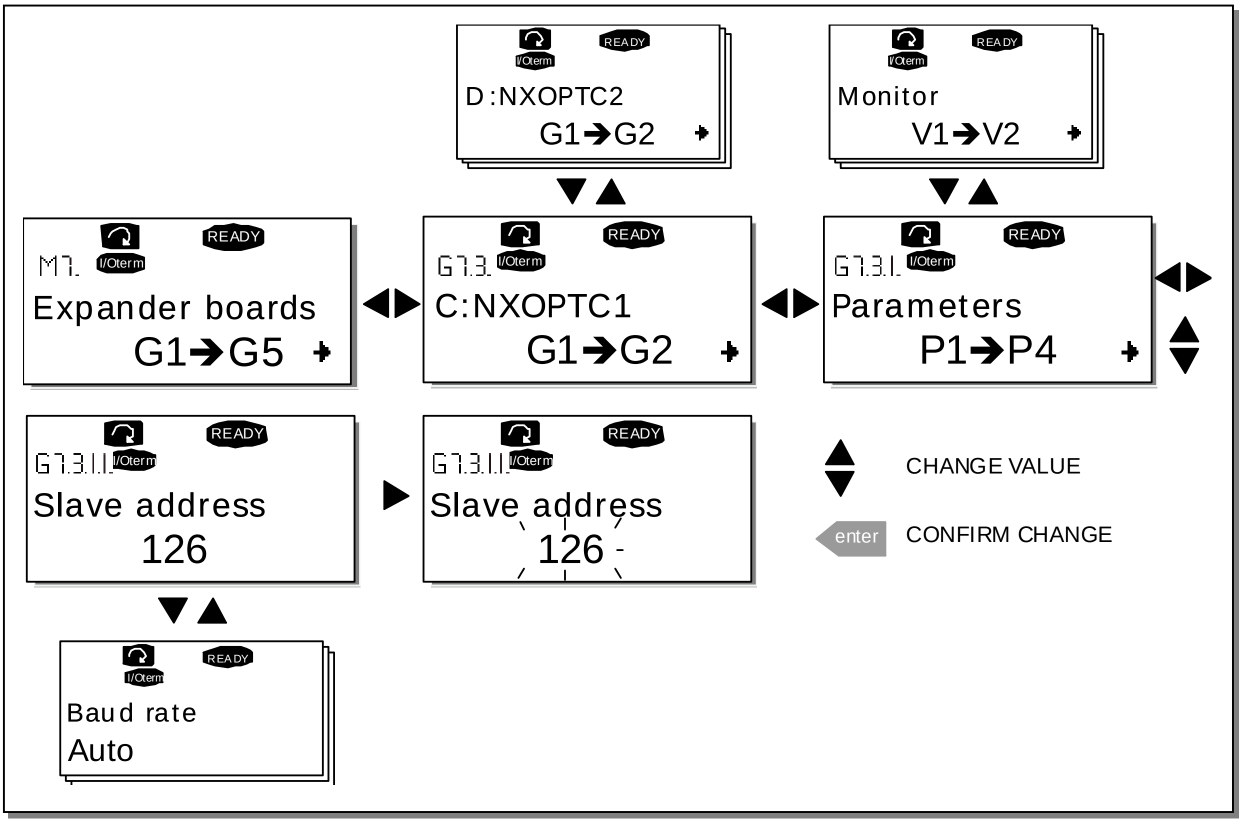

Figure 7-27. Expander board information menu

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:

	1	Internal components and circuit boards of the frequency drive (except for the galvanically isolated I/O terminals) are **live** when the NX is connected to the main power. **Coming into contact with this voltage is extremely dangerous and may cause death or severe injury.**
	2	The motor terminals U, V, W and the DC-link/brake resistor terminals –/+ are **live** when the NX is connected to mains, **even if the motor is not running**.
	3	The control I/O-terminals are isolated from the mains potential. However, the relay outputs and other I/O-terminals may have a dangerous control voltage present even when the NX is disconnected from the main power.
	4	Do not make any connections with the frequency drive connected to the mains.
WARNING	**5**	After having disconnected the frequency drive 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.
	6	Before connecting the frequency drive to mains make sure that the NX front cover is closed.
HOT SURFACE	**7**	When running, the side of drive FR8 is extremely hot. Do not touch with hands!
	8	When running, the back of frequency drive FR6 is extremely hot. Therefore it MUST NOT be mounted onto a surface which is not fireproof.

8.2 Commissioning of the frequency drive

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

2 After the installation, you must ensure:

- that both the frequency drive 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 0, step 3), the shields of the shielded cables are connected to protective ground ⏚. The wires may not touch the electrical components of the frequency drive.
- 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 5-10).

4 Check the inside of the frequency drive for condensation.

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

6 Connect the frequency drive 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 start *.*

*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 stop *.*

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 until the drive has stopped **as advised in Chapter 8.1, step 5**.*

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

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**.*

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9. FAULT TRACING

When a fault is detected by the frequency drive 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 items written in white on black background present faults for which you can be program different responses in the application. See parameter group Protections.

Note: When contacting distributor because of a fault condition, always write down all text and codes on the keypad display.

Fault code	Fault	Possible cause	Correcting measures
1	Overcurrent	Frequency drive has detected too high a current (>4*I_n) in the motor cable: – sudden heavy load increase – short circuit in motor cables – unsuitable motor	Check loading. Check motor. Check cables.
2	Overvoltage	The DC-link voltage has exceeded the limits defined in Table 4-2. – too short a deceleration time – high overvoltage spikes in supply	Make the deceleration time longer. Use brake chopper or brake resistor (available as options)
3	Ground fault	Current measurement has detected that the sum of motor phase current is not zero. – insulation failure in cables or motor	Check motor cables and motor.
5	Charging switch	The charging switch is open, when the START command has been given. – faulty operation – component failure	Reset the fault How? and restart. Should the fault re-occur, contact your nearest distributor..
6	Emergency stop	Stop signal has been given from the option board.	
7	Saturation trip	Various causes, e.g. defective component	Cannot be reset from the keypad. Switch off power. DO NOT RE-CONNECT POWER! Contact factory. If this fault appears simultaneously with Fault 1, check motor cables and motor
8	System fault	- component failure - faulty operation Note exceptional fault data record, see 7.3.4.3.	Reset the fault How? and restart. Should the fault re-occur, contact your nearest distributor.
9	Undervoltage	DC-link voltage is under the voltage limits defined in. – most probable cause: too low a supply voltage – frequency drive internal fault	In case of temporary supply voltage break reset the fault How? and restart the frequency drive. 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.

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11	Output phase supervision	Current measurement has detected that there is no current in one motor phase.	Check motor cable and motor.
12	Brake chopper supervision	– no brake resistor installed – brake resistor is broken – brake chopper failure	Check brake resistor. If the resistor is ok, the chopper is faulty. Contact your nearest distributor..
13	Frequency drive under-temperature	Heatsink temperature is under 14°F	
14	Frequency drive over-temperature	Heatsink temperature is over 194°F. Overtemperature warning is issued when the heatsink temperature exceeds 185°F.	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 drive 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	
25	Microprocessor watchdog fault	– faulty operation – component failure	Reset the fault How? and restart. Should the fault re-occur, contact your nearest distributor.
26	Start-up prevented	Start-up of the drive has been prevented.	Cancel prevention of start-up.
29	Thermistor fault	The thermistor input of option board has detected increase of the motor temperature	Check motor cooling and loading Check thermistor connection (If thermistor input of the option board is not in use it has to be short circuited)
32	Fan cooling	Cooling fan of the frequency drive 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 changed (same type)	Option board or control unit changed. Same type of board or same power rating of drive.	Reset **Note:** No fault time data record!
38	Device added (same type)	Option board or drive added. Drive of same power rating or same type of board added.	Reset **Note:** No fault time data record!
39	Device removed	Option board removed. Drive removed.	Reset **Note:** No fault time data record!
40	Device unknown	Unknown option board or drive.	Contact your nearest distributor.
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	Analog input I_{in} < 4mA (selected signal range 4 to 20 mA)	Current at the analogue input is < 4mA. – control cable is broken or loose – signal source has failed	Check the current loop circuitry.
51	External fault	Digital input fault.	
52	Keypad communication fault	The connection between the control keypad and the freq. drive is broken.	Check keypad connection and possible keypad cable.
53	Fieldbus fault	The data connection between the fieldbus Master and the fieldbus board is broken.	Check installation. If installation is correct contact your nearest distributor.
54	Slot fault	Defective option board or slot	Check board and slot. Contact your nearest distributor.
56	PT100 board temp. fault	Temperature limit values set for the PT100 board parameters have been exceeded	Find the cause of temperature rise

Table 9-1. Fault codes

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Constant and Variable Torque Variable Speed Drives for Induction Motors Software Application Manual

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CONTENTS

NX "All in One" APPLICATION MANUAL

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ABOUT THE "All in One" APPLICATION MANUAL

In the All in One Application Manual you will find information about the different applications included in the All in One Application Package. Should these applications not meet the requirements of your process please contact the manufacturer for information on special applications.

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

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

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

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"All in One" Application manual

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1. BASIC APPLICATION

1.1 Introduction

The Basic Application is easy and flexible to use due to its versatile fieldbus features. It is the default setting on delivery from the factory. Otherwise select the Basic Application in menu **M6** on page *S6.2*. See the product's User's Manual.

Digital input DIN3 is programmable.

The parameters of the Basic Application are explained in Chapter 8 of this manual. The explanations are arranged according to the individual ID number of the parameter.

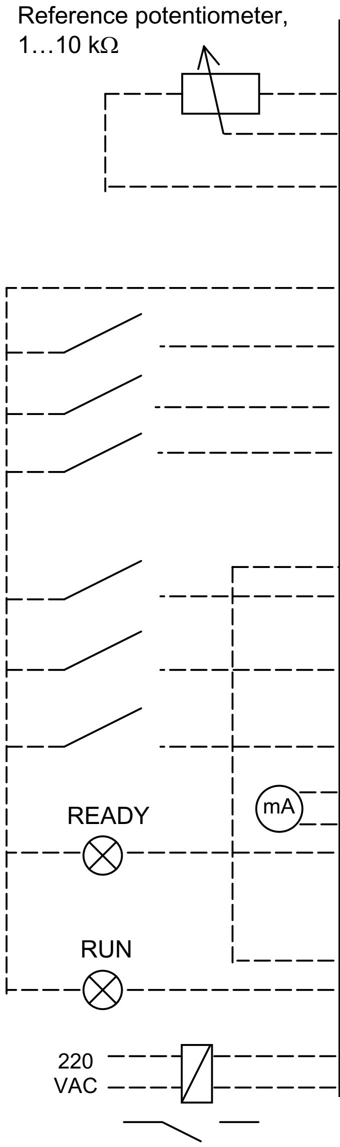
1.1.1 Motor protection functions in the Basic Application

The Basic Application provides almost all the same protection functions as the other applications:

- External fault protection
- Input phase supervision
- Undervoltage protection
- Output phase supervision
- Ground fault protection
- Motor thermal protection
- Thermistor fault protection
- Fieldbus fault protection
- Slot fault protection

Unlike the other applications, the Basic Application does not provide any parameters for choosing the response function or limit values for the faults. The motor thermal protection is explained in more detail on page 182.

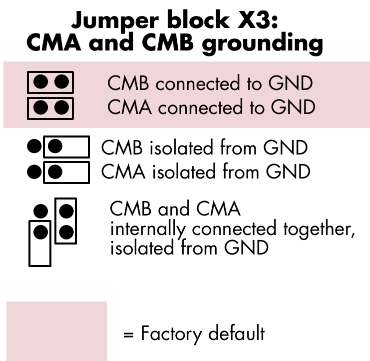
1.2 Control I/O



Terminal		Signal	Description		
OPT-A1					
1	+10V$_{ref}$	Reference output	Voltage for potentiometer, etc.		
2	AI1+	Analogue input, voltage range 0—10V DC	Voltage input frequency reference		
3	AI1-	I/O Ground	Ground for reference and controls		
4	AI2+	Analogue input, current range 0—20mA	Current input frequency reference		
5	AI2-				
6	+24V	Control voltage output	Voltage for switches, etc. max 0.1 A		
7	GND	I/O ground	Ground for reference and controls		
8	DIN1	Start forward	Contact closed = start forward		
9	DIN2	Start reverse	Contact closed = start reverse		
10	DIN3	External fault input (programmable)	Contact open = no fault Contact closed = fault		
11	CMA	Common for DIN 1—DIN 3	Connect to GND or +24V		
12	+24V	Control voltage output	Voltage for switches (see #6)		
13	GND	I/O ground	Ground for reference and controls		
14	DIN4	Multi-step speed select 1	DIN4	DIN5	Frequency ref.
15	DIN5	Multi-step speed select 2	Open	Open	Ref.U$_{in}$
			Closed	Open	Multi-step ref.1
			Open	Closed	Multi-step ref.2
			Closed	Closed	RefMax
16	DIN6	Fault reset	Contact open = no action Contact closed = fault reset		
17	CMB	Common for DIN4—DIN6	Connect to GND or +24V		
18	AO1+	Output frequency	Programmable		
19	AO1-	Analogue output	Range 0—20 mA/R$_L$, max. 500Ω		
20	DO1	Digital output READY	Programmable Open collector, I≤50mA, U≤48 VDC		
OPT-A2					
21	RO1	Relay output 1 RUN			
22	RO1				
23	RO1				
24	RO2	Relay output 2 FAULT			
25	RO2				
26	RO2				

Table 1-1. Basic application default I/O configuration.

Note: See jumper selections below. More information in the product's User's Manual.



1.3 Control signal logic in Basic Application

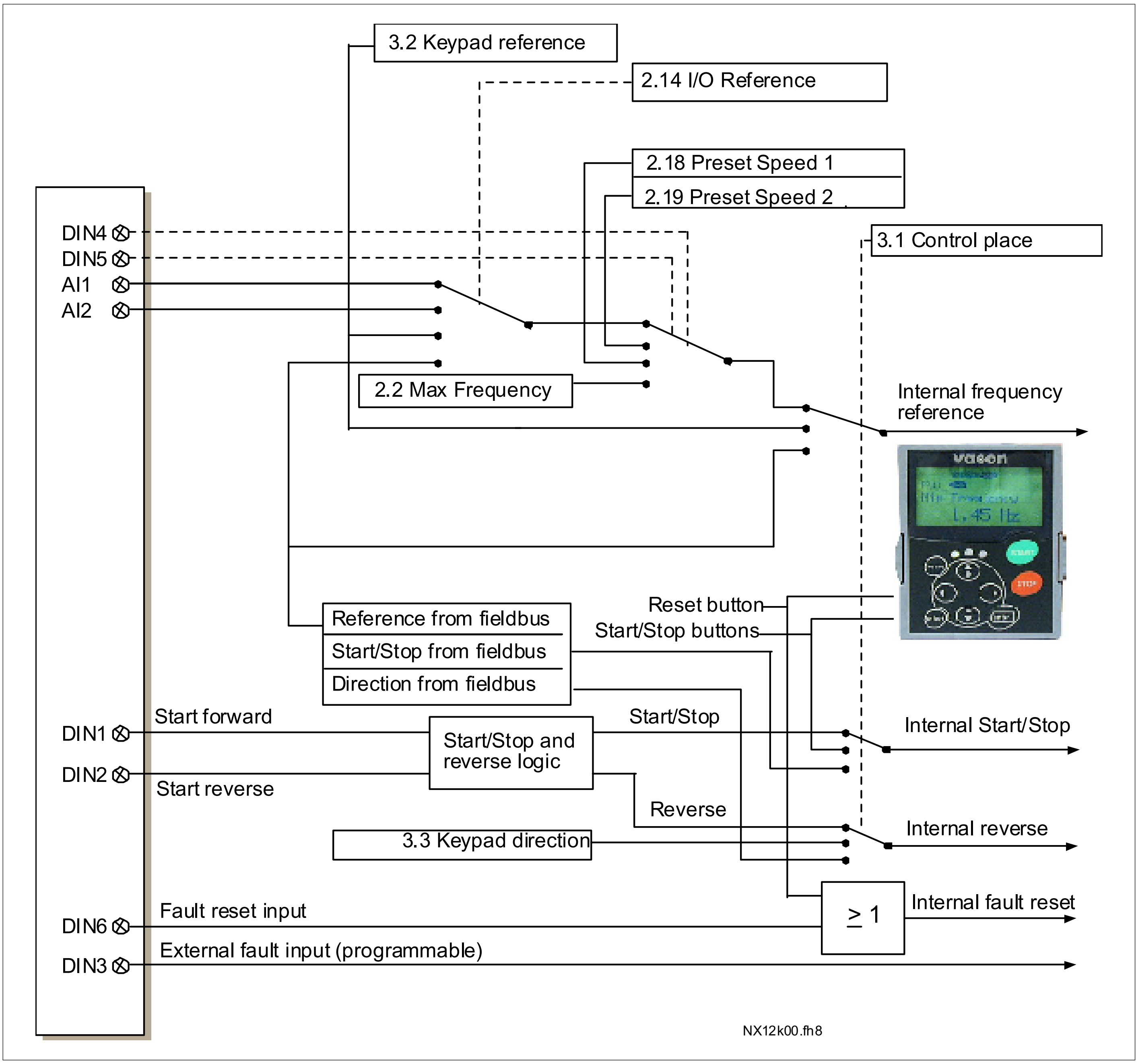


Figure 1-1. Control signal logic of the Basic Application

1.4 Basic Application – Parameter lists

On the next pages you will find the lists of parameters within the respective parameter groups. The parameter descriptions are given on pages 122 to 209.

Column explanations:

Code	=	Location indication on the keypad; Shows the operator the present parameter number
Parameter	=	Name of parameter
Min	=	Minimum value of parameter
Max	=	Maximum value of parameter
Unit	=	Unit of parameter value; Given if available
Default	=	Value preset by factory
Cust	=	Customer's own setting
ID	=	ID number of the parameter
	=	Parameter value can only be changed after the frequency drive has been stopped.

1.4.1 Monitoring values (Control keypad: menu M1)

The monitoring values are the actual values of parameters and signals as well as statuses and measurements. Monitoring values cannot be edited.
See the product's User's Manual for more information.

Code	Parameter	Unit	ID	Description
V1.1	Output frequency	Hz	1	Output frequency to motor
V1.2	Frequency reference	Hz	25	Frequency reference to motor control
V1.3	Motor speed	rpm	2	Motor speed in rpm
V1.4	Motor current	A	3	
V1.5	Motor torque	%	4	Calculated shaft torque
V1.6	Motor power	%	5	Motor shaft power
V1.7	Motor voltage	V	6	
V1.8	DC link voltage	V	7	
V1.9	Unit temperature	°C	8	Heatsink temperature
V1.10	Motor temperature	%	9	Calculated motor temperature
V1.11	Voltage input	V	13	AI1
V1.12	Current input	mA	14	AI2
V1.13	DIN1, DIN2, DIN3		15	Digital input statuses
V1.14	DIN4, DIN5, DIN6		16	Digital input statuses
V1.15	DO1, RO1, RO2		17	Digital and relay output statuses
V1.16	Analogue I_{out}	mA	26	AO1
M1.17	Multimonitoring items			Displays three selectable monitoring values

Table 1-2. Monitoring values

1.4.2 Basic parameters (Control keypad: Menu M2 → G2.1)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.1	Min frequency	0,00	Par. 2.2	Hz	0,00		101	
P2.2	Max frequency	Par. 2.1	320,00	Hz	50,00		102	**NOTE**: If f_{max} > than the motor synchronous speed, check suitability for motor and drive system
P2.3	Acceleration time 1	0,1	3000,0	s	3,0		103	
P2.4	Deceleration time 1	0,1	3000,0	s	3,0		104	
P2.5	Current limit	0,1 x I_H	2 x I_H	A	I_L		107	
P2.6	Nominal voltage of the motor	180	690	V	NX2: 230V NX5: 400V NX6: 690V		110	Check the rating plate of the motor.
P2.7	Nominal frequency of the motor	8,00	320,00	Hz	50,00		111	Check the rating plate of the motor.
P2.8	Nominal speed of the motor	24	20 000	rpm	1440		112	Check the rating plate of the motor. The default applies for a 4-pole motor and a nominal size frequency drive.
P2.9	Nominal current of the motor	0,1 x I_H	2 x I_H	A	I_H		113	Check the rating plate of the motor.
P2.10	Motor cosφ	0,30	1,00		0,85		120	Check the rating plate of the motor
P2.11	Start function	0	1		0		505	**0**=Ramp **1**=Flying start
P2.12	Stop function	0	3		0		506	**0**=Coasting **1**=Ramp **2**=Ramp+Run enable coast **3**=Coast+Run enable ramp
P2.13	U/f optimisation	0	1		0		109	**0**=Not used **1**=Automatic torque boost
P2.14	I/O reference	0	3		0		117	**0**=AI1 **1**=AI2 **2**=Keypad **3**=Fieldbus
P2.15	Current reference offset	0	1		1		302	**0**= No offset, 0—20mA **1**= Offset, 4mA—20 mA
P2.16	Analogue output function	0	8		1		307	**0**=Not used **1**=Output freq. (0—f_{max}) **2**=Freq. reference (0—f_{max}) **3**=Motor speed (0—Motor nominal speed) **4**=Output current (0-I_{nMotor}) **5**=Motor torque (0—T_{nMotor}) **6**=Motor power (0—P_{nMotor}) **7**=Motor voltage (0-U_{nMotor}) **8**=DC-link volt (0—1000V)
P2.17	DIN3 function	0	7		1		301	**0**=Not used **1**=Ext. fault, closing cont. **2**=Ext. fault, opening cont. **3**=Run enable, cc **4**=Run enable, oc **5**=Force cp. to IO **6**=Force cp. to keypad **7**=Force cp. to fieldbus
P2.18	Preset speed 1	0,00	Par. 2.1.2	Hz	0,00		105	Speeds preset by operator
P2.19	Preset speed 2	0,00	Par. 2.1.2	Hz	50,00		106	Speeds preset by operator
P2.20	Automatic restart	0	1		0		731	**0**=Disabled **1**=Enabled

Table 1-3. Basic parameters G2.1

1.4.3 Keypad control (Control keypad: Menu M3)

The parameters for the selection of control place and direction on the keypad are listed below. See the Keypad control menu in the product's User's Manual.

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P3.1	Control place	1	3		1		125	**1**=I/O terminal **2**=Keypad **3**=Fieldbus
R3.2	Keypad reference	Par. 2.1	Par. 2.2	Hz				
P3.3	Direction (on keypad)	0	1		0		123	Reverse request activated from the panel
R3.4	Stop button	0	1		1		114	**0**=Limited function of Stop button **1**=Stop button always enabled

Table 1-4. Keypad control parameters, M3

1.4.4 System menu (Control keypad: Menu M6)

For parameters and functions related to the general use of the frequency drive, such as application and language selection, customised parameter sets or information about the hardware and software, see the product's User's Manual.

1.4.5 Expander boards (Control keypad: Menu M7)

The **M7** menu shows the expander and option boards attached to the control board and board-related information. For more information, see the product's User's Manual.

2. STANDARD APPLICATION

2.1 Introduction

Select the Standard Application in menu **M6** on page *S6.2*.

The Standard Application is typically used in pump and fan applications and conveyors for which the Basic Application is too limited but where no special features are needed.

- The Standard Application has the same I/O signals and the same control logic as the Basic Application.

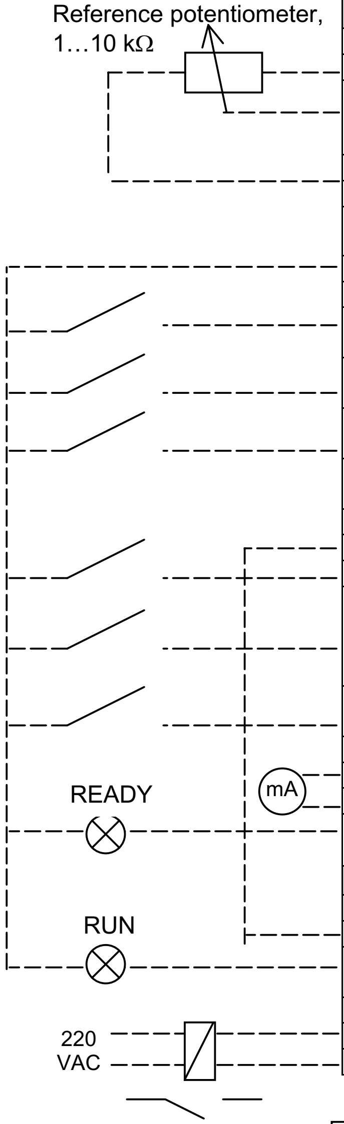
- Digital input DIN3 and all the outputs are freely programmable.

Additional functions:

- Programmable Start/Stop and Reverse signal logic
- Reference scaling
- One frequency limit supervision
- Second ramps and S-shape ramp programming
- Programmable start and stop functions
- DC-brake at stop
- One prohibit frequency area
- Programmable U/f curve and switching frequency
- Autorestart
- Motor thermal and stall protection: Programmable action; off, warning, fault

The parameters of the Standard Application are explained in Chapter 8 of this manual. The explanations are arranged according to the individual ID number of the parameter.

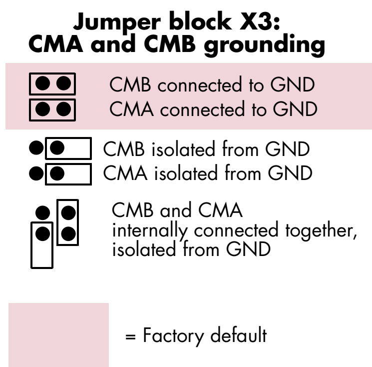
2.2 Control I/O



Terminal		Signal	Description
OPT-A1			
1	+10V$_{ref}$	Reference output	Voltage for potentiometer, etc.
2	AI1+	Analogue input, voltage range 0—10V DC	Voltage input frequency reference
3	AI1-	I/O Ground	Ground for reference and controls
4	AI2+	Analogue input, current range 0—20mA	Current input frequency reference
5	AI2-		
6	+24V	Control voltage output	Voltage for switches, etc. max 0.1 A
7	GND	I/O ground	Ground for reference and controls
8	DIN1	Start forward (programmable)	Contact closed = start forward
9	DIN2	Start reverse (programmable)	Contact closed = start reverse
10	DIN3	External fault input (programmable)	Contact open = no fault Contact closed = fault
11	CMA	Common for DIN 1—DIN 3	Connect to GND or +24V
12	+24V	Control voltage output	Voltage for switches (see #6)
13	GND	I/O ground	Ground for reference and controls
14	DIN4	Multi-step speed select 1	DIN4 / DIN5 / Frequency ref.
15	DIN5	Multi-step speed select 2	Open / Open / Ref.U$_{in}$ Closed / Open / Multi-step ref.1 Open / Closed / Multi-step ref.2 Closed / Closed / Ref.I$_{in}$
16	DIN6	Fault reset	Contact open = no action Contact closed = fault reset
17	CMB	Common for DIN4—DIN6	Connect to GND or +24V
18	AO1+	Output frequency	Programmable
19	AO1-	Analogue output	Range 0—20 mA/R$_L$, max. 500Ω
20	DO1	Digital output READY	Programmable Open collector, I≤50mA, U≤48 VDC
OPT-A2			
21	RO1	Relay output 1	Programmable
22	RO1	RUN	
23	RO1		
24	RO2	Relay output 2	Programmable
25	RO2	FAULT	
26	RO2		

Table 2-1. Standard application default I/O configuration.

Note: See jumper selections below. More information in the product's User's Manual.



2.3 Control signal logic in Standard Application

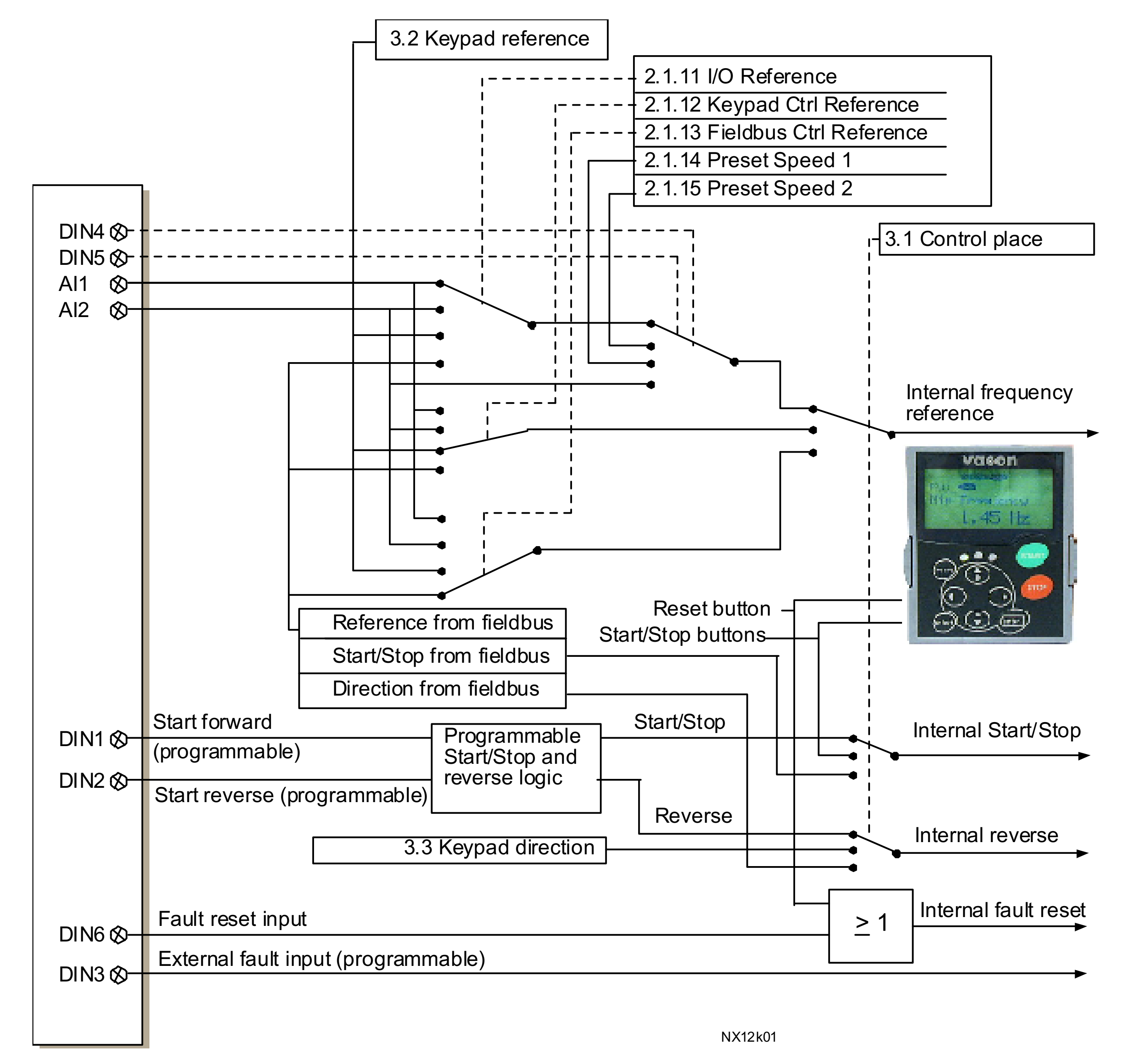


Figure 2-1. Control signal logic of the Standard Application

2.4 Standard Application – Parameter lists

On the next pages you will find the lists of parameters within the respective parameter groups. The parameter descriptions are given on pages 122 to 209. The descriptions are arranged according to the **ID number** of the parameter.

Column explanations:

Code	=	Location indication on the keypad; Shows the operator the present parameter number
Parameter	=	Name of parameter
Min	=	Minimum value of parameter
Max	=	Maximum value of parameter
Unit	=	Unit of parameter value; Given if available
Default	=	Value preset by factory
Cust	=	Customer's own setting
ID	=	ID number of the parameter
	=	In parameter row: Use TTF method to program these parameters.
	=	On parameter code: Parameter value can only be changed after the frequency drive has been stopped.

2.4.1 Monitoring values (Control keypad: menu M1)

The monitoring values are the actual values of parameters and signals as well as statuses and measurements. Monitoring values cannot be edited.
See the product's User's Manual for more information.

Code	Parameter	Unit	ID	Description
V1.1	Output frequency	Hz	1	Output frequency to motor
V1.2	Frequency reference	Hz	25	Frequency reference to motor control
V1.3	Motor speed	rpm	2	Motor speed in rpm
V1.4	Motor current	A	3	
V1.5	Motor torque	%	4	Calculated shaft torque
V1.6	Motor power	%	5	Motor shaft power
V1.7	Motor voltage	V	6	
V1.8	DC link voltage	V	7	
V1.9	Unit temperature	°C	8	Heatsink temperature
V1.10	Motor temperature	%	9	Calculated motor temperature
V1.11	Analogue input 1	V	13	AI1
V1.12	Analogue input 2	mA	14	AI2
V1.13	DIN1, DIN2, DIN3		15	Digital input statuses
V1.14	DIN4, DIN5, DIN6		16	Digital input statuses
V1.15	DO1, RO1, RO2		17	Digital and relay output statuses
V1.16	Analogue I_{out}	mA	26	AO1
M1.17	Monitoring items			Displays three selectable monitoring values

Table 2-2. Monitoring values

2.4.2 Basic parameters (Control keypad: Menu M2 → G2.1)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.1.1	Min frequency	0,00	Par. 2.1.2	Hz	0,00		101	
P2.1.2	Max frequency	Par. 2.1.1	320,00	Hz	50,00		102	**NOTE**: If f_{max} > than the motor synchronous speed, check suitability for motor and drive system
P2.1.3	Acceleration time 1	0,1	3000,0	s	3,0		103	
P2.1.4	Deceleration time 1	0,1	3000,0	s	3,0		104	
P2.1.5	Current limit	0,1 x I_H	2 x I_H	A	I_L		107	
P2.1.6	Nominal voltage of the motor	180	690	V	NX2: 230V NX5: 400V NX6: 690V		110	
P2.1.7	Nominal frequency of the motor	8,00	320,00	Hz	50,00		111	Check the rating plate of the motor
P2.1.8	Nominal speed of the motor	24	20 000	rpm	1440		112	The default applies for a 4-pole motor and a nominal size frequency drive.
P2.1.9	Nominal current of the motor	0,1 x I_H	2 x I_H	A	I_H		113	Check the rating plate of the motor.
2.1.10	Motor cosφ	0,30	1,00		0,85		120	Check the rating plate of the motor
2.1.11	I/O reference	0	3		0		117	**0**=AI1 **1**=AI2 **2**=Keypad **3**=Fieldbus
2.1.12	Keypad control reference	0	3		2		121	**0**=AI1 **1**=AI2 **2**=Keypad **3**=Fieldbus
2.1.13	Fieldbus control reference	0	3		3		122	**0**=AI1 **1**=AI2 **2**=Keypad **3**=Fieldbus
2.1.14	Preset speed 1	0,00	Par. 2.1.2	Hz	10,00		105	Speeds preset by operator
2.1.15	Preset speed 2	0,00	Par. 2.1.2	Hz	50,00		106	

Table 2-3. Basic parameters G2.1

2.4.3 *Input signals (Control keypad: Menu M2 → G2.2)*

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.2.1	Start/Stop logic	0	6		0		300	**DIN1** / **DIN2** Start fwd / Start rvs **0** Start/Stop / Rvs/Fwd **1** Start/Stop / Run enable **2** Start pulse / Stop pulse **3** Fwd* / Rvs* **4** Start*/Stop / Rvs/Fwd **5** Start*/Stop / Run enable **6**
P2.2.2	DIN3 function	0	8		1		301	**0**=Not used **1**=Ext. fault, closing cont. **2**=Ext. fault, opening cont. **3**=Run enable **4**=Acc./Dec. time select. **5**=Force cp. to IO **6**=Force cp. to keypad **7**=Force cp. to fieldbus **8**=Reverse
P2.2.3	Current reference offset	0	1		1		302	**0**=0—20mA **1**=4—20mA
P2.2.4	Reference scaling minimum value	0,00	320,00	Hz	0,00		303	Selects the frequency that corresponds to the min. reference signal 0,00 = No scaling
P2.2.5	Reference scaling maximum value	0,00	320,00	Hz	0,00		304	Selects the frequency that corresponds to the max. reference signal 0,00 = No scaling
P2.2.6	Reference inversion	0	1		0		305	**0** = Not inverted **1** = Inverted
P2.2.7	Reference filter time	0,00	10,00	s	0,10		306	**0** = No filtering
P2.2.8	AI1 signal selection				A.1		377	TTF programming method used. See page 65
P2.2.9	AI2 signal selection				A.2		388	TTF programming method used. See page 65.

Table 2-4. Input signals, G2.2

* = Rising edge required to start

2.4.4 Output signals (Control keypad: Menu M2 → G2.3)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.3.1	Analogue output 1 signal selection	0			A.1		464	TTF programming method used. See page 65.
P2.3.2	Analogue output function	0	8		1		307	**0**=Not used **1**=Output freq. (0—f_{max}) **2**=Freq. reference (0—f_{max}) **3**=Motor speed (0—Motor nominal speed) **4**=Motor current (0—I_{nMotor}) **5**=Motor torque (0—T_{nMotor}) **6**=Motor power (0—P_{nMotor}) **7**=Motor voltage (0--U_{nMotor}) **8**=DC-link volt (0—1000V)
P2.3.3	Analogue output filter time	0,00	10,00	s	1,00		308	**0**=No filtering
P2.3.4	Analogue output inversion	0	1		0		309	**0**=Not inverted **1**=Inverted
P2.3.5	Analogue output minimum	0	1		0		310	**0**=0 mA **1**=4 mA
P2.3.6	Analogue output scale	10	1000	%	100		311	
P2.3.7	Digital output 1 function	0	16		1		312	**0**=Not used **1**=Ready **2**=Run **3**=Fault **4**=Fault inverted **5**=FC overheat warning **6**=Ext. fault or warning **7**=Ref. fault or warning **8**=Warning **9**=Reversed **10**=Preset speed 1 **11**=At speed **12**=Mot. regulator active **13**=OP freq. limit 1 superv. **14**=Control place: IO **15**=Thermistor fault/warng **16**=Fieldbus input data
P2.3.8	RO1 function	0	16		2		313	As parameter 2.3.7
P2.3.9	RO2 function	0	16		3		314	As parameter 2.3.7
P2.3.10	Output frequency limit 1 supervision	0	2		0		315	**0**=No limit **1**=Low limit supervision **2**=High limit supervision
P2.3.11	Output frequency limit 1; Supervised value	0,00	320,00	Hz	0,00		316	
P2.3.12	Analogue output 2 signal selection	0			0.1		471	TTF programming method used. See page 65.
P2.3.13	Analogue output 2 function	0	8		4		472	As parameter 2.3.2
P2.3.14	Analogue output 2 filter time	0,00	10,00	s	1,00		473	**0**=No filtering
P2.3.15	Analogue output 2 inversion	0	1		0		474	**0**=Not inverted **1**=Inverted
P2.3.16	Analogue output 2 minimum	0	1		0		475	**0**=0 mA **1**=4 mA
P2.3.17	Analogue output 2 scaling	10	1000	%	100		476	

Table 2-5. Output signals, G2.3

2.4.5 Drive control parameters (Control keypad: Menu M2 → G2.4)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.4.1	Ramp 1 shape	0,0	10,0	s	0,1		500	**0**=Linear **>0**=S-curve ramp time
P2.4.2	Ramp 2 shape	0,0	10,0	s	0,0		501	**0**=Linear **>0**=S-curve ramp time
P2.4.3	Acceleration time 2	0,1	3000,0	s	10,0		502	
P2.4.4	Deceleration time 2	0,1	3000,0	s	10,0		503	
P2.4.5	Brake chopper	0	4		0		504	**0**=Disabled **1**=Used when running **2**=External brake chopper **3**=Used when stopped/ running **4**=Used when running (no testing)
P2.4.6	Start function	0	1		0		505	**0**=Ramp **1**=Flying start
P2.4.7	Stop function	0	3		0		506	**0**=Coasting **1**=Ramp **2**=Ramp+Run enable coast **3**=Coast+Run enable ramp
P2.4.8	DC braking current	0,00	I_L	A	0,7 x I_H		507	
P2.4.9	DC braking time at stop	0,00	600,00	s	0,00		508	**0**=DC brake is off at stop
P2.4.10	Frequency to start DC braking during ramp stop	0,10	10,00	Hz	1,50		515	
P2.4.11	DC braking time at start	0,00	600,00	s	0,00		516	**0**=DC brake is off at start
P2.4.12	Flux brake	0	1		0		520	**0**=Off **1**=On
P2.4.13	Flux braking current	0,00	I_L	A	I_H		519	

Table 2-6. Drive control parameters, G2.4

2.4.6 Prohibit frequency parameters (Control keypad: Menu M2 → G2.5)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.5.1	Prohibit frequency range 1 low limit	0,00	320,00	Hz	0,00		509	
P2.5.2	Prohibit frequency range 1 high limit	0,00	320,00	Hz	0,0		510	
P2.5.3	Prohibit acc./dec. ramp	0,1	10,0	x	1,0		518	

Table 2-7. Prohibit frequency parameters, G2.5

2.4.7 Motor control parameters (Control keypad: Menu M2 → G2.6)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.6.1	Motor control mode	0	1/3		0		600	**0**=Frequency control **1**=Speed control **Additionally for NXP:** **2**=Not used **3**=Closed loop speed ctrl
P2.6.2	U/f optimisation	0	1		0		109	**0**=Not used **1**=Automatic torque boost
P2.6.3	U/f ratio selection	0	3		0		108	**0**=Linear **1**=Squared **2**=Programmable **3**=Linear with flux optim.
P2.6.4	Field weakening point	8,00	320,00	Hz	50,00		602	
P2.6.5	Voltage at field weakening point	10,00	200,00	%	100,00		603	n% x U_{nmot}
P2.6.6	U/f curve midpoint frequency	0,00	par. P2.6.4	Hz	50,00		604	
P2.6.7	U/f curve midpoint voltage	0,00	100,00	%	100,00		605	n% x U_{nmot} Parameter max. value = par. 2.6.5
P2.6.8	Output voltage at zero frequency	0,00	40,00	%	Varies		606	n% x U_{nmot}
P2.6.9	Switching frequency	1,0	Varies	kHz	Varies		601	See Table 8-12 for exact values
P2.6.10	Overvoltage controller	0	2		1		607	**0**=Not used **1**=Used (no ramping) **2**=Used (ramping)
P2.6.11	Undervoltage controller	0	1		1		608	**0**=Not used **1**=Used
P2.6.12	Load drooping	0,00	100,00	%	0,00		620	
P2.6.13	Identification	0	1/2		0		631	**0**=No action **1**=Identification w/o run **2**=Identification with run
Closed Loop parameter group 2.6.14								
P2.6.14.1	Magnetizing current	0,00	100,00	A	0,00		612	
P2.6.14.2	Speed control P gain	1	1000		30		613	
P2.6.14.3	Speed control I time	0,0	500,0	ms	30,0		614	
P2.6.14.5	Acceleration compensation	0,00	300,00	s	0,00		626	
P2.6.14.6	Slip adjust	0	500	%	100		619	
P2.6.14.7	Magnetizing current at start	0,00	I_L	A	0,00		627	
P2.6.14.8	Magnetizing time at start	0	60000	ms	0		628	
P2.6.14.9	0-speed time at start	0	32000	ms	100		615	
P2.6.14.10	0-speed time at stop	0	32000	ms	100		616	
P2.6.14.11	Start-up torque	0	3		0		621	**0**=Not used **1**=Torque memory **2**=Torque reference **3**=Start-up torque fwd/rev
P2.6.14.12	Start-up torque FWD	–300,0	300,0	%	0,0		633	
P2.6.14.13	Start-up torque REV	–300,0	300,0	%	0,0		634	
P2.6.14.15	Encoder filter time	0,0	100,0	ms	0,0		618	
P2.6.14.17	Current control P gain	0,00	100,00	%	40,00		617	

Table 2-8. Motor control parameters, G2.6

2.4.8 Protections (Control keypad: Menu M2 → G2.7)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.7.1	Response to 4mA reference fault	0	5		0		700	**0**=No response **1**=Warning **2**=Warning+Previous Freq. **3**=Wrng+PresetFreq 2.7.2 **4**=Fault,stop acc. to 2.4.7 **5**=Fault,stop by coasting
P2.7.2	4mA reference fault frequency	0,00	Par. 2.1.2	Hz	0,00		728	
P2.7.3	Response to external fault	0	3		2		701	**0**=No response **1**=Warning **2**=Fault,stop acc. to 2.4.7 **3**=Fault,stop by coasting
P2.7.4	Input phase supervision	0	3		0		730	
P2.7.5	Response to undervoltage fault	0	1		0		727	**0**=Fault stored in history **1**=Fault not stored
P2.7.6	Output phase supervision	0	3		2		702	**0**=No response **1**=Warning **2**=Fault,stop acc. to 2.4.7 **3**=Fault,stop by coasting
P2.7.7	Ground fault protection	0	3		2		703	
P2.7.8	Thermal protection of the motor	0	3		2		704	
P2.7.9	Motor ambient temperature factor	–100,0	100,0	%	0,0		705	
P2.7.10	Motor cooling factor at zero speed	0,0	150,0	%	40,0		706	
P2.7.11	Motor thermal time constant	1	200	min	Varies		707	
P2.7.12	Motor duty cycle	0	100	%	100		708	
P2.7.13	Stall protection	0	3		0		709	**0**=No response **1**=Warning **2**=Fault,stop acc. to 2.4.7 **3**=Fault,stop by coasting
P2.7.14	Stall current	0,00	2 x I_H	A	I_H		710	
P2.7.15	Stall time limit	1,00	120,00	s	15,00		711	
P2.7.16	Stall frequency limit	1,0	Par. 2.1.2	Hz	25,0		712	
P2.7.17	Underload protection	0	3		0		713	**0**=No response **1**=Warning **2**=Fault,stop acc. to 2.4.7 **3**=Fault,stop by coasting
P2.7.18	Field weakening area load	10	150	%	50		714	
P2.7.19	Zero frequency load	5,0	150,0	%	10,0		715	
P2.7.20	Underload protection time limit	2	600	s	20		716	
P2.7.21	Response to thermistor fault	0	3		2		732	**0**=No response **1**=Warning **2**=Fault,stop acc. to 2.4.7 **3**=Fault,stop by coasting
P2.7.22	Response to fieldbus fault	0	3		2		733	See P2.7.21
P2.7.23	Response to slot fault	0	3		2		734	See P2.7.21

Table 2-9. Protections, G2.7

2.4.9 Autorestart parameters (Control keypad: Menu M2 → G2.8)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.8.1	Wait time	0,10	10,00	s	0,50		717	
P2.8.2	Trial time	0,00	60,00	s	30,00		718	
P2.8.3	Start function	0	2		0		719	**0**=Ramp **1**=Flying start **2**=According to par. 2.4.6
P2.8.4	Number of tries after undervoltage trip	0	10		0		720	
P2.8.5	Number of tries after overvoltage trip	0	10		0		721	
P2.8.6	Number of tries after overcurrent trip	0	3		0		722	
P2.8.7	Number of tries after 4mA reference trip	0	10		0		723	
P2.8.8	Number of tries after motor temperature fault trip	0	10		0		726	
P2.8.9	Number of tries after external fault trip	0	10		0		725	
P2.8.10	Number of tries after underload fault trip	0	10		0		738	

Table 2-10. Autorestart parameters, G2.8

2.4.10 Keypad control (Control keypad: Menu M3)

The parameters for the selection of control place and direction on the keypad are listed below. See the Keypad control menu in the product's User's Manual.

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

Table 2-11. Keypad control parameters, M3

2.4.11 System menu (Control keypad: M6)

For parameters and functions related to the general use of the frequency drive, such as application and language selection, customised parameter sets or information about the hardware and software, see the product's User's Manual.

2.4.12 Expander boards (Control keypad: Menu M7)

The **M7** menu shows the expander and option boards attached to the control board and board-related information. For more information, see the product's User's Manual.

3. LOCAL/REMOTE CONTROL APPLICATION

3.1 Introduction

Select the Local/Remote Control Application in menu **M6** on page *S6.2*.

Utilising the Local/Remote Control Application it is possible to have two different control places. For each control place the frequency reference can be selected from either the control keypad, I/O terminal or fieldbus. The active control place is selected with the digital input DIN6.

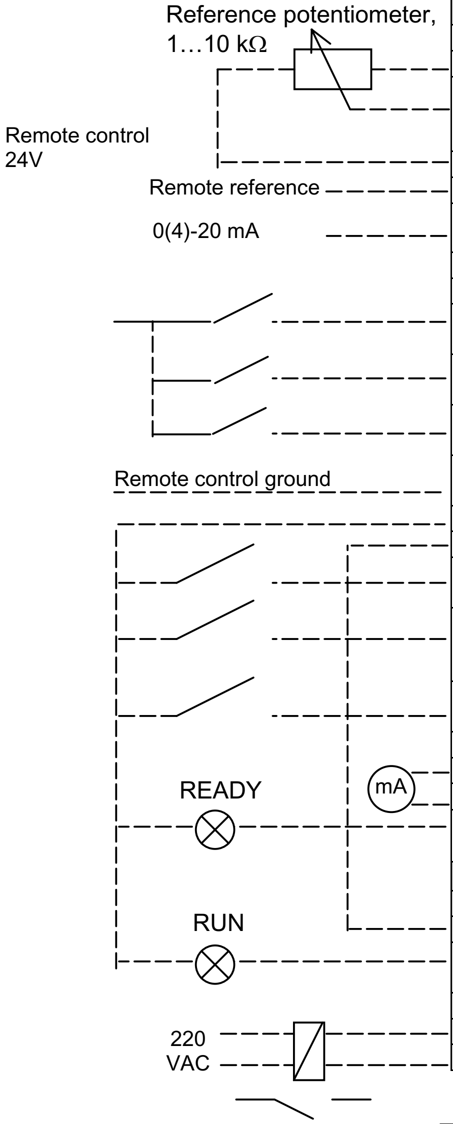
- All outputs are freely programmable.

Additional functions:

- Programmable Start/Stop and Reverse signal logic
- Reference scaling
- One frequency limit supervision
- Second ramps and S-shape ramp programming
- Programmable start and stop functions
- DC-brake at stop
- One prohibit frequency area
- Programmable U/f curve and switching frequency
- Autorestart
- Motor thermal and stall protection: Programmable action; off, warning, fault

The parameters of the Local/Remote Control Application are explained in Chapter 8 of this manual. The explanations are arranged according to the individual ID number of the parameter.

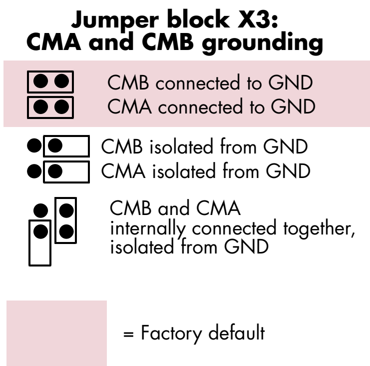
3.2 Control I/O



OPT-A1			
Terminal		Signal	Description
1	+10V$_{ref}$	Reference output	Voltage for potentiometer, etc.
2	AI1+	Analogue input, voltage range 0—10V DC	Place B frequency reference range 0-10 V DC
3	AI1-	I/O Ground	Ground for reference and controls
4	AI2+	Analogue input, current range 0—20mA	Place A frequency reference, range 0-20 mA
5	AI2-		
6	+24V	Control voltage output	Voltage for switches, etc. max 0.1 A
7	GND	I/O ground	Ground for reference and controls
8	DIN1	Place A start forward (programmable)	Contact closed = start forward
9	DIN2	Place A start reverse (programmable)	Contact closed = start reverse
10	DIN3	External fault input (programmable)	Contact open = no fault Contact closed = fault
11	CMA	Common for DIN 1—DIN 3	Connect to GND or +24V
12	+24V	Control voltage output	Voltage for switches (see #6)
13	GND	I/O ground	Ground for reference and controls
14	DIN4	Place B: Start forward (programmable)	Contact closed = start forward
15	DIN5	Place B: Start reverse (programmable)	Contact closed = start reverse
16	DIN6	Place A/B selection	Contact open = place A is active Contact closed = Place B is active
17	CMB	Common for DIN4—DIN6	Connect to GND or +24V
18	AO1+	Output frequency	Programmable
19	AO1-	Analogue output	Range 0—20 mA/R$_L$, max. 500Ω
20	DO1	Digital output READY	Programmable Open collector, I≤50mA, U≤48 VDC
OPT-A2			
21	RO1	Relay output 1 RUN	Programmable
22	RO1		
23	RO1		
24	RO2	Relay output 2 FAULT	Programmable
25	RO2		
26	RO2		

Table 3-1. Local/Remote control application default I/O configuration.

Note: See jumper selections below. More information in the product's User's Manual.



Automation and Control Solutions
Honeywell
1985 Douglas Drive North
Golden Valley, MIN 55422

Honeywell Limited-Honeywell Limitée
35 Dynamic Drive
Scarborough, Ontario
MIV 4Z9

3.3 Control signal logic in Local/Remote Application

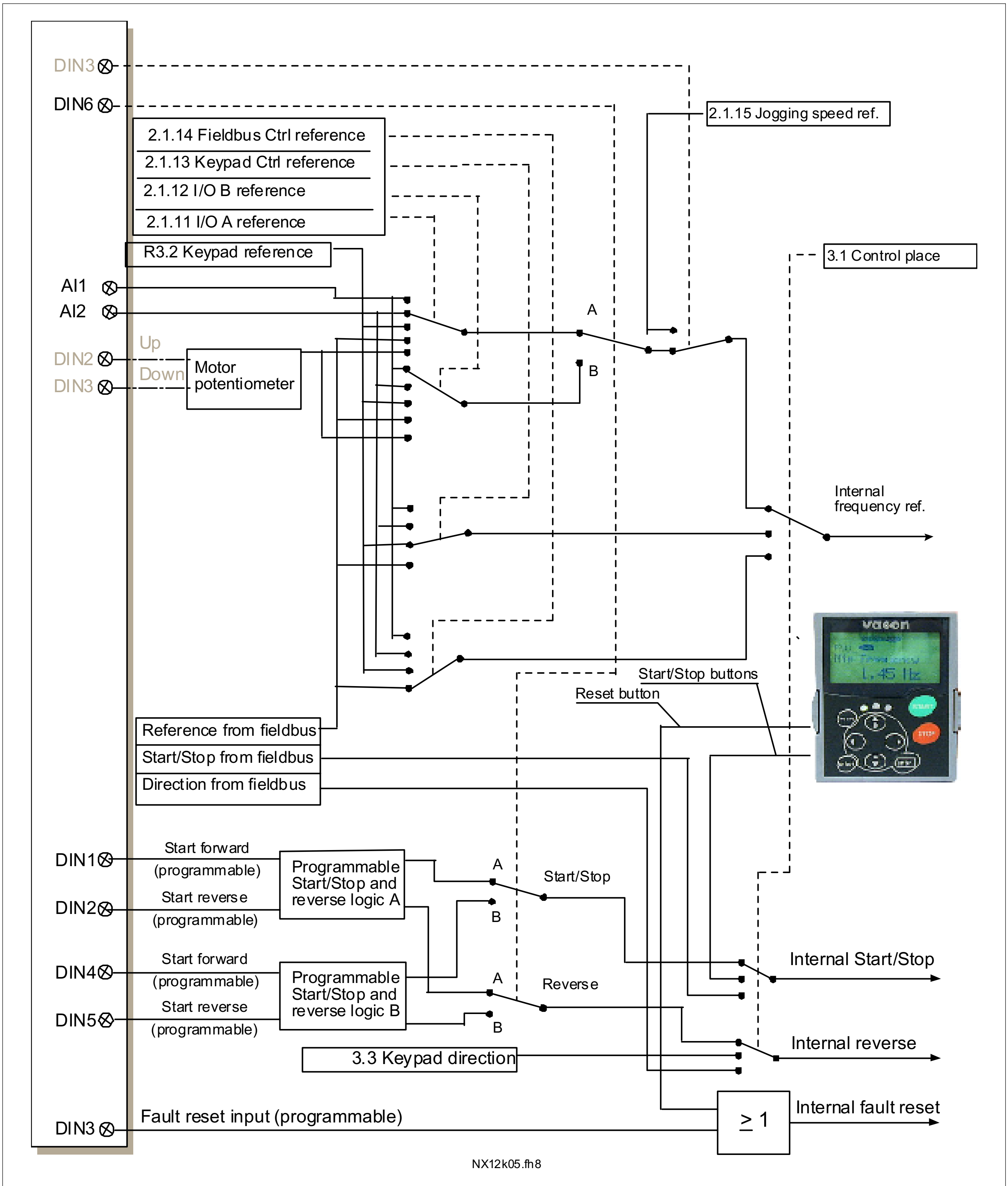


Figure 3-1. Control signal logic of the Local/Remote Control Application

3.4 Local/Remote control application – Parameter lists

On the next pages you will find the lists of parameters within the respective parameter groups. The parameter descriptions are given on pages 122 to 209.

Column explanations:

Code	=	Location indication on the keypad; Shows the operator the present parameter number
Parameter	=	Name of parameter
Min	=	Minimum value of parameter
Max	=	Maximum value of parameter
Unit	=	Unit of parameter value; Given if available
Default	=	Value preset by factory
Cust	=	Customer's own settings
ID	=	ID number of the parameter
	=	In parameter row: Use TTF method to program these parameters.
	=	On parameter number: Parameter value can only be changed after the frequency drive has been stopped.

3.4.1 Monitoring values (Control keypad: menu M1)

The monitoring values are the actual values of parameters and signals as well as statuses and measurements. Monitoring values cannot be edited. See the product's User's Manual for more information.

Code	Parameter	Unit	ID	Description
V1.1	Output frequency	Hz	1	Output frequency to motor
V1.2	Frequency reference	Hz	25	Frequency reference to motor control
V1.3	Motor speed	rpm	2	Motor speed in rpm
V1.4	Motor current	A	3	
V1.5	Motor torque	%	4	Calculated shaft torque
V1.6	Motor power	%	5	Motor shaft power
V1.7	Motor voltage	V	6	
V1.8	DC link voltage	V	7	
V1.9	Unit temperature	°C	8	Heatsink temperature
V1.10	Motor temperature	%	9	Calculated motor temperature
V1.11	Analogue input 1	V	13	AI1
V1.12	Analogue input 2	mA	14	AI2
V1.13	DIN1, DIN2, DIN3		15	Digital input statuses
V1.14	DIN4, DIN5, DIN6		16	Digital input statuses
V1.15	DO1, RO1, RO2		17	Digital and relay output statuses
V1.16	Analogue I_{out}	mA	26	AO1
M1.17	Multimonitoring items			Displays three selectable monitoring values

Table 3-2. Monitoring values

3.4.2 Basic parameters (Control keypad: Menu M2 → G2.1)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.1.1	Min frequency	0,00	Par. 2.1.2	Hz	0,00		101	
P2.1.2	Max frequency	Par. 2.1.1	320,00	Hz	50,00		102	**NOTE**: If f_{max} > than the motor synchronous speed, check suitability for motor and drive system
P2.1.3	Acceleration time 1	0,1	3000,0	s	3,0		103	
P2.1.4	Deceleration time 1	0,1	3000,0	s	3,0		104	
P2.1.5	Current limit	0,1 x I_H	2 x I_H	A	I_L		107	
P2.1.6	Nominal voltage of the motor	180	690	V	NX2: 230V NX5: 400V NX6: 690V		110	
P2.1.7	Nominal frequency of the motor	8,00	320,00	Hz	50,00		111	Check the rating plate of the motor
P2.1.8	Nominal speed of the motor	24	20 000	rpm	1440		112	The default applies for a 4-pole motor and a nominal size frequency drive.
P2.1.9	Nominal current of the motor	0,1 x I_H	2 x I_H	A	I_H		113	Check the rating plate of the motor.
P2.1.10	Motor cosφ	0,30	1,00		0,85		120	Check the rating plate of the motor
P2.1.11	I/O A reference	0	4		1		117	**0**=AI1 **1**=AI2 **2**=Keypad **3**=Fieldbus **4**=Motor potentiometer
P2.1.12	I/O B reference	0	4		0		131	**0**=AI1 **1**=AI2 **2**=Keypad **3**=Fieldbus **4**=Motor potentiometer
P2.1.13	Keypad control reference	0	3		2		121	**0**=AI1 **1**=AI2 **2**=Keypad **3**=Fieldbus
P2.1.14	Fieldbus control reference	0	3		3		122	**0**=AI1 **1**=AI2 **2**=Keypad **3**=Fieldbus
P2.1.15	Jogging speed reference	0,00	Par. 2.1.2	Hz	0,00		124	

Table 3-3. Basic parameters G2.1

3.4.3 Input signals (Control keypad: Menu M2 → G2.2)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.2.1	Place A Start/Stop logic selection	0	8		0		300	**DIN1** / **DIN2** **0** Start fwd / Start rvs **1** Start/Stop / Reverse **2** Start/Stop / Run enable **3** Start pulse / Stop pulse **4** Start fwd / Mot.pot.UP **5** Fwd* / Rvs* **6** Start*/Stop / Rvs/Fwd **7** Start*/Stop / Run enable **8** Start fwd* / Mot.pot.UP
P2.2.2	DIN3 function	0	13		1		301	**0**=Not used **1**=Ext. fault, closing cont. **2**=Ext. fault, opening cont. **3**=Run enable **4**=Acc./Dec. time select. **5**=Force cp. to IO **6**=Force cp. to keypad **7**=Force cp. to fieldbus **8**=Reverse **9**=Jogging speed **10**=Fault reset **11**=Acc./Dec. operation prohibit **12**=DC Braking command **13**=Motor potentiometer DOWN
P2.2.3	AI1 signal selection	0			A.1		377	TTF programming method used. See page 65.
P2.2.4	AI1 signal range	0	2		0		320	**0**=0…100%** **1**=20…100%** **2**=Custom setting range**
P2.2.5	AI1 custom setting minimum	-160,00	160,00	%	0,00		321	Analogue input 1 scale minimum
P2.2.6	AI1 custom setting maximum	-160,00	160,00	%	100,0		322	Analogue input 1 scale maximum
P2.2.7	AI1 signal inversion	0	1		0		323	Analogue input 1 reference inversion yes/no
P2.2.8	AI1 signal filter time	0,00	10,00	s	0,10		324	Analogue input 1 reference filter time, constant
P2.2.9	AI2 signal selector	0			A.2		388	TTF programming method used. See page 65.
P2.2.10	AI2 signal range	0	2		1		325	**0**=0 – 20 mA** **1**=4 – 20 mA** **2**=custom setting range
P2.2.11	AI2 custom setting minimum	-160,00	160,00	%	0,00		326	Analogue input 2 scale minimum
P2.2.12	AI2 custom setting maximum	-160,00	160,00	%	100,00		327	Analogue input 2 scale maximum
P2.2.13	AI2 signal inversion	0	1		0		328	Analogue input 2 reference inversion yes/no
P2.2.14	AI2 signal filter time	0,00	10,00	s	0,10		329	Analogue input 2 reference filter time, constant

P2.2.15	Place B Start/Stop logic selection	0	6		0		363	**DIN4** / **DIN5** **0** Start fwd / Start rvs **1** Start/Stop / Rvs/Fwd **2** Start/Stop / Run enable **3** Start pulse / Stop pulse **4** Fwd* / Rvs* **5** Start*/Stop / Rvs/Fwd **6** Start*/Stop / Run enable
P2.2.16	Place A Reference scaling minimum value	0,00	320,00	Hz	0,00		303	Selects the frequency that corresponds to the min. reference signal
P2.2.17	Place A Reference scaling maximum value	0,00	320,00	Hz	0,00		304	Selects the frequency that corresponds to the max. reference signal 0,00 = No scaling >0 = scaled max. value
P2.2.18	Place B Reference scaling minimum value	0,00	320,00	Hz	0,00		364	Selects the frequency that corresponds to the min. reference signal
P2.2.19	Place B Reference scaling maximum value	0,00	320,00	Hz	0,00		365	Selects the frequency that corresponds to the max. reference signal 0,00 = No scaling >0 = scaled max. value
P2.2.20	Free analogue input, signal selection	0	2		0		361	**0**=Not used **1**=U_{in} (analogue volt. input **2**=I_{in} (analogue curr. input)
P2.2.21	Free analogue input, function	0	4		0		362	**0**=No function **1**=Reduces current limit (par. 2.1.5) **2**=Reduces DC braking current **3**=Reduces accel. and decel. times **4**=Reduces torque supervision limit
P2.2.22	Motor potentiometer ramp time	0,1	2000,0	Hz/s	10,0		331	
P2.2.23	Motor potentiometer frequency reference memory reset	0	2		1		367	**0**=No reset **1**=Reset if stopped or powered down **2**=Reset if powered down
P2.2.24	Start pulse memory	0	1		0		498	**0**=Run state not copied **1**=Run state copied

Table 3-4. Input signals, G2.2

* = Rising edge required to start
** = Remember to place jumpers of block X2 accordingly. See the product's User's Manual.

