THE AC DRIVES CATALOG

EVERY AC MOTOR DESERVES A VACON DRIVE

VACON

DRIVEN BY DRIVES

TABLE OF CONTENTS

SAVE 10% OF THE WORLD'S ENERGY CONSUMPTION WITH VACON

Vacon is driven by a passion to design, manufacture and sell only the best AC drives on the planet. AC drives can be used to control electric motors or to help generate power from renewable sources. Vacon has R&D and production facilities in Finland, the United States, China and Italy, and sales offices in more than 25 countries. In 2008, revenues totalled 431 MUSD, and Vacon employed approximately 1,200 persons worldwide. Vacon's shares (VAC1V) are listed and publicly traded on the Helsinki Stock Exchange.

Passionate attitude towards product leadership

Exclusively focused on variable speed AC drives, Vacon offers a unique blend of a dynamic and passionate attitude towards product leadership and customer services. Vacon is constantly working with a wide customer base where AC drives play an integral part of the business.

Vacon concentrates only on the essential: improving the customer's own product or process in order to bring the best possible value for the customer. With many years of experience in the field, we understand the customer's needs and can offer the most cost-effective solution to meet them in terms of process efficiency, energy savings, eco-friendliness, and the total cost of ownership.

Unique craftsmanship and R&D

More than 1,200 Vacon professionals worldwide concentrate on one thing only: providing state-of-the-art AC drives as close to the customer as possible. The secret behind Vacon's success lies in unique engineering craftsmanship and innovations. Vacon's R&D is constantly investigating the best practices in the field that are most appropriate for customers.

Today, as much as 7% of the revenues are invested into R&D, and our R&D units are located in Finland, China, USA and Italy. Therefore, we dare to say that Vacon AC drives make a difference in the market: whatever the need is – from the simplest to the most demanding – we are always open to take the challenge!

Cleantech which brings substantial savings

Vacon AC drives are 100% cleantech. Cleantech refers to all products, services, processes and systems that are less harmful to the environment than their alternatives. Vacon AC drives represent technology that not only helps you save in energy costs but also significantly improves the process control in your business.

If all AC motors in the world were equipped with Vacon AC drives, it could give savings of about 30% in the energy consumption of AC motors. This saving is about 10% of the world's total consumption of electrical energy.

Attractive partner

Vacon has a unique position in the market. It is an independent company that can focus entirely on developing AC drives. A global network combined with local production in different parts of the world makes Vacon an attractive business partner on all continents.

Vacon offers OEM partners, system integrators, brand label customers, distributors and industrial end-users a broad product portfolio and a high level of product and application expertise.

Global production & multichannel product and service network

Vacon currently manufactures AC drives in Finland, China, Italy and the United States. Adapting products as close as possible to the customer gives flexible production and short delivery times.

Vacon AC drives are sold in more than 100 countries. We have subsidiaries, business partners and service centers around the world. We increase our local presence systematically, ensuring good availability of products and service wherever you are.

Vacon grows at a fast pace

For many years, Vacon has been growing two times faster than the global AC drive market. Today, Vacon is one of the biggest AC drives manufacturers in the world. Vacon's main competitors are global conglomerates, for which AC drives are just one product among many.

The growth in the AC drive market is based on rising energy prices, increasing automation, falling electronics prices, and investments in renewable energy generation. There is room for growth in the market, for at the moment only about 10% of the electric motors in the world are controlled by AC drives.

PRODUCT SECTION EXAMPLES AND MODEL NUMBER EXPLANATION

HOW TO USE THIS SECTION

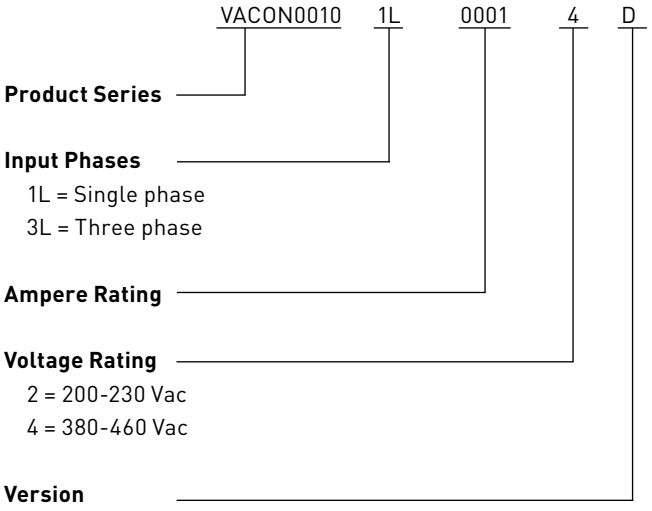
Each AC Drive product section consists of four pages that provide information about applications, features and benefits, specifications, general information such as model numbers, dimensions and options.

This easy-to-follow format prompts you
Where to Find:

- **Application Information –** The first page of each product section summarizes appropriate applications for the drive and provides other useful information to help you determine if the drive is right for your need.
- **Features & Benefits –** The first page also includes a succinct list of the drive's key features, along with the benefit of the feature.
- **Specifications –** The second page of each product section includes environmental, electrical, and control feature specifications for the drive.
- **General Information –** The third page of each product section provides model numbers, constant and variable torque HP, kW, input and output current, dimensional data, and weight for the drive.
- **Options –** The fourth page of each product section lists options available for the drive, along with a brief explanation.

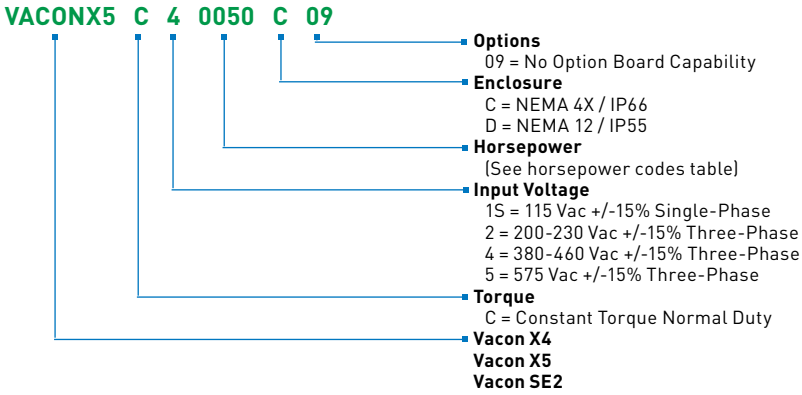
MODEL NUMBER EXPLANATION (VACON 10)

The Vacon 10 model numbers are created using an intelligent part numbering system. The following diagram is an example of how to construct the model number:



MODEL NUMBER EXPLANATION (X SERIES)

Vacon AC Drive model numbers are created using an intelligent part-numbering system. Model numbers for each drive product are listed in the left column of the grid located on the third page of each product section. The following diagram is an example of how to construct an AC Drive model number.



VACON NXS TYPE DESIGNATION CODE

NXS 0007 5 A 2 H 1 SSS A1A2000000

- Factory installed I/O boards and expanders (slots A, B, C, D and E)
- Option PCBs; each slot is represented by two characters where:
  - Ax = basic I/O PCBs, Bx = expander I/O PCBs
  - Cx = fieldbus PCBs, Dx = special PCBs
- Hardware modifications (power unit, special modifications, board varnishing)
- Brake chopper option:
  - 0 = no brake chopper
  - 1 = internal brake chopper
  - 2 = internal brake chopper and resistor
- Emission level:
  - H = fulfils the standard EN 61800-3 (2004), category C2
  - T = fulfils the standard EN 61800-3 (2004), category C4. Low earth current solution for IT networks
  - L = fulfils the standard EN 61800-3 (2004), category C3
  - C = fulfils the standard EN 61800-3 (2004), category C1
- Enclosure classification:
  - 2 = IP21
  - 5 = IP54
- Control keypad:
  - A = standard alpha-numeric keypad
  - B = no keypad
  - G = graphic keypad (Chinese and Russian letters)
- Nominal mains voltage:
  - 2 = 208...240 V AC (3-phase)
  - 5 = 380...500 V AC (3-phase)
  - 6 = 500...690 V AC (3-phase)
- Nominal current
  - Maximum continuous current of the unit @ 40°C
  - e.g. 0007 = 7 Amps
- Product range:
  - NXS

VACON NXP/NXC TYPE DESIGNATION CODE

NXC 0520 5 A 2 L 0 SSF A1A2000000 + IFD

- NXC options, see table below
- Option PCBs; each slot is represented by two characters where:
  - Ax = basic I/O PCBs, Bx = expander I/O PCBs
  - Cx = fieldbus PCBs, Dx = special PCBs
- Control
  - S = standard FR4-FR8
  - F = standard FR9 and NXC
  - A = standard NXP FR10-FR12
  - N = standard IP00 ≥ FR10 and NXC with IP54 control unit enclosure
  - V = as S, but varnished PCBs
  - G = as F, but varnished PCBs
  - B = as A, but varnished PCBs
  - O = as N, but varnished PCBs
- Cooling
  - S = standard air-cooled, T = through-hole mounting FR4-FR9
- Supply
  - S = 6-pulse, T = 12-pulse, O = 6-pulse + load switch (standalone)
  - R = Regenerative low-harmonic (AFE)
- Brake chopper
  - 0 = no brake chopper
  - 1 = integrated brake chopper
- EMC emission level EN61800-3
  - C = 1st env., unrestricted distribution
  - H = 1st env., restricted distribution
  - L = 2nd environment
  - T = for IT networks
  - N = enclosure required (FR10-FR14)
- Enclosure class
  - 0 = IP00 (module only)
  - 2 = IP21 (NEMA 1)
  - 5 = IP54 (NEMA 12)
- Control keypad
  - A = standard alphanumeric
  - B = no local keypad
  - F = dummy keypad
  - G = graphic display
- Nominal mains voltage
  - 5 = 380-500 VAC, 6 = 500-690 VAC, 2 = 208-240 VAC
- Nominal current voltage
  - 0520 = 520 A
- Product range
  - NXP = wall-mounted / standalone / module
  - NXC = cabinet

VACON 10

COMPACT AND FEATURE-RICH AC DRIVE

VACON

DRIVEN BY DRIVES

THE EASY AC DRIVE OF ALL TRADES

The Vacon 10 is a compact and feature-rich AC drive in the power range of 0.25 kW/ 0.33 HP – 5.5 kW/ 7.5 HP. Available for input voltages of 110-120 V (1-phase), 208–240 V (1-phase and 3-phase models) and 380–480 V (3-phase), the Vacon 10 is an ideal solution for pumps and fans, simple conveyors, and various door applications. Simply put: A general-purpose micro drive for basic applications.

The Vacon 10 is specially configured to meet the most common market needs, emphasizing only the important features, which makes the selection of the Vacon 10 as easy and smooth as possible. In case more flexibility or tailorability is required, Vacon also offers a customizable version of the Vacon 10.

Easy installation and commissioning
- Small physical size
- DIN rail and screw mountable
- Intelligent menu
  - Basic application macros (pumps, fans, conveyors & others)
  - Commissioning wizard
  - Full parameter commissioning

Versatile features
- Fully programmable I/O
- Conformal coated boards as standard
- Brake chopper as standard in 3-phase MI2 and MI3 frames
- PI controller as standard
- Integrated EMC filter for category level C2 available as an option

Extensive I/O
- 6 digital inputs
- 2 analog inputs
- 1 digital output
- 1 analog output
- 2 relay outputs
- RS-485/Modbus RTU as standard

Environmentally friendly
- RoHS compliant
- Recyclable materials
- Energy saving
- Decreased mechanical stress
- Reduced noise levels

MAIN DIMENSIONS

	Width		Height		Depth	
	mm	in	mm	in	mm	in
MI1	66	2.6	157	6.2	98	3.9
MI2	90	3.5	195	9.9	102	4.0
MI3	100	3.9	262	10.3	109	4.3

SELECTION GUIDE — JUST 2 EASY STEPS

Selecting your Vacon 10 is easy and straightforward. First, just choose your supply voltage, then choose the nominal motor current. That's all!

STEP 1		STEP 2	THIS IS YOUR VACON 10				
Choose your supply voltage	Motor voltage	Choose motor current (A)	↓	Do you need an EMC filter?	Power kW	HP	Frame
110-120 VAC, 1-phase	208-230 VAC, 3-phase	1.7	VACON0010-1L-0001-1-D		0.25	0.33	MI2
		2.4	VACON0010-1L-0002-1-D		0.37	0.5	MI2
		2.8	VACON0010-1L-0003-1-D		0.55	0.75	MI2
		3.7	VACON0010-1L-0004-1-D		0.75	1	MI2
		4.8	VACON0010-1L-0005-1-D		1.1	1.5	MI3
208-240 VAC, 1-phase	208-230 VAC, 3-phase	1.7	VACON0010-1L-0001-2-D		0.25	0.33	MI1
		2.4	VACON0010-1L-0002-2-D		0.37	0.5	MI1
		2.8	VACON0010-1L-0003-2-D		0.55	0.75	MI1
		3.7	VACON0010-1L-0004-2-D	add *EMC2*	0.75	1	MI2
		4.8	VACON0010-1L-0005-2-D		1.1	1.5	MI2
		7	VACON0010-1L-0007-2-D		1.5	2	MI2
		9.6	VACON0010-1L-0009-2-D		2.2	3	MI3
208-240 VAC, 3-phase	208-230 VAC, 3-phase	1.7	VACON0010-3L-0001-2-D		0.25	0.33	MI1
		2.4	VACON0010-3L-0002-2-D		0.37	0.5	MI1
		2.8	VACON0010-3L-0003-2-D		0.55	0.75	MI1
		3.7	VACON0010-3L-0004-2-D		0.75	1	MI2
		4.8	VACON0010-3L-0005-2-D		1.1	1.5	MI2
		7	VACON0010-3L-0007-2-D		1.5	2	MI2
		11	VACON0010-3L-0011-2-D		2.2	3	MI3
380-480 VAC, 3-phase	380-480 VAC, 3-phase	1.3	VACON0010-3L-0001-4-D		0.37	0.5	MI1
		1.9	VACON0010-3L-0002-4-D		0.55	0.75	MI1
		2.4	VACON0010-3L-0003-4-D		0.75	1	MI1
		3.3	VACON0010-3L-0004-4-D		1.1	1.5	MI2
		4.3	VACON0010-3L-0005-4-D	add *EMC2*	1.5	2	MI2
		5.6	VACON0010-3L-0006-4-D		2.2	3	MI2
		7.6	VACON0010-3L-0008-4-D		3	--	MI3
		9	VACON0010-3L-0009-4-D		4	5	MI3
		12	VACON0010-3L-0012-4-D		5.5	7.5	MI3
575 VAC, 3-phase	575 VAC, 3-phase	1.7	VACON0010-3L-0002-7D		0.75	1	MI3
		2.7	VACON0010-3L-0003-7D		1.5	2	MI3
		3.0	VACON0010-3L-0004-7D		2.2	3	MI3
		6.1	VACON0010-3L-0006-7D		4	5	MI3
		9	VACON0010-3L-0009-7D		5.5	7.5	MI3

*) Minimum quantities apply. Consult factory.

OPTIONS

Option	Order code	Description
IP21 cover	ENC-IP21-MIx	x = Frame size 1, 2 or 3
NEMA Type 1 Kit	ENC-IN01-MIx	x = Frame size 1, 2 or 3
MCA Kit	VACON-ADP-MCAA-KIT	Micro communication adapter with PC cable
Brake resistor MI2 & MI3	BRR-0022-LD-5	Low duty
Brake resistor MI2 & MI3	BRR-0022-HD-5	High duty

TECHNICAL DATA

Mains connection	Input voltage U_{in}	115 V, -15 %...+10 % 1~ 230 V, -15 %...+10 % 1~ 230 V, -15 %...+10 % 3~ 460 V, -15 %...+10 % 3~
	Input frequency	45...66 Hz
	Connection to mains	Once per minute or less (normal case)
Motor connection	Output voltage	0...U_{in} , (2 x U_{in}, 115 V drives)
	Output current	Continuous rated current I_N at ambient temperature max. +50°C, overload 1.5 x I_N max. 1 min/10 min
	Starting current / torque	Current 2 x I_N for 2 secs in every 20 sec period Torque depends on motor
	Output frequency	0...320 Hz
	Frequency resolution	0.01 Hz
Control characteristics	Control method	Frequency Control U/f Open loop sensorless vector control
	Switching frequency	1...16 kHz; Factory default 6 kHz
	Frequency reference	Resolution 0.01 Hz
	Field weakening point	30...320 Hz
	Acceleration time	0.1...3000 sec
	Deceleration time	0.1...3000 sec
	Braking torque	100 % x T_N with brake in 3-phase MI2 and MI3 frames 30 % x T_N without brake
Ambient conditions	Ambient operating temperature	–10°C (no frost)...+50°C: rated loadability I_N
	Storage temperature	–40°C...+70°C
	Relative humidity	0...95 % RH, non-condensing, non-corrosive, no dripping water
	Air quality: - chemical vapours - 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 1000 m 1 % derating for each 100 m above 1000 m; max. 2000 m
	Vibration EN60068-2-6	3...150 Hz Displacement amplitude 1 (peak) mm at 3...15.8 Hz Max acceleration amplitude 1 G at 15.8...150 Hz
	Shock IEC 68-2-27	UPS Drop Test (for applicable UPS weights) Storage and shipping: max 15 G, 11 ms (in package)
	Enclosure class	IP20
EMC	Immunity	Complies with EN61800-3 (2004)
	Emissions	230 V: EMC C2: with an internal RFI filter option 400 V: EMC C2: with an internal RFI filter option
Safety		61800-5-1, EN60204-1, CE, UL, cUL, IEC (see unit nameplate for more detailed approvals)
Protections	Overvoltage protection	230 V series: 437 VDC; 400 V series: 874 VDC trip level
	Undervoltage protection	230 V series: 183 VDC; 400 V series: 333 VDC trip level
	Ground fault protection	Ground fault is tested before every start. In case of ground fault in motor or motor cable, only the frequency converter is protected
	Unit overtemperature	Yes
	Motor overload	Yes
	Motor stall	Yes
	Motor underload	Yes
	Overcurrent protection	Yes, trip limit 4.0 x I_N instantaneously

VACON SE2
SIMPLE DRIVE FOR HARSH ENVIRONMENTS

VACON
DRIVEN BY DRIVES

SIMPLE DRIVE FOR HARSH ENVIRONMENTS

The Vacon SE2 family of AC drives is small in size, big on performance and economical to operate providing a powerful solution for many industrial applications. They feature remote communications capability (using Modbus® protocol), a keypad for easy configuration, and standard NEMA 12 / IP55 enclosures that eliminate the need for mounting in separate enclosures. The Vacon SE2 is suited for all types of applications including industrial conveyors, fans and pumps.

HP Range	Voltage Range	Input Phases
0.5 – 1.5 HP	**115 Vac**	**Single Phase**
0.5 – 3 HP	**230 Vac**	**Single Phase**
1 – 5 HP	**230 Vac**	**Three Phase**
1 – 10 HP	**460 Vac**	**Three Phase**

The Vacon SE2 range offers alternatives with or without an integrated main switch, providing solutions for a wide range of applications.

Easy to install and set up with only a dozen basic parameters related to ramp times and motor data to adjust. The Modbus RTU is included as standard, making integration into fieldbus control systems easy.

NEMA12/IP55 Drives meet UL and cUL, CE* standards.

Benefit – Ensures compliance with global systems.

Consult with Vacon, Inc. about compliance with European CE standards when using Vacon SE2 with integrated RFI filters that meet industrial standards needed.

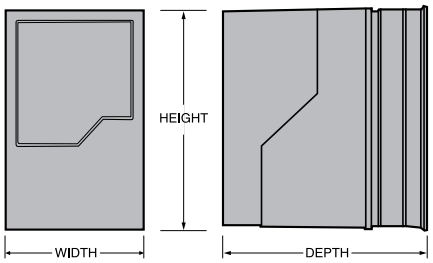
INDUSTRY SECTORS

- Food processing
- Bottling
- Pumping
- Chemical
- Waste Water
- HVAC

FEATURES

- Industrial-duty NEMA 12/IP55
- Small footprint & wall mountable
- Integrated main power disconnect, speed control and forward/stop/reverse controls available
- Designed for a harsh 40°C environment
- Resists low-pressure water, dust, dirt and chemicals
- Simple construction
- Full keypad control
- Easy to use due to advanced features
- Fast setup: common parameters available in Level 1
- Display of motor current and motor rpm
- Modbus RTU included
- Control location can be chosen: keypad, terminal strip or fieldbus
- Integrated brake chopper for sizes 2 and 3
- Duplistick programming for easy copying of data between drives
- Ratings reflect overload capacity of 150% for one minute and up to 175% for momentary overloads in high torque applications

	Frame 1		Frame 2		Frame 3	
	Inches	mm	Inches	mm	Inches	mm
Height	7.87	200	12.20	310	12.20	310
Width	5.51	140	6.49	164.8	8.29	210.5
Depth	6.38	162	6.83	176	9.65	245
Weight: lbs (kg)	5.06 (2.3)		9.90 (4.5)		13.2 (6)	



Product Code	Motor Shaft Power and Current							Frame
	High Overload (150%)			Low Overload (120%)			OL Amps (1 Min/10 Min)	Size
	HP	kW	Amps	HP	kW	Amps		
VACON SE2 110-115 Vac 1-ph, NEMA 12/IP55, EMC Class C4								
VACONSE2C1S005D01	0.5	0.37	2.3	---	---	---	3.5	F1
VACONSE2C1S010D01	1	0.75	4.3	---	---	---	6.5	F1
VACONSE2C1S015D02	1.5	1.1	5.8	---	---	---	8.7	F2
VACON SE2 110-115 Vac 1-ph, NEMA 12/IP55, EMC Class C4, Power and Control Switches Included								
VACONSE2C1S005D01S	0.5	0.37	2.3	---	---	---	3.5	F1
VACONSE2C1S010D01S	1	0.75	4.3	---	---	---	6.5	F1
VACONSE2C1S015D02S	1.5	1.1	5.8	---	---	---	8.7	F2
VACON SE2 200-240 Vac 1-ph, NEMA 12/IP55, EMC Class C4								
VACONSE2C2S005D01	0.5	0.37	2.3	---	---	---	3.5	F1
VACONSE2C2S010D01	1	0.75	4.3	---	---	---	6.5	F1
VACONSE2C2S020D01	2	1.5	7	---	---	---	10.5	F1
VACONSE2C2S020D02	2	1.5	7	---	---	---	10.5	F2
VACONSE2C2S030D02	3	2.2	10.5	---	---	---	15.8	F2
VACON SE2 200-240 Vac 1-ph, NEMA 12/IP55, EMC Class C4, Power and Control Switches Included								
VACONSE2C2S005D01S	0.5	0.37	2.3	---	---	---	3.5	F1
VACONSE2C2S010D01S	1	0.75	4.3	---	---	---	6.5	F1
VACONSE2C2S020D01S	2	1.5	7	---	---	---	10.5	F1
VACONSE2C2S020D02S	2	1.5	7	---	---	---	10.5	F2
VACONSE2C2S030D02S	3	2.2	10.5	---	---	---	15.8	F2
VACON SE2 200-240 Vac 3-ph, NEMA 12/IP55, EMC Class C4								
VACONSE2C20010D01	1	0.75	4.3	---	---	---	6.5	F1
VACONSE2C20020D01	2	1.5	7	---	---	---	10.5	F1
VACONSE2C20020D02	2	1.5	7	---	---	---	10.5	F2
VACONSE2C20030D02	3	2.2	10.5	---	---	---	15.8	F2
VACONSE2C20050D02	5	4	18	---	---	---	27	F2
VACON SE2 200-240 Vac 3-ph, NEMA 12/IP55, EMC Class C4, Power and Control Switches Included								
VACONSE2C20010D01S	1	0.75	4.3	---	---	---	6.5	F1
VACONSE2C20020D01S	2	1.5	7	---	---	---	10.5	F1
VACONSE2C20020D02S	2	1.5	7	---	---	---	10.5	F2
VACONSE2C20030D02S	3	2.2	10.5	---	---	---	15.8	F2
VACONSE2C20050D02S	5	4	18	---	---	---	27	F3
VACON SE2 380-480 Vac 3-ph, NEMA 12/IP55, EMC Class C4								
VACONSE2C40010D01	1	0.75	2.2	---	---	---	3.3	F1
VACONSE2C40020D01	2	1.5	4.1	---	---	---	6.2	F1
VACONSE2C40020D02	2	1.5	4.1	---	---	---	6.2	F2
VACONSE2C40030D02	3	2.2	5.8	---	---	---	8.7	F2
VACONSE2C40050D02	5	4	9.5	---	---	---	14.3	F2
VACONSE2C40075D02	7.5	5.5	14	---	---	---	21	F3
VACONSE2C40100D02	10	7.5	18	---	---	---	27	F3
VACON SE2 380-480 Vac 3-ph, NEMA 12/IP55, EMC Class C4, Power and Control Switches Included								
VACONSE2C40010D01S	1	0.75	2.2	---	---	---	3.3	F1
VACONSE2C40020D01S	2	1.5	4.1	---	---	---	6.2	F1
VACONSE2C40020D02S	2	1.5	4.1	---	---	---	6.2	F2
VACONSE2C40030D02S	3	2.2	5.8	---	---	---	8.7	F2
VACONSE2C40050D02S	5	4	9.5	---	---	---	14.3	F2
VACONSE2C40075D02S	7.5	5.5	14	---	---	---	21	F3
VACONSE2C40100D02S	10	7.5	18	---	---	---	27	F3

I/O CONNECTIONS

- 2 analog inputs: configurable 0...10 V, 0/4...20 mA (speed reference and actual value signal)
- 3 digital inputs (0/24 V): one of which is one of the analog inputs as well
- 1 analog/digital output 0...10 V or 0/4...20 mA analog; 24 V max as digital output
- 1 NO relay
- 10 V reference voltage out
- 24 V I/O supply voltage

OPTIONAL EXTERNAL BRAKE RESISTORS

AC drive	Minimum brake resistance
200 V single- and three-phase models	47 ohms
400 V models, size 2	100 ohms
400 V models, size 3	22 ohms

VACON SE2 SPECIFICATIONS

Mains connection	Input voltage ± 10%	115 Vac; 208-240 Vac; 380-480 Vac;
	Input frequency	48 Hz - 62 Hz
Motor connection	Output voltage	0% - 100% of Line Voltage (0-230 Vac for 115Vac drives)
	Continuous output current	Nominal output current @ +40°C; 150% overload for 1 minute
	Starting current	Nominal output current for 2 sec every 20 sec
	Output frequency	0...500 Hz
	Frequency resolution	0.1 Hz
Control characteristics	Control method	Open Loop Control
	Switching frequency	4...32 kHz effective
	Frequency reference Analog input Panel reference	Analog (0...10 V, 0...20 mA, 4...20 mA) Digital (keypad) PI control (integral) Modbus RTU
	Field weakening point	25...500 Hz
	Acceleration time	0...600 sec
	Deceleration time	0...600 sec
	Braking torque	DC brake: 30% without brake option
Ambient conditions	Ambient operating temperature	–10°C (no frost)...+40°C: I_H
	Storage temperature	–40°C...+60°C
	Relative humidity	0 to 95% RH, non-condensing, non-corrosive
	Altitude	100% load capacity (no derating) up to 1,000 m 1% derating for each 100 m above 1,000 m max. 2,000 m with UL, max. 4,000 m without UL
	Enclosure class	NEMA 12 / IP55
EMC	Immunity	Fulfils EN61800-3, first and second environment
	Emissions	Fulfils EN61800-3, first and second environment
Safety*		EN 61800-5-1 (2003), EN 60204-1 (2006), CE, UL, cUL; (see unit nameplate for more detailed approvals)
Control connections	Analog input voltage	0...+10 V, R_i = 72 kΩ Resolution 0.025%, linearity < 1% deviation
	Analog input current	0(4)...20 mA, R_i = 500 Ω
	Digital inputs (3)	Positive logic; 18...30 VDC Logic 0: 0...2 V, Logic 1: 8...30 V
	Auxiliary voltage	+24 V, ±5%, max. voltage ripple < 100 mV; max. 100 mA
	Output reference voltage	+10 V, +3%, max. load 10 mA
	Analog output	Analog output: 0...10 V (20 mA max). Resolution: 10 bits, linearity < 2% deviation
	Digital outputs	Digital output: 0 V / 24 V push-pull, 20 mA max
	Relay outputs	1 NO relay output Switching capacity: 30 VDC / 5 A, 250 VAC / 6 A, Min. switching load: 5 V / 10 mA
Protections	Overvoltage trip limit Undervoltage trip limit	230 V Drives / 400 V Drives Overvoltage trip level: 418 V / 835 V Undervoltage trip level (rising volts): 239 V / 478 V Undervoltage trip level (falling volts): 160 V / 320 V
	Earth fault protection	In case of earth fault in motor or motor cable, only the frequency converter is protected
	Mains supervision	Trips if any of the input phases is missing
	Motor phase supervision	Trips if any of the output phases is missing
	Overcurrent protection	Yes
	Unit overtemperature protection	Yes
	Motor overload protection	Yes
	Motor stall protection	Yes
	Motor underload protection	Yes
	Short-circuit protection of +24 V and +10 V reference voltages	Yes

VACON X SERIES

RUGGED DRIVES FOR THE REAL WORLD

VACON

DRIVEN BY DRIVES

THE TOUGHEST AC DRIVES ON THE PLANET!

