Honeywell

Honeywell NX Series Frequency Converters

The Drive for all Applications.

Honeywell NX-Series

Contents

NX Series – the Drive for all Applications

The Honeywell NX Series drives have been built on the principles of software and hard-ware modularity. The power unit utilises the most sophisticated semiconductor technology, with highly modular construction that can be adapted to a customer's specific requirements. Typical power options include input and output filters, brake resistors together with IP21 (NEMA1) and IP54 (NEMA12) enclosure types.

Two types of control units are available - The standard sensor-less vector control unit, which has performance that is usually sufficient for most applications. The closed loop vector control unit, which has servo type performance for more demanding applications - e.g. - cranes, lifts, multiple synchronised drives.

The input and output I/O configuration is comprised of option cards, each with its own 'identity & personality'. The control module is designed to accept a total of five of these cards. The cards contain not only normal analogue and digital inputs/ outputs but also various fieldbus and additional application specific hardware. The modular and robust design, combined with powerful software support for creation of IEC 61131-3 compatible applications, make the NX Series an ideal solution for even the most demanding applications. Furthermore, the wide temperature range, multi-lingual control panel, high reliability and flexibility makes the NX Series, the drive for all applications.

For end users

For the end user, the NX Series offers a range of new application capabilities and possibilities for reducing the stock and spares to a minimum. The NX is compatible with its predecessor, the CX Series, therefore drawings, installation and training material can be easily utilised. In addition, a wide selection of option cards offers new possibilities for reconfiguring the drive to future requirements. The wide voltage range, high overload capacity, and a user-friendly alphanumeric control panel, make the choice of the correct drive very easy.

For OEM customers

For the OEM customer the modular construction and wide selection of option cards make the NX Series a drive that can easily be incorporated into almost any machine. The versatile block-programming tool allows the NX Series to be programmed to replace a PLC and therefore significantly simplify the machine control. The servo performance of the NXP, the simplicity of the NXS and the compatible application software for both, makes the choice easy.

For system designers

The flexible I/O configuration and the high dynamic performance of the NX Series, can fully be exploited when used in various system applications. Typically, these include drives used in the paper, metal and textile industries. The NX Series can be configured to operate via several different Fieldbuses simultaneously, making it easy to communicate with a variety of control systems. The powerful control unit can be used for local control tasks, thus freeing the control system for overall control tasks.

Advanced Features

NXS

The NX Series is built on many years of experience in designing and manufacturing reliable, robust drives.
The robust design of the CX Series is synonymous with reliability.
The NX Series, builds on the reputation of the CX Series i.e same high level of immunity to electromagnetic interference.

The NX Series has two different control units, the NXS with a standard open loop sensorless vector control software, sufficient for the majority of applications, and the NXP with a high-performance closed loop control software for more demanding applications.
Both control units incorporate the same application packages, control panels, I/O cards and can connect to the same PC tools package.

The major features of the NX Series include:

- Continuous runtime self-supervision and alarm system, for enhanced reliability and safety
- Control logic can be powered from an external auxiliary supply, maintaining power to the control panel, internal drive functions and fieldbuses
- Integrated AC choke for maximum protection and minimum harmonics
- Each drive tested at maximum temperature and load prior to shipment
- A brake resistor can be incorporated in all drives below 72 A for rapid machine deceleration without tripping
- Integrated RFI filter - industrial level
- Unsurpassed flexibility in communication via multiple concurrent fieldbuses
- Very flexible I/O configuration
- Multilingual control display
- Multi Application software package pre-installed
- Wide selection of additional application software available
- NC1131-3 Engineering tool to write ‘bespoke’ applications
- Versatile PC tools for loading, adjusting and comparing parameters
- Parameter transfers between drives and applications
- Slim, space-saving “bookshelf” design
- Side-by-side installation
- Super Cooling technology
- Integral RFI filter for 1st environment, restricted distribution (household, light industry) as well as 2nd environment (industry)
- Now available at 380...500 V, up to 110 kW (150 Hp)

Advanced Features

NXS

Applications
The standard drive is normally supplied with the following pre-engineered applications:

1 Basic
2 Standard
3 Local/Remote Control
4 Multi-step Speed Control
5 PID Control
6 Multi-purpose Control
7 Pump and Fan Control with Autochange

Several tailor-made special-purpose applications are also available, such as for lifts, cranes or winders etc. All applications are compatible with those of the CX Series.

User-friendly
- Simple to operate
- Comprehensive manuals available in most common languages
- All the applications have a minimum number of parameters
- Multilingual control panel, similar operation for all power ratings
- Smart preset parameters: in most cases just enter the motor ratings, the NX does the rest
- Simple quick connect control terminals
- Wide variety of I/O cards to suit different applications
- RS232C port for connection to PC

Advanced Motor Control

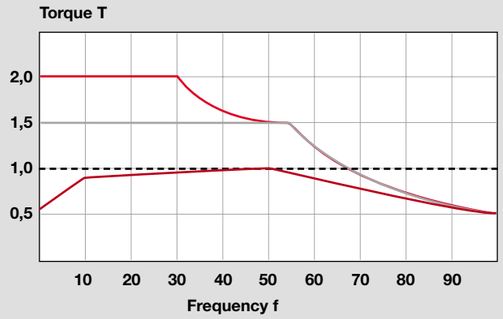
NXS

At the core of the NXS is the sensorless vector control technology, coupled with an adaptive motor model and a sophisticated ASIC.
The motor flux model is based on the measurement of all three output phase currents and the voltage level obtained from the ASIC. The model automatically identifies motor parameters for both the sensorless vector mode and the U/f mode, keeping track of changes in the parameters over time.
The vector control is carried out in a system of stator flux coordinates, which is immune to small variations in measurements and motor parameters. No demanding or complicated calculations are required. The ASIC circuit also supervises the internal buses and some external functions, therefore freeing the processor for other tasks.

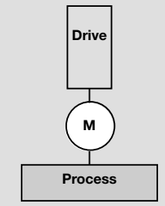
Vector control without feedback
The vector calculations, are carried out every ONE millisecond, based on the instantaneous values of the phase currents and their phase angles. These values are then fed to the motor model to calculate the torque and the flux. The calculation excludes integrators that can cause drift problems due to inaccuracies in parameters, measurements, or changes in motor values. The motor voltage is obtained from the ASIC, thus errors in measurements have no effect. The adaptive motor model also incorporates the converter and the motor cable, providing the precise status of the motor at all times.