3.4.4 Output signals (Control keypad: Menu M2 → G2.3)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.3.1	AO1 signal selection	0			A.1		464	TTF programming method used. See page 65.
P2.3.2	Analogue output function	0	8		1		307	**0**=Not used **1**=Output freq. (0—f_{max}) **2**=Freq. reference (0—f_{max}) **3**=Motor speed (0—Motor nominal speed) **4**=Motor current (0—I_{nMotor}) **5**=Motor torque (0—T_{nMotor}) **6**=Motor power (0—P_{nMotor}) **7**=Motor voltage (0-U_{nMotor}) **8**=DC-link volt (0—1000V)
P2.3.3	Analogue output filter time	0,00	10,00	s	1,00		308	**0**=No filtering
P2.3.4	Analogue output inversion	0	1		0		309	**0**=Not inverted **1**=Inverted
P2.3.5	Analogue output minimum	0	1		0		310	**0**=0 mA **1**=4 mA
P2.3.6	Analogue output scale	10	1000	%	100		311	
P2.3.7	Digital output 1 function	0	22		1		312	**0**=Not used **1**=Ready **2**=Run **3**=Fault **4**=Fault inverted **5**=FC overheat warning **6**=Ext. fault or warning **7**=Ref. fault or warning **8**=Warning **9**=Reversed **10**=Jogging spd selected **11**=At speed **12**=Mot. regulator active **13**=OP freq.limit superv. 1 **14**=OP freq.limit superv. 2 **15**=Torque limit superv. **16**=Ref. limit superv. **17**=Ext. brake control **18**= Control place: IO **19**=FC temp. limit superv. **20**=Unrequested rotation direction **21**=Ext. brake control inverted **22**=Thermistor fault/warn.
P2.3.8	Relay output 1 function	0	22		2		313	As parameter 2.3.7
P2.3.9	Relay output 2 function	0	22		3		314	As parameter 2.3.7
P2.3.10	Output frequency limit 1 supervision	0	2		0		315	**0**=No limit **1**=Low limit supervision **2**=High limit supervision
P2.3.11	Output frequency limit 1; Supervision value	0,00	320,00	Hz	0,00		316	
P2.3.12	Output frequency limit 2 supervision	0	2		0		346	**0**=No limit **1**=Low limit supervision **2**=High limit supervision

P2.3.13	Output frequency limit 2; Supervision value	0,00	320,00	Hz	0,00		347	
P2.3.14	Torque limit supervision function	0	2		0		348	**0**=No **1**=Low limit **2**=High limit
P2.3.15	Torque limit supervision value	-300,0	300,0	%	0,0		349	
P2.3.16	Reference limit supervision function	0	2		0		350	**0**=No **1**=Low limit **2**=High limit
P2.3.17	Reference limit supervision value	0,0	100,0	%	0,0		351	
P2.3.18	External brake Off-delay	0,0	100,0	s	0,5		352	
P2.3.19	External brake On-delay	0,0	100,0	s	1,5		353	
P2.3.20	Frequency drive temperature limit supervision	0	2		0		354	**0**=No **1**=Low limit **2**=High limit
P2.3.21	Frequency drive temperature limit value	-10	100	°C	40		355	
P2.3.22	Analogue output 2 signal selection	0			0.1		471	TTF programming method used. See page 65.
P2.3.23	Analogue output 2 function	0	8		4		472	As parameter 2.3.2
P2.3.24	Analogue output 2 filter time	0,00	10,00	s	1,00		473	**0**=No filtering
P2.3.25	Analogue output 2 inversion	0	1		0		474	**0**=Not inverted **1**=Inverted
P2.3.26	Analogue output 2 minimum	0	1		0		475	**0**=0 mA **1**=4 mA
P2.3.27	Analogue output 2 scaling	10	1000	%	100		476	

Table 3-5. Output signals, G2.3

3.4.5 Drive control parameters (Control keypad: Menu M2 → G2.4)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.4.1	Ramp 1 shape	0,0	10,0	s	0,1		500	**0**=Linear **>0**=S-curve ramp time
P2.4.2	Ramp 2 shape	0,0	10,0	s	0,0		501	**0**=Linear **>0**=S-curve ramp time
P2.4.3	Acceleration time 2	0,1	3000,0	s	10,0		502	
P2.4.4	Deceleration time 2	0,1	3000,0	s	10,0		503	
P2.4.5	Brake chopper	0	4		0		504	**0**=Disabled **1**=Used when running **2**=External brake chopper **3**=Used when stopped/ running **4**=Used when running (no testing)
P2.4.6	Start function	0	1		0		505	**0**=Ramp **1**=Flying start
P2.4.7	Stop function	0	3		0		506	**0**=Coasting **1**=Ramp **2**=Ramp+Run enable coast **3**=Coast+Run enable ramp
P2.4.8	DC braking current	0,00	I_L	A	0,7 x I_H		507	
P2.4.9	DC braking time at stop	0,00	600,00	s	0,00		508	**0**=DC brake is off at stop
P2.4.10	Frequency to start DC braking during ramp stop	0,10	10,00	Hz	1,50		515	
P2.4.11	DC braking time at start	0,00	600,00	s	0,00		516	**0**=DC brake is off at start
P2.4.12	Flux brake	0	1		0		520	**0**=Off **1**=On
P2.4.13	Flux braking current	0,00	I_L	A	I_H		519	

Table 3-6. Drive control parameters, G2.4

3.4.6 Prohibit frequency parameters (Control keypad: Menu M2 → G2.5)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.5.1	Prohibit frequency range 1 low limit	0,00	320,00	Hz	0,00		509	
P2.5.2	Prohibit frequency range 1 high limit	0,00	320,00	Hz	0,0		510	**0**=Prohibit range 1 is off
P2.5.3	Prohibit frequency range 2 low limit	0,00	320,00	Hz	0,00		511	
P2.5.4	Prohibit frequency range 2 high limit	0,00	320,00	Hz	0,0		512	**0**=Prohibit range 2 is off
P2.5.5	Prohibit frequency range 3 low limit	0,00	320,00	Hz	0,00		513	
P2.5.6	Prohibit frequency range 3 high limit	0,00	320,00	Hz	0,0		514	**0**=Prohibit range 3 is off
P2.5.7	Prohibit acc./dec. ramp	0,1	10,0	x	1,0		518	

Table 3-7. Prohibit frequency parameters, G2.5

3.4.7 Motor control parameters (Control keypad: Menu M2 → G2.6)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.6.1	Motor control mode	0	1/3		0		600	**0**=Frequency control **1**=Speed control **Additionally for NXP:** **2**=Not used **3**=Closed loop speed ctrl
P2.6.2	U/f optimisation	0	1		0		109	**0**=Not used **1**=Automatic torque boost
P2.6.3	U/f ratio selection	0	3		0		108	**0**=Linear **1**=Squared **2**=Programmable **3**=Linear with flux optim.
P2.6.4	Field weakening point	8,00	320,00	Hz	50,00		602	
P2.6.5	Voltage at field weakening point	10,00	200,00	%	100,00		603	n% x U_{nmot}
P2.6.6	U/f curve midpoint frequency	0,00	par. P2.6.4	Hz	50,00		604	
P2.6.7	U/f curve midpoint voltage	0,00	100,00	%	100,00		605	n% x U_{nmot} Parameter max. value = par. 2.6.5
P2.6.8	Output voltage at zero frequency	0,00	40,00	%	Varies		606	n% x U_{nmot}
P2.6.9	Switching frequency	1,0	Varies	kHz	Varies		601	See Table 8-12 for exact values
P2.6.10	Overvoltage controller	0	2		1		607	**0**=Not used **1**=Used (no ramping) **2**=Used (ramping)
P2.6.11	Undervoltage controller	0	1		1		608	**0**=Not used **1**=Used
P2.6.12	Load drooping	0,00	100,00	%	0,00		620	
P2.6.13	Identification	0	1/2		0		631	**0**=No action **1**=Identification w/o run **2**=Identification with run
Closed Loop parameter group 2.6.14								
P2.6.14.1	Magnetizing current	0,00	100,00	A	0,00		612	
P2.6.14.2	Speed control P gain	1	1000		30		613	
P2.6.14.3	Speed control I time	0,0	500,0	ms	30,0		614	
P2.6.14.5	Acceleration compensation	0,00	300,00	s	0,00		626	
P2.6.14.6	Slip adjust	0	500	%	100		619	
P2.6.14.7	Magnetizing current at start	0,00	I_L	A	0,00		627	
P2.6.14.8	Magnetizing time at start	0	60000	ms	0		628	
P2.6.14.9	0-speed time at start	0	32000	ms	100		615	
P2.6.14.10	0-speed time at stop	0	32000	ms	100		616	
P2.6.14.11	Start-up torque	0	3		0		621	**0**=Not used **1**=Torque memory **2**=Torque reference **3**=Start-up torque fwd/rev
P2.6.14.12	Start-up torque FWD	–300,0	300,0	%	0,0		633	
P2.6.14.13	Start-up torque REV	–300,0	300,0	%	0,0		634	
P2.6.14.15	Encoder filter time	0,0	100,0	ms	0,0		618	
P2.6.14.17	Current control P gain	0,00	100,00	%	40,00		617	

Table 3-8. Motor control parameters, G2.6

3.4.8 Protections (Control keypad: Menu M2 → G2.7)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.7.1	Response to 4mA reference fault	0	5		0		700	**0**=No response **1**=Warning **2**=Warning+Previous Freq. **3**=Wrng+PresetFreq 2.7.2 **4**=Fault,stop acc. to 2.4.7 **5**=Fault,stop by coasting
P2.7.2	4mA reference fault frequency	0,00	Par. 2.1.2	Hz	0,00		728	
P2.7.3	Response to external fault	0	3		2		701	**0**=No response **1**=Warning **2**=Fault,stop acc. to 2.4.7 **3**=Fault,stop by coasting
P2.7.4	Input phase supervision	0	3		0		730	
P2.7.5	Response to undervoltage fault	0	1		0		727	**0**=Fault stored in history **1**=Fault not stored
P2.7.6	Output phase supervision	0	3		2		702	**0**=No response **1**=Warning **2**=Fault,stop acc. to 2.4.7 **3**=Fault,stop by coasting
P2.7.7	Ground fault protection	0	3		2		703	
P2.7.8	Thermal protection of the motor	0	3		2		704	
P2.7.9	Motor ambient temperature factor	–100,0	100,0	%	0,0		705	
P2.7.10	Motor cooling factor at zero speed	0,0	150,0	%	40,0		706	
P2.7.11	Motor thermal time constant	1	200	min	Varies		707	
P2.7.12	Motor duty cycle	0	100	%	100		708	
P2.7.13	Stall protection	0	3		0		709	**0**=No response **1**=Warning **2**=Fault,stop acc. to 2.4.7 **3**=Fault,stop by coasting
P2.7.14	Stall current	0,00	2 x I_H	A	I_H		710	
P2.7.15	Stall time limit	1,00	120,00	s	15,00		711	
P2.7.16	Stall frequency limit	1,0	Par. 2.1.2	Hz	25,0		712	
P2.7.17	Underload protection	0	3		0		713	**0**=No response **1**=Warning **2**=Fault,stop acc. to 2.4.7 **3**=Fault,stop by coasting
P2.7.18	Field weakening area load	10	150	%	50		714	
P2.7.19	Zero frequency load	5,0	150,0	%	10,0		715	
P2.7.20	Underload protection time limit	2	600	s	20		716	
P2.7.21	Response to thermistor fault	0	3		2		732	**0**=No response **1**=Warning **2**=Fault,stop acc. to 2.4.7 **3**=Fault,stop by coasting
P2.7.22	Response to fieldbus fault	0	3		2		733	See P2.7.21
P2.7.23	Response to slot fault	0	3		2		734	See P2.7.21

Table 3-9. Protections, G2.7

3.4.9 Autorestart parameters (Control keypad: Menu M2 → G2.8)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.8.1	Wait time	0,10	10,00	s	0,50		717	
P2.8.2	Trial time	0,00	60,00	s	30,00		718	
P2.8.3	Start function	0	2		0		719	**0**=Ramp **1**=Flying start **2**=According to par. 2.4.6
P2.8.4	Number of tries after undervoltage trip	0	10		0		720	
P2.8.5	Number of tries after overvoltage trip	0	10		0		721	
P2.8.6	Number of tries after overcurrent trip	0	3		0		722	
P2.8.7	Number of tries after 4mA reference trip	0	10		0		723	
P2.8.8	Number of tries after motor temp fault trip	0	10		0		726	
P2.8.9	Number of tries after external fault trip	0	10		0		725	
P2.8.10	Number of tries after underload fault trip	0	10		0		738	

Table 3-10. Autorestart parameters, G2.8

3.4.10 Keypad control (Control keypad: Menu M3)

The parameters for the selection of control place and direction on the keypad are listed below. See the Keypad control menu in the product's User's Manual.

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

Table 3-11. Keypad control parameters, M3

3.4.11 System menu (Control keypad: Menu M6)

For parameters and functions related to the general use of the frequency drive, such as application and language selection, customised parameter sets or information about the hardware and software, see the product's User's Manual.

3.4.12 Expander boards (Control keypad: Menu M7)

The **M7** menu shows the expander and option boards attached to the control board and board-related information. For more information, see the product's User's Manual.

4. MULTI-STEP SPEED CONTROL APPLICATION

(Software ASFIFF04)

4.1 Introduction

Select the Multi-step Speed Control Application in menu **M6** on page *S6.2*.

The Multi-step Speed Control Application can be used in applications where fixed speeds are needed. Totally 15 + 2 different speeds can be programmed: one basic speed, 15 multi-step speeds and one jogging speed. The speed steps are selected with digital signals DIN3, DIN4, DIN5 and DIN6. If jogging speed is used, DIN3 can be programmed from fault reset to jogging speed select. The basic speed reference can be either voltage or current signal via analogue input terminals (2/3 or 4/5). The other one of the analogue inputs can be programmed for other purposes.

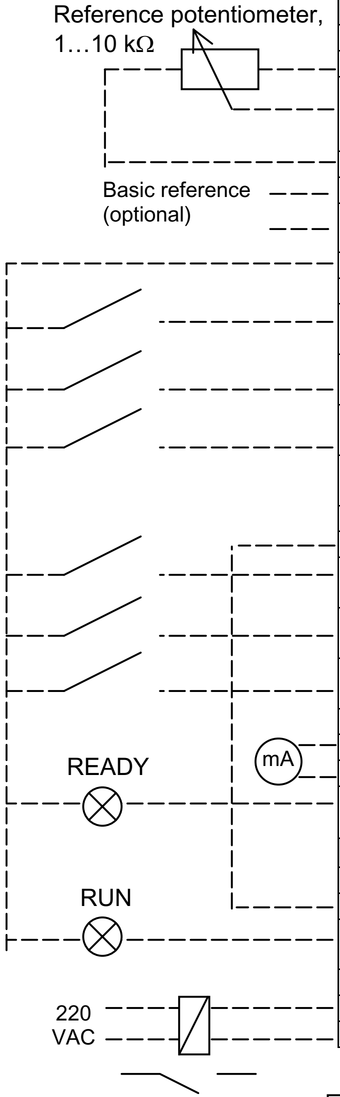
- All outputs are freely programmable.

Additional functions:

- Programmable Start/Stop and Reverse signal logic
- Reference scaling
- One frequency limit supervision
- Second ramps and S-shape ramp programming
- Programmable start and stop functions
- DC-brake at stop
- One prohibit frequency area
- Programmable U/f curve and switching frequency
- Autorestart
- Motor thermal and stall protection: Programmable action; off, warning, fault

The parameters of the Multi-Step Speed Control Application are explained in Chapter 8 of this manual. The explanations are arranged according to the individual ID number of the parameter.

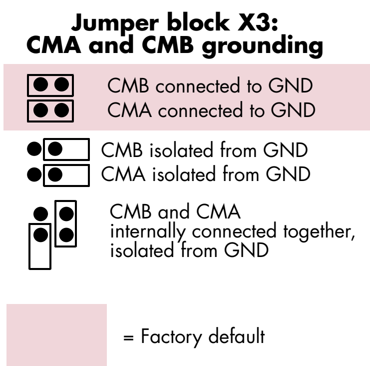
4.2 Control I/O



OPT-A1			
Terminal		Signal	Description
1	+10V$_{ref}$	Reference output	Voltage for potentiometer, etc.
2	AI1+	Analogue input, voltage range 0—10V DC	Basic reference (programmable), range 0-10 V DC
3	AI1-	I/O Ground	Ground for reference and controls
4	AI2+	Input for reference current	Basic reference (programmable), range 0-20 mA
5	AI2-		
6	+24V	Control voltage output	Voltage for switches, etc. max 0.1 A
7	GND	I/O ground	Ground for reference and controls
8	DIN1	Start forward (programmable)	Contact closed = start forward
9	DIN2	Start reverse (programmable)	Contact closed = start reverse
10	DIN3	External fault input (programmable)	Contact open = no fault Contact closed = fault
11	CMA	Common for DIN 1—DIN 3	Connect to GND or +24V
12	+24V	Control voltage output	Voltage for switches (see #6)
13	GND	I/O ground	Ground for reference and controls
14	DIN4	Multi-step speed select 1	sel 1 sel 2 sel 3 sel 4 (with DIN3) 0 0 0 0 basic speed
15	DIN5	Multi-step speed select 2	1 0 0 0 speed 1 0 1 0 0 speed 2
16	DIN6	Multi-step speed select 3	- - - - - - 1 1 1 1 speed 15
17	CMB	Common for DIN4—DIN6	Connect to GND or +24V
18	AO1+	Output frequency	Programmable
19	AO1-	Analogue output	Range 0—20 mA/R$_L$, max. 500Ω
20	DO1	Digital output READY	Programmable Open collector, I≤50mA, U≤48 VDC
OPT-A2			
21	RO1	Relay output 1 RUN	Programmable
22	RO1		
23	RO1		
24	RO2	Relay output 2 FAULT	Programmable
25	RO2		
26	RO2		

Table 4-1. Multi-step speed control application default I/O configuration.

Note: See jumper selections below.
More information in the product's User's Manual.



4.3 Control signal logic in Multi-Step Speed Control Application

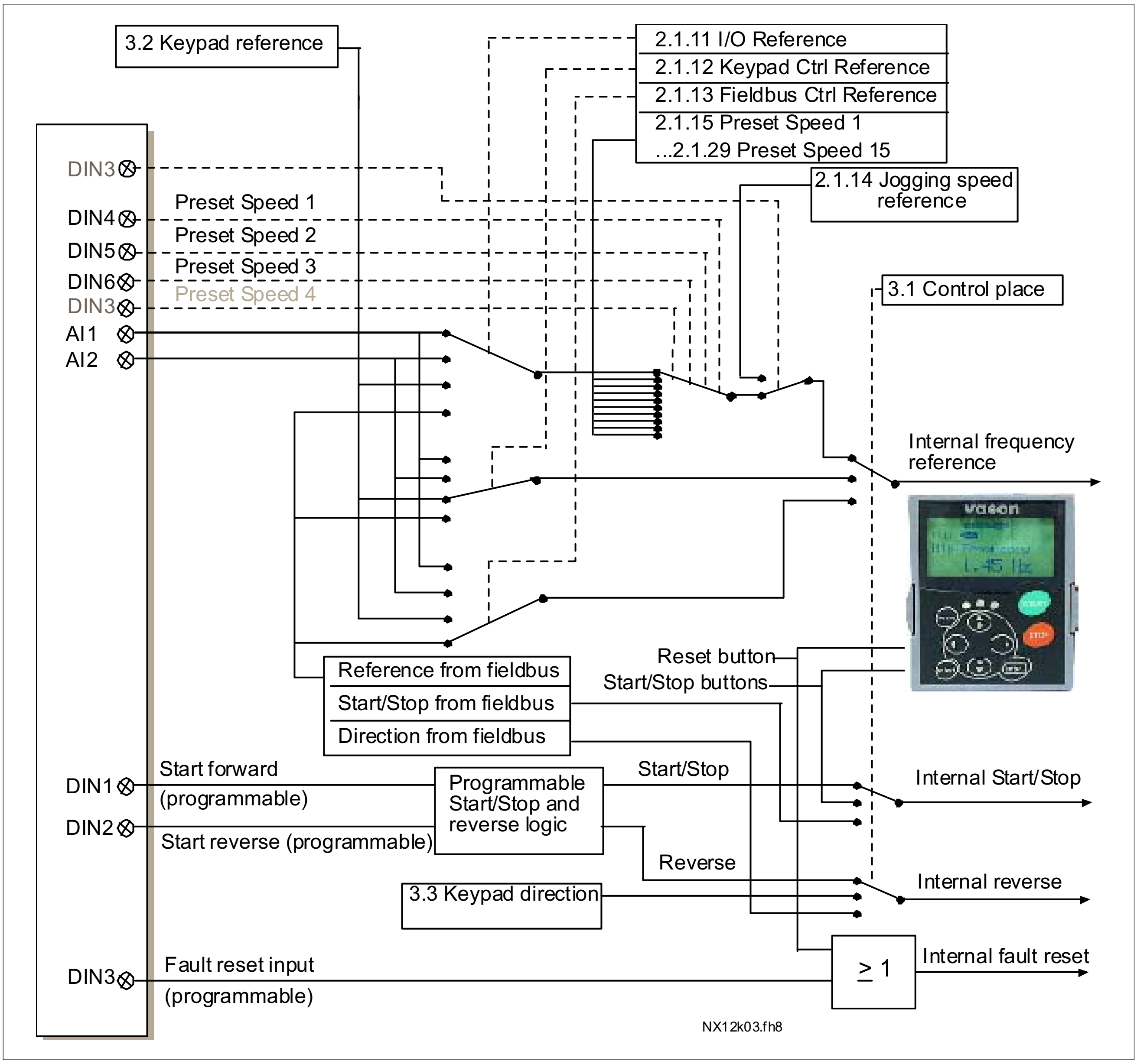


Figure 4-1. Control signal logic of the Multi-step Speed Application

4.4 Multi-step speed control application – Parameter lists

On the next pages you will find the lists of parameters within the respective parameter groups. The parameter descriptions are given on pages 122 to 209.

Column explanations:

Code	=	Location indication on the keypad; Shows the operator the present parameter number
Parameter	=	Name of parameter
Min	=	Minimum value of parameter
Max	=	Maximum value of parameter
Unit	=	Unit of parameter value; Given if available
Default	=	Value preset by factory
Cust	=	Customer's own setting
ID	=	ID number of the parameter
	=	In parameter row: Use TTF method to program these parameters.
	=	On parameter code: Parameter value can only be changed after the frequency drive has been stopped.

4.4.1 Monitoring values (Control keypad: menu M1)

The monitoring values are the actual values of parameters and signals as well as statuses and measurements. Monitoring values cannot be edited.
See the product's User's Manual for more information.

Code	Parameter	Unit	ID	Description
V1.1	Output frequency	Hz	1	Output frequency to motor
V1.2	Frequency reference	Hz	25	Frequency reference to motor control
V1.3	Motor speed	rpm	2	Motor speed in rpm
V1.4	Motor current	A	3	
V1.5	Motor torque	%	4	Calculated shaft torque
V1.6	Motor power	%	5	Motor shaft power
V1.7	Motor voltage	V	6	
V1.8	DC link voltage	V	7	
V1.9	Unit temperature	°C	8	Heatsink temperature
V1.10	Motor temperature	%	9	Calculated motor temperature
V1.11	Analogue input 1	V	13	AI1
V1.12	Analogue input 2	mA	14	AI2
V1.13	DIN1, DIN2, DIN3		15	Digital input statuses
V1.14	DIN4, DIN5, DIN6		16	Digital input statuses
V1.15	DO1, RO1, RO2		17	Digital and relay output statuses
V1.16	Analogue I_{out}	mA	26	AO1
M1.17	Multimonitoring items			Displays three selectable monitoring values

Table 4-2. Monitoring values

4.4.2 Basic parameters (Control keypad: Menu M2 → G2.1)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.1.1	Min frequency	0,00	Par. 2.1.2	Hz	0,00		101	
P2.1.2	Max frequency	Par. 2.1.1	320,00	Hz	50,00		102	**NOTE**: If f_{max} > than the motor synchronous speed, check suitability for motor and drive system
P2.1.3	Acceleration time 1	0,1	3000,0	s	3,0		103	
P2.1.4	Deceleration time 1	0,1	3000,0	s	3,0		104	
P2.1.5	Current limit	0,1 x I_H	2 x I_H	A	I_L		107	
P2.1.6	Nominal voltage of the motor	180	690	V	NX2: 230V NX5: 400V NX6: 690V		110	
P2.1.7	Nominal frequency of the motor	8,00	320,00	Hz	50,00		111	Check the rating plate of the motor
P2.1.8	Nominal speed of the motor	24	20 000	rpm	1440		112	The default applies for a 4-pole motor and a nominal size frequency drive.
P2.1.9	Nominal current of the motor	0,1 x I_H	2 x I_H	A	I_H		113	Check the rating plate of the motor.
P2.1.10	Motor cosφ	0,30	1,00		0,85		120	Check the rating plate of the motor
P2.1.11	I/O reference	0	3		1		117	**0**=AI1 **1**=AI2 **2**=Keypad **3**=Fieldbus
P2.1.12	Keypad control reference	0	3		2		121	**0**=AI1 **1**=AI2 **2**=Keypad **3**=Fieldbus
P2.1.13	Fieldbus control reference	0	3		3		122	**0**=AI1 **1**=AI2 **2**=Keypad **3**=Fieldbus
P2.1.14	Jogging speed pref.	0,00	Par. 2.1.2	Hz	0,00		124	
P2.1.15	Preset speed 1	0,00	Par. 2.1.2	Hz	5,00		105	Multi-step speed 1
P2.1.16	Preset speed 2	0,00	Par. 2.1.2	Hz	10,00		106	Multi-step speed 2
P2.1.17	Preset speed 3	0,00	Par. 2.1.2	Hz	12,50		126	Multi-step speed 3
P2.1.18	Preset speed 4	0,00	Par. 2.1.2	Hz	15,00		127	Multi-step speed 4
P2.1.19	Preset speed 5	0,00	Par. 2.1.2	Hz	17,50		128	Multi-step speed 5
P2.1.20	Preset speed 6	0,00	Par. 2.1.2	Hz	20,00		129	Multi-step speed 6
P2.1.21	Preset speed 7	0,00	Par. 2.1.2	Hz	22,50		130	Multi-step speed 7
P2.1.22	Preset speed 8	0,00	Par. 2.1.2	Hz	25,00		133	Multi-step speed 8
P2.1.23	Preset speed 9	0,00	Par. 2.1.2	Hz	27,50		134	Multi-step speed 9
P2.1.24	Preset speed 10	0,00	Par. 2.1.2	Hz	30,00		135	Multi-step speed 10
P2.1.25	Preset speed 11	0,00	Par. 2.1.2	Hz	32,50		136	Multi-step speed 11
P2.1.26	Preset speed 12	0,00	Par. 2.1.2	Hz	35,00		137	Multi-step speed 12
P2.1.27	Preset speed 13	0,00	Par. 2.1.2	Hz	40,00		138	Multi-step speed 13
P2.1.28	Preset speed 14	0,00	Par. 2.1.2	Hz	45,00		139	Multi-step speed 14
P2.1.29	Preset speed 15	0,00	Par. 2.1.2	Hz	50,00		140	Multi-step speed 15

Table 4-3. Basic parameters G2.1

4.4.3 Input signals (Control keypad: Menu M2 → G2.2)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.2.1	Start/Stop logic	0	6		0		300	DIN1 / DIN2 **0** Start fwd / Start rvs **1** Start/Stop / Rvs/Fwd **2** Start/Stop / Run enable **3** Start pulse / Stop pulse **4** Fwd* / Rvs* **5** Start*/Stop / Rvs/Fwd **6** Start*/Stop / Run enable
P2.2.2	DIN3 function	0	13		1		301	**0**=Not used **1**=Ext. fault, closing cont. **2**=Ext. fault, opening cont. **3**=Run enable **4**=Acc./Dec. time select. **5**=Force cp. to IO **6**=Force cp. to keypad **7**=Force cp. to fieldbus **8**=Rvs (if par. 2.2.1=3) **9**=Jogging speed **10**=Fault reset **11**=Acc./Dec. operation prohibit **12**=DC Braking command **13**=Preset speed
P2.2.3	AI1 signal selection	0			A.1		377	TTF programming method used. See page 65.
P2.2.4	AI1 signal range	0	2		0		320	**0**=0…100%* **1**=20…100%* **2**=Custom setting range*
P2.2.5	AI1 custom setting minimum	-160,00	160,00	%	0,00		321	Analogue input 1 scale minimum
P2.2.6	AI1 custom setting maximum	-160,00	160,00	%	100,0		322	Analogue input 1 scale maximum
P2.2.7	AI1 signal inversion	0	1		0		323	Analogue input 1 reference inversion yes/no
P2.2.8	AI1 signal filter time	0,00	10,00	s	0,10		324	Analogue input 1 reference filter time, constant
P2.2.9	AI2 signal selection	0			A.2		388	TTF programming method used. See page 65.
P2.2.10	AI2 signal range	0	2		1		325	**0**=0 – 20 mA* **1**=4 – 20 mA* **2**=custom setting range
P2.2.11	AI2 custom setting minimum	-160,00	160,00	%	0,00		326	Analogue input 2 scale minimum
P2.2.12	AI2 custom setting maximum	-160,00	160,00	%	100,00		327	Analogue input 2 scale maximum
P2.2.13	AI2 signal inversion	0	1		0		328	Analogue input 2 reference inversion yes/no
P2.2.14	AI2 signal filter time	0,00	10,00	s	0,10		329	Analogue input 2 reference filter time, constant
P2.2.15	Reference scaling minimum value	0,00	320,00	Hz	0,00		303	Selects the frequency that corresponds to the min. reference signal
P2.2.16	Reference scaling maximum value	0,00	320,00	Hz	0,00		304	Selects the frequency that corresponds to the max. reference signal 0,00 = No scaling >0 = scaled max. value

P2.2.17	Free analogue input, signal selection	0	2		0		361	**0**=Not used **1**=U_{in} (analogue volt. input) **2**=I_{in} (analogue curr. input)
P2.2.18	Free analogue input, function	0	4		0		362	**0**=No function **1**=Reduces current limit (par. 2.1.5) **2**=Reduces DC braking current **3**=Reduces accel. and decel. times **4**=Reduces torque supervision limit

Table 4-4. Input signals, G2.2

CP=control place
cc=closing contact
oc=opening contact

*Remember to place jumpers of block X2 accordingly. See the product's User's Manual, chapter 6.2.2.2

4.4.4 Output signals (Control keypad: Menu M2 → G2.3)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.3.1	ιO1 signal selectio	0			A.1		464	TTF programming method used. See page 65.
P2.3.2	Analogue output function	0	8		1		307	**0**=Not used **1**=Output freq. (0—f_{max}) **2**=Freq. reference (0—f_{max}) **3**=Motor speed (0—Motor nominal speed) **4**=Motor current (0—I_{nMotor}) **5**=Motor torque (0—T_{nMotor}) **6**=Motor power (0—P_{nMotor}) **7**=Motor voltage (0-U_{nMotor}) **8**=DC-link volt (0—1000V)
P2.3.3	Analogue output filter time	0,00	10,00	s	1,00		308	**0**=No filtering
P2.3.4	Analogue output inversion	0	1		0		309	**0**=Not inverted **1**=Inverted
P2.3.5	Analogue output minimum	0	1		0		310	**0**=0 mA **1**=4 mA
P2.3.6	Analogue output scale	10	1000	%	100		311	
P2.3.7	Digital output 1 function	0	22		1		312	**0**=Not used **1**=Ready **2**=Run **3**=Fault **4**=Fault inverted **5**=FC overheat warning **6**=Ext. fault or warning **7**=Ref. fault or warning **8**=Warning **9**=Reversed **10**=Jogging spd selected **11**=At speed **12**=Mot. regulator active **13**=OP freq.limit superv. 1 **14**=OP freq.limit superv. 2 **15**=Torque limit superv. **16**=Ref. limit superv. **17**=Ext. brake control **18**= Control place: IO **19**=FC temp. limit superv. **20**=Unrequested rotation direction **21**=Ext. brake control inverted **22**=Thermistor fault/warn.
P2.3.8	Relay output 1 function	0	22		2		313	As parameter 2.3.7
P2.3.9	Relay output 2 function	0	22		3		314	As parameter 2.3.7
P2.3.10	Output frequency limit 1 supervision	0	2		0		315	**0**=No limit **1**=Low limit supervision **2**=High limit supervision
P2.3.11	Output frequency limit 1; Supervision value	0,00	320,00	Hz	0,00		316	
P2.3.12	Output frequency limit 2 supervision	0	2		0		346	**0**=No limit **1**=Low limit supervision **2**=High limit supervision

P2.3.13	Output frequency limit 2; Supervision value	0,00	320,00	Hz	0,00		347	
P2.3.14	Torque limit supervision function	0	2		0		348	**0**=No **1**=Low limit **2**=High limit
P2.3.15	Torque limit supervision value	-300,0	300,0	%	100,0		349	
P2.3.16	Reference limit supervision function	0	2		0		350	**0**=No **1**=Low limit **2**=High limit
P2.3.17	Reference limit supervision value	0,0	100,0	%	0,0		351	
P2.3.18	External brake Off-delay	0,0	100,0	s	0,5		352	
P2.3.19	External brake On-delay	0,0	100,0	s	1,5		353	
P2.3.20	Frequency drive temperature limit supervision	0	2		0		354	**0**=No **1**=Low limit **2**=High limit
P2.3.21	Frequency drive temperature limit value	-10	100	°C	40		355	
P2.3.22	Analogue output 2 signal selection	0			0.1		471	TTF programming method used. See page 65.
P2.3.23	Analogue output 2 function	0	8		4		472	As parameter 2.3.2
P2.3.24	Analogue output 2 filter time	0,00	10,00	s	1,00		473	**0**=No filtering
P2.3.25	Analogue output 2 inversion	0	1		0		474	**0**=Not inverted **1**=Inverted
P2.3.26	Analogue output 2 minimum	0	1		0		475	**0**=0 mA **1**=4 mA
P2.3.27	Analogue output 2 scaling	10	1000	%	100		476	

Table 4-5. Output signals, G2.3

4.4.5 Drive control parameters (Control keypad: Menu M2 → G2.4)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.4.1	Ramp 1 shape	0,0	10,0	s	0,1		500	**0**=Linear **>0**=S-curve ramp time
P2.4.2	Ramp 2 shape	0,0	10,0	s	0,0		501	**0**=Linear **>0**=S-curve ramp time
P2.4.3	Acceleration time 2	0,1	3000,0	s	10,0		502	
P2.4.4	Deceleration time 2	0,1	3000,0	s	10,0		503	
P2.4.5	Brake chopper	0	4		0		504	**0**=Disabled **1**=Used when running **2**=External brake chopper **3**=Used when stopped/running **4**=Used when running (no testing)
P2.4.6	Start function	0	1		0		505	**0**=Ramp **1**=Flying start
P2.4.7	Stop function	0	3		0		506	**0**=Coasting **1**=Ramp **2**=Ramp+Run enable coast **3**=Coast+Run enable ramp
P2.4.8	DC braking current	0,00	I_L	A	0,7 x I_H		507	
P2.4.9	DC braking time at stop	0,00	600,00	s	0,00		508	**0**=DC brake is off at stop
P2.4.10	Frequency to start DC braking during ramp stop	0,10	10,00	Hz	1,50		515	
P2.4.11	DC braking time at start	0,00	600,00	s	0,00		516	**0**=DC brake is off at start
P2.4.12	Flux brake	0	1		0		520	**0**=Off **1**=On
P2.4.13	Flux braking current	0,00	I_L	A	I_H		519	

Table 4-6. Drive control parameters, G2.4

4.4.6 Prohibit frequency parameters (Control keypad: Menu M2 → G2.5)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.5.1	Prohibit frequency range 1 low limit	0,00	320,00	Hz	0,00		509	
P2.5.2	Prohibit frequency range 1 high limit	0,00	320,00	Hz	0,0		510	**0**=Prohibit range 1 is off
P2.5.3	Prohibit frequency range 2 low limit	0,00	320,00	Hz	0,00		511	
P2.5.4	Prohibit frequency range 2 high limit	0,00	320,00	Hz	0,0		512	**0**=Prohibit range 2 is off
P2.5.5	Prohibit frequency range 3 low limit	0,00	320,00	Hz	0,00		513	
P2.5.6	Prohibit frequency range 3 high limit	0,00	320,00	Hz	0,0		514	**0**=Prohibit range 3 is off
P2.5.7	Prohibit acc./dec. ramp	0,1	10,0	x	1,0		518	

Table 4-7. Prohibit frequency parameters, G2.5

4.4.7 Motor control parameters (Control keypad: Menu M2 → G2.6)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.6.1	Motor control mode	0	1/3		0		600	**0**=Frequency control **1**=Speed control **Additionally for NXP:** **2**=Not used **3**=Closed loop speed ctrl
P2.6.2	U/f optimisation	0	1		0		109	**0**=Not used **1**=Automatic torque boost
P2.6.3	U/f ratio selection	0	3		0		108	**0**=Linear **1**=Squared **2**=Programmable **3**=Linear with flux optim.
P2.6.4	Field weakening point	8,00	320,00	Hz	50,00		602	
P2.6.5	Voltage at field weakening point	10,00	200,00	%	100,00		603	n% x U_{nmot}
P2.6.6	U/f curve midpoint frequency	0,00	par. P2.6.4	Hz	50,00		604	
P2.6.7	U/f curve midpoint voltage	0,00	100,00	%	100,00		605	n% x U_{nmot} Parameter max. value = par. 2.6.5
P2.6.8	Output voltage at zero frequency	0,00	40,00	%	Varies		606	n% x U_{nmot}
P2.6.9	Switching frequency	1,0	Varies	kHz	Varies		601	See Table 8-12 for exact values
P2.6.10	Overvoltage controller	0	2		1		607	**0**=Not used **1**=Used (no ramping) **2**=Used (ramping
P2.6.11	Undervoltage controller	0	1		1		608	**0**=Not used **1**=Used
P2.6.12	Load drooping	0,00	100,00	%	0,00		620	
P2.6.13	Identification	0	1/2		0		631	**0**=No action **1**=Identification w/o run **2**=Identification with run
Closed Loop parameter group 2.6.14								
P2.6.14.1	Magnetizing current	0,00	100,00	A	0,00		612	
P2.6.14.2	Speed control P gain	1	1000		30		613	
P2.6.14.3	Speed control I time	0,0	500,0	ms	30,0		614	
P2.6.14.5	Acceleration compensation	0,00	300,00	s	0,00		626	
P2.6.14.6	Slip adjust	0	500	%	100		619	
P2.6.14.7	Magnetizing current at start	0,00	I_L	A	0,00		627	
P2.6.14.8	Magnetizing time at start	0	60000	ms	0		628	
P2.6.14.9	0-speed time at start	0	32000	ms	100		615	
P2.6.14.10	0-speed time at stop	0	32000	ms	100		616	
P2.6.14.11	Start-up torque	0	3		0		621	**0**=Not used **1**=Torque memory **2**=Torque reference **3**=Start-up torque fwd/rev
P2.6.14.12	Start-up torque FWD	–300,0	300,0	%	0,0		633	
P2.6.14.13	Start-up torque REV	–300,0	300,0	%	0,0		634	
P2.6.14.15	Encoder filter time	0,0	100,0	ms	0,0		618	
P2.6.14.17	Current control P gain	0,00	100,00	%	40,00		617	

Table 4-8. Motor control parameters, G2.6

4.4.8 Protections (Control keypad: Menu M2 → G2.7)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.7.1	Response to 4mA reference fault	0	5		0		700	**0**=No response **1**=Warning **2**=Warning+Previous Freq. **3**=Wrng+PresetFreq 2.7.2 **4**=Fault,stop acc. to 2.4.7 **5**=Fault,stop by coasting
P2.7.2	4mA reference fault frequency	0,00	Par. 2.1.2	Hz	0,00		728	
P2.7.3	Response to external fault	0	3		2		701	**0**=No response **1**=Warning **2**=Fault,stop acc. to 2.4.7 **3**=Fault,stop by coasting
P2.7.4	Input phase supervision	0	3		0		730	
P2.7.5	Response to undervoltage fault	0	1		0		727	**0**=Fault stored in history **1**=Fault not stored
P2.7.6	Output phase supervision	0	3		2		702	**0**=No response **1**=Warning **2**=Fault,stop acc. to 2.4.7 **3**=Fault,stop by coasting
P2.7.7	Ground fault protection	0	3		2		703	
P2.7.8	Thermal protection of the motor	0	3		2		704	
P2.7.9	Motor ambient temperature factor	–100,0	100,0	%	0,0		705	
P2.7.10	Motor cooling factor at zero speed	0,0	150,0	%	40,0		706	
P2.7.11	Motor thermal time constant	1	200	min	Varies		707	
P2.7.12	Motor duty cycle	0	100	%	100		708	
P2.7.13	Stall protection	0	3		0		709	**0**=No response **1**=Warning **2**=Fault,stop acc. to 2.4.7 **3**=Fault,stop by coasting
P2.7.14	Stall current	0,00	2 x I_H	A	I_H		710	
P2.7.15	Stall time limit	1,00	120,00	s	15,00		711	
P2.7.16	Stall frequency limit	1,0	Par. 2.1.2	Hz	25,0		712	
P2.7.17	Underload protection	0	3		0		713	**0**=No response **1**=Warning **2**=Fault,stop acc. to 2.4.7 **3**=Fault,stop by coasting
P2.7.18	Field weakening area load	10	150	%	50		714	
P2.7.19	Zero frequency load	5,0	150,0	%	10,0		715	
P2.7.20	Underload protection time limit	2	600	s	20		716	
P2.7.21	Response to thermistor fault	0	3		2		732	**0**=No response **1**=Warning **2**=Fault,stop acc. to 2.4.7 **3**=Fault,stop by coasting
P2.7.22	Response to fieldbus fault	0	3		2		733	See P2.7.21
P2.7.23	Response to slot fault	0	3		2		734	See P2.7.21

Table 4-9. Protections, G2.7

4.4.9 Autorestart parameters (Control keypad: Menu M2 → G2.8)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.8.1	Wait time	0,10	10,00	s	0,50		717	
P2.8.2	Trial time	0,00	60,00	s	30,00		718	
P2.8.3	Start function	0	2		0		719	**0**=Ramp **1**=Flying start **2**=According to par. 2.4.6
P2.8.4	Number of tries after undervoltage trip	0	10		0		720	
P2.8.5	Number of tries after overvoltage trip	0	10		0		721	
P2.8.6	Number of tries after overcurrent trip	0	3		0		722	
P2.8.7	Number of tries after 4mA reference trip	0	10		0		723	
P2.8.8	Number of tries after motor temp fault trip	0	10		0		726	
P2.8.9	Number of tries after external fault trip	0	10		0		725	
P2.8.10	Number of tries after underload fault trip	0	10		0		738	

Table 4-10. Autorestart parameters, G2.8

4.4.10 Keypad control (Control keypad: Menu M3)

The parameters for the selection of control place and direction on the keypad are listed below. See the Keypad control menu in the product's user's manual.

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

Table 4-11. Keypad control parameters, M3

4.4.11 System menu (Control keypad: M6)

For parameters and functions related to the general use of the frequency drive, such as application and language selection, customised parameter sets or information about the hardware and software, see the product's user's manual.

4.4.12 Expander boards (Control keypad: Menu M7)

The **M7** menu shows the expander and option boards attached to the control board and board-related information. For more information, see the product's user's manual.

5. PID CONTROL APPLICATION

(Software ASFIFF05)

5.1 Introduction

Select the PID Control Application in menu **M6** on page *S6.2*.

In the PID Control Application, there are two I/O terminal control places; place A is the PID controller and source B is the direct frequency reference. The control place A or B is selected with digital input DIN6.

The PID controller reference can be selected from the analogue inputs, fieldbus, motorised potentiometer, enabling the PID Reference 2 or applying the control keypad reference. The PID controller actual value can be selected from the analogue inputs, fieldbus, the actual values of the motor or through the mathematical functions of these.

The direct frequency reference can be used for the control without the PID controller and selected from the analogue inputs, fieldbus, motor potentiometer or keypad.

The PID Application is typically used to control level measuring or pumps and fans. In these applications, the PID Application provides a smooth control and an integrated measuring and controlling package where no additional components are needed.

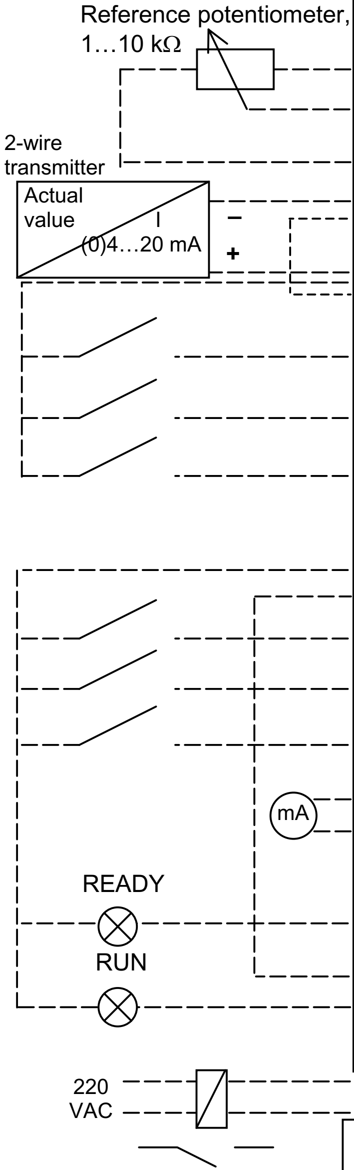
- Digital inputs DIN2, DIN3, DIN5 and all the outputs are freely programmable.

Additional functions:

- Analogue input signal range selection
- Two frequency limit supervisions
- Torque limit supervision
- Reference limit supervision
- Second ramps and S-shape ramp programming
- Programmable start and stop functions
- DC-brake at start and stop
- Three prohibit frequency areas
- Programmable U/f curve and switching frequency
- Autorestart
- Motor thermal and stall protection: fully programmable; off, warning, fault
- Motor underload protection
- Input and output phase supervision
- Sum point frequency addition to PID output
- The PID controller can additionally be used from control places I/O B, keypad and fieldbus
- Easy ChangeOver function
- Sleep function

The parameters of the PID Control Application are explained in Chapter 8 of this manual. The explanations are arranged according to the individual ID number of the parameter.

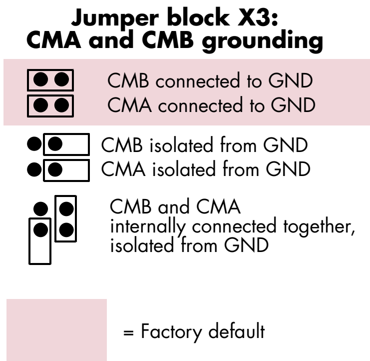
5.2 Control I/O



Terminal		Signal	Description
OPT-A1			
1	+10V$_{ref}$	Reference output	Voltage for potentiometer, etc.
2	AI1+	Analogue input, voltage range 0—10V DC	Voltage input frequency reference
3	AI1-	I/O Ground	Ground for reference and controls
4	AI2+	Analogue input, current range 0—20mA	Current input frequency reference
5	AI2-		
6	+24V	Control voltage output	Voltage for switches, etc. max 0.1 A
7	GND	I/O ground	Ground for reference and controls
8	DIN1	Start/Stop Control place A (PID controller)	Contact closed = start
9	DIN2	External fault input (programmable)	Contact closed = fault Contact open = no fault
10	DIN3	Fault reset (programmable)	Contact closed = fault reset
11	CMA	Common for DIN 1—DIN 3	Connect to GND or +24V
12	+24V	Control voltage output	Voltage for switches (see #6)
13	GND	I/O ground	Ground for reference and controls
14	DIN4	Start/Stop Control place B (Direct frequency reference)	Contact closed = Start
15	DIN5	Jogging speed selection (programmable)	Contact closed = Jogging speed active
16	DIN6	Control place A/B selection	Contact open = Control place A is active Contact closed = Control place B is active
17	CMB	Common for DIN4—DIN6	Connect to GND or +24V
18	AO1+	Output frequency	Programmable
19	AO1-	Analogue output	Range 0—20 mA/R_L, max. 500Ω
20	DO1	Digital output READY	Programmable Open collector, I≤50mA, U≤48 VDC
OPT-A2			
21	RO1	Relay output 1 RUN	Programmable
22	RO1		
23	RO1		
24	RO2	Relay output 2 FAULT	Programmable
25	RO2		
26	RO2		

Table 5-1. PID application default I/O configuration (with 2-wire transmitter).

Note: See jumper selections below.
More information in the product's user's manual.



5.3 Control signal logic in PID Control Application

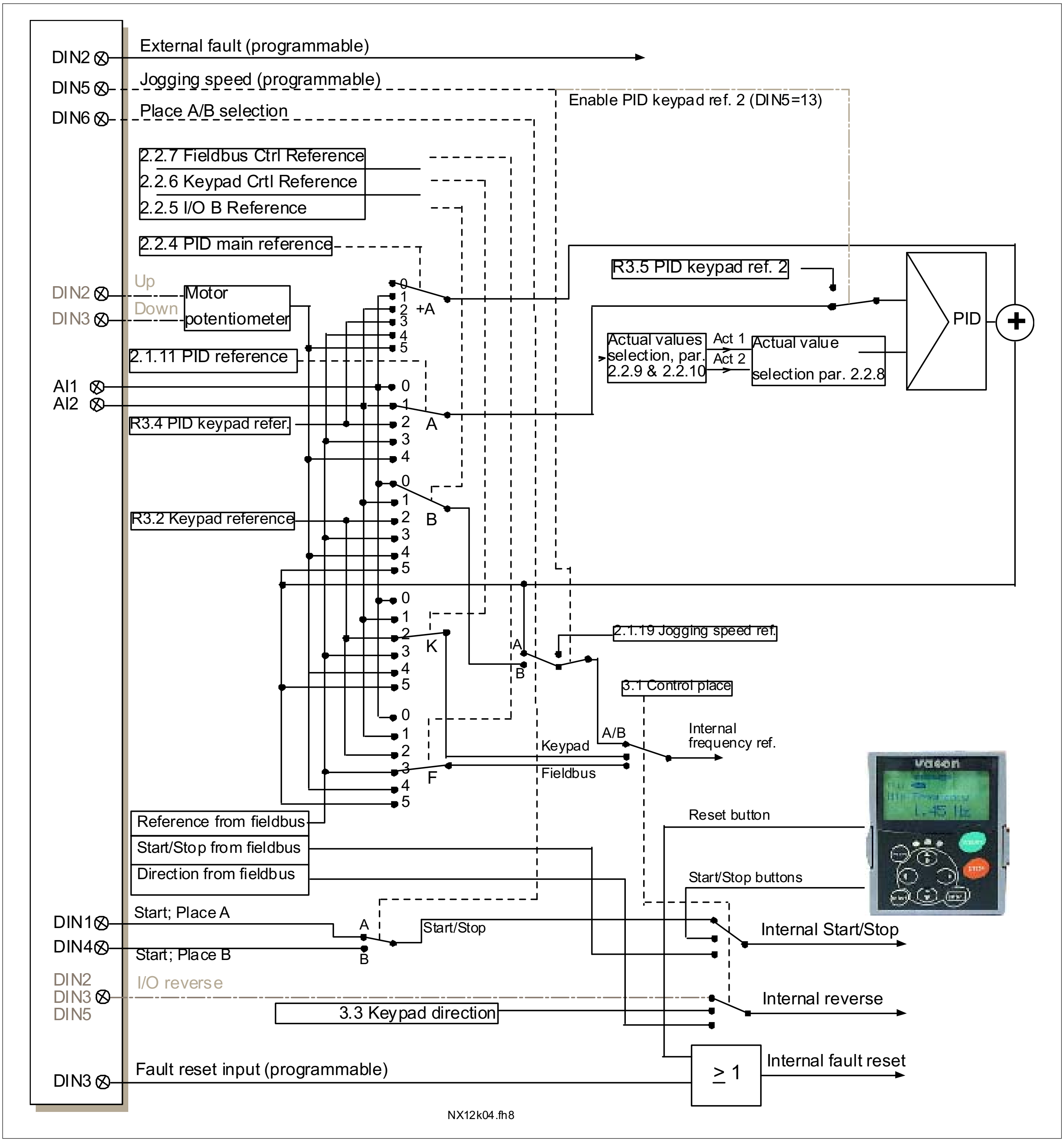


Figure 5-1. Control signal logic of the PID Control Application

5.4 PID Application – Parameter lists

On the next pages you will find the lists of parameters within the respective parameter groups. The parameter descriptions are given on pages 122 to 209.

Column explanations:

Code	=	Location indication on the keypad; Shows the operator the present param. number
Parameter	=	Name of parameter
Min	=	Minimum value of parameter
Max	=	Maximum value of parameter
Unit	=	Unit of parameter value; Given if available
Default	=	Value preset by factory
Cust	=	Customer's own setting
ID	=	ID number of the parameter
	=	In parameter row: Use TTF method to program these parameters.
	=	On parameter code: Parameter value can only be changed after the FC has been stopped.

5.4.1 Monitoring values (Control keypad: menu M1)

The monitoring values are the actual values of parameters and signals as well as statuses and measurements. Monitoring values cannot be edited.
See the product's user's manual for more information. Note that the monitoring values V1.19 to V1.22 are available with the PID control application only.

Code	Parameter	Unit	ID	Description
V1.1	Output frequency	Hz	1	Output frequency to motor
V1.2	Frequency reference	Hz	25	Frequency reference to motor control
V1.3	Motor speed	rpm	2	Motor speed in rpm
V1.4	Motor current	A	3	
V1.5	Motor torque	%	4	Calculated shaft torque
V1.6	Motor power	%	5	Motor shaft power
V1.7	Motor voltage	V	6	
V1.8	DC link voltage	V	7	
V1.9	Unit temperature	°C	8	Heatsink temperature
V1.10	Motor temperature	%	9	Calculated motor temperature
V1.11	Analogue input 1	V	13	AI1
V1.12	Analogue input 2	mA	14	AI2
V1.13	Analogue input 3		27	AI3
V1.14	Analogue input 4		28	AI4
V1.15	DIN1, DIN2, DIN3		15	Digital input statuses
V1.16	DIN4, DIN5, DIN6		16	Digital input statuses
V1.17	DO1, RO1, RO2		17	Digital and relay output statuses
V1.18	Analogue I_{out}	mA	26	AO1
V1.19	PID Reference	%	20	In % of the max. frequency
V1.20	PID Actual value	%	21	In % of the max. actual value
V1.21	PID Error value	%	22	In % of the max. error value
V1.22	PID Output	%	23	In % of the max. output value
V1.23	Special display for actual value		29	See parameters 2.2.46 to 2.2.49
V1.24	PT-100 Temperature	C°	42	Highest temperature of used inputs
G1.25	Monitoring items			Displays three selectable monitoring values

Table 5-2. Monitoring values

5.4.2 Basic parameters (Control keypad: Menu M2 → G2.1)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.1.1	Min frequency	0,00	Par. 2.1.2	Hz	0,00		101	
P2.1.2	Max frequency	Par. 2.1.1	320,00	Hz	50,00		102	**NOTE**: If f_{max} > than the motor synchronous speed, check suitability for motor and drive system
P2.1.3	Acceleration time 1	0,1	3000,0	s	1,0		103	**NOTE**: If PID-controller is used, Acceleration time 2 (par. 2.4.3) is automatically applied
P2.1.4	Deceleration time 1	0,1	3000,0	s	1,0		104	**NOTE**: If PID-controller is used, Deceleration time 2 (par. 2.4.4) is automatically applied
P2.1.5	Current limit	0,1 x I_H	2 x I_H	A	I_L		107	
P2.1.6	Nominal voltage of the motor	180	690	V	NX2: 230V NX5: 400V NX6: 690V		110	
P2.1.7	Nominal frequency of the motor	8,00	320,00	Hz	50,00		111	Check the rating plate of the motor
P2.1.8	Nominal speed of the motor	24	20 000	rpm	1440		112	The default applies for a 4-pole motor and a nominal size frequency drive.
P2.1.9	Nominal current of the motor	0,1 x I_H	2 x I_H	A	I_H		113	Check the rating plate of the motor.
P2.1.10	Motor cosφ	0,30	1,00		0,85		120	Check the rating plate of the motor
P2.1.11	PID controller reference signal (Place A)	0	4		0		332	**0**=Anal.volt. input (#2—3) **1**=Anal.curr.input (#4—5) **2**=PID ref from Keypad control page, par. 3.4 **3**=PID ref from fieldbus (ProcessDataIN 1) **4**=Motor potentiometer
P2.1.12	PID controller gain	0,0	1000,0	%	100,0		118	
P2.1.13	PID controller I-time	0,00	320,00	s	1,00		119	
P2.1.14	PID controller D-time	0,00	100,00	s	0,00		132	
P2.1.15	Sleep frequency	0,00	Par. 2.1.2	Hz	10,00		1016	
P2.1.16	Sleep delay	0	3600	s	30		1017	
P2.1.17	Wake up level	0,00	100,00	%	25,00		1018	
P2.1.18	Wake up function	0	1		0		1019	**0**=Wake-up at fall below wake up level (2.1.17) **1**=Wake-up at exceeded wake up level (2.1.17)
P2.1.19	Jogging speed reference	0,00	Par. 2.1.2	Hz	10,00		124	

Table 5-3. Basic parameters G2.1

5.4.3 Input signals (Control keypad: Menu M2 → G2.2)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.2.1	DIN2 function	0	13		1		319	**0**=Not used **1**=External fault cc **2**=External fault oc **3**=Run enable **4**=Acc/Dec time selection **5**=CP: I/O terminal **6**=CP: Keypad **7**=CP: Fieldbus **8**=Forward/Reverse **9**=Jogging frequency (cc) **10**=Fault reset (cc) **11**=Acc/Dec prohibit (cc) **12**=DC braking command **13**=Motor pot. UP (cc)
P2.2.2	DIN3 function	0	13		10		301	See above except: **13**=Motor pot. DOWN (cc)
P2.2.3	DIN5 function	0	13		9		330	See above except: **13**=Enable PID reference 2
P2.2.4	PID sum point reference	0	7		0		376	**0**=Direct PID output value **1**=AI1+PID output **2**=AI2+PID output **3**=AI3+PID output **4**=AI4+PID output **5**=PID keypad+PID output **6**=Fieldbus+PID output (ProcessDataIN3) **7**=Mot.pot.+PID output
P2.2.5	I/O B reference selection	0	7		1		343	**0**=AI1 **1**=AI2 **2**=AI3 **3**=AI4 **4**=Keypad reference **5**=Fieldbus reference (FBSpeedReference) **6**=Motor potentiometer **7**=PID controller
P2.2.6	Keypad control reference selection	0	7		4		121	As in par. 2.2.5
P2.2.7	Fieldbus control reference selection	0	7		5		122	As in par. 2.2.5
P2.2.8	Actual value selection	0	7		0		333	**0**=Actual value 1 **1**=Actual 1 + Actual 2 **2**=Actual 1 – Actual 2 **3**=Actual 1 * Actual 2 **4**=Max(Actual 1, Actual 2) **5**=Min(Actual 1, Actual 2) **6**=Mean(Actual1, Actual2) **7**=Sqrt (Act1) + Sqrt (Act2)
P2.2.9	Actual value 1 selection	0	10		2		334	**0**=Not used **1**=AI1 signal (c-board) **2**=AI2 signal (c-board) **3**=AI3 **4**=AI4 **5**=Fieldbus ProcessDataIN2 **6**=Motor torque **7**=Motor speed **8**=Motor current **9**=Motor power **10**=Encoder frequency

CP=control place, cc=closing contact oc=opening contact

P2.2.10	Actual value 2 input	0	9		0		335	**0**=Not used **1**=AI1 signal (c-board) **2**=AI2 signal (c-board) **3**=AI3 **4**=AI4 **5**=Fieldbus ProcessDataIN3 **6**=Motor torque **7**=Motor speed **8**=Motor current **9**=Motor power
P2.2.11	Actual value 1 minimum scale	–1600,0	1600,0	%	0,0		336	**0**=No minimum scaling
P2.2.12	Actual value 1 maximum scale	–1600,0	1600,0	%	100,0		337	**100**=No maximum scaling
P2.2.13	Actual value 2 minimum scale	–1600,0	1600,0	%	0,0		338	**0**=No minimum scaling
P2.2.14	Actual value 2 maximum scale	–1600,0	1600,0	%	100,0		339	**100**=No maximum scaling
P2.2.15	AI1 signal selection	0			A.1		377	TTF programming method used. See page 65
P2.2.16	AI1 signal range	0	2		0		320	**0**=Signal range 0-100%* **1**=Signal range 20-100%* **2**=Custom range*
P2.2.17	AI1 custom minimum setting	-160,00	160,00	%	0,00		321	
P2.2.18	AI1 custom maximum setting	-160,00	160,00	%	100,00		322	
P2.2.19	AI1 inversion	0	1		0		323	**0**=Not inverted **1**=Inverted
P2.2.20	AI1 filter time	0,00	10,00	s	0,10		324	**0**=No filtering
P2.2.21	AI2 signal selection	0			A.2		388	TTF programming method used. See page 65
P2.2.22	AI2 signal range	0	2		1		325	**0**=0—20 mA* **1**=4—20 mA* **2**=Customised*
P2.2.23	AI2 custom minimum setting	-160,00	160,00	%	0,00		326	
P2.2.24	AI2 custom maximum setting	-160,00	160,00	%	100,00		327	
P2.2.25	AI2 inversion	0	1		0		328	**0**=Not inverted **1**=Inverted
P2.2.26	AI2 filter time	0,00	10,00	s	0,10		329	**0**=No filtering
P2.2.27	Motor potentiometer ramp time	0,1	2000,0	Hz/s	10,0		331	
P2.2.28	Motor potentiometer frequency reference memory reset	0	2		1		367	**0**=No reset **1**=Reset if stopped or powered down **2**=Reset if powered down
P2.2.29	Motor potentiometer PID reference memory reset	0	2		0		370	**0**=No reset **1**=Reset if stopped or powered down **2**=Reset if powered down
P2.2.30	PID minimum limit	–1600,0	Par. 2.2.31	%	0,00		359	
P2.2.31	PID maximum limit	Par. 2.2.30	1600,0	%	100,00		360	
P2.2.32	Error value inversion	0	1		0		340	**0**=No inversion **1**=Inversion
P2.2.33	PID reference rising time	0,0	100,0	s	5,0		341	

P2.2.34	PID reference falling time	0,0	100,0	s	5,0		342	
P2.2.35	Reference scaling minimum value, place B	0,00	320,00	Hz	0,00		344	
P2.2.36	Reference scaling maximum value, place B	0,00	320,00	Hz	0,00		345	
P2.2.37	Easy changeover	0	1		0		366	**0**=Keep reference **1**=Copy actual reference
P2.2.38	AI3 signal selection	0			0.1		141	TTF programming method used. See page 65
P2.2.39	AI3 signal range	0	1		1		143	**0**=Signal range 0—10V **1**=Signal range 2—10V
P2.2.40	AI3 inversion	0	1		0		151	**0**=Not inverted **1**=Inverted
P2.2.41	AI3 filter time	0,00	10,00	s	0,10		142	**0**=No filtering
P2.2.42	AI4 signal selection	0			0.1		152	TTF programming method used. See page 65
P2.2.43	AI4 signal range	0	1		1		154	**0**=Signal range 0—10V **1**=Signal range 2—10V
P2.2.44	AI4 inversion	0	1		0		162	**0**=Not inverted **1**=Inverted
P2.2.45	AI4 filter time	0,00	10,00	s	0,10		153	**0**=No filtering
P2.2.46	Actual value special display minimum	0	30000		0		1033	
P2.2.47	Actual value special display maximum	0	30000		100		1034	
P2.2.48	Actual value special display decimals	0	4		1		1035	
P2.2.49	Actual value special display unit	0	28		4		1036	See page 200.