The Vacon X4 and X5 AC Drives are designed for REAL world that is not gentle or forgiving to electronic products. They have been designed to keep driving in harsh environments and are built from the ground up to survive hostile conditions and still be simple to use. They are built to be mounted where the work is, not hidden in another enclosure or room that adds costs and space.

The same enclosures that can survive in the harsh industrial world makes them ideal when cleanliness is extremely important, such as the Food and Beverage industry where high pressure washings are needed on a regular basis. The Vacon X4 and X5 drives, through 100 HP, exceed the specifications of their rated NEMA 4X / IP66 Indoor and Outdoor Use enclosures. AND all models up through 30 HP can withstand high pressure washdown of 1,000 PSI at 6 inches!

The Vacon X Series drives have the brains to go with their brawn. All models are packed with advanced control and operation features that make them the best choice for everything from simple, stand-alone applications to advanced system-level controls.

The Vacon X Series drives also boast the easiest programming and operation in the industry. The bright, clear, backlit display provides an easy to read and customizable view for operation and programming. The Vacon X Series keypad has large, well marked buttons to control all aspects of the drive operation and programming.

The Vacon X4 has the toughness and features to handle most industrial jobs with ease. If the application is more unique, the X5 accepts option boards, and has a USB interface, fully coated PC boards for added protection and other advanced features such as a real-time-clock.

A tough enclosure, an easy to read display, simple programming and the confidence of knowing you can mount the drive almost anywhere make the Vacon X4 and Vacon X5 drives the only choice.

Toughest packaging

- NEMA 4X / IP66 Indoor and Outdoor Use enclosures through 100 HP; NEMA 12 / IP55 for 125 HP and above
- Withstands 1,000 PSI washdown at 6 inches on models though 30 HP
- Thick injected foam and metal covers protect against bumps and misuse
- Mounts close to the motor to eliminate long motor lead problems

Easiest to use

- Simple intuitive programming
- Multi-language display – no codes to learn
- Wireless programming using PDA-trAC+® for Windows Mobile 5®
- Application Marcos make set-up a breeze

Most versatile

- Operate form keypad, remote signals, computers or any combination
- Mount them where you use them
- Built-in 9-step PLC functions (25-step with X5)
- ARCTIC Mode maintains safe operating temperature in cold locations

SIMPLE TO OPERATE

Basic operations are a breeze with Vacon's enhanced keypad. The familiar design uses color-coded buttons with text and symbols, remains easy-to-use and understand, yet offers an unprecedented breadth of functionality. With a few simple touch commands, operators have access to parameters for configuration, start-up, operation and troubleshooting.

- Run set-up macros for fan, pump, or sensorless vector applications with real time clock capabilities. Collect real time data and event logs using a choice of communication protocols or through the standard USB port.

- Expand the basic operations with predefined macro commands that simplify common application set ups. One-touch menu selection collects the most frequently used parameters and presets them with common application settings. Collect real time data and event logs using a choice of communication protocols or through standard USB port.

Vacon's user-friendly keypad makes operation simple. The easy-to-read display communicates status information.

PDA-trAC+® software allows Pocket PC devices with infrared networking capabilities to be used for accurate product configuration. No more need for special cables, adapters or opening enclosures to change a setting! Download your free copy from our web site: www.vacon.com

- The user-connection terminal strip handles common jobs with ease while providing application flexibility with extra inputs and relays not found on other drives.
- Standard "Built-In" Dynamic Braking Resistors virtually eliminate nuisance trips, providing more uptime.
- 60:1 constant torque turn down ratio provides low speed performance when you need it. Optional performance with enhanced turndown ratio using encoder feedback option.

ADVANCED VACON X5 FEATURES

USB FUNCTIONS

- Parameter Save / Recall
- Save parameter set to USB stick and upload to another drive
- Stored data easily opened with Microsoft Excel
- Ability to define custom file name (numbers or text)
- Easy firmware upgrades using standard USB memory stick

REAL TIME CLOCK FUNCTION

- Control operation based on time-of-day. Separate weekday and weekend settings available
- Fault Information — real time data is stored with all faults
- Signals an event via text on the display or contact closure, independent of drive operation
- Keeper Function — logs time-based data from external or internal signals
- Data read via serial communication or transferred to USB Memory Stick

PROGRAM SEQUENCER ENHANCEMENTS

- Improved functionality is closer to traditional PLC than available with current X4
- New loop and branch capabilities available
- Real Time Clock — time-of-day (TOD) enable function, allows programmed operation to specific periods of the day or week

OPTIONS

The ability to accept option boards enhances the Vacon X5's application flexibility.

Current options afford Vacon X5 Profibus with the opportunity to communicate on powerful serial communication networks like DeviceNet, Ethernet IP Profibus and Modbus TCP/IP. An additional option affords the opportunity to interface a shaft mounted optical encoder to the Vacon X5 for improved performance. All options include five (5) channels of 115Vac control options.

Remote IP66-rated keypad are also available for both the Vacon X4 and X5 drives.

APPLICATIONS

Municipal Water Supply Application — User needs to gather information on a scheduled basis of the amount of water that is pumped out of a municipal well. The readings must be gathered weekly and be in thousands of gallons per day. The Keeper function can gather this automatically and the operator only needs to download once a week. The information is in CSV format that will open in Excel with defined headers.

Unattended Operation — Energy savings add up every day with Vacon X5's time-of-day functionality providing automated startup of critical operating systems. Prior to the arrival of the production team, each morning the dust collector, cooling fans and even the lights in a foundry all start-up to full operating status without the need for human intervention. At the end of the day, no one needs to remember to shut these systems down. The Vacon X5 takes care watching the clock for you. Saving energy is just one of the benefits delivered by the Vacon X5.

PRODUCT RANGE

VACON X Series 115 Vac 1-ph, NEMA 4X/IP66 Indoor and Outdoor, EMC Class C4

Product Code		Motor Shaft Power and Current							Frame	Option Board
Vacon X4	Vacon X5	Heavy Duty (150%)			Normal Duty (120%)			OL Amps (1 Min/10 Min)	Size	(Y/N)
		HP	kW	Amps	HP	kW	Amps			
---	VACONX5C1S010C	0.5	0.37	2.2	1	0.75	4.2	5	F1A	Y
VACONX4C1S010C	VACONX5C1S010C09	0.5	0.37	2.2	1	0.75	4.2	5	F0	N

VACON X Series 200-230 Vac 3-ph, NEMA 4X/IP66 Indoor and Outdoor, EMC Class C4

Product Code		Motor Shaft Power and Current							Frame	Option Board
Vacon X4	Vacon X5	Heavy Duty (150%)			Normal Duty (120%)			OL Amps (1 Min/10 Min)	Size	(Y/N)
		HP	kW	Amps	HP	kW	Amps			
---	VACONX5C20010C	0.5	0.37	2.2	1	0.75	4.2	5	F1A	Y
---	VACONX5C20020C	1	0.75	4.2	2	1.5	6.8	8.2	F1A	Y
---	VACONX5C20030C	2	1.5	6.8	3	2.2	9.6	11.5	F1A	Y
---	VACONX5C20050C	3	2.2	9.6	5	4	15.2	18.2	F1A	Y
---	VACONX5C20075C	5	4	15.2	7.5	5.5	22	26	F1A	Y
---	VACONX5C20100C	7.5	5.5	22	10	7.5	28	34	F2A	Y
---	VACONX5C20150C	10	7.5	28	15	11	42	50	F2A	Y
---	VACONX5C20200C	15	11	42	20	15	54	65	F3	Y
---	VACONX5C20250C	20	15	54	25	18.5	68	82	F3	Y
VACONX4C20010C	VACONX5C20010C09	0.5	0.37	2.2	1	0.75	4.2	5	F0	N
VACONX4C20020C	VACONX5C20020C09	1	0.75	4.2	2	1.5	6.8	8.2	F0	N
VACONX4C20030C	VACONX5C20030C09	2	1.5	6.8	3	2.2	9.6	11.5	F0	N
VACONX4C20050C	VACONX5C20050C09	3	2.2	9.6	5	4	15.2	18.2	F1	N
VACONX4C20075C	VACONX5C20075C09	5	4	15.2	7.5	5.5	22	26	F1	N
VACONX4C20100C	VACONX5C20100C09	7.5	5.5	22	10	7.5	28	34	F2	N
VACONX4C20150C	VACONX5C20150C09	10	7.5	28	15	11	42	50	F2	N
VACONX4C20200C	---	15	11	42	20	15	54	65	F3	N
VACONX4C20250C	---	20	15	54	25	18.5	68	82	F3	N

VACON X Series 380-460 Vac 3-ph, NEMA 4X/IP66 Indoor and Outdoor, EMC Class C4

Product Code		Motor Shaft Power and Current							Frame	Option Board
Vacon X4	Vacon X5	Heavy Duty (150%)			Normal Duty (120%)			OL Amps (1 Min/10 Min)	Size	(Y/N)
		HP	kW	Amps	HP	kW	Amps			
---	VACONX5C40010C	0.5	0.37	1.1	1	0.75	2.1	2.5	F1A	Y
---	VACONX5C40020C	1	0.75	2.1	2	1.5	3.4	4.1	F1A	Y
---	VACONX5C40030C	2	1.5	3.4	3	2.2	4.8	5.8	F1A	Y
---	VACONX5C40050C	3	2.2	4.8	5	4	7.6	9.1	F1A	Y
---	VACONX5C40075C	5	4	7.6	7.5	5.5	11	13.2	F1A	Y
---	VACONX5C40100C	7.5	5.5	11	10	7.5	14	16.8	F1A	Y
---	VACONX5C40150C	10	7.5	14	15	11	21	25	F2A	Y
---	VACONX5C40200C	15	11	21	20	15	27	32	F2A	Y
---	VACONX5C40250C	20	15	27	25	18.5	34	41	F2A	Y
---	VACONX5C40300C	25	18.5	34	30	22	40	48	F2A	Y
---	VACONX5C40400C	30	22	40	40	30	52	63	F3	Y
---	VACONX5C40500C	40	30	52	50	37	65	78	F3	Y
---	VACONX5C40600C	50	37	65	60	45	77	92	F4	Y
---	VACONX5C40750C	60	45	77	75	55	96	115	F4	Y
---	VACONX5C41000C	75	55	96	100	75	124	149	F4	Y
VACONX4C40010C	VACONX5C40010C09	0.5	0.37	1.1	1	0.75	2.1	2.5	F0	N
VACONX4C40020C	VACONX5C40020C09	1	0.75	2.1	2	1.5	3.4	4.1	F0	N
VACONX4C40030C	VACONX5C40030C09	2	1.5	3.4	3	2.2	4.8	5.8	F0	N
VACONX4C40050C	VACONX5C40050C09	3	2.2	4.8	5	4	7.6	9.1	F1	N
VACONX4C40075C	VACONX5C40075C09	5	4	7.6	7.5	5.5	11	13.2	F1	N
VACONX4C40100C	VACONX5C40100C09	7.5	5.5	11	10	7.5	14	16.8	F1	N
VACONX4C40150C	VACONX5C40150C09	10	7.5	14	15	11	21	25	F2	N
VACONX4C40200C	VACONX5C40200C09	15	11	21	20	15	27	32	F2	N
VACONX4C40250C	VACONX5C40250C09	20	15	27	25	18.5	34	41	F2	N
VACONX4C40300C	VACONX5C40300C09	25	18.5	34	30	22	40	48	F2	N
VACONX4C40400C	---	30	22	40	40	30	52	63	F3	N
VACONX4C40500C	---	40	30	52	50	37	65	78	F3	N
VACONX4C40600C	---	50	37	65	60	45	77	92	F4	N
VACONX4C40750C	---	60	45	77	75	55	96	115	F4	N
VACONX4C41000C	---	75	55	96	100	75	124	149	F4	N

VACON X Series 380-460 Vac 3-ph, NEMA 12/IP55, EMC Class C4

Product Code		Motor Shaft Power and Current							Frame	Option Board
Vacon X4	Vacon X5	Heavy Duty (150%)			Normal Duty (120%)			OL Amps (1 Min/10 Min)	Size	(Y/N)
		HP	kW	Amps	HP	kW	Amps			
---	VACONX5C41250D	100	75	124	120	90	156	187	F5	Y
---	VACONX5C41500D	125	90	156	150	110	180	216	F5	Y
---	VACONX5C42000D	150	110	180	200	132	240	288	F5	Y
VACONX4C41250D	---	100	75	124	120	90	156	187	F5	N
VACONX4C41500D	---	125	90	156	150	110	180	216	F5	N
VACONX4C42000D	---	150	110	180	200	132	240	288	F5	N

VACON X Series 575 Vac 3-ph, NEMA 4X/IP66 Indoor and Outdoor, EMC Class C4

Product Code		Motor Shaft Power and Current							Frame	Option
Vacon X4	Vacon X5	Heavy Duty (150%)			Normal Duty (120%)			OL Amps (1 Min/10 Min)	Size	Boards? (Y/N)
		HP	kW	Amps	HP	kW	Amps			
---	VACONX5C50010C	0.5	0.37	0.9	1	0.75	1.7	2	F1A	Y
---	VACONX5C50020C	1	0.75	1.7	2	1.5	2.7	3.2	F1A	Y
---	VACONX5C50030C	2	1.5	2.7	3	2.2	3.9	4.7	F1A	Y
---	VACONX5C50050C	3	2.2	3.9	5	4	6.1	7.3	F1A	Y
---	VACONX5C50075C	5	4	6.1	7.5	5.5	9	10.8	F1A	Y
---	VACONX5C50100C	7.5	5.5	9	10	7.5	11	13.2	F1A	Y
---	VACONX5C50150C	10	7.5	11	15	11	17	20	F2A	Y
---	VACONX5C50200C	15	11	17	20	15	22	26	F2A	Y
---	VACONX5C50250C	20	15	22	25	18.5	27	32	F2A	Y
---	VACONX5C50300C	25	18.5	27	30	22	32	38	F2A	Y
---	VACONX5C50400C	30	22	32	40	30	41	49	F3	Y
---	VACONX5C50500C	40	30	41	50	37	52	62	F3	Y
---	VACONX5C50600C	50	37	52	60	45	62	74	F4	Y
---	VACONX5C50750C	60	45	62	75	55	77	92	F4	Y
---	VACONX5C51000C	75	55	77	100	75	99	119	F4	Y
VACONX4C50010C	VACONX5C50010C09	0.5	0.37	0.9	1	0.75	1.7	2	F1	N
VACONX4C50020C	VACONX5C50020C09	1	0.75	1.7	2	1.5	2.7	3.2	F1	N
VACONX4C50030C	VACONX5C50030C09	2	1.5	2.7	3	2.2	3.9	4.7	F1	N
VACONX4C50050C	VACONX5C50050C09	3	2.2	3.9	5	4	6.1	7.3	F1	N
VACONX4C50075C	VACONX5C50075C09	5	4	6.1	7.5	5.5	9	10.8	F1	N
VACONX4C50100C	VACONX5C50100C09	7.5	5.5	9	10	7.5	11	13.2	F1	N
VACONX4C50150C	VACONX5C50150C09	10	7.5	11	15	11	17	20	F2	N
VACONX4C50200C	VACONX5C50200C09	15	11	17	20	15	22	26	F2	N
VACONX4C50250C	VACONX5C50250C09	20	15	22	25	18.5	27	32	F2	N
VACONX4C50300C	VACONX5C50300C09	25	18.5	27	30	22	32	38	F2	N
VACONX4C50400C	---	30	22	32	40	30	41	49	F3	N
VACONX4C50500C	---	40	30	41	50	37	52	62	F3	N
VACONX4C50600C	---	50	37	52	60	45	62	74	F4	N
VACONX4C50750C	---	60	45	62	75	55	77	92	F4	N
VACONX4C51000C	---	75	55	77	100	75	99	119	F4	N

VACON X Series 575 Vac 3-ph, NEMA 12/IP55, EMC Class C4

Product Code		Motor Shaft Power and Current							Frame	Option
Vacon X4	Vacon X5	Heavy Duty (150%)			Normal Duty (120%)			OL Amps (1 Min/10 Min)	Size	Boards? (Y/N)
		HP	kW	Amps	HP	kW	Amps			
---	VACONX5C51250D	100	75	99	120	90	125	150	F5	Y
---	VACONX5C51500D	125	90	125	150	110	144	173	F5	Y
---	VACONX5C52000D	150	110	144	200	132	192	230	F5	Y
VACONX4C51250D	---	100	75	99	120	90	125	150	F5	N
VACONX4C51500D	---	125	90	125	150	110	144	173	F5	N
VACONX4C52000D	---	150	110	144	200	132	192	230	F5	N

Vacon X4 & X5 Frame Dimensions and Weights

	Dimensions (Inches) *			Weight *	Dimensions (mm) *			Weight *
	W	H	D	(lbs)	W	H	D	(kg)
Frame 0	6.5	9.47	6.08	8.5	165	241	155	3.85
Frame 1	8.72	12.01	6.51	14	221	306	166	6.35
Frame 1A	8.72	12.01	8.49	14	221	306	216	6.35
Frame 2	10.75	17.38	7.91	29.5	273	442	201	13.38
Frame 2A	10.75	17.38	9.89	29.5	273	442	251	13.38
Frame 3	11.19	20.19	11.73	50	286	513	314	22.68
Frame 4	12.84	29.35	13.8	95	326	745	351	43.1
Frame 5	16.31	50.77	16.88	305	414	1290	429	138.35

*without shipping package

TYPE DESIGNATION CODE

VACONX5 C 4 0050 C 09

Options
09 = No Option Board Capability

Enclosure
C = NEMA 4X / IP66
D = NEMA 12 / IP55

Horsepower
(See horsepower codes table)

Input Voltage
1S = 115 Vac +/-15% Single-Phase
2 = 200-230 Vac +/-15% Three-Phase
4 = 380-460 Vac +/-15% Three-Phase
5 = 575 Vac +/-15% Three-Phase

Torque
C = Constant Torque Normal Duty

Vacon X4
Vacon X5

VACON X4 AND VACON X5 SPECIFICATIONS

Environmental	Operating temperature	-10°C to +40°C (14°F to 104°F)			
	Storage temperature	-20°C to 65°C (-4°F to 149°F)			
	Humidity	0% to 95% non-condensing			
	Altitude	1,000 m (3,300 ft) without derating			
	Maximum vibration	Per EN50178: Frame Size 0 and 1 5G			
	Acoustic noise	80 dba sound power at 1 m (3 ft)			
	Cooling	1 - 5 HP models: Natural convection 7.5 - 200 HP: Forced air (temperature controlled external fan)			
	Protection Level	1 – 100 HP models: NEMA 4X / IP66 Indoor or Outdoor Use (1 – 30 HP models: 1,000 psi water spray at 6 inches) 125 – 200 HP models: NEMA 12 / IP55			
	Agency approvals	UL, cUL, CE			
Electrical	Input voltage	115 Vac 1 phase, +/- 15% 1 HP 200-230 Vac, 3 phase, +/- 15% 1-25 HP 380-460 Vac, 3 phase, +/- 15% 1-200 HP 575 Vac, 3 phase, +/- 15% 1-200 HP			
	Line frequency	50 / 60 Hz +/-2 Hz			
	Source kVA (maximum)	10 times the unit rated kVA (65kA maximum)			
	DC bus voltage for: Overvoltage trip Dynamic brake activation Normal undervoltage (UV) trip	115 Vac models 406 Vdc 388 Vdc 199 Vdc	230 Vac models 406 Vdc 388 Vdc 199 Vdc	460 Vac models 814 Vdc 776 Vdc 397 Vdc	575 Vac models 1017 Vdc 970 Vdc 497 Vdc
	Control system	V/Hz or Sensorless Vector Control (SVC) Carrier frequency = 1 to 16 kHz programmable			
	Output voltage	0 to 100% of line voltage, 3 phase			
	Overload capacity	120% of rated RMS current for 60 seconds (Normal Duty rating) 150% of rated RMS current for 60 seconds (Heavy Duty rating)			
	Frequency output	Range: 0.1 – 400Hz; Stability: 0.1Hz, 0.1% analog over 24 hours +/- 10°C			
Control Features	Reference inputs	3 – Analog / digital input: 0-5 / 0-10 Vdc, 0-4/20mAdc, 0-1/10/100kHz; each includes independent calibration adjustments			
	Reference supply voltage	10 Vdc (10 mAdc maximum)			
	Digital inputs (10)	Off = 0 to 3 Vdc, On = 10 to 32 Vdc (pull-up logic), selectable between pull-up and pull-down logic			
	Digital supply voltage	24 Vdc (150 mAdc maximum)			
	Preset frequencies	X4: 8 preset frequencies; X5: 16 preset frequencies			
	Digital outputs	2 SPDT relay output: 130 Vac, 1 Amp / 250 Vac, 0.5 Amp 2 open collector outputs 50 mA per device			
	Analog output	0-10Vdc (5mA max) / 0-4/20mAdc (500 ohm load)			
	DC holding/injection braking	At start, stop, by frequency with adjustable current level and time or continuous DC injection by digital input			
	Current limit	Four-quadrant adjustable from 5 to 150%			
	Speed ramps	Primary and alternate adjustable from 0.1 to 3200.0 seconds			
	Voltage boost	Adjustable fixed boost or adjustable auto boost			
	Voltage characteristic	V/Hz - Linear, pump, fan or 2-piece linear; Sensorless Vector			
	Timed overload	Adjustable inverse time trip (shear pin, 30 sec, 60 sec, 5 minutes) for standard or inverter-duty motors			
	Protective features	Overcurrent, Overvoltage fault, ground fault, short circuit, Dynamic Brake overload, drive temperature, power wiring fault. Drive-timed overload, input voltage quality, overvoltage ridethrough			
	Program Sequence Controller	X4: 9-step, PLC-type functionality to control speed, direction and ramp times based on time, analog input, digital input or pulse count. X5: 25-step, PLC-type functionality that can control speed, direction and ramps based on time, analog input,digital input, or pulse input. Conditional branching, addressable outputs and real time operations possible.			
	PI and PID Feedback	X4: PI Process control available with the use of a customer supplied transducer, either 0-10Vdc, 4-20mA or optical encoder input to the drive. X5: Process control available with the use of a customer supplied transducer, either 0-10Vdc, 4-20mA or optical encoder input to the drive. Includes an optional sleep mode, activated when the loop is satisfied.			

VACON NXS
ROBUST DRIVE FOR HEAVY USE

VACON
DRIVEN BY DRIVES

THE RELIABLE CHOICE

The Vacon NXS is a compact AC drive in the power range of 0.50—750 HP and supply voltages of 208—690 V for heavy use in machines, buildings and all branches of industry.

The robust design incorporates effective protection against supply network disturbances. Trip-free operation is also guaranteed due to sophisticated motor control principles and motor/drive protection features, component selection and effective cooling.

Enclosure classes of NEMA 1 and NEMA 12 and integrated high-level EMC filters make the Vacon NXS suitable for all environments.

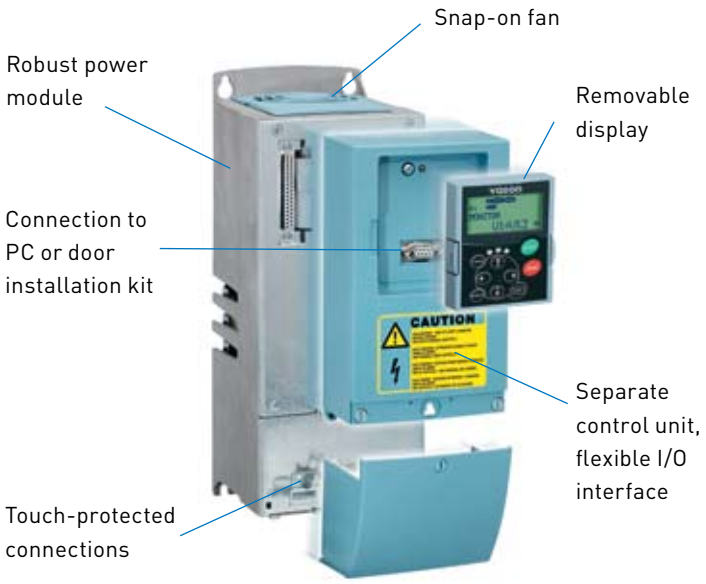
The Start-Up Wizard and the standard All-In-One Application Package make parameter setting extremely easy in all cases, from simple to complex.