Exact control
The sensorless flux vector control mode achieves the precision of closed loop motor control, over most of the speed range:
- Speed error in stable conditions < 0.5%
- Torque rise time: < 10 ms
- Minimal torque ripple
- Immunity to resonant vibrations
- High starting torque: 200% (dependant on motor/drive selection)
- High starting current: 2.5 x IH
- Suitable for multi-motor drive systems.
- High-speed applications, with max output frequency up to 7200 Hz (special application)

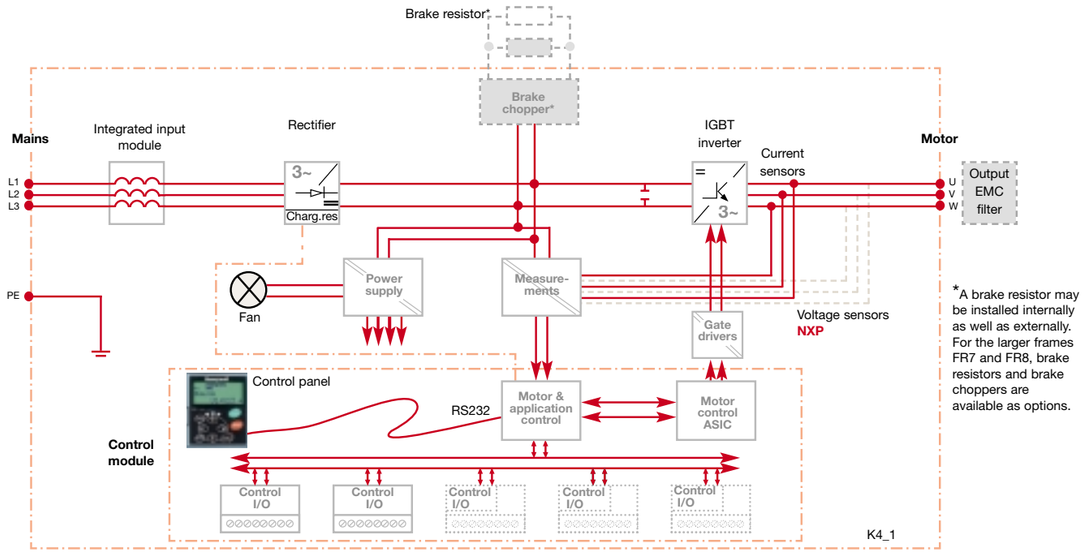
The ripple-free torque causes no additional stress on gears or other drivetrain components.



Example of the loadability of a standard motor supplied by a frequency converter
- Starting torque
- Overloadability
- Nominal torque of the motor
- Continuous loadability of the motor when supplied by a frequency converter



Motor control NXS



*A brake resistor may be installed internally as well as externally. For the larger frames FR7 and FR8, brake resistors and brake choppers are available as options.

High Performance

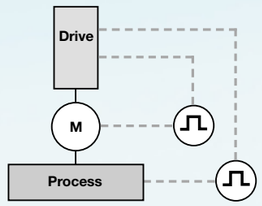
NXP.

The Modular Design

Full torque control at zero speed cannot be maintained without feedback. When a speed error of less than 0.5% or full torque control at all speeds is required, then feed back by an encoder is an absolute necessity.
The NXP uses a current measurement system similar to the NXS, and also uses output voltage values, along with feedback values from the encoder. The more powerfull microprocessor used in the NXP is capable of fast calculations every 150 microseconds.The NXP control unit can be used for closed loop applications requiring high precision and for open loop applications requiring high dynamic performance.
Typical high precision applications include master/slave drives, synchronisation and positioning.

Dynamic control

- Speed error: < 0.01%, depending on the encoder
- Speed ratio accuracy: < 0.01%, depending on the encoder
- Output voltage measure ment for extremely precise control
- Encoder input up to 5000 pulses per revolution
- Encoder voltages of 5, 15 or 24 V, depending on the option card
- Full torque control at all speeds, including zero
- Torque accuracy: < 2%
- Starting torque: > 200%, depending on motor and drive selection
- Capability for master/slave configurations
- Positioning capabilities
- High-speed bus (12 Mbit/s) for fast drive-to-drive communication



Motor control NXP

Control unit
Along with an enhanced microprocessor and ASIC circuitry, the control unit incorporates a control panel for setting parameters and controlling the functions of the drive. The display provides information, such as the actual values of current, power and voltage. In the local control mode it can also be used for starting and stopping the drive. The display, if necessary, can be mounted directly on the enclosure door.
The control unit provides five 'slots' for various I/O cards. A wide selection of cards is available, ranging from cards with simple analogue and digital inputs to 'Smart' fieldbus cards. A list of option cards with their features can be found on page 16.
The check final page number control unit is capable of handling several fieldbus connections simultaneously. The option cards are interchangeable between both the NXS and the NXP. Certain cards such as the encoder can only be used with the NXP.
The control unit is normally powered from the power unit. However, it can also be powered from an external 24 V supply, thus maintaining access to the stored data and other parameters (for example, in fieldbus applications) even if the main supply is disconnected.

Power unit
The power unit is available in 200...240, 380...500 and 525...690 three-phase AC input voltage ranges. This unit incorporates all power circuit components necessary for the operation of the drive, and is connected to the control unit via a multipole connector or an optical fiber. All drives in FR4-6 are equipped with a built-in brake chopper and an optional resistor. This resistor is designed for a 2-second full torque rapid stop once every minute. As an option, an external brake resistor can be installed.
The resistor is designed for a 2 second full power rapid stop once every minute. As an option, an external brake resistor can be installed.

Enclosure class
The standard enclosure class for all drives is IP21 (NEMA1). The enclosure class can be upgraded to IP54 (NEMA12).

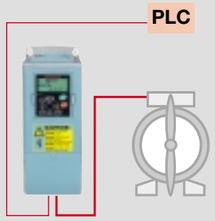
Separated in two units: power and control

Applications

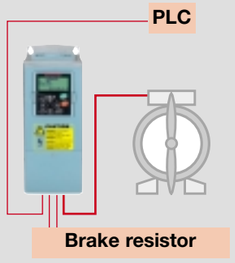
The NX Series can be flexibly adapted to a variety of needs using the preinstalled application package.
All applications can support a fieldbus system without any additional software.Typical uses include pumps and fans, compressors, conveyors, winders, mixers, cranes and hoists, elevators and crushers. The most suitable application & IO configuration that best suits your needs can be selected from the following:

There are also a wide range of customised special applications, including Lift, Winder, High-speed, Torque control and Torque control with closed loop.
There is also the NC1131-3 Engineering tool for customising applications to better meet customer requirements.

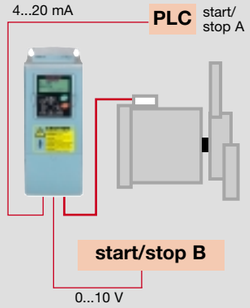
The NXP is most suitable for demanding applications e.g. closed loop control, system drives, master/slave drives, positioning, winders or winches.



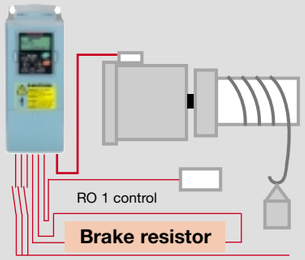
The basic application is set as factory default.
The I/O signals are fixed (not programmable). A single parameter group containing 18 parameters is available.
The frequency reference can be provided either as a current or as a voltage signal, or directly from the control panel. This is the most popular application.



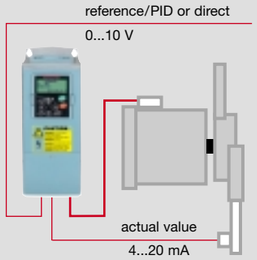
The standard application features the same control signal logic as the basic application with the added possibility of freely programming all digital inputs and outputs. Eight parameter groups are available, including basic, input signal, output and supervision, drive control, frequency, motor control, protection and auto-restart parameters.