Table 5-4. Input signals, G2.2

*Remember to place jumpers of block X2 accordingly. See the product's User's Manual.

5.4.4 Output signals (Control keypad: Menu M2 → G2.3)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.3.1	Analogue output 1 signal selection	0			A.1		464	TTF programming method used. See page 65
P2.3.2	Analogue output function	0	14		1		307	**0**=Not used **1**=Output freq. (0—f_{max}) **2**=Freq. reference (0—f_{max}) **3**=Motor speed (0—Motor nominal speed) **4**=Motor current (0—I_{nMotor}) **5**=Motor torque (0—T_{nMotor}) **6**=Motor power (0—P_{nMotor}) **7**=Motor voltage (0-U_{nMotor}) **8**=DC-link volt (0—1000V) **9**=PID controller ref. value **10**=PID contr. act. value 1 **11**=PID contr. act. value 2 **12**=PID contr. error value **13**=PID controller output **14**=PT100 temperature
P2.3.3	Analogue output filter time	0,00	10,00	s	1,00		308	**0**=No filtering
P2.3.4	Analogue output inversion	0	1		0		309	**0**=Not inverted **1**=Inverted
P2.3.5	Analogue output minimum	0	1		0		310	**0**=0 mA **1**=4 mA
P2.3.6	Analogue output scale	10	1000	%	100		311	
P2.3.7	Digital output 1 function	0	23		1		312	**0**=Not used **1**=Ready **2**=Run **3**=Fault **4**=Fault inverted **5**=FC overheat warning **6**=Ext. fault or warning **7**=Ref. fault or warning **8**=Warning **9**=Reversed **10**=Preset speed 1 **11**=At speed **12**=Mot. regulator active **13**=OP freq. limit superv.1 **14**=OP freq.limit superv.2 **15**=Torque limit superv. **16**=Ref. limit supervision **17**=External brake control **18**=Control place: IO **19**=FC temp. limit superv. **20**=Unrequested direction **21**=Ext. brake control inv. **22**=Thermistor fault/warn. **23**=Fieldbus input data
P2.3.8	Relay output 1 function	0	23		2		313	As parameter 2.3.7
P2.3.9	Relay output 2 function	0	23		3		314	As parameter 2.3.7
P2.3.10	Output frequency limit 1 supervision	0	2		0		315	**0**=No limit **1**=Low limit supervision **2**=High limit supervision
P2.3.11	Output frequency limit 1; Supervised value	0,00	320,00	Hz	0,00		316	

P2.3.12	Output frequency limit 2 supervision	0	2		0		346	**0**=No limit **1**=Low limit supervision **2**=High limit supervision
P2.3.13	Output frequency limit 2; Supervised value	0,00	320,00	Hz	0,00		347	
P2.3.14	Torque limit supervision	0	2		0		348	**0**=Not used **1**=Low limit supervision **2**=High limit supervision
P2.3.15	Torque limit supervision value	-300,0	300,0	%	100,0		349	
P2.3.16	Reference limit supervision	0	2		0		350	**0**=Not used **1**=Low limit **2**=High limit
P2.3.17	Reference limit supervision value	0,00	100,00	%	0,00		351	
P2.3.18	External brake-off delay	0,0	100,0	s	0,5		352	
P2.3.19	External brake-on delay	0,0	100,0	s	1,5		353	
P2.3.20	FC temperature supervision	0	2		0		354	**0**=Not used **1**=Low limit **2**=High limit
P2.3.21	FC temperature supervised value	–10	100	°C	40		355	
P2.3.22	Analogue output 2 signal selection	0			0.1		471	TTF programming method used. See page 65.
P2.3.23	Analogue output 2 function	0	14		4		472	As parameter 2.3.2
P2.3.24	Analogue output 2 filter time	0,00	10,00	s	1,00		473	**0**=No filtering
P2.3.25	Analogue output 2 inversion	0	1		0		474	**0**=Not inverted **1**=Inverted
P2.3.26	Analogue output 2 minimum	0	1		0		475	**0**=0 mA **1**=4 mA
P2.3.27	Analogue output 2 scaling	10	1000	%	100		476	

Table 5-5. Output signals, G2.3

5.4.5 Drive control parameters (Control keypad: Menu M2 → G2.4)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.4.1	Ramp 1 shape	0,0	10,0	s	0,1		500	**0**=Linear **>0**=S-curve ramp time
P2.4.2	Ramp 2 shape	0,0	10,0	s	0,0		501	**0**=Linear **>0**=S-curve ramp time
P2.4.3	Acceleration time 2	0,1	3000,0	s	0,1		502	
P2.4.4	Deceleration time 2	0,1	3000,0	s	0,1		503	
P2.4.5	Brake chopper	0	4		0		504	**0**=Disabled **1**=Used when running **2**=External brake chopper **3**=Used when stopped/running **4**=Used when running (no testing)
P2.4.6	Start function	0	1		0		505	**0**=Ramp **1**=Flying start
P2.4.7	Stop function	0	3		0		506	**0**=Coasting **1**=Ramp **2**=Ramp+Run enable coast **3**=Coast+Run enable ramp
P2.4.8	DC braking current	0,00	I_L	A	0,7 x I_H		507	
P2.4.9	DC braking time at stop	0,00	600,00	s	0,00		508	**0**=DC brake is off at stop
P2.4.10	Frequency to start DC braking during ramp stop	0,10	10,00	Hz	1,50		515	
P2.4.11	DC braking time at start	0,00	600,00	s	0,00		516	**0**=DC brake is off at start
P2.4.12	Flux brake	0	1		0		520	**0**=Off **1**=On
P2.4.13	Flux braking current	0,00	I_L	A	I_H		519	

Table 5-6. Drive control parameters, G2.4

5.4.6 Prohibit frequency parameters (Control keypad: Menu M2 → G2.5)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.5.1	Prohibit frequency range 1 low limit	0,0	320,00	Hz	0,0		509	**0**=Not used
P2.5.2	Prohibit frequency range 1 high limit	0,0	320,00	Hz	0,0		510	**0**=Not used
P2.5.3	Prohibit frequency range 2 low limit	0,0	320,00	Hz	0,0		511	**0**=Not used
P2.5.4	Prohibit frequency range 2 high limit	0,0	320,00	Hz	0,0		512	**0**=Not used
P2.5.5	Prohibit frequency range 3 low limit	0,0	320,00	Hz	0,0		513	**0**=Not used
P2.5.6	Prohibit frequency range 3 high limit	0,0	320,00	Hz	0,0		514	**0**=Not used
P2.5.7	Prohibit acc./dec. ramp	0,1	10,0	x	1,0		518	

Table 5-7. Prohibit frequency parameters, G2.5

5.4.7 Motor control parameters (Control keypad: Menu M2 → G2.6)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.6.1	Motor control mode	0	1/3		0		600	**0**=Frequency control **1**=Speed control **Additionally for NXP:** **2**=Not used **3**=Closed loop speed ctrl
P2.6.2	U/f optimisation	0	1		0		109	**0**=Not used **1**=Automatic torque boost
P2.6.3	U/f ratio selection	0	3		0		108	**0**=Linear **1**=Squared **2**=Programmable **3**=Linear with flux optim.
P2.6.4	Field weakening point	8,00	320,00	Hz	50,00		602	
P2.6.5	Voltage at field weakening point	10,00	200,00	%	100,00		603	n% x U_{nmot}
P2.6.6	U/f curve midpoint frequency	0,00	par. P2.6.4	Hz	50,00		604	
P2.6.7	U/f curve midpoint voltage	0,00	100,00	%	100,00		605	n% x U_{nmot} Parameter max. value = par. 2.6.5
P2.6.8	Output voltage at zero frequency	0,00	40,00	%	Varies		606	n% x U_{nmot}
P2.6.9	Switching frequency	1,0	Varies	kHz	Varies		601	See Table 8-12 for exact values
P2.6.10	Overvoltage controller	0	2		1		607	**0**=Not used **1**=Used (no ramping) **2**=Used (ramping)
P2.6.11	Undervoltage controller	0	1		1		608	**0**=Not used **1**=Used
P2.6.12	Load drooping	0,00	100,00	%	0,00		620	
P2.6.13	Identification	0	1/2		0		631	**0**=No action **1**=Identification w/o run **2**=Identification with run
Closed Loop parameter group 2.6.14								
P2.6.14.1	Magnetizing current	0,00	100,00	A	0,00		612	
P2.6.14.2	Speed control P gain	1	1000		30		613	
P2.6.14.3	Speed control I time	0,0	500,0	ms	30,0		614	
P2.6.14.5	Acceleration compensation	0,00	300,00	s	0,00		626	
P2.6.14.6	Slip adjust	0	500	%	100		619	
P2.6.14.7	Magnetizing current at start	0,00	I_L	A	0,00		627	
P2.6.14.8	Magnetizing time at start	0	60000	ms	0,0		628	
P2.6.14.9	0-speed time at start	0	32000	ms	100		615	
P2.6.14.10	0-speed time at stop	0	32000	ms	100		616	
P2.6.14.11	Start-up torque	0	3		0		621	**0**=Not used **1**=Torque memory **2**=Torque reference **3**=Start-up torque fwd/rev
P2.6.14.12	Start-up torque FWD	–300,0	300,0	%	0,0		633	
P2.6.14.13	Start-up torque REV	–300,0	300,0	%	0,0		634	
P2.6.14.15	Encoder filter time	0,0	100,0	ms	0,0		618	
P2.6.14.17	Current control P gain	0,00	100,00	%	40,00		617	

Table 5-8. Motor control parameters, G2.6

5.4.8 Protections (Control keypad: Menu M2 → G2.7)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.7.1	Response to 4mA reference fault	0	5		4		700	**0**=No response **1**=Warning **2**=Warning+Previous Freq. **3**=Wrng+PresetFreq 2.7.2 **4**=Fault,stop acc. to 2.4.7 **5**=Fault,stop by coasting
P2.7.2	4mA reference fault frequency	0,00	Par. 2.1.2	Hz	0,00		728	
P2.7.3	Response to external fault	0	3		2		701	**0**=No response **1**=Warning **2**=Fault,stop acc. to 2.4.7 **3**=Fault,stop by coasting
P2.7.4	Input phase supervision	0	3		0		730	
P2.7.5	Response to undervoltage fault	0	1		0		727	**0**=Fault stored in history **1**=Fault not stored
P2.7.6	Output phase supervision	0	3		2		702	**0**=No response **1**=Warning **2**=Fault,stop acc. to 2.4.7 **3**=Fault,stop by coasting
P2.7.7	Ground fault protection	0	3		2		703	
P2.7.8	Thermal protection of the motor	0	3		2		704	
P2.7.9	Motor ambient temperature factor	–100,0	100,0	%	0,0		705	
P2.7.10	Motor cooling factor at zero speed	0,0	150,0	%	40,0		706	
P2.7.11	Motor thermal time constant	1	200	min	Varies		707	
P2.7.12	Motor duty cycle	0	100	%	100		708	
P2.7.13	Stall protection	0	3		1		709	**0**=No response **1**=Warning **2**=Fault,stop acc. to 2.4.7 **3**=Fault,stop by coasting
P2.7.14	Stall current	0,00	2 x I_H	A	I_H		710	
P2.7.15	Stall time limit	1,00	120,00	s	15,00		711	
P2.7.16	Stall frequency limit	1,0	Par. 2.1.2	Hz	25,0		712	
P2.7.17	Underload protection	0	3		0		713	**0**=No response **1**=Warning **2**=Fault,stop acc. to 2.4.7 **3**=Fault,stop by coasting
P2.7.18	Field weakening area load	10	150	%	50		714	
P2.7.19	Zero frequency load	5,0	150,0	%	10,0		715	
P2.7.20	Underload protection time limit	2	600	s	20		716	
P2.7.21	Response to thermistor fault	0	3		2		732	**0**=No response **1**=Warning **2**=Fault,stop acc. to 2.4.7 **3**=Fault,stop by coasting
P2.7.22	Response to fieldbus fault	0	3		2		733	See P2.7.21
P2.7.23	Response to slot fault	0	3		2		734	See P2.7.21
P2.7.24	No. of PT100 inputs	0	3		0		739	
P2.7.25	Response to PT100 fault	0	3		2		740	**0**=No response **1**=Warning **2**=Fault,stop acc. to 2.4.7 **3**=Fault,stop by coasting
P2.7.26	PT100 warning limit	–30,0	200,0	C°	120,0		741	
P2.7.27	PT100 fault limit	–30,0	200,0	C°	130,0		742	

Table 5-9. Protections, G2.7

5.4.9 Autorestart parameters (Control keypad: Menu M2 → G2.8)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.8.1	Wait time	0,10	10,00	s	0,50		717	
P2.8.2	Trial time	0,00	60,00	s	30,00		718	
P2.8.3	Start function	0	2		0		719	**0**=Ramp **1**=Flying start **2**=According to par. 2.4.6
P2.8.4	Number of tries after undervoltage trip	0	10		0		720	
P2.8.5	Number of tries after overvoltage trip	0	10		0		721	
P2.8.6	Number of tries after overcurrent trip	0	3		0		722	
P2.8.7	Number of tries after 4mA reference trip	0	10		0		723	
P2.8.8	Number of tries after motor temp fault trip	0	10		0		726	
P2.8.9	Number of tries after external fault trip	0	10		0		725	
P2.8.10	Number of tries after underload fault trip	0	10		0		738	

Table 5-10. Autorestart parameters, G2.8

5.4.10 Keypad control (Control keypad: Menu M3)

The parameters for the selection of control place and direction on the keypad are listed below. See the Keypad control menu in the product's user's manual.

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P3.1	Control place	1	3		1		125	**1**=I/O terminal **2**=Keypad **3**=Fieldbus
R3.2	Keypad reference	Par. 2.1.1	Par. 2.1.2	Hz				
P3.3	Direction (on keypad)	0	1		0		123	**0**=Forward **1**=Reverse
R3.4	PID reference	0,00	100,00	%	0,00			
R3.5	PID reference 2	0,00	100,00	%	0,00			
R3.6	Stop button	0	1		1		114	**0**=Limited function of Stop button **1**=Stop button always enabled

Table 5-11. Keypad control parameters, M3

5.4.11 System menu (Control keypad: M6)

For parameters and functions related to the general use of the frequency drive, such as application and language selection, customised parameter sets or information about the hardware and software, see the product's user's manual.

5.4.12 Expander boards (Control keypad: Menu M7)

The **M7** menu shows the expander and option boards attached to the control board and board-related information. For more information, see the product's user's manual.

6. MULTI-PURPOSE CONTROL APPLICATION

(Software ASFIFF06)

6.1 Introduction

Select the Multi-purpose Control Application in menu **M6** on page *S6.2.*

Multi-purpose control application provides a wide range of parameters for controlling motors. It can be used for various kinds of different processes, where wide flexibility of I/O signals is needed and PID control is not necessary (if you need PID control functions, use the PID Control Application or Pump and Fan Control Application).
The frequency reference can be selected e.g. from the analogue inputs, joystick control, motor potentiometer and from a mathematical function of the analogue inputs. There are parameters also for Fieldbus communication. Multi-step speeds and jogging speed can also be selected if digital inputs are programmed for these functions.

- The digital inputs and all the outputs are freely programmable and the application supports all I/O-boards

Additional functions:

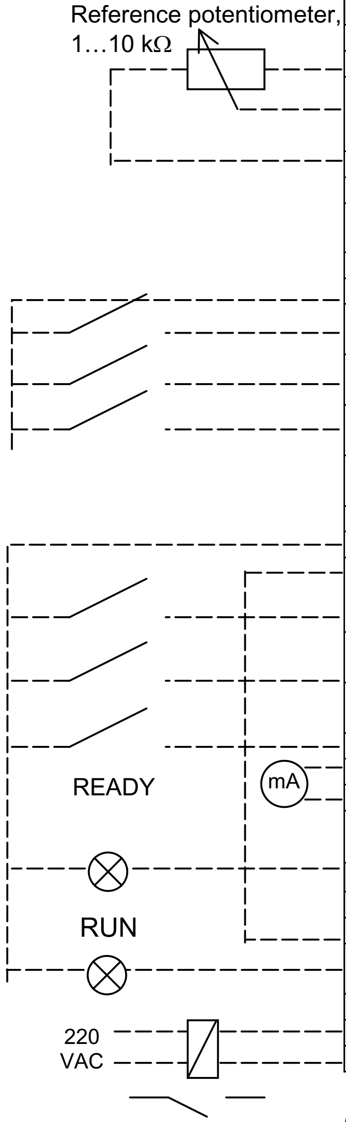
- Analogue input signal range selection
- Two frequency limit supervisions
- Torque limit supervision
- Reference limit supervision
- Second ramps and S-shape ramp programming
- Programmable Start/Stop and Reverse logic
- DC-brake at start and stop
- Three prohibit frequency areas
- Programmable U/f curve and switching frequency
- Autorestart
- Motor thermal and stall protection: fully programmable; off, warning, fault
- Motor underload protection
- Input and output phase supervision
- Joystick hysteresis
- Sleep function

NXP functions:

- Power limit functions
- Different power limits for motoring and generating side
- Master Follower function
- Different torque limits for motoring and generating side
- Cooling monitor input from heat exchange unit
- Brake monitoring input and actual current monitor for immediate brake close.
- Separate speed control tuning for different speeds and loads
- Inching function two different references
- Possibility to connect the FB Process data to any parameter and some monitoring values
- Identification parameter can be adjusted manually

The parameters of the Multi-Purpose Control Application are explained in Chapter 8 of this manual. The explanations are arranged according to the individual ID number of the parameter.

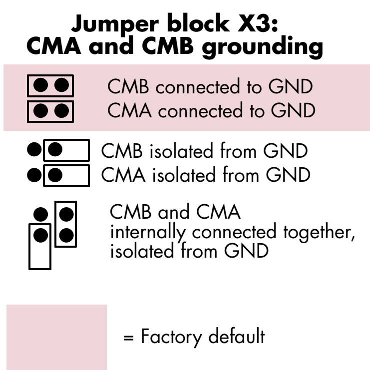
6.2 Control I/O



OPT-A1			
Terminal		Signal	Description
1	+10V$_{ref}$	Reference output	Voltage for potentiometer, etc.
2	AI1+	Analogue input, voltage range 0—10V DC	Voltage input frequency reference
3	AI1-	I/O Ground	Ground for reference and controls
4	AI2+	Analogue input, current range 0—20mA	Current input frequency reference
5	AI2-		
6	+24V	Control voltage output	Voltage for switches, etc. max 0.1 A
7	GND	I/O ground	Ground for reference and controls
8	DIN1	Start forward (programmable)	Contact closed = start forward
9	DIN2	Start reverse (programmable)	Contact closed = start reverse
10	DIN3	Fault reset (programmable)	Contact closed = fault reset
11	CMA	Common for DIN 1—DIN 3	Connect to GND or +24V
12	+24V	Control voltage output	Voltage for switches (see #6)
13	GND	I/O ground	Ground for reference and controls
14	DIN4	Jogging speed selection *(programmable)*	Contact closed = Jogging speed active
15	DIN5	External fault (Programmable)	Contact open = no fault Contact closed = fault
16	DIN6	Accel. /decel. time select (Programmable)	Contact open = par. 2.1.3, 2.1.4 in use Contact closed = par. 2.4.3., 2.4.4 in use
17	CMB	Common for DIN4—DIN6	Connect to GND or +24V
18	AOA1+	Output frequency	Programmable
19	AOA1-	Analogue output	Range 0—20 mA/R$_L$, max. 500Ω
20	DOA1	Digital output READY	Programmable Open collector, I≤50mA, U≤48 VDC
OPT-A2			
21	RO1	Relay output 1 RUN	Programmable
22	RO1		
23	RO1		
24	RO2	Relay output 2 FAULT	Programmable
25	RO2		
26	RO2		

Table 6-1. Multi-purpose control application default I/O configuration and connection example.

Note: See jumper selections below. More information in the product's user's manual.



6.3 Control signal logic in Multi-Purpose Control Application

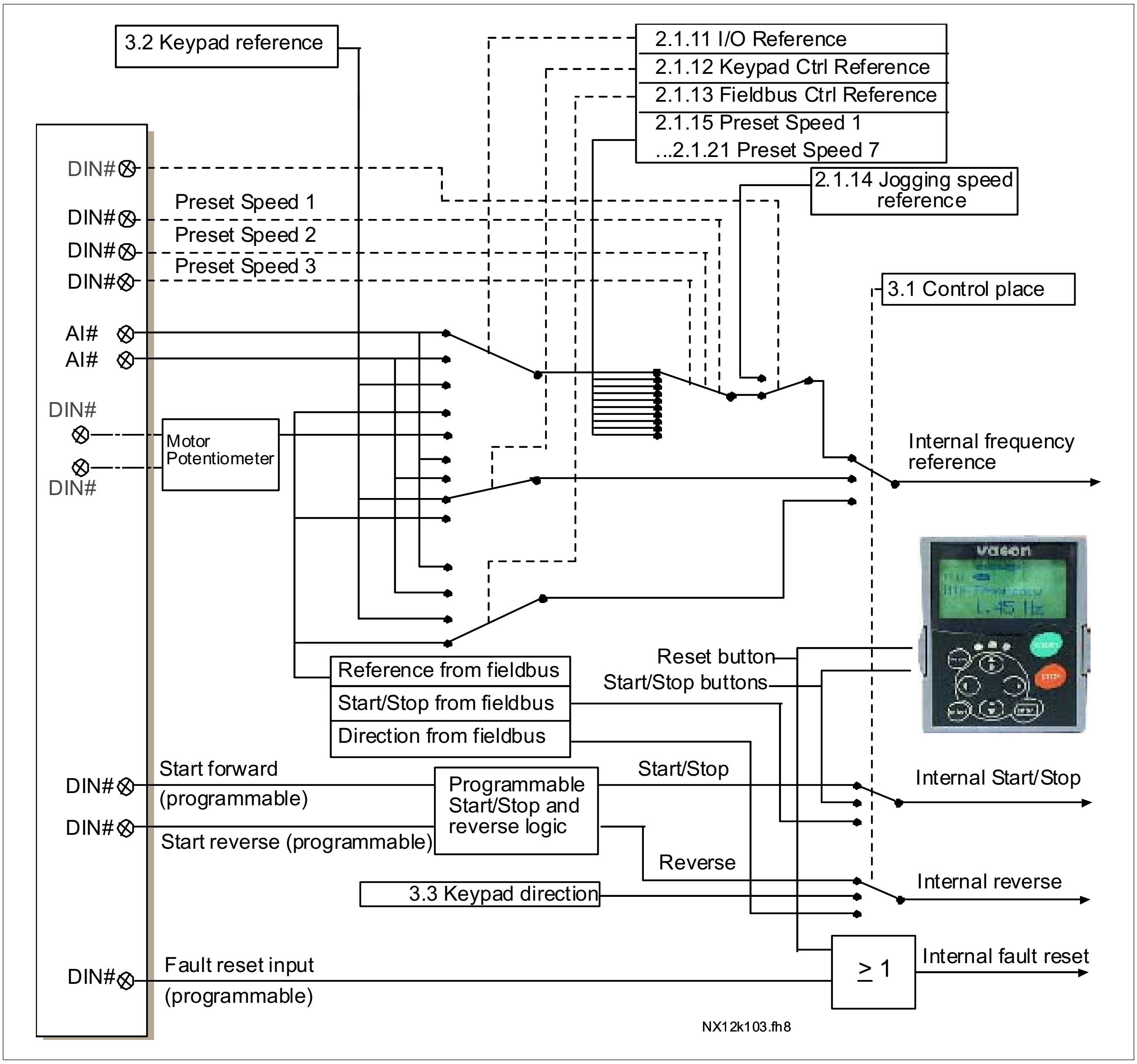


Figure 6-1. Control signal logic of the Multi-purpose Control Application

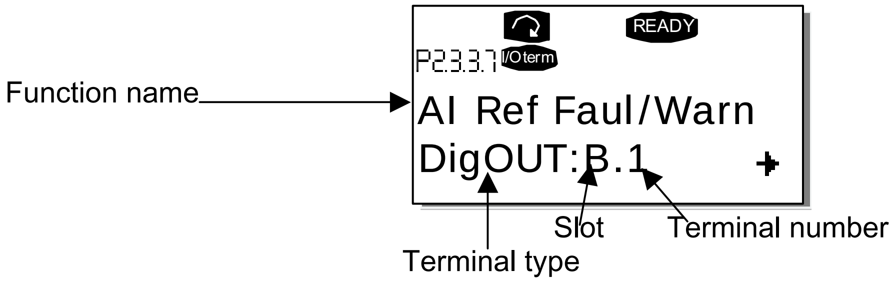
6.4 "Terminal To Function" (TTF) programming principle

The programming principle of the input and output signals in the **Multipurpose Control Application** as well as in the **Pump and Fan Control Application** (and partly in the other applications) is different compared to the conventional method used in other NX applications.

In the conventional programming method, *Function to Terminal Programming Method (FTT),* you have a fixed input or output that you define a certain function for. The applications mentioned above, however, use the *Terminal to Function Programming method (TTF)* in which the programming process is carried out the other way round: Functions appear as parameters which the operator defines a certain input/output for. See *Warning* on page 66.

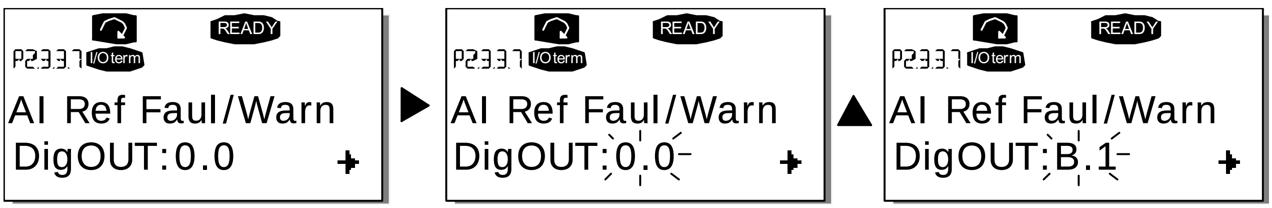
6.4.1 Defining an input/output for a certain function on keypad

Connecting a certain input or output with a certain function (parameter) is done by giving the parameter an appropriate value. The value is formed of the *Board slot* on the NX control board (see the product's user's manual) and the *respective signal number*, see below.



Example: You want to connect the digital output function *Reference fault/warning* (parameter 2.3.3.7) to the digital output DO1 on the basic board OPT-A1 (see the product's user's manual).

First find the parameter 2.3.3.7 on the keypad. Press the *Menu button right* once to enter the edit mode. On the *value line*, you will see the terminal type on the left (DigIN, DigOUT, An.IN, An.OUT) and on the right, the present input/output the function is connected to (B.3, A.2 etc.), or if not connected, a value (0.#).
When the value is blinking, hold down the *Browser button up* or *down* to find the desired board slot and signal number. The program will scroll the board slots starting from **0** and proceeding from **A** to **E** and the I/O selection from **1** to **10**.
Once you have set the desired value, press the *Enter button* once to confirm the change.



6.4.2 Defining a terminal for a certain function with NCDrive programming tool

If you use the NCDrive Programming Tool for parametrizing you will have to establish the connection between the function and input/output in the same way as with the control panel. Just pick the address code from the drop-down menu in the *Value* column (see the Figure below).

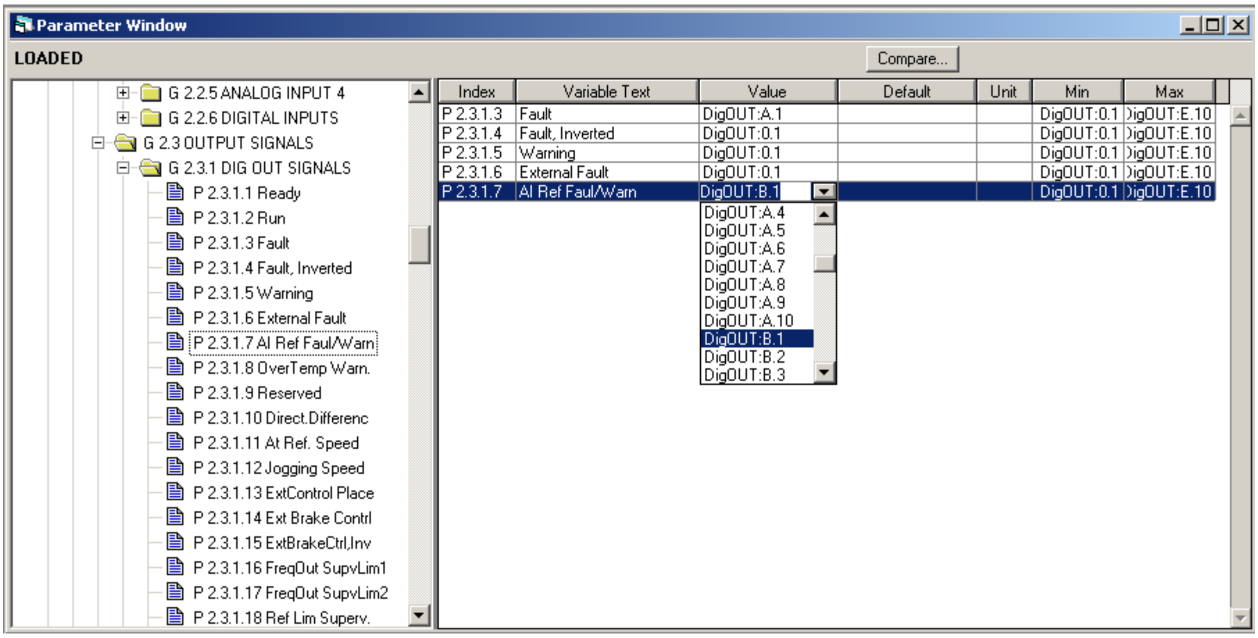


Figure 6-2. Screenshot of NCDrive programming tool; Entering the address code

WARNING	**Be ABSOLUTELY sure not to connect two functions to one and same <u>output</u> in order to avoid function overruns and to ensure flawless operation.**

Note: The *inputs*, unlike the *outputs*, cannot be changed in RUN state.

6.4.3 Defining unused inputs/outputs

All unused inputs and outputs must be given the board slot value **0** and the value **1** also for the terminal number. The value **0.1** is also the default value for most of the functions. However, if you want to use the **values of a digital input signal** for e.g. testing purposes only, you can set the board slot value to **0** and the terminal number to any number between 2…10 to place the input to a TRUE state. In other words, the value 1 corresponds to 'open contact' and values 2 to 10 to 'closed contact'.

In case of analogue inputs, giving the value **1** for the terminal number corresponds to 0% signal level, value **2** corresponds to 20%, value **3** to 30% and so on. Giving value **10** for the terminal number corresponds to 100% signal level.

6.5 Master/Follower function (NXP only)

The Master/Follower function is designed for applications in which the system is run by several NXP drives and the motor shafts are coupled to each other via gearing, chain, belt etc. The NXP drives are in closed loop control mode.

The external control signals are connected to the Master NXP only. The Master controls the Follower(s) via a SystemBus. The Master station is typically speed-controlled and the other drives follow its torque or speed reference.

Torque control of the Follower should be used when the motor shafts of the Master and Follower drives are coupled solidly to each other by gearing, a chain etc., so that no speed difference between the drives is possible.

Speed control of the Follower should be used when the motor shafts of the Master and the Follower drives are coupled flexibly to each other, so that a slight speed difference between the drives is possible. When both the Master and the Followers are speed-controlled, drooping is typically also used.

6.5.1 Master/Follower link physical connections

The master drive is located on the left side and all others are followers. The master/follower physical link can be built with OPT-D1 or OPT-D2 option boards.

6.5.2 Optical fibre connection between frequency drives with OPT-D1

Connect the output 1 of Device 1 to the input 2 of Device 2 and the input of Device 1 to the output 2 of Device 2. Note that in the end devices one terminal pair remains unused.

6.5.3 Optical fibre connection between frequency drives with OPT-D2

In this connection example, the leftmost device is the Master and the others are followers. The OPT-D2 board in the Master has the default jumper selections, i.e. X6:1-2, X5:1-2. For the followers, the jumper positions have to be changed: X6:1-2, **X5:2-3**.

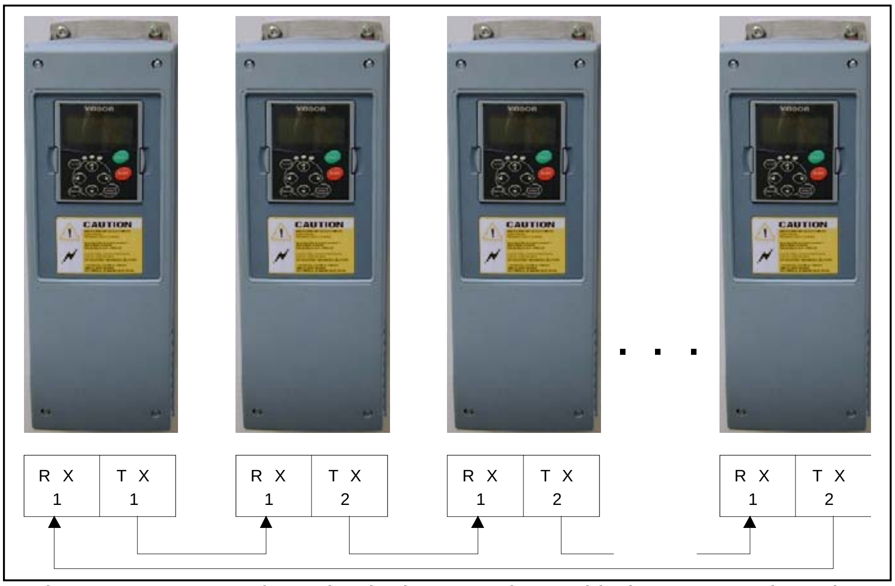


Figure 6-3. System bus physical connections with the OPT-D2 board

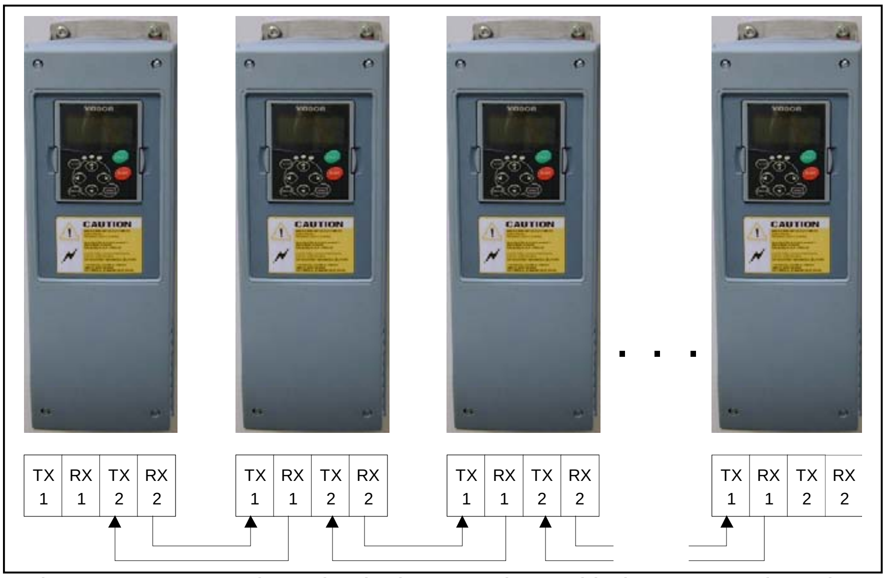


Figure 6-4. System bus physical connections with the OPT-D1 board

6.5.4 OPT-D2 expander board menu

SBCRCErrorCounter

Indicates the number of CRC-errors in the communication.

SBOk

Indicator: SystemBus working properly.

SBInUse

Parameter for activating SystemBus communication.

0 = Not in used
1 = Communication activated

SBId

Drive number in SystemBus line. Use 1 for Master or the same ID as in CAN line.

SBNextId

Next Drive number in SystemBus line.

SBSpeed

Parameter for the selection of SystemBus speed.

6.6 Multi-purpose Control Application – Parameter lists

On the next pages you will find the lists of parameters within the respective parameter groups. The parameter descriptions are given on pages 122 to 209.

Column explanations:

Code = Location indication on the keypad; Shows the operator the present parameter number
Parameter = Name of parameter
Min = Minimum value of parameter
Max = Maximum value of parameter
Unit = Unit of parameter value; Given if available
Default = Value preset by factory
Cust = Customer's own setting
ID = ID number of the parameter
= On param. code: Parameter value can only be changed after the FC has been stopped
= Apply the Terminal to Function method (TTF) to these parameters (see chapter 6.4)
= Monitoring values controllable from fieldbus using the ID number

6.6.1 Monitoring values (Control keypad: menu M1)

The monitoring values are the actual values of parameters and signals as well as statuses and measurements. Monitoring values on shadowed background can be controlled from the fieldbus. See the product's user's manual for more information.

Code	Parameter	Unit	ID	Description
V1.1	Output frequency	Hz	1	Output frequency to motor
V1.2	Frequency reference	Hz	25	Frequency reference to motor control
V1.3	Motor speed	rpm	2	Motor speed in rpm
V1.4	Motor current	A	3	
V1.5	Motor torque	%	4	Calculated shaft torque
V1.6	Motor power	%	5	Motor shaft power
V1.7	Motor voltage	V	6	
V1.8	DC link voltage	V	7	
V1.9	Unit temperature	°C	8	Heatsink temperature
V1.10	Motor temperature	%	9	Calculated motor temperature
V1.11	Analogue input 1	V/mA	13	AI1
V1.12	Analogue input 2	V/mA	14	AI2
V1.13	DIN1, DIN2, DIN3		15	Digital input statuses
V1.14	DIN4, DIN5, DIN6		16	Digital input statuses
V1.15	Analogue output 1	V/mA	26	AO1
V1.16	Analogue input 3	V/mA	27	AI3
V1.17	Analogue input 4	V/mA	28	AI4
V1.18	Torque reference	%	18	
V1.19	PT-100 temperature	C°	42	Highest temperature of used PT100 inputs
G1.20	Multimonitoring items			Displays three selectable monitoring values
V1.21.1	Current	A	1113	Unfiltered motor current
V1.21.2	Torque	%	1125	Unfiltered motor torque
V1.21.3	DC Voltage	V	44	Unfiltered DC link voltage
V1.21.4	Status Word		43	
V1.21.5	Motor Current to FB	A	45	Motor current (drive independent) given with one decimal point

Table 6-2. Monitoring values, NXS drives

Code	Parameter	Unit	ID	Description
V1.1	Output frequency	Hz	1	Output frequency to motor
V1.2	Frequency reference	Hz	25	Frequency reference to motor control
V1.3	Motor speed	rpm	2	Motor speed in rpm
V1.4	Motor current	A	3	
V1.5	Motor torque	%	4	Calculated shaft torque
V1.6	Motor power	%	5	Motor shaft power
V1.7	Motor voltage	V	6	
V1.8	DC link voltage	V	7	
V1.9	Unit temperature	°C	8	Heatsink temperature
V1.10	Motor temperature	%	9	Calculated motor temperature
V1.11	Analogue input 1	V/mA	13	AI1
V1.12	Analogue input 2	V/mA	14	AI2
V1.13	DIN1, DIN2, DIN3		15	Digital input statuses
V1.14	DIN4, DIN5, DIN6		16	Digital input statuses
V1.15	Analogue output 1	V/mA	26	AO1
V1.16	Analogue input 3	V/mA	27	AI3
V1.17	Analogue input 4	V/mA	28	AI4
V1.18	Torque reference	%	18	
V1.19	PT-100 temperature	C°	42	Highest temperature of used PT100 inputs
G1.20	Multimonitoring items			Displays three selectable monitoring values
V1.21.1	Current	A	1113	Unfiltered motor current
V1.21.2	Torque	%	1125	Unfiltered motor torque
V1.21.3	DC Voltage	V	44	Unfiltered DC link voltage
V1.21.4	Status Word		43	See chapter 6.6.2
V1.21.5	Encoder 1 Frequency	Hz	1124	
V1.21.6	Shaft Rounds	r	1170	See ID 1090
V1.21.7	Shaft Angle	Deg	1169	See ID 1090
V1.21.8	Measured temperature 1	C°	50	
V1.21.9	Measured temperature 2	C°	51	
V1.21.10	Measured temperature 3	C°	52	
V1.21.11	Encoder 2 Frequency	Hz	53	From OPTA7 board
V1.21.12	Absolute encoder position		54	From OPTBB board
V1.21.13	Absolute encod. rotations		55	From OPTBB board
V1.21.14	ID Run Status		49	
V1.21.15	PolePairNumber		58	
V1.21.16	Analogue input 1	%	59	AI1
V1.21.17	Analogue input 2	%	60	AI2
V1.21.18	Analogue input 3	%	61	
V1.21.19	Analogue input 4	%	62	
V1.21.20	Analogue output 2	%	50	AO2
V1.21.21	Analogue output 3	%	51	AO3
V1.21.22	Final Frequency Reference Closed Loop	Hz	1131	Used for Closed Loop speed tuning
V1.21.23	Step Response	Hz	1132	
V1.22.1	FB torque reference	%	1140	Default control of FB PD 1
V1.22.2	FB limit scaling	%	46	Default control of FB PD 2
V1.22.3	FB adjust reference	%	47	Default control of FB PD 3

V1.22.4	FB analogue output	%	48	Default control of FB PD 4
V1.22.5	Last Active Fault		37	
V1.22.6	Motor Current to FB	A	45	Motor current (drive independent) given with one decimal point
V1.24.7	DIN StatusWord 1		56	
V1.24.8	DIN StatusWord 2		57	

Table 6-3. Monitoring values, NXP drives

Automation and Control Solutions
Honeywell
1985 Douglas Drive North
Golden Valley, MIN 55422

Honeywell Limited-Honeywell Limitée
35 Dynamic Drive
Scarborough, Ontario
MIV 4Z9

6.6.2 Application Status Word

Application Status Word						
Application Status Word	*Standard*	*Loc/Rem*	*Multi-Step*	*PID*	*MP*	*PFC*
b0						
b1	Ready	Ready	Ready	Ready	Ready	Ready
b2	Run	Run	Run	Run	Run	Run
b3	Fault	Fault	Fault	Fault	Fault	Fault
b4						
b5					No EMStop (NXP)	
b6	Run Enable	Run Enable	Run Enable	Run Enable	Run Enable	Run Enable
b7	Warning	Warning	Warning	Warning	Warning	Warning
b8						
b9						
b10						
b11	DC Brake	DC Brake	DC Brake	DC Brake	DC Brake	DC Brake
b12	Run request	Run request	Run request	Run request	Run request	Run request
b13	Limit control	Limit control	Limit control	Limit control	Limit control	Limit control
b14					Brake control	Aux 1
b15				PID active		Aux 2

Table 6-4. Application Status Word content

6.6.3 Basic parameters (Control keypad: Menu M2 → G2.1)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.1.1	Min frequency	0,00	Par. 2.1.2	Hz	0,00		101	
P2.1.2	Max frequency	Par. 2.1.1	320,00	Hz	50,00		102	**NOTE**: If f_{max} > than the motor synchronous speed, check suitability for motor and drive system
P2.1.3	Acceleration time 1	0,1	3000,0	s	3,0		103	
P2.1.4	Deceleration time 1	0,1	3000,0	s	3,0		104	
P2.1.5	Current limit	0,1 x I_H	2 x I_H	A	I_L		107	
P2.1.6	Nominal voltage of the motor	180	690	V	NX2: 230V NX5: 400V NX6: 690V		110	
P2.1.7	Nominal frequency of the motor	8,00	320,00	Hz	50,00		111	Check the rating plate of the motor
P2.1.8	Nominal speed of the motor	24	20 000	rpm	1440		112	The default applies for a 4-pole motor and a nominal size frequency drive.
P2.1.9	Nominal current of the motor	0,1 x I_H	2 x I_H	A	I_H		113	Check the rating plate of the motor.
P2.1.10	Motor cosφ	0,30	1,00		0,85		120	Check the rating plate of the motor
P2.1.11	I/O Reference	0	15/16		0		117	**0**=AI1 **1**=AI2 **2**=AI1+AI2 **3**=AI1-AI2 **4**=AI2-AI1 **5**=AI1xAI2 **6**=AI1 Joystick **7**=AI2 Joystick **8**=Keypad **9**=Fieldbus **10**=Motor potentiometer **11**=AI1, AI2 minimum **12**=AI1, AI2 maximum **13**=Max frequency **14**=AI1/AI2 selection **15**=Encoder 1 **16**=Encoder 2 (NXP only)
P2.1.12	Keypad control reference	0	9		8		121	**0**=AI1 **1**=AI2 **2**=AI1+AI2 **3**=AI1-AI2 **4**=AI2-AI1 **5**=AI1xAI2 **6**=AI1 Joystick **7**=AI2 Joystick **8**=Keypad **9**=Fieldbus
P2.1.13	Fieldbus control reference	0	9		9		122	See par. 2.1.12
P2.1.14	Jogging speed reference	0,00	Par. 2.1.2	Hz	5,00		124	See ID413.
P2.1.15	Preset speed 1	0,00	Par. 2.1.2	Hz	10,00		105	Multi-step speed 1
P2.1.16	Preset speed 2	0,00	Par. 2.1.2	Hz	15,00		106	Multi-step speed 2
P2.1.17	Preset speed 3	0,00	Par. 2.1.2	Hz	20,00		126	Multi-step speed 3
P2.1.18	Preset speed 4	0,00	Par. 2.1.2	Hz	25,00		127	Multi-step speed 4
P2.1.19	Preset speed 5	0,00	Par. 2.1.2	Hz	30,00		128	Multi-step speed 5
P2.1.20	Preset speed 6	0,00	Par. 2.1.2	Hz	40,00		129	Multi-step speed 6
P2.1.21	Preset speed 7	0,00	Par. 2.1.2	Hz	50,00		130	Multi-step speed 7

Table 6-5. Basic parameters G2.1

6.6.4 Input signals

6.6.4.1 Basic Settings (Control keypad: Menu M2 → G2.2.1)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.2.1.1	Start/Stop logic selection	0	7		0		300	Start signal **1** (Default: DIN1) / Start signal **2** (Default: DIN2) **0** Start forw. / Start rev. **1** Start/Stop / Reverse **2** Start/Stop / Run enable **3** Start pulse / Stop pulse **4** Start / Mot.pot.UP **5** Fwd pulse / Rev pulse **6** Start pulse / Rev pulse **7** Start pulse / Enabl pulse
P2.2.1.2	Motor potentiometer ramp time	0,1	2000,0	Hz/s	10,0		331	
P2.2.1.3	Motor potentiometer frequency reference memory reset	0	2		1		367	**0**=No reset **1**=Reset if stopped or powered down **2**=Reset if powered down
P2.2.1.4	Adjust input	0	5		0		493	**0**=Not used **1**=AI1 **2**=AI2 **3**=AI3 **4**=AI4 **5**=Fieldbus (FBProcessDataIN3)
P2.2.1.5	Adjust minimum	0,0	100,0	%	0,0		494	
P2.2.1.6	Adjust maximum	0,0	100,0	%	0,0		495	

Table 6-6. Input signals: basic settings, G2.2.1

6.6.4.2 Analogue input 1 (Control keypad: Menu M2 → G2.2.2)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.2.2.1	AI1 signal selection	0			A.1		377	
P2.2.2.2	AI1 filter time	0,00	10,00	s	0,10		324	**0**=No filtering
P2.2.2.3	AI1 signal range	0	3		0		320	**0**=0…100%* **1**=20…100%* **2**= -10V…+10V* **3**= Custom range*
P2.2.2.4	AI1 custom minimum setting	-160,00	160,00	%	0,00		321	
P2.2.2.5	AI1 custom maximum setting	-160,00	160,00	%	100,00		322	
P2.2.2.6	AI1 reference scaling, minimum value	0,00	320,00	Hz	0,00		303	Selects the frequency that corresponds to the min. reference signal
P2.2.2.7	AI1 reference scaling, maximum value	0,00	320,00	Hz	0,00		304	Selects the frequency that corresponds to the max. reference signal
P2.2.2.8	AI1 joystick hysteresis	0,00	20,00	%	0,00		384	
P2.2.2.9	AI1 sleep limit	0,00	100,00	%	0,00		385	
P2.2.2.10	AI1 sleep delay	0,00	320,00	s	0,00		386	
P2.2.2.11	AI1 joystick offset	-100,00	100,00	%	0,00		165	

Table 6-7. Analogue input 1 parameters, G2.2.2

*Remember to place jumpers of block X2 accordingly.
See the product's User's Manual

6.6.4.3 Analogue input 2 (Control keypad: Menu M2 → G2.2.3)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.2.3.1	AI2 signal selection	0			A.2		388	
P2.2.3.2	AI2 filter time	0,00	10,00	s	0,10		329	**0**=No filtering
P2.2.3.3	AI2 signal range	0	3		1		325	**0**=0…100%* **1**=20…100%* **2**= -10V…+10V* **3**= Custom range*
P2.2.3.4	AI2 custom minimum setting	-160,00	160,00	%	20,00		326	
P2.2.3.5	AI2 custom maximum setting	-160,00	160,00	%	100,00		327	
P2.2.3.6	AI2 reference scaling, minimum value	0,00	320,00	Hz	0,00		393	Selects the frequency that corresponds to the min. reference signal
P2.2.3.7	AI2 reference scaling, maximum value	0,00	320,00	Hz	0,00		394	Selects the frequency that corresponds to the max. reference signal
P2.2.3.8	AI2 joystick hysteresis	0,00	20,00	%	0,00		395	
P2.2.3.9	AI2 sleep limit	0,00	100,00	%	0,00		396	
P2.2.3.10	AI2 sleep delay	0,00	320,00	s	0,00		397	
P2.2.3.11	AI2 joystick offset	-100,00	100,00	%	0,00		166	

Table 6-8. Analogue input 2 parameters, G2.2.3

6.6.4.4 Analogue input 3 (Control keypad: Menu M2 → G2.2.4)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.2.4.1	AI3 signal selection	0			0.1		141	
P2.2.4.2	AI3 filter time	0,00	10,00	s	0,00		142	**0**=No filtering
P2.2.4.3	AI3 signal range	0	3		0		143	**0**=0…100% **1**=20…100% **2**= -10V…+10V **3**=Custom range
P2.2.4.4	AI3 custom minimum setting	-160,00	160,00	%	0,00		144	
P2.2.4.5	AI3 custom maximum setting	-160,00	160,00	%	100,00		145	
P2.2.4.6	AI3 signal inversion	0	1		0		151	**0**=Not inverted **1**=Inverted

Table 6-9. Analogue input 3 parameters, G2.2.4

**Remember to place jumpers of block X2 accordingly.
See the product's User's Manual.

6.6.4.5 Analogue input 4 (Control keypad: Menu M2 → G2.2.5)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.2.5.1	AI4 signal selection	0			0.1		152	
P2.2.5.2	AI4 filter time	0,00	10,00	s	0,00		153	**0**=No filtering
P2.2.5.3	AI4 signal range	0	3		1		154	**0**=0…100% **1**=20…100% **2**= -10V…+10V **3**=Custom range
P2.2.5.4	AI4 custom minimum setting	-160,00	160,00	%	20,00		155	
P2.2.5.5	AI4 custom maximum setting	-160,00	160,00	%	100,00		156	
P2.2.5.6	AI4 signal inversion	0	1		0		162	**0**=Not inverted **1**=Inverted

Table 6-10. Analogue input 4 parameters, G2.2.5

6.6.4.6 Free analogue input, signal selection (Keypad: Menu M2 → G2.2.6)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.2.6.1	Scaling of current limit	0	5		0		399	**0**=Not used **1**=AI1 **2**=AI2 **3**=AI3 **4**=AI4 **5**=FB limit scaling ID46
P2.2.6.2	Scaling of DC-braking current	0	5		0		400	Scaling from 0 to ID507
P2.2.6.3	Reducing of acc./dec. times	0	5		0		401	Scaling from Ramp Time to 0,1 s
P2.2.6.4	Reducing of torque supervision limit	0	5		0		402	Scaling from 0 to ID348
P2.2.6.5	Scaling of torque limit	0	5		0		485	Scaling from 0 to (ID609 (NXS) or ID1287 (NXP))
NXP drives only								
P2.2.6.6	Scaling of generator torque limit	0	5		0		1087	Scaling from 0 to ID1288
P2.2.6.7	Scaling of motoring power limit	0	5		0		179	Scaling from 0 to ID1289
P2.2.6.8	Scaling of generator power limit	0	5		0		1088	Scaling from 0 to ID1290

Table 6-11. Free analogue input signal selection, G2.2.6

6.6.4.7 Digital inputs (Control keypad: Menu M2 → G2.2.4)

Code	Parameter	Min	Default	Cust	ID	Note
P2.2.7.1	Start signal 1	0	A.1		403	
P2.2.7.2	Start signal 2	0	A.2		404	
P2.2.7.3	Run enable	0	0.2		407	Motor start enabled (cc)
P2.2.7.4	Reverse	0	0.1		412	Direction forward (oc) Direction reverse (cc)
P2.2.7.5	Preset speed 1	0	0.1		419	See preset speeds in Basic Parameters (G2.1)
P2.2.7.6	Preset speed 2	0	0.1		420	
P2.2.7.7	Preset speed 3	0	0.1		421	
P2.2.7.8	Motor potentiometer reference DOWN	0	0.1		417	Mot.pot. reference decreases (cc)
P2.2.7.9	Motor potentiometer reference UP	0	0.1		418	Mot.pot. reference increases (cc)
P2.2.7.10	Fault reset	0	0.1		414	All faults reset (cc)
P2.2.7.11	External fault (close)	0	0.1		405	Ext. fault displayed (cc)
P2.2.7.12	External fault (open)	0	0.2		406	Ext. fault displayed (oc)
P2.2.7.13	Acc/Dec time selection	0	0.1		408	Acc/Dec time 1 (oc) Acc/Dec time 2 (cc)
P2.2.7.14	Acc/Dec prohibit	0	0.1		415	Acc/Dec prohibited (cc)
P2.2.7.15	DC braking	0	0.1		416	DC braking active (cc)
P2.2.7.16	Jogging speed	0	A.4		413	Jogging speed selected for frequency reference (cc)
P2.2.7.17	AI1/AI2 selection	0	0.1		422	
P2.2.7.18	Control from I/O terminal	0	0.1		409	Force control place to I/O terminal (cc)
P2.2.7.19	Control from keypad	0	0.1		410	Force control place to keypad (cc)
P2.2.7.20	Control from fieldbus	0	0.1		411	Force control place to fieldbus (cc)
P2.2.7.21	Parameter set 1/set 2 selection	0	0.1		496	Closed cont.=Set 2 is used Open cont.=Set 1 is used
P2.2.7.22	Motor control mode 1/2	0	0.1		164	Closed cont.=Mode 2 is used Open cont.=Mode 1 is used See par 2.6.1, 2.6.12
NXP drives only						
P2.2.7.23	Cooling monitor	0	0.2		750	Used with liquid-cooled unit
P2.2.7.24	External brake acknowledge	0	0.2		1210	Monitoring signal from mechanical brake
P2.2.7.25	Prevention of startup	0	0.2		1420	Safety switch input
P2.2.7.26	Enable inching	0	0.1		532	Enables Inching function
P2.2.7.27	Inching reference 1	0	0.1		530	Inching reference 1. **This will start the drive**
P2.2.7.28	Inching reference 2	0	0.1		531	Inching reference 2. **This will start the drive**
P2.2.7.29	Reset encoder counter	0	0.1		1090	Reset monitoring signals, shaft rounds and angle
P2.2.7.30	Emergency stop	0	0.2		1213	
P2.2.7.31	Master Follower mode 2	0	0.1		1092	
P2.2.7.32	Input switch acknowledgement	0	0.2		1209	

Table 6-12. Digital input signals, G2.2.4

cc = closing contact
oc = opening contact

6.6.5 Output signals

6.6.5.1 Delayed digital output 1 (Keypad: Menu M2 → G2.3.1)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.3.1.1	Digital output 1 signal selection	0			0.1		486	Possible to invert with ID1084 (NXP only)
P2.3.1.2	Digital output 1 function	0	26		1		312	**0**=Not used **1**=Ready **2**=Run **3**=Fault **4**=Fault inverted **5**=FC overheat warning **6**=Ext. fault or warning **7**=Ref. fault or warning **8**=Warning **9**=Reverse **10**=Jogging spd selected **11**=At speed **12**=Mot. regulator active **13**=Freq. limit 1 superv. **14**=Freq. limit 2 superv. **15**=Torque limit superv. **16**=Ref. limit supervision **17**=External brake control **18**=I/O control place act. **19**=FC temp. limit superv. **20**=Reference inverted **21**=Ext. brake control inverted **22**=Therm. fault or warn. **23**=AI supervision **24**=Fieldbus input data 1 **25**=Fieldbus input data 2 **26**=Fieldbus input data 3
P2.3.1.3	Digital output 1 on delay	0,00	320,00	s	0,00		487	0,00 = delay not in use
P2.3.1.4	Digital output 1 off delay	0,00	320,00	s	0.00		488	0,00 = delay not in use

Table 6-13. Delayed digital output 1 parameters, G2.3.1

6.6.5.2 Delayed digital output 2 (Keypad: Menu M2 → G2.3.2)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.3.2.1	Digital output 2 signal selection	0			0.1		489	Possible to invert with ID1084 (NXP only)
P2.3.2.2	Digital output 2 function	0	26		0		490	See par. 2.3.1.2
P2.3.2.3	Digital output 2 on delay	0,00	320,00	s	0,00		491	0,00 = delay not in use
P2.3.2.4	Digital output 2 off delay	0,00	320,00	s	0,00		492	0,00 = delay not in use

Table 6-14. Delayed digital output 2 parameters, G2.3.2

6.6.5.3 Digital output signals (Control keypad: Menu M2 → G2.3.3)

Code	Parameter	Min	Default	Cust	ID	Note
P2.3.3.1	Ready	0	A.1		432	Ready to Run
P2.3.3.2	Run	0	B.1		433	Running
P2.3.3.3	Fault	0	B.2		434	Drive in fault state
P2.3.3.4	Inverted fault	0	0.1		435	Drive not in fault state
P2.3.3.5	Warning	0	0.1		436	Warning active
P2.3.3.6	External fault	0	0.1		437	External fault active
P2.3.3.7	Reference fault/warnin	0	0.1		438	4 mA fault active
P2.3.3.8	Overtemperature warning	0	0.1		439	Drive overtemperature active
P2.3.3.9	Reverse	0	0.1		440	Output frequency < 0 Hz
P2.3.3.10	Unrequested direction	0	0.1		441	Reference <> Output freqyency
P2.3.3.11	At speed	0	0.1		442	Reference = Output frequency
P2.3.3.12	Jogging speed	0	0.1		443	Jgging or preset speed command active
P2.3.3.13	External control place	0	0.1		444	IO control active
P2.3.3.14	External brake control	0	0.1		445	See explanations on page 163.
P2.3.3.15	External brake control, inverted	0	0.1		446	
P2.3.3.16	Output frequency limit 1 supervision	0	0.1		447	See ID315.
P2.3.3.17	Output frequency limit 2 supervision	0	0.1		448	See ID346.
P2.3.3.18	Reference limit supervision	0	0.1		449	See ID350.
P2.3.3.19	Temperature limit supervision	0	0.1		450	See ID354.
P2.3.3.20	Torque limit supervisio	0	0.1		451	See ID348.
P2.3.3.21	Motor thermal protection	0	0.1		452	
P2.3.3.22	Analogue input supervision limit	0	0.1		463	See ID356
P2.3.3.23	Motor regulator activation	0	0.1		454	
P2.3.3.24	Fieldbus input data 1	0	0.1		455	FB CW B11
P2.3.3.25	Fieldbus input data 2	0	0.1		456	FB CW B12
P2.3.3.26	Fieldbus input data 3	0	0.1		457	FB CW B13
P2.3.3.27	Fieldbus input data 4	0	0.1		169	FB CW B14
P2.3.3.28	Fieldbus input data 5	0	0.1		170	FB CW B15
NXP drives only						
P2.3.3.29	DC ready pulse	0	0.1		1218	

Table 6-15. Digital output signals, G2.3.3

WARNING	**Be ABSOLUTELY sure not to connect two functions to one and same output in order to avoid function overruns and to ensure flawless operation.**

6.6.5.4 Limit settings (Control keypad: Menu M2 → G2.3.4)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.3.4.1	Output frequency limit 1 supervision	0	3		0		315	**0**=No limit **1**=Low limit supervision **2**=High limit supervision **3**=Brake-on control
P2.3.4.2	Output frequency limit 1; Supervised value	0,00	320,00	Hz	0,00		316	
P2.3.4.3	Output frequency limit 2 supervision	0	4		0		346	**0**=No limit **1**=Low limit supervision **2**=High limit supervision **3**=Brake-off control **4**=Brake on/off-control
P2.3.4.4	Output frequency limit 2; Supervised value	0,00	320,00	Hz	0,00		347	
P2.3.4.5	Torque limit supervision	0	3		0		348	**0**=Not used **1**=Low limit supervision **2**=High limit supervision **3**=Brake-off control
P2.3.4.6	Torque limit supervision value	-300,0	300,0	%	100,0		349	
P2.3.4.7	Reference limit supervision	0	2		0		350	**0**=Not used **1**=Low limit **2**=High limit
P2.3.4.8	Reference limit supervision value	0,0	100,0	%	0,0		351	
P2.3.4.9	External brake-off delay	0,0	100,0	s	0,5		352	
P2.3.4.10	External brake-on delay	0,0	100,0	s	1,5		353	
P2.3.4.11	FC temperature supervision	0	2		0		354	**0**=Not used **1**=Low limit **2**=High limit
P2.3.4.12	FC temperature supervised value	–10	100	°C	40		355	
P2.3.4.13	Analogue supervision signal	0	4		0		356	**0**=Not used **1**=AI1 **2**=AI2 **3**=AI3 **4**=AI4
P2.3.4.14	Analogue super-vision low limit	0,00	100,00	%	10,00		357	
P2.3.4.15	Analogue super-vision high limit	0,00	100,00	%	90,00		358	
NXP drives only								
P2.3.4.16	Brake On/Off Current Limit	0	2 x I_H	A	0		1085	Brake is kept closed if current is below this value.