The wide and flexible standard I/O and option for five I/O boards provide versatile controllability. The most common fieldbus options are also available.

The modular design of the Vacon NXS brings several advantages: the control terminals are safely separated from power terminals, upgrading the control inputs and outputs is easy and convenient, replacing the cooling fan (the only regularly replaceable component) is fast, the display panel can be utilized for parameter copying, etc.

Features

- Easy to use display panel
- Interactive programming with Start-Up Wizard
- Versatile All-in-One Package
- PID controller and PFC for 1-5 pumps
- Special applications available (water application package, high speed, etc.)
- Five slots for control boards (2 basic boards and 3 option boards)
- High switching frequency, low noise
- Steady state speed error < 1%
- Low torque ripple
- Starting torque > 200%, depending on AC drive sizing
- Suitable for multi-motor applications



VACON NXS NEMA 1

FR4 FR5 FR6 FR7 FR8 FR9

The mechanical design is extremely compact. The NEMA 12 units in particular are the smallest AC drives on the market. All units are suitable for both wall and enclosure mounting with all necessary components: integrated EMC filters, AC chokes, cable protection, dust and water protection. The effective super-cooling principle allows high ambient temperatures and high switching frequencies without derating.

Vacon NXS 208—240 V (3 phase supply). NEMA 1/NEMA 12. EMC level C2. air-cooled AC drive

Order type code	Motor shaft power and current							Size	Dimensions	Weight
NEMA 1/NEMA 12	High overload (150%)				Low overload (120%)					
For NEMA 12, replace '2' with '5', e.g. NXS00042A**5**H1....	HP	kW	Amps	Amps overload	HP	kW	Amps overload	FR	W x H x D inches	[lbs]
NXS00042A2H1SSSA1A2	0.75	.55	3.7	5.6	1	.75	4.8	FR4	5.04x11.50x7.48	11
NXS00072A2H1SSSA1A2	1	.75	4.8	7.2	1.5	1.1	6.6	FR4	5.04x11.50x7.48	11
NXS00082A2H1SSSA1A2	1.5	1.1	6.6	9,9	2	1.5	7.8	FR4	5.04x11.50x7.48	11
NXS00112A2H1SSSA1A2	2	1.5	7.8	11.7	3	2.2	11	FR4	5.04x11.50x7.48	11
NXS00122A2H1SSSA1A2	3	2.2	11	16.5	3	2.2	12.5	FR4	5.04x11.50x7.48	11
NXS00172A2H1SSSA1A2	3	2.2	12.5	18.8	5	3.7	17.5	FR5	5.67x15.39x8.43	18
NXS00252A2H1SSSA1A2	5	3.7	17.5	26.3	7.5	5.5	25	FR5	5.67x15.39x8.43	18
NXS00312A2H1SSSA1A2	7.5	5.5	25	37.5	10	7.5	31	FR5	5.67x15.39x8.43	18
NXS00482A2H1SSSA1A2	10	7.5	31	46.5	15	10	48	FR6	7.68x20.43x9.33	41
NXS00612A2H1SSSA1A2	15	10	48	72	20	15	61	FR6	7.68x20.43x9.33	41
NXS00752A2H0SSSA1A2	20	15	61	91.5	25	18.5	75	FR7	9.33x23.27x10.12	77
NXS00882A2H0SSSA1A2	25	18.5	75	112.5	30	22	88	FR7	9.33x23.27x10.12	77
NXS01142A2H0SSSA1A2	30	22	88	132	40	30	114	FR7	9.33x23.27x10.12	77
NXS01402A2H0SSSA1A2	40	30	105	158	50	37	140	FR8	11.46x29.84x13.54	128
NXS01702A2H0SSSA1A2	50	37	140	210	60	45	170	FR8	11.46x29.84x13.54	128
NXS02052A2H0SSSA1A2	60	45	170	255	75	55	205	FR8	11.46x29.84x13.54	128
NXS02612A2H0SSFA1A2	75	55	205	308	100	75	261	FR9	18.90x45.28x14.25	322
NXS03002A2H0SSFA1A2	75	55	245	368	100	75	300	FR9	18.90x45.28x14.25	322
NXS02612A5H0SSFA1A2	75	55	205	308	100	75	261	FR9	18.90x45.28x14.25	322
NXS03002A5H0SSFA1A2	75	55	245	368	100	75	300	FR9	18.90x45.28x14.25	322

VACON NXS NEMA 12

FR4 FR5 FR6 FR7 FR8 FR9

PRODUCT RANGE

Vacon NXS 380—500 V. NEMA 1/NEMA 12. EMC level C2. air-cooled AC drive

Order type code NEMA 1/NEMA 12 For NEMA 12, replace '2' by '5', e.g. NXS00035A**5**H1....	Motor shaft power and current							Size	Dimensions	Weight
	High overload				Low overload					
	HP	kW	Amps	Amps overload	HP	kW	Amps overload	FR	W x H x D inches	[lbs]
NXS00035A2H1SSSA1A2	1	.75	2.2	3,3	2	1.1	3.3	FR4	5.04x11.5x7.48	11
NXS00045A2H1SSSA1A2	1.5	1.1	3.3	5	2	1.1	4.3	FR4	5.04x11.5x7.48	11
NXS00055A2H1SSSA1A2	2	1.5	4.3	6,5	3	2.2	5.6	FR4	5.04x11.5x7.48	11
NXS00075A2H1SSSA1A2	3	2.2	5.6	8,4	5	3.7	7.6	FR4	5.04x11.5x7.48	11
NXS00095A2H1SSSA1A2	5	3.7	7.6	11,4	5	3.7	9	FR4	5.04x11.5x7.48	11
NXS00125A2H1SSSA1A2	5	3.7	9	13,5	7.5	5.5	12	FR4	5.04x11.5x7.48	11
NXS00165A2H1SSSA1A2	7.5	5.5	12	18	10	7.5	16	FR5	5.67x15.39x8.43	18
NXS00225A2H1SSSA1A2	10	7.5	16	24	15	10	23	FR5	5.67x15.39x8.43	18
NXS00315A2H1SSSA1A2	15	10	23	35	20	15	31	FR5	5.67x15.39x8.43	18
NXS00385A2H1SSSA1A2	20	15	31	47	25	18.5	38	FR6	7.68x20.43x9.33	41
NXS00455A2H1SSSA1A2	25	18.5	38	57	30	22	46	FR6	7.68x20.43x9.33	41
NXS00615A2H1SSSA1A2	30	22	46	69	40	30	61	FR6	7.68x20.43x9.33	41
NXS00725A2H0SSSA1A2	40	30	61	92	50	37	72	FR7	9.33x23.27x10.12	77
NXS00875A2H0SSSA1A2	50	37	72	108	60	45	87	FR7	9.33x23.27x10.12	77
NXS01055A2H0SSSA1A2	60	45	87	131	75	55	105	FR7	9.33x23.27x10.12	77
NXS01405A2H0SSSA1A2	75	55	105	158	100	75	140	FR8	11.46x29.84x13.54	128
NXS01685A2H0SSSA1A2	100	75	140	210	125	90	170	FR8	11.46x29.84x13.54	128
NXS02055A2H0SSSA1A2	125	90	170	255	150	110	205	FR8	11.46x29.84x13.54	128
NXS02615A2H0SSFA1A2	150	110	205	308	200	150	261	FR9	18.9x45.28x14.25	322
NXS03005A2H0SSFA1A2	200	150	245	368	250	190	300	FR9	18.9x45.28x14.25	322

Vacon NXS 500—690 V. NEMA 1/NEMA 12. EMC level C3. air-cooled AC drive

Order type code NEMA 1/NEMA 12 For NEMA 12, replace '2' by '5', e.g. NXS00035A**5**H1....	Motor shaft power and current							Size	Dimensions	Weight
	High overload				Low overload					
	HP	kW	Amps	Amps overload	HP	kW	Amps overload	FR	W x H x D inches	[lbs]
NXS00046A2L0SSSA1A2	2	1.5	3.2	5	3	2.2	4.5	FR6	7.68x20.43x9.33	41
NXS00056A2L0SSSA1A2	3	2.2	4.5	6,8	3	2.2	5.5	FR6	7.68x20.43x9.33	41
NXS00076A2L0SSSA1A2	3	2.2	5.5	8,3	5	3.7	7.5	FR6	7.68x20.43x9.33	41
NXS00106A2L0SSSA1A2	5	3.7	7.5	11,3	7.5	55.	10	FR6	7.68x20.43x9.33	41
NXS00136A2L0SSSA1A2	7.5	5.5	10	15	10	7.5	13.5	FR6	7.68x20.43x9.33	41
NXS00186A2L0SSSA1A2	10	7.5	13.5	20,3	15	10	18	FR6	7.68x20.43x9.33	41
NXS00226A2L0SSSA1A2	15	10	18	27	20	15	22	FR6	7.68x20.43x9.33	41
NXS00276A2L0SSSA1A2	20	15	22	33	25	18.5	27	FR6	7.68x20.43x9.33	41
NXS00346A2L0SSSA1A2	25	18.5	27	41	30	22	34	FR6	7.68x20.43x9.33	41
NXS00416A2L0SSSA1A2	30	22	34	51	40	30	41	FR7	9.33x23.27x10.12	77
NXS00526A2L0SSSA1A2	40	30	41	62	50	37	52	FR7	9.33x23.27x10.12	77
NXS00626A2L0SSSA1A2	50	37	52	78	60	45	62	FR8	11.46x29.84x13.54	128
NXS00806A2L0SSSA1A2	60	45	62	93	75	55	80	FR8	11.46x29.84x13.54	128
NXS01006A2L0SSSA1A2	75	55	80	120	100	75	100	FR8	11.46x29.84x13.54	128
NXS01256A2L0SSFA1A2	100	75	100	150	125	90	125	FR9	18.9x45.28x14.25	322
NXS01446A2L0SSFA1A2	125	90	125	188	150	110	144	FR9	18.9x45.28x14.25	322
NXS01706A2L0SSFA1A2	150	110	144	216	150	110	170	FR9	18.9x45.28x14.25	322
NXS02086A2L0SSFA1A2	200	150	170	255	200	150	208	FR9	18.9x45.28x14.25	322

Hardware configurations, Standalone units

FUNCTION	AVAILABILITY
IP21	Standard
IP54 (FR10 only)	Optional (H: +20mm)
Integrated fuses	Standard
Integrated load switch	Optional
EMC filtering L	Standard
EMC filtering T	Optional
Integrated brake chopper (cabling top entry)	Optional (H: +122 mm)

FR10

FR11

Vacon NXS 500—690 V. NEMA 1/NEMA 12. EMC level C3. air-cooled standalone AC drive

Order type code	Motor shaft power and current							Size	Dimensions	Weight
	High overload				Low overload					
NEMA 1	HP	kW	Amps	Amps overload	HP	kW	Amps overload	FR	W x H x D inches	[lbs]
NXS02616A2L0SSAA1A2	200	150	208	312	250	185	261	FR10	23.43x79.53x23.7	750
NXS03256A2L0SSAA1A2	250	185	261	392	300	225	325	FR10	23.43x79.53x23.7	750
NXS03856A2L0SSAA1A2	300	225	325	488	400	300	385	FR10	23.43x79.53x23.7	750
NXS04166A2L0SSAA1A2	300	225	325	488	450	335	416	FR10	23.43x79.53x23.7	750
NXS04606A2L0SSAA1A2	400	300	385	578	450	335	460	FR11	31.26x79.45x23.7	882
NXS05026A2L0SSAA1A2	450	335	460	690	500	375	502	FR11	31.26x79.45x23.7	882
NXS05906A2L0SSAA1A2	500	375	502	753	550	410	590	FR11	31.26x79.45x23.7	1036
NEMA 12										
NXS02616A5L0SSAA1A2	200	150	208	312	250	185	261	FR10	23.43x79.53x23.7	750
NXS03256A5L0SSAA1A2	250	185	261	392	300	225	325	FR10	23.43x79.53x23.7	750
NXS03856A5L0SSAA1A2	300	225	325	488	400	300	385	FR10	23.43x79.53x23.7	750
NXS04166A5L0SSAA1A2	300	225	325	488	450	335	416	FR10	23.43x79.53x23.7	750

VACON NXS TYPE DESIGNATION CODE

NXC 0520 5 A 2 L 0 SSF A1A2000000 + IFD

- NXC options, see table below
- Option PCBs; each slot is represented by two characters where:
  - Ax = basic I/O PCBs, Bx = expander I/O PCBs
  - Cx = fieldbus PCBs, Dx = special PCBs
- Control
  - S = standard FR4-FR8
  - F = standard FR9 and NXC
  - A = standard NXP FR10-FR12
  - N = standard IP00 ≥ FR10 and NXC with IP54 control unit enclosure
  - V = as S, but varnished PCBs
  - G = as F, but varnished PCBs
  - B = as A, but varnished PCBs
  - O = as N, but varnished PCBs
- Cooling
  - S = standard air-cooled, T = through-hole mounting FR4-FR9
- Supply
  - S = 6-pulse, T = 12-pulse, O = 6-pulse + load switch (standalone)
  - R = Regenerative low-harmonic (AFE)
- Brake chopper
  - 0 = no brake chopper
  - 1 = integrated brake chopper
- EMC emission level EN61800-3
  - C = 1st env., unrestricted distribution
  - H = 1st env., restricted distribution
  - L = 2nd environment
  - T = for IT networks
  - N = enclosure required (FR10-FR14)
- Enclosure class
  - 0 = IP00 (module only)
  - 2 = IP21 (NEMA 1)
  - 5 = IP54 (NEMA 12)
- Control keypad
  - A = standard alphanumeric
  - B = no local keypad
  - F = dummy keypad
  - G = graphic display
- Nominal mains voltage
  - 5 = 380-500 VAC, 6 = 500-690 VAC, 2 = 208-240 VAC
- Nominal current voltage
  - 0520 = 520 A
- Product range
  - NXP = wall-mounted / standalone / module
  - NXC = cabinet

VACON NXS CONTROL UNIT

There are no fixed inputs or outputs in the Vacon NXS. There are five slots (A, B, C, D and E) for I/O boards, and a suitable board can be selected for each slot (see the table below).

The NXS units are delivered with OPT-A1 and OPT-A2 boards if the I/O is not specified. In many countries, boards OPT-A1 and OPT-A3 are used as standard I/O as the galvanically isolated thermistor input is often required.

Removable terminals, snap-in card installation, automatic card identification and instructions on the drive help making quick connections. If necessary, the inputs, outputs and fieldbus boards can be added in the field. The Vacon NXS is simply the most flexible frequency converter series on the market.

An external +24 V supply option enables communication with the control unit even if the mains supply is switched off (e.g. fieldbus communication and parameter settings).

VACON OPTION BOARDS

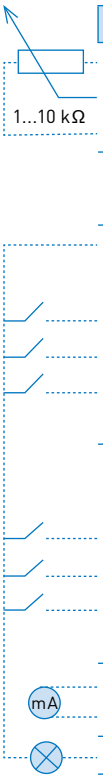
Card typecode	Card slot					I / O signal													
	A	B	C	D	E	DI	DO	DI DO	AI mA ±V	AI mA isol.	AO mA V	AO mA isol.	RO NO NC	RO NO	+10V ref	Therm	+24 EXT +24V	Pt100	42-240 VAC input	NOTE
Basic I/O cards (OPT-A)																				
OPT-A1						6	1		2		1				1		2			
OPT-A2													2							
OPT-A3													1	1		1				
OPT-A8						6	1		2		1				1		2			1)
OPT-A9						6	1		2		1				1		2			2.5 mm² terminals
I/O expander cards (OPT-B)																				
OPT-B1								6									1			Selectable DI/DO
OPT-B2													1	1		1				
OPT-B4										1		2					1			2)
OPT-B5														3						
OPT-B8																	1	3		
OPT-B9														1					5	
Fieldbus cards (OPT-C)																				
OPT-C2						RS-485 (Multiprotocol)														Modbus, N2
OPT-C3						Profibus DP														
OPT-C4						LonWorks														
OPT-C5						Profibus DP (D9 type connector)														
OPT-C6						CANopen (slave)														
OPT-C7						DeviceNet														
OPT-C8						RS-485 (Multiprotocol, D9 type connector)														Modbus, N2
OPT-CI						Modbus/TCP														
OPT-CJ						BACNet														

NOTES: Allowed slots for the board are marked in blue.

1) analogue signals galvanically isolated as a group, 2) analogue signals galvanically isolated separately.

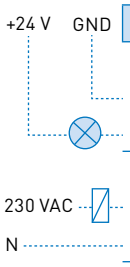
VACON NXS STANDARD I/O

OPT-A1



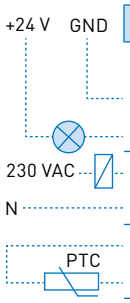
Terminal		Defaults settings	Programmable
1	+10V	Reference voltage	
2	AI1+	Frequency reference 0–10 V	-10–+10 V, 0/4–20 mA
3	AI1-	AI common (GND)	Differential
4	AI2+	Frequency reference 4–20 mA	0–20mA, 0/-10 V–10 V
5	AI2-	AI common (differential)	GND
6	+24V	Control supply (bidirectional)	
7	GND	I/O Ground	
8	DIN1	Start forward	Many possibilities
9	DIN2	Start reverse	Many possibilities
10	DIN3	External fault input	Many possibilities
11	CMA	Common for DIN1 - DIN3 (GND)	Floating
12	+24V	Control supply (bidirectional)	
13	GND	I/O Ground	
14	DIN4	Multi-step speed select 1	Many possibilities
15	DIN5	Multi-step speed select 2	Many possibilities
16	DIN6	Fault reset	Many possibilities
17	CMB	Common for DIN4 - DIN6 (GND)	Floating
18	AO1+	Output frequency (0–20 mA)	Many possibilities
19	AO1-	AO common (GND)	4–20 mA, 0–10 V
20	DO1	READY, I ≤ 50 mA, U ≤ 48 VDC	Many possibilities

OPT-A2



Terminal		Defaults settings	Programmable
21	R01	RUN	Many possibilities
22	R01		
23	R01		
24	R02	FAULT	Many possibilities
25	R02		
26	R02		

OPT-A3 (alternative)



Terminal		Defaults settings	Programmable
21	R01	RUN	Many possibilities
22	R01		
23	R01		
25	R02	FAULT	Many possibilities
26	R02		
28	TI1+	Thermistor input fault	Warning, fault, no response
29	TI1-		

Default settings of OPT-A1, OPT-A2 and OPT-A3 for the Basic and Standard Applications.

OTHER TYPICAL OPTIONS

OPTION	ORDER TYPECODE	AVAILABILITY	NOTE
NEMA 12 enclosure	Factory option	All	Replace '2' by '5' in the type code, e.g. NXS02605A**5**H0 (SSS...)
	IP5-FR_	FR4, FR5, FR6	NEMA 12 kit, e.g. IP5-FR4
Through-hole mounting	Factory option	FR4-FR9	E.g. NXS02605A**T**H0S**T**S..., IP54 back, IP21 front, kits available
Integrated brake choppers	Standard	FR4-6/230, 500 V	E.g. NXS00455A2H**1** (SSS...)
	Factory option	FR7-, FR6-/690 V	E.g. NXS02605A2H**1** (SSS...)
External brake resistors (380 - 500 V range)	BRR-0022-LD-5	00035-00225	LD = Light duty: 5 sec nominal torque braking from nominal speed decreasing linearily to zero, once per 120 sec. HD = Heavy duty: 3 sec nominal torque braking at nominal speed + 7 sec nominal torque braking from nominal speed decreasing linearily to zero, once per 120 sec. Replace LD by HD in the type code, e.g. BRR-0105-**HD**-5 Brake resistors are also available for 208-240 V and 500-690 V NXS drives The brake resistor manual is available for more precise selection
	BRR-0031-LD-5	00315	
	BRR-0045-LD-5	00385-00455	
	BRR-0061-LD-5	00615	
	BRR-0105-LD-5	00725-01055	
	BRR-0300-LD-5	01405-03005	
Integrated brake resistors	Factory option	FR4-6/500 V	Replace '1' by '2' in the typecode, e.g. NXS00455A2H**2** (SSS...) Light duty: 2 sec nominal torque braking from nominal speed decreasing linearily to zero, once per 60 sec.
Graphical display panel	Factory option	All	Replace 'A' by 'G', e.g. NXS00455**G**2H1 (SSS..), supports Chinese & Russian
	PAN-G	All	Order typecode when ordered separately
Panel door installation sets	DRA-02B (-04B, -15B)	All	Length of RS232C cable is specified in the typecode, e.g. DRA-02B includes 2-meter RS232C cable
Varnished circuit boards	Factory option	All	Frame sizes FR4-FR8: replace the 'S' by 'V', e.g. NXS00455A2H1SS**V**..., frame size FR9-FR11: replace 'S' by 'G'
C-level RFI filters	Factory option	FR4-6/500 V	Replace 'H' by 'C' in the typecode, e.g. NXS00455A5**C**1 (SSS..)
Du/dt & sinus filters			Available for all drives, contact local Vacon supplier

FIRST-CLASS USABILITY

The uncluttered text display panel with a well-defined menu structure and functions such as automatic parameter copy and start-up wizard makes commissioning and fine-tuning as easy as possible.

A maximum of three values can be monitored simultaneously (the multi-monitoring feature).

The Vacon PC tools are available for downloading from the Vacon website at http://www.vacon.com. These include:

- Vacon NCDrive for parameter setting, copying, storing, printing, monitoring and controlling
- Vacon NCLoad for software updating and uploading special software to the drive
- Vacon NC61131-3 Engineering is available for making tailor-made software. A license key and training required.

The Vacon PC tools require only an RS232C cable for communication with the drive (no adapters etc. required).

Basic

I/O	Defaults	
AI1	fref	P
AI2	fref	P
DI1	Start forward	
DI2	Start reverse	
DI3	External fault	P
DI4	Speed select 1	
DI5	Speed select 2	
DI6	Fault reset	
AO1	fout	P
DO1	Ready	
RO1	Run	
RO2	Fault	

Suitable for most purposes

Standard

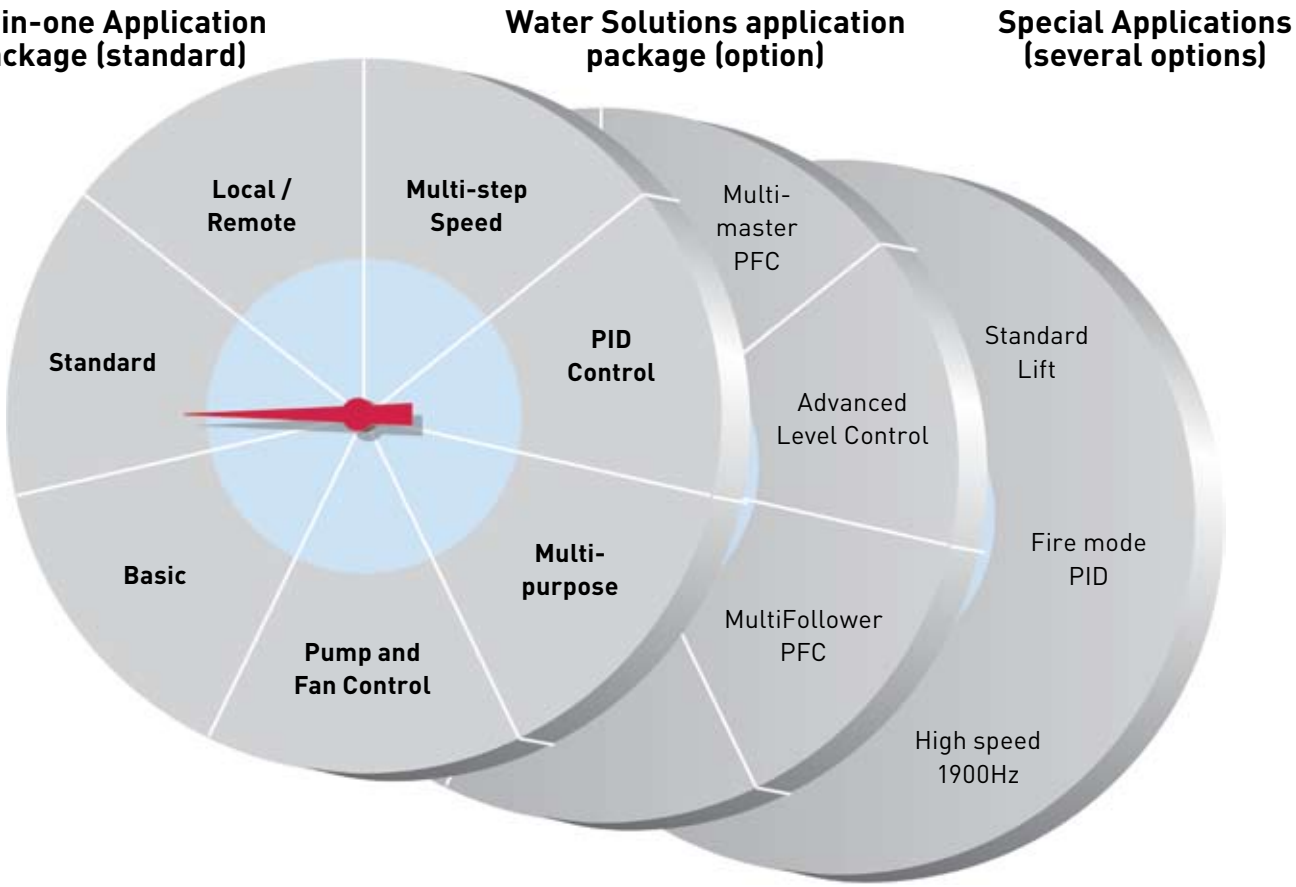
I/O	Defaults	
AI1	fref	P
AI2	fref	P
DI1	Start forward	P
DI2	Start reverse	P
DI3	External fault	P
DI4	Speed select 1	
DI5	Speed select 2	
DI6	Fault reset	
AO1	fout	P
DO1	Ready	P
RO1	Run	P
RO2	Fault	P

Basic, with more programming possibilities

Local/Remote

I/O	Defaults	
AI1	B fref	P
AI2	A fref	P
DI1	A Start forward	P
DI2	A Start reverse	P
DI3	External fault	P
DI4	B Start forward	P
DI5	B Start reverse	P
DI6	A/B selection	
AO1	fout	P
DO1	Ready	P
RO1	Run	P
RO2	Fault	P

Two external control places



The All-in-One application package has seven applications (=default settings and functionality of control inputs and outputs, see tables below) which can be selected with one parameter. The application will also be requested by the Start-up Wizard at the first power-up. With this single setting, the controls can be programmed e.g. for two external control places or a pressure control with the integrated PID controller. In most cases, the default basic application is suitable and only the min/max frequencies as well as motor nominal values must be set.