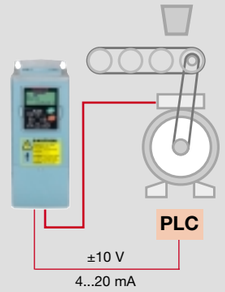
The local/remote application is an ideal choice for operation with two active control sources. The source of the frequency reference can be freely programmed. The active control source is selected via a digital input. All outputs are programmable, and eight parameter groups are provided as standard.



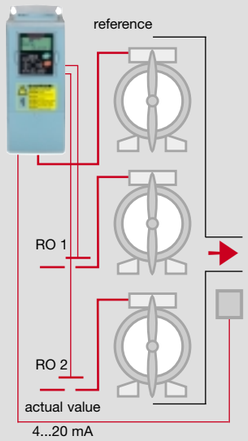
The multi-step speed control application is intended for selecting the reference between several fixed speeds.
Nine programmable speeds include basic, seven multistep and jogging. The speed is selected by means of a digital input signal. The basic speed reference can be provided either as a current or as a voltage signal.
All inputs and outputs are programmable, and the eight parameter groups are provided as standard.



The PID control application features two I/O terminal control sources. Source A is the PID controller and source B is a direct frequency reference.The PID controller reference can be supplied via an analogue input, from a potentiometer or the panel. The actual value can be obtained via an analogue input or from a mathematical function of the analogue inputs. Typical PID control applications include those where one variable must be kept constant, such as pressure in water mains despite changes in the load. All outputs are programmable,and eight parameter groups are provided as standard.



The multi-purpose control application incorporates a frequency reference that can be obtained via an analogue input, from the joystick control, a potentiometer or a mathematical function of the analogue inputs. A variety of multi-step and jogging speeds can be programmed. All outputs are programmable, and eight parameter groups are provided as standard. With its extensive range of parameters, this is the most versatile & flexible of all the applications.



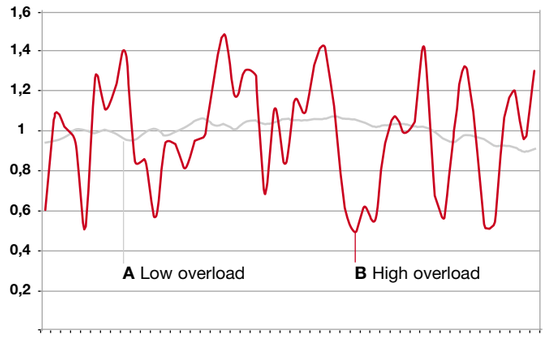
The Pump and Fan Control with Autochange application can be used for controlling one variable speed drive and a total of four auxiliary drives.
The PI regulator controls the speed of the variable speed drive and provides start and stop signals to the auxiliary drives. All outputs are freely programmable.

In addition to the eight parameter groups provided as standard, a parameter group for multi-pump and fan control functions is available. As an example of use would be the control of a multi pump water booster station, providing near constant supply pressure across a wide flow demand.
The application utilises external contactors for switching between the motors connected to the frequency converter.
The autochange feature alternates the starting order of the pumps.

Technical Specification

Choice of drives
All drives are dimensioned using the same principle, i.e. the current required by the load. The selection of the drive is determined by the degree of over load capacity required and the ambient temperature.

Two types of overload conditions have been defined:
A. Low overload – 10% for 1 minute every 10 minutes, 150% starting torque, 40°C ambient temperature.
Typical applications include centrifugal fans and pumps as well as rotary compressors with slow variations in load.
B. High overload – 50% for 1 minute every 10 minutes, 200% starting torque, 50°C ambient temperature.
Typical applications include cranes, hoists, lifts and conveyors as well as others with rapidly changing load.
In addition to the rated currents for the low and high overloads, a two-second short term overload current has been allowed.
The following rating tables will assist in choosing the correct drive for either of two over-load types at a given supply voltage. When selecting by kW - and the drive is to be used with a motor with 8 poles or more, verify the current capacity of the drive is sufficient. The NX drives are suitable for multi-motor applications. The total value of the rated motor currents must then be less than the rated drive current.
If the motors are required to start on a running drive, the starting current of the-largest motor must be added to the total value of the running currents.
Use the high over-load rating for multi-motor applications as well as the use of an output choke if the total length of the motor cable exceeds 100 meters.



Typical low and high overload behavior over time

Ratings at 380/400 V supply		Ratings at 480/500 V supply*											
						Low overload			High overload				
Low overload P(kW)	High overload P(kW)	Low overload P(kW)	(Hp)*	High overload P(kW)	(Hp)*	Frequency converter type	Continuous current (I_L)	10% overload current (A)	Continuous current (I_H)	50% overload current (A)	Maximum 2 sec current (I_S)	Dimensions WxHxD	Frame size (mm)	Weight (kg)
1.1	0.75	1.5	(1.5)	1.1	(1)	NXx 0003	3.1	3.5	2.2	3.5	4.4	128x285x190	FR4	5
1.5	1.1	2.2	(2)	1.5	(1.5)	NXx 0004	4	4.4	3.1	4.4	5.6	128x285x190	FR4	5
2.2	1.5	3	(3)	2.2	(2)	NXx 0005	5.4	6	4	6	7.2	128x285x190	FR4	5
3	2.2	4		3	(3)	NXx 0007	7	7.7	5.4	7.7	10.8	128x285x190	FR4	5
4	3	5.5	(5)	4		NXx 0009	9	10	7	10	14	128x285x190	FR4	5
5.5	4	7.5	(7.5)	5.5	(5)	NXx 0012	12	13.2	9	13.2	18	128x285x190	FR4	5
7.5	5.5	11	(10)	7.5	(7.5)	NXx 0016	16	18	12	18	24	140x380x215	FR5	8
11	7.5	15	(15)	11	(10)	NXx 0022	22	24	16	24	32	140x380x215	FR5	8
15	11	18.5	(20)	15	(15)	NXx 0031	31	35	22	35	44	140x380x215	FR5	8
18.5	15	22	(25)	18.5	(20)	NXx 0038	38	47	31	47	62	190x510x240	FR6	17
22	18.5	30	(30)	22	(25)	NXx 0045	45	54	38	54	76	190x510x240	FR6	17
30	22	37	(40)	30	(30)	NXx 0061	61	68	45	68	90	190x510x240	FR6	17
37	30	45	(50)	37	(40)	NXx 0072	72	92	61	92	122	230x585x260	FR7	35
45	37	55	(60)	45	(50)	NXx 0087	87	108	72	108	144	230x585x260	FR7	35
55	45	75	(75)	55	(60)	NXx 0105	105	131	87	131	174	230x585x260	FR7	35
75	55	90	(100)	75	(75)	NXx 0140	140	158	105	158	210	300x747x295	FR8	58
90	75	110	(125)	90	(100)	NXx 0168	168	210	140	210	280	300x747x295	FR8	58
110	90	132	(150)	110	(125)	NXx 0205	205	252	168	252	336	300x747x295	FR8	58

*HP ratings according to NEC currents

Technical Specification

Power range	
NX Series	0.75...110 kW (1...150 Hp)

Mains Input Connection	
Input voltage	200...240 V, 380...500 V, 525...690 V -15%... + 10%
Input frequency	45...66 Hz
Connection to the mains	Once per minute. For more frequent connections, request advise.