Table 6-16. Limit settings, G2.3.4

6.6.5.5 Analogue output 1 (Control keypad: Menu M2 → G2.3.5)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.3.5.1	Analogue output 1 signal selection	0			A.1		464	
P2.3.5.2	Analogue output 1 function	0	15		1		307	**0**=Not used **1**=Output freq. (0—f_{max}) **2**=Freq. reference (0—f_{max}) **3**=Motor speed (0—Motor nominal speed) **4**=Motor current (0—I_{nMotor}) **5**=Motor torque (0—T_{nMotor}) **6**=Motor power (0—P_{nMotor}) **7**=Motor voltage (0-U_{nMotor}) **8**=DC-link volt (0—1000V) **9**=AI1 **10**=AI2 **11**=Output freq. (f_{min} - f_{max}) **12**=Motor torque (–2…+2xT_{Nmot}) **13**=Motor power (–2…+2xT_{Nmot}) **14**=PT100 temperature **15**=FB analogue output
P2.3.5.3	Analogue output 1 filter time	0,00	10,00	s	1,00		308	**0**=No filtering
P2.3.5.4	Analogue output 1 inversion	0	1		0		309	**0**=Not inverted **1**=Inverted
P2.3.5.5	Analogue output 1 minimum	0	1		0		310	**0**=0 mA **1**=4 mA
P2.3.5.6	Analogue output 1 scale	10	1000	%	100		311	
P2.3.5.7	Analogue output 1 offset	-100,00	100,00	%	0,00		375	

Table 6-17. Analogue output 1 parameters, G2.3.5

6.6.5.6 Analogue output 2 (Control keypad: Menu M2 → G2.3.6)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.3.6.1	Analogue output 2 signal selection	0			0.1		471	
P2.3.6.2	Analogue output 2 function	0	15		4		472	See par. 2.3.5.2
P2.3.6.3	Analogue output 2 filter time	0,00	10,00	s	1,00		473	**0**=No filtering
P2.3.6.4	Analogue output 2 inversion	0	1		0		474	**0**=Not inverted **1**=Inverted
P2.3.6.5	Analogue output 2 minimum	0	1		0		475	**0**=0 mA **1**=4 mA
P2.3.6.6	Analogue output 2 scale	10	1000	%	100		476	
P2.3.6.7	Analogue output 2 offset	-100,00	100,00	%	0,00		477	

Table 6-18. Analogue output 2 parameters, G2.3.6

6.6.5.7 Analogue output 3 (Control keypad: Menu M2 → G2.3.7)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.3.7.1	Analogue output 3 signal selection	0			0.1		478	
P2.3.7.2	Analogue output 3 function	0	15		5		479	See par. 2.3.5.2
P2.3.7.3	Analogue output 3 filter time	0,00	10,00	s	1,00		480	**0**=No filtering
P2.3.7.4	Analogue output 3 inversion	0	1		0		481	**0**=Not inverted **1**=Inverted
P2.3.7.5	Analogue output 3 minimum	0	1		0		482	**0**=0 mA **1**=4 mA
P2.3.7.6	Analogue output 3 scale	10	1000	%	100		483	
P2.3.7.7	Analogue output 3 offset	-100,00	100,00	%	0,00		484	

Table 6-19. Analogue output 3 parameters, G2.3.7

6.6.6 Drive control parameters (Control keypad: Menu M2 → G2.4)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.4.1	Ramp 1 shape	0,0	10,0	s	0,1		500	**0**=Linear **>0**=S-curve ramp time
P2.4.2	Ramp 2 shape	0,0	10,0	s	0,0		501	**0**=Linear **>0**=S-curve ramp time
P2.4.3	Acceleration time 2	0,1	3000,0	s	10,0		502	
P2.4.4	Deceleration time 2	0,1	3000,0	s	10,0		503	
P2.4.5	Brake chopper	0	4		0		504	**0**=Disabled **1**=Used when running **2**=External brake chopper **3**=Used when stopped/running **4**=Used when running (no testing)
P2.4.6	Start function	0	1		0		505	**0**=Ramp **1**=Flying start
P2.4.7	Stop function	0	3		0		506	**0**=Coasting **1**=Ramp **2**=Ramp+Run enable coast **3**=Coast+Run enable ramp
P2.4.8	DC braking current	0	I_L	A	0,7 x I_H		507	
P2.4.9	DC braking time at stop	0,00	600,00	s	0,00		508	**0**=DC brake is off at stop
P2.4.10	Frequency to start DC braking during ramp stop	0,10	10,00	Hz	1,50		515	
P2.4.11	DC braking time at start	0,00	600,00	s	0,00		516	**0**=DC brake is off at start
P2.4.12	Flux brake	0	1		0		520	**0**=Off **1**=On
P2.4.13	Flux braking current	0	I_L	A	I_H		519	
NXP drives only								
P2.4.15	DC-brake current at stop	0	I_L	A	0,1 x I_H		1080	
P2.4.16	Inching reference 1	-320,00	320,00	Hz	2,00		1239	
P2.4.17	Inching reference 2	-320,00	320,00	Hz	-2,00		1240	
P2.4.18	Inching ramp	0,1	3200,0	s	1,0		533	
P2.4.21	Emergency stop mode	0	1		0		1276	**0**=Coasting **1**=Ramp
P2.4.22	Control options	0	65536		0		1084	

Table 6-20. Drive control parameters, G2.4

6.6.7 NXS Drives: Prohibit frequency parameters (Control keypad: Menu M2 → G2.5)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.5.1	Prohibit frequency range 1 low limit	0,0	320,00	Hz	0,0		509	**0**=Not used
P2.5.2	Prohibit frequency range 1 high limit	0,0	320,00	Hz	0,0		510	**0**=Not used
P2.5.3	Prohibit frequency range 2 low limit	0,0	320,00	Hz	0,0		511	**0**=Not used
P2.5.4	Prohibit frequency range 2 high limit	0,0	320,00	Hz	0,0		512	**0**=Not used
P2.5.5	Prohibit frequency range 3 low limit	0,0	320,00	Hz	0,0		513	**0**=Not used
P2.5.6	Prohibit frequency range 3 high limit	0,0	320,00	Hz	0,0		514	**0**=Not used
P2.5.7	Prohibit acc./dec. ramp	0,1	10,0	x	1,0		518	

Table 6-21. Prohibit frequencies, NXS drives (G2.5)

6.6.8 NXS drives: Motor control parameters (Control keypad: Menu M2 → G2.6)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.6.1	Motor control mode	0	4		0		600	**0**=Frequency control **1**=Speed control **2**=Torque control **3**=Closed loop speed ctrl **4**=Closed loop torque ctrl
P2.6.2	U/f optimisation	0	1		0		109	**0**=Not used **1**=Automatic torque boost
P2.6.3	U/f ratio selection	0	3		0		108	**0**=Linear **1**=Squared **2**=Programmable **3**=Linear with flux optim.
P2.6.4	Field weakening point	8,00	320,00	Hz	50,00		602	
P2.6.5	Voltage at field weakening point	10,00	200,00	%	100,00		603	n% x U_{nmot}
P2.6.6	U/f curve midpoint frequency	0,00	par. P2.6.4	Hz	50,00		604	
P2.6.7	U/f curve midpoint voltage	0,00	100,00	%	100,00		605	n% x U_{nmot} Parameter max. value = par. 2.6.5
P2.6.8	Output voltage at zero frequency	0,00	40,00	%	Varies		606	n% x U_{nmot}
P2.6.9	Switching frequency	1,0	Varies	kHz	Varies		601	See Table 8-12 for exact values
P2.6.10	Overvoltage controller	0	2		1		607	**0**=Not used **1**=Used (no ramping) **2**=Used (ramping)
P2.6.11	Undervoltage controller	0	2		1		608	**0**=Not used **1**=Used (no ramping) **2**=Used (ramping to zero)
P2.6.12	Motor control mode 2	0	4		2		521	See par. 2.6.1
P2.6.13	Speed controller P gain (open loop)	0	32767		3000		637	
P2.6.14	Speed controller I gain (open loop)	0	32767		300		638	
P2.6.15	Load drooping	0,00	100,00	%	0,00		620	
P2.6.16	Identification	0	2		0		631	**0**=No action **1**=Identification w/o run **2**=Identification with run

Table 6-22. Motor control parameters, NXS drives G2.6

6.6.8.1 NXS drives: Closed Loop parameters (Control keypad: Menu M2→G2.6.17)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.6.17.1	Magnetizing current	0,00	100,00	A	0,00		612	If zero internally calculated
P2.6.17.2	Speed control P gain	1	1000		30		613	
P2.6.17.3	Speed control I time	-32000	32000	ms	100,0		614	Negative value uses 0,1 ms accuracy instead of 1 ms
P2.6.17.5	Acceleration compensation	0,00	300,00	s	0,00		626	
P2.6.17.6	Slip adjust	0	500	%	75		619	
P2.6.17.7	Magnetizing current at start	0,00	I_L	A	0,00		627	
P2.6.17.8	Magnetizing time at start	0	32000	ms	0		628	
P2.6.17.9	0-speed time at start	0	32000	ms	100		615	
P2.6.17.10	0-speed time at stop	0	32000	ms	100		616	
P2.6.17.11	Start-up torque	0	3		0		621	**0**=Not used **1**=Torque memory **2**=Torque reference **3**=Start-up torque fwd/rev
P2.6.17.12	Start-up torque FWD	–300,0	300,0	%	0,0		633	
P2.6.17.13	Start-up torque REV	–300,0	300,0	%	0,0		634	
P2.6.17.15	Encoder filter time	0,0	100,0	ms	0,0		618	
P2.6.17.17	Current control P gain	0,00	100,00	%	40,00		617	

Table 6-23. Closed Loop parameters, NXS drives

6.6.8.2 NXS drives: Identification (Control keypad: Menu M2→G2.6.19)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.6.19.23	Speed step	-50,0	50,0	0,0	0,0		1252	NCDrive speed tuning
P2.6.19.24	Torque step	-100,0	100,0	0,0	0,0		1253	NCDrive torque tuning

Table 6-24. Identification parameters, NXS drives

6.6.9 NXP drives: Motor control parameters (Control keypad: Menu M2 → G2.6)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.6.1	Motor control mode	0	4		0		600	**0**=Frequency control **1**=Speed control **2**=Torque control **3**=Closed loop speed ctrl **4**=Closed loop torque ctrl
P2.6.2	U/f optimisation	0	1		0		109	**0**=Not used **1**=Automatic torque boost
P2.6.3	U/f ratio selection	0	3		0		108	**0**=Linear **1**=Squared **2**=Programmable **3**=Linear with flux optim.
P2.6.4	Field weakening point	8,00	320,00	Hz	50,00		602	
P2.6.5	Voltage at field weakening point	10,00	200,00	%	100,00		603	n% x U_{nmot}
P2.6.6	U/f curve midpoint frequency	0,00	par. P2.6.4	Hz	50,00		604	
P2.6.7	U/f curve midpoint voltage	0,00	100,00	%	100,00		605	n% x U_{nmot} Parameter max. value = par. 2.6.5
P2.6.8	Output voltage at zero frequency	0,00	40,00	%	Varies		606	n% x U_{nmot}
P2.6.9	Switching frequency	1,0	Varies	kHz	Varies		601	See Table 8-12 for exact values
P2.6.10	Overvoltage controller	0	2		1		607	**0**=Not used **1**=Used (no ramping) **2**=Used (ramping)
P2.6.11	Undervoltage controller	0	2		1		608	**0**=Not used **1**=Used (no ramping) **2**=Used (ramping to zero)
P2.6.12	Motor control mode 2	0	4		2		521	See par. 2.6.1
P2.6.13	Speed controller P gain (open loop)	0	32767		3000		637	
P2.6.14	Speed controller I gain (open loop)	0	32767		300		638	
P2.6.15	Load drooping	0,00	100,00	%	0,00		620	
P2.6.16	Identification	0	3		0		631	**0**=No action **1**=Identification w/o run **2**=Identification with run **3**=Encoder ID Run
P2.6.17	Restart delay	0,000	65,535	s	Varies		1424	
P2.6.18	Load drooping time	0	32000	ms	0		656	
P2.6.19	Negat. frequency limit	-320,00	320,00	Hz	-320,00		1286	
P2.6.20	Posit. frequency limit	-320,00	320,00	Hz	320,00		1285	
P2.6.21	Generator torque limit	0,0	300,0	%	300,0		1288	
P2.6.22	Motoring torque limit	0,0	300,0	%	300,0		1287	

Table 6-25. Motor control parameters, NXP drives

6.6.9.1 NXP drives: Closed Loop parameters (Control keypad: Menu M2 → G2.6.27)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.6.27.1	Magnetizing current	0,00	100,00	A	0,00		612	If zero internally calculated
P2.6.27.2	Speed control P gain	1	1000		30		613	
P2.6.27.3	Speed control I time	-32000	3200,0	ms	100,0		614	Negative value uses 1 ms accuracy instead of 0,1 ms
P2.6.27.5	Acceleration compensation	0,00	300,00	s	0,00		626	
P2.6.27.6	Slip adjust	0	500	%	75		619	
P2.6.27.7	Magnetizing current at start	0	I_L	A	0,00		627	
P2.6.27.8	Magnetizing time at start	0	32000	ms	0		628	
P2.6.27.9	0-speed time at start	0	32000	ms	100		615	
P2.6.27.10	0-speed time at stop	0	32000	ms	100		616	
P2.6.27.11	Start-up torque	0	3		0		621	**0**=Not used **1**=Torque memory **2**=Torque reference **3**=Start-up torque fwd/rev
P2.6.27.12	Start-up torque FWD	–300,0	300,0	%	0,0		633	
P2.6.27.13	Start-up torque REV	–300,0	300,0	%	0,0		634	
P2.6.27.15	Encoder filter time	0,0	100,0	ms	0,0		618	
P2.6.27.17	Current control P gain	0,00	100,00	%	40,00		617	
P2.6.27.19	Generator power limit	0,0	300,0	%	300,0		1290	
P2.6.27.20	Motoring power limit	0,0	300,0	%	300,0		1289	
P2.6.27.21	Negative torque limit	0,0	300,0	%	300,0		645	
P2.6.27.22	Positive torque limit	0,0	300,0	%	300,0		646	
P2.6.27.23	Flux off delay	-1	32000	s	0		1402	**-1=**Always
P2.6.27.24	Stop state flux	0,0	150,0	%	100,0		1401	
P2.6.27.25	SPC f1 point	0,00	320,00	Hz	0,00		1301	
P2.6.27.26	SPC f0 point	0,00	320,00	Hz	0,00		1300	
P2.6.27.27	SPC Kp f0	0	1000	%	100		1299	
P2.6.27.28	SPC Kp FWP	0	1000	%	100		1298	
P2.6.27.29	SPC torque minimum	0	400,0	%	0,0		1296	
P2.6.27.30	SPC torque minimum Kp	0	1000	%	100		1295	
P2.6.27.31	SPC Kp TC torque	0	1000	ms	0		1297	
P2.6.27.32	Flux reference	0,0	500,0	%	100,0		1250	
P2.6.27.33	Speed error filter TC	0	1000	ms	0		1311	

Table 6-26. Closed Loop motor control parameters (G2.6.4)

6.6.9.2 NXP drives: PMS Motor control parameters (Control keypad: Menu M2 → G2.6.28)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.6.28.1	Motor type	0	1		0		650	**0**=Induction Motor **1**=PMS Motor
P2.6.28.2	Flux Current Kp	0	32000		5000		651	
P2.6.28.3	Flux Current Ti	0	1000		25		652	
P2.6.28.4	PMSM ShaftPosi	0	65565		0		649	
P2.6.28.5	EnableRsIdentifi	0	1		1		654	**0**=No **1**=Yes
P2.6.28.6	Torque stabilator gain	0	1000		800		1412	
P2.6.28.7	Torque stabilator damping	0	1000		100		1413	
P2.6.28.8	Torque stabilator gain FWP	0	1000		50		1414	

Table 6-27. PMS Motor control parameters, NXP drives

6.6.9.3 NXP drives: Identification parameters (Control keypad: Menu M2 → G2.6.29)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.6.29.1	Flux 10 %	0	2500	%	10		1355	
P2.6.29.2	Flux 20 %	0	2500	%	20		1356	
P2.6.29.3	Flux 30 %	0	2500	%	30		1357	
P2.6.29.4	Flux 40 %	0	2500	%	40		1358	
P2.6.29.5	Flux 50 %	0	2500	%	50		1359	
P2.6.29.6	Flux 60 %	0	2500	%	60		1360	
P2.6.29.7	Flux 70 %	0	2500	%	70		1361	
P2.6.29.8	Flux 80 %	0	2500	%	80		1362	
P2.6.29.9	Flux 90 %	0	2500	%	90		1363	
P2.6.29.10	Flux 100 %	0	2500	%	100		1364	
P2.6.29.11	Flux 110 %	0	2500	%	110		1365	
P2.6.29.12	Flux 120 %	0	2500	%	120		1366	
P2.6.29.13	Flux 130 %	0	2500	%	130		1367	
P2.6.29.14	Flux 140 %	0	2500	%	140		1368	
P2.6.29.15	Flux 150 %	0	2500	%	150		1369	
P2.6.29.16	Rs voltage drop	0	30000		Varies		662	
P2.6.29.19	Ir add generator scale	0	30000		Varies		665	
P2.6.29.20	Ir add motoring scale	0	30000		Varies		667	
P2.6.29.21	Iu Offset	-32000	32000		0		668	
P2.6.29.22	Iv Offset	-32000	32000		0		669	
P2.6.29.23	Iw Offset	-32000	32000		0		670	
P2.6.29.24	Speed step	-50,0	50,0	0,0	0,0		1252	NCDrive speed tuning
P2.6.29.25	Torque step	-100,0	100,0	0,0	0,0		1253	NCDrive torque tuning

Table 6-28. Identification parameters, NXP drives

6.6.10 Protections (Control keypad: Menu M2 → G2.7)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.7.1	Response to 4mA reference fault	0	5		0		700	**0**=No response **1**=Warning **2**=Warning+Previous freq. **3**=Wrng+PresetFreq 2.7.2 **4**=Fault,stop acc. to 2.4.7 **5**=Fault,stop by coasting
P2.7.2	4mA reference fault frequency	0,00	Par. 2.1.2	Hz	0,00		728	
P2.7.3	Response to external fault	0	3		2		701	**0**=No response **1**=Warning **2**=Fault,stop acc. to 2.4.7 **3**=Fault,stop by coasting
P2.7.4	Input phase supervision	0	3		0		730	
P2.7.5	Response to undervoltage fault	0	1		0		727	**0**=Fault stored in history **1**=Fault not stored
P2.7.6	Output phase supervision	0	3		2		702	**0**=No response **1**=Warning **2**=Fault,stop acc. to 2.4.7 **3**=Fault,stop by coasting
P2.7.7	Ground fault protection	0	3		2		703	
P2.7.8	Thermal protection of the motor	0	3		2		704	
P2.7.9	Motor ambient temperature factor	–100,0	100,0	%	0,0		705	
P2.7.10	Motor cooling factor at zero speed	0,0	150,0	%	40,0		706	
P2.7.11	Motor thermal time constant	1	200	min	Varies		707	
P2.7.12	Motor duty cycle	0	100	%	100		708	
P2.7.13	Stall protection	0	3		0		709	**0**=No response **1**=Warning **2**=Fault,stop acc. to 2.4.7 **3**=Fault,stop by coasting
P2.7.14	Stall current	0,00	2 x I_H	A	I_H		710	
P2.7.15	Stall time limit	1,00	120,00	s	15,00		711	
P2.7.16	Stall frequency limit	1,00	Par. 2.1.2	Hz	25,00		712	
P2.7.17	Underload protection	0	3		0		713	**0**=No response **1**=Warning **2**=Fault,stop acc. to 2.4.7 **3**=Fault,stop by coasting
P2.7.18	Field weakening area load	10,0	150,0	%	50,0		714	
P2.7.19	Zero frequency load	5,0	150,0	%	10,0		715	
P2.7.20	Underload protec-tion time limit	2,00	600,00	s	20,00		716	
P2.7.21	Response to thermistor fault	0	3		2		732	**0**=No response **1**=Warning **2**=Fault,stop acc. to 2.4.7 **3**=Fault,stop by coasting
P2.7.22	Response to fieldbus fault	0	3		2		733	See P2.7.21
P2.7.23	Resp. to slot fault	0	3		2		734	See P2.7.21
P2.7.24	No. of PT100 inputs	0	3		0		739	
P2.7.25	Response to PT100 fault	0	3		0		740	**0**=No response **1**=Warning **2**=Fault,stop acc. to 2.4.7 **3**=Fault,stop by coasting
P2.7.26	PT100 warning limit	–30,0	200,0	C°	120,0		741	
P2.7.27	PT100 fault limit	–30,0	200,0	C°	130,0		742	

NXP drives only								
P2.7.28	Brake fault action	1	3		1		1316	**1**=Warning **2**=Fault,stop acc. to 2.4.7 **3**=Fault,stop by coasting
P2.7.29	Brake fault delay	0,00	320,00	s	0,20		1317	
P2.7.30	System bus fault	2	2		2		1082	**0**=No response **1**=Warning **2**=Fault,stop acc. to 2.4.7 **3**=Fault,stop by coasting
P2.7.31	System bus fault delay	0,00	320,00	s	3,00		1352	
P2.7.32	Cooling fault delay	0,00	7,00	s	2,00		751	

Table 6-29. Protections, G2.7

6.6.11 Autorestart parameters (Control keypad: Menu M2 → G2.8)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.8.1	Wait time	0,10	10,00	s	0,50		717	
P2.8.2	Trial time	0,00	60,00	s	30,00		718	
P2.8.3	Start function	0	2		0		719	**0**=Ramp **1**=Flying start **2**=According to par. 2.4.6
P2.8.4	Number of tries after undervoltage trip	0	10		0		720	
P2.8.5	Number of tries after overvoltage trip	0	10		0		721	
P2.8.6	Number of tries after overcurrent trip	0	3		0		722	
P2.8.7	Number of tries after 4mA reference trip	0	10		0		723	
P2.8.8	Number of tries after motor temperature fault trip	0	10		0		726	
P2.8.9	Number of tries after external fault trip	0	10		0		725	
P2.8.10	Number of tries after underload fault trip	0	10		0		738	

Table 6-30. Autorestart parameters, G2.8

6.6.12 Fieldbus parameters (Control Keypad: Menu M2 →G2.9)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.9.1	Fieldbus min scale	0,00	320,00	Hz	0,00		850	
P2.9.2	Fieldbus max scale	0,00	320,00	Hz	0,00		851	
P2.9.3	Fieldbus data out 1 selection	0	10000		1		852	Choose monitoring data with parameter ID
P2.9.4	Fieldbus data out 2 selection	0	10000		2		853	Choose monitoring data with parameter ID
P2.9.5	Fieldbus data out 3 selection	0	10000		45		854	Choose monitoring data with parameter ID
P2.9.6	Fieldbus data out 4 selection	0	10000		4		855	Choose monitoring data with parameter ID
P2.9.7	Fieldbus data out 5 selection	0	10000		5		856	Choose monitoring data with parameter ID
P2.9.8	Fieldbus data out 6 selection	0	10000		6		857	Choose monitoring data with parameter ID
P2.9.9	Fieldbus data out 7 selection	0	10000		7		858	Choose monitoring data with parameter ID
P2.9.10	Fieldbus data out 8 selection	0	10000		37		859	Choose controlled data with parameter ID
NXP drives only								
P2.9.11	Fieldbus data in 1 selection	0	10000		1140		876	Choose controlled data with parameter ID
P2.9.12	Fieldbus data in 2 selection	0	10000		46		877	Choose controlled data with parameter ID
P2.9.13	Fieldbus data in 3 selection	0	10000		47		878	Choose controlled data with parameter ID
P2.9.14	Fieldbus data in 4 selection	0	10000		48		879	Choose controlled data with parameter ID
P2.9.15	Fieldbus data in 5 selection	0	10000		0		880	Choose controlled data with parameter ID
P2.9.16	Fieldbus data in 6 selection	0	10000		0		881	Choose controlled data with parameter ID
P2.9.17	Fieldbus data in 7 selection	0	10000		0		882	Choose controlled data with parameter ID
P2.9.18	Fieldbus data in 8 selection	0	10000		0		883	Choose controlled data with parameter ID

Table 6-31. Fieldbus parameters

6.6.13 Torque control parameters (Control Keypad: Menu M2 →G2.10)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.10.1	Torque limit	0,0	300,0	%	300,0		609	
P2.10.2	Torque limit control P-gain	0,0	32000		3000		610	Used only in Open Loop control mode
P2.10.3	Torque limit control I-gain	0,0	32000		200		611	
P2.10.4	Torque reference selection	0	8		0		641	**0**=Not used **1**=AI1 **2**=AI2 **3**=AI3 **4**=AI4 **5**=AI1 joystick **6**=AI2 joystick **7**=Torque reference from keypad, R3.5 **8**=Fieldbus torque ref.
P2.10.5	Torque reference max.	–300,0	300,0	%	100		642	
P2.10.6	Torque reference min.	–300,0	300,0	%	0,0		643	
P2.10.7	Torque speed limit	0	2		1		644	**0=**Max. frequency **1=**Selected frequency ref. **2=**Preset speed 7
P2.10.8	Minimum frequency for open loop torque control	0,00	50,00	Hz	3,00		636	
P2.10.9	Torque controller P gain	0	32000		150		639	
P2.10.10	Torque controller I gain	0	32000		10		640	
NXP drives only								
P2.10.11	Torque speed limit CL	0	7		2		1278	**0**=CL speed control **1**=Pos/neg freq limits **2**=RampOut (-/+) **3**=NegFreqLimit-RampOut **4**=RampOut-PosFreqLimit **5**=RampOut Window **6**=0-RampOut **7**=RampOut Window On/Off
P2.10.12	Torque reference filtering time	0	32000	ms	0		1244	
P2.10.13	Window negative	0,00	50,00	Hz	2,00		1305	
P2.10.14	Window positive	0,00	50,00	Hz	2,00		1304	
P2.10.15	Window negative off	0,00	P2.10.13	Hz	0,00		1307	
P2.10.16	Window positive off	0,00	P2.10.14	Hz	0,00		1306	
P2.10.17	Speed control output limit	0,0	300,0	%	300,0		1382	

Table 6-32. Torque control parameters, G2.10

6.6.14 NXP drives: Master Follower parameters (Control keypad: Menu M2 → G2.11)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.11.1	Master Follower mode	0	4		0		1324	**0**=Single drive **1**=Master drive **2**=Follower drive **3**=Current master **4**=Current follower
P2.11.2	Follower stop function	0	2		2		1089	**0**=Coasting **1**=Ramping **2**=As Master
P2.11.3	Follower speed reference select	0	18		17		1081	**0**=AI1 **1**=AI2 **2**=AI1+AI2 **3**=AI1-AI2 **4**=AI2-AI1 **5**=AI1xAI2 **6**=AI1 Joystick **7**=AI2 Joystick **8**=Keypad **9**=Fieldbus **10**=Motor potentiometer **11**=AI1, AI2 minimum **12**=AI1, AI2 maximum **13**=Max frequency **14**=AI1/AI2 selection **15**=Encoder 1 **16**=Encoder 2 **17**=Master Reference **18**=Master Ramp Out
P2.11.4	Follower torque reference select	0	10		10		1083	**0**=Not used **1**=AI1 **2**=AI2 **3**=AI3 **4**=AI4 **5**=AI1 joystick **6**=AI2 joystick **7**=Torque reference from keypad, R3.5 **8**=FB Torque Reference **9**=Master Torque
P2.11.5	Speed share	-300,00	300,00	%	100,00		1283	Active also in Single mode
P2.11.6	Load share	0,0	500,0	%	100,0		1248	Active also in Single mode
P2.11.7	Master Follower mode 2	0	4		0		1093	**0**=Single drive **1**=Master drive **2**=Follower drive **3**=Current master **4**=Current follower

Table 6-33. Master Follower parameters, G2.5

6.6.15 Keypad control (Control keypad: Menu M3)

The parameters for the selection of control place and direction on the keypad are listed below. See the Keypad control menu in the product's user's manual.

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P3.1	Control place	0	3		1		125	**0**=PC Control **1**=I/O terminal **2**=Keypad **3**=Fieldbus
R3.2	Keypad reference	Par. 2.1.1	Par. 2.1.2	Hz				
P3.3	Direction (on keypad)	0	1		0		123	**0**=Forward **1**=Reverse
P3.4	Stop button	0	1		1		114	**0**=Limited function of Stop button **1**=Stop button always enabled
R3.5	Torque reference	0,0	100,0	%	0,0			

Table 6-34. Keypad control parameters, M3

6.6.16 System menu (Control keypad: Menu M6)

For parameters and functions related to the general use of the frequency drive, such as application and language selection, customised parameter sets or information about the hardware and software, see the product's user's manual.

6.6.17 Expander boards (Control keypad: Menu M7)

The **M7** menu shows the expander and option boards attached to the control board and board-related information. For more information, see the product's user's manual.

7. PUMP AND FAN CONTROL APPLICATION

(Software ASFIFF07)

7.1 Introduction

Select the Pump and Fan Control Application in menu **M6** on page *S6.2*.

The Pump and Fan Control Application can be used to control one variable speed drive and up to four auxiliary drives. The PID controller of the frequency drive controls the speed of the variable speed drive and gives control signals to start and stop the auxiliary drives to control the total flow. In addition to the eight parameter groups provided as standard, a parameter group for multi-pump and fan control functions is available.

The application has two control places on the I/O terminal. Place A is the pump and fan control and place B is the direct frequency reference. The control place is selected with input DIN6.

As already its name tells, the Pump and Fan Control Application is used to control the operation of pumps and fans. It can be used, for example, to decrease the delivery pressure in booster stations if the measured input pressure falls below a limit specified by the user.

The application utilizes external contactors for switching between the motors connected to the frequency drive. The autochange feature provides the capability of changing the starting order of the auxiliary drives. Autochange between 2 drives (main drive + 1 auxiliary drive) is set as default, see chapter 7.4.1.

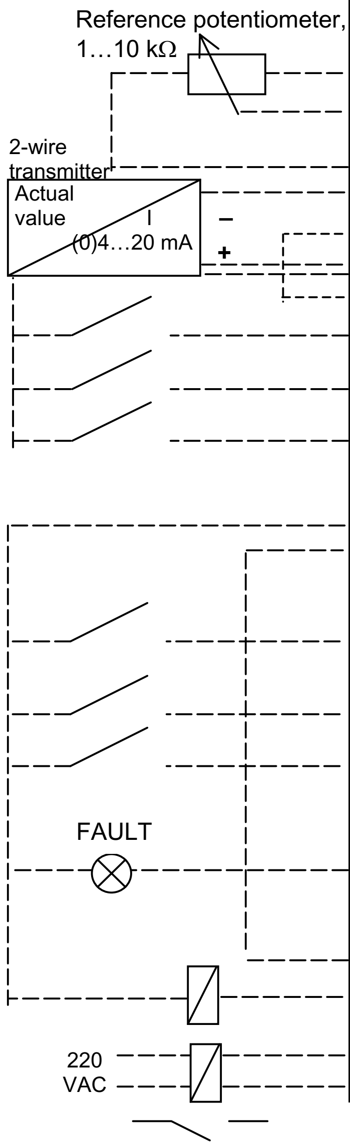
- All inputs and outputs are freely programmable.

Additional functions:

- Analogue input signal range selection
- Two frequency limit supervisions
- Torque limit supervision
- Reference limit supervision
- Second ramps and S-shape ramp programming
- Programmable Start/Stop and Reverse logic
- DC-brake at start and stop
- Three prohibit frequency areas
- Programmable U/f curve and switching frequency
- Autorestart
- Motor thermal and stall protection: fully programmable; off, warning, fault
- Motor underload protection
- Input and output phase supervision
- Sleep function

The parameters of the Pump and Fan Control Application are explained in Chapter 8 of this manual. The explanations are arranged according to the individual ID number of the parameter.

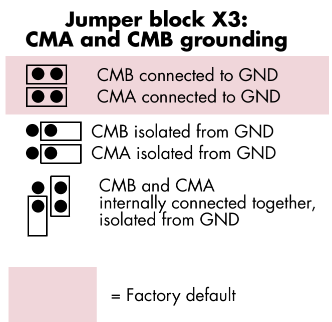
7.2 Control I/O



OPT-A1			
Terminal		Signal	Description
1	+10V$_{ref}$	Reference output	Voltage for potentiometer, etc.
2	AI1+	Analogue input, voltage range 0—10V DC	Voltage input frequency reference
3	AI1-	I/O Ground	Ground for reference and controls
4	AI2+	Analogue input, current range 0—20mA	Current input frequency reference
5	AI2-		
6	+24V	Control voltage output	Voltage for switches, etc. max 0.1 A
7	GND	I/O ground	Ground for reference and controls
8	DIN1	Start/Stop; Control place A (PID controller) (programm.)	Contact closed = start
9	DIN2	Interlock 1 (programmable)	Contact closed = Interlock used Contact open = Interlock not used
10	DIN3	Interlock 2 (programmable)	Contact closed = Interlock used Contact open = Interlock not used
11	CMA	Common for DIN 1—DIN 3	Connect to GND or +24V
12	+24V	Control voltage output	Voltage for switches (see #6)
13	GND	I/O ground	Ground for reference and controls
14	DIN4	Start/Stop Control place B (Direct frequency reference) (programmable)	Contact closed = Start
15	DIN5	Jogging speed selection (programmable)	Contact closed = Jogging speed active
16	DIN6	Control place A/B selection (programmable)	Contact open = Control place A is active Contact closed = Control place B is active
17	CMB	Common for DIN4—DIN6	Connect to GND or +24V
18	AO1+	Output frequency Analogue output	Programmable; See chapters 7.5.4.3, 7.5.4.4 and 7.5.4.5 Range 0—20 mA/R$_L$, max. 500Ω
19	AO1- (GND)		
20	DO1	Digital output FAULT	Programmable Open collector, I≤50mA, U≤48 VDC
OPT-A2			
21	RO1	Relay output 1 Aux/Autochange 1	Programmable; See chapter 7.5.4.1
22	RO1		
23	RO1		
24	RO2	Relay output 2 Aux/Autochange 2	Programmable; See chapter 7.5.4.1
25	RO2		
26	RO2		

Table 7-1. Pump and fan control application default I/O configuration and connection example (with 2-wire transmitter).

Note: See jumper selections below. More information in the product's user's manual.



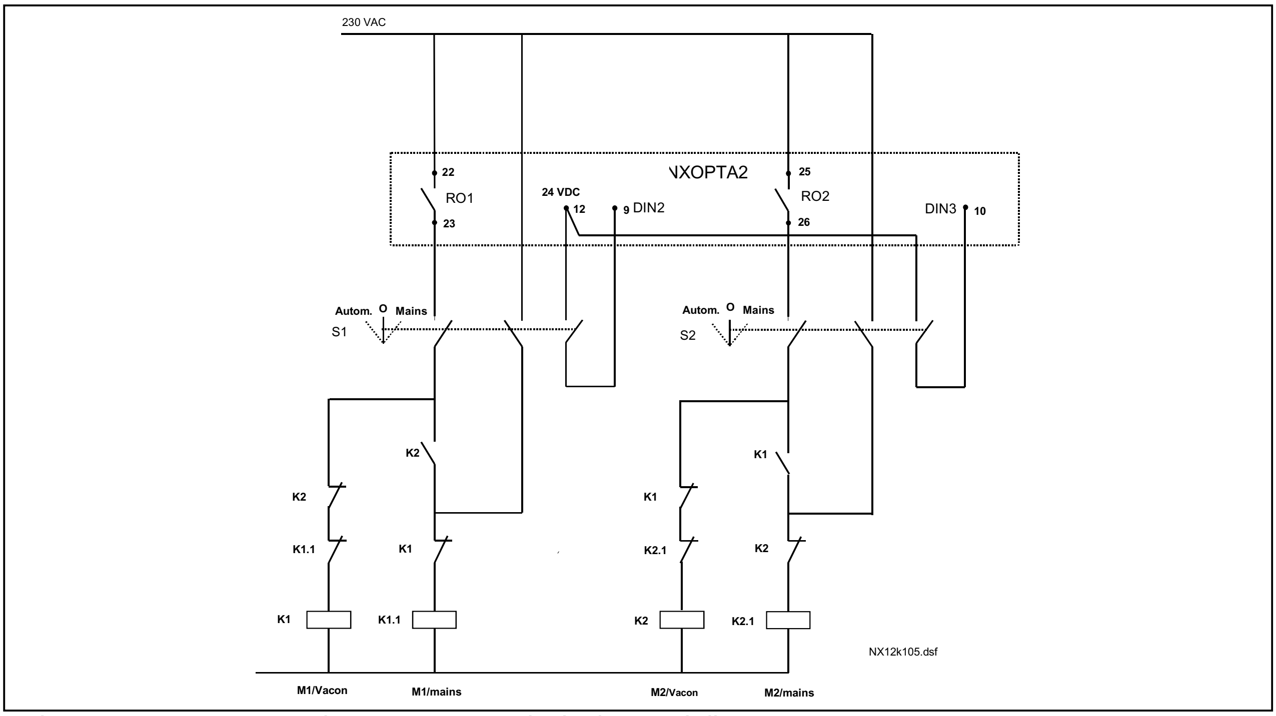


Figure 7-1. 2-pump autochange system, principal control diagram

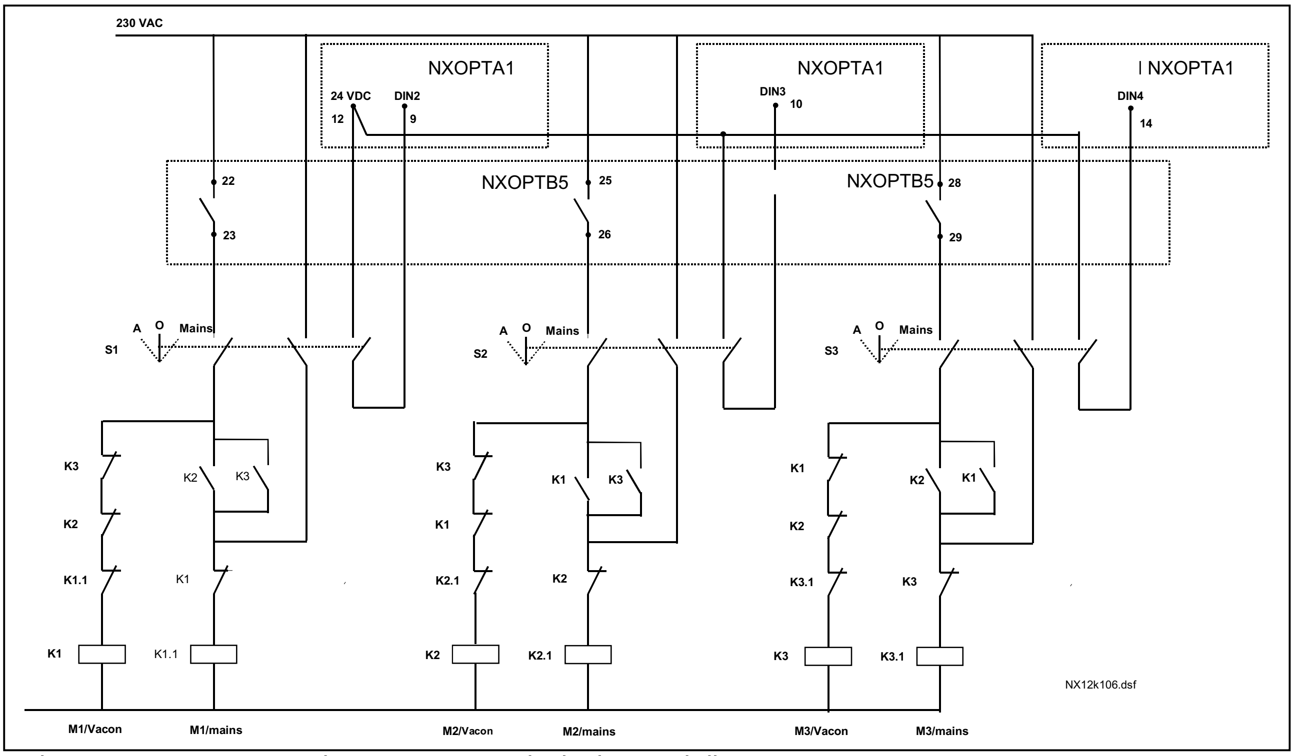


Figure 7-2. 3-pump autochange system, principal control diagram

7.3 Control signal logic in Pump and Fan Control Application

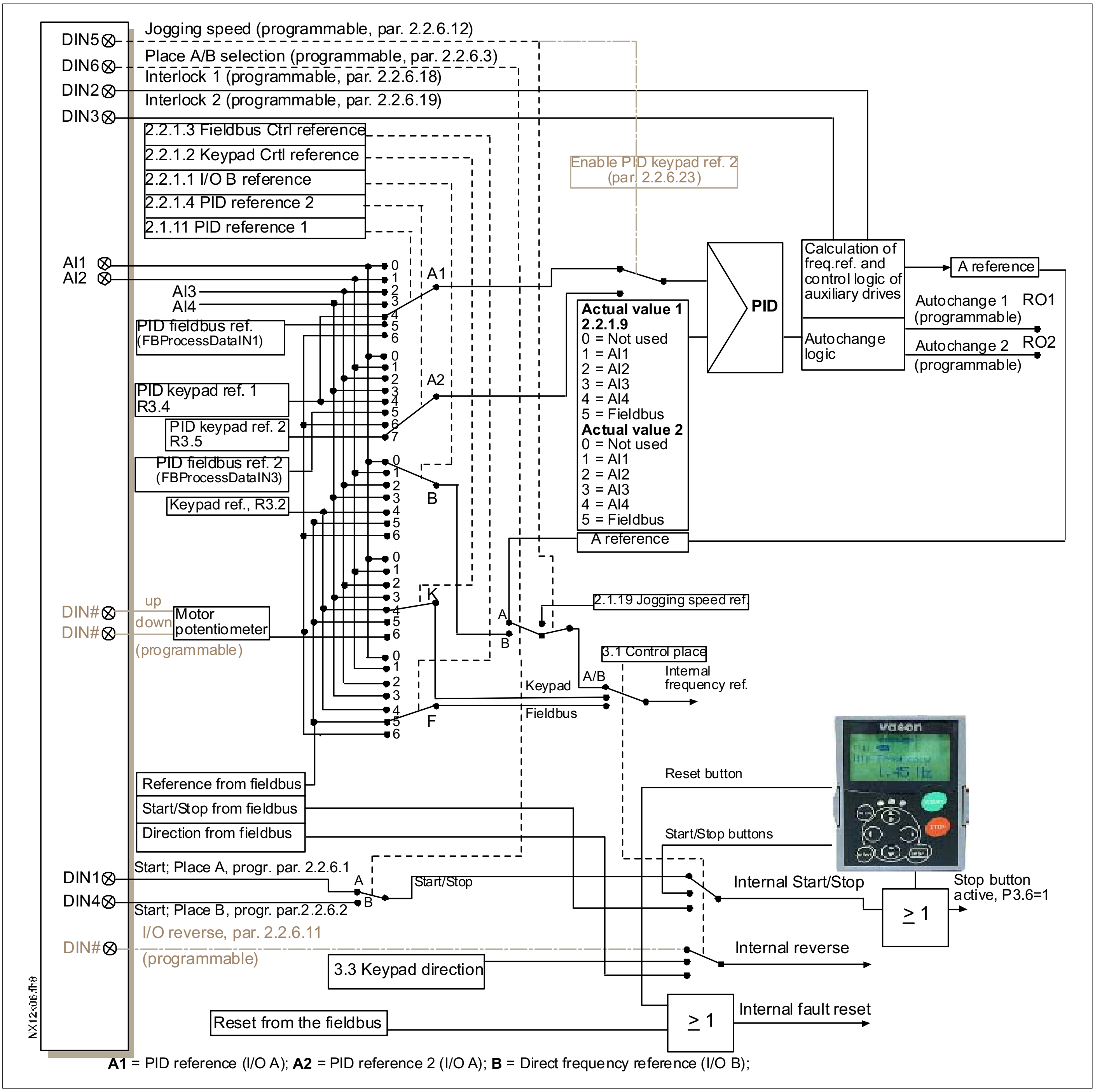


Figure 7-3. Control signal logic of the Pump and Fan Control Application

7.4 Short description of function and essential parameters

7.4.1 Automatic changing between drives (Autochange, P2.9.24)

The *Autochange function* allows the starting and stopping order of drives controlled by the pump and fan automatics to be changed at desired intervals. The drive controlled by frequency drive can also be included in the automatic changing and locking sequence (par. 2.9.25). The Autochange function makes it possible to equalize the run times of the motors and to prevent e.g. pump stalls due to too long running breaks.

- Apply the Autochange function with parameter 2.9.24, *Autochange*.

- The autochange takes place when the time set with parameter 2.9.26, *Autochange interval,* has expired and the capacity used is below the level defined with parameter 2.9.28, *Autochange frequency limit*.

- The running drives are stopped and re-started according to the new order.

- External contactors controlled through the relay outputs of the frequency drive connect the drives to the frequency drive or to the mains. If the motor controlled by the frequency drive is included in the autochange sequence, it is always controlled through the relay output activated first. The other relays activated later control the auxiliary drives (see Figure 7-5 and Figure 7-6).

Parameter 2.9.24, Autochange

0 Autochange not used
1 Autochange used

The automatic change of starting and stopping order is activated and applied to either the auxiliary drives only or the auxiliary drives **and** the drive controlled by the frequency drive. depending on the setting of parameter 2.9.25, *Automatics selection*. By default, the Autochange is activated for 2 drives. See Figure 7-1 and Figure 7-5.

Parameter 2.9.25, Autochange/Interlockings automatics selection

0 Automatics (autochange/interlockings) applied to auxiliary drives only

The drive controlled by the frequency drive remains the same. Therefore, mains contactor is needed for one auxiliary drive only.

1 All drives included in the autochange/interlockings sequence

The drive controlled by the frequency drive is included in the automatics and a contactor is needed for each drive to connect it to either the mains or the frequency drive.

Parameter 2.9.26, Autochange interval

After the expiry of the time defined with this parameter, the autochange function takes place if the capacity used lies below the level defined with parameters 2.9.28 (*Autochange frequency limit*) and 2.9.27 (*Maximum number of auxiliary drives*). Should the capacity exceed the value of P2.9.28, the autochange will not take place before the capacity goes below this limit.

- The time count is activated only if the Start/Stop request is active at control place A.
- The time count is reset after the autochange has taken place or on removal of Start request at control place A

Parameters 2.9.27, Maximum number of auxiliary drives and 2.9.28, Autochange frequency limit

These parameters define the level below which the capacity used must remain so that the autochange can take place.

This level is defined as follows:

- If the number of running auxiliary drives is smaller than the value of parameter 2.9.27 the autochange function can take place.
- If the number of running auxiliary drives is equal to the value of parameter 2.9.27 and the frequency of the controlled drive is below the value of parameter 2.9.28 the autochange can take place.
- If the value of parameter 2.9.28 is 0.0 Hz, the autochange can take place only in rest position (Stop and Sleep) regardless of the value of parameter 2.9.27.

7.4.2 Interlock selection (P2.9.23)

This parameter is used to activate the interlock inputs. The interlocking signals come from the motor switches. The signals (functions) are connected to digital inputs which are programmed as interlock inputs using the corresponding parameters. The pump and fan control automatics only control the motors with active interlock data.

- The interlock data can be used even when the Autochange function is not activated
- If the interlock of an auxiliary drive is inactivated and another unused auxiliary drive available, the latter will be put to use without stopping the frequency drive.
- If the interlock of the controlled drive is inactivated, all motors will be stopped and re-started with the new set-up.
- If the interlock is re-activated in Run status, the automatics functions according to parameter 2.9.23, *Interlock selection*:

0 Not used

1 Update in stop

Interlocks are used. The new drive will be placed last in the autochange line without stopping the system. However, if the autochange order now becomes, for example, [P1 → P3 → P4 → P2], it will be updated in the next Stop (autochange, sleep, stop, etc.)

Example:

[P1 → P3 → P4] → [P2 LOCKED] →[P1 → P3 → P4 → P2] → [SLEEP] → [P1 → P2 → P3 → P4]

2 Stop & Update

Interlockings are used. The automatics will stop all motors immediately and re-start with a new set-up

Example:

[P1 → P2 → P4] → [P3 LOCKED] → [STOP] → [P1 → P2 → P3 → P4]

See Chapter 7.4.3, Examples.

7.4.3 Examples

Pump and fan automatics with interlocks and no autochange

Situation: One controlled drive and three auxiliary drives.
Parameter settings: 2.9.1=3, 2.9.25=0
Interlock feedback signals used, autochange not used.
Parameter settings: 2.9.23=1, 2.9.24=0
The interlock feedback signals come from the digital inputs selected with parameters 2.2.6.18 to 2.2.6.21.
The Auxiliary drive 1 control (par. 2.3.1.27) is enabled through Interlock 1 (par. 2.2.6.18), the Auxiliary drive 2 control (par. 2.3.1.28) through Interlock 2 (par. 2.2.6.19) etc.

Phases:

1) The system and the motor controlled by the frequency drive are started.
2) The Auxiliary drive 1 starts when the main drive reaches the starting frequency set (par. 2.9.2).
3) The main drive decreases speed down to Auxiliary drive 1 Stop frequency (par. 2.9.3) and starts to rise toward the Start frequency of Auxiliary drive 2, if needed.
4) The Auxiliary drive 2 starts when the main drive has reached the starting frequency set (par. 2.9.4).
5) The Interlock feedback is removed from Aux. drive 2. Because the Aux. drive 3 is unused, it will be started to replace the removed Aux. drive 2.
6) The main drive increases speed to maximum because no more auxiliary drives are available.
7) The removed Aux.drive 2 is reconnected and placed last in the auxiliary drive start order which now is 1-3-2. The main drive decreases speed to the set Stop frequency. The auxiliary drive start order will be updated either immediately or in the next Stop (autochange, sleep, stop, etc.) according to par. 2.9.23.
8) If still more power is needed, the main drive speed rises up to the maximum frequency placing 100% of the output power in the system's disposal.

When the need of power decreases, the auxiliary drives turn off in the opposite order (2-3-1; after the update 3-2-1).

Pump and fan automatics with interlocks and autochange

The above is also applicable if the autochange function is used. In addition to the changed and updated start order, also the change order of main drives depends on parameter 2.9.23.

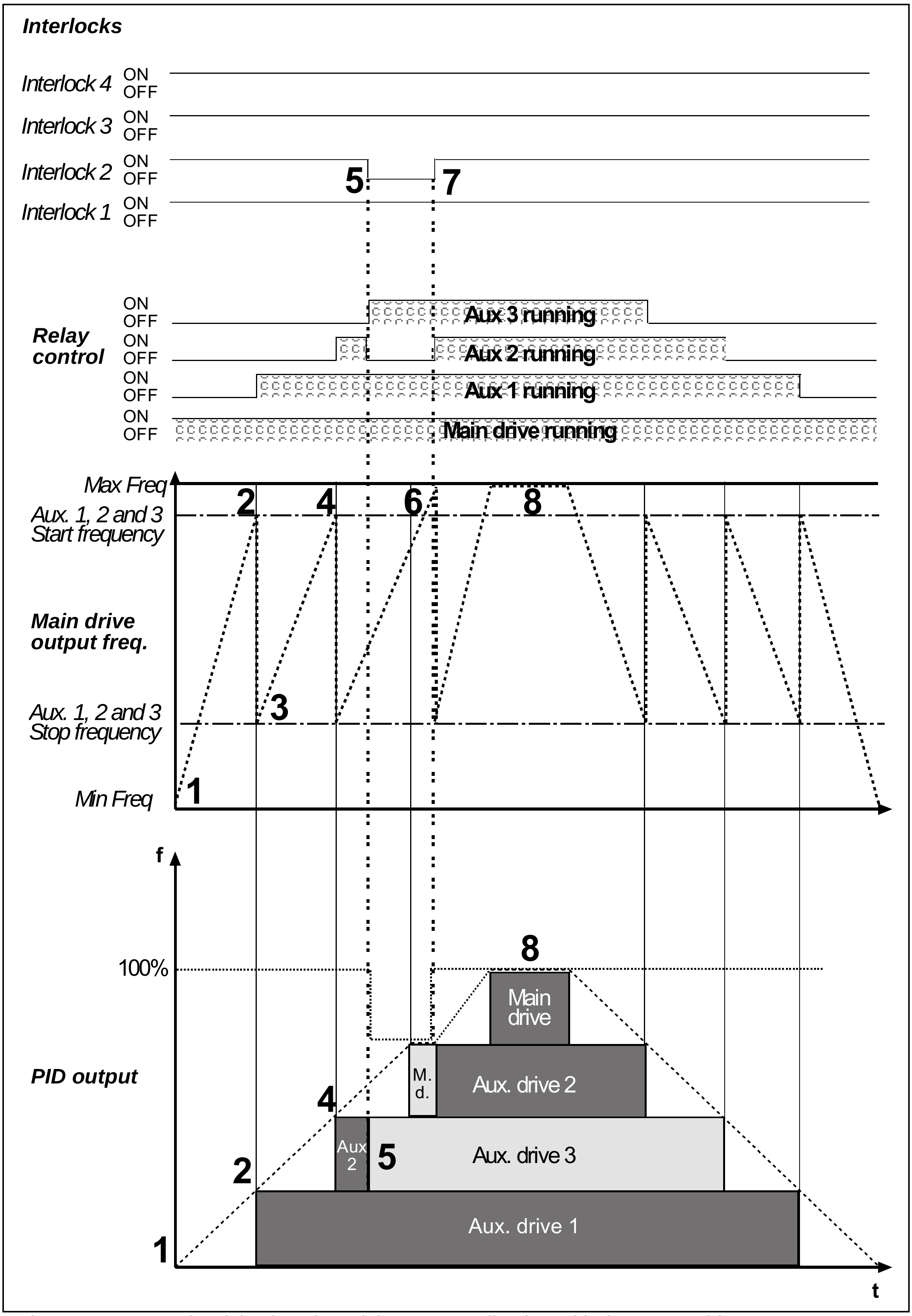


Figure 7-4. Example of the function of the PFC application with three aux. drives.

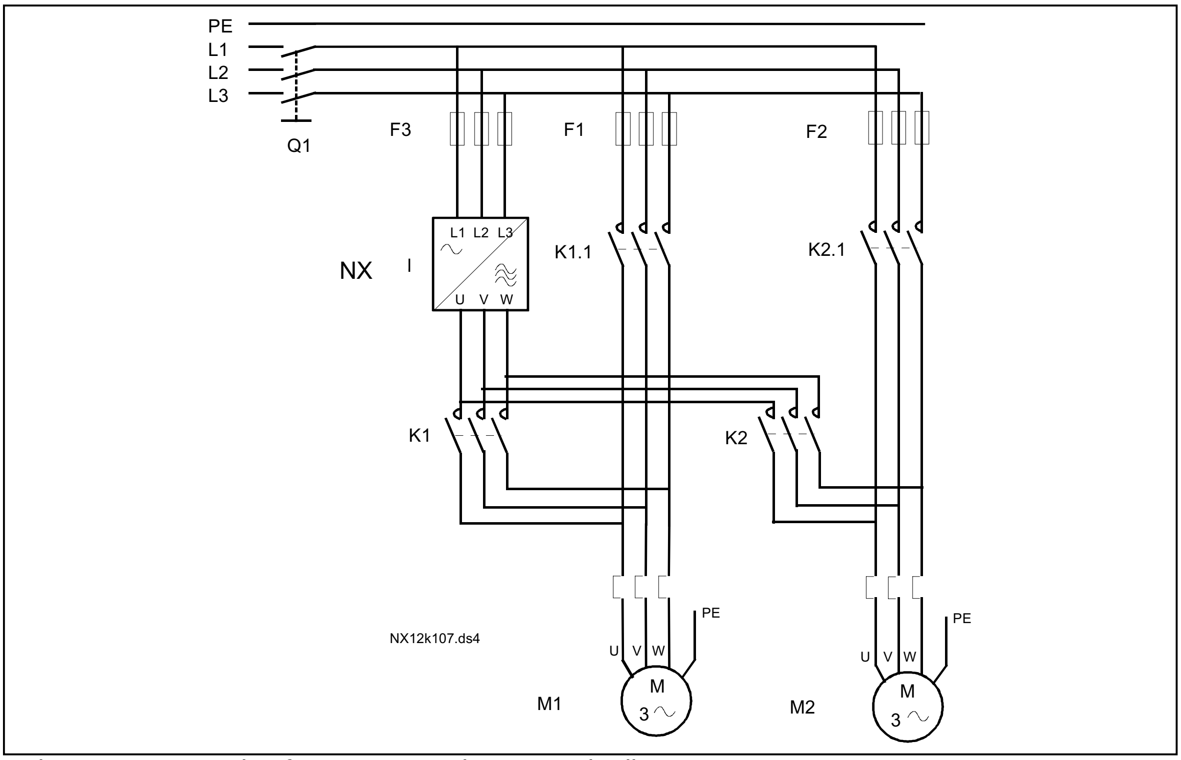


Figure 7-5. Example of 2-pump autochange, main diagram

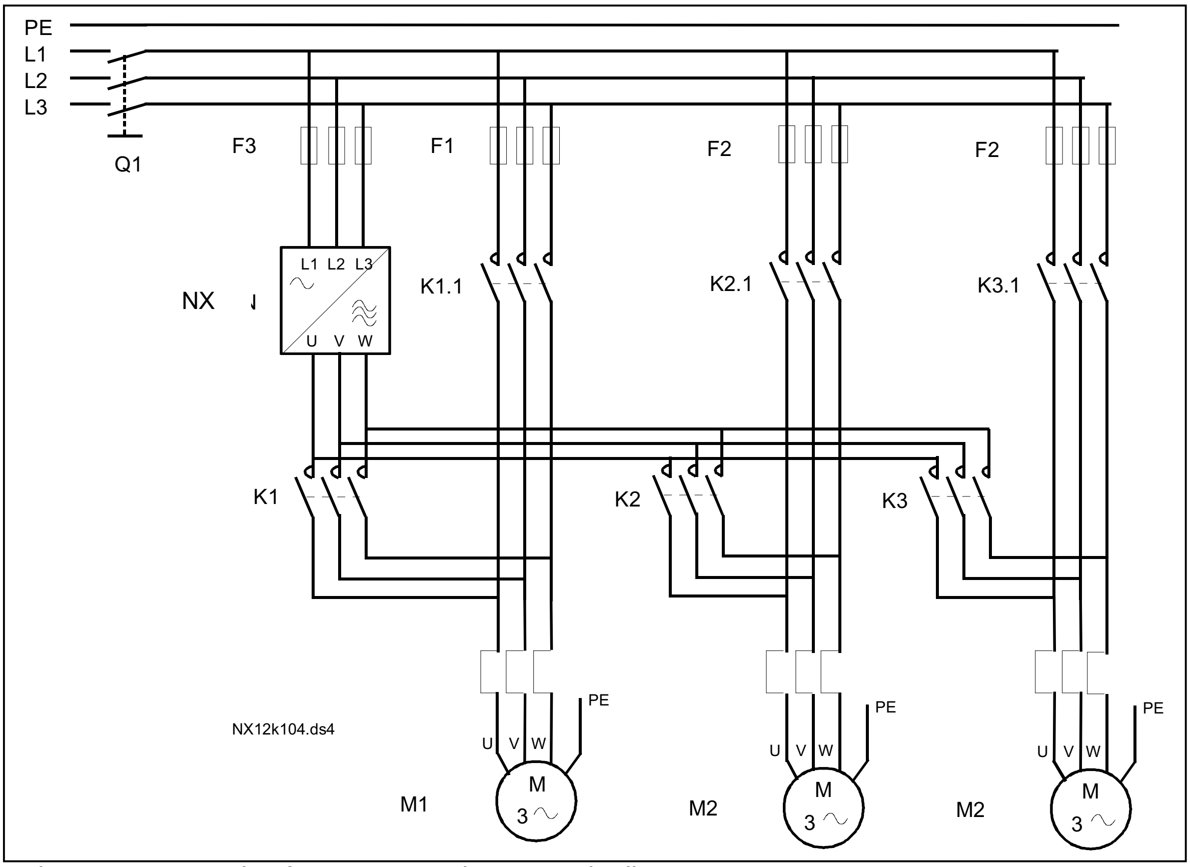


Figure 7-6. Example of 3-pump autochange, main diagram

Automation and Control Solutions
Honeywell
1985 Douglas Drive North
Golden Valley, MIN 55422

Honeywell Limited-Honeywell Limitée
35 Dynamic Drive
Scarborough, Ontario
MIV 4Z9

7.5 Pump and Fan Control Application – Parameter lists

On the next pages you will find the lists of parameters within the respective parameter groups. The parameter descriptions are given on pages 122 to 209.

Column explanations:

Code = Location indication on the keypad; Shows the operator the present param. number
Parameter = Name of parameter
Min = Minimum value of parameter
Max = Maximum value of parameter
Unit = Unit of parameter value; Given if available
Default = Value preset by factory
Cust = Customer's own settings
ID = ID number of the parameter
= On parameter code: Parameter value can only be changed after the FC has been stopped.
= Apply the Terminal to Function method (TTF) to these parameters (see chapter 6.4)

7.5.1 Monitoring values (Control keypad: menu M1)

The monitoring values are the actual values of parameters and signals as well as statuses and measurements. Monitoring values cannot be edited.
See the product's user's manual for more information. Note that the monitoring values V1.18 to V1.23 are available in the PFC control application only.

