

VACON NX - THE DRIVE FOR THE NEW CENTURY

Founded in 1993, Vacon has rapidly gained acceptance as a supplier of robust and reliable frequency converters for a multitude of applications in all branches of industry and public sectors.

Vacon presents a new range of drives, built on the principles of software and hardware modularity. The power unit makes use of the most sophisticated semiconductor technology and a highly modular construction that can be flexibly adapted to the customer's needs. Typical power options include input and output filters, brake resistors as well as IP21 (NEMA1) and IP54 (NEMA12) enclosure classes.

Two types of control units are available and separated from the power unit. The performance of the standard sensorless vector control unit is sufficient for most of the common applications. A closed loop vector control unit with servo performance is available for more demanding applications. Typical applications include sectional drives, cranes and lifts as well as systems where several drives must operate closely together or where precise control of speed and torque at speeds close to zero is required.

The input and output configuration (I/O) is designed with modularity in mind. The I/O is comprised of option cards, each with its own input and output configuration. The control module is designed to accept a total of five of these cards. The cards contain not only normal analog and digital inputs and outputs but also fieldbuses and additional application-specific hardware.

The modular and robust design combined with the powerful IEC61131-3 compatible software support for the creation of new applications make the Vacon NX an ideal solution for even the most demanding applications. The wide temperature range, the multi-lingual control panel that speaks your language and the high reliability make the Vacon NX the drive for the new century.

For end users

For the end user the Vacon NX offers a range of new exciting application capabilities and possibilities for keeping stock and spares to a minimum. The NX is compatible with its predecessor, the Vacon CX, so all drawings, installation and training material can be reused. In addition, a wide selection of option cards offers new possibilities for re-configuring the drive to future requirements. The wide voltage range, high overloadability, and a user-friendly alphanumeric keypad make the choice of the correct drive easy.

For OEM customers

For the OEM customer the modular construction and wide selection of option cards make the Vacon NX a drive that can easily be incorporated into any machine. By means of our versatile block-programming tool the Vacon NX can be designed 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 make the choice easy.

For system designers

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

ADVANCED FEATURES

The major features of the Vacon NX include:

- Continuous run-time self-supervision and alarm system for enhanced reliability and safety
- Testing performed on fully assembled drive
- Each drive tested at maximum temperature and motor load prior to shipment
- The control logic can be powered from an external auxiliary supply, maintaining power to the control panel, internal drive functions and fieldbuses if necessary
- Integrated AC choke for maximum protection and minimum harmonics
- FR4-6 optional internal brake resistor for rapid stops
- Unsurpassed flexibility in communication via multiple fieldbuses
- Sophisticated, expandable I/O configuration
- Easily configurable multilingual control display
- "All in One" software package pre-installed
- Wide selection of application software available
- NC1131-3 Engineering tool for creating new applications
- Versatile PC tools for loading, setting and comparing parameters
- Parameter transfers between drives and applications
- Integral RFI filter for 1st environment, restricted distribution as well as 2nd environment (industry)
- External RFI filter for demanding environments
- FR4-6 IP21 to IP54 conversion kit
- Same power section for 380...500V
- Slim, space-saving "bookshelf" design
- Side-by-side installation
- Super Cooling technology
- Now available at 380...500 V, up to 355 kW (450 Hp)

The Vacon NX builds on our long expertise in designing and manufacturing reliable, robust drives. The Vacon CX is synonymous with reliability. In designing the new NX, we have exercised the same level of care and attention to detail. Like its predecessor, the NX also enjoys the same high level of immunity to electromagnetic interference.

The Vacon NX provides 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 most demanding applications.

The design approach of both control units incorporating the same application packages, control panels, I/O cards and PC tools provides unsurpassed ease of use.