Auxiliary voltage	
	Control logic can be powered from an external auxiliary supply, maintaining power to the control panel, internal drive functions and fieldbuses if necessary. 24 V DC, 300 mA

Motor Output Connection	
Voltage	0...U_{in}
Rated output	I_L : Low overload requirement, 10% for 1 minute every 10 minutes, 150% starting torque requirement, 40°C ambient temperature. I_H : High overload requirement, 50% for 1 minute every 10 minutes, 200% starting torque requirement, 50°C ambient temperature.
Starting current	I_S : Current defined for 2 sec every 20 sec if output frequency <30Hz and if the heatsink temp. <+60°C. See rating tables.
Starting torque	Motor and drive dependent
Output frequency	0...320 Hz (higher with different applications, max 7200 Hz)
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	1...16 kHz
Frequency reference	Analogue resolution 10 bit, accuracy±1% (I/O card dependent)
Panel reference resolution	0.01 Hz
Field weakening point	30...320 Hz
Acceleration time	0...3000 sec (set minimum to set maximum frequency)
Deceleration time	0...3000 sec
Braking torque	DC brake: 30% x T_N (without brake option) Dynamic braking with optional internal resistor (FR4-6): 2 sec at T_N every 1 min. T_N based on high overload rating

Protective functions	
Overcurrent protection	Instantaneous trip limit 2 x I_H RMS current.
Overvoltage protection	Trip limit 1.35 x Un
Undervoltage protection	Trip limit 0.65 x Un
Earth-fault protection	Protects the drive from an earth-fault in the output (motor or motor cable). I_E > 20% x I_N .
Mains supervision	Trips if any input phase is missing (programmable)
Motor phase	Trips if any output phase supervision is missing
Other	Unit over temperature protection, motor overload protection, stall protection, motor underload protection, short circuit protection of +24V and +10V reference voltages.

Control connections	
Depend on the control card configuration, see page 16. Typical values, check the specific card.	
Analogue voltage	0...+10V, R_i = 200 kΩ, single ended (-10...+10V, joystick control), resolution 10 bit, accur. ±1%
Analogue current	0(4)...20 mA, Ri = 250 Ω, differential
Digital inputs (6)	Positive or negative logic
Aux. voltage out	+24V ±20%, max 250 mA
Aux voltage in	+24V ±20%, max 300 mA
Pot. meter ref.	+10V, +3%, max 10 mA
Analogue output	0(4)...20 mA, RL < 500 ., resolution 10 bit, accur. ±3%
Digital output	Open collector output, 50 mA/48V
Relay outputs	Max switching voltage: 125V DC, 250 V AC
Max switching load	8A/24V DC, 0.4A/125V DC, 2kVA/250V AC
Max continuous load	2 A rms

Environmental limits	
Ambient operating temperature	–10 (no frost)...+40°C for low overload selection, –10 (no frost)...+ 50°C for high overload selection
Storage	–40°C...+60°C
Relative humidity	<95%, no condensation allowed
Air quality chemical vapours	IEC 721–3–3, unit in operation, class 3C2
Mechanical particles	IEC 721–3–3, unit in operation, class 3S2
Altitude	max 1000 m at rated current. Over 1000 m reduce rated current by 1% per each 100 m, for altitudes >3000 m contact factory.
Vibration	EN50178 EN60068-2-6 IEC68-2-6, -34, -35, -36 IEC721-3-3
Operation	max displacement amplitude 3 mm at 5...10,7 Hz, max acceleration amplitude 0.7 G at 10,7...200 Hz
Shock	EN50178 IEC68-2-27
Operation	max. 8 G, 11 ms
Storage and shipping	max. 15 G, 11 ms (in the package)

EMC	
Noise immunity	Complies with EN50082 –1, –2, EN61800–3
Emissions	Coded series (see Type designation) complies with EN61800–3, 1st environment restricted distribution, 2nd environment restricted distribution. With external filter complies with EN50081-1,-2, EN61800–3, 1st environment unrestricted distribution requirements.
Safety	Fulfills EN50178, EN60204-1, CE, UL, C-UL, (CSA) FI, GOST R (check the rating plate for specified approvals for each unit)
CE mark	yes

All specifications subject to change without notice.

Type Designation Code

e.g. NXS 0022 V35 A 2 H 1	
Product range	NXS = standard drive NXP = high-performance drive
Maximum continuous output current @ +40°C	0022 = 22 A
Nominal mains voltage	2 = 200…240 V AC (3-phase) 5 = 380…500 V AC (3-phase) 6 = 525…690 V AC (3-phase)
Control panel	A = Standard Alphanumeric keypad B = No keypad F = Dummy keypad (just case, no electronics, black overlay with LEDs visible)
Enclosure classification	2 = IP21/NEMA1 5 = IP54/NEMA12
RFI level	H = complies with the standard IEC61800-3, 1st environment, restricted distribution, 2nd environment T = fulfills the standard IEC61800-3 for IT networks L = complies with EN61800-3, 2nd environment
Internal brake chopper option	0 = no brake chopper 1 = built-in brake chopper 2 = built-in brake chopper and brake resistor

Card Types

I/O-card types

Currently four types of cards are available, and they all carry the type designation of type NXOPTxx as follows:

Card type A

Basic cards
NXOPTA1, NXOPTA9,
NXOPTAA, … NXOPTAZ

- all type designations are NXOPT**A**_
- basic cards
- this type of card can only use slots A, B and C. Check documentation for details.

Card type B

Expander cards
NXOPTB1 NXOPTB9,
NXOPTBA, … NXOPTBZ

- all type designations are NXOPT**B**_
- expander cards
- this type of card can only use slots B, C, D and E. Check documentation for details.

Card type C

Fieldbus cards
NXOPTC1, NXOPTC9,
NXOPTCA, NXOPTCZ

- all type designations are NXOPT**C**_
- fieldbus cards (Modbus, Profibus, etc.)
- this type of card can only use slots D and E. Check documentation for details.

Card type D

Adapter cards
NXOPTD1, NXOPTD9,
NXOPTDA, NXOPTDZ

- all type designations are NXOPT**D**_
- fiber optic adapters, e.g. system bus fiber optic adapter card
- this type of card can only use slots D and E. Check documentation for details.

Specifications

Card type A

I/O type	NXOPTA1	NXOPTA2	NXOPTA3	NXOPTA4 (only NXP)	NXOPTA5 (only NXP)
DI	6				
DO	1				
AI (mA/V/+V)	2				
AO (mA/V)	1				
RO (NO/NC)		2	1		
RO (NO)			1		
+10V ref	1				
Thermistor			1		
+24V / EXT +24V	2				
DI / Encoder (10…24V)					3
DI / Encoder (RS422)				3	
Out +5V / +15V				1	
Out +15V / +24V					1

Note 1:
Slot **A** can accept only option card NXOPTA1, slot **B** only option cards NXOPTA2, NXOPTA3

Note 2:
NXOPTA4 and NXOPTA5 fit only in slot **C**.