Code	Parameter	Unit	ID	Description
V1.1	Output frequency	Hz	1	Output frequency to motor
V1.2	Frequency reference	Hz	25	Frequency reference to motor control
V1.3	Motor speed	rpm	2	Motor speed in rpm
V1.4	Motor current	A	3	
V1.5	Motor torque	%	4	Calculated shaft torque
V1.6	Motor power	%	5	Motor shaft power
V1.7	Motor voltage	V	6	
V1.8	DC link voltage	V	7	
V1.9	Unit temperature	°C	8	Heatsink temperature
V1.10	Motor temperature	%	9	Calculated motor temperature
V1.11	Analogue input 1	V/mA	13	AI1 input value
V1.12	Analogue input 2	V/mA	14	AI2 input value
V1.13	DIN1, DIN2, DIN3		15	Digital input statuses
V1.14	DIN4, DIN5, DIN6		16	Digital input statuses
V1.15	Analogue I_{out}	mA	26	AO1
V1.16	Analogue input 3	V/mA	27	AI3 input value
V1.17	Analogue input 4	V/mA	28	AI4 input value
V1.18	PID Reference	%	20	In % of the max. frequency
V1.19	PID Actual value	%	21	In % of the max actual value
V1.20	PID Error value	%	22	In % of the max error value
V1.21	PID Output	%	23	In % of the max output value
V1.22	Running auxiliary drives		30	Number of running auxiliary drives
V1.23	Special display for actual value		29	See parameters 2.9.29 to 2.9.31
V1.24	PT-100 temperature	C°	42	Highest temperature of used PT100 inputs
G1.25	Multimonitoring items			Displays 3 selectable monitor. values

Table 7-2. Monitoring values

7.5.2 Basic parameters (Control keypad: Menu M2 → G2.1)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.1.1	Min frequency	0,00	Par. 2.1.2	Hz	0,00		101	
P2.1.2	Max frequency	Par. 2.1.1	320,00	Hz	50,00		102	**NOTE**: If f_{max} > than the motor synchronous speed, check suitability for motor and drive system
P2.1.3	Acceleration time 1	0,1	3000,0	s	1,0		103	
P2.1.4	Deceleration time 1	0,1	3000,0	s	1,0		104	
P2.1.5	Current limit	0,1 x I_H	2 x I_H	A	I_L		107	
P2.1.6	Nominal voltage of the motor	180	690	V	NX2: 230V NX5: 400V NX6: 690V		110	
P2.1.7	Nominal frequency of the motor	8,00	320,00	Hz	50,00		111	Check the rating plate of the motor
P2.1.8	Nominal speed of the motor	24	20 000	rpm	1440		112	The default applies for a 4-pole motor and a nominal size frequency drive.
P2.1.9	Nominal current of the motor	0,1 x I_H	2 x I_H	A	I_H		113	Check the rating plate of the motor.
P2.1.10	Motor cosφ	0,30	1,00		0,85		120	Check the rating plate of the motor
P2.1.11	PID controller reference signal (Place A)	0	6		4		332	**0**=AI1 (#2—3) **1**=AI2 (#4—5) **2**=AI3 **3**=AI4 **4**=PID ref from Keypad control page, par. 3.4 **5**=PID ref. from fieldbus (FBProcessDataIN1) **6**=Motor potentiometer
P2.1.12	PID controller gain	0,0	1000,0	%	100,0		118	
P2.1.13	PID controller I-time	0,00	320,00	s	1,00		119	
P2.1.14	PID controller D-time	0,00	10,00	s	0,00		132	
P2.1.15	Sleep frequency	0	Par. 2.1.2	Hz	10,00		1016	
P2.1.16	Sleep delay	0	3600	s	30		1017	
P2.1.17	Wake up level	0,00	100,00	%	25,00		1018	
P2.1.18	Wake up function	0	3		0		1019	**0**=Wake-up at fall below wake up level (2.1.17) **1**=Wake-up at exceeded wake up level (2.1.17) **2**=Wake-up at fall below wake up level (PID ref) **3**=Wake-up at exceeded wake up level (PID ref)
P2.1.19	Jogging speed reference	0,00	Par. 2.1.2	Hz	10,00		124	

Table 7-3. Basic parameters G2.1

7.5.3 Input signals

7.5.3.1 Basic Settings (Control keypad: Menu M2 → G2.2.1)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.2.1.1	I/O B reference selection	0	7		0		343	**0**=AI1 **1**=AI2 **2**=AI3 **3**=AI4 **4**=Keypad reference **5**=Fieldbus reference (FB SpeedReference) **6**=Motor potentiometer **7**=PID controller
P2.2.1.2	Keypad control reference selection	0	7		4		121	As in par. 2.2.1.1
P2.2.1.3	Fieldbus control reference selection	0	7		5		122	As in par. 2.2.1.1
P2.2.1.4	PID Reference 2	0	7		7		371	**0**=AI1 **1**=AI2 **2**=AI3 **3**=AI4 **4**=PID reference 1 from keypad **5**=Fieldbus reference (FBProcessDataIN3) **6**=Motor potentiometer **7**=PID reference 2 from keypad
P2.2.1.5	PID error value inversion	0	1		0		340	**0**=No inversion **1**=Inversion
P2.2.1.6	PID reference rising time	0,0	100,0	s	5,0		341	Time for reference value to change from 0% to 100%
P2.2.1.7	PID reference falling time	0,0	100,0	s	5,0		342	Time for reference value to change from 100% to 0%
P2.2.1.8	PID actual value selection	0	7		0		333	**0**=Actual value 1 **1**=Actual 1 + Actual 2 **2**=Actual 1 – Actual 2 **3**=Actual 1 * Actual 2 **4**=Max(Actual 1, Actual 2) **5**=Min(Actual 1, Actual 2) **6**=Mean(Actual1, Actual2) **7**=Sqrt (Act1) + Sqrt (Act2)
P2.2.1.9	Actual value 1 selection	0	5		2		334	**0**=Not used **1**=AI1 (control board) **2**=AI2 (control board) **3**=AI3 **4**=AI4 **5**=Fieldbus (FBProcessDataIN2)
P2.2.1.10	Actual value 2 input	0	5		0		335	**0**=Not used **1**=AI1 (control board) **2**=AI2 (control board) **3**=AI3 **4**=AI4 **5**=Fieldbus (FBProcessDataIN3)
P2.2.1.11	Actual value 1 minimum scale	–1600,0	1600,0	%	0,0		336	**0**=No minimum scaling
P2.2.1.12	Actual value 1 maximum scale	–1600,0	1600,0	%	100,0		337	**100**=No maximum scaling
P2.2.1.13	Actual value 2 minimum scale	–1600,0	1600,0	%	0,0		338	**0**=No minimum scaling

P2.2.1.14	Actual value 2 maximum scale	–1600,0	1600,0	%	100,0		339	**100**=No maximum scaling
P2.2.1.15	Motor potentiometer ramp time	0,1	2000,0	Hz/s	10,0		331	
P2.2.1.16	Motor potentiometer frequency reference memory reset	0	2		1		367	**0**=No reset **1**=Reset if stopped or powered down **2**=Reset if powered down
P2.2.1.17	Motor potentiometer PID reference memory reset	0	2		0		370	**0**=No reset **1**=Reset if stopped or powered down **2**=Reset if powered down
P2.2.1.18	B reference scale, minimum	0,00	320,00	Hz	0,00		344	**0**=Scaling off **>0**=Scaled min. value
P2.2.1.19	B reference scale, maximum	0,00	320,00	Hz	0,00		345	**0**=Scaling off **>0**=Scaled max. value

Table 7-4. Input signals, Basic settings

7.5.3.2 Analogue input 1 (Control keypad: Menu M2 → G2.2.2)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.2.2.1	AI1 signal selection	0			A.1		377	
P2.2.2.2	AI1 filter time	0,00	10,00	s	0,10		324	**0**=No filtering
P2.2.2.3	AI1 signal range	0	2		0		320	**0**=Signal range 0-100%* **1**=Signal range 20-100%* **2**=Custom range
P2.2.2.4	AI1 custom minimum setting	-160,00	160,00	%	0,00		321	
P2.2.2.5	AI1 custom maximum setting	-160,00	160,00	%	100,00		322	
P2.2.2.6	AI1 signal inversion	0	1		0		323	**0**=Not inverted **1**=Inverted

Table 7-5. Input signals, Analogue input 1

7.5.3.3 Analogue input 2 (Control keypad: Menu M2 → G2.2.3)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.2.3.1	AI2 signal selection	0			A.2		388	
P2.2.3.2	AI2 filter time	0,00	10,00	s	0,10		329	**0**=No filtering
P2.2.3.3	AI2 signal range	0	2		1		325	**0**=0—20 mA* **1**=4—20 mA* **2**=Customised*
P2.2.3.4	AI2 custom minimum setting	-160,00	160,00	%	0,00		326	
P2.2.3.5	AI2 custom maximum setting	-160,00	160,00	%	100,00		327	
P2.2.3.6	AI2 inversion	0	1		0		328	**0**=Not inverted **1**=Inverted

Table 7-6. Input signals, Analogue input 2

*Remember to place jumpers of block X2 accordingly.
See NX User's Manual, chapter 6.2.2.2

7.5.3.4 Analogue input 3 (Control keypad: Menu M2 → G2.2.4)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.2.4.1	AI3 signal selection	0			0.1		141	
P2.2.4.2	AI3 filter time	0,00	10,00	s	0,10		142	**0**=No filtering
P2.2.4.3	AI3 signal range	0	2		1		143	**0**=0—20 mA **1**=4—20 mA **2**=Customised
P2.2.4.4	AI3 custom minimum setting	-160,00	160,00	%	0,00		144	
P2.2.4.5	AI3 custom maximum setting	-160,00	160,00	%	100,00		145	
P2.2.4.6	AI3 inversion	0	1		0		151	**0**=Not inverted **1**=Inverted

Table 7-7. Input signals, Analogue input 3

7.5.3.5 Analogue input 4, (Control keypad: Menu M2 → G2.2.5)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.2.5.1	AI4 signal selection	0			0.1		152	
P2.2.5.2	AI4 filter time	0,00	10,00	s	0,10		153	**0**=No filtering
P2.2.5.3	AI4 signal range	0	2		1		154	**0**=0—20 mA **1**=4—20 mA **2**=Customised
P2.2.5.4	AI4 custom minimum setting	-160,00	160,00	%	0,00		155	
P2.2.5.5	AI4 custom maximum setting	-160,00	160,00	%	100,00		156	
P2.2.5.6	AI4 inversion	0	1		0		162	**0**=Not inverted **1**=Inverted

Table 7-8. Input signals, Analogue input 4

*Remember to place jumpers of block X2 accordingly.
See the product's User's Manual

7.5.3.6 Digital inputs (Control keypad: Menu M2 → G2.2.4)

Code	Parameter	Min	Default	Cust	ID	Note
P2.2.6.1	Start A signal	0	A.1		423	
P2.2.6.2	Start B signal	0	A.4		424	
P2.2.6.3	Control place A/B selection	0	A.6		425	Control place A (oc) Control place B (cc)
P2.2.6.4	External fault (close)	0	0.1		405	Ext. fault displayed (cc)
P2.2.6.5	External fault (open)	0	0.2		406	Ext. fault displayed (oc)
P2.2.6.6	Run enable	0	0.2		407	Motor start enabled (cc)
P2.2.6.7	Acc/Dec time selection	0	0.1		408	Acc/Dec time 1 (oc) Acc/Dec time 2 (cc)
P2.2.6.8	Control from I/O terminal	0	0.1		409	Force control place to I/O terminal (cc)
P2.2.6.9	Control from keypad	0	0.1		410	Force control place to keypad (cc)
P2.2.6.10	Control from fieldbus	0	0.1		411	Force control place to fieldbus (cc)
P2.2.6.11	Reverse	0	0.1		412	Direction forward (oc) Direction reverse (cc)
P2.2.6.12	Jogging speed	0	A.5		413	Jogging speed selected for frequency reference (cc)
P2.2.6.13	Fault reset	0	0.1		414	All faults reset (cc)
P2.2.6.14	Acc/Dec prohibit	0	0.1		415	Acc/Dec prohibited (cc)
P2.2.6.15	DC braking	0	0.1		416	DC braking active (cc)
P2.2.6.16	Motor potentiometer reference DOWN	0	0.1		417	Mot.pot. reference decreases (cc)
P2.2.6.17	Motor potentiometer reference UP	0	0.1		418	Mot.pot. reference increases (cc)
P2.2.6.18	Autochange 1 Interlock	0	A.2		426	Activated if cc
P2.2.6.19	Autochange 2 Interlock	0	A.3		427	Activated if cc
P2.2.6.20	Autochange 3 Interlock	0	0.1		428	Activated if cc
P2.2.6.21	Autochange 4 Interlock	0	0.1		429	Activated if cc
P2.2.6.22	Autochange 5 Interlock	0	0.1		430	Activated if cc
P2.2.6.23	PID reference 2	0	0.1		431	Selected with 2.1.11 (oc) Selected with 2.2.1.4 (cc)

Table 7-9. Input signals, Digital inputs

cc = closing contact
oc = opening contact

7.5.4 Output signals

7.5.4.1 Digital output signals (Control keypad: Menu M2 → G2.3.1)

Code	Parameter	Min	Default	Cust	ID	Note
P2.3.1.1	Ready	0	0.1		432	
P2.3.1.2	Run	0	0.1		433	
P2.3.1.3	Fault	0	A.1		434	
P2.3.1.4	Inverted fault	0	0.1		435	
P2.3.1.5	Warning	0	0.1		436	
P2.3.1.6	External fault	0	0.1		437	
P2.3.1.7	Reference fault/warnin	0	0.1		438	
P2.3.1.8	Overtemperature warning	0	0.1		439	
P2.3.1.9	Reverse	0	0.1		440	
P2.3.1.10	Unrequested direction	0	0.1		441	
P2.3.1.11	At speed	0	0.1		442	
P2.3.1.12	Jogging speed	0	0.1		443	
P2.3.1.13	External control place	0	0.1		444	
P2.3.1.14	External brake control	0	0.1		445	
P2.3.1.15	External brake control, inverted	0	0.1		446	
P2.3.1.16	Output frequency limit 1 supervision	0	0.1		447	
P2.3.1.17	Output frequency limit 2 supervision	0	0.1		448	
P2.3.1.18	Reference limit supervision	0	0.1		449	
P2.3.1.19	Temperature limit supervision	0	0.1		450	
P2.3.1.20	Torque limit supervisio	0	0.1		451	
P2.3.1.21	Motor thermal protection	0	0.1		452	
P2.3.1.22	Analogue input supervision limit	0	0.1		463	
P2.3.1.23	Motor regulator activation	0	0.1		454	
P2.3.1.24	Fieldbus input data 1	0	0.1		455	
P2.3.1.25	Fieldbus input data 2	0	0.1		456	
P2.3.1.26	Fieldbus input data 3	0	0.1		457	
P2.3.1.27	Autochange 1/Aux 1 control	0	B.1		458	
P2.3.1.28	Autochange 2/Aux 2 control	0	B.2		459	
P2.3.1.29	Autochange 3/Aux 3 control	0	0.1		460	
P2.3.1.30	Autochange 4/Aux 4 control	0	0.1		461	
P2.3.1.31	Autochange 5	0	0.1		462	

Table 7-10. Output signals, Digital outputs

7.5.4.2 Limit settings (Control keypad: Menu M2 → G2.3.2)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.3.2.1	Output frequency limit 1 supervision	0	2		0		315	**0**=No limit **1**=Low limit supervision **2**=High limit supervision
P2.3.2.2	Output freq. limit 1; Supervised value	0,00	320,00	Hz	0,00		316	
P2.3.2.3	Output frequency limit 2 supervision	0	2		0		346	**0**=No limit **1**=Low limit supervision **2**=High limit supervision
P2.3.2.4	Output freq. limit 2; Supervised value	0,00	320,00	Hz	0,00		347	
P2.3.2.5	Torque limit supervision	0	2		0		348	**0**=Not used **1**=Low limit supervision **2**=High limit supervision
P2.3.2.6	Torque limit supervision value	-300,0	300,0	%	100,0		349	
P2.3.2.7	Reference limit supervision	0	2		0		350	**0**=Not used **1**=Low limit **2**=High limit
P2.3.2.8	Reference limit supervision value	0,0	100,0	%	0,0		351	
P2.3.2.9	External brake-off delay	0,0	100,0	s	0,5		352	
P2.3.2.10	External brake-on delay	0,0	100,0	s	1,5		353	
P2.3.2.11	FC temperature supervision	0	2		0		354	**0**=Not used **1**=Low limit **2**=High limit
P2.3.2.12	FC temperature supervised value	–10	100	°C	40		355	
P2.3.2.13	Supervised analogue input	0	3		0		372	**0**=AI1 **1**=AI2
P2.3.2.14	Analogue input limit supervision	0	2		0		373	**0**=No limit **1**=Low limit supervision **2**=High limit supervision
P2.3.2.15	Analogue input supervised value	0,00	100,00	%	0,00		374	

Table 7-11. Output signals, Limit settings

7.5.4.3 Analogue output 1 (Control keypad: Menu M2 → G2.3.3)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.3.3.1	Analogue output signal selection	0			A.1		464	
P2.3.3.2	Analogue output function	0	14		1		307	**0**=Not used **1**=Output freq. (0—f_{max}) **2**=Freq. reference (0—f_{max}) **3**=Motor speed (0—Motor nominal speed) **4**=Motor current (0—I_{nMotor}) **5**=Motor torque (0—T_{nMotor}) **6**=Motor power (0—P_{nMotor}) **7**=Motor voltage (0–U_{nMotor}) **8**=DC-link volt (0—1000V) **9**=PID controller ref. value **10**=PID contr. act.value 1 **11**=PID contr. act.value 2 **12**=PID contr. error value **13**=PID controller output **14**=PT100 temperature
P2.3.3.3	Analogue output filter time	0,00	10,00	s	1,00		308	**0**=No filtering
P2.3.3.4	Analogue output inversion	0	1		0		309	**0**=Not inverted **1**=Inverted
P2.3.3.5	Analogue output minimum	0	1		0		310	**0**=0 mA **1**=4 mA
P2.3.3.6	Analogue output scale	10	1000	%	100		311	
P2.3.3.7	Analogue output offset	–100,00	100,00	%	0,00		375	

Table 7-12. Output signals, Analogue output 1

7.5.4.4 Analogue output 2 (Control keypad: Menu M2 → G2.3.4)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.3.4.1	Analogue output 2 signal selection	0			0.1		471	
P2.3.4.2	Analogue output 2 function	0	14		0		472	See par. 2.3.3.2
P2.3.4.3	Analogue output 2 filter time	0,00	10,00	s	1,00		473	**0**=No filtering
P2.3.4.4	Analogue output 2 inversion	0	1		0		474	**0**=Not inverted **1**=Inverted
P2.3.4.5	Analogue output 2 minimum	0	1		0		475	**0**=0 mA **1**=4 mA
P2.3.4.6	Analogue output 2 scale	10	1000	%	100		476	
P2.3.4.7	Analogue output 2 offset	–100,00	100,00	%	0,00		477	

Table 7-13. Output signals, Analogue output 2

7.5.4.5 Analogue output 3 (Control keypad: Menu M2 → G2.3.5)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.3.5.1	Analogue output 3 signal selection	0			0.1		478	
P2.3.5.2	Analogue output 3 function	0	14		0		479	See par. 2.3.3.2
P2.3.5.3	Analogue output 3 filter time	0,00	10,00	s	1,00		480	**0**=No filtering
P2.3.5.4	Analogue output 3 inversion	0	1		0		481	**0**=Not inverted **1**=Inverted
P2.3.5.5	Analogue output 3 minimum	0	1		0		482	**0**=0 mA **1**=4 mA
P2.3.5.6	Analogue output 3 scale	10	1000	%	100		483	
P2.3.5.7	Analogue output 3 offset	–100,00	100,00	%	0,00		484	

Table 7-14. Output signals, Analogue output 3

7.5.5 Drive control parameters (Control keypad: Menu M2 → G2.4)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.4.1	Ramp 1 shape	0,0	10,0	s	0,1		500	**0**=Linear **>0**=S-curve ramp time
P2.4.2	Ramp 2 shape	0,0	10,0	s	0,0		501	**0**=Linear **>0**=S-curve ramp time
P2.4.3	Acceleration time 2	0,1	3000,0	s	10,0		502	
P2.4.4	Deceleration time 2	0,1	3000,0	s	10,0		503	
P2.4.5	Brake chopper	0	4		0		504	**0**=Disabled **1**=Used when running **2**=External brake chopper **3**=Used when stopped/running **4**=Used when running (no testing)
P2.4.6	Start function	0	1		0		505	**0**=Ramp **1**=Flying start
P2.4.7	Stop function	0	3		0		506	**0**=Coasting **1**=Ramp **2**=Ramp+Run enable coast **3**=Coast+Run enable ramp
P2.4.8	DC braking current	0,00	I_L	A	0,7 x I_H		507	
P2.4.9	DC braking time at stop	0,00	600,00	s	0,00		508	**0**=DC brake is off at stop
P2.4.10	Frequency to start DC braking during ramp stop	0,10	10,00	Hz	1,50		515	
P2.4.11	DC braking time at start	0,00	600,00	s	0,00		516	**0**=DC brake is off at start
P2.4.12	Flux brake	0	1		0		520	**0**=Off **1**=On
P2.4.13	Flux braking current	0,00	I_L	A	I_H		519	

Table 7-15. Drive control parameters, G2.4

7.5.6 Prohibit frequency parameters (Control keypad: Menu M2 → G2.5)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.5.1	Prohibit frequency range 1 low limit	0,00	320,00	Hz	0,00		509	**0**=Not used
P2.5.2	Prohibit frequency range 1 high limit	0,00	320,00	Hz	0,00		510	**0**=Not used
P2.5.3	Prohibit frequency range 2 low limit	0,00	320,00	Hz	0,00		511	**0**=Not used
P2.5.4	Prohibit frequency range 2 high limit	0,00	320,00	Hz	0,00		512	**0**=Not used
P2.5.5	Prohibit frequency range 3 low limit	0,00	320,00	Hz	0,00		513	**0**=Not used
P2.5.6	Prohibit frequency range 3 high limit	0,00	320,00	Hz	0,00		514	**0**=Not used
P2.5.7	Prohibit acc./dec. ramp	0,1	10,0	x	1,0		518	

Table 7-16. Prohibit frequency parameters, G2.5

7.5.7 Motor control parameters (Control keypad: Menu M2 → G2.6)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.6.1	Motor control mode	0	1		0		600	**0**=Frequency control **1**=Speed control
P2.6.2	U/f optimisation	0	1		0		109	**0**=Not used **1**=Automatic torque boost
P2.6.3	U/f ratio selection	0	3		0		108	**0**=Linear **1**=Squared **2**=Programmable **3**=Linear with flux optim.
P2.6.4	Field weakening point	8,00	320,00	Hz	50,00		602	
P2.6.5	Voltage at field weakening point	10,00	200,00	%	100,00		603	n% x U_{nmot}
P2.6.6	U/f curve midpoint frequency	0,00	par. P2.6.4	Hz	50,00		604	
P2.6.7	U/f curve midpoint voltage	0,00	100,00	%	100,00		605	n% x U_{nmot} Parameter max. value = par. 2.6.5
P2.6.8	Output voltage at zero frequency	0,00	40,00	%	Varies		606	n% x U_{nmot}
P2.6.9	Switching frequency	1,0	Varies	kHz	Varies		601	See Table 8-12 for exact values
P2.6.10	Overvoltage controller	0	2		1		607	**0**=Not used **1**=Used (no ramping) **2**=Used (ramping)
P2.6.11	Undervoltage controller	0	1		1		608	**0**=Not used **1**=Used

Table 7-17. Motor control parameters, G2.6

7.5.8 Protections (Control keypad: Menu M2 → G2.7)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.7.1	Response to 4mA reference fault	0	5		4		700	**0**=No response **1**=Warning **2**=Warning+Previous Freq. **3**=Wrng+PresetFreq 2.7.2 **4**=Fault,stop acc. to 2.4.7 **5**=Fault,stop by coasting
P2.7.2	4mA reference fault frequency	0,00	Par. 2.1.2	Hz	0,00		728	
P2.7.3	Response to external fault	0	3		2		701	**0**=No response **1**=Warning **2**=Fault,stop acc. to 2.4.7 **3**=Fault,stop by coasting
P2.7.4	Input phase supervision	0	3		0		730	
P2.7.5	Response to undervoltage fault	0	1		0		727	**0**=Fault stored in history **1**=Fault not stored
P2.7.6	Output phase supervision	0	3		2		702	**0**=No response **1**=Warning **2**=Fault,stop acc. to 2.4.7 **3**=Fault,stop by coasting
P2.7.7	Ground fault protection	0	3		2		703	
P2.7.8	Thermal protection of the motor	0	3		2		704	
P2.7.9	Motor ambient temperature factor	–100,0	100,0	%	0,0		705	
P2.7.10	Motor cooling factor at zero speed	0,0	150,0	%	40,0		706	
P2.7.11	Motor thermal time constant	1	200	min	Varies		707	
P2.7.12	Motor duty cycle	0	100	%	100		708	
P2.7.13	Stall protection	0	3		1		709	**0**=No response **1**=Warning **2**=Fault,stop acc. to 2.4.7 **3**=Fault,stop by coasting
P2.7.14	Stall current	0,00	2 x I_H	A	I_H		710	
P2.7.15	Stall time limit	1,00	120,00	s	15,00		711	
P2.7.16	Stall frequency limit	1,0	Par. 2.1.2	Hz	25,0		712	
P2.7.17	Underload protection	0	3		0		713	**0**=No response **1**=Warning **2**=Fault,stop acc. to 2.4.7 **3**=Fault,stop by coasting
P2.7.18	Field weakening area load	10	150	%	50		714	
P2.7.19	Zero frequency load	5,0	150,0	%	10,0		715	
P2.7.20	Underload protection time limit	2	600	s	20		716	
P2.7.21	Response to thermistor fault	0	3		2		732	**0**=No response **1**=Warning **2**=Fault,stop acc. to 2.4.7 **3**=Fault,stop by coasting
P2.7.22	Response to fieldbus fault	0	3		2		733	See P2.7.21
P2.7.23	Response to slot fault	0	3		2		734	See P2.7.21
P2.7.24	No. of PT100 inputs	0	3		0		739	
P2.7.25	Response to PT100 fault	0	3		2		740	**0**=No response **1**=Warning **2**=Fault,stop acc. to 2.4.7 **3**=Fault,stop by coasting
P2.7.26	PT100 warning limit	–30,0	200,0	C°	120,0		741	
P2.7.27	PT100 fault limit	–30,0	200,0	C°	130,0		742	

Table 7-18. Protections, G2.7

7.5.9 Autorestart parameters (Control keypad: Menu M2 → G2.8)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.8.1	Wait time	0,10	10,00	s	0,50		717	
P2.8.2	Trial time	0,00	60,00	s	30,00		718	
P2.8.3	Start function	0	2		0		719	**0**=Ramp **1**=Flying start **2**=According to par. 2.4.6
P2.8.4	Number of tries after undervoltage trip	0	10		1		720	
P2.8.5	Number of tries after overvoltage trip	0	10		1		721	
P2.8.6	Number of tries after overcurrent trip	0	3		1		722	
P2.8.7	Number of tries after 4mA reference trip	0	10		1		723	
P2.8.8	Number of tries after motor temperature fault trip	0	10		1		726	
P2.8.9	Number of tries after external fault trip	0	10		0		725	
P2.8.10	Number of tries after underload fault trip	0	10		1		738	

Table 7-19. Autorestart parameters, G2.8

7.5.10 Pump and fan control parameters (Control keypad: Menu M2 → G2.9)

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P2.9.1	Number of auxiliary drives	0	4		1		1001	
P2.9.2	Start frequency, auxiliary drive 1	Par. 2.9.3	320,00	Hz	51,00		1002	
P2.9.3	Stop frequency, auxiliary drive 1	Par. 2.1.1	Par. 2.9.2	Hz	10,00		1003	
P2.9.4	Start frequency, auxiliary drive 2	Par. 2.9.5	320,00	Hz	51,00		1004	
P2.9.5	Stop frequency, auxiliary drive 2	Par. 2.1.1	Par. 2.9.4	Hz	10,00		1005	
P2.9.6	Start frequency, auxiliary drive 3	Par. 2.9.7	320,00	Hz	51,00		1006	
P2.9.7	Stop frequency, auxiliary drive 3	Par. 2.1.1	Par. 2.9.6	Hz	10,00		1007	
P2.9.8	Start frequency, auxiliary drive 4	Par. 2.9.9	320,00	Hz	51,00		1008	
P2.9.9	Stop frequency, auxiliary drive 4	Par. 2.1.1	Par. 2.9.8	Hz	10,00		1009	
P2.9.10	Start delay, auxiliary drives	0,0	300,0	s	4,0		1010	
P2.9.11	Stop delay, auxiliary drives	0,0	300,0	s	2,0		1011	
P2.9.12	Reference step, auxiliary drive 1	0,0	100,0	%	0,0		1012	
P2.9.13	Reference step, auxiliary drive 2	0,0	100,0	%	0,0		1013	
P2.9.14	Reference step, auxiliary drive 3	0,0	100,0	%	0,0		1014	
P2.9.15	Reference step, auxiliary drive 4	0,0	100,0	%	0,0		1015	
P2.9.16	PID controller bypass	0	1		0		1020	**1**=PID contr. bypassed
P2.9.17	Analogue input selection for input pressure measurement	0	5		0		1021	**0**=Not used **1**=AI1 **2**=AI2 **3**=AI3 **4**=AI4 **5**=Fieldbus signal (FBProcessDataIN3)
P2.9.18	Input pressure high limit	0,0	100,0	%	30,00		1022	
P2.9.19	Input pressure low limit	0,0	100,0	%	20,00		1023	
P2.9.20	Output pressure drop	0,0	100,0	%	30,00		1024	
P2.9.21	Frequency drop delay	0,0	300,0	s	0,0		1025	**0**=No delay **300**=No frequency drop nor increase
P2.9.22	Frequency increase delay	0,0	300,0	s	0,0		1026	**0**=No delay **300**=No frequency drop nor increase
P2.9.23	Interlock selection	0	2		1		1032	**0**=Interlocks not used **1**=Set new interlock last; update order after value of par. 2.9.26 or Stop state **2**=Stop and update order immediately
P2.9.24	Autochange	0	1		1		1027	**0**=Not used **1**=Autochange used
P2.9.25	Autoch. and interl. automatics selection	0	1		1		1028	**0**=Auxiliary drives only **1**=All drives

P2.9.26	Autochange interval	0,0	3000,0	h	48,0		1029	**0,0**=TEST=40 s
P2.9.27	Autochange; Maximum number of auxiliary drives	0	4		1		1030	
P2.9.28	Autochange frequency limit	0,00	par. 2.1.2	Hz	25,00		1031	
P2.9.29	Actual value special display minimum	0	30000		0		1033	
P2.9.30	Actual value special display maximum	0	30000		100		1034	
P2.9.31	Actual value special display decimals	0	4		1		1035	
P2.9.32	Actual value special display unit	0	28		4		1036	See page 200.

Table 7-20. Pump and fan control parameters

7.5.11 Keypad control (Control keypad: Menu M3)

The parameters for the selection of control place and direction on the keypad are listed below. See the Keypad control menu in the product's user's manual.

Code	Parameter	Min	Max	Unit	Default	Cust	ID	Note
P3.1	Control place	1	3		1		125	**1**=I/O terminal **2**=Keypad **3**=Fieldbus
R3.2	Keypad reference	Par. 2.1.1	Par. 2.1.2	Hz				
P3.3	Direction (on keypad)	0	1		0		123	**0**=Forward **1**=Reverse
R3.4	PID reference 1	0,00	100,00	%	0,00			
R3.5	PID reference 2	0,00	100,00	%	0,00			
R3.6	Stop button	0	1		1		114	**0**=Limited function of Stop button **1**=Stop button always enabled

Table 7-21. Keypad control parameters, M3

7.5.12 System menu (Control keypad: M6)

For parameters and functions related to the general use of the frequency drive, such as application and language selection, customised parameter sets or information about the hardware and software, see the product's user's manual.

7.5.13 Expander boards (Control keypad: Menu M7)

The **M7** menu shows the expander and option boards attached to the control board and board-related information. For more information, see the product's user's manual.

8. DESCRIPTION OF PARAMETERS

On the following pages you will find the parameter descriptions arranged according to the individual ID number of the parameter. A shaded parameter ID number (e.g. ***418 Motor potentiometer UP***) indicates that the *TTF programming method* shall be applied to this parameter (see chapter 6.4). Some parameter names are followed by a number code indicating the "All in One" applications in which the parameter is included. If **no code** is shown the parameter is available in **all applications**. See below. The parameter numbers under which the parameter appears in different applications are also given.

1 *Basic Application*
2 *Standard Application*
3 *Local/Remote Control Application*
4 *Multi-Step Speed Control Application*
5 *PID Control Application*
6 *Multi-Purpose Control Application*
7 *Pump and Fan Control Application*

101 ***Minimum frequency*** *(2.1, 2.1.1)*
102 ***Maximum frequency*** *(2.2, 2.1.2)*

Defines the frequency limits of the frequency drive.
The maximum value for these parameters is 320 Hz.
The software will automatically check the values of parameters ID105, ID106 and ID728.

103 ***Acceleration time 1*** *(2.3, 2.1.3)*
104 ***Deceleration time 1*** *(2.4, 2.1.4)*

These limits correspond to the time required for the output frequency to accelerate from the zero frequency to the set maximum frequency (par. ID102).

105 ***Preset speed 1*** ***1246*** *(2.18, 2.1.14, 2.1.15)*
106 ***Preset speed 2*** ***1246*** *(2.19, 2.1.15, 2.1.16)*

Parameter values are automatically limited between the minimum and maximum frequencies (par. ID101, ID102).
Note the use of TTF-programming method in the Multi-purpose Control Application. See parameters ID419, ID420 and ID421.

Speed	Multi-step speed sel. 1 (DIN4)	Multi-step speed sel. 2 (DIN5)
Basic speed	0	0
ID105	1	0
ID106	0	1

Table 8-1. Preset speed

107 ***Current limit*** *(2.5, 2.1.5)*

This parameter determines the maximum motor current from the frequency drive. The parameter value range differs from size to size. When this parameter is changed the stall current limit (ID710) is internally calculated to 90% of current limit.

108 U/f ration selection 234567 *(2.6.3)*

Linear: **0** The voltage of the motor changes linearly with the frequency in the constant flux area from 0 Hz to the field weakening point where the nominal voltage is supplied to the motor. Linear U/f ration should be used in constant torque applications. **This default setting should be used if there is no special need for another setting**.

Squared: **1** The voltage of the motor changes following a squared curve form with the frequency in the area from 0 Hz to the field weakening point where the nominal voltage is also supplied to the motor. The motor runs undermagnetised below the field weakening point and produces less torque and electromechanical noise. Squared U/f ratio can be used in applications where torque demand of the load is proportional to the square of the speed, e.g. in centrifugal fans and pumps.

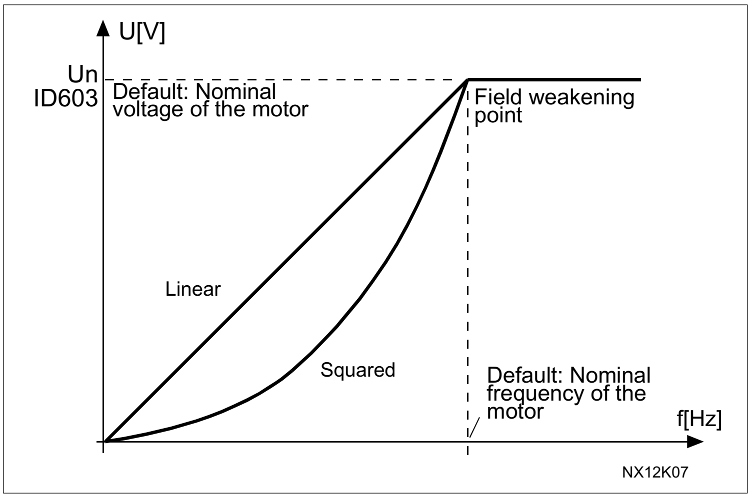


Figure 8-1. Linear and squared change of motor voltage

Programmable U/f curve:

2 The U/f curve can be programmed with three different points. Programmable U/f curve can be used if the other settings do not satisfy the needs of the application.

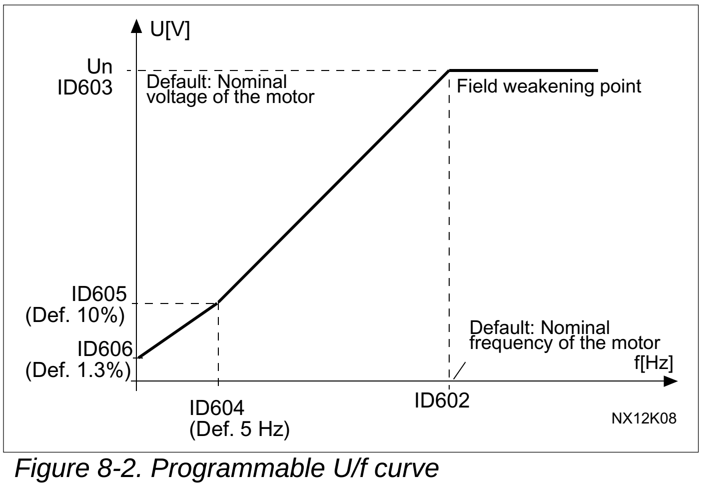


Figure 8-2. Programmable U/f curve

Linear with flux optimisation:

3 The frequency drive starts to search for the minimum motor current in order to save energy, lower the disturbance level and the noise. This function can be used in applications with constant motor load, such as fans, pumps etc.

109 U/f optimisation *(2.13, 2.6.2)*

Automatic torque boost The voltage to the motor changes automatically which makes the motor produce sufficient torque to start and run at low frequencies. The voltage increase depends on the motor type and power. Automatic torque boost can be used in applications where starting torque due to starting friction is high, e.g. in conveyors.

EXAMPLE:

What changes are required to start with load from 0 Hz?

- First set the motor nominal values (Parameter group 2.1).

Option 1: Activate the Automatic torque boost.

Option 2: Programmable U/f curve
To get torque you need to set the zero point voltage and midpoint voltage/frequency (in parameter group 2.6) so that the motor takes enough current at low frequencies.
First set par. ID108 to *Programmable U/f curve* (value **2**). Increase zero point voltage (ID606) to get enough current at zero speed. Set then the midpoint voltage (ID605) to 1.4142*ID606 and midpoint frequency (ID604) to value ID606/100%*ID111.

NOTE! In high torque – low speed applications – it is likely that the motor will overheat. If the motor has to run a prolonged time under these conditions, special attention must be paid to cooling the motor. Use external cooling for the motor if the temperature tends to rise too high.

110 Nominal voltage of the motor *(2.6, 2.1.6)*

Find this value U_n on the rating plate of the motor. This parameter sets the voltage at the field weakening point (ID603) to 100% * U_{nMotor}. Note also used connection Delta/Star.

111 Nominal frequency of the motor *(2.7, 2.1.7)*

Find this value f_n on the rating plate of the motor. This parameter sets the field weakening point (ID602) to the same value.

112 Nominal speed of the motor *(2.8, 2.1.8)*

Find this value n_n on the rating plate of the motor.

113 Nominal current of the motor *(2.9, 2.1.9)*

Find this value I_n on the rating plate of the motor.

117 I/O frequency reference selection ***12346*** *(2.14, 2.1.11)*

Defines which frequency reference source is selected when controlled from the I/O control place.

Applic. / Sel.	1 to 4	6
0	Analogue volt.ref. Terminals 2-3	Analogue volt. ref. Terminals 2-3
1	Analogue curr.ref. Terminals 4-5	Analogue curr.ref. Terminals 4-5
2	Keypad reference (Menu M3)	AI1+AI2
3	Fieldbus reference	AI1–AI2
4		AI2–AI1
5		AI1*AI2
6		AI1 joystick
7		AI2 joystick
8		Keypad reference (Menu M3)
9		Fieldbus reference
10		Potentiometer reference; controlled with DIN5 (TRUE=increase) and DIN6 (TRUE=decrease)
11		AI1 or AI2, whichever is lower
12		AI1 or AI2, whichever is greater
13		Max. frequency (recommended in torque control only)
14		AI1/AI2 selection
15		Encoder 1
16		Encoder 2 (With OPT-A7 Speed Synchronization, NXP only)

Table 8-2. Selections for parameter ID117

118 PID controller gain ***57*** *(2.1.12)*

This parameter defines the gain of the PID controller. If the value of the paramter is set to 100% a change of 10% in the error value causes the controller output to change by 10%. If the parameter value is set to **0** the PID controller operates as ID-controller.
See examples on page 127.

119 PID controller I-time ***57*** *(2.1.13)*

The parameter ID119 defines the integration time of the PID controller. If this parameter is set to 1,00 second a change of 10% in the error value causes the controller output to change by 10.00%/s. If the parameter value is set to 0.00 s the PID controller will operate as PD controller.
See examples on page 127.

120 Motor cos phi *(2.10, 2.1.10)*

Find this value “cos phi” on the rating plate of the motor.

121 ***Keypad frequency reference selection*** ***234567*** *(2.1.12, 2.1.13, 2.2.6, 2.2.1.2)*

Defines which frequency reference source is selected when controlled from the keypad.

Applic. Sel.	2–4	5	6	7
0	Analogue volt.ref. Terminals 2–3	Analogue volt.ref. Terminals 2–3	Analogue volt.ref. Terminals 2–3	Analogue volt.ref. Terminals 2–3
1	Analogue curr.ref. Terminals 4–5	Analogue curr.ref. Terminals 4–5	Analogue curr.ref. Terminals 4–5	Analogue curr.ref. Terminals 4–5
2	Keypad reference (Menu M3)	AI3	AI1+AI2	AI3
3	Fieldbus reference*	AI4	AI1–AI2	AI4
4		Keypad reference (Menu M3)	AI2–AI1	Keypad reference (Menu M3)
5		Fieldbus reference*	AI1*AI2	Fieldbus reference*
6		Potentiometer ref.	AI1 joystick	Potentiometer ref.
7		PID controller ref.	AI2 joystick	PID controller ref.
8			Keypad reference (Menu M3)	
9			Fieldbus reference*	

Table 8-3. Selections for parameter ID121

*FBSpeedReference

122 ***Fieldbus frequency reference selection*** ***234567*** *(2.1.13, 2.1.14, 2.2.7, 2.2.1.3)*

Defines which frequency reference source is selected when controlled from the fieldbus. For selections in different applications, see ID121.

124 ***Jogging speed reference*** ***34567*** *(2.1.14, 2.1.15, 2.1.19)*

Defines the jogging speed selected with the DIN3 digital input which can be programmed for Jogging speed. See parameter ID301.

Parameter value is automatically limited between minimum and maximum frequency (ID's 101 and 102).

126 ***Preset speed 3*** ***46*** *(2.1.17)*
127 ***Preset speed 4*** ***46*** *(2.1.18)*
128 ***Preset speed 5*** ***46*** *(2.1.19)*
129 ***Preset speed 6*** ***46*** *(2.1.20)*
130 ***Preset speed 7*** ***46*** *(2.1.21)*

Parameter values define the Multi-step speeds selected with the DIN3, DIN4, DIN5 and DIN6 digital inputs. See also parameter ID’s 105 and 106.

Parameter value is automatically limited between minimum and maximum frequency (ID's 101 and 102).

Speed	Multi-step speed sel. 1 (DIN4)	Multi-step speed sel. 2 (DIN5)	Multi-step speed sel. 3 (DIN6)	Multi-step speed sel. 4 (DIN3)
Basic speed	0	0	0	0
P2.1.17 (3)	1	1	0	0
P2.1.18 (4)	0	0	1	0
P2.1.19 (5)	1	0	1	0
P2.1.20 (6)	0	1	1	0
P2.1.21 (7)	1	1	1	0

Table 8-4. Preset speeds 3 to 7

131 I/O frequency reference selection, place B 3 *(2.1.12)*

See the values of the parameter ID117 above.

132 PID controller D-time 57 *(2.1.14)*

The parameter ID132 defines the derivation time of the PID controller. If this parameter is set to 1,00 second a change of 10% in the error value during 1.00 s causes the controller output to change by 10.00%. If the parameter value is set to 0.00 s the PID controller will operate as PI controller.
See examples below.

Example 1:
In order to reduce the error value to zero, with the given values, the frequency drive output behaves as follows:

Given values:
Par. 2.1.12, P = 0%
Par. 2.1.13, I-time = 1.00 s
Par. 2.1.14, D-time = 0.00 s Min freq. = 0 Hz
Error value (setpoint – process value) = 10.00% Max freq. = 50 Hz

In this example, the PID controller operates practically as I-controller only.
According to the given value of parameter 2.1.13 (I-time), the PID output increases by 5 Hz (10% of the difference between the maximum and minimum frequency) every second until the error value is 0.

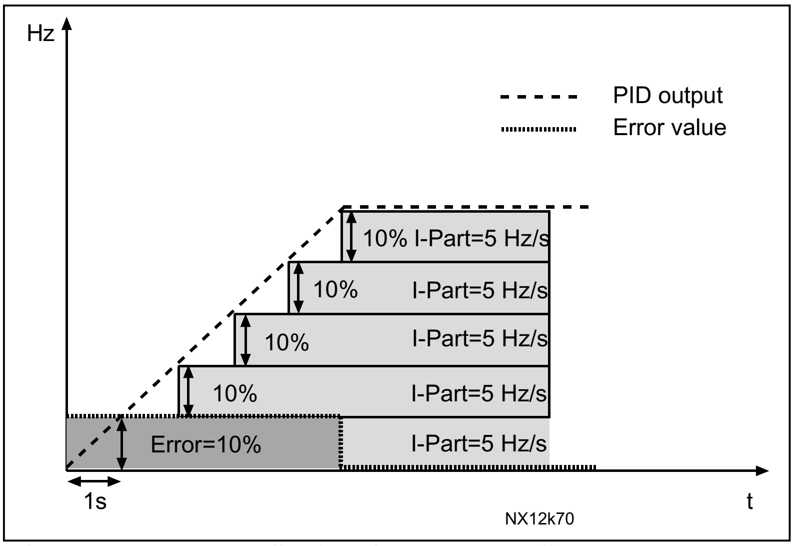


Figure 8-3. PID controller function as I-controller.

Example 2:
Given values:

Par. 2.1.12, P = 100%
Par. 2.1.13, I-time = 1.00 s
Par. 2.1.14, D-time = 1.00 s   Min freq. = 0 Hz
Error value (setpoint – process value) = ±10%   Max freq. = 50 Hz

As the power is switched on, the system detects the difference between the setpoint and the actual process value and starts to either raise or decrease (in case the error value is negative) the PID output according to the I-time. Once the difference between the set-point and the process value has been reduced to 0 the output is reduced by the amount corresponding to the value of parameter 2.1.13.
In case the error value is negative, the frequency drive reacts reducing the output correspondingly. See Figure 8-4.

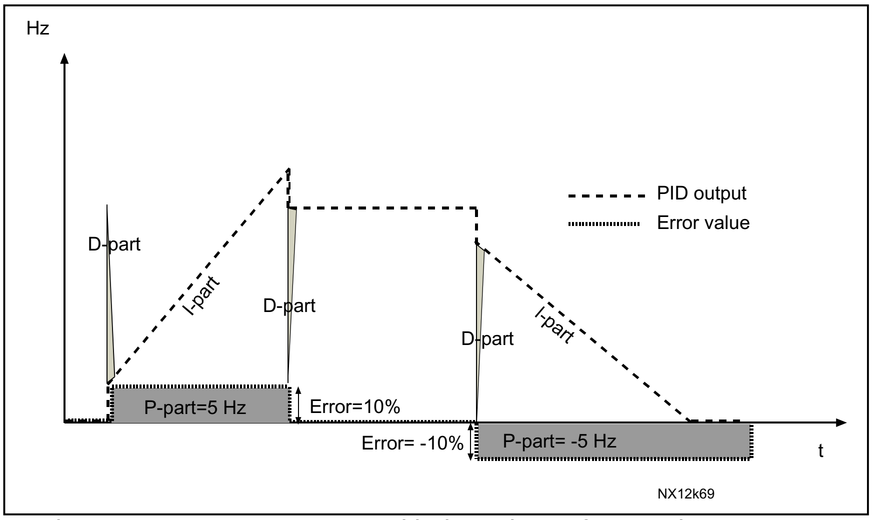


Figure 8-4. PID output curve with the values of Example 2.

Example 3:
Given values:

Par. 2.1.12, P = 100%
Par. 2.1.13, I-time = 0.00 s
Par. 2.1.14, D-time = 1.00 s Min freq. = 0 Hz
Error value (setpoint – process value) = ±10%/s Max freq. = 50 Hz

As the error value increases, also the PID output increases according to the set values (D-time = 1.00s)

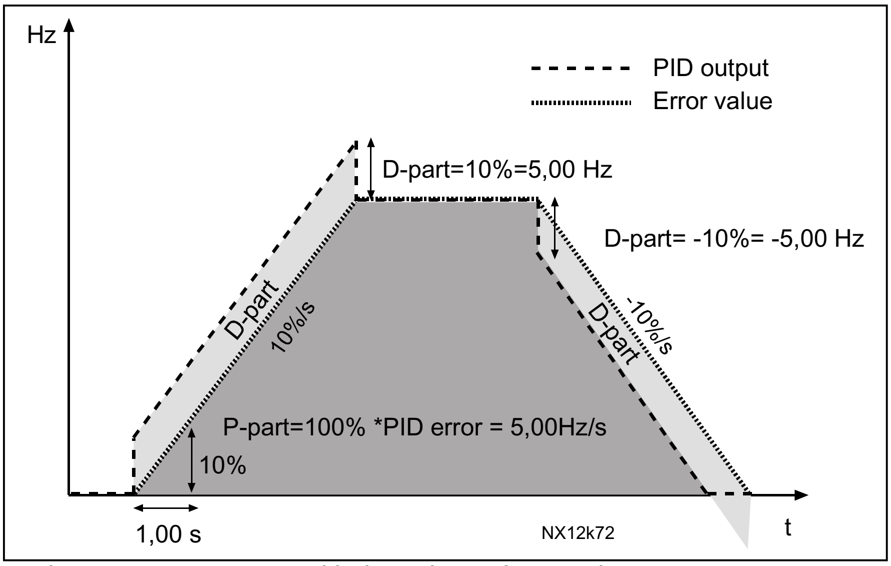


Figure 8-5. PID output with the values of Example 3.

133 Preset speed 8 4 *(2.1.22)*
134 Preset speed 9 4 *(2.1.23)*
135 Preset speed 10 4 *(2.1.24)*
136 Preset speed 11 4 *(2.1.25)*
137 Preset speed 12 4 *(2.1.26)*
138 Preset speed 13 4 *(2.1.27)*
139 Preset speed 14 4 *(2.1.28)*
140 Preset speed 15 4 *(2.1.29)*

Speed	Multi-step speed sel. 1 (DIN4)	Multi-step speed sel. 2 (DIN5)	Multi-step speed sel. 3 (DIN6)	Multi-step speed sel. 4 (DIN3)
P2.1.22 (8)	0	0	0	1
P2.1.23 (9)	1	0	0	1
P2.1.24 (10)	0	1	0	1
P2.1.25 (11)	1	1	0	1
P2.1.26 (12)	0	0	1	1
P2.1.27 (13)	1	0	1	1
P2.1.28 (14)	0	1	1	1
P2.1.29 (15)	1	1	1	1

Table 8-5. Multi-step speed selections with digital inputs DIN3, DIN4, DIN5 and DIN6

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63-2600-1

141 ***AI3 signal selection*** ***567*** *(2.2.38, 2.2.4.1)*

Connect the AI3 signal to the analogue input of your choice with this parameter. For more information, see Chapter 6.4 “Terminal To Function” (TTF) programming principle.

142 ***AI3 signal filter time*** ***567*** *(2.2.41, 2.2.4.2)*

When this parameter is given a value greater than 0 the function that filters out disturbances from the incoming analogue signal is activated.
Long filtering time makes the regulation response slower. See parameter ID324.

143 ***AI3 signal range*** ***567*** *(2.2.39, 2.2.4.3)*

With this parameter you can select the AI3 signal range.

Applic. / Sel.	5	6	7
0	0…100%	0…100%	0…100%
1	20…100%	20…100%	20…100%
2		–10…+10V	Customised
3		Customised	

Table 8-6. Selections for parameter ID143

144 ***AI3 custom setting minimum*** ***67*** *(2.2.4.4)*
145 ***AI3 custom setting maximum*** ***67*** *(2.2.4.5)*

Set the custom minimum and maximum levels for the AI3 signal within -160…160%.

151 ***AI3 signal inversion*** ***567*** *(2.2.40, 2.2.4.6)*

0 = No inversion
1 = Signal inverted

152 ***AI4 signal selection*** ***567*** *(2.2.42, 2.2.5.1)*

See ID141.

153 ***AI4 filter time*** ***567*** *(2.2.45, 2.2.5.2)*

See ID142.

154 ***AI4 signal range*** ***567*** *(2.2.43, 2.2.5.3)*

See ID143.

155 ***AI4 custom setting minimum*** ***67*** *(2.2.5.3, 2.2.5.4)*
156 ***AI4 custom setting maximum*** ***67*** *(2.2.5.4, 2.2.5.5)*

See ID’s 144 and 145.

162 ***AI4 signal inversion*** ***567*** *(2.2.44, 2.2.5.5, 2.2.5.6)*

See ID151.

164 ***Motor control mode 1/2*** ***6*** *(2.2.7.22)*

Contact is open = Motor control mode 1 is selected
Contact is closed = Motor control mode 2 is selected
See parameter ID's 600 and 521.

165 ***AI1 joystick offset*** ***6*** *(2.2.2.11)*

Define the frequency zero point as follows: With this parameter on display, place the potentiometer at the assumed zero point and press *Enter* on the keypad. **Note:** This will not, however, change the reference scaling.
Press *Reset* button to change the parameter value back to 0,00%.

166 ***AI2 joystick offset*** ***6*** *(2.2.3.11)*

See par. ID165.

169 ***Fieldbus input data 4 (FBFixedControlWord, bit 6)*** ***6*** *(2.3.3.27)*
170 ***Fieldbus input data 5 (FBFixedControlWord, bit 7)*** ***6*** *(2.3.3.28)*

The data from the fieldbus (FBFixedControlWord) can be led to the digital outputs of the frequency drive.

179 ***Scaling of motoring power limit*** ***6*** *(2.2.6.7)*

The motoring power limit is equal to ID1289 if value 'Not used' is selected. If any of the inputs is selected the motoring power limit is scaled between zero and parameter ID1289. This parameter is available for NXP drives only.

0 = Not used
1 = AI1
2 = AI2
3 = AI3
4 = AI4
5 = FB Limit Scaling ID46 (monitoring value)

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300 ***Start/Stop logic selection*** ***2346*** *(2.2.1, 2.2.1.1)*

0 DIN1: closed contact = start forward
DIN2: closed contact = start reverse

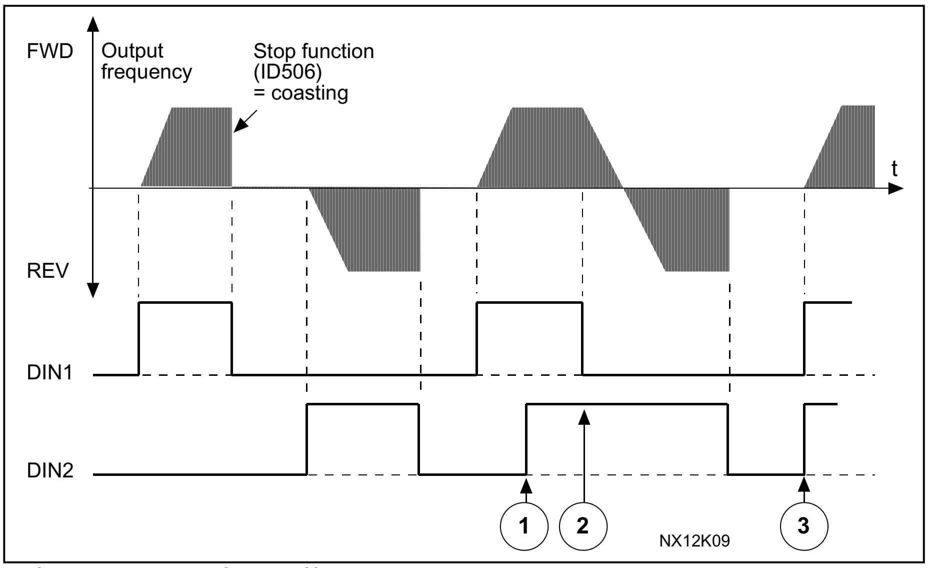


Figure 8-6. Start forward/Start reverse

① The first selected direction has the highest priority.

② When the DIN1 contact opens the direction of rotation starts the change.

③ If Start forward (DIN1) and Start reverse (DIN2) signals are active simultaneously the Start forward signal (DIN1) has priority.

1 DIN1: closed contact = start open contact = stop
DIN2: closed contact = reverse open contact = forward
See below.

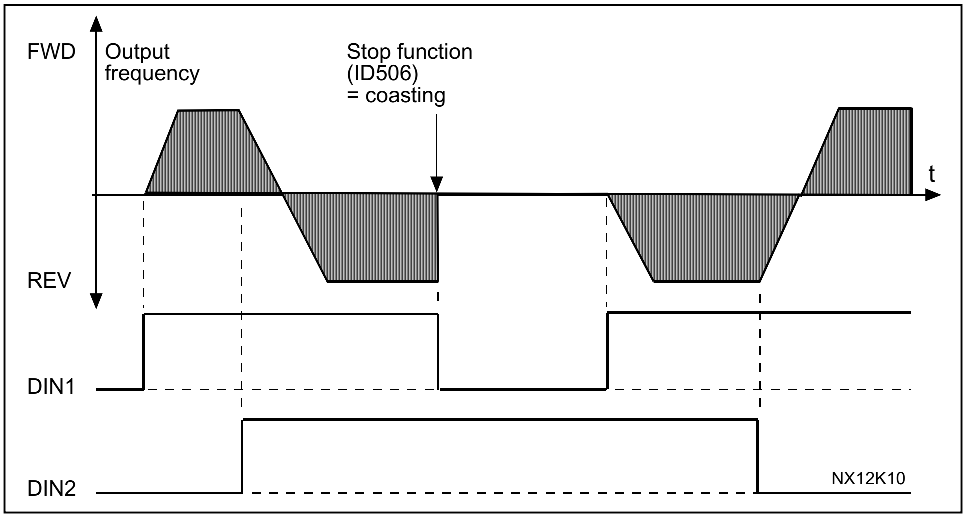


Figure 8-7. Start, Stop, Reverse

2 DIN1: closed contact = start open contact = stop
DIN2: closed contact = start enabled open contact = start disabled and drive stopped if running
(DIN3 can be programmed for reverse command)

3 3-wire connection (pulse control):
DIN1: closed contact = start pulse
DIN2: open contact = stop pulse
(DIN3 can be programmed for reverse command)
See Figure 8-8.

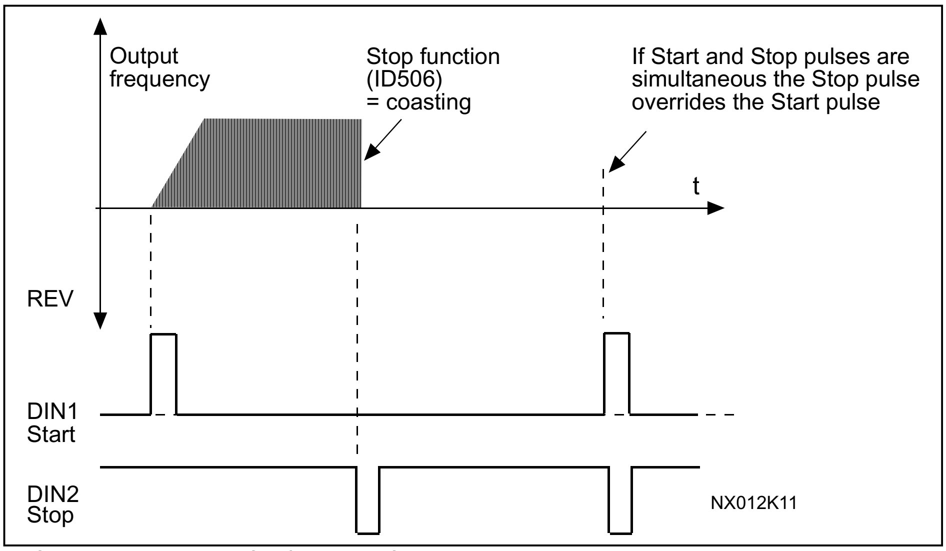


Figure 8-8. Start pulse/ Stop pulse.

The selections including the text **'Rising edge required to start'** shall be used to exclude the possibility of an unintentional start when, for example, power is connected, re-connected after a power failure, after a fault reset, after the drive is stopped by Run Enable (Run Enable = False) or when the control place is changed. The Start/Stop contact must be opened before the motor can be started.

Applications 2 and 4:

4 DIN1: closed contact = start forward **(Rising edge required to start)**
DIN2: closed contact = start reverse **(Rising edge required to start)**

5 DIN1: closed contact = start **(Rising edge required to start)**
open contact = stop
DIN2: closed contact = reverse
open contact = forward

6 DIN1: closed contact = start **(Rising edge required to start)**
open contact = stop
DIN2: closed contact = start enabled
open contact = start disabled and drive stopped if running
(DIN3 can be programmed for reverse command)

Application 3 and 6:

4 DIN1: closed contact = start forward
DIN2: closed contact = reference increases (motor potentiometer reference; this parameter is automatically set to 4 if par. ID117 is set to 3 or 4).

5 DIN1: closed contact = start forward **(Rising edge required to start)**
DIN2: closed contact = start reverse **(Rising edge required to start)**

6 DIN1: closed contact = start **(Rising edge required to start)**
open contact = stop
DIN2: closed contact = reverse
open contact = forward

7 DIN1: closed contact = start **(Rising edge required to start)**
open contact = stop
DIN2: closed contact = start enabled
open contact = start disabled and drive stopped if running

Application 3:

8 DIN1: closed contact = start forward **(Rising edge required to start)**
DIN2: closed contact = reference increases (motor potentiometer reference; this parameter is automatically set to 4 if par. ID117 is set to 3 or 4).

301 DIN3 function 12345 *(2.17, 2.2.2)*

0 Not used
1 External fault, closing contact = Fault is shown and motor is stopped when the input is active.
2 External fault, opening contact = Fault is shown and motor is stopped when the input is not active.
3 Run enable, contact open = Motor start disabled and the motor is stopped
contact closed = Motor start enabled

Application 1:
4 Run enable contact open = Motor start enabled
contact closed = Motor start disabled and the motor is stopped
Applications 2 to 5:
4 Acc./Dec time select. contact open = Acceleration/deceleration time 1 selected
contact closed = Acceleration/deceleration time 2 selected

5 Closing contact: Force control place to I/O terminal
6 Closing contact: Force control place to keypad
7 Closing contact: Force control place to fieldbus
When the control place is forced to change the values of Start/Stop, Direction and Reference valid in the respective control place are used (reference according to parameters ID117, ID121 and ID122).
Note: The value of parameter ID125 Keypad Control Place does not change.
When DIN3 opens the control place is selected according to parameter 3.1.

Applications 2 to 5:
8 Reverse contact open = Forward
contact closed = Reverse

Can be used for reversing if start signal 2 is used for other functions

Applications 3 to 5:
9 Jogging sp. contact closed = Jogging speed selected for frequency reference
10 Fault reset contact closed = Resets all faults
11 Acc./dec. operation prohibited
contact closed = Stops acceleration or deceleration until the contact is opened
12 DC-braking command
contact closed = In Stop mode, the DC-braking operates until the contact is opened, see Figure 8-9

Applications 3 and 5:
13 Motor potentiometer down contact closed = Reference decreases until the contact is opened

Application 4:
13 Preset speed

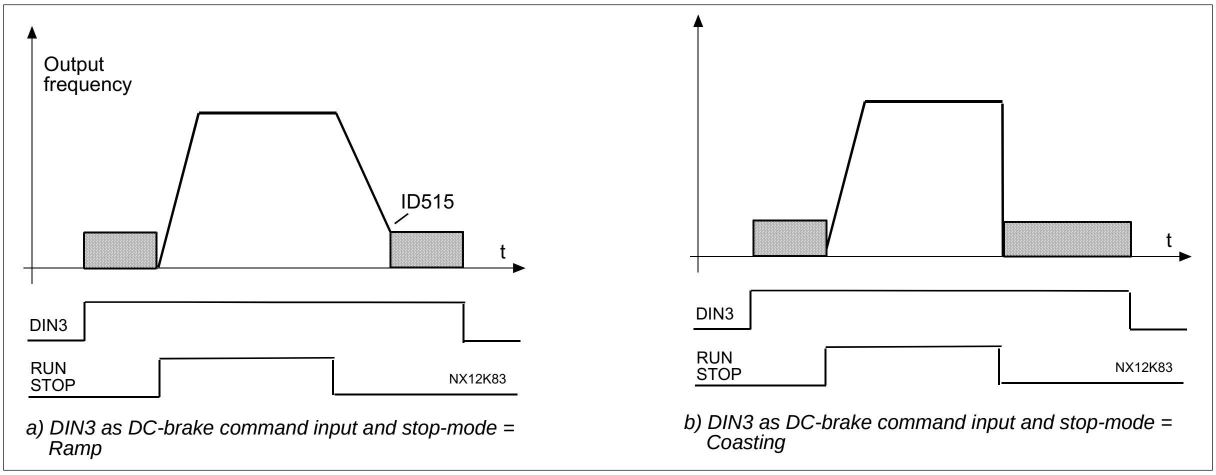


Figure 8-9. DIN3 as DC-brake command input: a) Stop mode = Ramp, b) Stop mode = coasting

302 Reference offset for current input ***12*** *(2.15, 2.2.3)*

0 No offset: 0—20mA
1 Offset 4 mA ("living zero"), provides supervision of zero level signal. In Standard Application, the response to reference fault can be programmed with parameter ID700.

303 Reference scaling, minimum value ***2346*** *(2.2.4, 2.2.16, 2.2.2.6)*
304 Reference scaling, maximum value ***2346*** *(2.2.5, 2.2.17, 2.2.2.7)*

Setting value limits: 0 ≤ par. ID303 ≤ par. ID304 ≤ par. ID102. If both parameter ID303 and parameter ID394 = 0 scaling is set off. The minimum and maximum frequencies are used for scaling.

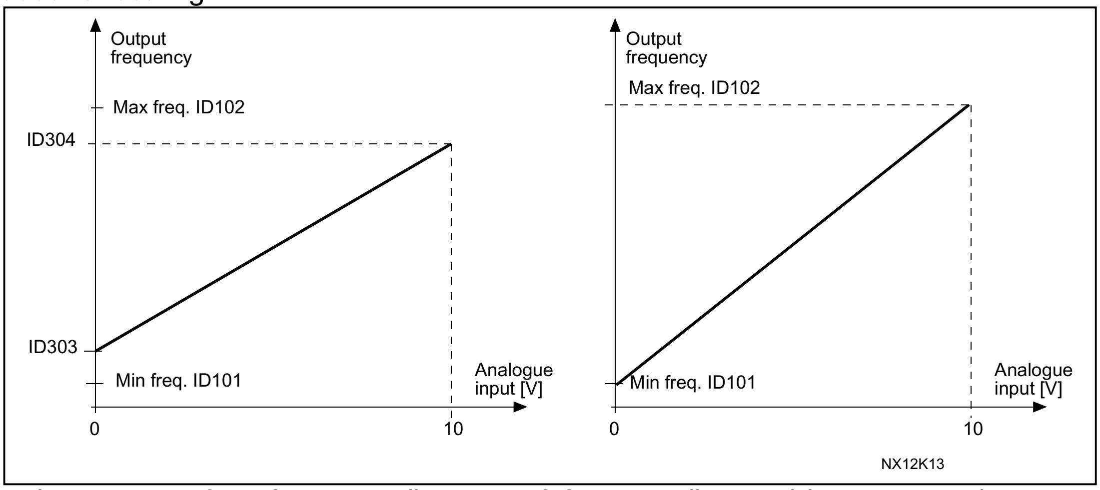


*Figure 8-10. **Left**: Reference scaling;* ***Right**: No scaling used (par. ID303 = 0).*

305 Reference inversion 2 (2.2.6)

Inverts reference signal:
Max. ref. signal = Min. set freq.
Min. ref. signal = Max. set freq.