Thanks to the modular software applications made by the Vacon NC61131-3 Engineering tool, the All-in-One application package can be replaced by the Water application package that contains several applications optimized for water handling. There are also several other general-purpose software applications available.

P = Programmable

Multi-step Speed Control

I/O	Defaults	
AI1	f_{ref}	P
AI2	f_{ref}	P
DI1	Start forward	P
DI2	Start reverse	P
DI3	External fault	P
DI4	Speed select 1	
DI5	Speed select 2	
DI6	Speed select 3	
AO1	f_{out}	P
DO1	Ready	P
RO1	Run	P
RO2	Fault	P

16 fixed speeds

PID Control

I/O	Defaults	
AI1	PID reference	P
AI2	PID actual value	P
DI1	PID start/stop	
DI2	External fault	P
DI3	Fault reset	P
DI4	f ctrl start/stop	
DI5	Jog speed select	P
DI6	PID/f ctrl select	
AO1	f_{out}	P
DO1	Ready	P
RO1	Run	P
RO2	Fault	P

When PID is required

Multi-purpose Control

I/O	Defaults	
AI1	f_{ref}	P
AI2	f_{ref}	P
DI1	Start forward	P
DI2	Start reverse	P
DI3	Fault reset	P
DI4	Jog speed sel	P
DI5	External fault	P
DI6	Acc/dec time sel	P
AO1	f_{out}	P
DO1	Ready	P
RO1	Run	P
RO2	Fault	P

Most flexible of all

Pump and Fan Control

I/O	Defaults	
AI1	PID reference	P
AI2	PID actual value	P
DI1	PID start/stop	P
DI2	Interlock 1	P
DI3	Interlock 2	P
DI4	f ctrl start/stop	P
DI5	Jog speed select	P
DI6	PID/f ctrl select	P
AO1	f_{out}	P
DO1	Fault	P
RO1	Autochange 1	P
RO2	Autochange 2	P

Control of up to five pumps with auto-change

TECHNICAL DATA

Mains connection	Input voltage U_{in}	208...240 V; 380...500 V; 500...690 V; (–10%...+10%)
	Input frequency	50...60 Hz (± 10%)
	Connection to mains	Once per minute or less (normal case)
Motor connection	Output voltage	0—V_{in}
	Continuous output current	High overloadability Amps Low overloadability Amps
	Overload Capacity	High: 150% Nominal Amps; 1 min, Low: 110% Nominal Amps; 1 min
	Output frequency	0...320 Hz; up to 7200 Hz with special software
	Frequency resolution	0.01 Hz
Control characteristics	Control method	Frequency control V/f; Open Loop Vector Control (speed, torque)
	Switching frequency	208..240V/380..500V: FR4-6: 1...16 kHz; Factory default: 10 kHz FR7-9: 1...10 kHz; Factory default: 3.6 kHz FR10-11: 1...6 kHz; Factory default: 3.6 kHz 500..690V: FR4-11: 1...6 kHz, Factory default: 1.5 kHz
	Field weakening point	8...320 Hz
	Acceleration time	0...3000 sec
	Deceleration time	0...3000 sec
	Braking	DC brake: 30% * T_N (without brake resistor), flux braking
Ambient conditions	Ambient operating temperature	14 F (no frost)...122 F: High OL (FR10-FR11: max 104 F) 14 F (no frost)...104 F: Low OL (NXS 0416 6 and NXS 0590 6: max 95 F)
	Storage temperature	-40F...158 F
	Relative humidity	0 to 95% RH, non-condensing, non-corrosive, no dripping water
	Air quality: - chemical vapours - mechanical particles	 IEC 60721-3-3, unit in operation, class 3C2 IEC 60721-3-3, unit in operation, class 3S2
	Altitude	100% load capacity (no derating) up to 3280 feet 1-% derating for each 328 feet above 3280 feet; max. 9840 feet
	Vibration EN50178/EN60068-2-6	5...150 Hz: Displacement amplitude 1 mm (peak) at 5...15.8 Hz (FR10-FR11: 0,25 mm (peak) at 5...31 Hz) Max acceleration amplitude 1 G at 15.8...150 Hz (FR10 and up: 1 G at 31...150 Hz)
	Shock EN50178, EN60068-2-27	UPS Drop Test (for applicable UPS weights) Storage and shipping: max 15 G, 11 ms (in package)
	Enclosure class	NEMA 1 and NEMA 12
EMC	Immunity	Fulfil all EMC immunity requirements
	Emissions	**EMC level C1**: IEC/EN61800-3 (2004), category C1 **EMC level C2**: IEC/EN61800-3 (2004), category C2 **EMC level C3**: IEC/EN61800-3 (2004), category C3 **EMC level C4**: Low earth-current solution suitable for IT networks, IEC/EN61800-3 (2004), category C4
Safety		EN 50178 (1997), EN 60204-1 (2006), IEC 61800-5, CE, UL, CUL; (see unit nameplate for more detailed approvals)
Control connections (OPT-A1, -A2 or OPT-A1, -A3)	Analogue input voltage	0...+10 V (–10 V...+10 V joystick control), R_i = 200 kΩ, resolution 0.1%, accuracy ±1%
	Analogue input current	0(4)...20 mA, R_i = 250 Ω differential, resolution 0.1%, accuracy ±1%
	Digital inputs	6, positive or negative logic; 18...30 VDC
	Auxiliary voltage	+24 V, ±15%, max. 250 mA
	Output reference voltage	+10 V, +3%, max. load 10 mA
	Analogue output	0(4)...20 mA; R_L max. 500 Ω, resolution 10 bit, accuracy ±2%
	Digital output	Open collector output, 50 mA/48 V
	Relay outputs	2 programmable change-over (NO/NC) relay outputs (OPT-A3: NO/NC+NO) Switching capacity: 24 VDC/8 A, 250 VAC/8 A, 125 VDC/0.4 A. Min. switching load: 5 V/10 mA
	Thermistor input (OPT-A3)	Galvanically isolated, R_{trip} = 4.7 kΩ
Protections		Overvoltage, undervoltage, earth fault, mains supervision, motor phase supervision, overcurrent, unit overtemperature, motor overload, motor stall, motor underload, short-circuit of +24 V and +10 V reference voltages

VACON NXP AND NXC
SUPERLATIVE PERFORMANCE

VACON

DRIVEN BY DRIVES

THE DYNAMIC CHOICE

The Vacon NXP is a state-of-art AC drive for use in all applications where reliability, dynamic performance, precision and power are required.

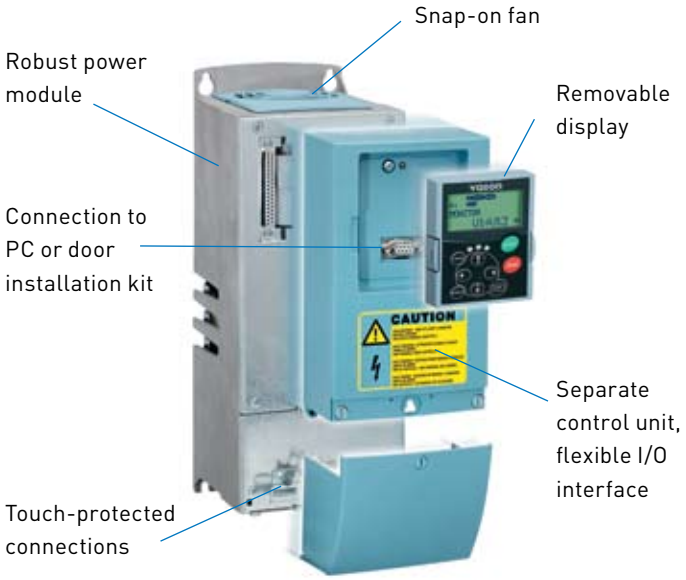
The quality and reliability of a machine or process is in most cases the result of the precise, dynamic control of AC motors. The Vacon NXP has been designed to provide the best possible control under all circumstances, ensuring high operational quality and availability for the entire lifetime of a system.

A forerunner in designing and manufacturing AC drives, Vacon has developed innovative solutions and leading-edge technology for demanding applications and high power ranges.

By bringing these solutions to customers, the Vacon NXP opens up new opportunities and helps them create the best and highly innovative products and achieve the most challenging targets.

Features

- Full power and voltage range
- High number of options
- Wide set of applications adapts the Vacon NXP to virtually any need
- Controls induction and permanent magnet motors
- Dynamic open and closed loop vector control
- Complete range of communications and I/O options
- Fast drive-to-drive communication



FR4—FR9

FR4 FR5 FR6 FR7 FR8 FR9

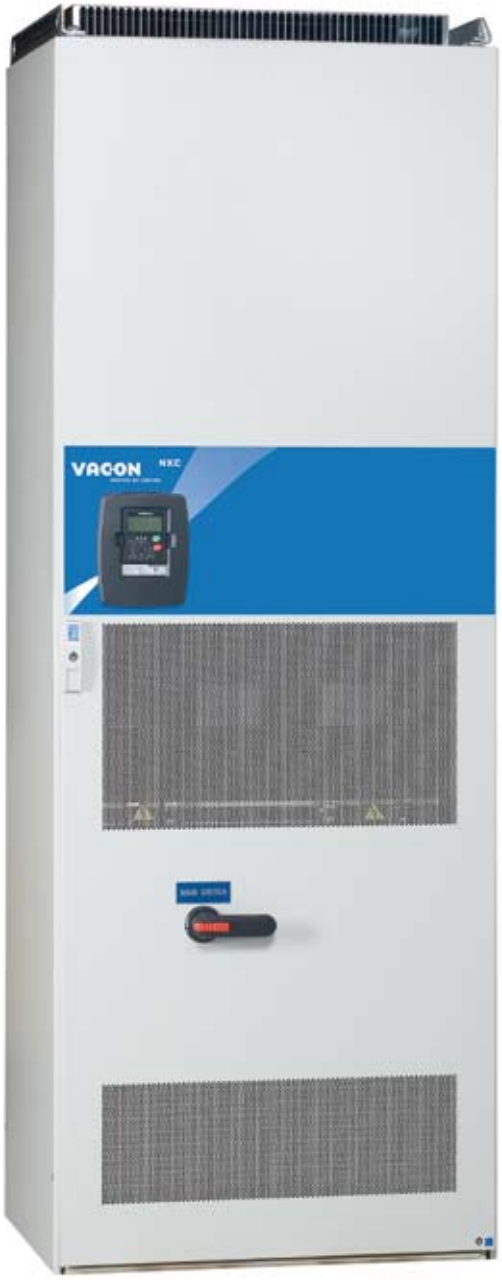
The Vacon NXP offers, in addition to its control characteristics, a wide choice of products and cabinets for the varying needs in the high-power range.

Three models are available to meet various customer needs as follows:

- Vacon NXP IP21/IP54 wall-mounted or standalone drives for installation wherever there is space available
- Vacon NXP high-power IP00 drive modules for installation in the customer's cabinet
- Vacon NXC robust cabinet drive with maximum flexibility and a wide range of options

VACON NXP
DRIVE MODULES

VACON NXP
STANDALONE DRIVES



VACON NXC
CABINET DRIVES

WALL-MOUNTED VACON NXP

For the lower power range, Vacon NXP drives are available in a compact IP21 or IP54 enclosure. One of the most compact and complete drives on the market, it has all necessary components integrated a single enclosure.

The wall-mounted units are equipped with internal EMC filtering, and the power electronics are integrated into an all-metal frame. The smaller frame sizes (FR4-FR6) have an integrated brake chopper as standard, and the 380-500 V units can be equipped with an integrated brake resistor. The larger frames (FR7-FR12) can be equipped with an integrated brake chopper as option.

Mains voltage 208—240 V, 50/60 Hz, 3~

AC drive type	Loadability					Motor shaft power		Frame size	Dimensions and weight W*H*D (mm)/ kg
	Low (+40°C)		High (+50°C)		Maximum current I_S	230 V supply			
	Rated continuous current I_L (A)	10% overload current (A)	Rated continuous current I_H (A)	50% overload current (A)		10% overload P (kW)	50% overload P (kW)		
NXP 0003 2 A 2 H 1 SSS	3.7	4.1	2.4	3.6	4.8	0.55	0.37	FR4	128*292*190/ 5
NXP 0004 2 A 2 H 1 SSS	4.8	5.3	3.7	5.6	7.4	0.75	0.55	FR4	128*292*190/ 5
NXP 0007 2 A 2 H 1 SSS	6.6	7.3	4.8	7.2	9.6	1.1	0.75	FR4	128*292*190/ 5
NXP 0008 2 A 2 H 1 SSS	7.8	8.6	6.6	9.9	13.2	1.5	1.1	FR4	128*292*190/ 5
NXP 0011 2 A 2 H 1 SSS	11	12.1	7.8	11.7	15.6	2.2	1.5	FR4	128*292*190/ 5
NXP 0012 2 A 2 H 1 SSS	12.5	13.8	11	16.5	22	3	2.2	FR4	128*292*190/ 5
NXP 0017 2 A 2 H 1 SSS	17.5	19.3	12.5	18.8	25	4	3	FR5	144*391*214/ 8.1
NXP 0025 2 A 2 H 1 SSS	25	27.5	17.5	26.3	35	5.5	4	FR5	144*391*214/ 8.1
NXP 0031 2 A 2 H 1 SSS	31	34.1	25	37.5	50	7.5	5.5	FR5	144*391*214/ 8.1
NXP 0048 2 A 2 H 1 SSS	48	52.8	31	46.5	62	11	7.5	FR6	195*519*237/ 18.5
NXP 0061 2 A 2 H 1 SSS	61	67.1	48	72	96	15	11	FR6	195*519*237/ 18.5
NXP 0075 2 A 2 H 0 SSS	75	83	61	92	122	22	15	FR7	237*591*257/ 35
NXP 0088 2 A 2 H 0 SSS	88	97	75	113	150	22	22	FR7	237*591*257/ 35
NXP 0114 2 A 2 H 0 SSS	114	125	88	132	176	30	22	FR7	237*591*257/ 35
NXP 0140 2 A 2 H 0 SSS	140	154	105	158	210	37	30	FR8	291*758*344 / 58
NXP 0170 2 A 2 H 0 SSS	170	187	140	210	280	45	37	FR8	291*758*344 / 58
NXP 0205 2 A 2 H 0 SSS	205	226	170	255	336	55	45	FR8	291*758*344 / 58
NXP 0261 2 A 2 H 0 SSF	261	287	205	308	349	75	55	FR9	480*1150*362/ 146
NXP 0300 2 A 2 H 0 SSF	300	330	245	368	444	90	75	FR9	480*1150*362/ 146

Mains voltage 380—500 V, 50/60 Hz, 3~

AC drive type	Loadability					Motor shaft power		Frame size	Dimensions and weight W*H*D (mm)/ kg
	Low (+40°C)		High (+50°C)		Maximum current I_S	400 V supply			
	Rated continuous current I_L (A)	10% overload current (A)	Rated continuous current I_H (A)	50% overload current (A)		10% overload P (kW)	50% overload P (kW)		
NXP 0003 5 A 2 H 1 SSS	3.3	3.6	2.2	3.3	4.4	1.1	0.75	FR4	128*292*190/ 5
NXP 0004 5 A 2 H 1 SSS	4.3	4.7	3.3	5	6.2	1.5	1.1	FR4	128*292*190/ 5
NXP 0005 5 A 2 H 1 SSS	5.6	6.2	4.3	6.5	8.6	2.2	1.5	FR4	128*292*190/ 5
NXP 0007 5 A 2 H 1 SSS	7.6	8.4	5.6	8.4	10.8	3	2.2	FR4	128*292*190/ 5
NXP 0009 5 A 2 H 1 SSS	9	9.9	7.6	11.4	14	4	3	FR4	128*292*190/ 5
NXP 0012 5 A 2 H 1 SSS	12	13.2	9	13.5	18	5.5	4	FR4	128*292*190/ 5
NXP 0016 5 A 2 H 1 SSS	16	17.6	12	18	24	7.5	5.5	FR5	144*391*214/ 8.1
NXP 0022 5 A 2 H 1 SSS	23	25.3	16	24	32	11	7.5	FR5	144*391*214/ 8.1
NXP 0031 5 A 2 H 1 SSS	31	34	23	35	46	15	11	FR5	144*391*214/ 8.1
NXP 0038 5 A 2 H 1 SSS	38	42	31	47	62	18.5	15	FR6	195*519*237/ 18.5
NXP 0045 5 A 2 H 1 SSS	46	51	38	57	76	22	18.5	FR6	195*519*237/ 18.5
NXP 0061 5 A 2 H 1 SSS	61	67	46	69	92	30	22	FR6	195*519*237/ 18.5
NXP 0072 5 A 2 H 0 SSS	72	79	61	92	122	37	30	FR7	237*591*257/ 35
NXP 0087 5 A 2 H 0 SSS	87	96	72	108	144	45	37	FR7	237*591*257/ 35
NXP 0105 5 A 2 H 0 SSS	105	116	87	131	174	55	45	FR7	237*591*257/ 35
NXP 0140 5 A 2 H 0 SSS	140	154	105	158	210	75	55	FR8	291*758*344 / 58
NXP 0168 5 A 2 H 0 SSS	170	187	140	210	280	90	75	FR8	291*758*344 / 58
NXP 0205 5 A 2 H 0 SSS	205	226	170	255	336	110	90	FR8	291*758*344 / 58
NXP 0261 5 A 2 H 0 SSF	261	287	205	308	349	132	110	FR9	480*1150*362/ 146
NXP 0300 5 A 2 H 0 SSF	300	330	245	368	444	160	132	FR9	480*1150*362/ 146

Mains voltage 500—690 V, 50/60 Hz, 3~

AC drive type	Loadability					Motor shaft power		Frame size	Dimensions and weight W*H*D (mm)/ kg
	Low (+40°C)		High (+50°C)		Maximum current I_S	690 V supply			
	Rated continuous current I_L (A)	10% overload current (A)	Rated continuous current I_H (A)	50% overload current (A)		10% overload P (kW)	50% overload P (kW)		
NXP 0004 6 A 2 L 0 SSS	4.5	5	3.2	4.8	6.4	3	2.2	FR6	195*519*237/ 18.5
NXP 0005 6 A 2 L 0SSS	5.5	6.1	4.5	6.8	9.0	4	3	FR6	195*519*237/ 18.5
NXP 0007 6 A 2 L 0 SSS	7.5	8.3	5.5	8.3	11	5.5	4	FR6	195*519*237/ 18.5
NXP 0010 6 A 2 L 0 SSS	10	11	7.5	11.3	15	7.5	5.5	FR6	195*519*237/ 18.5
NXP 0013 6 A 2 L 0 SSS	13.5	14.9	10	15	20	11	7.5	FR6	195*519*237/ 18.5
NXP 0018 6 A 2 L 0 SSS	18	19.8	13.5	20.3	27	15	11	FR6	195*519*237/ 18.5
NXP 0022 6 A 2 L 0 SSS	22	24.2	18	27	36	18.5	15	FR6	195*519*237/ 18.5
NXP 0027 6 A 2 L 0 SSS	27	29.7	22	33	44	22	18.5	FR6	195*519*237/ 18.5
NXP 0034 6 A 2 L 0 SSS	34	37	27	41	54	30	22	FR6	195*519*237/ 18.5
NXP 0041 6 A 2 L 0 SSS	41	45	34	51	68	37.5	30	FR7	237*591*257/ 35
NXP 0052 6 A 2 L 0 SSS	52	57	41	62	82	45	37.5	FR7	237*591*257/ 35
NXP 0062 6 A 2 L 0 SSS	62	68	52	78	104	55	45	FR8	291*758*344 / 58
NXP 0080 6 A 2 L 0 SSS	80	88	62	93	124	75	55	FR8	291*758*344 / 58
NXP 0100 6 A 2 L 0 SSS	100	110	80	120	160	90	75	FR8	291*758*344 / 58
NXP 0125 6 A 2 L 0 SSF	125	138	100	150	200	110	90	FR9	480*1150*362/ 146
NXP 0144 6 A 2 L 0 SSF	144	158	125	188	213	132	110	FR9	480*1150*362/ 146
NXP 0170 6 A 2 L 0 SSF	170	187	144	216	245	160	132	FR9	480*1150*362/ 146
NXP 0208 6 A 2 L 0 SSF	208	229	170	255	289	200	160	FR9	480*1150*362/ 146

STANDALONE VACON NXP

High-power Vacon NXP drives are also available in a compact standalone IP21 or IP54 enclosure. These units are designed for use in applications where the drive has to be compact and easy to install.

The Vacon NXP standalone drives are fully enclosed at the factory and are ready for immediate installation. The drive has integrated fuses as standard and no extra protections are required by the drive. It is also possible to equip the drive with an optional integrated load switch, which further simplifies handling in the field.

Mains voltage 380—500 V, 50/60 Hz, 3~

AC drive type	Loadability					Motor shaft power		Frame size	Dimensions and weight W*H*D (mm)/ kg
	Low (+40°C)		High (+40°C)		Maximum current I_S	400 V supply			
	Rated continuous current I_L (A)	10% overload current (A)	Rated continuous current I_H (A)	50% overload current (A)		10% overload P (kW)	50% overload P (kW)		
NXP 0385 5 A 2 L 0 SSA	385	424	300	450	540	200	160	FR10	595*2020*602/ 340
NXP 0460 5 A 2 L 0 SSA	460	506	385	578	693	250	200	FR10	595*2020*602/ 340
NXP 0520 5 A 2 L 0 SSA	520	572	460	690	828	250	250	FR10	595*2020*602/ 340
NXP 0590 5 A 2 L 0 SSA	590	649	520	780	936	315	250	FR11	794*2020*602/ 470
NXP 0650 5 A 2 L 0 SSA	650	715	590	885	1062	355	315	FR11	794*2020*602/ 470
NXP 0730 5 A 2 L 0 SSA	730	803	650	975	1170	400	355	FR11	794*2020*602/ 470

Mains voltage 500—690 V, 50/60 Hz, 3~

AC drive type	Loadability					Motor shaft power		Frame size	Dimensions and weight W*H*D (mm)/ kg
	Low (+40°C)		High (+40°C)		Maximum current I_S	690 V supply			
	Rated continuous current I_L (A)	10% overload current (A)	Rated continuous current I_H (A)	50% overload current (A)		10% overload P (kW)	50% overload P (kW)		
NXP 0261 6 A 2 L 0 SSA	261	287	208	312	375	250	200	FR10	595*2020*602/ 340
NXP 0325 6 A 2 L 0 SSA	325	358	261	392	470	315	250	FR10	595*2020*602/ 340
NXP 0385 6 A 2 L 0 SSA	385	424	325	488	585	355	315	FR10	595*2020*602/ 340
NXP 0416 6 A 2 L 0 SSA#	416	458	325	488	585	400	315	FR10	595*2020*602/ 340
NXP 0460 6 A 2 L 0 SSA	460	506	385	578	693	450	355	FR11	794*2020*602/ 400
NXP 0502 6 A 2 L 0 SSA	502	552	460	690	828	500	450	FR11	794*2020*602/ 400
NXP 0590 6 A 2 L 0 SSA#	590	649	502	753	904	560	500	FR11	794*2020*602/ 470

max. ambient temperature of +35°C

HARDWARE CONFIGURATIONS

FUNCTION	AVAILABILITY
IP21	Standard
IP54 (FR10 only)	Optional
Integrated fuses	Standard
Load switch	Optional
EMC filtering L	Standard
EMC filtering T	Optional
Brake chopper (cabling top entry)	Optional (H: +122 mm)

IP00 VACON NXP MODULES

The Vacon NXP high-power IP00 drive modules are intended for installation in a separate enclosure. Thanks to the robust, square-shaped design of the module, enclosure design is easy and straightforward.

Mains voltage 380—500 V, 50/60 Hz, 3~

AC drive type	Loadability					Motor shaft power		Frame size	Module W*H*D (mm)/ kg	Chokes W*H*D (mm)/ kg
	Low (+40°C)		High (+40°C)		Maximum current I_S	400 V supply				
	Rated continuous current I_L (A)	10% overload current (A)	Rated continuous current I_H (A)	50% overload current (A)		10% overload P (kW)	50% overload P (kW)			
NXP 0385 5 A 0 N 0 SSA	385	424	300	450	540	200	160	FR10	500*1165*506/ 120	350*383*262/ 84 [1]
NXP 0460 5 A 0 N 0 SSA	460	506	385	578	693	250	200	FR10	500*1165*506/ 120	497*399*244/ 115 [1]
NXP 0520 5 A 0 N 0 SSA	520	572	460	690	828	250	250	FR10	500*1165*506/ 120	497*399*244/ 115 [1]
NXP 0590 5 A 0 N 0 SSA	590	649	520	780	936	315	250	FR11	709*1206*506/ 210	2x(350*383*262/ 84)
NXP 0650 5 A 0 N 0 SSA	650	715	590	885	1062	355	315	FR11	709*1206*506/ 210	2x(350*383*262/ 84)
NXP 0730 5 A 0 N 0 SSA	730	803	650	975	1170	400	355	FR11	709*1206*506/ 210	2x(350*383*262/ 84)
NXP 0820 5 A 0 N 0 SSA	820	902	730	1095	1314	450	400	FR12	2x(500*1165*506/ 120)	2x(497*399*244/ 115)
NXP 0920 5 A 0 N 0 SSA	920	1012	820	1230	1476	500	450	FR12	2x(500*1165*506/ 120)	2x(497*399*244/ 115)
NXP 1030 5 A 0 N 0 SSA	1030	1133	920	1380	1656	560	500	FR12	2x(500*1165*506/ 120)	2x(497*399*244/ 115)

1) 12-pulse units, 2x(354*319*230/ 53 kg)

Mains voltage 500—690 V, 50/60 Hz, 3~

AC drive type	Loadability					Motor shaft power		Frame size	Module W*H*D (mm)/ kg	Chokes W*H*D (mm)/ kg
	Low (+40°C)		High (+40°C)		Maximum current I_S	690 V supply				
	Rated continuous current I_L (A)	10% overload current (A)	Rated continuous current I_H (A)	50% overload current (A)		10% overload P (kW)	50% overload P (kW)			
NXP 0261 6 A 0 N 0 SSA	261	287	208	312	375	250	200	FR10	500*1165*506/ 120	354*319*230/ 53 [1]
NXP 0325 6 A 0 N 0 SSA	325	358	261	392	470	315	250	FR10	500*1165*506/ 120	350*383*262/ 84 [1]
NXP 0385 6 A 0 N 0 SSA	385	424	325	488	585	355	315	FR10	500*1165*506/ 120	350*383*262/ 84 [1]
NXP 0416 6 A 0 N 0 SSA#	416	458	325	488	585	400	315	FR10	500*1165*506/ 120	350*383*262/ 84 [1]
NXP 0460 6 A 0 N 0 SSA	460	506	385	578	693	450	355	FR11	709*1206*506/ 210	497*399*244/ 115 [2]
NXP 0502 6 A 0 N 0 SSA	502	552	460	690	828	500	450	FR11	709*1206*506/ 210	497*399*244/ 115 [2]
NXP 0590 6 A 0 N 0 SSA#	590	649	502	753	904	560	500	FR11	709*1206*506/ 210	2x(350*383*262/ 84)
NXP 0650 6 A 0 N 0 SSA	650	715	590	885	1062	630	560	FR12	2x(500*1165*506/ 120)	2x(350*383*262/ 84)
NXP 0750 6 A 0 N 0 SSA	750	825	650	975	1170	710	630	FR12	2x(500*1165*506/ 120)	2x(350*383*262/ 84)
NXP 0820 6 A 0 N 0 SSA#	820	902	650	975	1170	800	630	FR12	2x(500*1165*506/ 120)	2x(350*383*262/ 84)

max. ambient temperature of +35°C 1) 12-pulse units, 2x(354*319*230/ 53 kg) 2) 12-pulse units, 2x(350*383*262/ 84 kg)

Bigger units are available on request.