Card type B

I/O type	NXOPTB2	NXOPTB4	NXOPTB5	NXOPTB9
AI (mA) isolated		1		
AO (mA) isolated		2		
RO (NO/NC)	1			
RO (NO)	1		3	1
Therm	1			
+24V/Ext +24V		1		
42...240 VAC input				5

NXOPTC2 (Modbus)
NXOPTC3 (Profibus DP)
NXOPTC5 (Profibus DP/D9 connector)
Note: These cards can be installed in slots **D and E**

NXOPTD1 (NXP, System Bus adapter)
Note: These cards can only use slots **D and E**
Additional cards are under development, please enquire at your local Honeywell office.

Card type C

Note: These cards can only use slots **B, C, D and E**, NXOPTB5 and NXOPTB9 in slots **B, C and D**

Card type D

Note: These cards can only use slots **B, C, D and E**, NXOPTB5 and NXOPTB9 in slots **B, C and D**

The I/0 Cards Options

Enclosure kit
NX54FR_

Door installation kit
NXDRA: IP54 remote control panel, including cables

Brake resistors
NXBR__: For dynamic braking

RFI, dU/dt and sinus filters

RFI 250 5 A 0 AA

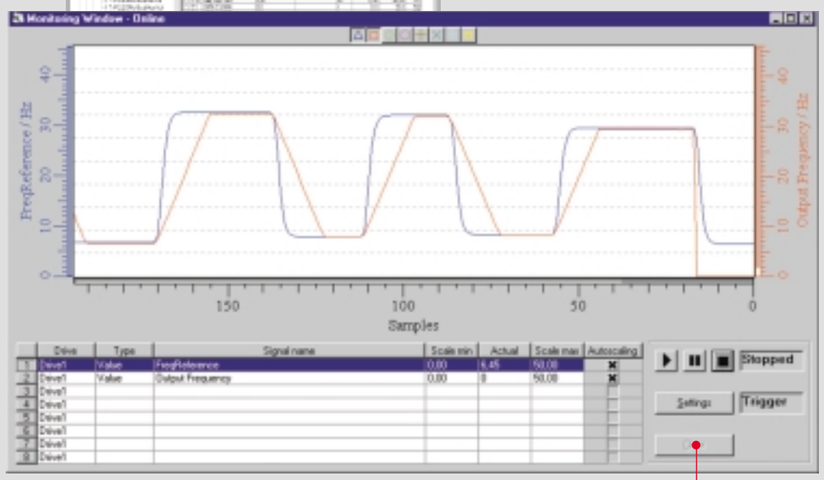
- **RFI** Filter type
  RFI=RFI filter
  DUT=dU/dt filter
  SIN=sinus filter
  CHK=choke
  REG=regenerative line filter
- **250** Max. current of the filter
- **5** Nominal input voltage
  2=230 V, 4=400 V
  5=500 V, 6=690 V
- **A** Filter type
  A=input, B=output
  C=both
- **0** Enclosure classification
  0=IP00, 2=IP20
- **AA** Reserved

Graphical Tools

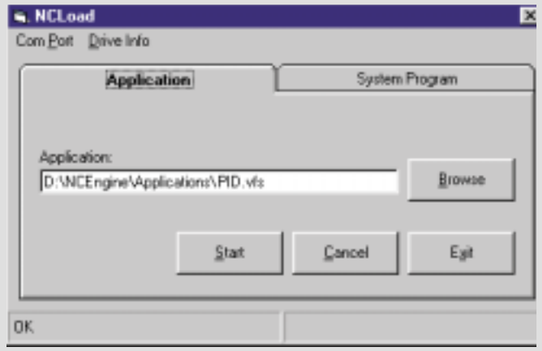
A number of Windows based PC programs are available for working with the NX Series e.g. commissioning, loading applications, and block programming.

NCDrive
NCDrive is a full featured commissioning and control application for the NX Series. It provides the following functions :- parameter adjust, compare & save, trending 6 up to 6 signals. Fault finding/trouble shooting NCDrive requires a PC equipped with a Pentium II processor, 32 MB free RAM, 10 MB free disk space and Windows 95/98 or 2000.

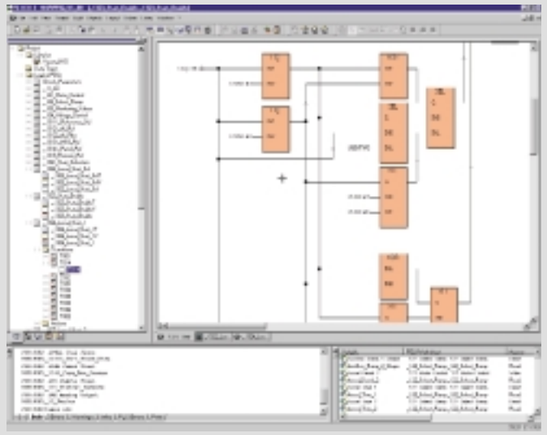
Parameter window
Adjust, compare and save parameters



Monitor window
Up to eight user-selectable variables can be monitored simultaneously.



NCLoad
is a tool for loading software into the drive e.g.
a) system software (the operating system)
b) application software (standard & custom made)
c) option card software
NCLoad is a simple to use – but very powerfull tool & should only be used by trained personnel.



NC1131-3 Engineering
Creating customer specific applications for the NX Series is easy, with the NC1131-3 Engineering tool (IEC 611131-3 compliant) NC1131-3 is a graphical design tool for customising the control logic and parameters in the NX Series drives. The modular I/O, together with sophisticated software, provides an ideal platform for system engineers, and users with special requirements. NC1131-3 incorporates Functional Block Diagram (FBD), Ladder Diagram (LD) and Structured Text (ST) for definition of the function of the application. It utilises state machines, containing both basic function blocks and more sophisticated function blocks such as filters, PI controllers and integrators. With up to additional 2000 blocks can be added to any standard application. New parameters, fault messages and other application-related features can be created.

Drives and the Electrical Environment

Most drive installations require the addition of other equipment, such as computers and sensors etc. which is often installed in close proximity to the drive creating the potential for interference.
There are two major types of interference:

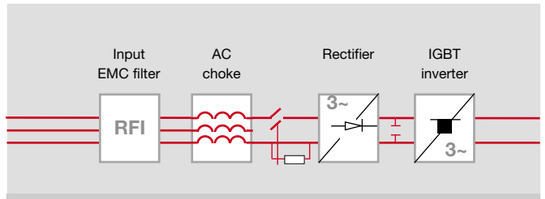
- Low frequency – harmonics
- High frequency – EMI

Harmonic currents

All current and voltage waveforms can be expressed as the sum of the basic frequency (50 or 60 Hz) and higher multiples of this. In a balanced three-phase system, only odd harmonics will be present, the even ones are usually cancelled out.
Non-linear loads draw currents that are not sinusoidal and thus generate these harmonics.
Typical sources include rectifier bridges in power electronics, switch-mode power supplies in office equipment and fluorescent lamps. For a three phase rectifier load, the harmonic currents present are 6 x n ± 1, i.e. 5, 7, 11, 13, 17, 19, etc.
The magnitude of these currents decreases as their frequency increases.
The additional harmonic current does not carry power, though it is an added current flowing in the cables. Typical effects are overloading of conductors, decrease in power factor, and disturbance of measuring systems.
The voltages created by these currents flowing in the transformer may also damage other equipment or interfere with power line communication equipment.