0 No inversion
1 Reference inverted

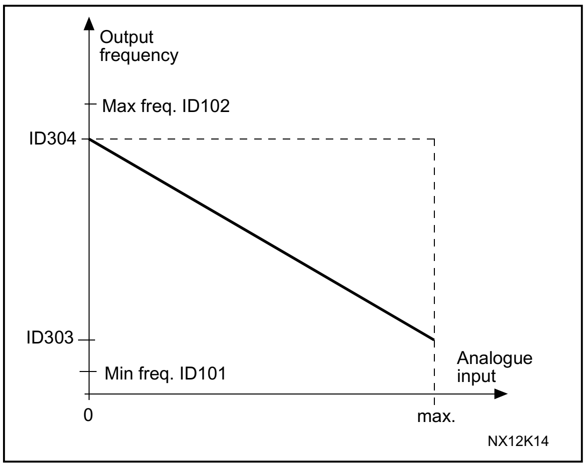


Figure 8-11. Reference invert.

306 Reference filter time 2 (2.2.7)

Filters out disturbances from the incoming analogue U_{in} signal. Long filtering time makes regulation response slower.

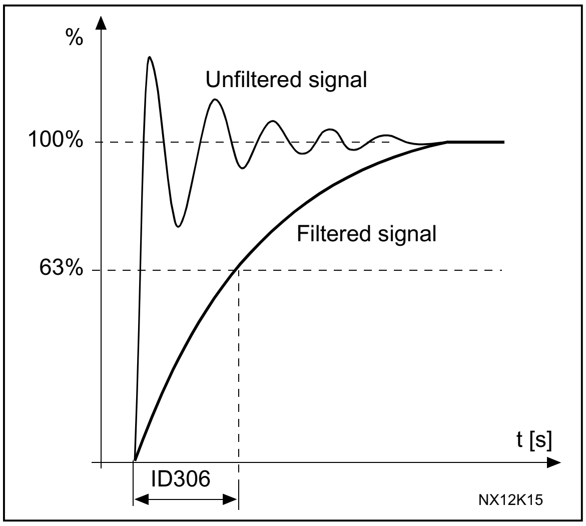


Figure 8-12. Reference filtering

307 Analogue output function *(2.16, 2.3.2, 2.3.5.2, 2.3.3.2)*

This parameter selects the desired function for the analogue output signal.
See pages 9, 17, 29, 42, 56, 81 and 114 for the parameter values available in the respective application.

308 Analogue output filter time ***234567*** *(2.3.3, 2.3.5.3, 2.3.3.3)*

Defines the filtering time of the analogue output signal.
Setting this parameter value **0** will deactivate filtering.

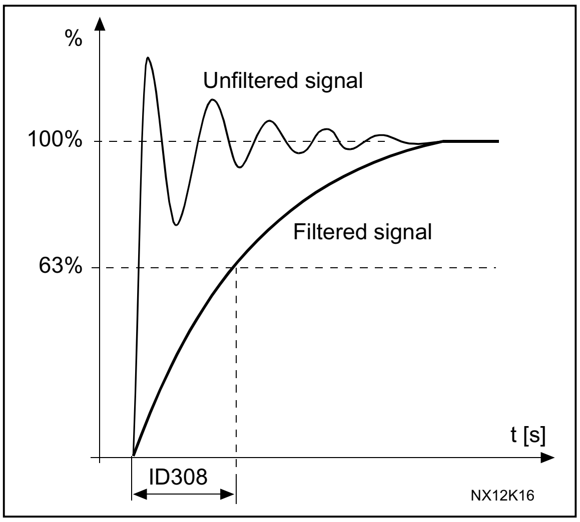


Figure 8-13. Analogue output filtering

309 Analogue output inversion ***234567*** *(2.3.4, 2.3.5.4, 2.3.3.4)*

Inverts the analogue output signal:

Maximum output signal = Minimum set value
Minimum output signal = Maximum set value

See parameter ID311 below.

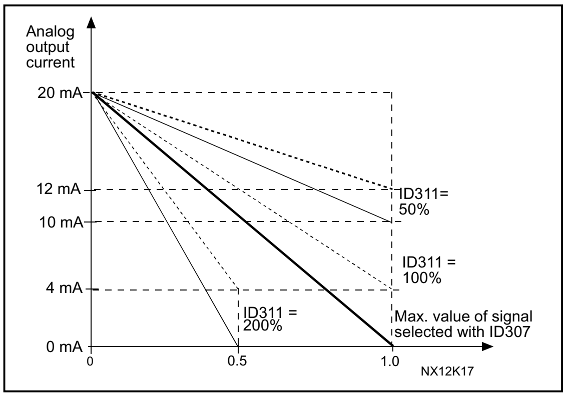


Figure 8-14. Analogue output invert

310 Analogue output minimum ***234567*** *(2.3.5, 2.3.5.5, 2.3.3.5)*

Defines the signal minimum to either 0 mA or 4 mA (living zero). Note the difference in analogue output scaling in parameter ID311 (Figure 8-15).

0 Set minimum value to 0 mA
1 Set minimum value to 4 mA

311 Analogue output scale 234567 (2.3.6, 2.3.5.6, 2.3.3.6)

Scaling factor for analogue output.

Signal	Max. value of the signal
Output frequency	Max frequency (par.ID102)
Freq. Reference	Max frequency (par.ID102)
Motor speed	Motor nom. speed $1xn_{mMotor}$
Output current	Motor nom. current $1xI_{nMotor}$
Motor torque	Motor nom. torque $1xT_{nMotor}$
Motor power	Motor nom. power $1xP_{nMotor}$
Motor voltage	100% x U_{nmotor}
DC-link voltage	1000 V
PI-ref. value	100% x ref. value max.
PI act. value 1	100% x actual value max.
PI act. value 2	100% x actual value max.
PI error value	100% x error value max.
PI output	100% x output max.

Table 8-7. Analogue output scaling

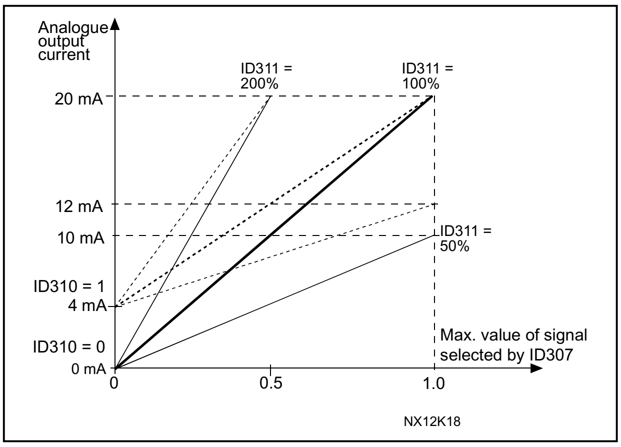


Figure 8-15. Analogue output scaling

312 Digital output function 23456 (2.3.7, 2.3.1.2)
313 Relay output 1 function 2345 (2.3.8, 2.3.1.3)
314 Relay output 2 function 2345 (2.3.9)

Setting value	**Signal content**
0 = Not used	Out of operation
	<u>Digital output DO1 sinks the current and programmable relay (RO1, RO2) is activated when:</u>
1 = Ready	The frequency drive is ready to operate
2 = Run	The frequency drive operates (motor is running)
3 = Fault	A fault trip has occurred
4 = Fault inverted	A fault trip <u>not</u> occurred
5 = NX overheat warning	The heat-sink temperature exceeds +70°C
6 = External fault or warning	Fault or warning depending on par. ID701
7 = Reference fault or warning	Fault or warning depending on par. ID700 - if analogue reference is 4—20 mA and signal is <4mA
8 = Warning	Always if a warning exists
9 = Reversed	The reverse command has been selected
10 = Preset speed 1 (Applications 2) 10 = Jogging speed (Applications 3456)	The preset speed has been selected with digital input The jogging speed has been selected with digital input
11 = At speed	The output frequency has reached the set reference
12 = Motor regulator activated	Overvoltage or overcurrent regulator was activated
13 = Output frequency limit supervision	The output frequency goes outside the set supervision low limit/high limit (see parameter ID's 315 and 316 below)
14 = Control from I/O terminals (Appl. 2) 14 = Output freq.limit 2 supervision (Applications 3456)	I/O control mode selected (in menu M3) The output frequency goes outside the set supervision low limit/high limit (see parameter ID's 346 and 347 below)

15 = Thermistor fault or warning (Appl.2) 15 = Torque limit supervision (Appl.3456)	The thermistor input of option board indicates overtemperature. Fault or warning depending on par ID732. The motor torque goes beyond the set supervision low limit/high limit (par. ID348 and ID349).
16 = Fieldbus input data (Application 2) 16 = Reference limit supervision	Fieldbus input data (FBFixedControlWord) to DO/RO. Active reference goes beyond the set supervision low limit/high limit (par. ID350 and ID351)
17 = External brake control (Appl. 3456)	External brake ON/OFF control with programmable delay (par. ID352 and ID353)
18 = Control from I/O terminals (Appl. 3456)	External control mode (Menu **M3**; ID125)
19 = Frequency drive temperature limit supervision (Appl. 3456)	Frequency drive heatsink temperature goes beyond the set supervision limits (par. ID354 and ID355).
20 = Unrequested rotation direction (Appl. 345) 20 = Reference inverted (Appl. 6)	Rotation direction is different from the requested one.
21 = External brake control inverted (Appl. 3456)	External brake ON/OFF control (par. ID352 and ID353); Output active when brake control is OFF
22 = Thermistor fault or warning (Appl.3456)	The thermistor input of option board indicates overtemperature. Fault or warning depending on parameter ID732.
23 = Fieldbus input data (Application 5) 23 = Analogue input supervision (Application 6)	Fieldbus input data (FBFixedControlWord) to DO/RO. Selects the analogue input to be monitored. See par. ID356, ID357, ID358 and ID463.
24 = Fieldbus input data 1 (Application 6)	Fieldbus data (FBFixedControlWord) to DO/RO
25 = Fieldbus input data 2 (Application 6)	Fieldbus data (FBFixedControlWord) to DO/RO
26 = Fieldbus input data 3 (Application 6)	Fieldbus data (FBFixedControlWord) to DO/RO

Table 8-8. Output signals via DO1 and output relays RO1 and RO2.

315 ***Output frequency limit supervision function 234567*** *(2.3.10, 2.3.4.1, 2.3.2.1)*

0 No supervision
1 Low limit supervision
2 High limit supervision
3 Brake-on control (Application 6 only, see chapter 9.1 on page 210)

If the output frequency goes under/over the set limit (ID316) this function generates a warning message via the digital output DO1 or via the relay output RO1 or RO2 depending on the settings of parameters ID312…ID314.

316 Output frequency limit supervision value 234567 (2.3.11, 2.3.4.2, 2.3.2.2)

Selects the frequency value supervised by parameter ID315. See Figure 8-16.

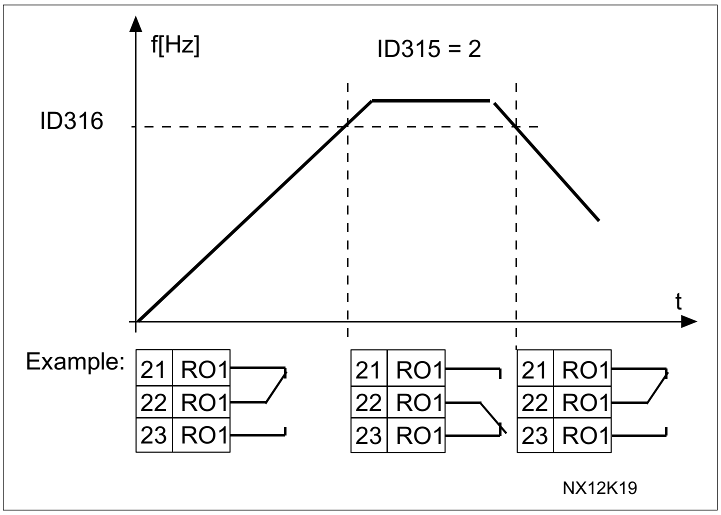


Figure 8-16. Output frequency supervision

319 DIN2 function 5 (2.2.1)

This parameter has 14 selections. If digital input DIN2 need not be used, set the parameter value to **0**.

1 External fault
Contact closed: Fault is displayed and motor stopped when the input is active
2 External fault
Contact open: Fault is displayed and motor stopped when the input is not active
3 Run enable
Contact open: Start of motor disabled
Contact closed: Start of motor enabled
4 Acceleration or deceleration time selection
Contact open: Acceleration/Deceleration time 1 selected
Contact closed: Acceleration/Deceleration time 2 selected
5 Closing contact: Force control place to I/O terminal
6 Closing contact: Force control place to keypad
7 Closing contact: Force control place to fieldbus
When the control place is forced to change the values of Start/Stop, Direction and Reference valid in the respective control place are used (reference according to parameters ID343, ID121 and ID122).
Note: The value of ID125 (Keypad Control Place) does not change.
When DIN2 opens the control place is selected according to keypad control place selection.

8 Reverse
Contact open: Forward
Contact closed: Reverse

> If several inputs are programmed to reverse, one active contact is enough to set the direction to reverse.

9 Jogging speed (see par. ID124)
Contact closed: Jogging speed selected for frequency reference
10 Fault reset
Contact closed: All faults reset

11 Acceleration/Deceleration prohibited
Contact closed: No acceleration or deceleration possible until the contact is opened

12 DC braking command
Contact closed: In Stop mode, the DC braking operates until the contact is opened. See Figure 8-17.

13 Motor potentiometer UP
Contact closed: Reference increases until the contact is opened.

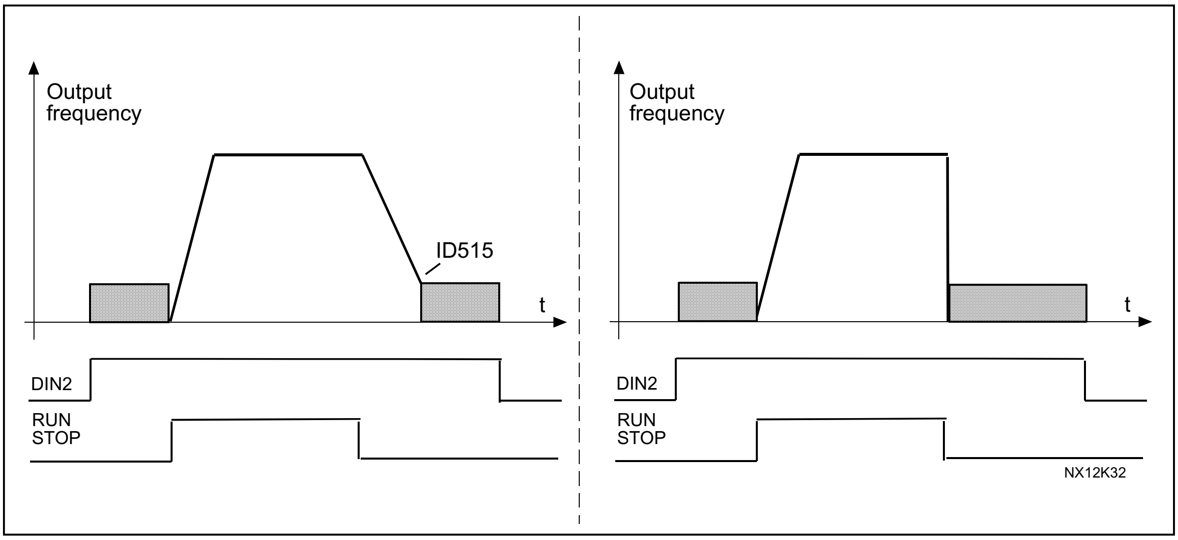


Figure 8-17. DC braking command (selection 12) selected for DIN2.
Left: Stop mode = Ramp; Right: Stop mode = Coasting

320 ***AI1 signal range*** ***34567*** *(2.2.4, 2.2.16, 2.2.2.3)*

Applic. / Sel.	3,4,5	6	7
0	0…100%	0…100%	0…100%
1	20…100%	20…100%	20…100%
2	Customised	–10…+10V	Customised
3		Customised	

Table 8-9. Selections for parameter ID320

For selection 'Customised', see parameters ID321 and ID322.

321 ***AI1 custom setting minimum*** ***34567*** *(2.2.5, 2.2.17, 2.2.2.4)*
322 ***AI1 custom setting maximum*** ***34567*** *(2.2.6, 2.2.18, 2.2.2.5)*

These parameters set the analogue input signal for any input signal span within -160—160%.

323 AI1 signal inversion 3457 (2.2.7, 2.2.19, 2.2.2.6)

If this parameter = **0**, no inversion of analogue U_{in} signal takes place.

Note: In application 3, AI1 is place B frequency reference if parameter ID131= 0 (default).

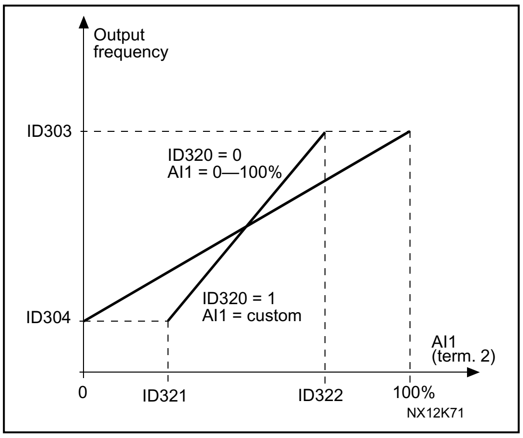


Figure 8-18. AI1 no signal inversion

If this parameter = **1** inversion of analogue signal takes place.
max. AI1 signal = minimum set speed
min. AI1 signal = maximum set speed

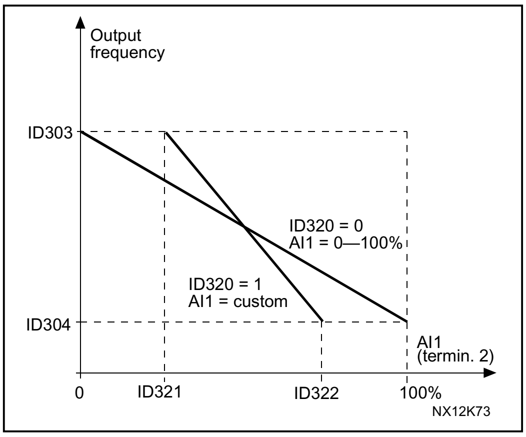


Figure 8-19. AI1 signal inversion

324 AI1 signal filter time 34567 (2.2.8, 2.2.20, 2.2.2.2)

When this parameter is given a value greater than 0 the function that filters out disturbances from the incoming analogue signal is activated.

Long filtering time makes the regulation response slower. See Figure 8-20.

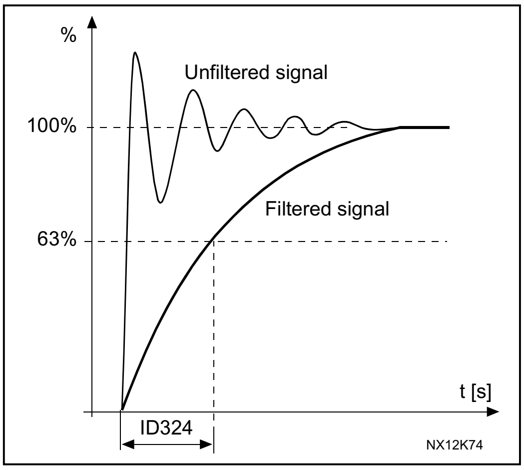


Figure 8-20. AI1 signal filtering

325 *Analogue input AI2 signal range* ***34567*** *(2.2.10, 2.2.22, 2.2.3.3)*

Applic. Sel.	3, 4	5	6	7
0	0…20mA	0…20mA	0…100%	0…100%
1	4…20mA	4mA/20…100%	20…100%	20…100%
2	Customised	Customised	–10…+10V	Customised
3			Customised	

Table 8-10. Selections for parameter ID325

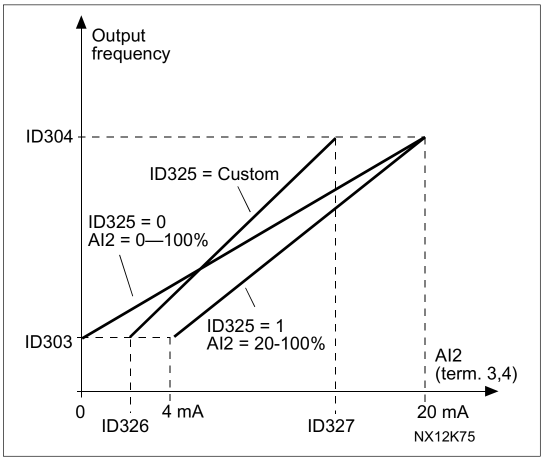


Figure 8-21. Analogue input AI2 scaling.

326 *Analogue input AI2 custom setting min.* ***34567*** *(2.2.11, 2.2.23, 2.2.3.4)*
327 *Analogue input AI2 custom setting max.* ***34567*** *(2.2.12, 2.2.24, 2.2.3.5)*

These parameters set AI2 for any input signal span within -160…160%.

328 *Analogue input AI2 inversion* ***3457*** *(2.2.13, 2.2.25, 2.2.3.6)*

See ID323.
Note: In application 3, AI2 is the place A frequency reference, if parameter ID117 = 1 (default)

329 *Analogue input AI2 (I_{in}) filter time* ***34567*** *(2.2.14, 2.2.26, 2.2.3.2)*

See ID324.

330 *DIN5 function* ***5*** *(2.2.3)*

The digital input DIN5 has 14 possible functions. If it need not be used, set the value of this parameter to **0**.
The selections are the same as in parameter ID319 except:

13 Enable PID reference 2
Contact open: PID controller reference selected with parameter ID332.
Contact closed: PID controller keypad reference 2 selected with parameter R3.5.

331 *Motor potentiometer ramp time* ***3567*** *(2.2.22, 2.2.27, 2.2.1.2, 2.2.1.15)*

Defines the speed of change of the motor potentiometer value (Hz/s).

332 PID controller reference signal (Place A) 57 *(2.1.11)*

Defines which frequency reference place is selected for the PID controller.

Applic. Sel.	5	7
0	AI1; terminals 2-3	AI1; terminals 2-3
1	AI2; terminals 4-5	AI2; terminals 4-5
2	PID ref. from menu M3, par. R34	AI3
3	Fieldbus ref. (FBProcessDataIN1)	AI4
4	Motor potentiometer reference	PID ref. from menu M3, par. R34
5		Fieldbus ref. (FBProcessDataIN1)
6		Motor potentiometer reference

Table 8-11. Selections for parameter ID332

333 PID controller actual value selection 57 *(2.2.8, 2.2.1.8)*

This parameter selects the PID controller actual value.
0 Actual value 1
1 Actual value 1 + Actual value 2
2 Actual value 1 – Actual value 2
3 Actual value 1 * Actual value 2
4 Greater one of Actual value 1 and Actual value 2
5 Smaller one of Actual value 1 and Actual value 2
6 Mean value of Actual value 1 and Actual value 2
7 Square root of Actual value 1 + Square root of Actual value 2

334 Actual value 1 selection 57 *(2.2.9, 2.2.1.9)*
335 Actual value 2 selection 57 *(2.2.10, 2.2.1.10)*

0 Not used
1 AI1 (control board)
2 AI2 (control board)
3 AI3
4 AI4
5 Fieldbus (*Actual value 1*: FBProcessDataIN2; *Actual value 2*: FBProcessDataIN3)
Application 5
6 Motor torque
7 Motor speed
8 Motor current
9 Motor power
10 Encoder frequency (for Actual value 1 only)

336 Actual value 1 minimum scale 57 *(2.2.11, 2.2.1.11)*

Sets the minimum scaling point for Actual value 1. See Figure 8-22.

337 Actual value 1 maximum scale57 *(2.2.12, 2.2.1.12)*

Sets the maximum scaling point for Actual value 1. See Figure 8-22.

338 Actual value 2 minimum scale 57 *(2.2.13, 2.2.1.13)*

Sets the minimum scaling point for Actual value 2. See Figure 8-22.

339 *Actual value 2 maximum scale57* *(2.2.14, 2.2.1.14)*

Sets the maximum scaling point for Actual value 2. See Figure 8-22.

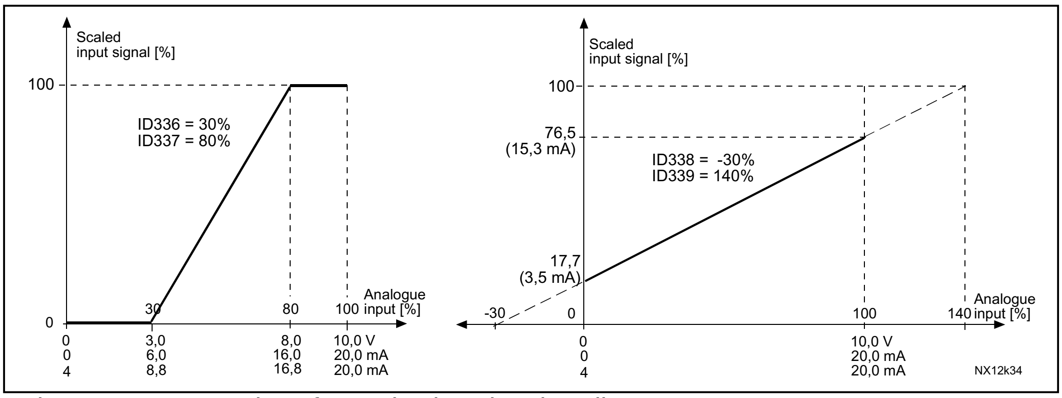


Figure 8-22. Examples of actual value signal scaling

340 *PID error value inversion* **57** *(2.2.32, 2.2.1.5)*

This parameter allows you to invert the error value of the PID controller (and thus the operation of the PID controller).

0 No inversion
1 Inverted

341 *PID reference rise time* **57** *(2.2.33, 2.2.1.6)*

Defines the time during which the PID controller reference rises from 0% to 100%.

342 *PID reference fall time* **57** *(2.2.34, 2.2.1.7)*

Defines the time during which the PID controller reference falls from 100% to 0%.

343 *I/O B reference selection* **57** *(2.2.5, 2.2.1.1)*

Defines the selected frequency reference place when the drive is controlled from the I/O terminal and reference place B is active (DIN6=closed).

0 AI1 reference (terminals 2 and 3, e.g. potentiometer)
1 AI2 reference (terminals 5 and 6, e.g. transducer)
2 AI3 reference
3 AI4 reference
4 Keypad reference (parameter R32)
5 Reference from Fieldbus (FBSpeedReference)
6 Motor potentiometer reference
7 PID controller reference
- select actual value (par. ID333 to ID339) and the PID control reference (par. ID332)

If value **6** is selected for this parameter in **Application 5**, the values of parameters ID319 and ID301 are automatically set to 13.

In **Application 7**, the functions *Motorpotentiometer DOWN* and *Motorpotentiometer UP* must be connected to digital inputs (parameters ID417 and ID418), if value **6** is selected for this parameter.

344 Reference scaling minimum value, place B 57 *(2.2.35, 2.2.1.18)*
345 Reference scaling maximum value, place B 57 *(2.2.36, 2.2.1.19)*

You can choose a scaling range for the frequency reference from control place B between the Minimum and Maximum frequency.
If no scaling is desired set the parameter value to **0**.
In the figures below, input AI1 with signal range 0…100% is selected for Place B reference.

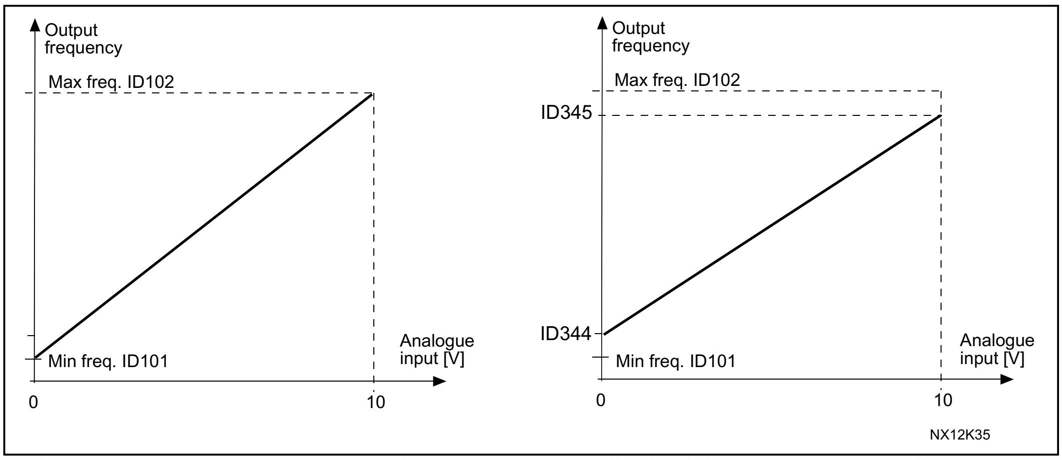


Figure 8-23. Left: Par. ID344=0 (No reference scaling) Right: Reference scaling

346 Output freq. limit 2 supervision function 34567 *(2.3.12, 2.3.4.3, 2.3.2.3)*

0 No supervision
1 Low limit supervision
2 High limit supervision
3 Brake-on control (Application 6 only, see chapter 9.1 on page 210)
4 Brake-on/off control (Application 6 only, see chapter 9.1 on page 210)

If the output frequency goes under/over the set limit (ID347) this function generates a warning message via the digital output DO1 and via the relay output RO1 or RO2 depending
1) on the settings of parameters ID312 to ID314 (applications 3,4,5) or
2) depending on to which output the supervision signals (par. ID447 and ID448) are connected (applications 6 and 7).

347 Output frequency limit 2 supervision value 34567 *(2.3.13, 2.3.4.4, 2.3.2.4)*

Selects the frequency value supervised by parameter ID346. See Figure 8-16.

348 Torque limit, supervision function 34567 *(2.3.14, 2.3.4.5, 2.3.2.5)*

0 = No supervision
1 = Low limit supervision
2 = High limit supervision
3 = Brake-off control (Application 6 only, see chapter 9.1 on page 210)

If the calculated torque value falls below or exceeds the set limit (ID349) this function generates a warning message via the digital output DO1 or via a relay output RO1 or RO2
1) depending on the settings of parameters ID312 to ID314 (applications 3,4,5) or
2) depending on to which output the supervision signal (par. ID451) is connected (applications 6 and 7).

349 Torque limit, supervision value ***34567*** *(2.3.15, 2.3.4.6, 2.3.2.6)*

Set here the torque value to be supervised by parameter ID348.

Applications 3 and 4:
Torque supervision value can be reduced below the setpoint with external free analogue input signal, see parameters ID361 and ID362.

350 Reference limit, supervision function ***34567*** *(2.3.16, 2.3.4.7, 2.3.2.7)*

0 = No supervision
1 = Low limit supervision
2 = High limit supervision
If the reference value falls below or exceeds the set limit (ID351), this function generates a warning message via the digital output DO1 or via a relay output RO1 or RO2
1) depending on the settings of parameters ID312 to ID314 (applications 3,4,5) or
2) depending on to which output the supervision signal (par. ID449) is connected (applications 6 and 7).

The supervised reference is the current active reference. It can be place A or B reference depending on DIN6 input, or panel reference if the panel is the active control place.

351 Reference limit, supervision value ***34567*** *(2.3.17, 2.3.4.8, 2.3.2.8)*

The frequency value to be supervised with the parameter ID350.

352 External brake-off delay ***34567*** *(2.3.18, 2.3.4.9, 2.3.2.9)*
353 External brake-on delay ***34567*** *(2.3.19, 2.3.4.10, 2.3.2.10)*

The function of the external brake can be timed to the start and stop control signals with these parameters. See Figure 8-24 and chapter 9.1 on page 210.
The brake control signal can be programmed via the digital output DO1 or via one of the relay outputs RO1 and RO2, see parameters ID312 to ID314 (applications 3,4,5) or ID445 (applications 6 and 7).

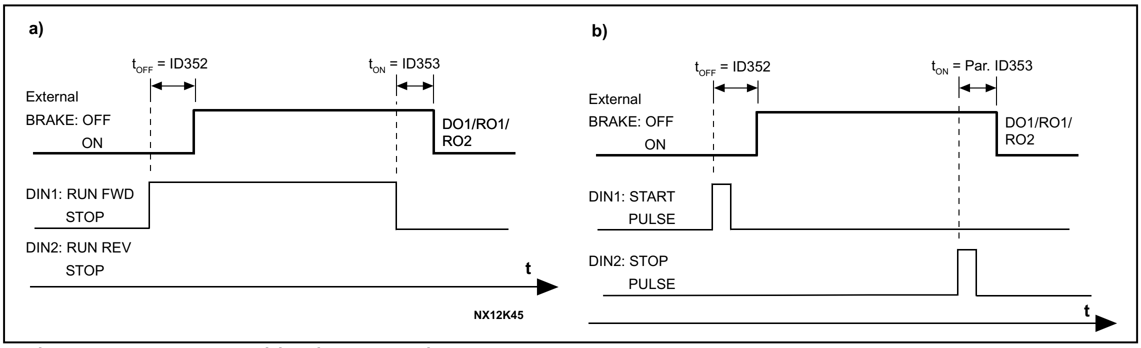


Figure 8-24. External brake control:
a) Start/Stop logic selection, ID300 = 0, 1 or 2
b) Start/Stop logic selection, ID300= 3

354 ***Frequency drive temperature limit supervision*** ***34567*** *(2.3.20, 2.3.4.11, 2.3.2.11)*

0 = No supervision
1 = Low limit supervision
2 = High limit supervision

If the temperature of the frequency drive unit falls below or exceeds the set limit (ID355), this function generates a warning message via the digital output DO1 or via a relay output RO1 or RO2
1) depending on the settings of parameters ID312 to ID314 (applications 3,4,5) or
2) depending on to which output the supervision signal (par. ID450) is connected (applications 6 and 7).

355 ***Frequency drive temperature limit value*** ***34567*** *(2.3.21, 2.3.4.12, 2.3.2.12)*

This temperature value is supervised by parameter ID354.

356 ***Analogue supervision signal*** ***6*** *(2.3.4.13)*

With this parameter you can select the analogue input to be monitored.

0 = Not used
1 = AI1
2 = AI2
3 = AI3
4 = AI4

357 ***Analogue supervision low limit*** ***6*** *(2.3.4.14)*
358 ***Analogue supervision high limit*** ***6*** *(2.3.4.15)*

These parameters set the low and high limits of the signal selected with par. ID356. See Figure 8-25.

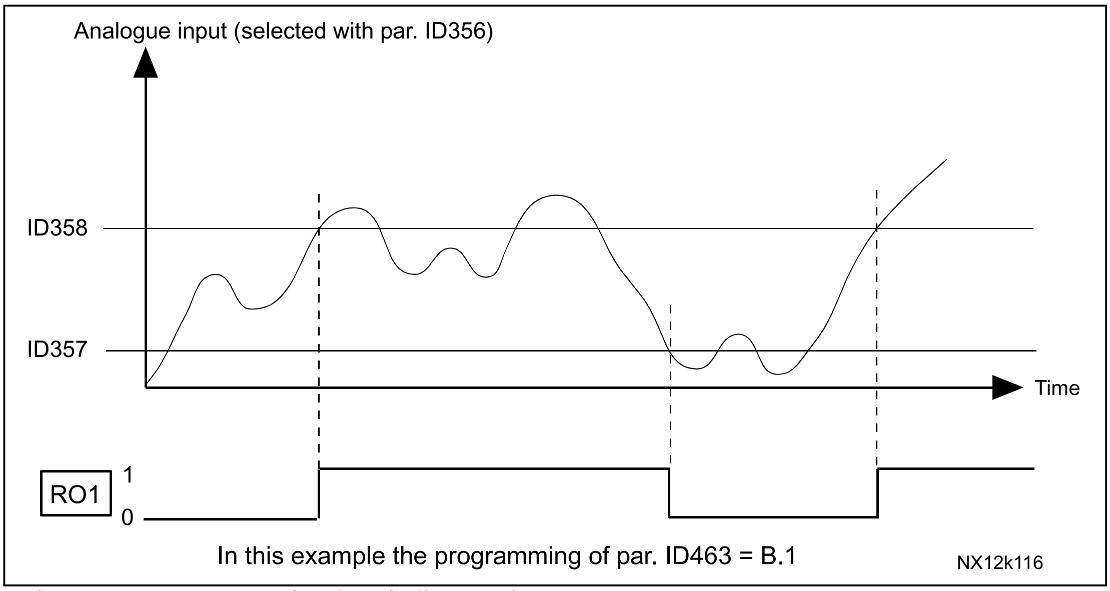


Figure 8-25. An example of On/Off-control

***359 PID controller minimum limit* 5** *(2.2.30)*
***360 PID controller maximum limit* 5** *(2.2.31)*

With these parameters you can set the minimum and maximum limits for the PID controller output.
Limit setting: –1600.0% (of f_{max}) < par. ID359 < par. ID360 < 1600.0% (of f_{max}).
These limits are of importance for example when you define the gain, I-time and D-time for the PID controller.

***361 Free analogue input, signal selection* 34** *(2.2.20, 2.2.17)*

Selection of input signal of a free analogue input (an input not used for reference signal):

0 = Not in use
1 = Voltage signal U_{in}
2 = Current signal I_{in}

***362 Free analogue input, function* 34** *(2.2.21, 2.2.18)*

This parameter is used for selecting a function for a free analogue input signal:

0 = Function is not in use

1 = Reduces motor current limit (ID107)

This signal will adjust the maximum motor current between 0 and max. limit set with ID107. See Figure 8-26.

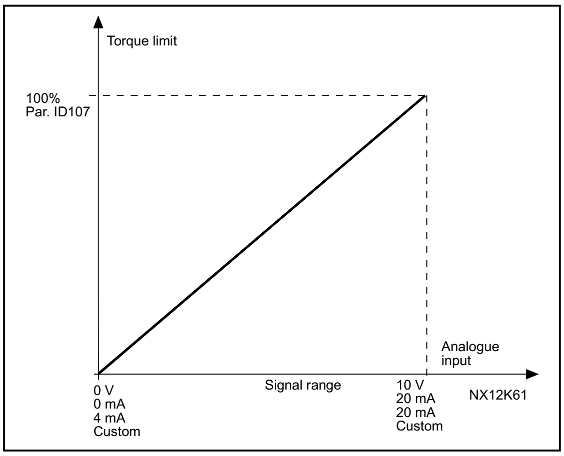


Figure 8-26. Scaling of max. motor current

2 = Reduces DC braking current.

DC braking current can be reduced with the free analogue input signal between zero current and the current set with the parameter ID507. See Figure 8-27.

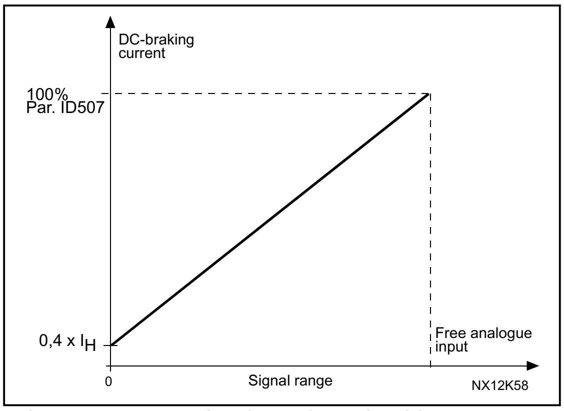


Figure 8-27. Reduction of DC braking current

3 = Reduces acceleration and deceleration times.

Acceleration and deceleration times can be reduced with the free analogue input signal according to the following formulas:

Reduced time = set acc./deceler. time (par.ID103, ID104; ID502, ID503) divided by the factor R in Figure 8-28.

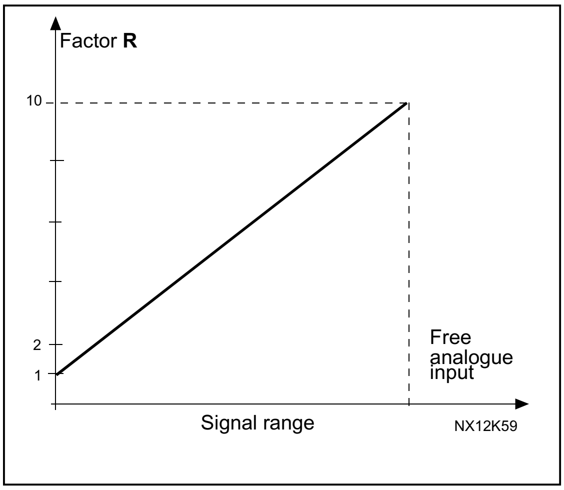


Figure 8-28. Reduction of acceleration and deceleration times

4 = Reduces torque supervision limit

Set supervision limit can be reduced with the free analogue input signal between 0 and set supervision limit (ID349), see Figure 8-29.

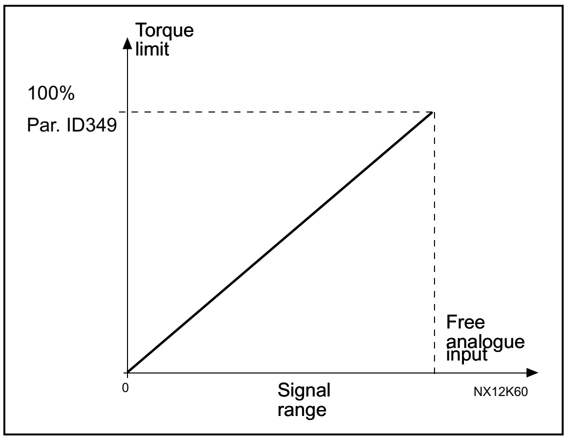


Figure 8-29. Reduction of torque supervision limit

363 Start/Stop logic selection, place B 3 *(2.2.15)*

0 DIN4: closed contact = start forward
DIN5: closed contact = start reverse

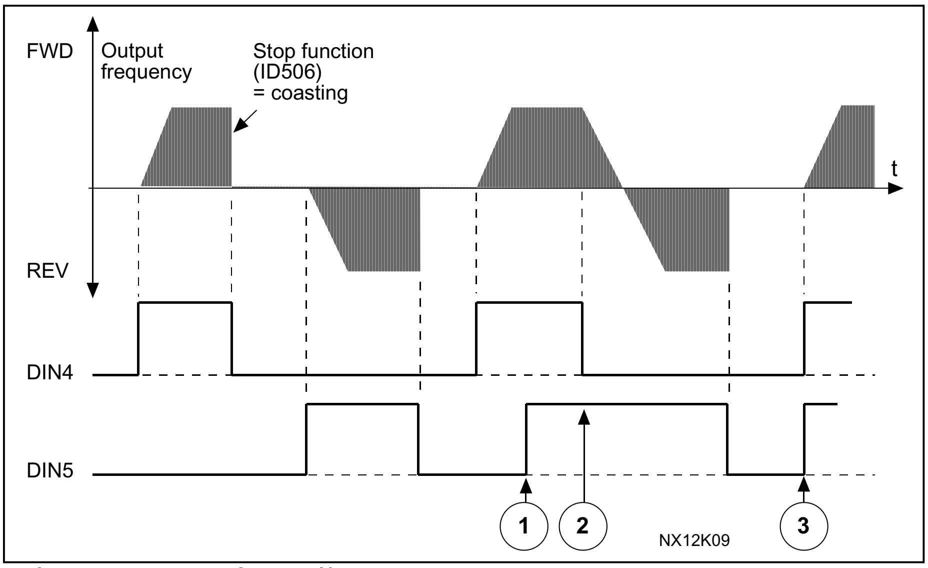


Figure 8-30. Start forward/Start reverse

① The first selected direction has the highest priority.

② When the DIN4 contact opens the direction of rotation starts the change.

③ If Start forward (DIN4) and Start reverse (DIN5) signals are active simultaneously the Start forward signal (DIN4) has priority.

1 DIN4: closed contact = start open contact = stop
DIN5: closed contact = reverse open contact = forward
See Figure 8-31.

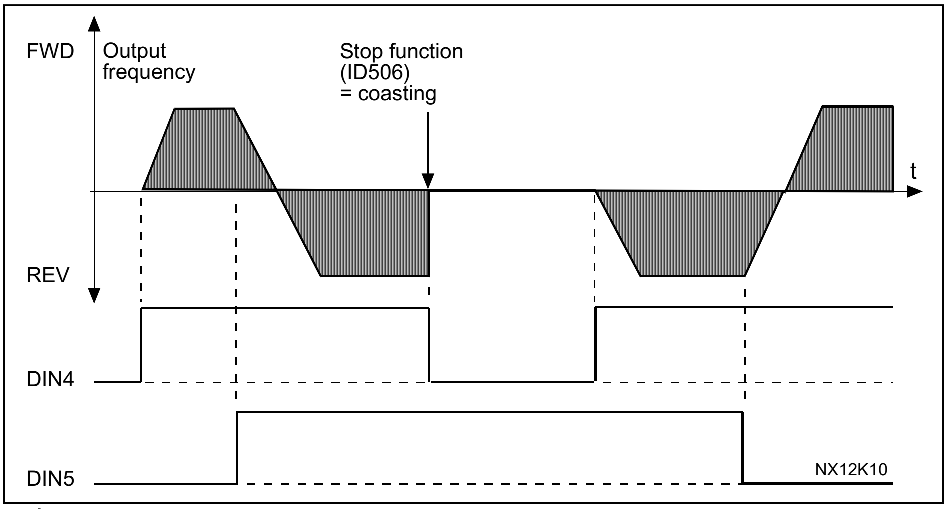


Figure 8-31. Start, Stop, Reverse

2 DIN4: closed contact = start open contact = stop
DIN5: closed contact = start enabled open contact = start disabled and drive stopped if running

3 3-wire connection (pulse control):
DIN4: closed contact = start pulse
DIN5: open contact = stop pulse
(DIN3 can be programmed for reverse command)
See Figure 8-32.

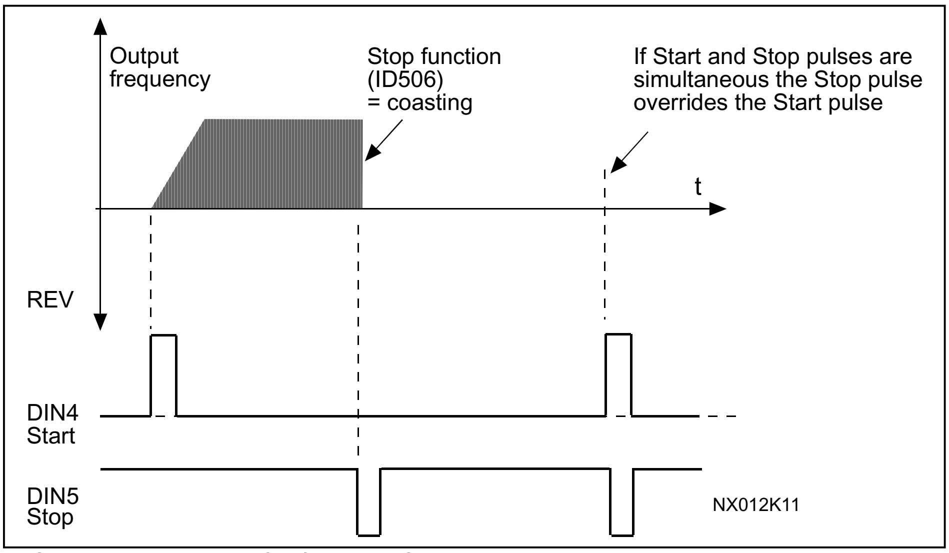


Figure 8-32. Start pulse/ Stop pulse.

The selections **4** to **6** shall be used to exclude the possibility of an unintentional start when, for example, power is connected, re-connected after a power failure, after a fault reset, after the drive is stopped by Run Enable (Run Enable = False) or when the control place is changed. The Start/Stop contact must be opened before the motor can be started.

4 DIN4: closed contact = start forward **(Rising edge required to start)**
DIN5: closed contact = start reverse **(Rising edge required to start)**

5 DIN4: closed contact = start **(Rising edge required to start)**
open contact = stop
DIN5: closed contact = reverse
open contact = forward

6 DIN4: closed contact = start **(Rising edge required to start)**
open contact = stop
DIN5: closed contact = start enabled
open contact = start disabled and drive stopped if running

364 Reference scaling, minimum value, place B 3 *(2.2.18)*
365 Reference scaling, maximum value, place B 3 *(2.2.19)*

See parameters ID303 and ID304 above.

366 ***Easy changeover*** ***5*** *(2.2.37)*

0 Keep reference
1 Copy reference

If Copy reference has been selected it is possible to switch from direct control to PID control and back without scaling the reference and actual value.
For example: The process is driven with direct frequency reference (Control place I/O B, fieldbus or keypad) to some point and then the control place is switched to one where the PID controller is selected. The PID control starts to maintain that point. The PID controller error value is forced to zero when the control place is changed.
It is also possible to change the control source back to direct frequency control. In this case, the output frequency is copied as the frequency reference. If the destination place is Keypad the run status (Run/Stop, Direction and Reference) will be copied.
The changeover is smooth when the reference of the destination source comes from the Keypad or an internal motor potentiometer (par. ID332 [PID Ref.] = 2 or 4, ID343 [I/O B Ref] = 2 or 4, par. ID121 [Keypad Ref] = 2 or 4 and ID122 [Fieldbus Ref]= 2 or 4.

367 ***Motor potentiometer memory reset (Frequency reference)*** ***3567*** *(2.2.23, 2.2.28, 2.2.1.3, 2.2.1.16)*

0 No reset
1 Memory reset in stop and powerdown
2 Memory reset in powerdown

370 ***Motor potentiometer memory reset (PID reference)*** ***57*** *(2.2.29, 2.2.1.17)*

0 No reset
1 Memory reset in stop and powerdown
2 Memory reset in powerdown

371 ***PID reference 2 (Place A additional reference)*** ***7*** *(2.2.1.4)*

If the *PID reference 2 enable* input function (ID330)= TRUE, this parameter defines which reference place is selected as PID controller reference.
0 = AI1 reference (terminals 2 and 3, e.g. potentiometer)
1 = AI2 reference (terminals 5 and 6, e.g. transducer)
2 = AI3 reference
3 = AI4 reference
4 = PID reference 1 from keypad
5 = Reference from Fieldbus (FBProcessDataIN3)
6 = Motor potentiometer
7 = PID reference 2 from keypad
If value **6** is selected for this parameter, the functions *Motor potentiometer DOWN* and *Motor potentiometer UP* must be connected to digital inputs (parameters ID417 and ID418).

372 ***Supervised analogue input*** ***7*** *(2.3.2.13)*

0 = Analogue reference from AI1 (terminals 2 and 3, e.g. potentiometer)
1 = Analogue reference from AI2 (terminals 4 and 5, e.g. transducer)

373 ***Analogue input limit supervision*** ***7*** *(2.3.2.14)*

If the value of the selected analogue input goes under/over the set limit (par. ID374) this function generates a warning message through the digital output or the relay outputs depending on to which output the supervision function (par. ID463) is connected.

0 No supervision
1 Low limit supervision
2 High limit supervision

374 ***Analogue input supervised value*** ***7*** *(2.3.2.15)*

The value of the selected analogue input to be supervised by parameter ID373.

375 ***Analogue output offset*** ***67*** *(2.3.5.7, 2.3.3.7)*

Add –100.0 to 100.0% to the analogue output.

376 ***PID sum point reference (Place A direct reference)*** ***5*** *(2.2.4)*

Defines which reference source is added to PID controller output if PID controller is used.
0 No additional reference (Direct PID output value)
1 PID output + AI1 reference from terminals 2 and 3 (e.g. potentiometer)
2 PID output + AI2 reference from terminals 4 and 5 (e.g. transducer)
3 PID output + PID keypad reference
4 PID output + Fieldbus reference (FBSpeedReference)
5 PID output + Motor potentiometer reference
6 Fieldbus + PID output (ProcessDataIN3)
7 Motor potentiometer + PID output
If value **7** is selected for this parameter, the values of parameters ID319 and ID301 are automatically set to 13. See Figure 8-33.

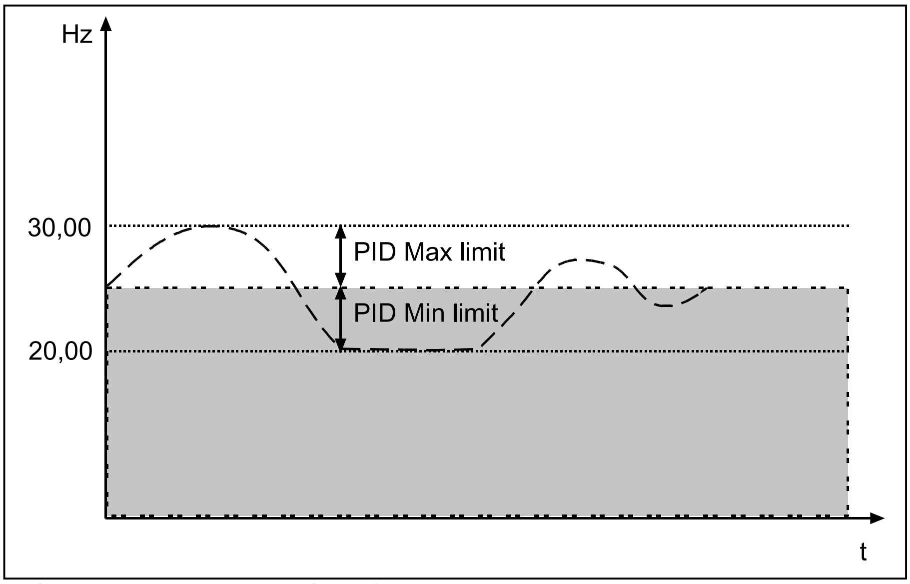


Figure 8-33. PID sum point reference

Note: The maximum and minimum limits illustrated in the picture limit only the PID output, no other outputs.

377 ***AI1 signal selection*** ***234567*** *(2.2.8, 2.2.3, 2.2.15, 2.2.2.1)*

Connect the AI1 signal to the analogue input of your choice with this parameter. For more information about the TTF programming method, see chapter 6.4.

384 ***AI1 joystick hysteresis 6*** *(2.2.2.8)*

This parameter defines the joystick hysteresis between 0 and 20 %.
When the joystick or potentiometer control is turned from reverse to forward, the output frequency falls linearly to the selected minimum frequency (joystick/potentiometer in middle position) and stays there until the joystick/potentiometer is turned towards the forward command. It depends on the amount of joystick hysteresis defined with this parameter, how much the joystick/potentiometer must be turned to start the increase of the frequency towards the selected maximum frequency.
If the value of this parameter is 0, the frequency starts to increase linearly immediately when the joystick/potentiometer is turned towards the forward command from the middle position. When the control is changed from forward to reverse, the frequency follows the same pattern the other way round. See Figure 8-34.

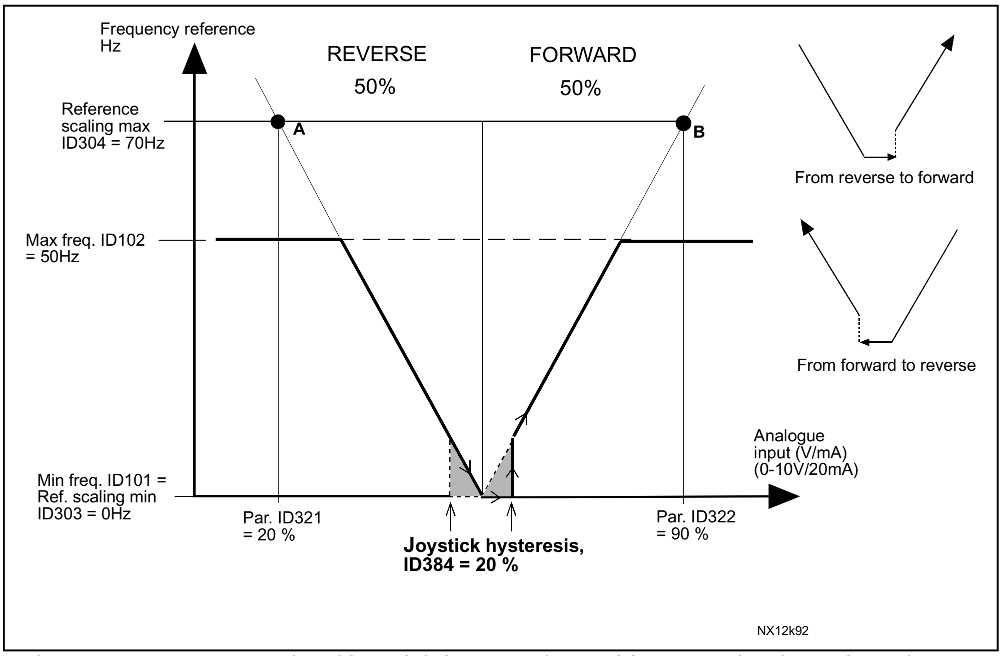


Figure 8-34. An example of joystick hysteresis. In this example, the value of par. ID385 (Sleep limit) = 0

385 *AI1 sleep limit* 6 *(2.2.2.9)*

The frequency drive is stopped automatically if the AI signal level falls below the *Sleep limit* defined with this parameter. See Figure 8-35.

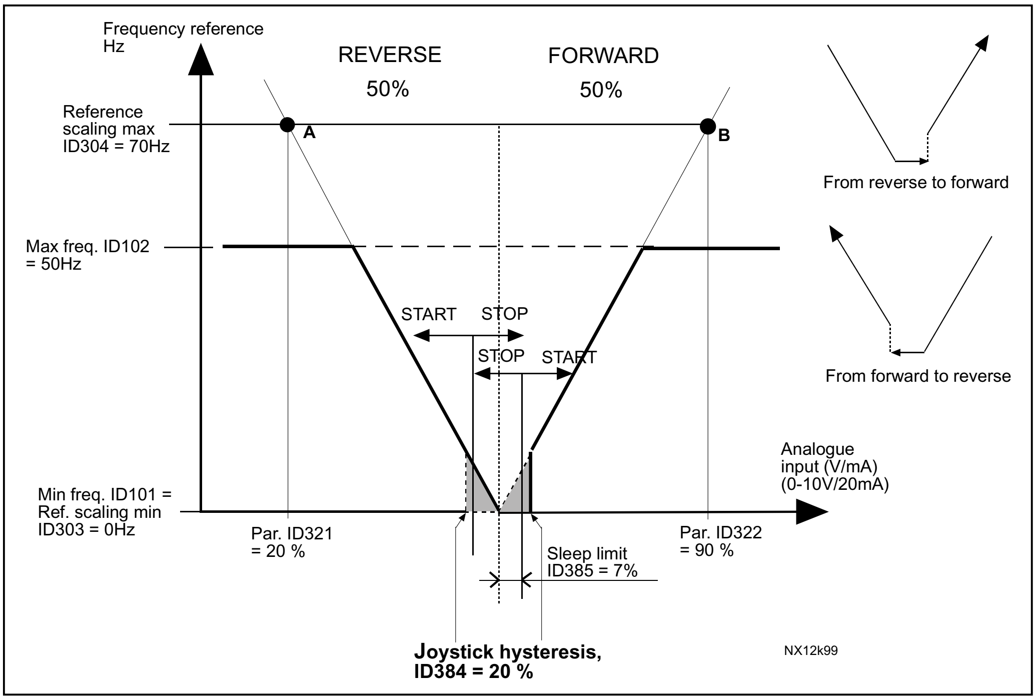


Figure 8-35. Example of sleep limit function

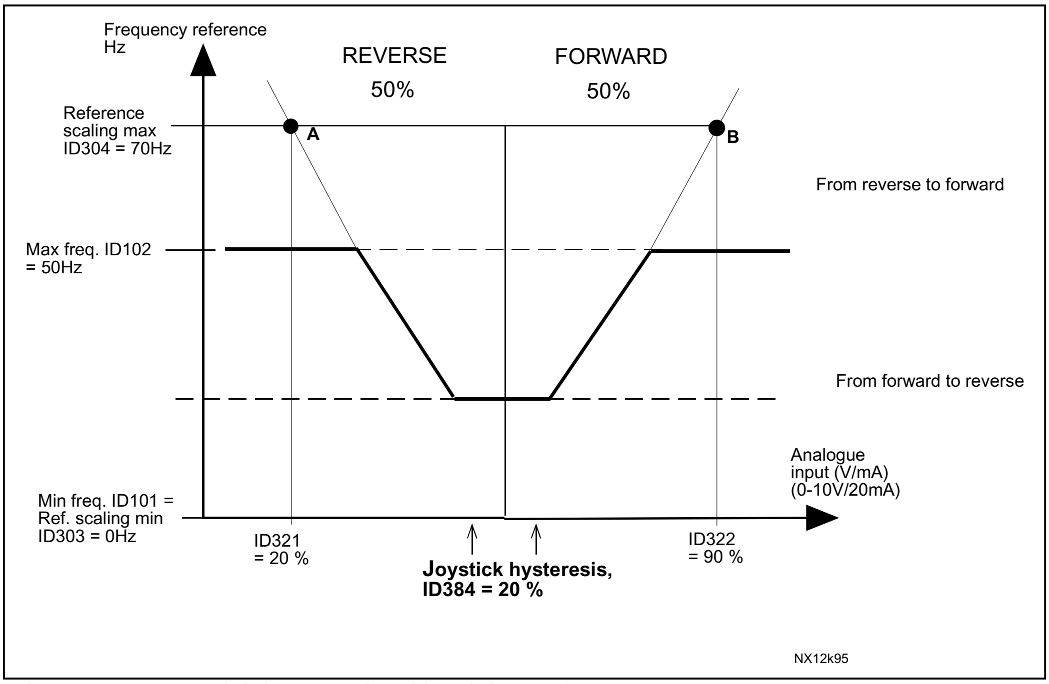


Figure 8-36. Joystick hysteresis with minimum frequency at 35Hz

386 *AI1 sleep delay* 6 *(2.2.2.10)*

This parameter defines the time the analoque input signal has to stay under the sleep limit determined with parameter ID385 in order to stop the frequency drive.

388 ***AI2 signal selection*** ***234567*** *(2.2.9, 2.2.21, 2.2.3.1)*

Connect the AI2 signal to the analogue input of your choice with this parameter. For more information about the TTF programming method, see chapter 6.4.

393 ***AI2 reference scaling, minimum value*** ***6*** *(2.2.3.6)*
394 ***AI2 reference scaling, maximum value*** ***6*** *(2.2.3.7)*

See ID's 303 and 304.

395 ***AI2 joystick hysteresis*** ***6*** *(2.2.3.8)*

See ID384.

396 ***AI2 sleep limit*** ***6*** *(2.2.3.9)*

See ID385.

397 ***AI2 sleep delay*** ***6*** *(2.2.3.10)*

See ID386.

399 ***Scaling of current limit*** ***6*** *(2.2.6.1)*

0 = Not used
1 = AI1
2 = AI2
3 = AI3
4 = AI4
5 = Fieldbus (FBProcessDataIN2)

This signal will adjust the maximum motor current between 0 and max. limit set with parameter ID107.

400 Scaling of DC-braking current 6 (2.2.6.2)

See par. ID399 for the selections.

DC-braking current can be reduced with the free analogue input signal between current 0.4 x I_H and the current set with parameter ID507. See Figure 8-37.

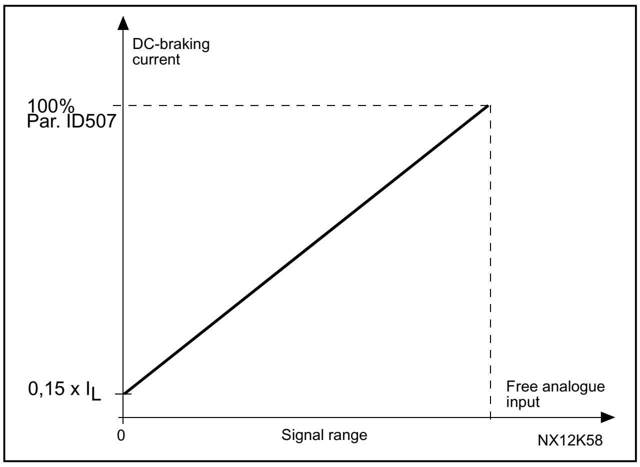


Figure 8-37. Scaling of DC-braking current

401 Reducing of acceleration and deceleration times 6 (2.2.6.3)

See par. ID399.