HARDWARE CONFIGURATIONS

FUNCTION	AVAILABILITY
Integrated control unit	Standard
External control unit	Optional
Integrated brake chopper	Optional
6-pulse supply	Standard
12-pulse supply	Optional
EMC filtering N	Standard
EMC filtering T	Optional

VACON NXP CONTROL

The Vacon NXP offers a high-performance control platform for all demanding drive applications. There are five slots (A, B, C, D and E) for I/O boards, and a suitable board can be selected for each slot (see table below).

An external +24 V supply option enables communication with the control unit even if the main supply is switched off (e.g. for fieldbus communication and parameter setting).

The Vacon NXP supports both **induction motors** and **permanent magnet motors** in open and closed loop control modes. The Vacon NXP also supports special motors such as **high-speed** motors.

For a closed loop control encoder, feedback from an incremental pulse encoder is normally used. It is also possible to use absolute encoders, since the Vacon NXP is available with EnDat, SSI and resolver interfaces.

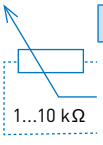
Fast drive-to-drive communication is possible using Vacon's fast SystemBus fiber optic communication.

OPTION BOARDS

Type	Card slot					I / O signal																				
	A	B	C	D	E	DI	DO	DI DO	AI (mA/ V/±V)	AI (mA) isolated	AO (mA/V)	AO (mA) isolated	RO (NO/ NC)	RO (NO)	+10V$_{ref}$	Therm	+24V/ EXT +24V	pt100	42-240 VAC input	DI/DO ⊓⊔ (10...24V)	DI/DO ⊓⊔ (RS422)	DI ~ 1Vp-p	Resolver	Out +5V/ +15V/ +24V	Out +15V/ +24V	Out +5V/ +12V/ +15V	Note
Basic I/O cards (OPT-A)																										
OPT-A1						6	1		2		1				1		2										
OPT-A2													2														
OPT-A3													1	1		1											
OPT-A4						2															3/0			1			
OPT-A5						2														3/0					1		
OPT-A7																				6/2					1		2 enc. input + 1 enc. output
OPT-A8						6	1		2		1				1		2										1)
OPT-A9						6	1		2		1				1		2										2.5 mm^2 terminals
OPT-AE							2													3/0					1		DO = Divider+Direction
OPT-AF						2							2			1											EN954-1, cat 3 / ATEX therm.
OPT-AK																						3			1		Sin/Cos/ Marker
I/O expander cards (OPT-B)																											
OPT-B1								6									1										Selectable DI/DO
OPT-B2													1	1		1											
OPT-B4										1		2					1										2)
OPT-B5														3													
OPT-B8																	1	3									
OPT-B9						2								1					5								
OPT-BB						2															0/2	2				1	Sin/Cos + EnDat
OPT-BC																				3/3			1				Encoder out = Resolver simulation
OPT-BE																											EnDat/SSI
Fieldbus cards (OPT-C)																											
OPT-C2						RS-485 (Multiprotocol)																					Modbus, N2
OPT-C3						Profibus DP																					
OPT-C4						LonWorks																					
OPT-C5						Profibus DP (D9-type connector)																					
OPT-C6						CANopen (slave)																					
OPT-C7						DeviceNet																					
OPT-C8						RS-485 (Multiprotocol, D9-type connector)																					Modbus, N2
OPT-CF						CAN / Euromap																					
OPT-CG						SELMA 2 protocol																					
OPT-CI						Modbus/TCP (Ethernet)																					
OPT-CJ						BACNet, RS-485																					
Communication cards (OPT-D)																											
OPT-D1						System Bus adapter (2 x fiber optic pairs)																					
OPT-D2						System Bus adapter (1 x fiber optic pair) & CAN-bus adapter (galvanically decoupled)																					
OPT-D3						RS232 adapter card (galvanically decoupled), used mainly for application engineering to connect another keypad																					
OPT-D6						CAN-bus adapter (galvanically decoupled)																					
OPT-D7						Line voltage measurement																					

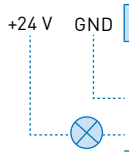
NOTES: Allowed slots for the board are marked in blue. 1) analogue signals galvanically isolated as a group 2) analogue signals galvanically isolated separately

OPT-A1



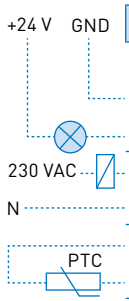
Terminal		Default settings	Programmable
1	+10V	Reference voltage	
2	AI1+	Frequency reference 0–10 V	-10–+10 V, 0/4–20 mA
3	AI1-	AI common (GND)	Differential
4	AI2+	Frequency reference 4–20 mA	0–20mA, 0/-10 V–10 V
5	AI2-	AI common (differential)	GND
6	+24V	Control supply (bidirectional)	
7	GND	I/O Ground	
8	DIN1	Start forward	Many possibilities
9	DIN2	Start reverse	Many possibilities
10	DIN3	External fault input	Many possibilities
11	CMA	Common for DIN1 - DIN3 (GND)	Floating
12	+24V	Control supply (bidirectional)	
13	GND	I/O Ground	
14	DIN4	Multi-step speed select 1	Many possibilities
15	DIN5	Multi-step speed select 2	Many possibilities
16	DIN6	Fault reset	Many possibilities
17	CMB	Common for DIN4 - DIN6 (GND)	Floating
18	AO1+	Output frequency (0–20 mA)	Many possibilities
19	AO1-	AO common (GND)	4–20 mA, 0–10 V
20	DO1	READY, I ≤ 50 mA, U ≤ 48 VDC	Many possibilities

OPT-A2



Terminal		Default settings	Programmable
21	R01		
22	R01	RUN	Many possibilities
23	R01		
24	R02		
25	R02	FAULT	Many possibilities
26	R02		

OPT-A3 (alternative)



Terminal		Default settings	Programmable
21	R01		
22	R01	RUN	Many possibilities
23	R01		
25	R02	FAULT	Many possibilities
26	R02		
28	TI1+	Thermistor	Warning
29	TI1-	input FAULT	No response

Default settings of OPT-A1, OPT-A2 and OPT-A3 for the Basic and Standard Applications.

OPT-A4 (encoder input example)

Terminal		Technical information
1	DIC1A+	Pulse input A
2	DIC1A-	
3	DIC2B+	Pulse input B; Phase shift of 90 degrees compared to pulse input A
4	DIC2B-	
5	DIC3Z+	Pulse input Z; one pulse per revolution
6	DIC3Z-	
7	ENC1Q	Qualifier input
8	DIC4	Fast DI
9	GND	Ground for control and inputs ENC1Q and DIC4
10	+5V/+15V/+24V	Control voltage (auxiliary voltage) output to encoder: Output voltage selectable with jumper X4.

VACON NXC, COMPACT AND FLEXIBLE

The Vacon NXC cabinet drive is compact and well tested, fully utilizing the flexibility of the Vacon NXP drive. The Vacon NXC is designed to meet the most demanding requirements for flexibility, robustness, compactness and service-friendliness. It is a safe choice for any application.

Easy ordering

The Vacon NXC contains the AC drive itself and optional items such as main switch, contactor, control options and output filtering in one compact unit which is easy to install and service. Ordering is made easy by integrating the Vacon NXC enclosure options into the typecode, to which they are appended with "+" codes.

User-friendly

In the Vacon NXC, the control unit is mounted in a separate compartment at an easily accessible height together with all control options. Ample space around the power terminals allows easy installation and connection of power cables. Bottom plates and earthing clamps for 360-degree earthing of motor cable shields are provided as standard.

Well tested

Vacon NXC drives are the result of more than 20 years of experience in enclosure design. It is a well tested and proven solution. The good thermal handling of the enclosure guarantees a long lifetime for the AC drive and trouble-free operation even in the most demanding environments. Approved EMC solutions ensure reliable operation of the converter without disturbing other electrical equipment.

Service-friendly

The Vacon NXC enclosures are designed to fully utilize the new and innovative installation features of the high-power Vacon NXP. The Vacon NXP power units are mounted on rails which are extendable with a pull-out jig. The jig can be used for pulling the power unit out of the enclosure for service.

VACON NXC OPTIONS

Vacon NXC options give greater flexibility and make it easy to extend the range of functions. Options are available in different categories and can be combined to meet almost any requirements.

Auxiliary equipment (A group)

+AMF	Motor fan control
+AMH	Motor heater feeder
+AMB	Mechanical brake control
+ACH	Cabinet heater
+ACL	Cabinet light
+ACR	Control relay
+AAI	Analog signal isolator
+AAA	Aux. contact (ctrl voltage)
+AAC	Aux. contact (input device)
+AT3	Aux. voltage transformer 2500 VA
+AT4	Aux. voltage transformer 4000 VA
+ADS	230 VAC customer socket

Door-mounted options (D group)

+DLV	Pilot light (control voltage on)
+DLD	Pilot light (DO1)
+DLF	Pilot light (FLT)
+DLR	Pilot light (RUN)
+DEP	Emergency stop push-button
+DRP	Reset push-button
+DAM	Analog meter (AO1)
+DAR	Potentiometer for reference
+DCM	Analog meter current trafo
+DVM	Analog voltage meter switch

Output filter options (O group)

+OCM	Common mode filters
+ODU	du/dt filter
+OSI	Sine wave filter

Protection devices (P group)

+PTR	External thermistor relay
+PES	Emergency stop (cat 0)
+PED	Emergency stop (cat 1)
+PAP	Arc protection
+PIF	Insulation fault sensor

Control terminal options (T group)

+TIO	Basic I/O wired to external terminals
+TID	Basic I/O wired to external terminals + additional terminals

General options (G group)

+G40	400 mm empty cabinet
+G60	600 mm empty cabinet
+G80	800 mm empty cabinet
+GPL	100 mm base

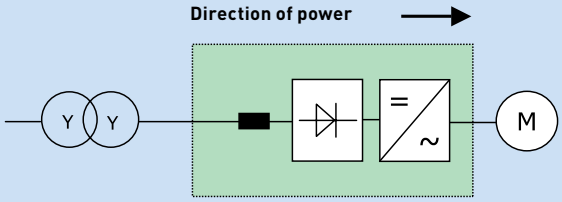
Cabling options (C group)

+CIT	Input (mains) cabling from top
+COT	Output (motor) cabling from top

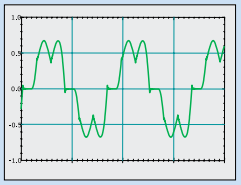
CURRENT HARMONIC MITIGATION

6-pulse rectifier with choke

Cost-effective transformer and simple power cabling with high current distortion. Oversizing of transformers needed due to high THDi.

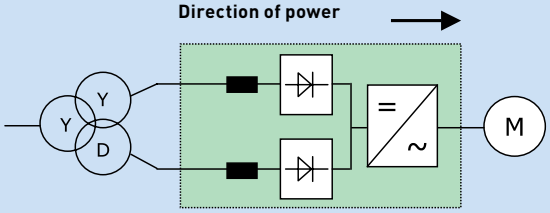


Current distortion (THDi) > 35 %

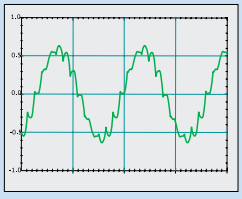


12-pulse rectifier with choke

Higher transformer and power cabling cost. Low current distortion on primary side of transformer.

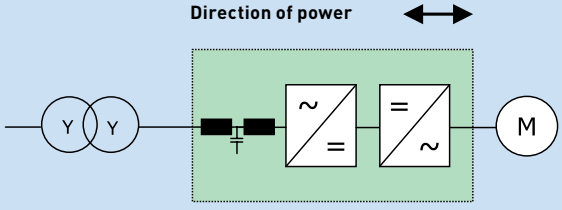


Current distortion (THDi) > 12 %

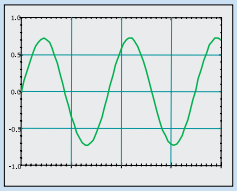


Active front-end with LCL filter

Cost effective transformer and power cabling with very low current distortion. No oversizing of transformer needed.



Current distortion (THDi) < 5 %



TECHNICAL DATA

Mains connection	Input voltage U_{in}	208...240 V; 380...500 V; 500...690 V; –10%...+10% NXC regenerative low-harmonic drive 525-690 V; -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	High overloadability: I_H, ambient temperature max. +50°C (≥FR10 + 40°C) Low overloadability: I_L, ambient temperature max. +40°C
	Overloadability	High: 1.5 x I_H (1 min/10 min), Low: 1.1 x I_L (1 min/10 min)
	Max. starting current	I_s for 2 s every 20 s
	Output frequency	0...320 Hz; up to 7200 Hz with special software
Control characteristics	Control performance	Open loop vector control (5-150% of base speed): speed control 0.5%, dynamic 0.3%sec, torque lin. <2%, torque rise time ~5 ms Closed loop vector control (entire speed range): speed control 0.01%, dynamic 0.2%sec, torque lin. <2%, torque rise time ~2 ms
	Switching frequency	NX_2/ Up to and including NX_0061: NX_5: 1...16 kHz; Factory default 10 kHz From NX_0072: 1...10 kHz; Factory default 3.6 kHz NX_6: 1...6 kHz; Factory default 1.5 kHz
	Field weakening point	8...320 Hz
	Acceleration time	0...3000 sec
	Deceleration time	0...3000 sec
	Braking	DC brake: 30% * T_N (without brake resistor), flux braking
Ambient conditions	Ambient operating temperature	–10°C (no frost)...+50°C: I_H (≥FR10 + 40°C) –10°C (no frost)...+40°C: I_L
	Storage temperature	–40°C...+70°C
	Relative humidity	0 to 95% RH, non-condensing, non-corrosive, no dripping water
	Air quality: - chemical vapours - mechanical particles	 IEC 721-3-3, unit in operation, class 3C2 IEC 721-3-3, unit in operation, class 3S2
	Altitude	100% load capacity (no derating) up to 1000 m 1% derating for each 100 m above 1000 m; max. 3000 m (690 V max. 2000 m)
	Vibration EN50178/EN60068-2-6	5...150 Hz: Displacement amplitude 1 mm (peak) at 5...15.8 Hz (≥FR10: 0.25 mm (peak) at 5...31 Hz) Max acceleration amplitude 1 G at 15.8...150 Hz (≥FR10: 1 G at 31...150 Hz)
	Shock EN50178, EN60068-2-27	UPS Drop Test (for applicable UPS weights) Storage and shipping: max 15 G, 11 ms (in package)
EMC	Immunity	Fulfil all EMC immunity requirements
	Emissions	**EMC level C1**: IEC/EN61800-3 (2004), category C1 **EMC level C2**: IEC/EN61800-3 (2004), category C2 **EMC level C3**: IEC/EN61800-3 (2004), category C3 **EMC level C4**: Low earth-current solution suitable for IT networks, IEC/EN61800-3 (2004), category C4 (can be modified from L/H-level units)
Safety		EN 50178 (1997), EN 60204-1 (1996), EN 60950 (2000, 3rd edition) (as relevant), IEC 61800-5, CE, UL, CUL; (see unit nameplate for more detailed approvals)
Control connections (OPT-A1, -A2 or OPT-A1, -A3)	Analogue input voltage	0...+10 V (–10 V...+10 V joystick control), R_i = 200 kΩ, resolution 0.1%, accuracy ±1%
	Analogue input current	0(4)...20 mA, R_i = 250 Ω differential, resolution 0.1%, accuracy ±1%
	Digital inputs	6, positive or negative logic; 18...30 VDC
	Auxiliary voltage	+24 V, ±15%, max. 250 mA
	Output reference voltage	+10 V, +3%, max. load 10 mA
	Analogue output	0(4)...20 mA; R_L max. 500 Ω, resolution 10 bit, accuracy ±2%
	Digital output	Open collector output, 50 mA/48 V
	Relay outputs	2 programmable change-over (NO/NC) relay outputs (OPT-A3: NO/NC+NO) Switching capacity: 24 VDC/8 A, 250 VAC/8 A, 125 VDC/0.4 A. Min. switching load: 5 V/10 mA
	Thermistor input (OPT-A3)	Galvanically isolated, R_{trip} = 4.7 kΩ
Protections		Overvoltage, undervoltage, earth fault, mains supervision, motor phase supervision, overcurrent, unit overtemperature, motor overload, motor stall, motor underload, short-circuit of +24 V and +10 V reference voltages

VACON HVAC AC DRIVES

COMFORT & CONTROL IN BUILDING AUTOMATION

VACON

DRIVEN BY DRIVES

EFFICIENT INVESTMENT

In building automation and in HVAC applications in particular, the payback period for an AC drive is typically one year or less. When compared with a lifetime of 10 years or more, this makes an AC drive an excellent investment.

Save energy and time, and conserve the environment

To keep the costs of the investment to a minimum over the lifetime of the building automation system, Vacon boosts energy savings and minimizes maintenance.

- **Energy cost**: Controlling the process with an AC drive can reduce electrical energy consumption by 20–50%. Please see the energy calculator at www.vacon.com.
- **Energy cost**: With built-in features such as real time clock, motor current optimization and sleep function, you can save and measure the savings with Vacon HVAC drives.
- **Maintenance cost**: All components have a typical lifetime of 10 years or more, including the capacitors and fan. There is no need to change any parts during periodic maintenance.
- **Maintenance cost**: The extensive technical support network of Vacon and its partners ensures effective service operations 24 hours a day, 7 days a week.

Compliance to standards made easy

Commercial, industrial and even residential buildings contain more and more equipment that is sensitive to disturbances. To ensure that your building automation complies with all the relevant standards, we have built them into Vacon HVAC drives.

- **EMC**: EN 61000-3-12, EN 61800-3 (1996) + A11 (2000) Category C1&C2
- **Safety**: 61800-5-1(2007), UL 508 C
- **Approvals**: CE, UL, cUL

Vacon HVAC save the cost of additional equipment

The Vacon HVAC contains numerous features that make additional controllers redundant. This saves the costs of additional controllers, and of their housing, power supply and cabling.

- **Fire mode**: To ensure that smoke exhaust fans function and thus potentially save lives, the Vacon HVAC overrides the self - protection and motor protection diagnostics.
- **Multipump/fan**: The Vacon HVAC can control several pumps or fans connected direct-on-line, in addition to the unit that is speed controlled. This makes additional controllers unnecessary.
- **PID**: Every Vacon HVAC has a built-in PID controller, so it acts as a controller for part of the HVAC process. With two PID controllers in the Vacon HVAC, actuators can be controlled through the drive I/O.
- **PLC**: Vacon AC drives have a fully programmable PLC inside. This saves the cost of an external PLC.
- **Real time clock**: With the real time clock, the Vacon HVAC can be programmed to control the HVAC in different ways when the office is busy and when it is closed.
- **Energy monitoring**: The Vacon HVAC monitors the kWh consumption and allows you to calculate the actual savings

In HVAC applications, the AC drive is connected to the building management system or field equipment controllers, and to the electrical network. All the necessary standard and optional hardware to integrate the drive into the automation and electrical networks is built in.

- **Chokes**: To minimize current harmonics.
- **RFI filter**: To minimize radio frequency disturbances.
- **Serial bus**: Built in and powered in. No need for extra housing.
- **Ethernet**: Built in and powered in. No need for extra housing.
- **I/O**: Standard I/O and optional expansion cards.

With all these built-in features, Vacon's IP54 enclosure is still one of the smallest on the HVAC market. The AC drive does not need to be installed in a costly cabinet.

Easy mounting built in

Size does matter, when you have to lift and mount the AC drive on the wall. The Vacon HVAC is one of the smallest HVAC drives on the market but still has everything built in.

- **IP54**: Mount it on the wall, fast and easy. All screws are accessible from the front. No cabinet needed.
- **All in one**: Just install one unit instead of several components. Minimize the time for installation work with the Vacon HVAC drive with built-in chokes, RFI filters, serial bus, Ethernet, I/O, PLC and keypad.
- **Manuals**: The Vacon HVAC has a dedicated installation manual for HVAC applications. All the relevant information can easily be found in the manual.

Easy connections built in

To ensure that your electrician can safely and effectively make the electrical connections, we have designed the mechanics and electrical connections for Vacon HVAC drives to be user friendly.

- **Terminals**: Removable control terminals allow ergonomic cabling.
- **Clamps**: The innovative cable seal and clamps make expensive cable throughput clamps obsolete.
- **Space**: Adequate connection space for the cables.
- **Safety**: Power terminals and control terminals are separated. This makes the control wiring work safe.
- **Manuals**: Dedicated manuals show examples of connections for different applications.

Easy commissioning built in

To ensure that anyone can safely and quickly commission the Vacon HVAC drive, whatever their background, we have developed an automatic commissioning function.

- **Auto commission**: There is no need to set parameters, it is all done automatically for basic applications.
- **Wizards**: In case you want to fine-tune the AC drive, our start-up, PID, serial communication and multipump wizards make it very easy and fast for you.
- **Manuals**: The embedded manual in the graphical keypad is always available.
- **PC tools**: The Vacon Live PC tool makes a demanding application or complex system easy to commission, while creating a backup copy as well.

World-class technical support locally

No matter how easy the AC drive is to install and commission, it is still reassuring to know that help is always available, locally. As a dedicated 100% drives manufacturer, Vacon technical support can focus on one thing: supporting you in your drives related challenges.

- **Local support**: Trained by global experts to match your demand.
- **Global support**: To ensure that local support is available globally.

COMFORT AND EFFICIENCY FOR USERS

Silence everywhere

Noise from a fan, pump compressor or motor is not appreciated by the users, the end customers of the building. We have taken this into account when designing the Vacon HVAC drive.

- **Silent fans or pumps**: Skip frequencies to avoid mechanical resonances. This makes the system silent and avoids unnecessary wear and tear.
- **Silent motors**: The high inverter switching frequency keeps the noise of the motor to a minimum.
- **Silent drives**: The cooling fan in the Vacon HVAC is speed controlled in accordance with the temperature. During low load times, like night time, the drive is pleasantly silent.
- **Silent HVAC systems**: When the HVAC system is speed controlled, the noise level is reduced during times when the maximum capacity is not needed.

Mechanical stress

Controlled acceleration and deceleration instead of jump starting or stopping with contactors means the mechanical system will have a longer lifetime and require less maintenance.

- **Pumps**: Smooth ramp-down avoids the hammer effect on pipes and valves. Pipes have a longer lifetime without mechanical shocks.
- **Fans**: Controlled acceleration means the belts will not slip, so they don't create noise or wear out so fast.
- **Compressors**: Smooth ramps reduce the stress on the compressor shaft and fluid and gas piping.

Electrical stress

With direct online starting, the electrical system momentarily takes up to seven times the nominal current. Transients like this may cause all kinds of unwanted phenomena. The electrical network will either suffer from frequent failures or need to be over-dimensioned. The voltage dips will also affect other equipment connected to the same network.

- **Current**: With an AC drive you can limit the maximum current taken by the system and thus use smaller fuses, switchgear and cabling. Smaller fuses mean a smaller monthly bill from your power company.
- **Voltage**: Switching heavy loads to the electrical network with contactors causes voltage dips and spikes. Using an AC drive will do away with these.
- **Reactive power**: Motors connected directly to the electrical network will consume both reactive power and active power from the network. With an AC drive, only active power is needed and the extra heat losses due to reactive power are avoided in the network.

Easy maintenance built in

To ensure that your technical staff does not have to use extra time in servicing AC drives, we have made Vacon HVAC drives maintenance-free. The Vacon HVAC also has built-in features that simplify the maintenance of process equipment such as motors, pumps and fans.

- **Long life**: No periodic maintenance needed. Components are designed to last.
- **Process diagnostics**: If a belt is broken or a pump is empty or jammed, the Vacon HVAC drive will let you know.
- **Maintenance**: Motor switch ride-through (patent pending) allows the motor to be disconnected and connected while running without tripping the AC drive. This is convenient when motor and drive are in different locations, as in roof-top fans.
- **Manuals**: Fault descriptions and suggested actions built in the keypad, the manual is always there when you need it.

Professional technical support always available

To ensure that technical staff never have to re-invent the wheel, our technically experienced personnel and partners are available to give support locally in more than 100 countries and in over 70 service centres on all continents.

Environmentally friendly

To do our share in providing for future generations, we have switched to materials that are substantially less polluting in the Vacon HVAC. In fact, the overall ecological footprint of our AC drives is positive, due to the energy savings they give.

- **Ecological footprint**: The Vacon HVAC drives have a positive overall impact on the environment due to the energy saved over their lifetime.
- **Waste directive**: RoHS compliant; there is no lead in printed circuit boards.
- **New technology capacitors**: Thin film capacitors do not contain toxic electrolytes, unlike the old electrolytic capacitors.

The Vacon 100 HVAC is an AC drive in the power range of 1.1–30 kW and for supply voltages of 380–480 V, dedicated to heating, ventilation and air conditioning. The Vacon 100 HVAC is suitable for pump, fan and compressor applications.