Eliminating the problem

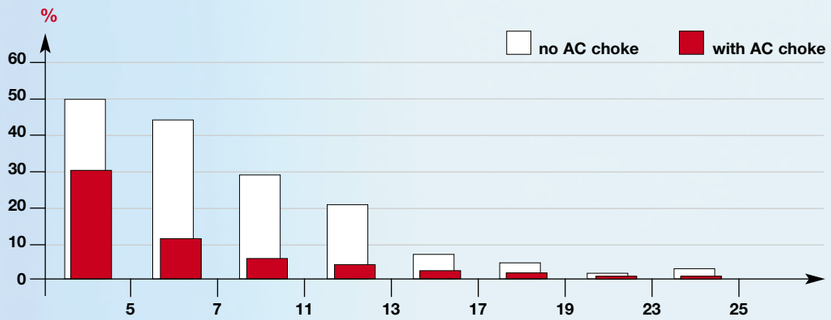
The magnitude of the harmonic currents decreases as their frequency increases



The NX Series have a built-in AC choke. The choke reduces the harmonic currents and protects the rectifier against voltage spikes in the supply (compared to a DC choke).

To control or limit their effects, the focus of effort should be at the lower frequencies.
Additional line impedance in the form of a choke has a significant effect.
Drives without input line chokes generate significantly higher levels of harmonics than drives that have one.
An AC choke has the added effect of protecting the drive against 'spikes' in the supply.
All NX drives have built-in AC chokes. At higher powers, a 12- or 18-pulse input is often used. This reduces the harmonics in the supply by eliminating the lowest order harmonics. In a 12-pulse drive, the lowest harmonics are the 11th and 13th, followed by the 23rd, 25th, etc. For the 18-pulse input drive, the harmonics are the 17th and 19th, etc. at still lower levels, with the supply current very close to a sine wave.
The creation of harmonics can be decreased in several other ways. One possibility is to use a regenerative drive, which has an almost sinusoidal supply current (current THD normally <4%).
However the most common solution is to use notch filters to change the impedance of the supply at specific frequencies.
These work well for stable, unchanging networks.
Another way is to increase the supply transformer capacity, as the lower reactance will cause lower harmonic voltages.
A third method is to use an active filter that compensates for the non-linearity of the load.
In the past few years, several standards have been published regarding harmonics, notably IEC10003,IEC1800-3 (EN61800-3), IEC555 (EN60555) and IEEE519-92.
In a correctly designed system the NX Series drives comply with all these.

Current Harmonics



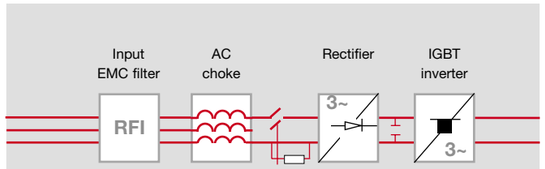
Comparison of 6-pulse rectifier with and without AC choke

Drives and the Electrical Environment

High frequency interference
High frequency interference consists of either radiated or conducted disturbances at frequencies above 9 kHz. Standards exist for 150 kHz to 1000 MHz.
These disturbances can be created by switching elements in any device, e.g. the crystal clocks in a computer, switch-mode power supplies and the output devices of drives. The high frequency noise emitted from any device may influence measuring systems, communication systems, and interfere with radio receivers.

Eliminating the problem
Two areas can be addressed:
- the immunity: standards EN50082-1,-2, EN61800-3
- the emissions: standards EN50081-1,-2, EN61800-3

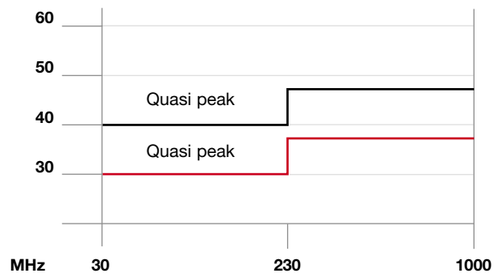
The generic standards EN50081 and 50082 as well as EN61800 (IEC1800-3) for drives define levels of immunity and emission required for devices designed to operate in different environments. Drives are designed to operate in a variety of environments, so they are designed with industrial level immunity against RFI. The standards also define the level of emissions accepted in various environments. E.g.
- L – No emission suppression. For use in a non-vulnerable environment or where the user takes responsibility for emission suppression.
- H – Emission suppression according to EN 61800-3, first environment restricted distribution and second environment.



You can also add external RFI filters to reduce the emission of L type devices to the H level.

For higher performance, there is an additional RFI filters to bring the drive to the commercial level – for general use in a non-industrial environment. (EN61800-3, first environment, unrestricted distribution).
All these filter grades have an EU Declaration of Conformity as well as a Technical Construction File (TCF), verified by FIMKO Ltd.

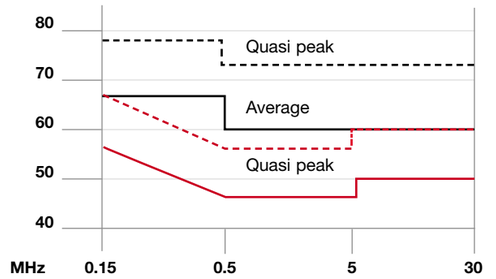
Radiated emission limits



— EN50081-2, EN61800-3. 1st environment, restricted distribution. 2nd environment (EN55011 class A)

— EN50081-1, EN61800-3. 1st environment, unrestricted distribution (EN55022 class B)

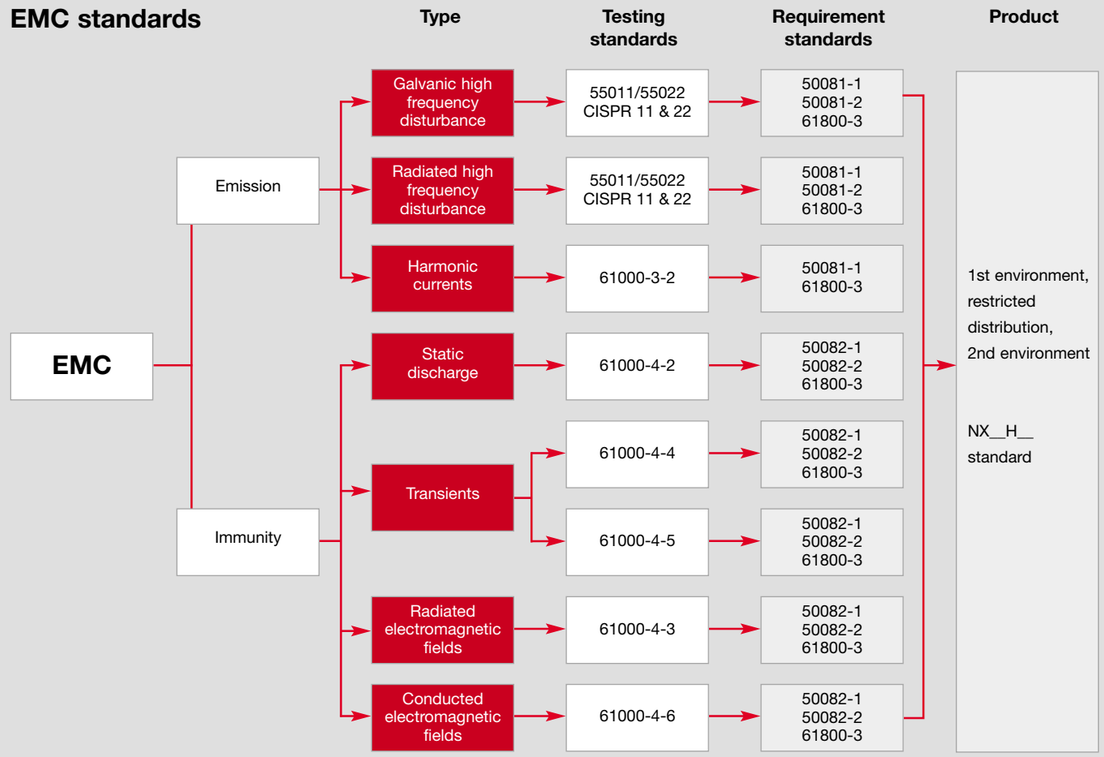
Conducted radiation limits



— EN50081-2, EN61800-3. First environment, restricted distribution. Second environment (EN55011 class A)