Acceleration and deceleration times can be reduced with the free analogue input signal according to the following formulas:

Reduced time = set acc./deceler. time (par. ID103, 104; ID502, ID503) divided by the factor R from Figure 8-38.

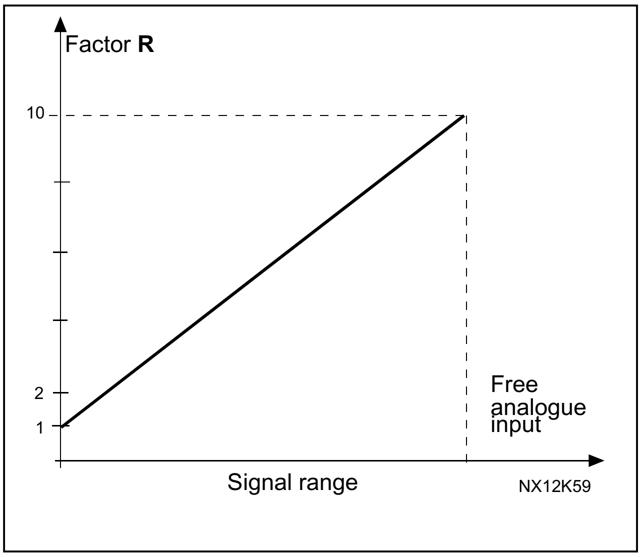


Figure 8-38. Reducing of acceleration and deceleration times

402 ***Reducing of torque supervision limit*** ***6*** *(2.2.6.4)*

See ID399.

The set torque supervision limit can be reduced with the free analogue input signal between 0 and the set supervision limit, ID349. See Figure 8-39.

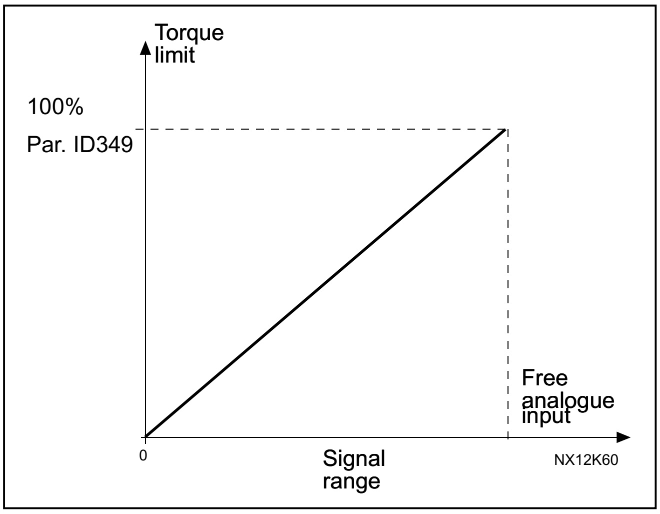


Figure 8-39. Reducing torque supervision limit

403 ***Start signal 1*** ***6*** *(2.2.7.1)*

Signal selection 1 for the start/stop logic.
Default programming A.1.

404 ***Start signal 2*** ***6*** *(2.2.7.2)*

Signal selection 2 for the start/stop logic.
Default programming A.2.

405 ***External fault (close)*** ***67*** *(2.2.7.11, 2.2.6.4)*

Contact closed: Fault is displayed and motor stopped.

406 ***External fault (open)*** ***67*** *(2.2.7.12, 2.2.6.5)*

Contact open: Fault is displayed and motor stopped.

407 ***Run enable*** ***67*** *(2.2.7.3, 2.2.6.6)*

Contact open: Start of motor disabled
Contact closed: Start of motor enabled

408 ***Acceleration/Deceleration time selection*** ***67*** *(2.2.7.13, 2.2.6.7)*

Contact open: Acceleration/Deceleration time 1 selected
Contact closed: Acceleration/Deceleration time 2 selected

Set Acceleration/Deceleration times with parameters ID103 and ID104.

409 ***Control from I/O terminal*** ***67*** *(2.2.7.18, 2.2.6.8)*

Contact closed: Force control place to I/O terminal

410 ***Control from keypad*** ***67*** *(2.2.7.19, 2.2.6.9)*

Contact closed: Force control place to keypad

411 ***Control from fieldbus*** ***67*** *(2.2.7.20, 2.2.6.10)*

Contact closed: Force control place to fieldbus

NOTE: When the control place is forced to change the values of Start/Stop, Direction and Reference valid in the respective control place are used.
The value of parameter ID125 (Keypad Control Place) does not change.
When the input opens the control place is selected according to keypad control parameter ID125.

412 ***Reverse*** ***67*** *(2.2.7.4, 2.2.6.11)*

Contact open: Direction forward
Contact closed: Direction reverse

413 ***Jogging speed*** ***67*** *(2.2.7.16, 2.2.6.12)*

Contact closed: Jogging speed selected for frequency reference
See parameter ID124.
Default programming: A.4.

414 ***Fault reset*** ***67*** *(2.2.7.10, 2.2.6.13)*

Contact closed: All faults are reset.

415 ***Acceleration/Deceleration prohibited*** ***67*** *(2.2.7.14, 2.2.6.14)*

Contact closed: No acceleration or deceleration possible until the contact is opened.

416 ***DC-braking*** ***67*** *(2.2.7.15, 2.2.6.15)*

Contact closed: In STOP mode, the DC braking operates until the contact is opened.

417 ***Motor potentiometer DOWN*** ***67*** *(2.2.7.8, 2.2.6.16)*

Contact closed: Motor potentiometer reference DECREASES until the contact is opened.

418 ***Motor potentiometer UP*** ***67*** *(2.2.7.9, 2.2.6.17)*

Contact closed: Motor potentiometer reference INCREASES until the contact is opened.

419 ***Preset speed 1*** ***6*** *(2.2.7.5)*
420 ***Preset speed 2*** ***6*** *(2.2.7.6)*
421 ***Preset speed 3*** ***6*** *(2.2.7.7)*

Parameter values are automatically limited between the minimum and maximum frequencies (parameters ID101 and ID102).

422 ***AI1/AI2 selection*** ***6*** *(2.2.7.17)*

With this parameter you can select either AI1 or AI2 signal for frequency reference.

423 ***Start A signal*** ***7*** *(2.2.6.1)*

Start command from control place A.
Default programming: A.1

424 ***Start B signal*** ***7*** *(2.2.6.2)*

Start command from control place B.
Default programming: A.4

425 ***Control place A/B selection*** ***7*** *(2.2.6.3)*

Contact open: Control place A
Contact closed: Control place B
Default programming: A.6

426 ***Autochange 1 interlock*** ***7*** *(2.2.6.18)*

Contact closed: Interlock of autochange drive 1 or auxiliary drive 1 activated.
Default programming: A.2.

427 ***Autochange 2 interlock*** ***7*** *(2.2.6.19)*

Contact closed: Interlock of autochange drive 2 or auxiliary drive 2 activated.
Default programming: A.3.

428 ***Autochange 3 interlock*** ***7*** *(2.2.6.20)*

Contact closed: Interlock of autochange drive 3 or auxiliary drive 3 activated.

429 ***Autochange 4 interlock*** ***7*** *(2.2.6.21)*

Contact closed: Interlock of autochange drive 4 or auxiliary drive 4 activated.

430 ***Autochange 5 interlock*** ***7*** *(2.2.6.22)*

Contact closed: Interlock of autochange drive 5 activated.

431 ***PID reference 2*** ***7*** *(2.2.6.23)*

Contact open: PID controller reference selected with parameter ID332.
Contact closed: PID controller keypad reference 2 selected with par. ID371.

432 ***Ready*** ***67*** *(2.3.3.1, 2.3.1.1)*

The frequency drive is ready to operate.

433 ***Run*** ***67*** *(2.3.3.2, 2.3.1.2)*

The frequency drive operates (the motor is running).

434 ***Fault*** ***67*** *(2.3.3.3, 2.3.1.3)*

A fault trip has occurred.
Default programming: A.1.

435 ***Inverted fault*** ***67*** *(2.3.3.4, 2.3.1.4)*

No fault trip has occurred.

436 ***Warning*** ***67*** *(2.3.3.5, 2.3.1.5)*

General warning signal.

437 ***External fault or warning*** ***67*** *(2.3.3.6, 2.3.1.6)*

Fault or warning depending on par. ID701.

438 ***Reference fault or warning*** ***67*** *(2.3.3.7, 2.3.1.7)*

Fault or warning depending on parameter ID700.

439 ***Overtemperature warning*** ***67*** *(2.3.3.8, 2.3.1.8)*

The heatsink temperature exceeds +70°C.

440 ***Reverse*** ***67*** *(2.3.3.9, 2.3.1.9)*

The Reverse command has been selected.

441 ***Unrequested direction*** ***67*** *(2.3.3.10, 2.3.1.10)*

Motor rotation direction is different from the requested one.

442 ***At speed*** ***67*** *(2.3.3.11, 2.3.1.11)*

The output frequency has reached the set reference.

443 ***Jogging speed*** ***67*** *(2.3.3.12, 2.3.1.12)*

Jogging speed selected.

444 ***External control place*** ***67*** *(2.3.3.13, 2.3.1.13)*

Control from I/O terminal selected (Menu **M3**; par. ID125).

445 ***External brake control*** ***67*** *(2.3.3.14, 2.3.1.14)*

External brake ON/OFF control with programmable delay. Used in applications where the mechanical brake is released when the brake coil is not energized.
When using the Master Follower function, the follower drive will open the brake at the same time as the Master does even if the Follower's conditions for brake opening have not been met.

446 ***External brake control, inverted*** ***67*** *(2.3.3.15, 2.3.1.15)*

External brake ON/OFF control; Output active when brake control is OFF. Used in applications where the mechanical brake is in duty when voltage is not applied to the brake coil.
When using the Master Follower function, the follower drive will open the brake at the same time as the Master does even if the Follower's conditions for brake opening have not been met.

447 ***Output frequency limit 1 supervision*** ***67*** *(2.3.3.16, 2.3.1.16)*

The output frequency goes outside the set supervision low limit/high limit (see parameters ID315 and ID316).

448 ***Output frequency limit 2 supervision*** ***67*** *(2.3.3.17, 2.3.1.17)*

The output frequency goes outside the set supervision low limit/high limit (see parameters ID346 and ID347)

449 ***Reference limit supervision*** ***67*** *(2.3.3.18, 2.3.1.18)*

Active reference goes beyond the set supervision low limit/high limit (see parameters ID350 and ID351).

450 ***Temperature limit supervision*** ***67*** *(2.3.3.19, 2.3.1.19)*

Frequency drive heatsink temperature goes beyond the set supervision limits (see parameters ID354 and ID355).

451 ***Torque limit supervision*** ***67*** *(2.3.3.20, 2.3.1.20)*

The motor torque goes beyond the set supervision limits (see parameters ID348 and ID349).

452 ***Motor thermal protection*** ***67*** *(2.3.3.21, 2.3.1.21)*

Motor thermistor initiates a overtemperature signal which can be led to a digital output.

NOTE: This parameter will not work unless you have OPT-A3 or OPT-B2 (thermistor relay board) connected.

454 ***Motor regulator activation*** ***67*** *(2.3.3.23, 2.3.1.23)*

Overvoltage or overcurrent regulator has been activated.

455 ***Fieldbus input data 1 (FBFixedControlWord, bit 3)*** ***67*** *(2.3.3.24, 2.3.1.24)*
456 ***Fieldbus input data 2 (FBFixedControlWord, bit 4)*** ***67*** *(2.3.3.25, 2.3.1.25)*
457 ***Fieldbus input data 3 (FBFixedControlWord, bit 5)*** ***67*** *(2.3.3.26, 2.3.1.26)*

The data from the fieldbus (FBFixedControlWord) can be led to frequency drive digital outputs.

458 ***Autochange 1/Auxiliary drive 1 control*** ***7*** *(2.3.1.27)*

Control signal for autochange/auxiliary drive 1.
Default programming: B.1

459 ***Autochange 2/Auxiliary drive 2 control*** ***7*** *(2.3.1.28)*

Control signal for autochange/auxiliary drive 2.
Default programming: B.2

460 ***Autochange 3/Auxiliary drive 3 control*** ***7*** *(2.3.1.29)*

Control signal for autochange/auxiliary drive 3. If three (or more) auxiliary drives are used, we recommend to connect nr 3, too, to a relay output. Since the OPT-A2 board only has two relay outputs it is advisable to purchase an I/O expander board with extra relay outputs (e.g. OPT-B5).

461 ***Autochange 4/Auxiliary drive 4 control*** ***7*** *(2.3.1.30)*

Control signal for autochange/auxiliary drive 4. If three (or more) auxiliary drives are used, we recommend to connect nr 3 and 4, too, to a relay output. Since the OPT-A2 board only has two relay outputs it is advisable to purchase an I/O expander board with extra relay outputs (e.g. OPT-B5).

462 ***Autochange 5 control*** ***7*** *(2.3.1.31)*

Control signal for autochange drive 5.

463 ***Analogue input supervision limit*** ***67*** *(2.3.3.22, 2.3.1.22)*

The selected analogue input signal goes beyond the set supervision limits (see parameters ID372, ID373 and ID374).

464 ***Analogue output 1 signal selection*** ***234567*** *(2.3.1, 2.3.5.1, 2.3.3.1)*

Connect the AO1 signal to the analogue output of your choice with this parameter. For more information about the TTF programming method, see chapter 6.4.

471 ***Analogue output 2 signal selection*** ***234567*** *(2.3.12, 2.3.22, 2.3.6.1, 2.3.4.1)*

Connect the AO2 signal to the analogue output of your choice with this parameter. For more information about the TTF programming method, see chapter 6.4.

472 ***Analogue output 2 function*** ***234567*** *(2.3.13, 2.3.23, 2.3.6.2, 2.3.4.2)*
473 ***Analogue output 2 filter time*** ***234567*** *(2.3.14, 2.3.24, 2.3.6.3, 2.3.4.3)*
474 ***Analogue output 2 inversion*** ***234567*** *(2.3.15, 2.3.25, 2.3.6.4, 2.3.4.4)*
475 ***Analogue output 2 minimum*** ***234567*** *(2.3.16, 2.3.26, 2.3.6.5, 2.3.4.5)*
476 ***Analogue output 2 scaling*** ***234567*** *(2.3.17, 2.3.27, 2.3.6.6, 2.3.4.6)*

For more information on these five parameters, see the corresponding parameters for the analogue output 1 on pages 138 to 139.

477 ***Analogue output 2 offset*** ***67*** *(2.3.6.7, 2.3.4.7)*

Add –100.0 to 100.0% to the analogue output.

478 ***Analogue output 3, signal selection*** ***67*** *(2.3.7.1, 2.3.5.1)*

See ID464.

479 ***Analogue output 3, function*** ***67*** *(2.3.7.2, 2.3.5.2)*

See ID307.

480 ***Analogue output 3, filter time*** ***67*** *(2.3.7.3, 2.3.5.3)*

See ID308.

481 ***Analogue output 3 inversion*** ***67*** *(2.3.7.4, 2.3.5.4)*

See ID309.

482 ***Analogue output 3 minimum*** ***67*** *(2.3.7.5, 2.3.5.5)*

See ID310.

483 ***Analogue output 3 scaling*** ***67*** *(2.3.7.6, 2.3.5.6)*

See ID311.

484 ***Analogue output 3 offset*** ***67*** *(2.3.7.7, 2.3.5.7)*

See ID375.

485 ***Scaling of motoring torque limit*** ***6*** *(2.2.6.5)*

See par. ID399 for the selections.

486 ***Digital output 1 signal selection*** ***6*** *(2.3.1.1)*

Connect the delayed DO1 signal to the digital output of your choice with this parameter. For more information about the TTF programming method, see chapter 6.4. Digital output function can be inverted by Control options, par. ID1084.

487 ***Digital output 1 on-delay*** ***6*** *(2.3.1.3)*
488 ***Digital output 1 off-delay*** ***6*** *(2.3.1.4)*

With these parameters you can set on- and off-delays to digital outputs.

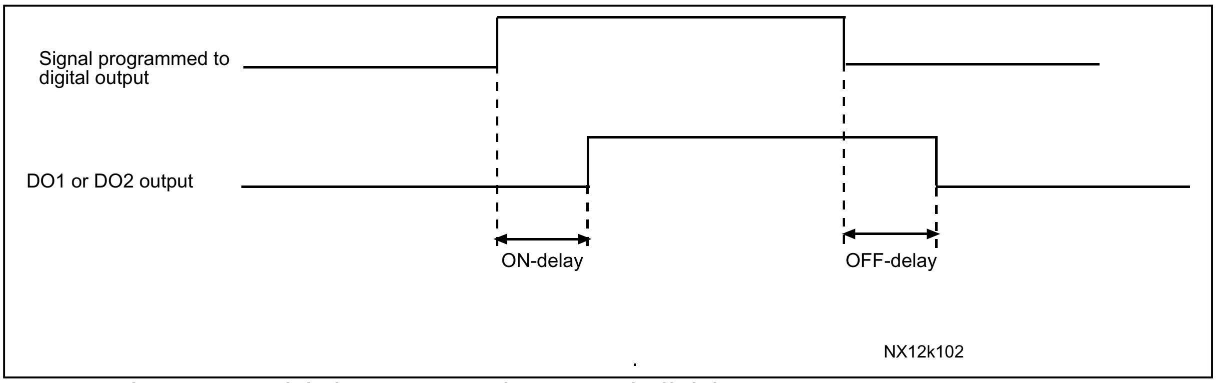


Figure 8-40. Digital outputs 1 and 2, on- and off-delays

489 ***Digital output 2 signal selection*** ***6*** *(2.3.2.1)*

See ID486.

490 ***Digital output 2 function*** ***6*** *(2.3.2.2)*

See ID312.

491 ***Digital output 2 on-delay*** ***6*** *(2.3.2.3)*

See ID487.

492 ***Digital output 2 off-delay*** ***6*** *(2.3.2.4)*

See ID488.

493 Adjust input ***6*** *(2.2.1.4)*

With this parameter you can select the signal, according to which the frequency reference to the motor is fine adjusted.

0 Not used
1 Analogue input 1
2 Analogue input 2
3 Analogue input 3
4 Analogue input 4
5 Signal from fieldbus (FBProcessDataIN)

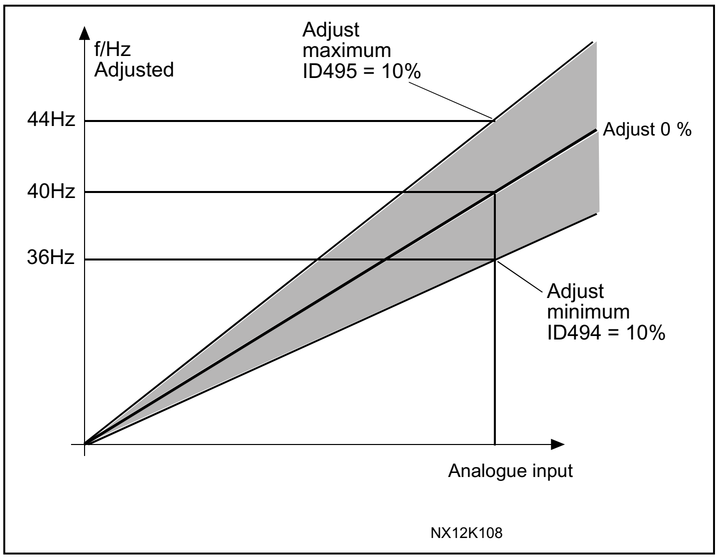


Figure 8-41. An example of adjust input

494 Adjust minimum ***6*** *(2.2.1.5)*
495 Adjust maximum ***6*** *(2.2.1.6)*

These parameters define the minimum and maximum of adjusted signals. See Figure 8-41.

496 Parameter Set 1/Set 2 selection ***6*** *(2.2.7.21)*

With this parameter you can select between Parameter Set 1 and Set 2. The input for this function can be selected from any slot. The procedure of selecting between the sets is explained in the product's user's manual.

Digital input = FALSE:
- Set 1 is loaded as the active set

Digital input = TRUE:
- The active set is saved to set 1

Note: The parameter values are stored only when selecting *P6.3.1 Parameter sets Store Set 1* or *Store Set 2* in System menu or from NCDrive: *Drive* > *Parameter Sets*.

498 Start pulse memory ***3*** *(2.2.24)*

Giving a value for this parameter determines if the present RUN status is copied when the control place is changed from A to B or vice versa.

0 = The RUN status is not copied
1 = The RUN status is copied

In order for this parameter to have effect, parameters ID300 and ID363 must have been set the value **3**.

500 Acceleration/Deceleration ramp 1 shape 234567 *(2.4.1)*
501 Acceleration/Deceleration ramp 2 shape 234567 *(2.4.2)*

The start and end of acceleration and deceleration ramps can be smoothed with these parameters. Setting value **0** gives a linear ramp shape which causes acceleration and deceleration to act immediately to the changes in the reference signal.
Setting value 0.1…10 seconds for this parameter produces an S-shaped acceleration/deceleration. The acceleration time is determined with parameters ID103/ID104 (ID502/ID503).

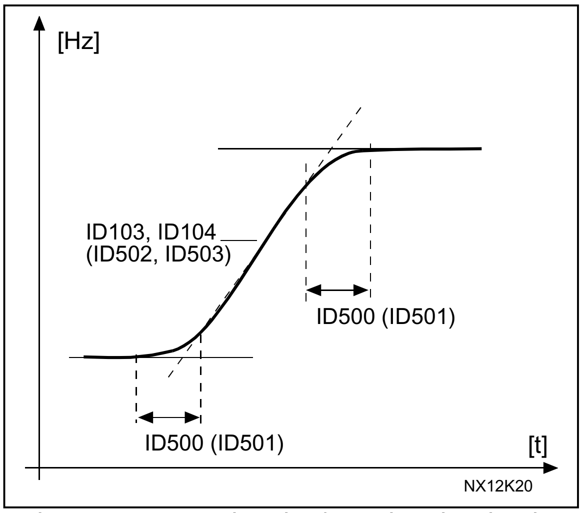


Figure 8-42. Acceleration/Deceleration (S-shaped)

502 Acceleration time 2 234567 *(2.4.3)*
503 Deceleration time 2 234567 *(2.4.4)*

These values correspond to the time required for the output frequency to accelerate from the zero frequency to the set maximum frequency (par. ID102). These parameters give the possibility to set two different acceleration/deceleration time sets for one application. The active set can be selected with the programmable signal DIN3 (par. ID301).

504 Brake chopper 234567 *(2.4.5)*

0 = No brake chopper used
1 = Brake chopper in use and tested when running. Can be tested also in READY state
2 = External brake chopper (no testing)
3 = Used and tested in READY state and when running
4 = Used when running (no testing)

When the frequency drive is decelerating the motor, the inertia of the motor and the load are fed into an external brake resistor. This enables the frequency drive to decelerate the load with a torque equal to that of acceleration (provided that the correct brake resistor has been selected). See separate Brake resistor installation manual.

505 Start function *(2.4.6)*

Ramp:
0 The frequency drive starts from 0 Hz and accelerates to the set reference frequency within the set acceleration time. (Load inertia or starting friction may cause prolonged acceleration times).

Flying start:

1 The frequency drive is able to start into a running motor by applying a small torque to motor and searching for the frequency corresponding to the speed the motor is running at. Searching starts from the maximum frequency towards the actual frequency until the correct value is detected. Thereafter, the output frequency will be increased/decreased to the set reference value according to the set acceleration/deceleration parameters.

Use this mode if the motor is coasting when the start command is given. With the flying start it is possible to ride through short mains voltage interruptions.

506 Stop function *(2.4.7)*

Coasting:

0 The motor coasts to a halt without any control from the frequency drive, after the Stop command.

Ramp:

1 After the Stop command, the speed of the motor is decelerated according to the set deceleration parameters.
If the regenerated energy is high it may be necessary to use an external braking resistor for faster deceleration.

Normal stop: Ramp/ Run Enable stop: coasting

2 After the Stop command, the speed of the motor is decelerated according to the set deceleration parameters. However, when Run Enable is selected, the motor coasts to a halt without any control from the frequency drive.

Normal stop: Coasting/ Run Enable stop: ramping

3 The motor coasts to a halt without any control from the frequency drive. However, when Run Enable signal is selected, the speed of the motor is decelerated according to the set deceleration parameters. If the regenerated energy is high it may be necessary to use an external braking resistor for faster deceleration.

507 DC-braking current 234567 *(2.4.8)*

Defines the current injected into the motor during DC-braking.

508 DC-braking time at stop 234567 *(2.4.9)*

Determines if braking is ON or OFF and the braking time of the DC-brake when the motor is stopping. The function of the DC-brake depends on the stop function, parameter ID506.

0 DC-brake is not used
>0 DC-brake is in use and its function depends on the Stop function, (param. ID506). The DC-braking time is determined with this parameter.

Par. ID506 = 0; Stop function = Coasting:

After the stop command, the motor coasts to a stop without control of the frequency drive.

With DC-injection, the motor can be electrically stopped in the shortest possible time, without using an optional external braking resistor.

The braking time is scaled according to the frequency when the DC-braking starts. If the frequency is ≥ the nominal frequency of the motor, the set value of parameter ID508 determines the braking time. When the frequency is ≤10% of the nominal, the braking time is 10% of the set value of parameter ID508.

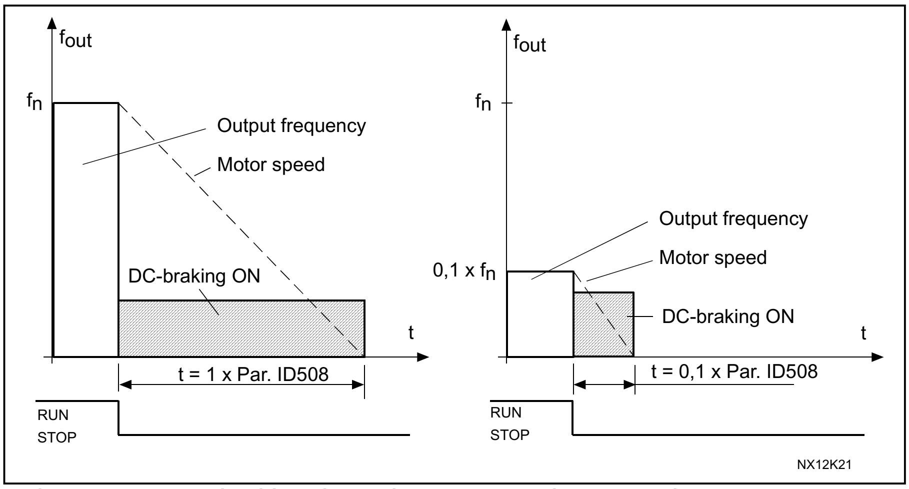


Figure 8-43. DC-braking time when Stop mode = Coasting.

Par. ID506 = 1; Stop function = Ramp:

After the Stop command, the speed of the motor is reduced according to the set deceleration parameters, as fast as possible, to the speed defined with parameter ID515, where the DC-braking starts.

The braking time is defined with parameter ID508. If high inertia exists, it is recommended to use an external braking resistor for faster deceleration. See Figure 8-44.

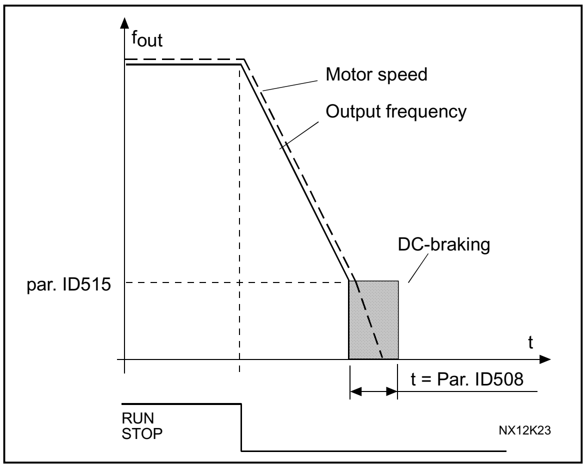


Figure 8-44. DC-braking time when Stop mode = Ramp

509 Prohibit frequency area 1; Low limit 23457 *(2.5.1)*
510 Prohibit frequency area 1; High limit 23457 *(2.5.2)*
511 Prohibit frequency area 2; Low limit 3457 *(2.5.3)*
512 Prohibit frequency area 2; High limit 3457 *(2.5.4)*
513 Prohibit frequency area 3; Low limit 3457 *(2.5.5)*
514 Prohibit frequency area 3; High limit 3457 *(2.5.6)*

In some systems it may be necessary to avoid certain frequencies because of mechanical resonance problems. With these parameters it is possible to set limits for the "skip frequency" region. See Figure 8-45.

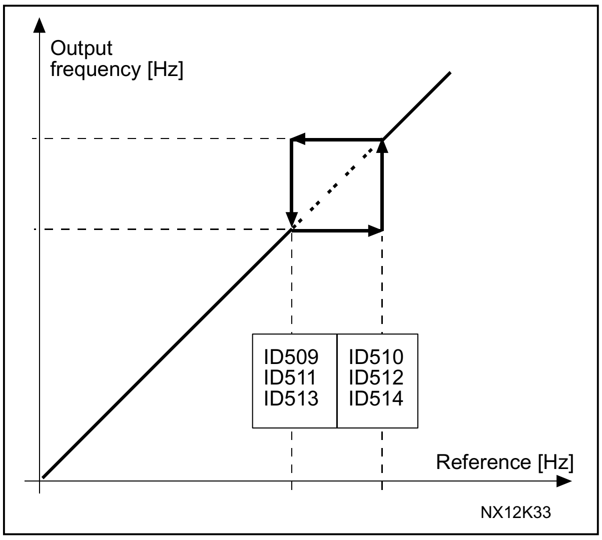


Figure 8-45. Example of prohibit frequency area setting.

515 DC-braking frequency at stop 234567 *(2.4.10)*

The output frequency at which the DC-braking is applied. See Figure 8-45.

516 DC-braking time at start 234567 *(2.4.11)*

DC-brake is activated when the start command is given. This parameter defines the time before the brake is released. After the brake is released, the output frequency increases according to the set start function by parameter ID505.

518 ***Acceleration/deceleration ramp speed scaling ratio between prohibit frequency limits*** ***23457*** *(2.5.3, 2.5.7)*

Defines the acceleration/deceleration time when the output frequency is between the selected prohibit frequency range limits (parameters ID509 and ID510). The ramping speed (selected acceleration/ deceleration time 1 or 2) is multiplied with this factor. E.g. value 0.1 makes the acceleration time 10 times shorter than outside the prohibit frequency range limits.

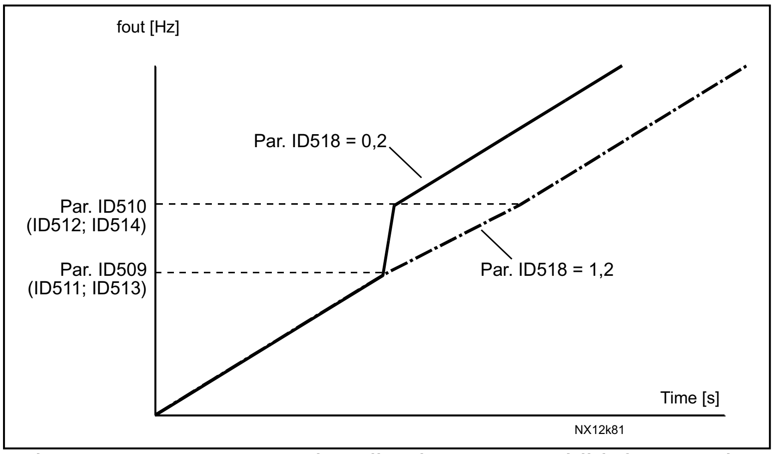


Figure 8-46. Ramp speed scaling between prohibit frequencies

519 ***Flux braking current*** ***234567*** *(2.4.13)*

Defines the flux braking current value. The value setting range depends on the used application.

520 ***Flux brake*** ***234567*** *(2.4.12)*

Instead of DC braking, flux braking is a useful way to raise the braking capacity in cases where additional brake resistors are not needed.
When braking is needed, the frequency is reduced and the flux in the motor is increased, which in turn increases the motor's capability to brake. Unlike DC braking, the motor speed remains controlled during braking.

The flux braking can be set ON or OFF.

0 = Flux braking OFF
1 = Flux braking ON

Note: Flux braking converts the energy into heat at the motor, and should be used intermittently to avoid motor damage.

521 ***Motor control mode 2*** ***6*** *(2.6.12)*

With this parameter you can set another motor control mode. Which mode is used is determined with parameter ID164.
For the selections, see parameter ID600.

***530 Inching reference 1 6** (2.2.7.27)*
***531 Inching reference 2 6** (2.2.7.28)*

These inputs activate the inching reference if inching is enabled. The inputs also start the drive if activated and if there is no Run Request command from anywhere else.
The parameter is available for NXP drives only.

***532 Enable inching 6** (2.2.7.26)*

If you are using the inching function the input value must be TRUE set by a digital signal or by setting the value of the parameter to **0.2**. The parameter is available for NXP drives only.

***533 Inching ramp 6** (2.4.18)*

This parameter defines the acceleration and deceleration times when inching is active.
The parameter is available for NXP drives only.

***600 Motor control mode 234567** (2.6.1)*

NXS:

0 Frequency control: The I/O terminal and keypad references are frequency references and the frequency drive controls the output frequency (output frequency resolution = 0.01 Hz)

1 Speed control: The I/O terminal and keypad references are speed references and the frequency drive controls the motor speed compensating the motor slip (accuracy ± 0,5%).

2 Torque control **(Multi-Purpose Control application only)** In torque control mode, the references are used to control the motor torque.

The following selections are available for NXP drives in applications **2**, **3**, **4**, **5** and **7**.
Selections 5 and 6 are not available in application **6** (Multipurpose Control Application).

3 Speed crtl (closed loop) The I/O terminal and keypad references are speed references and the frequency drive controls the motor speed very accurately comparing the actual speed received from the tachometer to the speed reference (accuracy ±0.01%).

4 Torque crtl (closed loop) The I/O terminal and keypad references are torque references and the frequency drive controls the motor torque.

***601 Switching frequency 234567** (2.6.9)*

Motor noise can be minimised using a high switching frequency. Increasing the switching frequency reduces the capacity of the frequency drive unit.
The range of this parameter depends on the size of the frequency drive:

Type	Min. [kHz]	Max. [kHz]	Default [kHz]
0003—0061 NX_5 0003—0061 NX_2	1.0	16,0	10.0
0072—0520 NX_5	1.0	10.0	3.6
0041—0062 NX_6 0144—0208 NX_6	1.0	6.0	1.5

Table 8-12. Size-dependent switching frequencies

Note! The actual switching frequency might be reduced down to 1,5kHz by thermal management functions. This has to be considered when using sine wave filters or other output filters with a low resonance frequency.

602 Field weakening point ***234567*** *(2.6.4)*

The field weakening point is the output frequency at which the output voltage reaches the set (ID603) maximum value.

603 Voltage at field weakening point ***234567*** *(2.6.5)*

Above the frequency at the field weakening point, the output voltage remains at the set maximum value. Below the frequency at the field weakening point, the output voltage depends on the setting of the U/f curve parameters. See parameters ID109, ID108, ID604 and ID605.
When the parameters ID110 and ID111 (nominal voltage and nominal frequency of the motor) are set, the parameters ID602 and ID603 are automatically given the corresponding values. If you need different values for the field weakening point and the maximum output voltage, change these parameters **after** setting the parameters ID110 and ID111.

604 U/f curve, middle point frequency ***234567*** *(2.6.6)*

If the programmable U/f curve has been selected with parameter ID108 this parameter defines the middle point frequency of the curve. See Figure 8-2.

605 U/f curve, middle point voltage ***234567*** *(2.6.7)*

If the programmable U/f curve has been selected with the parameter ID108 this parameter defines the middle point voltage of the curve. See Figure 8-2.

606 Output voltage at zero frequency ***234567*** *(2.6.8)*

If the programmable U/f curve has been selected with the parameter ID108 this parameter defines the zero frequency voltage of the curve. NOTE: If the value of parameter ID108 is changed this parameter is set to zero.See Figure 8-2.

607 Overvoltage controller ***234567*** *(2.6.10)*

These parameters allow the under-/overvoltage controllers to be switched out of operation. This may be useful, for example, if the mains supply voltage varies more than –15% to +10% and the application will not tolerate this over-/undervoltage. In this case, the regulator controls the output frequency taking the supply fluctuations into account.

0 Controller switched off
1 Controller switched on (no ramping) = Minor adjustments of OP frequency are made
2 Controller switched on (with ramping) = Controller adjusts OP freq. up to max.freq.

608 Undervoltage controller ***234567*** *(2.6.11)*

See par. ID607.
Note: Over-/undervoltage trips may occur when controllers are switched out of operation.

0 Controller switched off
1 Controller switched on (no ramping) = Minor adjustments of OP frequency are made
2 Controller switched on (with ramping) = Controller adjusts OP freq. up to zero speed

609 ***Torque limit*** ***6*** *(2.10.1)*

With this parameter you can set the torque limit control between 0.0 – 300.0 %.

610 ***Torque limit control P-gain*** ***6*** *(2.10.1)*

This parameter defines the gain of the torque limit controller. It is used in Open Loop control mode only.

611 ***Torque limit control I-gain*** ***6*** *(2.10.2)*

This parameter determines the I-gain of the torque limit controller. It is used in Open Loop control mode only.

612 ***CL: Magnetizing current*** ***23456*** *(2.6.4.1, 2.6.27.1)*

Set here the motor magnetizing current (no-load current). See chapter 9.2.

613 ***CL: Speed control P gain*** ***23456*** *(2.6.4.2, 2.6.27.2)*

Sets the gain for the speed controller in % per Hz. See chapter 9.2.

614 ***CL: Speed control I time*** ***23456*** *(2.6.4.3, 2.6.27.3)*

Sets the integral time constant for the speed controller. Increasing the I-time increases stability but lengthens the speed response time. See chapter 9.2.

615 ***CL: Zero speed time at start*** ***23456*** *(2.6.4.9, 2.6.27.9)*

After giving the start command the drive will remain at zero speed for the time defined by this parameter. The ramp will be released to follow the set frequency/speed reference after this time has elapsed from the instant where the command is given. See chapter 9.2.

616 ***CL: Zero speed time at stop*** ***23456*** *(2.6.4.10, 2.6.27.10)*

The drive will remain at zero speed with controllers active for the time defined by this parameter after reaching the zero speed when a stop command is given. This parameter has no effect if the selected stop function (ID506) is *Coasting*. See chapter 9.2.

617 ***CL: Current control P gain*** ***23456*** *(2.6.4.17, 2.6.27.17)*

Sets the gain for the current controller. This controller is active only in closed loop and advanced open loop modes. The controller generates the voltage vector reference to the modulator. See chapter 9.2.

618 ***CL: Encoder filter time*** ***23456*** *(2.6.4.15, 2.6.27.15)*

Sets the filter time constant for speed measurement.
The parameter can be used to eliminate encoder signal noise. Too high a filter time reduces speed control stability. See chapter 9.2.

619 ***CL: Slip adjust*** ***23456*** *(2.6.4.6, 2.6.27.6)*

The motor name plate speed is used to calculate the nominal slip. This value is used to adjust the voltage of motor when loaded. The name plate speed is sometimes a little inaccurate and this parameter can therefore be used to trim the slip. Reducing the slip adjust value increases the motor voltage when the motor is loaded. See chapter 9.2.

620 Load drooping 23456 *(2.6.12, 2.6.15)*

The drooping function enables speed drop as a function of load. This parameter sets that amount corresponding to the nominal torque of the motor.

621 CL: Startup torque 23456 *(2.6.4.11, 2.6.27.11)*

Choose here the startup torque.
Torque Memory is used in crane applications. Startup Torque FWD/REV can be used in other applications to help the speed controller. See chapter 9.2.
0 = Not Used
1 = TorqMemory
2 = Torque Ref
3 = Torq.Fwd/Rev

626 CL: Acceleration compensation 23456 *(2.6.4.5, 2.6.27.5)*

Sets the inertia compensation to improve speed response during acceleration and deceleration. The time is defined as acceleration time to nominal speed with nominal torque. This parameter is active also in advanced open loop mode.

627 CL: Magnetizing current at start 23456 *(2.6.4.7, 2.6.27.7)*

628 CL: Magnetizing time at start 23456 *(2.6.4.8, 2.6.27.8)*

Set here the rise time of magnetizing current.

631 Identification 23456 *(2.6.13, 2.6.16)*

Identification Run is a part of tuning the motor and the drive specific parameters. It is a tool for commissioning and service of the drive with the aim to find as good parameter values as possible for most drives. The automatic motor identification calculates or measures the motor parameters that are needed for optimum motor and speed control.

0 = No action

No identification requested.

1 = Identification without motor run

The drive is run without speed to identify the motor parameters. The motor is supplied with current and voltage but with zero frequency.

2 = Identification with motor run

The drive is run with speed to identify the motor parameters.
Note: It is recommended to do the this identification test with no load on the motor for best results.

3 = Encoder ID run

Identifies the shaft zero position when using PMS motor with absolute encoder.

The basic motor name plate data has to be set correctly before performing the identification run:

ID110 *Nominal voltage of the motor (par. 2.1.6)*
ID111 *Nominal frequency of the motor (par. 2.1.7)*
ID112 *Nominal speed of the motor (par. 2.1.8)*
ID113 *Nominal current of the motor (par. 2.1.9)*
ID120 *Motor cos phi (par. 2.1.10)*

When in closed loop and with an encoder installed, also the parameter for pulses / revolutions (in Menu M7) has to be set.

The automatic identification is activated by setting this parameter to the appropriate value followed by a start command in the requested direction. The start command to the drive has to be given within 20 s. If no start command is given within 20 s the identification run is cancelled and the parameter will be reset to its default setting.

The identification run can be stopped any time with normal stop command and the parameter is reset to its default setting. In case identification run detects fault or other problems, the identification run is completed if possible. After the identification is finished, the application checks the status of the identification and generates fault/ warning if any. During Identification Run, the brake control is disabled (see chapter 9.1).

633 ***CL: Start-up torque, forward*** ***23456*** *(2.6.4.12, 2.6.27.12)*

Sets the start-up torque for forward direction if selected with par. ID621.

634 ***CL: Start-up torque, reverse*** ***23456*** *(2.6.4.13, 2.6.27.13)*

Sets the start-up torque for reverse direction if selected with par. ID621.

636 ***Minimum frequency for Open Loop torque control*** ***6*** *(2.10.7)*

Defines the frequency limit below which the frequency drive operates in *frequency control mode*.
Because of the nominal slip of the motor, the internal torque calculation is inaccurate at low speeds where is it recommended to use the frequency control mode.

637 ***Speed controller P gain, Open Loop*** ***6*** *(2.6.13)*

Defines the P gain for the speed controlled in Open Loop control mode.

638 ***Speed controller I gain, Open Loop*** ***6*** *(2.6.14)*

Defines the I gain for the speed controlled in Open Loop control mode.

639 ***Torque controller P gain*** ***6*** *(2.10.8)*

Defines the P gain of the torque controller.

640 ***Torque controller I gain*** ***6*** *(2.10.9)*

Defines the I gain of the torque controller.

641 Torque reference selection **6** *(2.10.3)*

Defines the source for torque reference.
0 Not used
1 Analogue input 1
2 Analogue input 2
3 Analogue input 3
4 Analogue input 4
5 Analogue input 1 (joystick)
6 Analogue input 2 (joystick)
7 From keypad, parameter R3.5
8 Fieldbus torque reference

642 Torque reference scaling, maximum value **6** *(2.10.4)*
643 Torque reference scaling, minimum value **6** *(2.10.5)*

Scale the custom minimum and maximum levels for analogue inputs within -300,0…300,0%.

644 Torque speed limit, NXS **6** *(2.10.6)*

With this parameter the maximum frequency for the torque control can be selected.

0 Maximum frequency
1 Selected frequency reference
2 Preset speed 7

NXP drives have more selections for this parameter. See page 204.

645 Negative torque limit **6** *(2.6.27.21)*
646 Positive torque limit **6** *(2.6.27.22)*

Defines the torque limit for positive and negative directions.

649 PMS motor shaft position **6** *(2.6.28.4)*

Identified zero shaft position when using absolute encoder for PMS motor.

650 Motor type **6** *(2.6.28.1)*

Select used motor type with this parameter.

0 Induction motor
1 Permanent magnet synchronous motor

654 Enable Rs identification **6** *(2.6.28.5)*

Stator resistance identification at start.

0 No
1 Yes

655 Modulator index limit

This parameter can be used to increase motor voltage in field weakening area.

656 Load drooping time

This function is used in order to achieve a dynamic speed drooping because of changing load. The parameter defines the time during which the speed is restored to the level it was before the load increase.

662 Measured voltage drop 6 *(2.6.29.16)*

The measured voltage drop at stator resistance between two phases with the nominal current of the motor.

665 Ir: Add generator scale 6 *(2.6.29.19)*

Scaling factor for generator side IR-compensation.

667 Ir: Add motoring scale 6 *(2.6.29.20)*

Scaling factor for motoring side IR-compensation.

668 IU Offset 6 *(2.6.29.21)*
669 IV Offset 6 *(2.6.29.22)*
670 IW Offset 6 *(2.6.29.23)*

Offset values for phase current measurement.

Automation and Control Solutions
Honeywell
1985 Douglas Drive North
Golden Valley, MIN 55422

Honeywell Limited-Honeywell Limitée
35 Dynamic Drive
Scarborough, Ontario
MIV 4Z9

700 Response to the 4mA reference fault 234567 (2.7.1)

0 = No response
1 = Warning
2 = Warning, the frequency from 10 seconds back is set as reference
3 = Warning, the Preset Frequency (Par. ID728) is set as reference
4 = Fault, stop mode after fault according to ID506
5 = Fault, stop mode after fault always by coasting
A warning or a fault action and message is generated if the 4…20 mA reference signal is used and the signal falls below 3.5 mA for 5 seconds or below 0.5 mA for 0.5 seconds. The information can also be programmed into digital output DO1 or relay outputs RO1 and RO2.

701 Response to external fault 234567 (2.7.3)

0 = No response
1 = Warning
2 = Fault, stop mode after fault according to ID506
3 = Fault, stop mode after fault always by coasting
A warning or a fault action and message is generated from the external fault signal in the programmable digital inputs DIN3. The information can also be programmed into digital output DO1 and into relay outputs RO1 and RO2.

702 Output phase supervision 234567 (2.7.6)

0 = No response
1 = Warning
2 = Fault, stop mode after fault according to ID506
3 = Fault, stop mode after fault always by coasting
Output phase supervision of the motor ensures that the motor phases have an approximately equal current.

703 Ground fault protection 234567 (2.7.7)

0 = No response
1 = Warning
2 = Fault, stop mode after fault according to ID506
3 = Fault, stop mode after fault always by coasting
Ground fault protection ensures that the sum of the motor phase currents is zero. The overcurrent protection is always working and protects the frequency drive from ground faults with high currents.

704 Motor thermal protection 234567 (2.7.8)

0 = No response
1 = Warning
2 = Fault, stop mode after fault according to ID506
3 = Fault, stop mode after fault always by coasting

If tripping is selected the drive will stop and activate the fault stage.
Deactivating the protection, i.e. setting parameter to **0**, will reset the thermal stage of the motor to 0%. See chapter 9.4.

705 Motor thermal protection: Motor ambient temp. factor 234567 *(2.7.9)*

The factor can be set between -100.0%—100.0%. See chapter 9.4.

706 Motor thermal protection: Motor cooling factor at zero speed 234567 *(2.7.10)*

The current can be set between 0—150.0% x I_{nMotor}. This parameter sets the value for thermal current at zero frequency. See Figure 8-47.

The default value is set assuming that there is no external fan cooling the motor. If an external fan is used this parameter can be set to 90% (or even higher).

Note: The value is set as a percentage of the motor name plate data, par. ID113 (Nominal current of motor), not the drive's nominal output current. The motor's nominal current is the current that the motor can withstand in direct on-line use without being overheated.

If you change the parameter Nominal current of motor, this parameter is automatically restored to the default value.
Setting this parameter does not affect the maximum output current of the drive which is determined by parameter ID107 alone. See chapter 9.4.

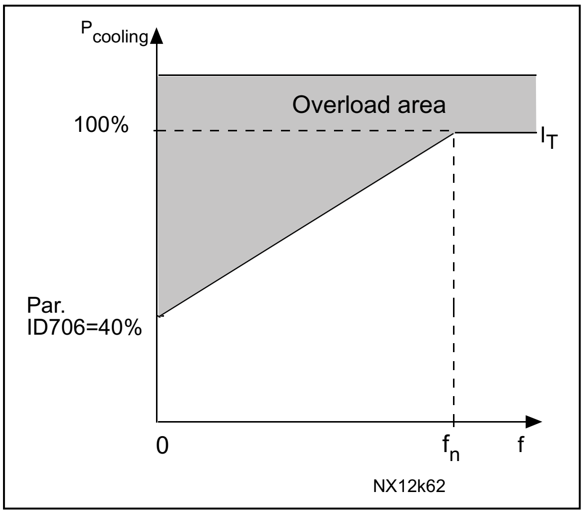


Figure 8-47. Motor thermal current I_T curve

707 Motor thermal protection: Time constant 234567 *(2.7.11)*

This time can be set between 1 and 200 minutes.

This is the thermal time constant of the motor. The bigger the motor, the bigger the time constant. The time constant is the time within which the calculated thermal stage has reached 63% of its final value.

The motor thermal time is specific to the motor design and it varies between different motor manufacturers.

If the motor's t6–time (t6 is the time in seconds the motor can safely operate at six times the rated current) is known (given by the motor manufacturer) the time constant parameter can be set basing on it. As a rule of thumb, the motor thermal time constant in minutes equals to 2xt6. If the drive is in stop stage the time constant is internally increased to three times the set parameter value. The cooling in the stop stage is based on convection and the time constant is increased. See also Figure 8-48.

708 Motor thermal protection: Motor duty cycle 234567 *(2.7.12)*

Defines how much of the nominal motor load is applied.
The value can be set to 0%…100%. See chapter 9.4.

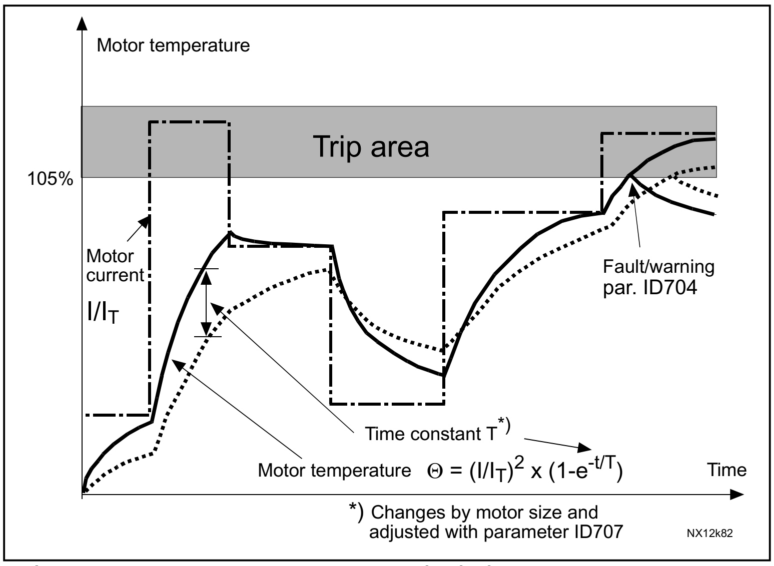


Figure 8-48. Motor temperature calculation

709 Stall protection 234567 *(2.7.13)*

0 = No response
1 = Warning
2 = Fault, stop mode after fault according to ID506
3 = Fault, stop mode after fault always by coasting

Setting the parameter to **0** will deactivate the protection and reset the stall time counter. See chapter 9.5.

710 Stall current limit 234567 *(2.7.14)*

The current can be set to 0.0…2*I_H. For a stall stage to occur, the current must have exceeded this limit. See Figure 8-49. The software does not allow entering a greater value than 2*I_H. If parameter ID107 Nominal current limit of motor is changed, this parameter is automatically calculated to 90% of the current limit. See chapter 9.5.

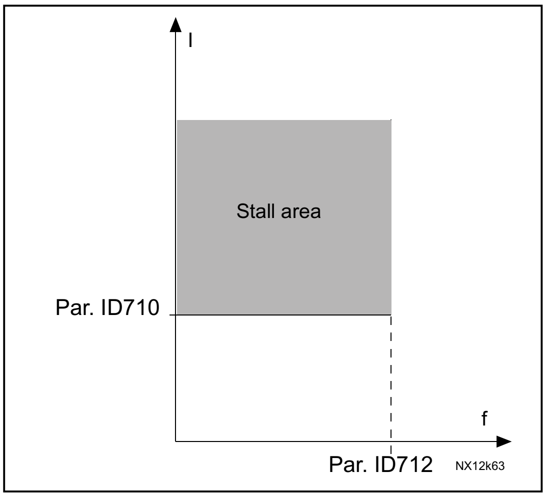


Figure 8-49. Stall characteristics settings

711 Stall time 234567 (2.7.15)

This time can be set between 1.0 and 120.0s.
This is the maximum time allowed for a stall stage. The stall time is counted by an internal up/down counter.
If the stall time counter value goes above this limit the protection will cause a trip (see ID709). See chapter 9.5.

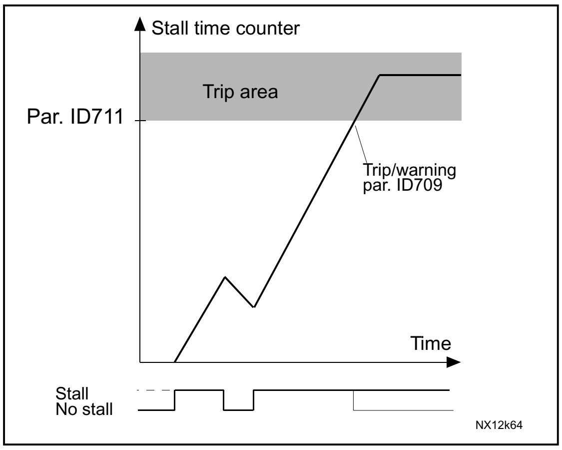


Figure 8-50. Stall time count

712 Stall frequency limit 234567 (2.7.16)

The frequency can be set between 1-f_{max} (ID102).
For a stall state to occur, the output frequency must have remained below this limit. See chapter 9.5.

713 Underload protection 234567 (2.7.17)

0 = No response
1 = Warning
2 = Fault, stop mode after fault according to ID506
3 = Fault, stop mode after fault always by coasting

If tripping is set active the drive will stop and activate the fault stage.
Deactivating the protection by setting the parameter to 0 will reset the underload time counter to zero. See chapter 9.6.

714 Underload protection, field weakening area load 234567 (2.7.18)

The torque limit can be set between 10.0—150.0 % x T_{nMotor}.
This parameter gives the value for the minimum torque allowed when the output frequency is above the field weakening point. See Figure 8-51.

If you change parameter ID113 (Motor nominal current) this parameter is automatically restored to the default value. See chapter 9.6.

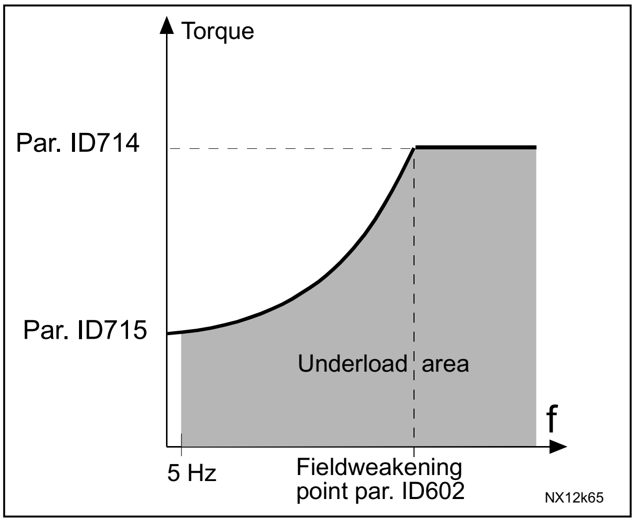


Figure 8-51. Setting of minimum load

715 Underload protection, zero frequency load 234567 (2.7.19)

The torque limit can be set between 5.0—150.0 % x TnMotor.
This parameter gives value for the minimum torque allowed with zero frequency. See Figure 8-51.

If you change the value of parameter ID113 (Motor nominal current) this parameter is automatically restored to the default value. See chapter 9.6.

716 Underload time 234567 (2.7.20)

This time can be set between 2.0 and 600.0 s.
This is the maximum time allowed for an underload state to exist. An internal up/down counter counts the accumulated underload time. If the underload counter value goes above this limit the protection will cause a trip according to parameter ID713). If the drive is stopped the underload counter is reset to zero. See Figure 8-52 and chapter 9.6.

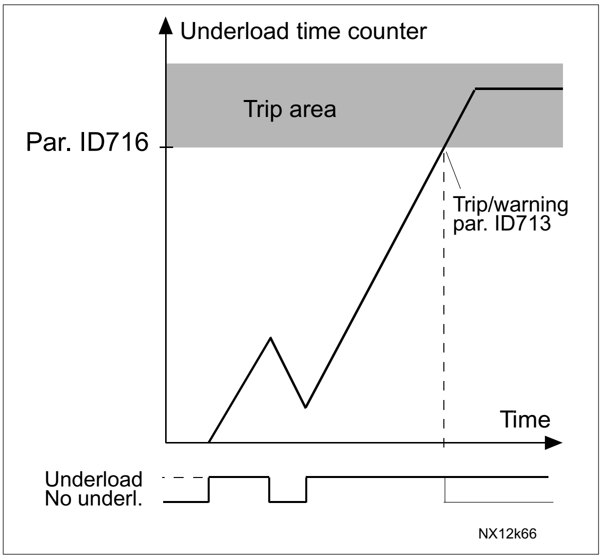


Figure 8-52. Underload time counter function

717 Automatic restart: Wait time 234567 (2.8.1)

Defines the time before the frequency drive tries to automatically restart the motor after the fault has disappeared.

718 Automatic restart: Trial time 234567 (2.8.2)

The Automatic restart function restarts the frequency drive when the faults selected with parameters ID720 to ID725 have disappeared and the waiting time has elapsed.

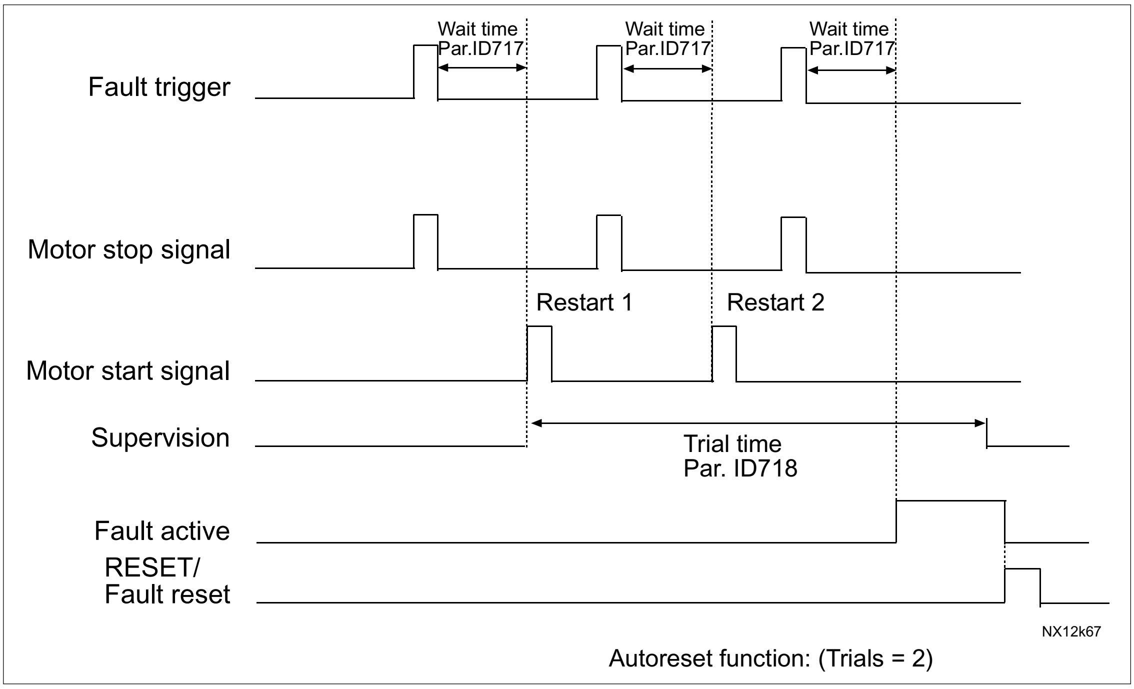


Figure 8-53. Example of Automatic restarts with two restarts

Parameters ID720 to ID725 determine the maximum number of automatic restarts during the trial time set by parameter ID718. The time count starts from the first autorestart. If the number of faults occurring during the trial time exceeds the values of parameters ID720 to ID725 the fault state becomes active. Otherwise the fault is cleared after the trial time has elapsed and the next fault start the trial time count again.

If a single fault remains during the trial time, a fault state is true.

719 Automatic restart: Start function ***234567*** *(2.8.3)*

The Start function for Automatic restart is selected with this parameter. The parameter defines the start mode:

0 = Start with ramp
1 = Flying start
2 = Start according to ID505

720 Automatic restart: Number of tries after undervoltage fault trip ***234567*** *(2.8.4)*

This parameter determines how many automatic restarts can be made during the trial time set by parameter ID718 after and undervoltage trip.

0 = No automatic restart
>0 = Number of automatic restarts after undervoltage fault. The fault is reset and the drive is started automatically after the DC-link voltage has returned to the normal level.

721 ***Automatic restart: Number of tries after overvoltage trip*** ***234567*** *(2.8.5)*

This parameter determines how many automatic restarts can be made during the trial time set by parameter ID718 after an overvoltage trip.

0 = No automatic restart after overvoltage fault trip
>0 = Number of automatic restarts after overvoltage fault trip. The fault is reset and the drive is started automatically after the DC-link voltage has returned to the normal level.

722 ***Automatic restart: Number of tries after overcurrent trip*** ***234567*** *(2.8.6)*

(NOTE! IGBT temp fault also included)
This parameter determines how many automatics restarts can be made during the trial time set by ID718.

0 = No automatic restart after overcurrent fault trip
>0 = Number of automatic restarts after overcurrent trip and IGBT temperature faults.

723 ***Automatic restart: Number of tries after 4mA reference trip*** ***234567*** *(2.8.7)*

This parameter determines how many automatics restarts can be made during the trial time set by ID718.

0 = No automatic restart after reference fault trip
>0 = Number of automatic restarts after the analogue current signal (4…20mA) has returned to the normal level ($\geq$4mA)

725 ***Automatic restart: Number of tries after external fault trip*** ***234567*** *(2.8.9)*

This parameter determines how many automatics restarts can be made during the trial time set by ID718.

0 = No automatic restart after External fault trip
>0 = Number of automatic restarts after External fault trip

726 ***Automatic restart: Number of tries after motor temperature fault trip*** ***234567*** *(2.8.8)*

This parameter determines how many automatics restarts can be made during the trial time set by ID718.

0 = No automatic restart after Motor temperature fault trip
>0 = Number of automatic restarts after the motor temperature has returned to its normal level

727 ***Response to undervoltage fault*** ***234567*** *(2.7.5)*

0 = Fault stored in fault history
1 = Fault not stored in fault history

For the undervoltage limits, see the product's user's manual.

728 ***4mA reference fault: preset frequency reference*** ***234567*** *(2.7.2)*

If the value of parameter ID700 is set to 3 and the 4mA fault occurs then the frequency reference to the motor is the value of this parameter.

730 ***Input phase supervision*** ***234567*** *(2.7.4)*

0 = No response
1 = Warning
2 = Fault, stop mode after fault according to ID506
3 = Fault, stop mode after fault always by coasting

The input phase supervision ensures that the input phases of the frequency drive have an approximately equal current.

731 ***Automatic restart*** ***1*** *(2.20)*

The Automatic restart is taken into use with this parameter.