Features

- Enclosure classes IP21 and IP54
- EMC harmonics: EN 61000-3-12 compliant
- According to IEC and Type 1 and Type 12 according to UL.
- EMC radio frequencies: EN 61800-3 Category C2 built in. Complies with radiated and conducted emissions
- RoHS compliant, no electrolytic capacitors, no lead in the circuit boards
- Intelligent cooling arrangement. Control and power airflow separated

Mains voltage 380–480 V, 50–60 Hz, 3~

AC drive type		Loadability			Motor shaft power
		Low			480 V supply
		Rated continuous current I_L (A)	10% overload current (A) 1 min/10 min	Max current I_S 2 s every 20 s	10% overload 40°C (HP)
MR4	0003	3.4	3.7	5.2	1.5
	0004	4.8	5.3	6.8	2.0
	0005	5.6	6.2	8.6	3.0
	0008	8.0	8.8	11.2	5.0
	0009	9.6	10.6	16.0	-
	0012	12.0	13.2	19.2	7.5
MR5	0016	16.0	17.6	24.0	10
	0023	23.0	25.3	32.0	15
	0031	31.0	34.1	46.0	20
MR6	0038	38.0	41.8	62.0	25
	0046	46.0	50.6	76.0	30
	0061	61.0	67.1	92.0	40

VACON 100 HVAC TECHNICAL DATA

General

Communication	RS485	Standard: Modbus RTU, BACnet MS/TP, N2
	Ethernet	Standard: Modbus/TCP, BACnet/IP
Software features	Energy-saving functions	Real-time clock for timed functions Energy monitor for kWh monitoring Sleep function to minimize downtime energy
	Protections	Overload and underload protections e.g. broken fan and dry pump Motor thermal protection Missing phase detection Automatic reset to avoid interruption of the process
Process control	2 * PID	For process control
	Multipump Flying start	For replacing the pump controller For tripless catching of spinning fan
Human interfaces	Keypad	Graphical display with built-in manual and wizards
	PC tools	Vacon Live for easy commissioning Vacon Savings for energy calculations Vacon Select for dimensioning the drive and the motor

I/O connections

Basic I/O board

Terminal		Signal
1	+10 V_{ref}	Reference output
2	AI1+	Analogue input, voltage or current
3	AI1-	Analogue input common (current)
4	AI2+	Analogue input, voltage or current
5	AI2-	Analogue input common (current)
6	24 V_{out}	24 V aux. voltage
7	GND	I/O ground
8	DI1	Digital input 1
9	DI2	Digital input 2
10	DI3	Digital input 3
11	CM	Common A for DI1-DI6
12	24 V_{out}	24 V aux. voltage
13	GND	I/O ground
14	DI4	Digital input 4
15	DI5	Digital input 5
16	DI6	Digital input 6
17	CM	Common A for DI1-DI6
18	AO1+	Analogue signal (+output)
19	AO-/GND	Analogue output common
30	+24 V_{in}	24 V auxiliary input voltage
A	RS485	Differential receiver/transmitter
B	RS485	Differential receiver/transmitter

Relay board 1

Terminal		Signal
21	RO1/1 NC	Relay output 1
22	RO1/2 CM	
23	RO1/3 NO	
24	RO2/1 NC	Relay output 2
25	RO2/2 CM	
26	RO2/3 NO	
32	RO3/1 CM	Relay output 3
33	RO3/2 NO	

Standard communications protocols

Modbus/TCP, BACnet/IP, N2

RS485 Modbus RTU, BACnet MS/TP

Dimensions

Type	Width (mm)	Height (mm)	Depth (mm)	Weight (kg)
MR4	128	328	190	6
MR5	144	419	214	10
MR6	195	557	229	20

VACON NXP LIQUID COOLED POWERDRIVES FOR EXTREME CONDITIONS

VACON

DRIVEN BY DRIVES

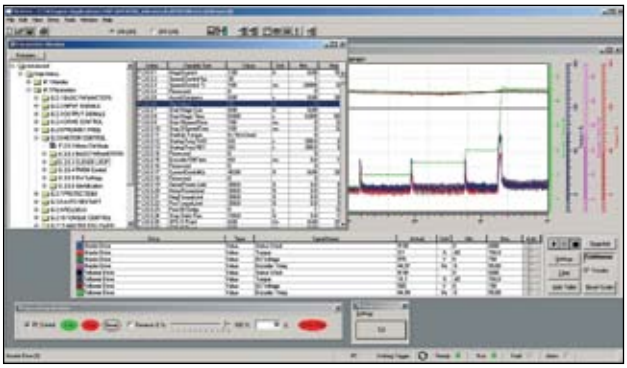
COMPLETE CONTROL PLATFORM

A robust modular design makes the Vacon NXP a suitable platform for all drive needs in different segments and applications, e.g. marine and offshore, renewable energy, mining and minerals as well as water and wastewater.

The core of the Vacon NXP is a fast micro controller, providing high dynamic performance for applications where good motor handling and reliability is required. It can be used both in open loop applications as well as in applications requiring encoder feedback.

The Vacon NXP supports fast drive-to-drive communication. It also offers an integrated data logger functionality for analysis of dynamic events without the need of additional hardware. Fast monitoring of several drives can be done simultaneously by using the NCDrive tool and CAN communication.

In applications where reliability and quality are words that are close to the heart the Vacon NXP is the logical choice.



Encoder options

- Normal pulse encoder
- Absolute encoder ENDAT
- Resolver
- SSI
- Sine cos.

Fieldbus options

- RS-485
- Profibus
- LonWorks
- CAN Open
- DeviceNet
- BACnet
- LonWorks
- Modbus/TCP

CAN Open I/O

Applications can be developed with third-party I/O modules of CAN Open, where a large number of I/Os are to be integrated into the drive.

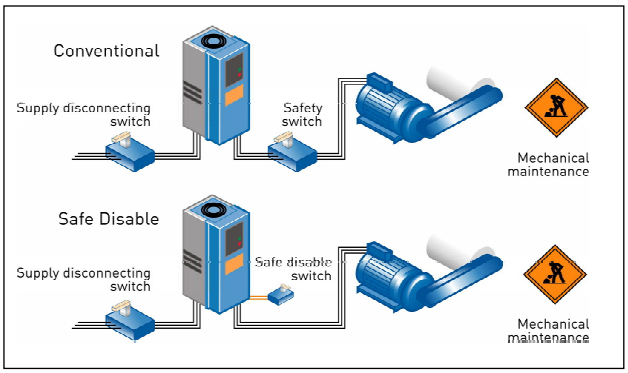
ATEX

Overtemperature detection using a thermistor can be used as a tripping device for ATEX certified motors. The thermistor tripping function is certified by VTT according to the ATEX directive 94/9/EC, for group II, category (2) in the 'G' area (areas where potentially explosive gas, vapor, mist or air mixtures are present) and the 'D' area (area with combustible dust).

Features

- Speed error < 0.01%, depending on the encoder
- Incremental or absolute encoder support
- Encoder voltages of 5 V (RS422), 15 V or 24 V, depending on the option card
- Full torque control at all speeds
- Torque accuracy < 2%; < 5% down to zero speed
- Full capability for master/follower configurations
- Integrated data logger for system analysis
- Fast multiple drive monitoring with PC
- High-speed bus (12 Mbit/s) for fast drive-to-drive communication
- High-speed applications (up to 7200 Hz) possible
- Supports asynchronous induction as well as permanent magnet synchronous motors
- The core of the Vacon NXP is a fast micro controller, providing high dynamic performance and a large memory for developing versatile applications.

Safe Disable



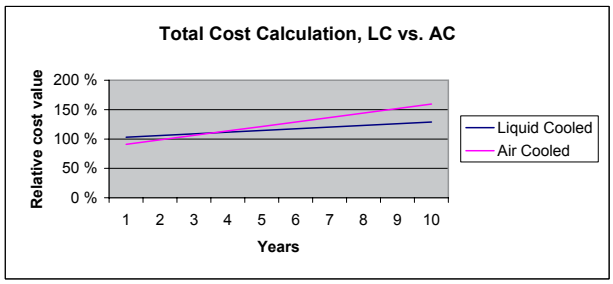
A hardware-based Safe Disable function is designed to prevent any torque on the motor shaft. The Safe Disable function is certified according to EN954-1, Cat 3. The Safe Disable function has been certified by BGIA.

THE ADVANTAGES OF THE COOLING TECHNOLOGY

When comparing the cooling technology solutions, it is important to understand the effects on the infrastructure of the electrical room, and electrical room requirements. Additional comparison parameters are the geographical location, the customer segment and the customer process.

400 kW, 690 VAC liquid cooled drive is:

- 32 % of the volume of the air cooled drive
- 50 % of the width of the air cooled drive
- 70 % of the weight of the air cooled drive
- 20 dBA more silent than the air cooled drive



In warm climates it is extremely important to observe the amount of heat load transferred to the electrical room because it is in a direct relationship to the electrical energy consumption.

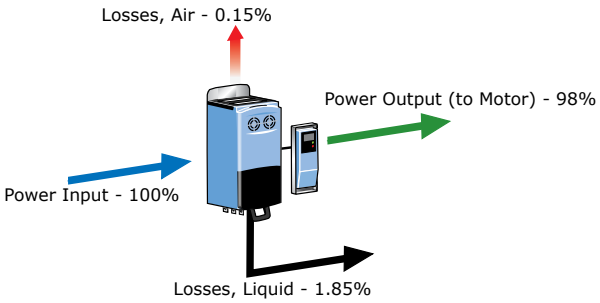
The type-tested switchgears standard EN 60439-1 specifies that the electrical room's 24-hour average temperature should be below +35°C and the maximum temporary temperature cannot exceed +40°C. Due to this, the cooling system in electrical rooms is typically based on air conditioning chillers, which are dimensioned by the maximum heat load, the inside temperature of the electrical room and the outdoor maximum temperature.

The normal electrical energy consumption of air conditioning is 25...33% of the cooling power. Therefore, high-power drives are creating huge energy consumption, based on the heat load produced.

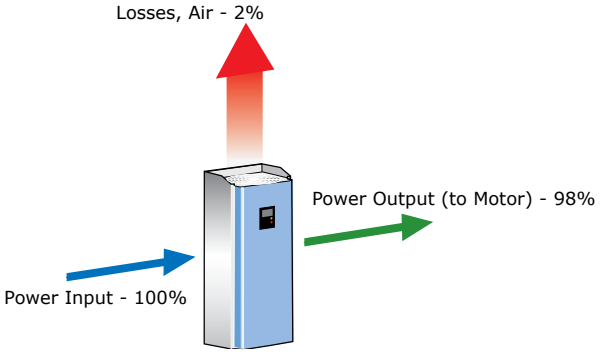
The initial investments in the liquid cooled AC drives technology are slightly more expensive than those in the air cooled AC drives technology because of the technology used, cooling piping arrangements and heat exchanger systems. It is significant to understand that a heat exchanger needs also be compared to ventilation and air condition systems with ventilation ducts, ventilation machine and ventilation automation system.

The non-evaluated features remarkably decrease the payback time of the liquid cooled drives. The payback time of a single 650-kW liquid cooled drive is 3 years. The payback time of >1 MW high power drives or drive groups reduces significantly and the initial investment difference can be compensated during the first operating year. The electrical energy cost trend supports a wider use of the liquid cooled drives technology, and the number of on-shore installations is growing rapidly.

Liquid Cooled Drive



Air Cooled Drive



LIQUID TO LIQUID HEAT EXCHANGERS

In cooperation with HVAC professionals, Vacon has designed a range of liquid-to-liquid heat exchangers (HX), which improve the availability and usability of AC drive systems. The heat exchangers added to the liquid cooled Vacon NXP range offer a reliable and cost-effective cooling without ventilation concerns.

Built with high-quality components, Vacon's standardized heat exchanger makes the use of liquid cooled drives easier, because a well-planned and sized unit is easier to apply than a project solution. In addition, a standard heat exchanger solution offers proven reliability.

To minimize the risk of possible leaks, splitting the cooling circuit into segments is worthwhile, because even in a large group of AC drives the volume of the liquid stays under 100 litres. An additional advantage of separated cooling segments is the possibility to use inhibitors and glycol against the corrosion, freezing and micro organisms.

The Vacon heat exchanger has versatile protection and control functions. The whole system is supervised by the drive's control application software, which meets the standards of even the most demanding customers. The operation of the unit can be monitored by an upper level automation system. The system controls the cooling conditions of the drives and supervises the flow and detects possible leaks in the cooling system.

The Vacon heat exhanger can be used in different kinds of electrical networks, where frequencies and voltages may vary, because the cooling pump is controlled by an AC drive. Such networks are typically used in the marine industry and other electrical island networks using diesel generators. This kind of solution brings an extra advantage because the flow capacity can be adjusted to the demand. Pressure losses that are higher than expected within the cooling circuit may be easily compensated by changing the speed of the pump and thus raising the pressure and flow.

A standard heat exchanger delivery consists of

- Self-supporting module rack construction, which can be integrated into generic switchgear and cabinet solutions
- Cooling circuit equipped with threaded joints or flanges
- Heavy industry PVC-C pipework; excellent, because it is light and prevents corrosion
- Industrial water heat exchanger, three-way-valve, pump, AC drive

Typical options of the heat exchangers available

- Stainless steel AISI piping
- Customer circuitry insulation for condensation prevention, typically needed when the process water is below 15°C
- Two-way-valve capable of optimizing the quantity of the cooling water, when the temperature of the process liquid is low
- Heat exhanger can be delivered installed inside a Rittal TS8 or VSG VEDA cabinet
- Double pumps can be selected for marine class requirements, types 120 kW and 300 kW
- Titanium heat exchanger is used in sea water circuits. The structure and performance differs from the fresh water models.

	HXL-M/V/R-040-N-P	HXL/M-M/V/R-120-N-P	HXS/T-M/V/R-070-N-P	HXL/M-M/R-300-N-P
Cooling power	0...40 kW	0...120 kW	0...69 kW	0...300 kW
Mains supply	380...420 VAC	380...420 VAC	380...420 VAC	380...500 VAC
Flow	40...120 l/min	120...360 l/min	120...200 l/min	360...900 l/min
Distribution pressure	0.3 bar / l=10 m, DN32*	HXL: 1 bar / l = 40 m, DN50 HXM: 0.7 bar / l = 30 m, DN50	HXS: 1 bar / l = 40 m, DN50 HXT: 0.7 bar / l = 25 m, DN50	HXL: 1 bar / l = 40 m, DN80 HXM: 0.7 bar / l = 25 m, DN80
Double pump		HXM	HXT	HXM
Cabinets	VEDA, Rittal	VEDA, Rittal	VEDA, Rittal	Rittal

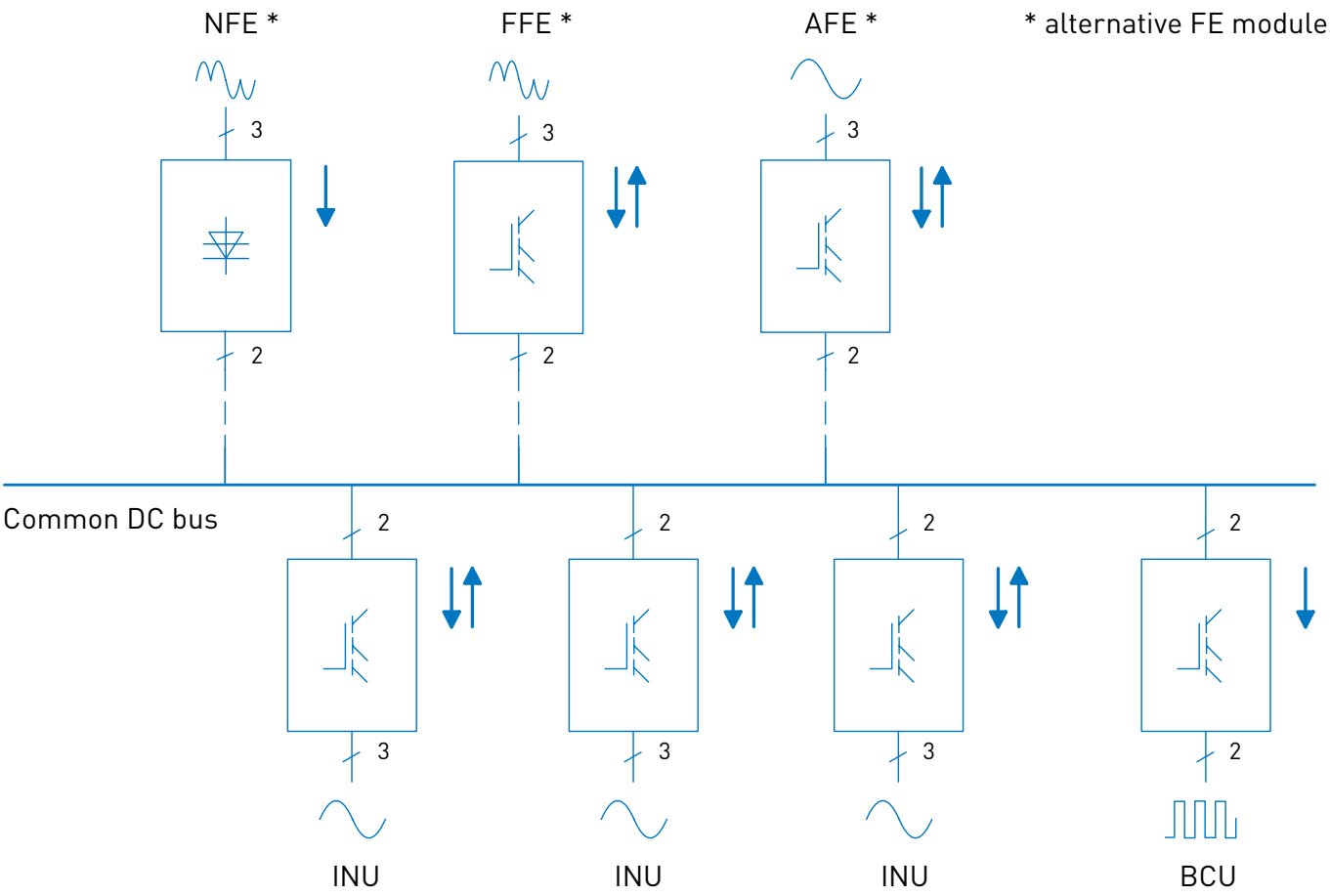
* l = maximum distribution distance with specific DN diameter

VACON NX PRODUCTS FOR COMMON DC BUS SYSTEMS

VACON

DRIVEN BY DRIVES

HIGH CONFIGURABILITY



Vacon offers a comprehensive range of common DC bus drive products. The product family covers a number of front-end units, inverter units and brake chopper units in the entire power range from 1 to 2000 kW at 380 VAC to 690 VAC. The drive components are built on the Vacon NX technology.

Common DC bus components are used in a multitude of combinations. In a typical DC bus configuration, the drives which are braking can transfer the energy directly to the drives in motoring mode.

FR4

FR6

FR7

FR8

Front-end units

The front-end units convert a mains AC voltage and current into a DC voltage and current. The power is transferred from the mains to a common DC bus (and, in certain cases, vice versa).

The AFE (Active front-end) unit is a bidirectional (regenerative) power converter for the front-end of a common DC bus drive line-up. An external LCL filter is used at the input. This unit is suitable in applications where low mains harmonics are required. AFE is able to boost DC link voltage (default +10%) higher than nominal DC link voltage (1,35x UN). AFE needs an external pre-charging circuit. However, AFE does not need any external measurements to operate. AFE units can be connected parallel without any special connections between the units. AFE units can be connected to the same fieldbus with inverters, and they can be controlled and monitored via fieldbus.

The FFE (Fundamental front-end) unit is a bidirectional (regenerative) power converter for the front-end of a common DC bus drive line-up. The FFE is a device that operates as a diode bridge for motoring power and like an anti-parallel thyristor bridge for regenerating power. In the FFE unit, IGBTs are used instead of thyristors. A dedicated external choke is used at the input. The FFE unit is suitable as a rectifying device when a "normal" level of harmonics is accepted but regeneration to the mains is required. There are many benefits when conparing with the anti-parallel thyristor bridges: no autotransformers are needed (for nominal DC link voltage 1,35xUN), max motor voltage is the same as supply voltage without autotransformer, controlled operation in case of supply failure and the spare parts are the same as in the inverter of the same size. FFE needs an external charging circuit. FFE unit can be connected to the same fieldbus with inverters, and it can be controlled and monitored via fieldbus.

The NFE (Non-regenerative front-end) unit is a unidirectional (motoring) power converter for the front-end of a common DC bus drive line-up. The NFE is a device that operates as a diode bridge using diode/thyristor components. A dedicated external choke is used at the input. The NFE unit has the capacity to charge a common DC bus. This unit is suitable as a rectifying device when a "normal" level of harmonics is accepted and no regeneration to the mains is required. No external charging circuit is needed because the charging is made by the controlling thyristors. NFE units can be connected parallel without any special connections between the units.

Inverter unit

The INU (Inverter unit) is a bidirectional DC-fed power inverter for the supply and control of AC motors. The INU is supplied from a common DC bus drive line-up. A charging circuit is needed in case the connection possibility to a live DC bus is required. The DC side charging circuit is integrated up to 75 kW (FR4-FR8) and external for higher power ratings (FI9-FI14).

Brake chopper unit

The BCU (Brake chopper unit) is a unidirectional power converter for the supply of excessive energy from a common DC bus drive line-up to resistors where the energy is dissipated as heat. External resistors are needed. By using two brake resistors, the braking power of the brake chopper is doubled.

FI9

FI10

FI12

FI13

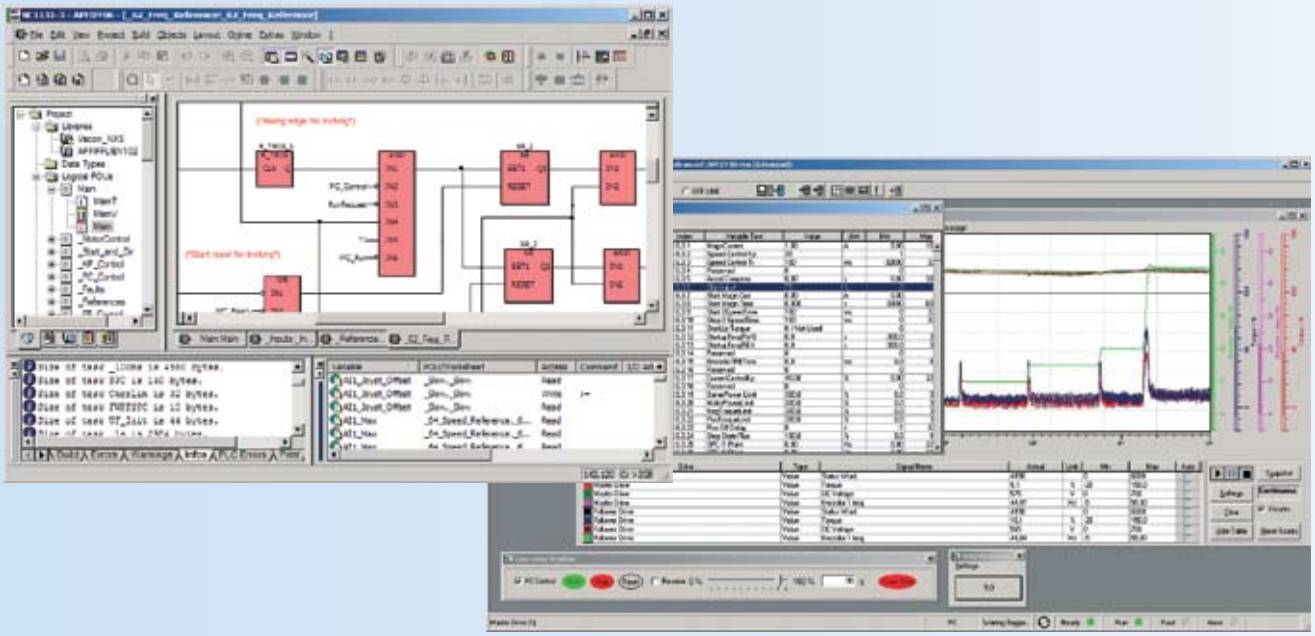
TECHNICAL DATA

Supply connection	Input voltage U_{in} (AC) Front-end modules	380-500 VAC / 525-690 VAC -10%...+10% (according to EN60204-1)
	Input voltage U_{in} (DC) Inverter and brake chopper modules	465...800 VDC / 640...1100 VDC. The voltage ripple of the inverter supply voltage, formed in rectification of the electric network's alternating voltage in basic frequency, must be less than 50 V peak-to-peak
	Output voltage U_{out} (AC) Inverter	3~ 0...U_{in} / 1.4
	Output voltage U_{out} (DC) Active front-end module	1.10 x 1.35 x U_{in} (Factory default)
	Output voltage U_{out} (DC) Fundamental and non-regenerative front-end module	1.35 x U_{in}
Ambient conditions	Ambient operating temperature	–10°C (no frost)...+40°C: I_H –10°C (no frost)...+40°C: I_L 1.5% derating for each 1°C above 40°C Max. ambient temperature +50°C
	Storage temperature	–40°C...+70°C
	Relative humidity	0 to 95% RH, non-condensing, non-corrosive, no dripping water
	Air quality: - chemical vapours - mechanical particles	 IEC 721-3-3, unit in operation, class 3C2 IEC 721-3-3, unit in operation, class 3S2
	Altitude	100% load capacity (no derating) up to 1000 m 1.5% derating for each 100 m above 1000 m Max. altitudes: NX_2: 3000 m; NX_5: 3000 m; NX_6: 2000 m
	Vibration EN50178/EN60068-2-6	FR4...FR8: Displacement amplitude 1 mm (peak) at 5...15.8 Hz Max acceleration 1 G at 15.8...150 Hz
		FI9...FI13: Displacement amplitude 0.25 mm (peak) at 5...31 Hz Max acceleration 1 G at 31...150 Hz
	Shock EN50178, EN60068-2-27	UPS Drop Test (for applicable UPS weights) Storage and shipping: max 15 G, 11 ms (in package)
	Cooling capacity required	approximately 2%
	Cooling air required	FR4 70 m^3/h, FR6 425 m^3/h, FR7 425 m^3/h, FR8 650 m^3/h FI9 1150 m^3/h, FI10 1400 m^3/h, FI12 2800 m^3/h, FI13 4200 m^3/h
	Unit enclosure class	FR8, FI9...14 (IP00); FR4...7 (IP21)
EMC (at default settings)	Immunity	Fulfils all EMC immunity requirements, level T
Safety		CE, UL, CUL, EN 61800-5-1 (2003), see unit nameplate for more detailed approvals
Control connections	Analogue input voltage	0...+10 V, R_i = 200 kΩ, (–10 V...+10 V joystick control) Resolution 0.1%, accuracy ±1%
	Analogue input current	0(4)...20 mA, R_i = 250 Ω differential
	Digital inputs	6, positive or negative logic; 18...30 VDC
	Auxiliary voltage	+24 V, ±15%, max. 250 mA
	Output reference voltage	+10 V, +3%, max. load 10 mA
	Analogue output	0(4)...20 mA; R_L max. 500 Ω; resolution 10 bits Accuracy ±2%
	Digital outputs	Open collector output, 50 mA / 48 V
	Relay outputs	2 programmable change-over relay outputs Switching capacity: 24 VDC / 8 A, 250 VAC / 8 A, 125 VDC / 0.4 A Min. switching load: 5 V / 10 mA
Protections	Overvoltage protection	**NX_5**: 911 VDC; **NX_6**: 1200 VDC
	Undervoltage protection	**NX_5**: 333 VDC; **NX_6**: 460 VDC
	Earth fault protection	Yes
	Motor phase supervision	Trips if any of the output phases is missing
	Overcurrent protection	Yes
	Unit overtemperature protection	Yes
	Motor overload protection	Yes
	Motor stall protection	Yes
	Motor underload protection	Yes
	Short-circuit protection of +24 V and +10 V reference voltages	Yes

VACON NC61131-3
APPLICATION PROGRAMMING SUITE

VACON
DRIVEN BY DRIVES

PROFESSIONAL APPLICATION DEVELOPMENT



The Vacon NC61131-3 Application Programming Suite consists of tools that offer all that is necessary for making professional and efficient applications. This suite enables you to adapt Vacon AC drives to your application-specific requirements.