User-friendly

- Extremely easy operation
- Comprehensive manuals available in more than 20 languages
- "All in One" precision applications for minimum number of parameters that must be set
- PC tools, manuals and special software available for downloading from our web site www.vacon.com
- Easy-to-use multilingual control panel
- Same panel operation for all power ratings
- Smart preset parameters: just enter the motor ratings, the Vacon NX does the rest
- I/O connections with simple quick connection terminals
- Wide selection of I/O cards for different applications
- RS232C terminal for PC connection (NCLoad, NCDrive and NC1131-3 Engineering tools)

Applications

The standard drive is 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 lifts, cranes or winders. All applications are compatible with those of the Vacon CX.

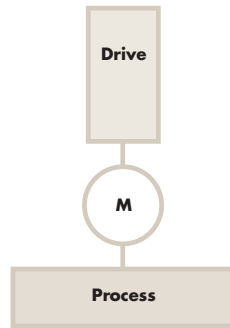


ADVANCED MOTOR CONTROL

At the core of the NXS is sensorless vector control technology coupled with an adaptive motor model and sophisticated ASIC circuit features. The motor flux model is based on measurements of all three output currents and the voltage as given by the ASIC circuit. 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 does some external functions, freeing the processor for other tasks.

Vector control without feedback

The vector calculation is carried out every millisecond, based on the measured instantaneous values of the phase currents and their phase angles. These values are then fed to the motor model for calculation of the torque and the flux. The calculation excludes integrators that can cause drift problems due to inaccuracies in parameters or measurements, or changes in motor values. The value and the direction of the motor voltage are obtained from the ASIC circuit, thus errors in measurements have no effect. The adaptive motor model also incorporates the converter and the motor cable, providing access to the precise status of the motor at all times.