0 = Disabled
1 = Enabled

The function resets the following faults (max. three times) (see the product's user's manual:

- Overcurrent (F1)
- Overvoltage (F2)
- Undervoltage (F9)
- Frequency drive overtemperature (F14)
- Motor overtemperature (F16)
- Reference fault (F50)

732 ***Response to thermistor fault*** ***234567*** *(2.7.21)*

0 = No response
1 = Warning
2 = Fault, stop mode after fault according to ID506
3 = Fault, stop mode after fault always by coasting

Setting the parameter to **0** will deactivate the protection.

733 ***Response to fieldbus fault*** ***234567*** *(2.7.22)*

Set here the response mode for the fieldbus fault if a fieldbus board is used. For more information, see the respective Fieldbus Board Manual.

See parameter ID732.

734 ***Response to slot fault*** ***234567*** *(2.7.23)*

Set here the response mode for a board slot fault due to missing or broken board.

See parameter ID732.

738 ***Automatic restart: Number of tries after underload fault trip*** *(2.8.10)*

This parameter determines how many automatic restarts can be made during the trial time set by parameter ID718.

0 = No automatic restart after Underload fault trip
>0 = Number of automatic restarts after Underload fault trip

739 ***Number of PT100 inputs in use*** ***567*** *(2.7.24)*

If you have a PT100 input board installed in your frequency drive you can choose here the number of PT100 inputs in use. See also the I/O boards manual.
Note: If the selected value is greater than the actual number of used PT100 inputs, the display will read 200ºC. If the input is short-circuited the displayed value is –30ºC.

740 ***Response to PT100 fault*** ***567*** *(2.7.25)*

0 = No response
1 = Warning
2 = Fault, stop mode after fault according to ID506
3 = Fault, stop mode after fault always by coasting

741 ***PT100 warning limit*** ***567*** *(2.7.26)*

Set here the limit at which the PT100 warning will be activated.

742 ***PT100 fault limit*** ***567*** *(2.7.27)*

Set here the limit at which the PT100 fault (F56) will be activated.

750 ***Cooling monitor*** ***6*** *(2.2.7.23)*

When using a water-cooled drive, connect this input to the *Cooling OK* signal from flow control application. The parameter is available for NXP drives only.

751 ***Cooling fault delay***

The delay after the motor is stopped with coasting after the cooling OK signal is missing.

850 ***Fieldbus reference minimum scaling*** ***6*** *(2.9.1)*
851 ***Fieldbus reference maximum scaling*** ***6*** *(2.9.2)*

Use these two parameters to scale the fieldbus reference signal.
Setting value limits: 0 ≤ par. ID850 ≤ ID851 ≤ ID102. If par. ID851 = 0 custom scaling is not used and the minimum and maximum frequencies are used for scaling.
The scaling takes place as presented in Figure 8-10. See also chapter 9.7.

Note: Using this custom scaling function also affects the scaling of the actual value.

852 to 859 ***Fieldbus data out selections 1 to 8*** ***6*** *(2.9.3 to 2.9.10)*

Using these parameters, you can monitor any monitoring or parameter value from the fieldbus. Enter the ID number of the item you wish to monitor for the value of these parameters. See chapter 9.7.

Some typical values:

1	Output frequency	15	Digital inputs 1,2,3 statuses
2	Motor speed	16	Digital inputs 4,5,6 statuses
3	Motor current	17	Digital and relay output statuses
4	Motor torque	25	Frequency reference
5	Motor power	26	Analogue output current
6	Motor voltage	27	AI3
7	DC link voltage	28	AI4
8	Unit temperature	31	AO1 (expander board)
9	Motor temperature	32	AO2 (expander board)
13	AI1	37	Active fault 1
14	AI2	45	Motor current (drive independent) given with one decimal point

Table 8-13.

876 to 883 ***Fieldbus data IN selections 1 to 8***

Using these parameters, you can control any monitoring or parameter value from the fieldbus. Enter the ID number of the item you wish to control for the value of these parameters.

1001 Number of auxiliary drives ***7*** *(2.9.1)*

With this parameter the number of auxiliary drives in use will be defined. The functions controlling the auxiliary drives (parameters ID458 to ID462) can be programmed to relay outputs or digital output. By default, one auxiliary drive is in use and it is programmed to relay output RO1 at B.1.

1002 Start frequency, auxiliary drive 1 ***7*** *(2.9.2)*

The frequency of the drive controlled by the frequency drive must exceed the limit defined with these parameters with 1 Hz before the auxiliary drive is started. The 1 Hz overdraft makes a hysteresis to avoid unnecessary starts and stops. See Figure 8-54. See also parameters ID101 and ID102, page 122.

1003 Stop frequency, auxiliary drive 1 ***7*** *(2.9.3)*

The frequency of the drive controlled by the frequency drive must fall with 1Hz below the limit defined with these parameters before the auxiliary drive is stopped. The stop frequency limit also defines the frequency to which the frequency of the drive controlled by the frequency drive is dropped after starting the auxiliary drive. See Figure 8-54.

1004 Start frequency, auxiliary drive 2 ***7*** *(2.9.4)*
1005 Stop frequency, auxiliary drive 2 ***7*** *(2.9.5)*
1006 Start frequency, auxiliary drive 3 ***7*** *(2.9.6)*
1007 Stop frequency, auxiliary drive 3 ***7*** *(2.9.7)*
1008 Start frequency, auxiliary drive 4 ***7*** *(2.9.8)*
1009 Stop frequency, auxiliary drive 4 ***7*** *(2.9.9)*

See ID's 1002 and 1003.

1010 Start delay of auxiliary drives ***7*** *(2.9.10)*

The frequency of the drive controlled by the frequency drive must remain above the start frequency of the auxiliary drive for the time defined with this parameter before the auxiliary drive is started. The delay defined applies to all auxiliary drives. This prevents unnecessary starts caused by momentary start limit exceedings. See Figure 8-54.

1011 Stop delay of auxiliary drives ***7*** *(2.9.11)*

The frequency of the drive controlled by the frequency drive must remain below the stop limit of the auxiliary drive for the time defined with this parameter before the drive is stopped. The delay defined applies to all auxiliary drives. This prevents unnecessary stops caused by momentary falls below the stop limit. See Figure 8-54.

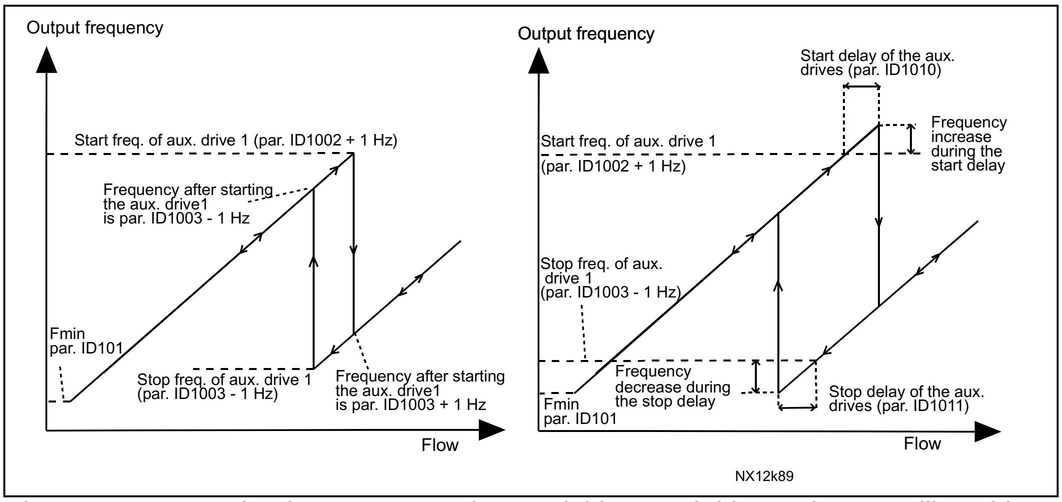


Figure 8-54. Example of parameter setting; Variable speed drive and one auxiliary drive

1012	***Reference step after start of auxiliary drive 1***	***7***	*(2.9.12)*
1013	***Reference step after start of auxiliary drive 2***	***7***	*(2.9.13)*
1014	***Reference step after start of auxiliary drive 3***	***7***	*(2.9.14)*
1015	***Reference step after start of auxiliary drive 4***	***7***	*(2.9.15)*

The reference step will be automatically added to the reference value always when the corresponding auxiliary drive is started. With the reference steps e.g. the pressure loss in the piping caused by the increased flow can be compensated. See Figure 8-55.

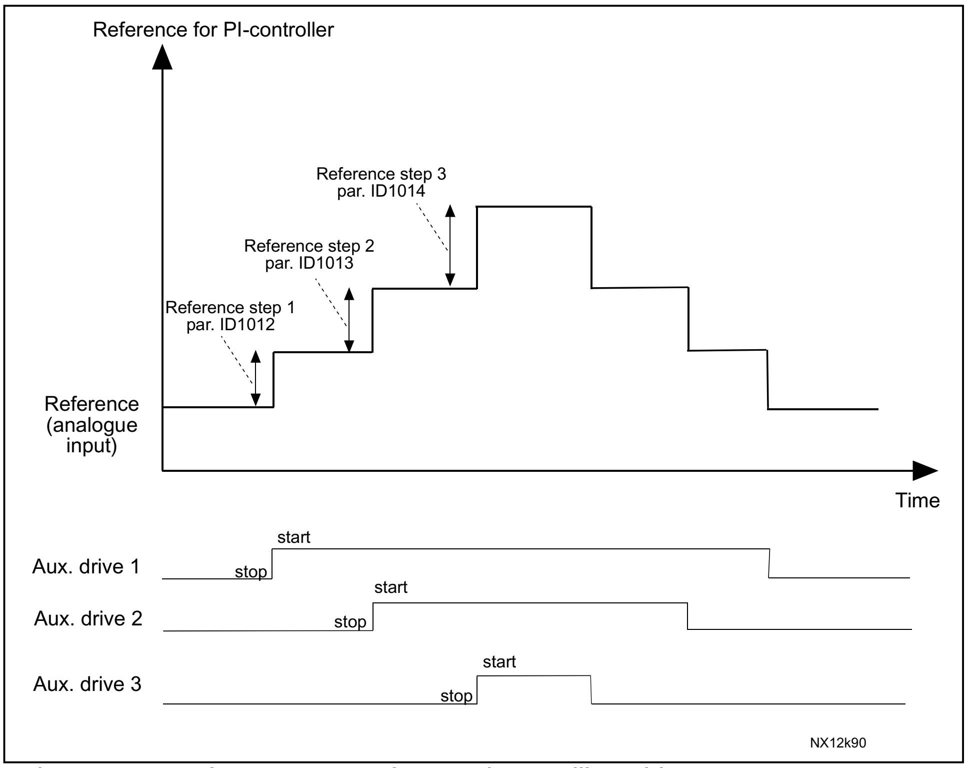


Figure 8-55. Reference steps after starting auxiliary drives

1016 Sleep frequency 57 *(2.1.15)*

The frequency drive is stopped automatically if the frequency of the drive falls below the S*leep level* defined with this parameter for a time greater than that determined by parameter ID1017. During the Stop state, the PID controller is operating switching the frequency drive to Run state when the actual value signal either falls below or exceeds (see par. ID1019) the *Wake-up level* determined by parameter ID1018. See Figure 8-56.

1017 Sleep delay 57 *(2.1.16)*

The minimum amount of time the frequency has to remain below the Sleep level before the frequency drive is stopped. See Figure 8-56.

1018 Wake-up level 57 *(2.1.17)*

The wake-up level defines the level below which the actual value must fall or which has to be exceeded before the Run state of the frequency drive is restored. See Figure 8-56.

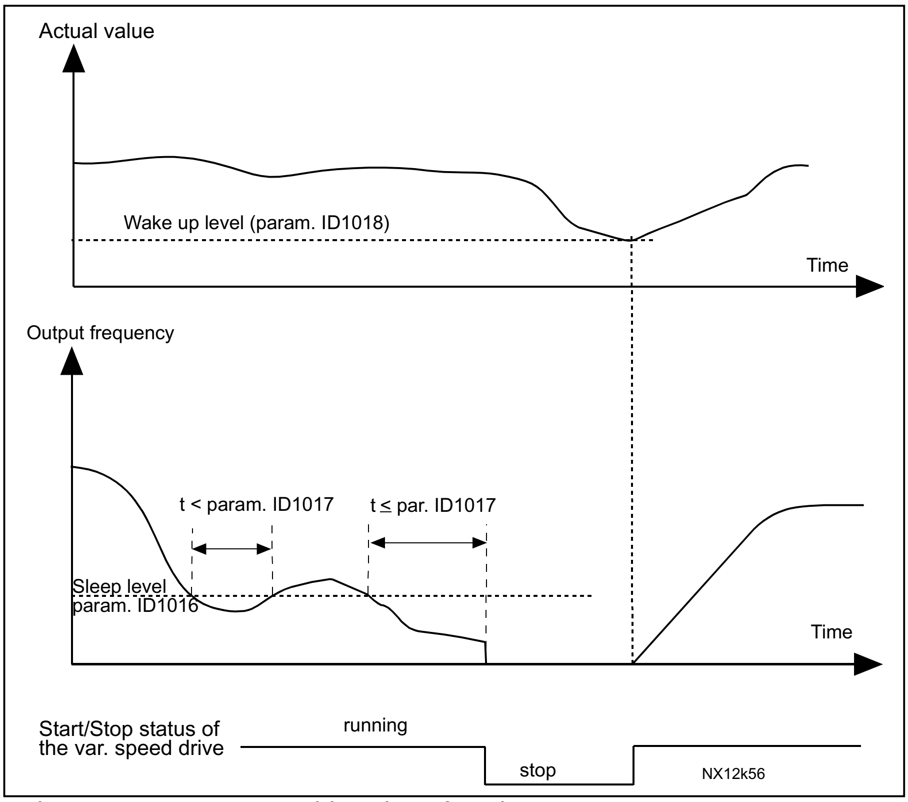
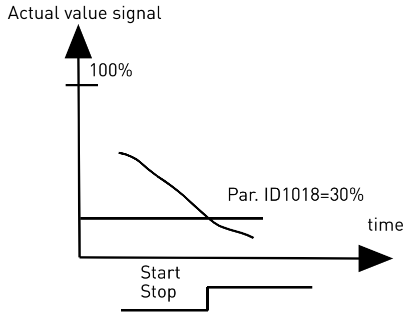
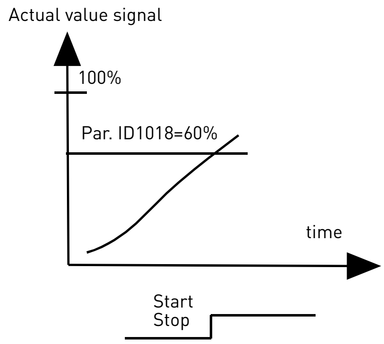
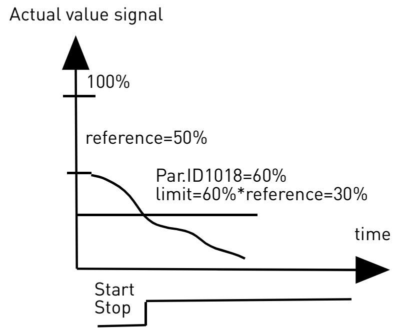
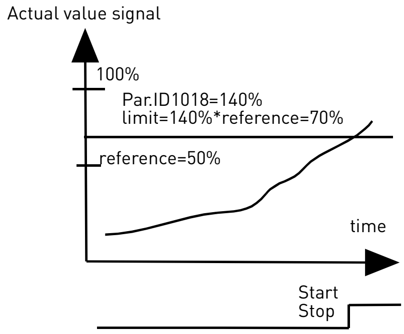


Figure 8-56. Frequency drive sleep function

1019 Wake-up function 57 *(2.1.18)*

This parameter defines whether the restoration of the Run state occurs when the actual value signal falls below or exceeds the *Wake-up level* (par. ID1018). See Figure 8-56 and Figure 8-57 on page 193.

The application 5 has selections **0-1** and application 7 selections **0-3** available.

Par. value	Function	Limit	Description
0	Wake-up happens when actual value goes below the limit	The limit defined with parameter ID1018 is in percent of the maximum actual value	
1	Wake-up happens when actual value exceeds the limit	The limit defined with parameter ID1018 is in percent of the maximum actual value	
2	Wake up happens when actual value goes below the limit	The limit defined with parameter ID1018 is in percent of the current value of the reference signal	
3	Wake up happens when actual value exceeds the limit	The limit defined with parameter ID1018 is in percent of the current value of the reference signal	

NX12k88.fh8

Figure 8-57. Selectable wake-up functions

1020 PID controller bypass 7 *(2.9.16)*

With this parameter, the PID controller can be programmed to be bypassed. Then the frequency of the controlled drive and the starting points of the auxiliary drives are defined according to the actual value signal. See Figure 8-58.

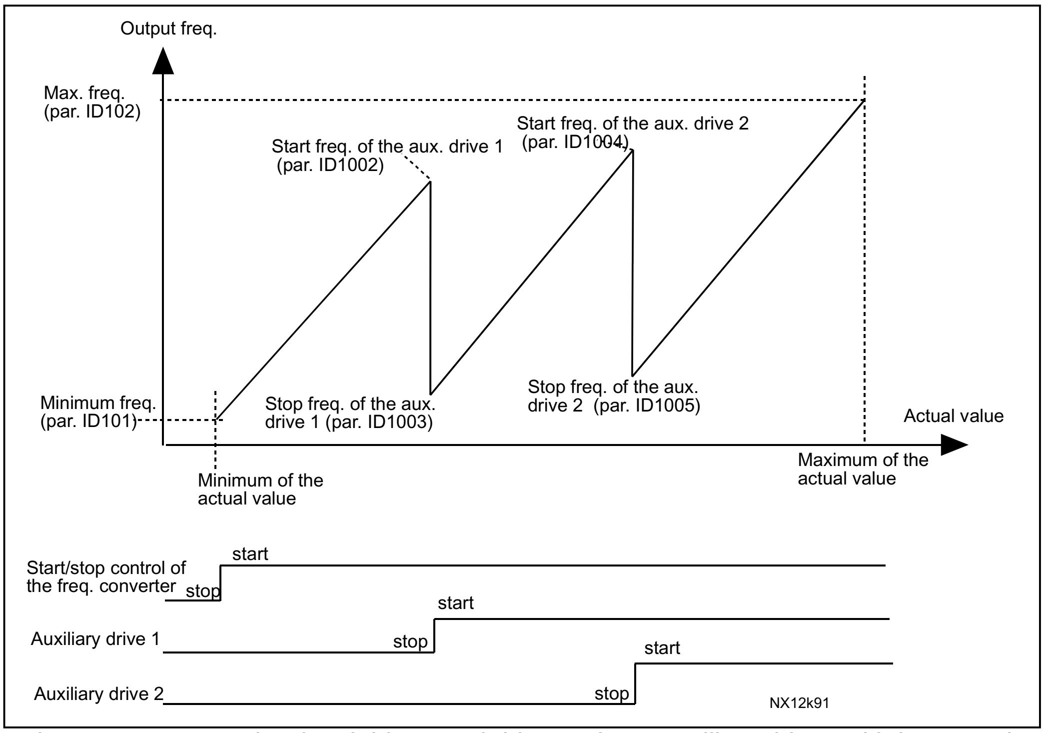


Figure 8-58. Example of variable speed drive and two auxiliary drives with bypassed PID controller

1021 Analogue input selection for input pressure measurement 7 *(2.9.17)*
1022 Input pressure high limit 7 *(2.9.18)*
1023 Input pressure low limit 7 *(2.9.19)*
1024 Output pressure drop value 7 *(2.9.20)*

In pressure increase stations there may be need for decreasing the output pressure if the input pressure decreases below a certain limit. The input pressure measurement which is needed is connected to the analogue input selected with parameter ID1021. See Figure 8-59.

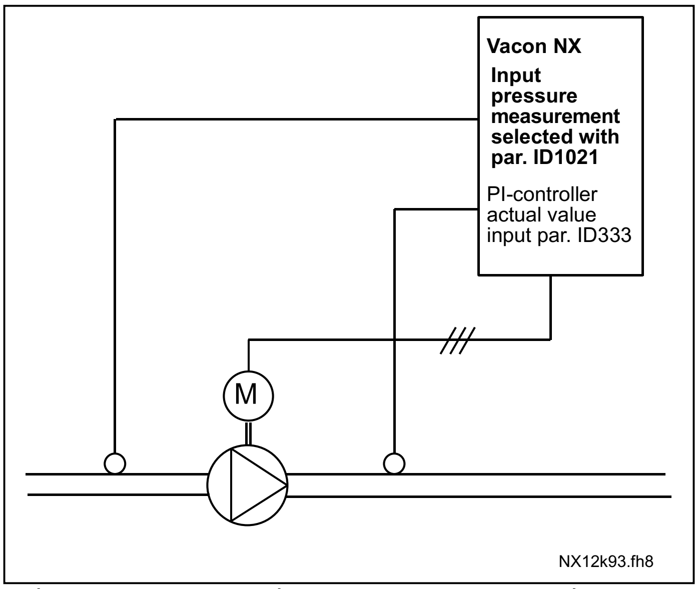


Figure 8-59. Input and output pressure measuring

With parameters ID1022 and ID1023 the limits for the area of the input pressure, where the output pressure is decreased, can be selected. The values are in percent of the input pressure measurement maximum value. With parameter ID1024 the value for the output pressure decrease within this area can be set. The value is in percent of the reference value maximum. See Figure 8-60.

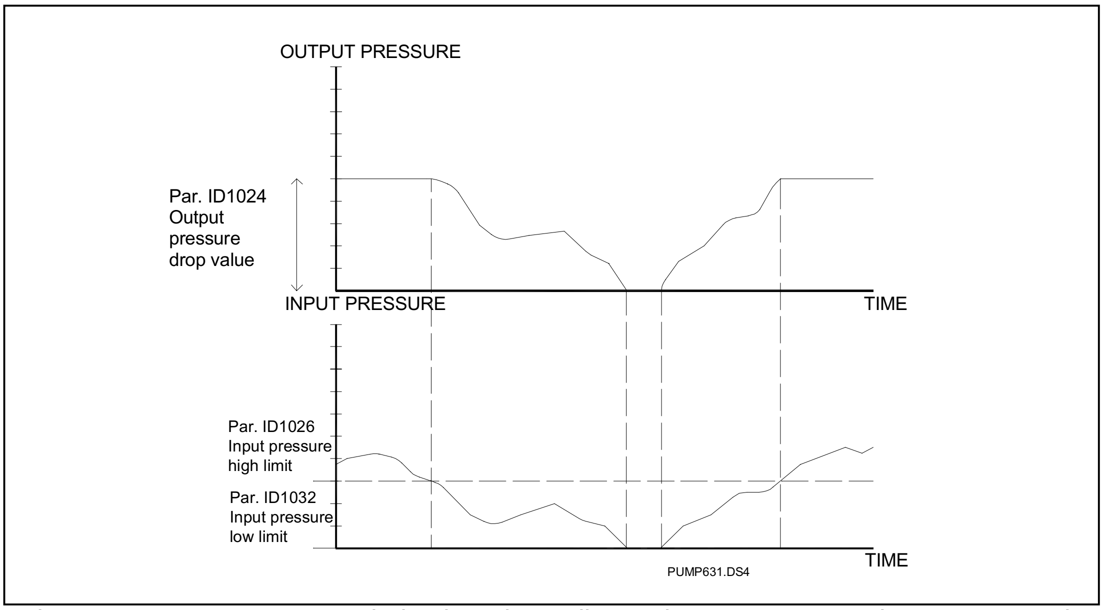


Figure 8-60. Output pressure behaviour depending on input pressure and parameter settings

1025 Frequency drop delay after starting auxiliary drive 7 *(2.9.21)*
1026 Frequency increase delay after stopping auxiliary drive 7 *(2.9.22)*

If the speed of auxiliary drive increases slowly (e.g. in soft starter control) then a delay between the start of auxiliary drive and the frequency drop of the variable speed drive will make the control smoother. This delay can be adjusted with parameter ID1025.
In the same way, if the speed of the auxiliary drives decreases slowly a delay between the auxiliary drive stop and the frequency increase of the variable speed drive can be programmed with parameter ID1026. See Figure 8-61.
If either of the values of parameters ID1025 and ID1026 is set to maximum (300,0 s) no frequency drop nor increase takes place.

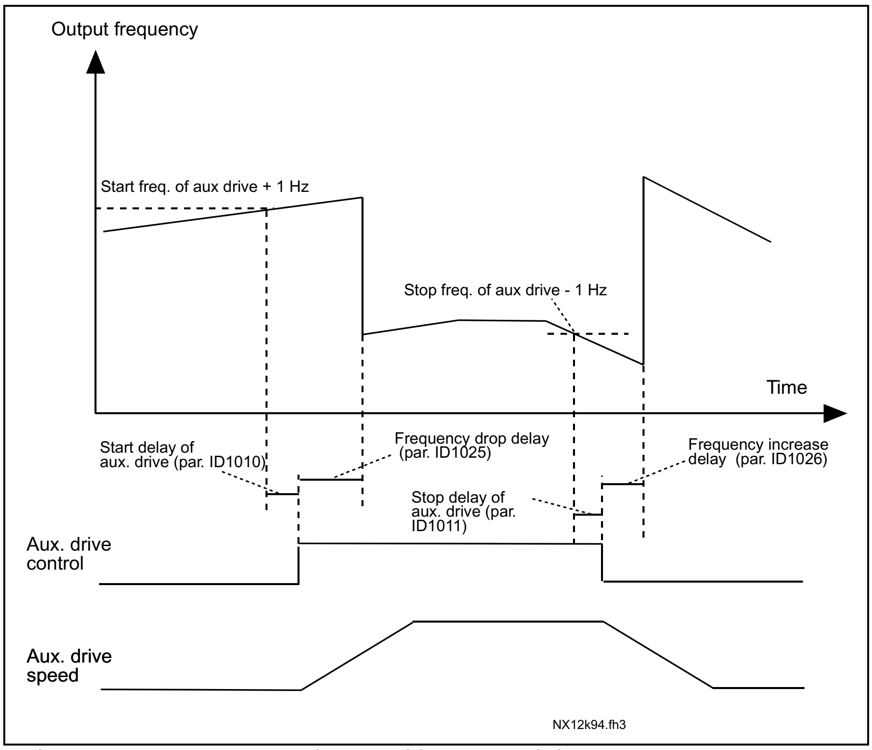


Figure 8-61. Frequency drop and increase delays

1027 Autochange 7 *(2.9.24)*

0 Autochange not used
1 Autochange used

1028 Autochange/interlocks automatics selection 7 *(2.9.25)*

0 Automatics (autochange/interlockings) applied to auxiliary drives only

The drive controlled by the frequency drive remains the same. Only the mains contactor is needed for each drive. See Figure 8-62.

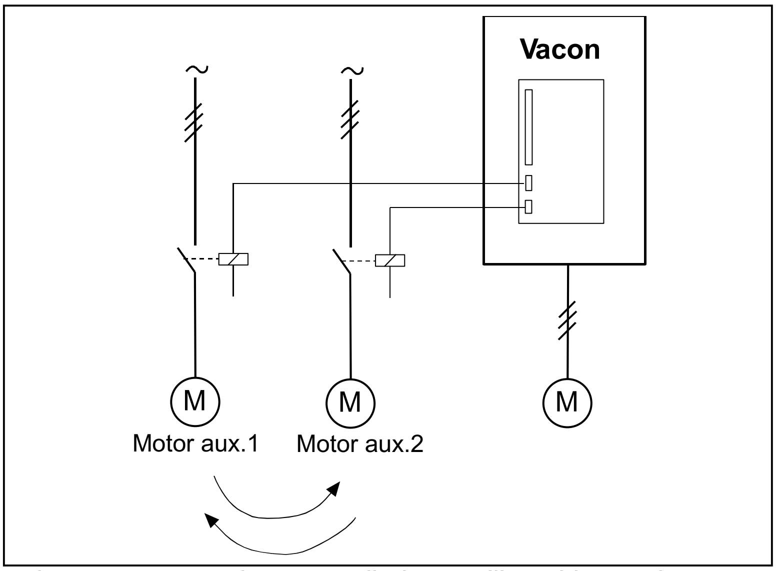


Figure 8-62. Autochange applied to auxiliary drives only.

1 All drives included in the autochange/interlockings sequence

The drive controlled by the frequency drive is included in the automatics and two contactors are needed for each drive to connect it to the mains or the frequency drive. See Figure 8-63.

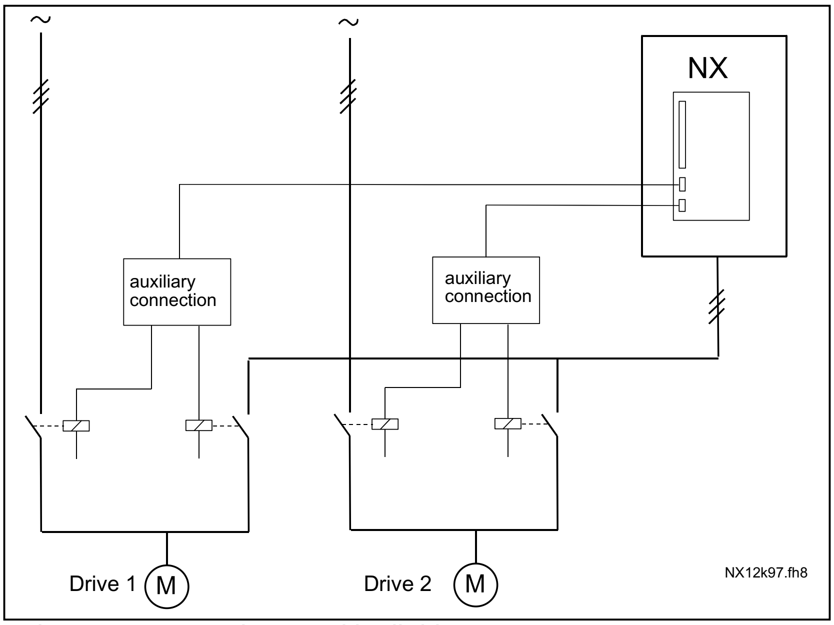


Figure 8-63. Autochange with all drives

***1029 Autochange interval 7** (2.9.26)*

After the expiry of the time defined with this parameter, the autochange function takes place if the capacity used lies below the level defined with parameters ID1031 (*Autochange frequency limit*) and ID1030 (*Maximum number of auxiliary drives*). Should the capacity exceed the value of ID1031, the autochange will not take place before the capacity goes below this limit.

- The time count is activated only if the Start/Stop request is active.
- The time count is reset after the autochange has taken place.

See Figure 8-64.

***1030 Maximum number of auxiliary drives 7** (2.9.27)*
***1031 Autochange frequency limit 7** (2.9.28)*

These parameters define the level below which the capacity used must remain so that the autochange can take place.

This level is defined as follows:

- If the number of running auxiliary drives is smaller than the value of parameter ID1030 the autochange function can take place.

- If the number of running auxiliary drives is equal to the value of parameter ID1030 and the frequency of the controlled drive is below the value of parameter ID1031 the autochange can take place.

- If the value of parameter ID1031 is 0.0 Hz, the autochange can take place only in rest position (Stop and Sleep) regardless of the value of parameter ID1030.

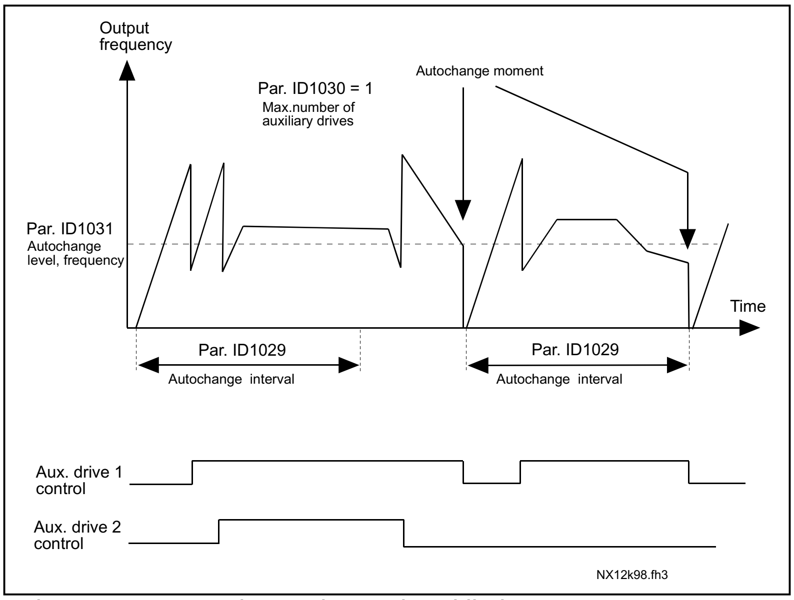


Figure 8-64. Autochange interval and limits

1032 Interlock selection ***7*** *(2.9.23)*

With this parameter you can activate or deactivate the feedback signal from the drives. The interlock feedback signals come from the switches that connect the motors to the automatic control (frequency drive), directly to the mains or place them to off-state. The interlock feedback functions are connected to the digital inputs of the frequency drive. Program parameters ID426 to ID430 to connect the feedback functions to the digital inputs. Each drive must be connected to its own interlock input. The Pump and fan control controls only those motors whose interlock input is active.

0 Interlock feedback not used

The frequency drive receives no interlock feedback from the drives

1 Update of autochange order in Stop

The frequency drive receives interlock feedback from the drives. In case one of the drives is, for some reason, disconnected from the system and eventually re-connected, it will be placed last in the autochange line without stopping the system. However, if the autochange order now becomes, for example, [P1 → P3 → P4 → P2], it will be updated in the next Stop (autochange, sleep, stop, etc.)

Example:
[P1 → P3 → P4] → [P2 LOCKED] → [P1 → P3 → P4 → P2] → [SLEEP] → [P1 → P2 → P3 → P4]

2 Update of order immediately

The frequency drive receives interlock feedback from the drives. At re-connection of a drive to the autochange line, the automatics will stop all motors immediately and re-start with a new set-up.

Example:
[P1 → P2 → P4] → [P3 LOCKED] → [STOP] → [P1 → P2 → P3 → P4]

1033 Actual value special display minimum ***57*** *(2.2.46, 2.9.29)*
1034 Actual value special display maximum ***57*** *(2.2.47, 2.9.30)*
1035 Actual value special display decimals ***57*** *(2.2.48, 2.9.31)*
1036 Actual value special display unit ***57*** *(2.2.49, 2.9.32)*

The *Actual value special display* parameters are used to convert and display the actual value signal in a form more informative to the user.

The Actual value special display parameters are available in *PID Control Application* and *Pump and Fan Control Application:*

Example:
The actual value signal sent from a sensor (in mA) tells you the amount of waste water pumped from a tank per second. The signal range is 0(4)…20mA. Instead of receiving the level of the actual value signal (in mA) on the display, you wish to receive the amount of water pumped in m^3/s. You then set a value for par. ID1033 to correspond to the minimum signal level (0/4 mA) and another value for par. ID1034 to correspond to the maximum signal level (20 mA). The number of decimals needed can be set with par. ID1035 and the unit (m^3/s) with par. ID1036. The level of the actual value signal is then scaled between the set min and max values and displayed in the selected unit.

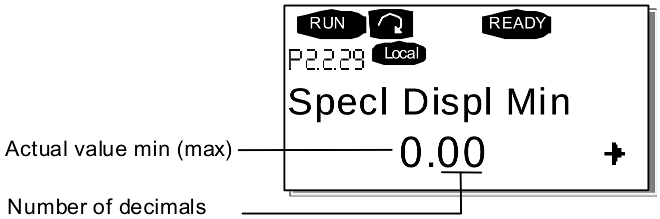
The following units can be selected (par. ID1036):

Value	Unit	On keypad
0	Not Used	
1	%	%
2	°C	°C
3	m	m
4	bar	bar
5	mbar	mbar
6	Pa	Pa
7	kPa	kPa
8	PSI	PSI
9	m / s	m/s
10	l / s	l/s
11	l / min	l/m
12	l / h	l/h
13	m3 /s	m3/s
14	m3 /min	m3/m

Value	Unit	On keypad
15	m3 /h	m3/h
16	°F	°F
17	ft	ft
18	gal / s	GPS
19	gal / min	GPM
20	gal / h	GPH
21	ft3 / s	CFS
22	ft3 / min	CFM
23	ft3 / h	CFH
24	A	A
25	V	V
26	W	W
27	kW	kW
28	Hp	Hp

Table 8-14. Selectable values for Actual Value Special Display

NOTE: The maximum number of characters that can be shown on keypad is 4. This means that in some cases the display of the unit on the keypad does not comply with the standards.



1080 ***DC-Brake Current at stop*** ***6*** *(2.4.15)*

Defines the current injected to the motor in stop state when parameter ID416 is active. The parameter is available for NXP drives only.

1081 ***Follower reference selection*** ***6*** *(2.11.3)*

Select the speed reference for the follower drive.

1082 ***SystemBus communication fault response*** ***6*** *(2.7.30)*

Defines the action when SystemBus heartbeat is missing.

0 = No response
1 = Warning
2 = Fault, stop mode after fault according to ID506
3 = Fault, stop mode after fault always by coasting

1083 Follower torque reference selection 6 (2.11.4)

Select the torque reference for the follower drive.

1084 Control options 6 (2.4.22)

These parameter functions depend on the Advance application version. The parameter is available for NXP drives only.

b0=Disables encoder fault
b1=Update Ramp Generator when MotorControlMode changes from TC (4) to SC (3)
b2=RampUp; use acceleration ramp
b3=RampDown; use deceleration ramp
b4=FollowActual; follow actual speed value within WindowPos/NegWidth
b5=TC ForceRampStop; Under stop request the speed limit forces the motor to stop

1085 Brake On/Off current limit 6 (2.3.4.16)

If motor current falls below this value the brake is closed immediately.
This parameter is available for NXP drives only.

1087 Scaling of generating torque limit 6 (2.2.6.6)

0 = Parameter
1 = AI1
2 = AI2
3 = AI3
4 = AI4
5 = FB limit scaling

This signal will adjust the maximum motor generating torque between 0 and max. limit set with parameter ID1288. This parameter is available for NXP drives only.

1088 Scaling of generating power limit 6 (2.2.6.8)

0 Parameter
1 AI1
2 AI2
3 AI3
4 AI4
5 FB limit scaling

This signal will adjust the maximum motor generating power between 0 and max. limit set with parameter ID1290. This parameter is available for NXP drives only.

1089 Follower stop function 6 (2.11.2)

Defines how the follower drive stops.

0 Coasting, follower remains in control even if master has stopped at fault
1 Ramping, follower remains in control even if master has stopped at fault
2 As master; follower behaves as master

1090 Reset encoder counter 6 (2.2.7.29)

Resets the monitoring values Shaft Angle and Shaft Rotations to zero.
The parameter is available for NXP drives only.

1092 Master Follower mode 2 6 (2.2.7.31)

Select the digital input to activate the second Master Follower mode selected by parameter ID1093. The parameter is available for NXP drives only.

1093 Master Follower mode 2 selection 6 *(2.11.7)*

Select Master Follower mode 2 that is used when the DI is activated. When *Follower* is selected the Run Request command is monitored from Master and all other references are selectable by parameters.

0 = Single Drive
1 = Master
2 = Follower
3 = Current master
4 = Current follower

1209 Input switch acknowledgement 6 *(2.2.7.32)*

Select the digital input to acknowledge the status of the input switch. The input switch is normally a switch fuse unit or main contactor with which the power is fed to the drive. If the input switch acknowledgement is missing, the drive trips at *Input switch open* fault (F64). The parameter is available for NXP drives only.

1210 External brake acknowledgement 6 *(2.2.7.24)*

If no acknowledgement is received within given time the drive will generate a brake fault. The parameter is available for NXP drives only.

1213 Emergency stop 6 *(2.2.7.30)*

Select the digital input to activate the emergency stop input to the drive. When the digital input is down the drive stops as per the parameter definition of ID1276 Emergency stop mode. The parameter is available for NXP drives only.

1218 DC ready pulse 6 *(2.3.3.29)*

Charge DC. Used to charge the inverter drive through OEVA type of input switch. When the DC link voltage is above the charging level a 2-second pulse train is generated to close the input switch. The pulse train is OFF when the input switch acknowledgement goes high. The parameter is available for NXP drives only.

1239 Inching reference 1 6 *(2.4.16)*
1240 Inching reference 2 6 *(2.4.17)*

These parameters define the frequency reference when inching is activated.
The parameter is available for NXP drives only.

1241 Speed share 6 *(2.11.5)*

Defines the percentage for final speed reference from received speed reference.

1244 Torque reference filtering time6 *(2.10.10)*

1248 Load share 6 *(2.11.6)*

Defines the percentage for final torque reference from received torque reference.

1250 Flux reference 6 *(2.6.27.32)*

Defines how much magnetization current will be used.

1252 Speed step 6 *(2.6.19.23, 2.6.29.24)*

NCDrive parameter to help adjusting the speed controller.

1253 Torque step 6 *(2.6.19.24, 2.6.29.25)*

NCDrive parameter to help adjusting the torque controller.

1276 ***Emergency stop mode*** **6** *(2.4.21)*

Defines the action after the IO emergency input goes low. The parameter is available for NXP drives only.

0 Coasting stop
1 Ramping stop

1278 ***Torque speed limit, Closed Loop*** **6** *(2.10.6)*

With this parameter the maximum frequency for the torque control can be selected.

0 Closed Loop speed control
1 Positive and negative frequency limit
2 Ramp generator output (-/+)
3 Negative frequency limit – Ramp generator output
4 Ramp generator output – Positive frequency limit
5 Ramp generator output with window
6 0 – Ramp generator output
7 Ramp generator output with window and On/Off limits

For the selection of this parameter in NXS drives, see page 178.

1285 ***Positive frequency limit*** **6** *(2.6.20)*

Maximum frequency limit for the drive. The parameter is available for NXP drives only.

1286 ***Negative frequency limit*** **6** *(2.6.19)*

Minimum frequency limit for the drive. The parameter is available for NXP drives only.

1287 ***Motoring torque limit*** **6** *(2.6.22)*

Defines the maximum motoring side torque limit. The parameter is available for NXP drives only.

1288 ***Generator torque limit*** **6** *(2.6.21)*

Defines the maximum generating side torque limit. The parameter is available for NXP drives only.

1289 ***Motoring power limit*** **6** *(2.6.27.20)*

Defines the maximum motoring side power limit.

1290 ***Generator power limit*** **6** *(2.6.27.19)*

Defines the maximum generating side power limit.

1316 ***Brake fault response*** ***6*** *(2.7.28)*

Defines the action when a brake fault is detected.

1317 ***Brake fault delays*** ***6*** *(2.7.29)*

The delay before the brake fault is activated. Used when there is mechanical delay in the brake.

1324 ***Master/Follower selection*** ***6*** *(2.11.1)*

Select Master/Follower mode. When the value *Follower* is selected the Run Request command is monitored from Master. All other references are selectable by parameters.

0 = Single Drive
1 = Master
2 = Follower
3 = Current master
4 = Current follower

1352 ***SystemBus fault delay*** ***6*** *(2.7.31)*

Defines the delays for the fault generation when heartbeat is missing.

1355 to
1369 ***Flux 10…150%*** ***6*** *(2.6.29.1 – 2.6.29.15)*

Motor voltage corresponding to 10%….150% of flux as a percentage of nominal flux voltage.

1382 ***Speed control output limit*** ***6*** *(2.10.15)*

The maximum torque limit for the speed controller output as a percentage of the motor nominal torque.

1401 ***Stop state flux*** ***6*** *(2.6.27.24)*

The amount of flux as a percentage of the motor nominal flux maintained in the motor after the drive is stopped. The flux is maintained for the time set by parameter ID1402. This parameter can be used in closed loop motor control mode only.

1402 ***Flux off delay*** ***6*** *(2.6.27.23)*

The flux defined by parameter ID1401 is maintained in the motor for the set time after the drive is stopped.

0 No flux after the motor is stopped.
>0 The flux off delay in seconds.
<0 The flux is maintained in the motor after stop until the next Run request is given to the drive.

1412 ***Torque stabilator gain*** ***6*** *(2.6.28.6)*

Additional gain for the torque stabilator at zero frequency.

1413 ***Torque stabilator damping*** ***6*** *(2.6.28.7)*

This parameter defines the time constant for the torque stabilator. The greater the parameter value, the shorter the time constant.

1414 ***Torque stabilator gain FWP*** ***6*** *(2.6.28.8)*

The general gain for the torque stabilatorx`.

1420 ***Prevention of startup*** ***6*** *(2.2.7.25)*

This parameter is enabled when the “Prevention of start” circuit is used to inhibit the gate pulses. The parameter is available for NXP drives only.

1424 ***Restart delay*** ***6*** *(2.6.17)*

The delay time within which the drive can not be restarted after the coast stop. The time can be set up to 60.000 seconds. The parameter is available for NXP drives only.

8.1 Speed control parameters (application 6 only)

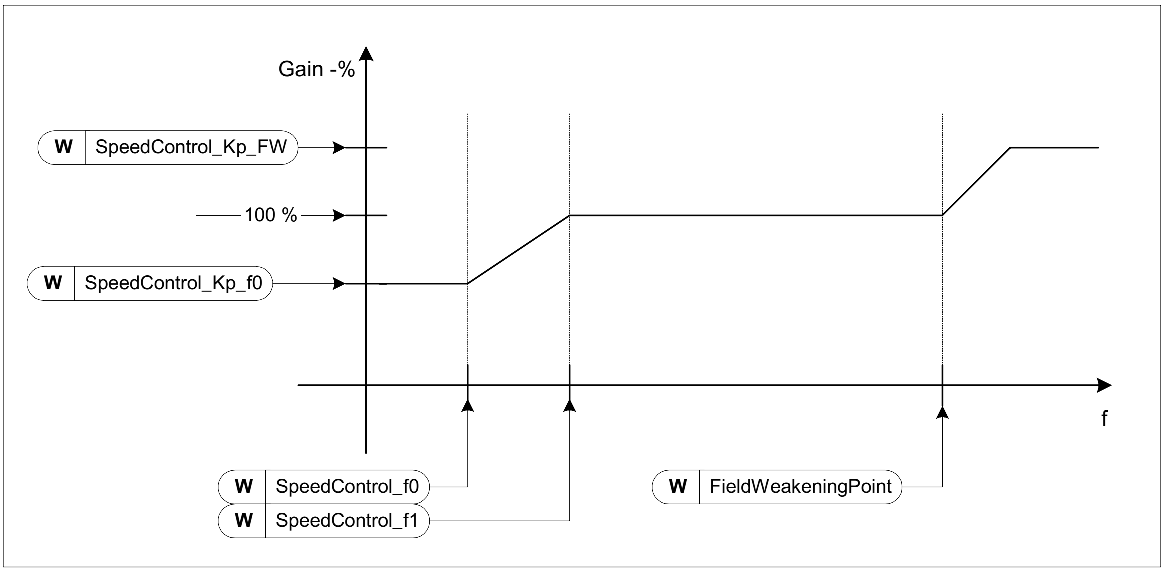


Figure 8-65 Speed Controller adaptive gain

1295 Speed controller torque minimum gain 6 *(2.6.27.30)*

The relative gain as a percentage of ID613 of the speed controller when the torque reference or the speed control output is less than the value of par. ID1296. This parameter is normally used to stabilise the speed controller for a drive system with gear backlash.

1296 Speed controller torque minimum 6 *(2.6.27.29)*

The level of torque reference below which the speed controller gain is changed from ID613 to ID1295 . This is in percentage of motor nominal torque. The change is filtered according to par. ID1297.

1297 Speed controller torque minimum filtering time 6 *(2.6.27.31)*

The filter time in ms used when the speed controller gain is changed from ID613 to ID1295.

1298 Speed controller gain in field weakening area 6 *(2.6.27.28)*

The relative gain of the speed controller in the field weakening area as a percentage of par. ID613.

1299 Speed controller gain f0 6 *(2.6.27.27)*

The relative gain of the speed controller as a percentage of par. ID613 when the speed is below the level defined by ID1300.

1300 ***Speed controller f0 point*** ***6*** *(2.6.27.26)*

The speed level in Hz below which the speed controller gain is equal to par. ID1299.

1301 ***Speed controller f1 point*** ***6*** *(2.6.27.25)*

The speed level in Hz above which the speed controller gain is equal to par. ID613. From the speed defined by par. ID1300 to speed defined by par. ID1301, the speed controller gain changes linearly from par. ID1299 to ID613 and vice versa.

1304 ***Window positive*** ***6*** *(2.10.12)*

Defines size of window to positive direction.

1305 ***Window negative*** ***6*** *(2.10.11)*

Defines size of window to negative direction.

1306 ***Window positive Off limit*** ***6*** *(2.10.14)*

Defines speed controller positive off limit when the speed controller brings speed back to window.

1307 ***Window negative Off limit*** ***6*** *(2.10.13)*

Defines speed controller negative off limit when the speed controller brings speed back to window.

1311 ***Speed error filter PC*** ***6*** *(2.6.27.33)*

Filter time constant for speed reference and actual speed error.

Automation and Control Solutions
Honeywell
1985 Douglas Drive North
Golden Valley, MIN 55422

Honeywell Limited-Honeywell Limitée
35 Dynamic Drive
Scarborough, Ontario
MIV 4Z9

8.2 Keypad control parameters

Unlike the parameters listed above, these parameters are located in the **M3** menu of the control keypad. The reference parameters do not have an ID number.

114 ***Stop button activated*** *(3.4, 3.6)*

If you wish to make the Stop button a "hotspot" which always stops the drive regardless of the selected control place, give this parameter the value **1**.
See also parameter ID125.

125 ***Control Place*** *(3.1)*

The active control place can be changed with this parameter. For more information, see the product's user's manual.
Pushing the *Start button* for 3 seconds selects the control keypad as the active control place and copies the Run status information (Run/Stop, direction and reference).

123 ***Keypad Direction*** *(3.3)*

0 Forward: The rotation of the motor is forward, when the keypad is the active control place.
1 Reverse: The rotation of the motor is reversed, when the keypad is the active control place.

For more information, see the product's user's manual.

R3.2 ***Keypad Reference*** *(3.2)*

The frequency reference can be adjusted from the keypad with this parameter.
The output frequency can be copied as the keypad reference by pushing the *Stop button* for 3 seconds when you are on any of the pages of menu ***M3***. For more information, see the product's user's manual.

R3.4 ***PID reference 1 57*** *(3.4)*

The PID controller keypad reference can be set between 0% and 100%. This reference value is the active PID reference if parameter ID332 = 2.

R3.5 ***PID reference 2 57*** *(3.5)*

The PID controller keypad reference 2 can be set between 0% and 100%. This reference is active if the DIN5 function=13 and the DIN5 contact is closed.

R3.5 ***Torque reference*** ***6*** *(3.5)*

Define here the torque reference within 0.0…100.0%.

9. APPENDICES

In this chapter you will find additional information on special parameter groups. Such groups are:

- *Parameters of External brake control with additional limits (Chapter 9.1)*
- *Closed Loop parameters (Chapter 9.2)*
- *Advanced Open Loop parameters (Chapter 9.3)*
- *Parameters of Motor thermal protection (Chapter 9.4)*
- *Parameters of Stall protection (Chapter 9.5)*
- *Parameters of Underload protection (Chapter 9.6)*
- *Fieldbus control parameters (Chapter 9.7)*

9.1 External brake control with additional limits (ID's 315, 316, 346 to 349, 352, 353)

The external brake used for additional braking can be controlled through parameters ID315, ID316, ID346 to ID349 and ID352/ID353. Selecting On/Off Control for the brake, defining the frequency or torque limit(s) the brake should react to and defining the Brake-On/-Off delays will allow an effective brake control. See Figure 9-1.

Note: During Identification Run (see par. ID631), brake control is disabled.

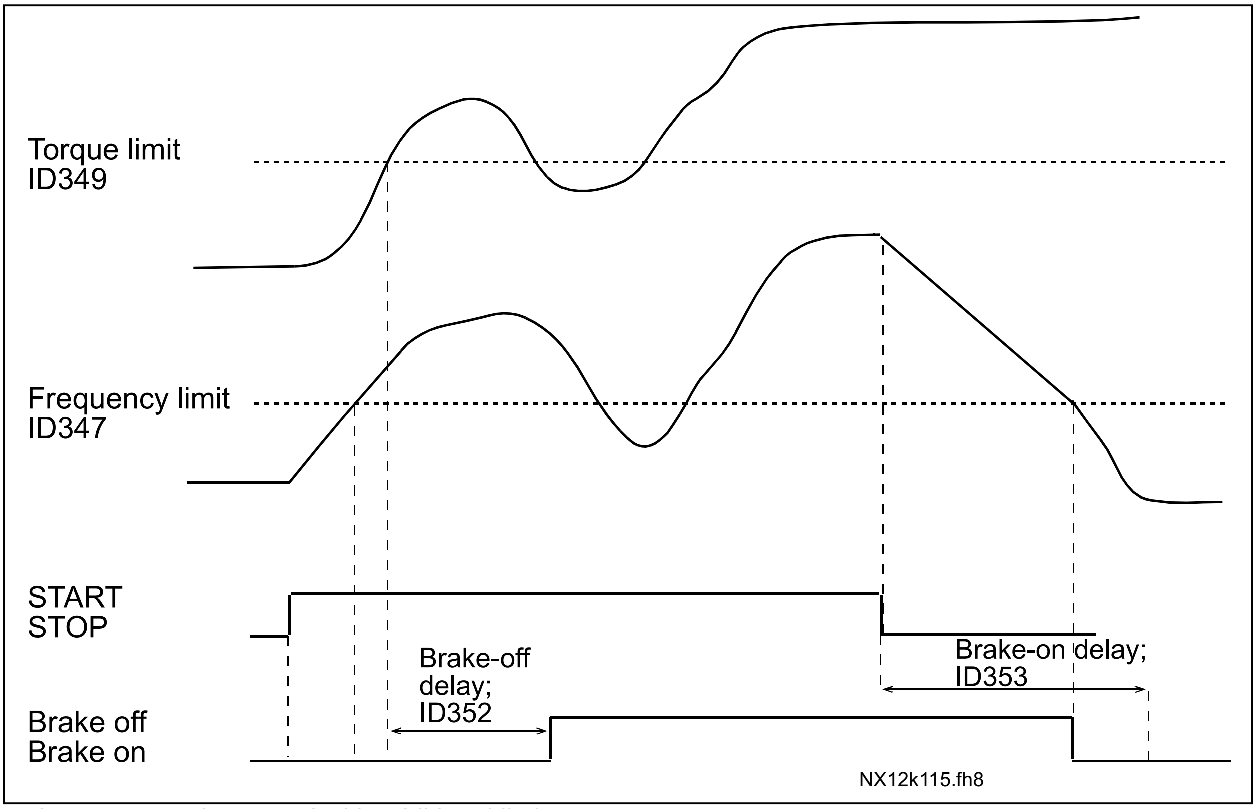


Figure 9-1. Brake control with additional limits

In Figure 9-1 above, the brake control is set to react to both the torque supervision limit (par. ID349) and frequency supervision limit (ID347). Additionally, the same frequency limit is used for both brake-off and brake-on control by giving parameter ID346 the value **4**. Use of two different frequency limits is also possible. Then parameters ID315 and ID346 must be given the value **3**.

Brake-off: In order for the brake to release, three conditions must be fulfilled: 1) the drive must be in Run state, 2) the torque must be over the set limit (if used) and 3) the output frequency must be over the set limit (if used).
Brake-on: Stop command activates the brake delay count and the brake is closed when the output frequency falls below the set limit (ID315 or ID346). As a precaution, the brake closes when the brake-on delay expires, at the latest.

Note: A fault or Stop state will close the brake immediately without a delay.

See Figure 9-2.

It is strongly advisable that the brake-on delay be set longer than the ramp time in order to avoid damaging of the brake.

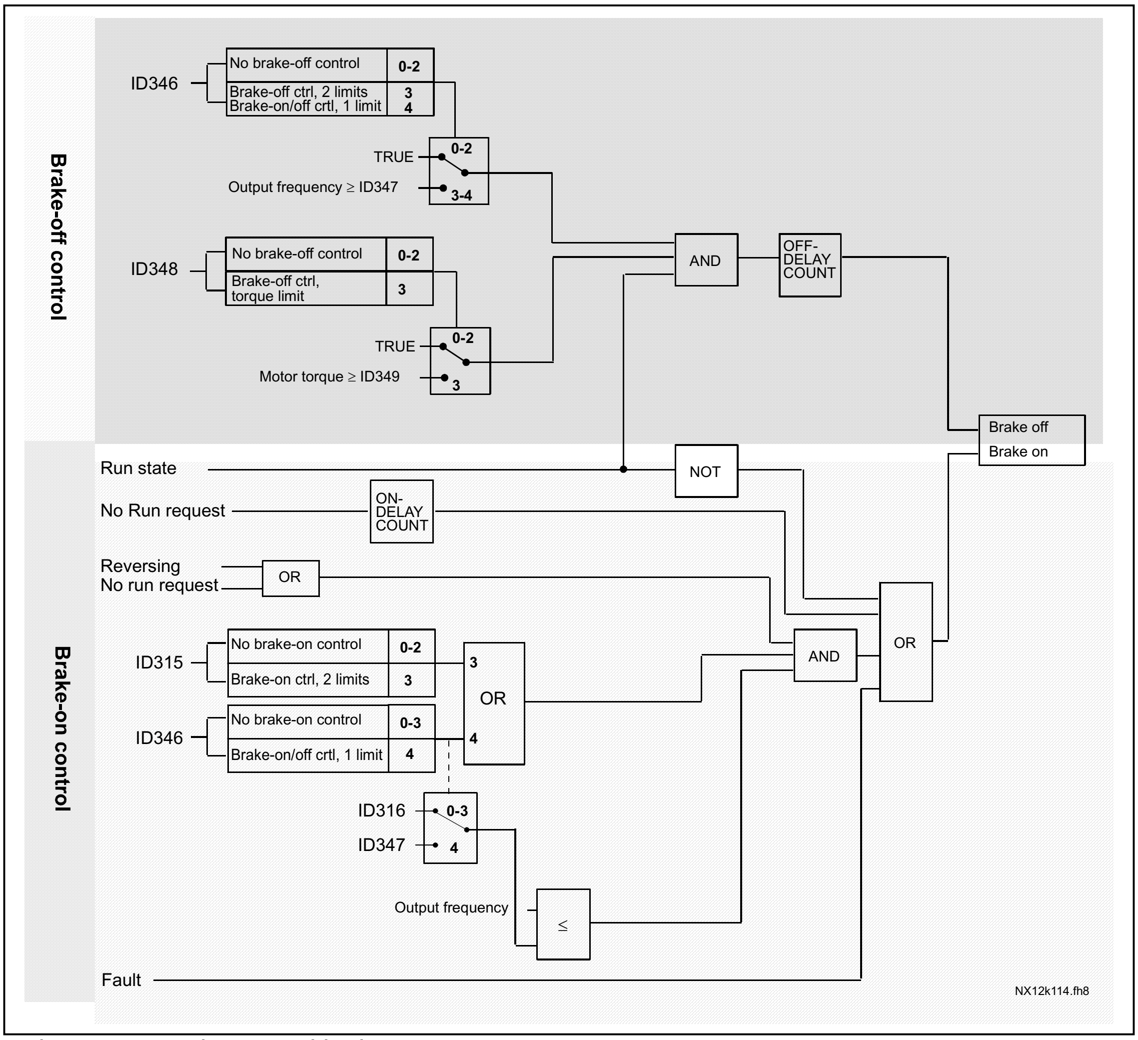


Figure 9-2. Brake control logic

When using the Master Follower function, the follower drive will open the brake at the same time with the Master even if the Follower's conditions for brake opening have not been met.

9.2 Closed loop parameters (ID’s 612 to 621)

Select the Closed loop control mode by setting value **3** or **4** for parameter ID600.
Closed loop control mode (see page 173) is used when enhanced performance near zero speed and better static speed accuracy with higher speeds are needed. Closed loop control mode is based on "rotor flux oriented current vector control". With this controlling principle, the phase currents are divided into a torque producing current portion and a magnetizing current portion. Thus, the squirrel cage induction machine can be controlled in a fashion of a separately excited DC motor.

Note: These parameters can be used with NXP drive only.

EXAMPLE:

Motor Control Mode = 3 (Closed loop speed control)

This is the usual operation mode when fast response times, high accuracy or controlled run at zero frequencies are needed. Encoder board should be connected to slot C of the control unit. Set the encoder P/R-parameter (P7.3.1.1). Run in open loop and check the encoder speed and direction (V7.3.2.2). Change the direction parameter (P7.3.1.2) or switch the phases of motor cables if necessary. Do not run if encoder speed is wrong. Program the no-load current to parameter ID612 and set parameter ID619 (Slip Adjust) to get the voltage slightly above the linear U/f-curve with the motor frequency at about 66% of the nominal motor frequency. The Motor Nominal Speed parameter (ID112) is critical. The Current Limit parameter (ID107) controls the available torque linearly in relative to motor nominal current.

9.3 Advanced Open Loop parameters (ID's 622 to 625, 632, 635)

Select the Advanced Open Loop control mode by setting value **5** or **6** for parameter ID600 (not available in applications 1 and 6).
The Advanced Open Loop control mode finds similar implementations as the Closed Loop control mode above. However, the control accuracy of the Closed Loop control mode is higher than that of the Advanced Open Loop control mode.

EXAMPLE:

Motor Control Mode = 5 Frequency control (Advanced open loop) and 6 Speed control (Advanced open loop)

The motor is running at current vector control at low frequencies. At frequencies above the frequency limit, the motor is in frequency control. The default current value is 120% at zero frequency. Use linear U/f-curve (ID108). 120% starting torque should now be possible. Sometimes increasing the frequency limit (ID635) will improve the run. The Frequency limit is the critical point. Increase the zero frequency point to get enough current at frequency limit.

9.4 Parameters of motor thermal protection (ID's 704 to 708):

General

The motor thermal protection is to protect the motor from overheating. The NX drive is capable of supplying higher than nominal current to the motor. If the load requires this high current there is a risk that the motor will be thermally overloaded. This is the case especially at low frequencies. At low frequencies the cooling effect of the motor is reduced as well as its capacity. If the motor is equipped with an external fan the load reduction at low speeds is small.

The motor thermal protection is based on a calculated model and it uses the output current of the drive to determine the load on the motor.

The motor thermal protection can be adjusted with parameters. The thermal current I_T specifies the load current above which the motor is overloaded. This current limit is a function of the output frequency.

The thermal stage of the motor can be monitored on the control keypad display. See the product's user's manual.

!	CAUTION! *The calculated model does not protect the motor if the airflow to the motor is reduced by blocked air intake grill.*

9.5 Parameters of Stall protection (ID's 709 to 712):

General

The motor stall protection protects the motor from short time overload situations such as one caused by a stalled shaft. The reaction time of the stall protection can be set shorter than that of motor thermal protection. The stall state is defined with two parameters, ID710 (Stall current) and ID712 (Stall frequency limit). If the current is higher than the set limit and output frequency is lower than the set limit, the stall state is true. There is actually no real indication of the shaft rotation. Stall protection is a type of overcurrent protection.

9.6 Parameters of Underload protection (ID's 713 to 716):

General

The purpose of the motor underload protection is to ensure that there is load on the motor when the drive is running. If the motor loses its load there might be a problem in the process, e.g. a broken belt or a dry pump.
Motor underload protection can be adjusted by setting the underload curve with parameters ID714 (Field weakening area load) and ID715 (Zero frequency load), see below. The underload curve is a squared curve set between the zero frequency and the field weakening point. The protection is not active below 5Hz (the underload time counter is stopped).

The torque values for setting the underload curve are set in percentage which refers to the nominal torque of the motor. The motor's name plate data, parameter motor nominal current and the drive's nominal current I_H are used to find the scaling ratio for the internal torque value. If other than nominal motor is used with the drive, the accuracy of the torque calculation decreases.

9.7 Fieldbus control parameters (ID's 850 to 859)

The Fieldbus control parameters are used when the frequency or the speed reference comes from the fieldbus (Modbus, Profibus, DeviceNet etc.). With the Fieldbus Data Out Selection 1…8 you can monitor values from the fieldbus.

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