The Vacon NC61131-3 Application Programming Suite supports many programming languages which are based on the IEC61131-3 standard. An entire application can be done in a few easy steps by using a specific tool for each programming phase. The Application Programming Suite offers a graphical programming environment for the functional design of an application.

NC61131-3, Block programming tool

The NC61131-3 is a block programming tool to make a graphical presentation of the application. The application is made with the user-selected programming language (Function Block Diagram, Structured Text, Sequential Function Chart, or Ladder Diagram). The user selects the necessary functions and function blocks from the library to the worksheet and wires them together in order to define the desired functionality for the application.

The tool incorporates a wide range of IEC features. The PLC type of logic can be programmed with Boolean functions, timers, counters, comparators and flip-flops. In addition, frequency-converter-related functions can be created by using scaling, ramp control, PI(D) control, and more can be added. These features ensure that the drive control and the PLC control can be combined, and external equipment (e.g. small PLCs with control logic) are no longer necessary.

The NC61131-3 also has a new online debugging feature. It displays all the internal variables of the application with their status.

NCDef, Definition tool

The NCDef is a tool to make local control panel definitions for an application. The NCDef is a link between the logic program and keypad layout. This tool is used for creating parameters, variables, references and special buttons for the AC drive. If you want to show text instead of numerical values for a parameter, the tool offers an option to define unique value-to-text conversion pairs.

The NCDef also assists in customizing the menu groups for easy and clear parameter and variable reading via a local control panel. The menu groups can be modified, deleted or added as required.

NCLoad, Loading tool

The NCLoad is an easy-to-use service tool for downloading applications, language packages, option board software, and system software to Vacon AC drives. The graphical user interface provides an easy point-and-click selection of applications to be downloaded. After a successful download, the drive will be reset, and the custom application is ready to use.

You can download multiple applications to Vacon AC drives and activate the one that is required at the given moment. All hardware, software and option board details are readily available for viewing via the NCLoad.
The NCDrive uses a simple RS232 communication cable between the PC and Vacon AC drive. A fast and multidrop CAN

NCDRIVE FOR VERSATILE COMMISSIONING

The NCDrive is a versatile commissioning and maintenance tool for Vacon. The tool provides four main windows for different purposes: parameter, monitor, operating and diagnostic window. Moreover, there is a data logger and trend recorder for the Vacon DV2 drives.

communication can be used with the Vacon DV2. The CAN bus cable can be connected to a PC using a USB-to-CAN interface or a CAN-to-Ethernet interface.

Parameter window features

- Parameter values are visible with the parameter name, default value and its minimum and maximum limits
- Parameters can be uploaded or downloaded to/from Vacon AC drives
- Parameters can be edited online or offline. In the online mode, the changes take place immediately in Vacon AC drives
- Parameters can be saved on a computer hard disk in text or Excel format for back-up purposes
- The parameters in Vacon AC drives or in a file can be compared with the parameters in any other parameter file in the computer

Monitor window features

- Monitoring of eight signals in graphical format on the same time axis
- Minimum sample time of 50 ms with RS232 and of 1 ms with CAN communication
- Minimum and maximum scaling can be modified any time
- Graphical screen can be saved onto the hard disk. It can also be exported in BMP or Excel format.
- The monitoring data can be triggered on condition to debug specific problems.

Operating window features

- Vacon AC drives can be controlled from the NCDrive and motor can be run as required
- Run, Stop, Fault reset, Coast stop, Direction reverse through simple graphical buttons
- Speed/frequency reference can be set directly, or by using the scroll bar
- Status indication for ready, running, fault, alarm, active control place and datalogger status in the task bar

Diagnostic window features

- Active faults in Vacon AC drives with associated signal values at the time of fault such as frequency, current, and more
- Fault history with associated signal values at the time of each fault. The last 30 faults can be viewed.

Datalogger window features

- Data logged in the drive for eight signals with a minimum sample time of 1 ms
- NCDrive can, for instance, be used to set the signals, trigger condition, and so forth
- The triggered data saved in the drive can be uploaded in graphical form, and can also be exported as BMP or Excel
- Available only for the Vacon DV2

Trend recorder window features

- The data can be saved continuously for longer periods, typically for hours, onto the hard disk
- The saved trend data can be opened any time in graphical format and scrolled through the time axis
- Available only for the Vacon DV2 via the CAN bus interface

Other features

- Real-time clock setting in the Vacon DV2
- Parameter, monitor, diagnostic, data logger and trend data can be printed
- Application file database can be generated from the drive
- Firmware and application variables can be monitored for advanced debugging
- Service info keeps the complete information of the drive including hardware, software details, hour counters, parameter settings, and a fault logger

TECHNICAL DATA

System requirements	
Operating system	Microsoft Windows 95, 98, 2000, NT 4.0 or XP
CPU	Pentium 200 MHz or better
Hard disk	Minimum of 80 MB free space available
RAM	Minimum of 64 MB RAM available
Interface	RS-232. Note : USB/Ethernet for CAN communication with Vacon DV2 drives.
Display	VGA 800 x 600 (1280 x 1024 recommended)

Delivery

The installation CD-ROM (CD number CD00001), including:

- NC61131-3 block programming tool
- NCDef definition tool
- NCLoad loading tool
- NCDebug debugging tool
- NCDrive parameterisation and commissioning tool
- User manuals
- Installation instructions

Ordering identification

- Vacon NC61131-3 Application Programming Suite

Tool licence covers

- Personal license, one license/person
- Vacon NC61131-3 Application Programming training course for one person is included in the license
- Unique CD-ROM ID code (password)
- All licenses are registered in the database at Vacon Plc, Finland
- Free upgrades for all registered licensees

APPENDIX

ENCLOSURE SPECIFICATIONS

Vacon drive products are constructed to be environmentally versatile – whether the application is indoors, outdoors, or in extremely harsh washdown situations. Our products are packaged to meet both NEMA (National Electrical Manufacturers Association) and European IP rating enclosure systems.

The NEMA system is used primarily in North America and the IP system is used in Europe and the rest of the world. Our products are packaged in NEMA and IP enclosures to meet virtually any application.

NEMA and IP ratings are similar, but there is not a one-to-one correlation between the two systems. NEMA enclosures are classified by type (e.g., Type 1, Type 4, etc.). IP enclosures employ a two-digit system to classify enclosures. The first digit defines the degree of protection provided against contact with solid objects and the second digit defines the protection level against water (e.g., IP54). The higher the number, the more protection provided.

Specific NEMA and IP enclosure types, their applications, and their protection capabilities are listed below with a photo of a corresponding Vacon product.

NEMA 1 – Intended for indoor use and provides protection to personnel from incidental contact with enclosure contents and provides minimal protection against falling dirt. IP23 is the approximate European rating.

NEMA 3R – Constructed for indoor or outdoor use and provides some protection against falling dirt, rain, sleet, snow, windblown dust and external formation of ice on the enclosure. IP32 is the approximate European rating.

NEMA 4 – Appropriate for indoor or outdoor use and provides some protection against falling dirt, rain, sleet, snow, windblown dust, splashing water, and hose-directed water, as well as external formation of ice on the enclosure. IP65 is the approximate European rating.

NEMA 4X – This enclosure, appropriate for indoor and outdoor use, protects against corrosion and exposure to saltwater spray. It also protects against falling dirt, rain, sleet, snow, windblown dust and external formation of ice on the enclosure. IP65 is the approximate European rating. The Vacon X4 AC Drives and Vacon X5 AC Drives are rated at IP66 through 100HP. The IP66 rating greatly exceeds NEMA 4 standards.

NEMA 12 – Constructed for indoor use and provides a degree of protection against dust, falling dirt, and dripping non-corrosive liquids. IP55 is the approximate European rating. Consult with your local Vacon sales representative to obtain additional information.

EXAMPLES OF VACON NEMA ENCLOSURES

IP20
Vacon 10

NEMA 12
Vacon SE2

NEMA 1
Vacon NXP

NEMA 4X
Vacon X4 / X5
<125HP

NEMA 12
Vacon X4 / X5
>100HP

AGENCY APPROVALS

Many of Vacon electronic drive products and accessories meet CE, UL, cUL, and C-Tick standards. Products that meet specified standards are identified in this catalog.

The European Community – The CE mark is the official marking for electronic products and equipment sold or put into service anywhere in the European Community. It signifies that the product meets all safety and environmental requirements defined under European Directives.

Underwriters Laboratories Inc. – When a product carries this mark, it means UL found that representative samples of this product met UL's safety requirements. These requirements are primarily based on UL's own published Standards of Safety.

Underwriters' Laboratories of Canada – UL introduced this new Listing Mark in early 1998. It indicates compliance with both Canadian and U.S. requirements. Products with this type of mark have been evaluated for both U.S. and Canadian safety requirements, which have somewhat different safety requirements.

Underwriters' Laboratories has a reciprocal agreement with the Canadian Standards Association where the cUL mark is considered equivalent to the CSA mark for meeting Canadian Safety Standards.

The Canadian Standards Association (CSA) – a non-government, non-profit association that operates internationally to set standards for products and services through testing, certification, and inspections for safety and performance. CSA enhances public safety and health while contributing to environmental preservation.

Australian Compliance – C-Tick is the mark of compliance with testing/evaluation standards in Australia, as developed by a number of organizations, including the Australian Communication Authority.

If you have any questions regarding these agency approvals, please contact your local Vacon sales representative.

POLICIES AND PROCEDURES

Prices and Terms of Payment

Vacon, Inc. (Vacon) will provide composite price and discount sheets will be printed for all stock products and distributed to each distributor. Consult the Sales department at the number listed above for electronic versions. Requests for price quotes on non-standard items or anything not covered in the printed price sheet must also be referred to the sales department.

By placing a purchase order, purchaser agrees that the total amount of the transaction shall be due and payable on a Net 30 Days basis from the date of invoice.

Unpaid balances beyond 30 days shall bear 1.5% interest per month until paid in full.

Request for price quotes on non-standard items or anything not covered in the printed price sheet must also be referred to the Sales department. Our payment terms are net 30 days.

Shipments and Freight Allowances

Shipment promises are made in good faith. If for any reason, whether due to Vacon fault or otherwise, delivery is delayed, it is agreed that Vacon shall not be liable for any consequential or secondary damages of any nature.

When a customer purchase order is received without final and complete shipping instructions, Vacon shall have the right to ship and bill Purchaser within 30 days of the date of completion of manufacture.

For damages or shortages in transit, consignee must make claims against the carrier. Claims for order shortages, overages or other order errors in shipments must be made to Vacon in writing within a period of 30 days from date of shipment; otherwise, such claims will not be considered valid.

All shipments are EXW (Ex Works per INCOTERMS 2000) Chambersburg, PA, USA. Orders will be shipped freight collect or prepay and add. Customer requests of partial shipments, shipment to more than one destination, or drop shipments to third party locations will ship freight collect or prepay and add. Vacon reserves the right to accept or reject these requests and use the carrier of its choice when shipping freight allowed. Excess charges resulting from routings or carriers specified by the customer will be added to the invoice.

Order Cancellations

Cancellations, reschedules, or suspensions of orders will be reviewed on a case-by-case basis and will be accepted only on terms which indemnify Vacon against any losses.

Product Reliability

Vacon products, with exceptions as noted, are sold with no express warranties, oral or written, and with no implied warranties of merchantability, fitness, or any other warranties whatsoever. There is no assumption of responsibility for damages caused during or resulting from transport, receipt of the delivery, installation, commissioning or use.

Vacon shall in no event and under no circumstances be held responsible for damages and failures resulting from misuse, improper installation, unacceptable ambient temperature, corrosive substances or operation outside the rated specifications. Additionally, there will be no assumption of liability for any incidental or consequential damages, secondary charges, expenses for installation, injuries to persons, or damage to property.

The time of warranty for Vacon drives is stated in each product manual and only covers defects in workmanship or material when purchased. If a drive is determined to be covered under warranty, we will, at our discretion, repair the product or provide a replacement EXW Vacon, Chambersburg, PA. Any agreed warranty will be deemed null and void if, after inspection, it is noted that the drive has been altered or repaired by unauthorized personnel.

Products may be returned only after written approval and a Returned Goods Authorization (RGA) number has been received from Customer Service. Return shipments must be prepaid (Refer to Returned Goods Policy). Final decision about repair or replacement rests solely with Vacon.

Product Changes and Improvements
Vacon is under no obligation to incorporate improvements or changes in products already shipped, nor will we substitute improved products for those already shipped. Changes and improvements may be made at any time.

Distributor Stocks
A Distributor must maintain adequate stock to service his trading area in order to be considered an authorized Stocking Distributor and qualify for assistance with training, sales and promotional activities. The Distributor and Vacon Sales Representative will cooperate to:

1. Establish aims, objectives and sales goals by product line.
   a. Consider the industry in the area, the similar stock presently available, the competitive situation and the Distributor's financial position.
   b. Review the potential we have developed and sales goals we have established.
2. Determine sizes, styles and types of each product line developed.

It is our objective to avoid Distributor stocks that do not move and have insufficient turns.

Advertising, Literature & Sales Promotional Material
Vacon will be prominent in industry publications to send a message of our corporate identity and brand as an industry leader.

Literature can be ordered by sending an Email to Literature@Vacon.com. This is a free service to all distributors. We also have promotional items for tradeshows, open houses, vendor fairs and other types of events. These items can be ordered for a nominal fee.

The Marketing department, along with the Regional Sales Representatives, will work to provide any type of promotional materials that will help you sell Vacon products.

Vacon retains all rights, including all intellectual property rights, to advertising, literature and sales promotional materials provided. Each Distributor must return all such materials if the Distributor relationship is terminated for any reason and the Distributor must cease using such materials, including materials posted on any internet site.

We are committed to providing you with the tools you need to be successful.

Sales Training and Field Assistance
We will assist our Distributors through our sales education program and Sales Representatives. Sales meetings may be conducted at the Distributor's place of business. In addition, they will work with the Distributor to:

1. Recommend stock, inventory levels, turnover expectations, literature requirements, etc.
2. Aid in training or familiarizing Distributor sales personnel with our products.
3. Acquaint sales personnel with competitive products, point out weaknesses and strengths, and develop counter selling plans.
4. Aid in developing integrated sales promotion programs for the trading areas.
5. Help close sales to important prospects.
6. Investigate and resolve complaints.

Returned Goods
The policy for returning products for defects in workmanship or materials is covered under the "Product Reliability" section.

Distributors who may want to return products that are overstocked or slow moving must obtain prior approval and a Returned Goods Authorization number from Customer Service. This number must be referenced on the returned goods shipment. It allows us to identify the contents of the shipment, the Distributor who originated it and the reason for return. All returns must be sent by prepaid freight and will be subject to a 15% restocking charge. There will be additional charges as necessary for re-boxing and refurbishing.

Returned goods must have been manufactured and/or sold by Vacon and must be in new and salable condition. They will be inspected at the factory and if reconditioning is necessary it will be charged to the Distributor. We reserve the right to reject products that are obsolete or not in the original, unopened box.

Distributor Stock Adjustment Program

In addition to our Returned Goods Policy, we provide Distributors with opportunities to adjust their initial stock order. New Distributors may find that their initial inventory does not properly reflect buying trends in their area.

New Distributors may, within one year of their initial inventory purchases, return slow-moving products for equal exchange on other items in the same product category. Such returns must be accompanied by an order at least equal in value to the returned products. After the first year, they may return slow-moving products of a value less than or equal to half the value of an accompanying order for new items in the same product category. These stock adjustments must follow our Returned Goods Policy: prior approval, returned goods authorization number, prepaid shipping, salable condition and current design.

Termination

Vacon reserves the right to terminate a Distributor whenever we believe that such action is in our best interest. A termination for cause, depending on the circumstances, may be effective immediately or upon any notice period that we believe is appropriate. Vacon, Inc. is under no obligation to accept return of any remaining inventory.

APPLICATION GUIDE BY INDUSTRY REQUIREMENTS

The chart on these pages provides requirements — such as HP range, speed range, load type and torque — when applying AC drives to industrial machinery, including pumps, fans, conveyors or extruders, to name a few, in a variety of industries. It also provides recommended control types for all listed applications: Volts per Hertz, Sensorless Vector, and Flux Vector.

	Application Requirements						Control Type		
	Typical HP Range	Speed Range	Load Type/ Duty	Regen Loading (NR/RG)	Starting Torque (%)	Running Torque (%)	Volts per Hertz	Sensorless Vector	Flux Vector
AUTOMOTIVE TESTING									
ChassisTesters	100-400	10:1	CT/HD	RG	150	150		X	X
Conveyors	5-250	3:1	CT/HD	NR	150	125	X	X	
Engine Testers	50-400	10:1	CT/HD	RG	150	150		X	X
Fans	5-400	3:1	VT/ND	NR	25	110	X	X	
Pumps	5-400	3:1	VT/ND	NR	40	100	X	X	
Transmission Testing	5-400	10:1	CT/HD	RG	150	150		X	X
CEMENT									
Conveyors/Feeders	10-150	10:1	CT/HD	NR/RG	150	150	X	X	X
Fans	10-400	3:1	VT/ND	NR	25	25	X	X	
Kilns	150-400	5:1	CT/HD	NR	250	250	X	X	X
Packers/Separators	150-400	5:1	CT/HD	NR	150	150	X	X	X
Pumps	10-500	3:1	VT/ND	NR	150	150	X	X	X
FOOD									
Capper	5-100	10:1	CT/HD	NR	50	100	X	X	X
Centrifuge	10-200	10:1	CT/HD	RG	150	125	X	X	X
Conveyers	1-25	10:1	CT/HD	NR	150	125	X	X	X
Extruder	5-100	10:1	CT/HD	NR	150	125	X	X	X
Fans	10-100	3:1	VT/ND	NR	25	110	X	X	
Kettle Cooker	10-200	10:1	CT/HD	NR	100	110	X	X	X
Mixers	1-400	10:1	CT/HD	NR	150	125	X	X	X
Pumps	10-100	3:1	VT/ND	NR	40	100	X	X	
Seamer	5-50	10:1	CT/HD	NR	40	100	X	X	X
Slicer	5-50	10:1	CT/HD	NR	40	100	X	X	X
GLASS									
Float Liners	50-250	20:1	CT/HD	NR	150	125		X	X
Rubber Tire Gantry Cranes	20-300	20:1	CT/HD	NR/RG	150	150			X
Quay Cranes	25-400	20:1	CT/HD	RG	150	150			X
METALS									
Adjustment Drives	1-25	100:1	CT/HD	RG	150	150		X	X
Coiler(s)	100-400	4:1	CT/HD	RG	175	175		X	X
Conveyors	10-400	10:1	CT/HD	NR	150	125	X	X	X
Crop Shear	100-400	4:1	CT/HD	NR/RG	450	450		X	X
Fans-boilers, Oven	150-400	3:1	VT/ND	NR	25	110	X	X	
Helper Rolls	5-25	100:1	CT/HD	RG	100	150		X	X
Low Hp Auxiliary Drives	15-400	20:1	CT/HD	RG	200	200		X	X
Material Handling	5-50	10:1	CT/HD	RG	100	150		X	X
Pumps & Fans	5-300	4:1	VT/ND	NR	100	100	X	X	
Runout Tables (multi-mtr)	100-400	20:1	CT/HD	RG	200	200		X	X
Slitters & Trimmers	10-100	10:1	CT/HD	RG	150	150		X	X
Table Drives	10-400	10:1	CT/HD	NR	150	125	X	X	X
MINING									
Conveyors	100-400	10:1	CT/HD	NR/RG	150	150	X		X
Fans	10-400	3:1	VT/ND	NR	25	25	X	X	
Grinders, Crushers	100-400	10:1	CT/HD	NR/RG	150	150	X	X	
Pumps	10-400	3:1	VT/ND	NR	40	40	X	X	

APPLICATION GUIDE BY INDUSTRY REQUIREMENTS

	Application Requirements						Control Type		
	Typical HP Range	Speed Range	Load Type/ Duty	Regen Loading (NR/RG)	Starting Torque (%)	Running Torque (%)	Volts per Hertz	Sensorless Vector	Flux Vector
MISC.									
Elevators	1-150	10:1	CT/HD	RG	275	275			X
Wind Tunnels	5-400	10:1	VT/ND	RG	50	125	X	X	
PULP & PAPER									
Boiler Fans	50-400	3:1	VT/ND	NR	25	110	X	X	
Calenders	25-400	10:1	CT/HD	NR	150	110	X	X	X
Dry End Paper Machine	5-400	10:1	CT/HD	RG	100	200		X	X
Fans & Pumps	20-400	3:1	VT/ND	NR	25	100	X	X	
Paper Converting-Transport	3-150	10:1	CT/HD	NR/RG	150	150	X	X	X
Paper Rolls	2-25	10:1	CT/HD	NR/RG	50	150		X	X
Pumps: Feed, Couch Pit Liquor, Water	5-400	3:1	VT/ND	NR	40	100	X	X	
Pumps-Thickeners, Fans, Decker, Washer	5-400	3:1	CT/HD	NR	150	125	X	X	X
Screw Conveyors	15-400	10:1	CT/HD	NR	150	125	X	X	X
Slitters	5-50	10:1	CT/HD	NR	25	100	X	X	X
Wet End Paper Machine	100-400	10:1	CT/HD	NR	100	150		X	X
Winder Auxiliaries	5-100	20:1	CT/HD	RG	50	150		X	X
Winder Drums	50-400	20:1	CT/HD	RG	100	200		X	X
Winder/Unwind	100-400	20:1	CT/HD	RG	100	200		X	X
PETROCHEMICAL									
Beam Pump (Pump Jack)	5-400	3:1	CT/HD	RG	100	125	X	X	X
Compressors	50-400	3:1	VT/ND	NR	40	100	X	X	
Progressive Cavity Pump	5-400	3:1	CT/HD	NR	100	125	X	X	X
RUBBER/PLASTICS									
Calenders, Mills	25-400	10:1	CT/HD	RG	200	150		X	X
Compressors	10-400	3:1	VT/ND	NR	40	100	X	X	
Conveyors	1-100	10:1	CT/HD	NR	150	125	X	X	X
Extruders, Mixers	5-400	10:1	CT/HD	NR	200	200	X	X	X
Fans	10-400	3:1	VT/ND	NR	25	110	X	X	
Pelletizers	25-400	10:1	CT/HD	NR	150	125	X	X	X
Process-Transport Rolls	1-400	10:1	CT/HD	RG	50	150		X	X
TEXTILES									
Fans	5-400	10:1	CT/HD	NR	25	110	X	X	X
Fiber Spinning	1-400	10:1	CT/HD	NR	20	100	X	X	X
Processes-Coordinated									
Range Drives	50-400	10:1	CT/HD	NR	150	150		X	X
Transport Rolls	10-400	20:1	CT/HD	RG	150	150		X	X
WATER/WASTEWATER									
Chemical Feed Pumps	1-150	3:1	VT/ND	NR	40	40	X	X	
Fans	5-400	3:1	VT/ND	NR	25	25	X	X	
Fresh Water Pumps	10-400	3:1	VT/ND	NR	40	40	X	X	
Heating & Ventilation	5-400	3:1	VT/ND	NR	25	25	X	X	
Lift Stations	5-400	3:1	VT/ND	NR	40	40	X	X	
Slurry Pumps	5-400	3:1	VT/ND	NR	150	150	X	X	
Waste Water Pumps	10-400	3:1	VT/ND	NR	40	40	X	X	

AC drive applications come in all shapes and sizes but they are grouped into one of three basic categories: Constant Torque, Variable Torque or Constant Horsepower. Each system has unique characteristics and sizing of the drive is dependent on the application type as well as the specific characteristics of the given load. A look at each type will help determine in which application category your machine resides.

constant torque

Constant torque applications are the most common type of load. The basic characteristic is that load demands are the same throughout the designed speed range of the machine. The drive system, consisting of the AC drive and motor, can supply constant torque because the motor can deliver the required horsepower proportional to the speed across the operating range. Matching drive and motor performance is essential to making sure you have enough power for the application. Constant torque loads are found in most industrial environments. Applications such as conveyers, positive displacement pumps, extruders, and hoists are good examples of this loading characteristic. Overloads, shock loading and high-inertia loads are also potential loading issues that are found in constant torque applications. This is where the issue of Normal Duty versus Heavy Duty comes into play.

Three basic characteristics are true for constant torque applications:

1. The same amount of torque is needed to move the load regardless of the operating speed.

2. The load usually requires more torque to break the load loose and start the load moving than to keep it moving.

3. The load has the potential to exceed the motor power rating during operation.

variable torque

Fans and centrifugal pumps comprise the majority of loads found in the variable torque group. In a fan application, the torque demand will vary with the square of the change in speed and the power requirement will vary as the cube of the change in speed. At full speed, the load requirement is 100% torque and power, but a 50% change in speed creates a 75% decrease in torque demand and a 88% decrease in power required. Fans will occasionally have inertia issues that must be overcome on starting.

Pumps have a similar load characteristic, but often have static pressure issues that must be overcome by the motor making them a little stubborn to start.