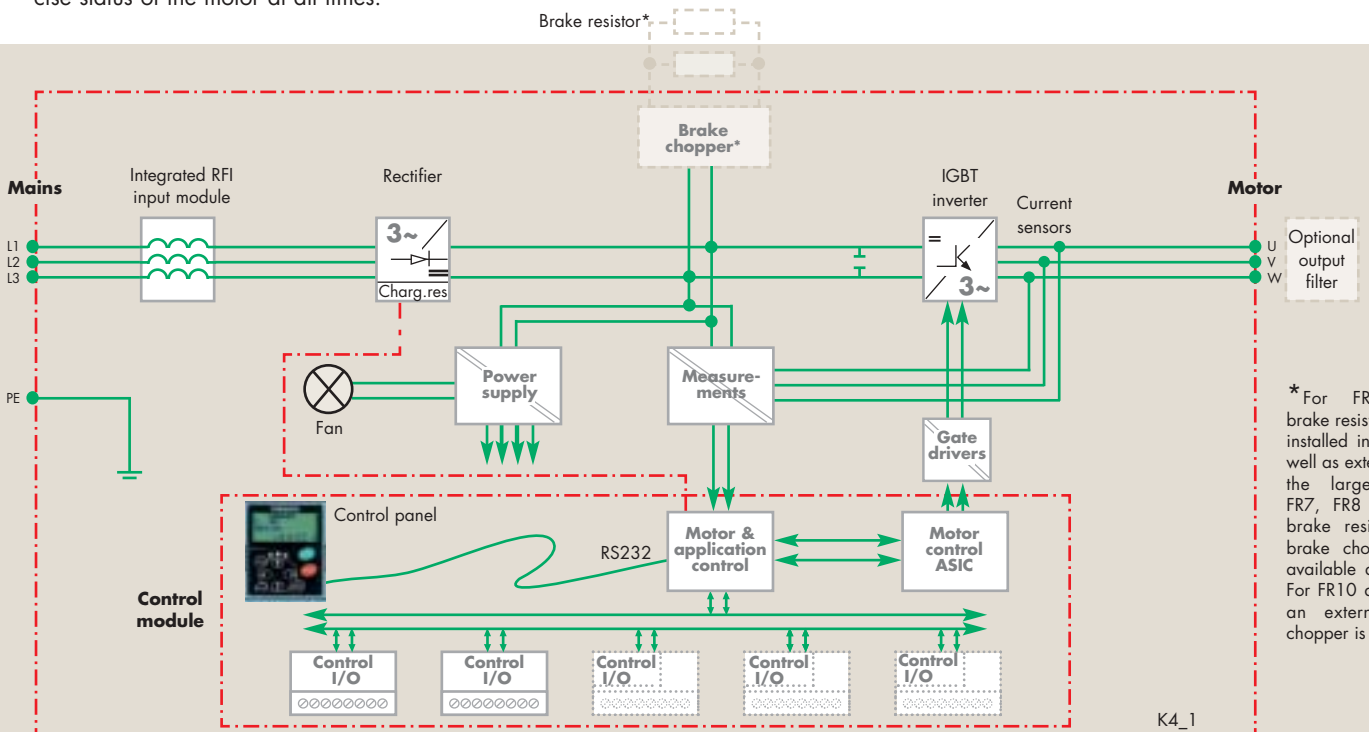
Motor control NXS

Exact control

The sophisticated sensorless flux vector control achieves the dynamic precision of closed loop motor control over most of the speed range:

- Steady state speed error: < 0.5%
- Torque rise time: < 10 ms
- Low ripple in the torque
- High immunity to resonance vibrations
- High starting torque: 200% (depends on motor/drive sizing)
- High starting current: $2.0 \times I_H$
- Suitable for multi-motor drive systems
- High-speed applications, max output frequency 7200 Hz (with special application)

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



* For FR4-FR6 a brake resistor may be installed internally as well as externally. For the larger frames FR7, FR8 and FR9, brake resistors and brake choppers are available as options. For FR10 and bigger an external brake chopper is required.

HIGH PERFORMANCE



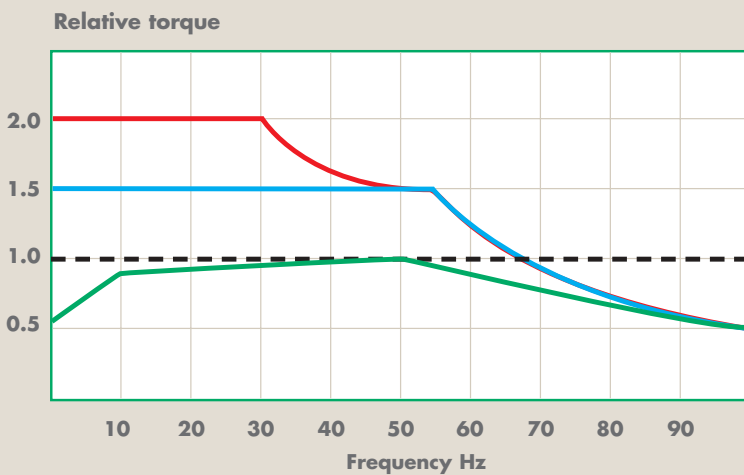
Full torque control at zero speed cannot be maintained without speed feedback. When a speed error of less than 0.5% or full torque control at all speeds is required in the application, motor control based on feedback from an encoder is an absolute necessity. This capability is incorporated into the NXP.

In addition to the current measurement system used in the NXS, the NXP utilizes feedback values from the encoder to determine the motor state. The enhanced microprocessor provided with 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, synchronization and positioning.

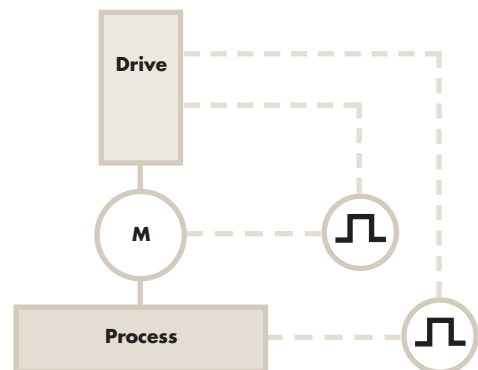
Dynamic control

- Speed error: < 0.01%, depending on the encoder
- Speed ratio accuracy: < 0.01%, depending on the encoder
- 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: < 3%
- Starting torque: > 200%, depending on motor and drive sizing
- Full capability for master/slave configurations
- Full positioning capabilities
- High-speed bus (12 Mbit/s) for fast drive-to-drive communication



Example of the loadability of a standard motor supplied by a Vacon frequency converter

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



Motor control NXP

THE MODULAR DESIGN

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 also provides information, of the actual values of current, power and voltage. In the local control mode it is used for starting and stopping the drive. The display can be mounted directly on the enclosure door, if necessary.