— EN50081-1, EN61800-3. First environment, unrestricted distribution (EN55022 class B)

EMC standards

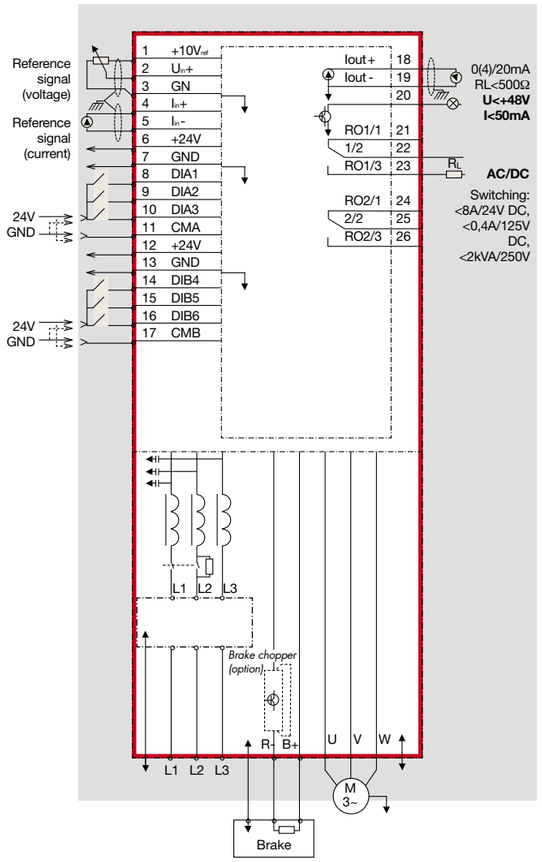


Cabling

Shielded motor cables should be used with the NX Series to comply with the EMC requirements of the EU. However, unshielded mains supply cables can be used to reduce cabling costs.
The motor cable should be routed as far away from other cables as possible. Avoid placing the motor cables parallel to other cables. Motor cables should cross other cables at a 90-degree. The motor cable must be earthed (grounded) at the drive end and motor end.
The maximum length of the motor cable with the NX Series is 200 meters.
with the exception of:

- NX 0003–0004: 50 meters
- NX 0005: 1.5...100 meters

The cables must have a heat resistance of at least +60°C. See local regulations for fusing and cable sizes or the table below for guidance



Typical configuration with standard I/O cards A1 and A2.

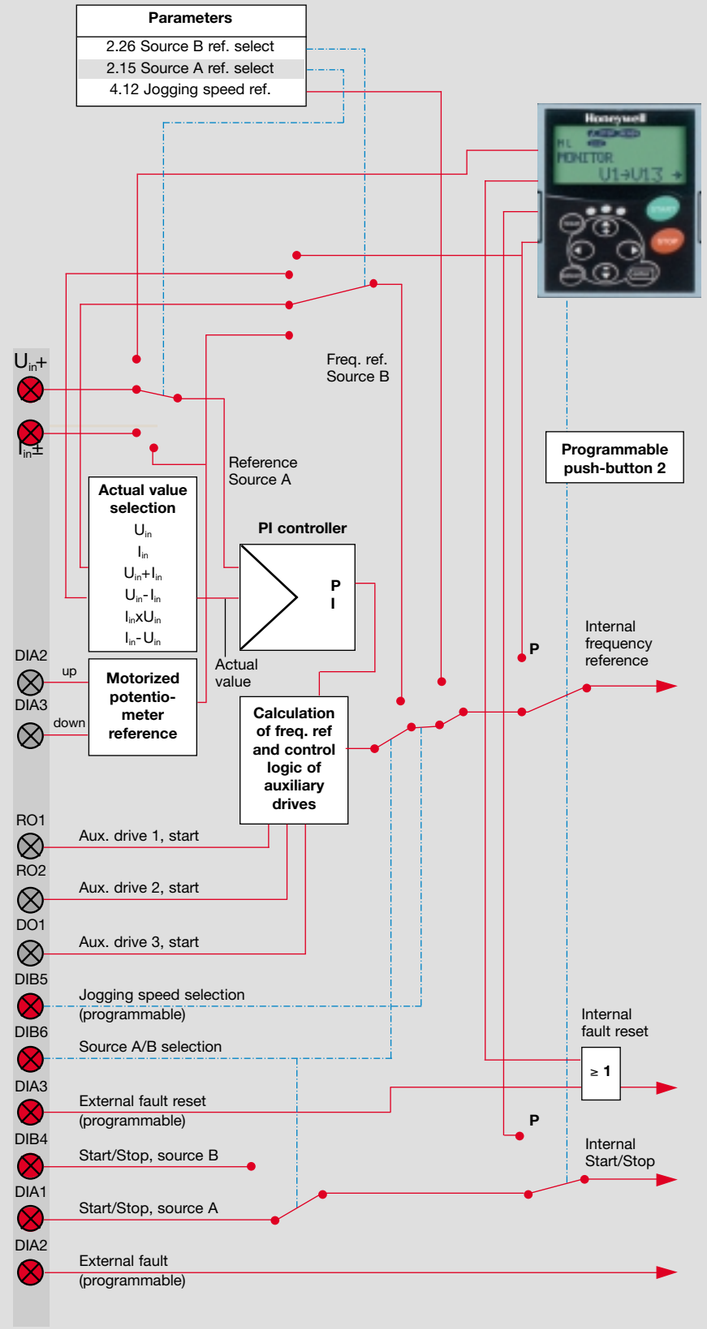
CABLE TYPE	1st environment unrestricted distribution external filter	1st environment unrestricted distribution 2nd environment	2nd environment
NORM	EN50081-1 EN61800-3	EN50081-2 EN61800-3	EN50081-3
RFI filter	C	H	L
Line cable	1	1	1
Motor cable	3	2	2
Control cable	4	4	4

Cable types for different EMC levels

1 = For fixed installation. Power cable for used supply voltage. No shield necessary
2 = Concentric neutral power cable for used supply voltage.
3 = Power cable equipped with tight low-impedance shield for the used supply voltage
4 = Protected power cable equipped with tight low-impedance shield.