The control unit provides five slots for various I/O cards. A wide selection of cards is available, ranging from cards with simple analog and digital inputs to sophisticated fieldbus cards. A list of option cards with their features can be found on page 16. The internal bus of the control unit is capable of handling several fieldbus connections simultaneously. The option cards are interchangeable between both the NXS and the NXP. Certain cards can only be used with the NXP.

The control unit is typically powered from the power unit. If necessary, it can also be powered from an external 24 V supply, 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. The unit incorporates all power circuit components necessary for the operation of the drive, and is connected to the control unit via a multi-pole connector or an optical fiber.

FR4-6 are equipped with a built-in brake chopper and an optional internal resistor. The resistor is designed for a 2-second full torque 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 field upgraded to IP54 (NEMA12).

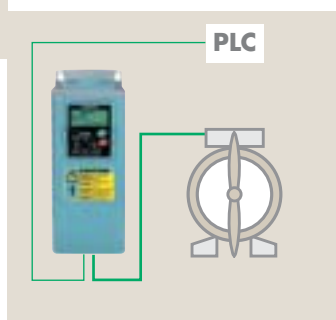


Separated in two units: power and control

APPLICATIONS

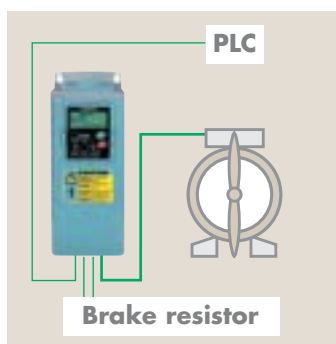
The Vacon NX can flexibly be adapted to a variety of needs using our pre-installed "All in One" targeted application package. All applications support control via a fieldbus without any additional software. Typical uses include pumps and fans, compressors, conveyors, winders, mixers, cranes and hoists, elevators and crushers. The application that best suits your needs and I/O requirements can be selected from the following:

1 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 (from a potentiometer or other source), or directly from the control panel. This application is suitable for most cases.



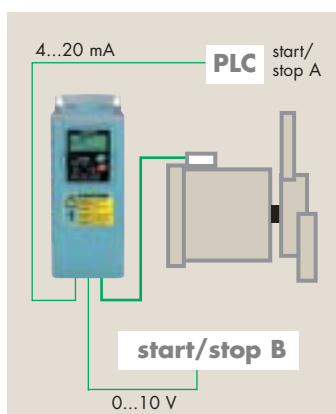
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2 The standard application features the same control signal logic as the basic application with the added possibility of freely programming all digital and analog inputs and outputs. Eight parameter groups are available, including basic, input signal,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



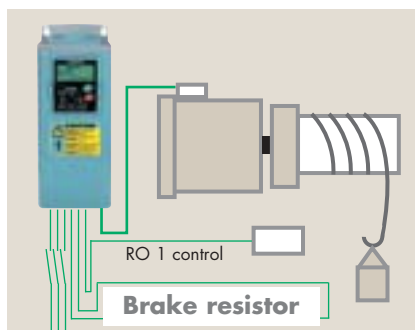
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3 The local/remote application is an ideal choice for operation with two alternative control sources. The source of the frequency reference can be freely programmed. The active control source is selected via a digital input. All outputs are programmable,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



3

4 The multi-step speed control application is intended for switching between fixed speeds. Nine programmable speeds include basic, seven multi-step 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.



4

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Separated in two units: power and control