Motor nominal current A	Fuse A	Cable Cu, mm^2
3	10	3*1,5+1,5
4	10	3*1,5+1,5
5	10	3*1,5+1,5
7	10	3*1,5+1,5
9	10	3*1,5+1,5
13	16	3*2,5+2,5
16	20	3*4+4
23	25	3*6+6
31	35	3*10+10
38	50	3*10+10
45	50	3*10+10
61	63	3*16+16
72	80	3*25+16
87	100	3*35+16
105	125	3*50+25
140	160	3*70+35
168	200	3*95+50
205	250	3*150+70

Line and motor cable recommendations for the 380...500 V series



Control signal logic.
An example of the Pump and Fan Control Application.

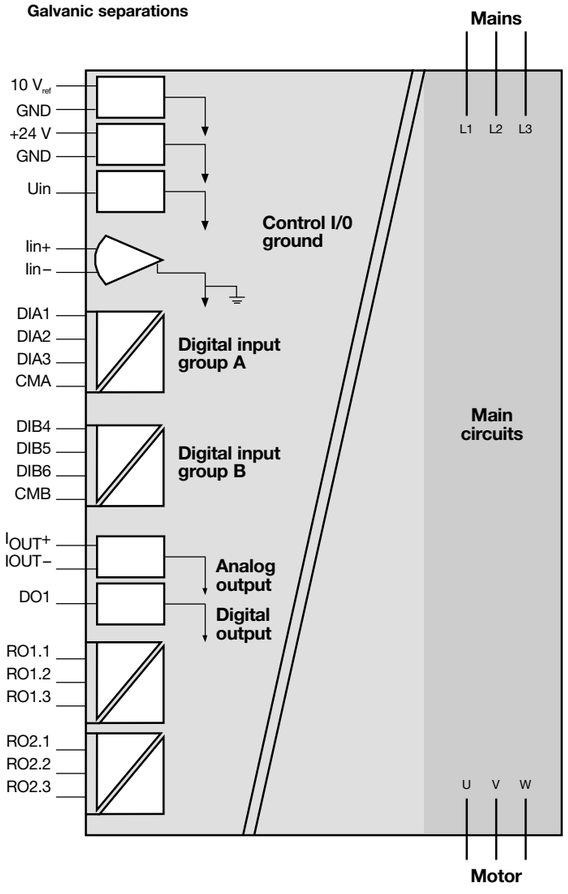
I/O connections
The I/O connections on the NX series is determined by the type of I/O card used.
If no special configuration is specified, the standard I/O provided is as follows:
2 analog inputs, 6 digital inputs, 1 analog output, 2 relay outputs, 1 digital output (open collector output) and auxiliary voltages.
See the description of the available cards for more information. Changing from one application to another sets the I/O configuration to the default of the chosen application.

control line

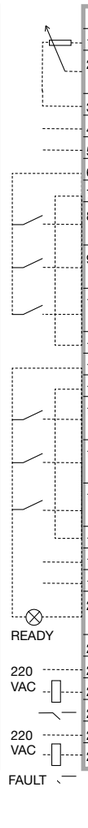
signal line

Input/Output Connections

Galvanic separations



Example of control terminal signals, cards A1 and A2. If potentiometer reference is used, the potentiometer R = 1...10 kΩ (linear)



Terminal		Function	Specification
1	+10V$_{ref}$	Reference voltage output	Burden max 10 mA*
2	U$_{in}$+	Analog signal input	Signal range -10V...+10V DC
3	GND	I/O ground	
4	I$_{in}$+	Analog signal input	Signal range 0(4)...20 mA
5	I$_{in}$-		
6	+24V	24V supply voltage	±20%, load max. 100 mA
7	GND	I/O ground	
8	DIA1	Digital input 1	R$_i$ = min. 5Ω
9	DIA2	Digital input 2	
10	DIA3	Digital input 3	
11	CMA	Common for DIA1-DIA3	Must be connected to GND or +24V
12	+24V	24V supply voltage	Same as #6
13	GND	I/O ground	Same as #7
14	DIB4	Digital input 4	R$_i$ = min. 5Ω
15	DIB5	Digital input 5	
16	DIB6	Digital input 6	
17	CMB	Common for DIB4-DIB6	Must be connected to GND or +24V
18	I$_{out}$+	Analog signal output	Signal range 0(4)...20 mA
19	I$_{out}$-		R$_L$ max. 500Ω
20	DO1	Open collector output	Transistor output
			≤ 50 mA, U$_{in}$ ≤ 48 VDC
21	RO1	Relay output 1	Max. switch voltage 250 VAC, 125 VDC
22	RO1		Max. switch current 8 A / 24 VDC,
23	RO1		0.4 A / 125 VDC
24	RO2	Relay output 2	Max. switch power < 2 kVA / 250 VAC
25	RO2		Max. cont. current < 2 A rms
26	RO2		

Installation

The NX Series must be installed in a vertical position. The slim, space-saving design of the NX Series allows easy wall or enclosure mounting even when space is limited.

When the drive is installed in an enclosure, there must be a free flow of air at both the top & bottom of the drive. An NX 0016 requires approximately 70 m³/h of fresh cooling air!

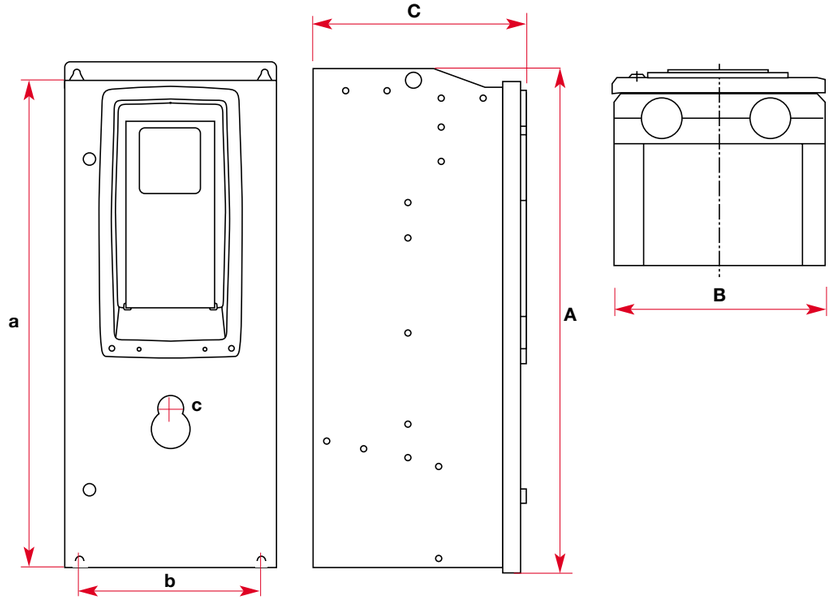
Recirculation of air within the enclosure should be avoided. Sufficient free space around the frequency converter guarantees proper air circulation and cooling.

Installation space and mounting dimensions

Measurement	FR4	FR5	FR6	FR7	FR8
A Height	292	391	519	590	745
B Width	128	144	195	237	285
C Depth	190	214	237	257	288

Fastening dimensions

a Height	313	406	541	614	721
b Width	100	100	148	190	255
c Size	7	7	9	9	9



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- Contact your local Honeywell partner
- View product details and the complete technical documentation at:

  http://europe.hbc.honeywell.com

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