For this reason, AC drives are excellent solutions for control of variable torque applications and provide both energy savings and a payback on the drive cost over a short time frame. It is important to look at the load inertia of a fan or the static pressure issues of a pump to consider the overall torque requirements and the short term overload requirements of the load.

constant horsepower

Sizing a drive on a constant horsepower application is the most difficult of the three types of applications. In this application type, the speed and torque demands have an inverse relationship. Torque demand is high at low speeds and is low at high speeds. Typical applications, such as center winders and some machine tools, require additional care when selecting a drive/motor combination. Sizing a drive/motor combination for any application is based on the torque demand both at starting and during operating speeds. But you must also account for the designed speed range and torque capacity of the motor. All AC motors have a designed operating range in which they can develop the optimum torque capacity based on the horsepower nameplate rating. Motors operating outside this designed speed range will not develop the torque required for the application. The current demand of the motor to develop this torque is the point at which the drive must be sized. Although drives are rated in horsepower, current capacity will be the deciding factor for reliable operation.

drive overload capacity

Each of the Load Characteristics listed describes controlling a load from zero to the base speed of the motor. During acceleration and when extra load is momentarily applied, the demand on the motor and drive can exceed 100% of the capacity of the pair. Every drive and motor has overload capacity built into it for these occasions and the drives are self-protected to prevent damage. Drives like the Vacon X4 and X5 have a dual rating from an overload perspective. Both a Normal Duty (ND) and a Heavy Duty (HD) rating are available on each model. Repeated fast speed changes with high-inertia loads, excessive static friction, short term overloads, shock loading, or in the case of pumps, static pressure loads are potential reasons that might drive you to choose the heavy duty rating of the inverter for sizing purposes. If there are no such issues, sizing the drive based on the normal duty rating is appropriate. These ratings difference are represented as:

- Normal Duty – 120% of nominal current for 60 seconds (110% for Vacon NXP)

- Heavy Duty – 150% of nominal current for 60 seconds

ELECTRICAL APPLICATION FORMULAS

ELECTRICAL FORMULAS

OHMS LAW:

Amperes = Volts / Ohms

Ohms = Volts / Amperes

Volts = Amperes x Ohms

POWER IN DC CIRCUITS:

Watts = Volts x Amperes

$$\text{Horsepower} = \frac{\text{Volts x Amperes}}{746}$$

$$\text{Kilowatts} = \frac{\text{Volts x Amperes}}{1000}$$

$$\text{Kilowatt-Hours} = \frac{\text{Volts x Amperes x Hours}}{1000}$$

POWER IN AC CIRCUITS:

Kilovolt-Amperes (KVA):

$$\text{KVA (Single-Phase)} = \frac{\text{Volts x Amperes}}{1000}$$

$$\text{KVA (Three-Phase)} = \frac{\text{Volts x Amperes x 1.73}}{1000}$$

Kilowatt (Kw):

$$\text{Kw (Single-Phase)} = \frac{\text{Volts x Amperes x Power Factor}}{1000}$$

$$\text{Kw (Two-Phase)} = \frac{\text{Volts x Amps x Power Factor x 1.42}}{1000}$$

$$\text{Kw (Three-Phase)} = \frac{\text{Volts x Amps x Power Factor x 1.73}}{1000}$$

$$\text{Power Factor} = \frac{\text{Kilowatts}}{\text{Kilovolts x Amperes}}$$

CONVERSION FACTORS

	MULTIPLY	BY	TO OBTAIN
Length	Meters	3.281	Feet
	Meters	39.37	Inches
	Inches	.0254	Meters
	Feet	.3048	Meters
	Millimeters	.0394	Inches
Torque	Newton-Meters	.7376	Ft-Lb
	Ft-Lb	1.3558	Newton-Meter
	In-Lb	.08333	Ft-Lb
	Ft-Lb	12.00	In-Lb
Rotation	RPM	6.00	Degrees/Sec.
	RPM	.1047	Rad./Sec.
	Degrees/Sec.	.1667	RPM
	Rad./Sec.	9.549	RPM
Moment of Inertia	Newton-Meters2	2.42	Lb-Ft2
	Oz-In2	.000434	Lb-Ft2
	Lb-In2	.00694	Lb-Ft2
	Slug-Ft2	32.1 7	Lb-Ft2
	Oz-In-Sec2	.1675	Lb-Ft2
	Lb-In-Sec2	2.68	Lb-Ft2
Power	Watts	.00134	HP
	Lb-Ft/Min	.0000303	HP
Tempera-ture	Degree C - (Degree F -32) x 5/9		
	Degree F - (Degree C x 9/5) + 32		

MECHANICAL FORMULAS

HOW TO CALCULATE TORQUE

If the horsepower and base speed of a motor are known, the full-load torque of the motor is determined by:

$$T = \frac{5250 \times HP}{N}$$

Where, T = Torque (Ft-Lb)

HP = Horsepower

N = Base Speed of Motor (RPM)

HOW TO CALCULATE HORSEPOWER

For Rotating Objects:

$$HP = \frac{TN}{63{,}000}$$

Where, T = Torque (In-Lb)

N = Speed (RPM)

OR:

$$HP = \frac{TN}{5250}$$

Where, T = Torque (Ft-Lb)

N = Speed (RPM)

For Objects in Linear Motion:

$$HP = \frac{FV}{396{,}000}$$

Where, F = Force (Lb)

V = Velocity (Inches/Minute)

OR:

$$HP = \frac{FV}{33{,}000}$$

Where, F = Force (Lb)

V = Velocity (FPM)

For Pumps:

$$HP = \frac{(GPM) \times (Head\ in\ Feet) \times (Specific\ Gravity)}{3950 \times (Efficiency\ of\ Pump)}$$

For Fans and Blowers:

$$HP = \frac{CFM \times (Pressure\ in\ Lbs/Sq\ Ft)}{33{,}000 \times Efficiency}$$

Time for motor to reach operating speed (seconds):

$$Seconds = \frac{WK^2 \times Speed\ Change}{308 \times Avg.\ Accelerating\ Torque}$$

WK^2 = Inertia of Rotor + Inertia of Load. $(LB\text{-}FT)^2$

$$Average\ Accelerating\ Torque = \frac{\frac{(FLT + BDT)}{2} + BDT + LRT}{3}$$

FLT = Full Load Torque

BDT = Breakdown Torque

LRT = Locked Rotor Torque

$$Load\ WK^2\ (at\ Motor\ Shaft) = \frac{WK^2\ (Load) \times Load\ RPM^2}{Motor\ RPM^2}$$

$$Shaft\ Stress\ (Lbs/Sq\ In) = \frac{HP \times 321{,}000}{RPM \times Shaft\ Diameter}$$

Speed:

$$Synchronous\ RPM = \frac{Hertz \times 120}{Poles}$$

$$Percent\ Slip = \frac{Synchronous\ RPM - Full\ Load\ RPM}{Synchronous\ RPM} \times 100$$

GLOSSARY
A–C

AC (Alternating Current)
A type of current in which the flow of electrons alternates back and forth as the voltage force alternates between pushing and pulling on electrons.

Acceleration
A change in velocity as a function of time. Acceleration usually refers to increasing speed of the motor, and deceleration to decreasing speed. Speed is directly proportional to frequency.

Accuracy
A measure of the difference between expected position and actual position of a motor or mechanical system. Motor accuracy is usually specified as an angle representing the maximum deviation from expected position.

Ambient Temperature
The temperature of the cooling medium, usually air, immediately surrounding the motor or another device.

Analog I/O
A type of I/O that may have a value within a set range.

Analog Input
An input to the drive consisting of a variable signal for dynamic adjustment of a setting. Typically either speed or Torque reference.

Analog Output
An output from a controller that is variable voltage or current in relationship to a real-time parameter.

Angular Accuracy
The measure of shaft positioning accuracy on a servo or stepping motor.

Armature
Another name for the rotor, which is more commonly referred to in DC motors.

Back EMF
The voltage generated when a permanent magnet motor is rotated. This voltage is proportional to motor speed and is present regardless of whether the motor winding(s) are energized or de-energized.

Breakaway Torque
The torque required to start a machine in motion. Almost always greater than the running torque.

Brushless Motor
Class of motors that operate using electronic commutation of phase currents, rather than electromechanical (brush-type) commutation. Brushless motors typically have a permanent magnet rotor and a wound stator.

Bypassing
A means of switching control of the motor from the drive to a starter.

C-Face Mounting
Standards NEMA mounting design, where the mounting holes in the face are threaded to receive the mating mount.

Canbus
A network used in products with multiple microcontrollers that need to communicate with each other.

Carrier Frequency
The rate of change of the PWM signal as measured at the motor terminals. Carrier is twice the switching frequency.

CE Mark
The European requirements for equipment sold within the EU. Drives have to comply with the Low Voltage directive and the EMC portions of the specifications.

Class B I nsulation
A NEMA insulation specification. Class B insulation is rated to an operating (internal) temperature of 130°C.

Class F Insulation

A NEMA insulation specification. Class F insulation is rated to an operating (internal) temperature of 155°C.

Class H Insulation

A NEMA insulation specification. Class H insulation is rated to an operating (internal) temperature of 180°C.

Closed Loop

A broadly applied term, relating to any system in which the output is measured and compared to the input. The output is then adjusted to reach the desired condition. Typical feedback is for speed, pressure, temperature and position.

Closed Loop Vector

A common term referring to the control of an AC motor to produce full torque across the entire speed range of the motor down to and including zero speed. This is only accomplished with the addition of a feedback device on the motor shaft.

Cogging

A term used to describe non-uniform angular velocity. Cogging appears as jerkiness, especially at low speeds.

Constant Horsepower

A load in applications where the amount of work to be done is independent of speed and torque, or that requires constant tension.

Constant Torque

Loads in applications where the amounts of force needed is independent of speed, and are the most common in industrial applications.

Continuous Rated Current (ICR) (Amperes)

The maximum allowable continuous current a motor can handle without exceeding the motor temperature limits.

Continuous Rated Torque (TCR) (lb-in)

The maximum allowable continuous torque a motor can handle without exceeding the motor temperature limits.

Continuous Stall Current (ICS) (Amperes)

Amount of current applied to a motor (at locked rotor conditions), which results in rated temperature rise. Refer also to definition of "Continuous Stall Torque."

Continuous Stall Torque (TCS) (lb-in)

The amount of torque at zero speed, which a motor can continuously deliver without exceeding its thermal rating.

Converter

An electrical circuit that changes AC power to DC power.

Current

The actual flow, and strength of flow, of electrons. Shown in amperes or Amps.

Current at Peak Torque (IPK) (Amperes)

The amount of input current required to develop "peak torque." This is often outside the linear torque/current relationship.

Current, Rated

The maximum allowable continuous current a motor can handle without exceeding motor temperature limits.

DC (Direct Current)

A type of current in which electrons flow in one continual direction.

DeviceNet®

The DeviceNet® network is an open low-level network that provides connections between simple industrial devices (such as sensors and actuators) and higher-level devices (such as PLC controllers and computers).

D-Flange Mounting

This type of mount has clearance holes on the flange, and the mounting bolts stick out through the flange from the motor side. This mount is common in cases where the motor is integral to the machine.

GLOSSARY
E—F

Digital I/O
A type of I/O which can be either on or off.

Digital Input
An input to a controller to activate a feature such as direction preset speeds or auxiliary functions.

Digital Output
An output from a controller to show the status of the controller's operation. Typically shows when a condition is true or false.

Diode Rectifier
Similar to SCRs, but diodes do not have a gate and thus cannot be controlled. Diodes only allow the positive portion of AC power to pass through the converter. Most AC drives use diodes.

DPBV (Dripproof Blower Ventilated)
Type of motor cooled by blowing air through the inside of the motor using an attached blower.

Drive
An electronic device that controls torque, speed and/or position of an AC or brushless motor.

Duty Cycle
For a repetitive cycle, the ratio of on time to total cycle time. Duty cycle (%) = [On time / (On time + Off time)] x 100%.

Dynamic Braking
A means of braking when a motor acts as a generator and the drive dissipates the excess energy.

EPROM
Electronic Programmable Read Only Memory

EEPROM
Erasable Electronic Programmable Read Only Memory

Efficiency
The ratio of power output to power input.

Enclosure
An outer covering that protects electrical devices that comprise the control aspects of the drive.

Encoder
A feedback device which converts mechanical motion into electronic signals. The most commonly used, rotary encoders, output digital pulses corresponding to incremental angular motion. For example, a 1000-line encoder produces 1000 pulses every mechanical revolution. The encoder consists of a glass or metal wheel with alternating transparent and opaque stripes, detected by optical sensors to produce the digital outputs. Metal tooth gears and magnetic pickups are commonly used as well.

Ethernet
A local-area network (LAN) architecture developed by Xerox Corporation in cooperation with DEC and Intel in 1976. Ethernet uses a bus or star topology and supports data transfer rates of 10 Mbps. A newer version of Ethernet, called 100Base-T (or Fast Ethernet), supports data transfer rates of 100 Mbps. And the newest version, Gigabit Ethernet supports data rates of 1 gigabit (1,000 megabits) per second.

E-trAC®
Family name of AC drives built by TB Wood's

Feedback
A signal which is transferred from the output back to the input for use in a closed loop system.

Feedback Devices
Sensors on the motor, or on a process line, that monitor actual performance. Transducers and encoders are examples.

Field Test
A means of determining the nature of the load, if it is not obvious.

Flux Vector (closed loop vector)
A common term referring to the control of an AC motor to produce full torque across the entire speed range of the motor down to and including zero speed. This is only accomplished with the addition of a feedback device on the motor shaft.

Four Quadrant

Refers to a motion system that can operate in all four quadrants; i.e., velocity in either direction or torque in either direction. This means that the motor can accelerate, run, and decelerate in either direction.

Frequency

A reference to how often AC changes polarity, and is measured in units of Hertz (or cycles per second).

Frequency Resolution

The increment of control provided within the design of the controller. In most AC drives, the analog resolution is stated as a number of bits used in the microprocessor. The higher the bit count, the better the resolution. In units with a digital keypad, the resolution is in how small of an increment the Hertz can be adjusted. Typically in either 0.01 or 0.05 Hz steps.

Frequency Stability

The long-term variance of the speed signal to the motor. Provided in a percentage of commanded signal. For example, 0.1% over 24h +/- 10°C change.

Frequency-Switching

The rate at which the output power devices are turned on and off as part of the Inverter section of the drive. See also PWM Frequency and Carrier Frequency.

Friction

A resistance to motion caused by contact with a surface. Friction can be constant with varying speed (Coulomb friction) or proportional to speed (viscous friction).

Harmonics

A special type of noise resulting from AC drives sinusoidal waves with higher frequencies than the main power supply, which are transmitted back to the AC line.

Holding Torque

Sometimes called static torque, holding torque specifies the maximum external torque that can be applied to a stopped, energized motor without causing the rotor to rotate. Generally used as a figure of merit when comparing motors.

Horsepower (HP)

An index of the amount of work a machine or motor can perform. One horsepower is equal to 746 watts. Since power is equal to torque multiplied by speed, horsepower is a measure of a motor's torque and speed capability; e.g., a 1 HP motor will produce 36 lb-in. at 1,750 rpm. Formula: HP = Torque (lb-in.) x Speed (RPM)/63,025 or HP = Torque (lb-ft.) x Speed (RPM)/5,252 or HP = Volts x Amps x Efficiency/746

IEC

The International Electro-technical Commission, which writes international standards for electrical devices.

IEEE

The Institute of Electrical and Electronic Engineers, which is an association that writes standards.

Inductance (L) (mH = millihenries)

The electrical equivalent to mechanical inertia; that is, the property of a circuit, which has a tendency to resist current flow when no current is flowing, and when current is flowing has a tendency to maintain that current flow. Line/Load reactors are an example of how this characteristic helps suppress spikes and surges over and above the norm.

Inductance (Mutual)

Mutual inductance is the property that exists between two current-carrying conductors or coils when magnetic lines of force from one link with those of the other. The basis for how a transformer works.

GLOSSARY
I—M

Inertia
The property of an object to resist change in velocity unless acted upon by an outside force. Higher inertia objects require larger torque to accelerate and decelerate. Inertia is dependent upon the mass and shape of the object.

Inertial Match
For most efficient operation, the system-coupling ratio should be selected so that the reflected inertia of the load is equal to the rotor inertia of the motor.

Injection Braking
A means of braking an AC motor by sending DC voltage to the motor to create a non-rotating magnetic field.

Insulated Gate Bipolar Transistor (IGBT)
A transistor used in AC drives to generate AC power from DC power through a control strategy called Pulse Width Modulation (PWM). IGBTs have replaced standard bipolar transistors over the years because of their higher efficiencies and higher switching frequencies that help with quiet motor operation.

Insulation Class
The rating assigned to the maximum temperature capability of the insulating components in a motor or other piece of equipment.

Inverter
A component of an AC drive that takes the regulated DC power and changes it back into a form of regulated (controlled) AC power. Also a common term used for an AC Drive.

I/O
Input/Output

IrDA
Infrared Data Association Standards

Load
The equipment being driven by the motor.

Load Cells
A type of feedback device that provides signals based upon characteristics of the connected application. Usually measures weight or force.

LonWorks
Enables control of several processes at once and allows convenient keypad programming. LONWORKS is a registered trademark of Echelon Corporation.

Metasys (N2)
An open system since 1992 used in many different applications. It allows communication through device level networks at the factory floor, cell level networks (field buses) at the manufacturing level and 10/100 Ethernet for upward communications

Mid-range Instability
A phenomenon in which a step motor can fall out of synchronism due to a loss of torque at mid-range speeds. The torque loss is due to the interaction of the motor's electrical characteristics and the driver's electronics. Some drivers have circuitry to eliminate or reduce the effects of mid-range instability.

MODBUS®
MODBUS Protocol is a messaging structure developed by Modicon in 1979. It is used to establish master-slave/client-server communication between intelligent devices and transfer discrete/analog I/O and register data between control devices.

MODBUS® RTU
MODBUS network using RTU (Remote Terminal Unit) Mode. This mode uses greater character density to allow better data throughput than ASCII for the same baud rate. Each message must be transmitted in a continuous stream.

NEMA

The National Electrical Manufacturers Association, which creates standards followed in the USA. The organization that sets standards for motors and other industrial electrical equipment.

Noise

Disruptions in a power or control system. Can be high or low frequency based an use of line suppression devices such as reactors, or controls devices such as shielded or twisted cable can help minimize its affect.

NTC (Negative Temperature Coefficient)

A negative temperature coefficient thermistor is used to detect and protect a motor winding from exceeding its maximum temperature rating. Resistance of the device decreases with an increase in temperature.

Open Loop Vector

A type of AC regulator that controls motor speed without feedback devices, regulates the current output to the motor, and controls the rotor/shaft speed by controlling the frequency of the magnetic flux in the stator. Also referred to as sensorless vector.

Open-Loop

A system in which there is no feedback. Motor motion is expected to faithfully follow the input command. Typical control scheme for both Volts per Hertz and Sensorless Vector Control.

Overload Capacity

The ability of a drive to withstand currents above its continuous rating. It is defined by NEMA as 150% of the rated full-load current for "standard industrial motors" for one minute.

Packaging

The metal or plastic enclosure protecting the internal drive components.

PDA-trAC+

Software from Vacon Inc. that allows the user to edit and save and upload drive parameters easily using a PDA.

Phases

A reference to how many currents (or voltage forces) are transmitted at one time.

PI Control

Proportional-Integral-acting control.

PID

A Proportional-Integral-Derivative controller (PID) is a standard feedback loop component in industrial control applications. It measures an "output" of a process and controls an "input", with a goal of maintaining the output at a target value, which is called the "set point".

Poles

Refers to the number of magnetic poles arranged on the rotor of the motor. In an AC motor, the number of poles has a direct relationship to the base speed of the motor.

Power

1. The rate at which work is done. In motion control, power is equal to torque multiplied by speed. 2. The rate of doing work or expending energy. It may be written as: Power (watts) = force x distance/time. Expressed in electrical terms it is voltage x current = power (watts)

Power Factor

Ratio of true power (kW) to apparent power (kVA).

PROFIBUS DP

A performance optimized version of PROFIBUS, specifically dedicated to time-critical communication between automation systems and distributed peripherals.

GLOSSARY
P—R

PSLC

Programmable Sequence Logic Controller allows the user to implement complex functions and limits based upon speed and load as well as other thresholds along with assigning desired ramps and dwell times.

PTC (Positive Temperature Coefficient)

A positive temperature coefficient thermistor is used to detect and protect a motor winding from exceeding its maximum temperature rating. Resistance of the device increases with an increase in temperature.

Pull-out Torque

The maximum friction loads, at a particular inertial load, that can be applied to the shaft of a synchronous motor (running at constant speed) and not cause it to lose synchronism.

Pulse Width Modulation (PWM)

A control strategy which uses Insulated Gate Bipolar Transistors to approximate an AC power supply by switching a DC supply voltage on and off at fixed frequencies. The length of the on/off interval or voltage waveform is variable.

Rated Current

The amount of current flowing through the drive/motor when under full load.

Reference

The analog or digital signal given to a Drive for either speed or torque command.

Regeneration

The action during motor braking in which the motor acts as a generator and takes kinetic energy from the load, converts it to electrical energy, and returns it to the controller.

Regenerative Braking

A form of dynamic braking in which the power is dissipated back into the main AC line, rather than through resistors.

Regulator

The control portion of the drive that determines what voltage and current is supplied to the motor, and the circuit through which power is supplied to the motor.

Repeatability

The degree to which a parameter such as position or velocity can be duplicated.

Resistance

The "frictional" force in wires opposing the flow of current.

Resistance, Hot (RH) (Ohms line-to-line)

The motor's terminal resistance value specified at the hot winding temperature, which is at the motor's maximum rated temperature.

Resolution

The smallest increment into which a parameter can be broken down. For example, a 1000 line encoder has a resolution of 1/1000 of a revolution.

Resolver

An electromagnetic feedback device that converts angular shaft position into analog signals. These signals can be processed in various ways, such as with an RDC (resolver-to-digital converter) to produce digital position information. There are two basic types of resolvers: transmitter and receiver. A transmitter-type is designed for rotor primary excitation and stator secondary outputs. Position is determined by the ratio of the sine output amplitude to cosine output amplitude. A receiver-type is designed for stator primary excitations and rotor secondary output. Position is determined by the phase shift between the rotor output signal and one of the primary excitation signals.

Resonance

Oscillatory behavior caused by mechanical limitations. This behavior is usually thought of as continuous.

Ringing
Oscillation of a system following a sudden change in state. Usually will diminish over time.

Rotor
The moving part of the motor.

Sensorless Vector
A control scheme used in AC drives to assist the motor in developing full torque capacity over the largest speed range. A motor model designed into the software of the drive makes assumptions based on commanded speed and current to calculate rotor position. These calculations are used to adjust the PWM signal and thus voltage and frequency to the motor.

Servo
A high-performance control utilizing similar control scheme to a Flux Vector drive but coupled with a low-inertia PM motor.

Settling Time
The time required for a parameter to stop oscillating or ringing and reach its final value.

Shaft
The part of the rotor that extends outside of the motor case and connects to the equipment to be rotated.

Shock Loading
A load that produces extremely high peak torque for very short duration. This type of load is associated with conveyorized grinding, crushing and separation processes.

SCR (Silicon Control Rectifier)
A gated diode that only allows current to pass through it when the current reaches a certain value, which turns on the SCR. DC drive converters typically use this device to transform AC current into a variable and tightly controlled form of DC current.

Speed
Describes the linear or rotational velocity of a motor or other object in motion.

Speed Range
The designed operational limits of an AC drive motor combination. Typically stated as a ratio such as 20:1 to indicate base frequency down to 1/20th of its base speed (1800 to 90 rpm).

Speed Regulation
The ability to have the load run at the precise speed it is commanded. Usually requires a feedback device and software within the control to look at the commanded speed and the actual speed and make the necessary adjustment.

Stall Torque
The amount of torque developed with voltage applied and shaft locked, or not rotating. Also known as locked-rotor torque.

Stator
The non-moving part of the motor. Specifically, it is the iron core with the wire winding in it that is pressed into the frame shell. The winding pattern determines the voltage constant of the motor.

Synchronized
A motor rotating at a speed corresponding correctly to the applied frequency is said to be synchronized. Load torque in excess of the motor's capacity (rated torque) will cause a loss of synchronism.

Synchronous Speed
The rotational speed on an AC motor if the rotor and the stator are exactly at the same point in time. This speed assumes no slip is occurring.

Tachometer
A device that monitors the actual speed of the motor. Feedback signal is usually an analog DC signal rated at so many volts per 1000 RPM.

GLOSSARY
T—W

TCP — Transmission Control Protocol, is one of the main protocols in TCP/IP networks. Whereas the IP protocol deals only with packets, TCP enables two hosts to establish a connection and exchange streams of data. TCP guarantees delivery of data and also guarantees that packets will be delivered in the same order in which they were sent.

TCP/IP — See above.

Thermal Protection — A thermal sensing device mounted to the motor to protect it from overheating. This is accomplished by disconnecting the motor phases from the drive in an over-temperature condition.

Thermal Resistance (Rth) (°C/watt) — An indication of how effectively a unit rids itself of heat; a measure of temperature rise per watts lost.

Thermostat — A temperature sensitive pilot duty device mounted on the interior of the motor to protect it from overheating.

Torque — Measure of angular force that produces rotational motion. This force is defined by a linear force multiplied by a radius; e.g. lb-in. Torque is an important parameter of any motion control system. Formula: Torque (lb-ft.) = 5,250 x HP/RPM

Torque Constant (KT = lb-ft/A) — An expression of the relationship between input current and output torque. For each ampere of current, a fixed amount of torque is produced.

Torque-Braking (Dynamic Braking) — The amount of braking capacity designed into the drive for stopping a regenerative load or torque required to stop the load.

Torque-Starting — The amount of torque it takes to accelerate the load to full speed.

Torque-to-Inertia Ratio — Defined as the motor's holding torque divided by the inertia of its rotor. The higher the ratio, the higher a motor's maximum acceleration capability will be.

User/Operator Interface — A means of allowing an operator to program control references to the drive/motor system, and to monitor motor and drive operating conditions.

Variable Torque Load — Loads in applications that exhibit both increases in torque and horsepower as speed increases.

Variable Voltage Control — A reference to drives because they manipulate the voltage supplied to the motor.

Velocity — The change in position as a function of time. Velocity has both a magnitude and sign.

Voltage — The force that pushes or pulls electrons, causing them to flow.

Voltage Spikes — A type of noise in which large quantities are suddenly transmitted across the line.

Volts Per Hertz — A type of AC control scheme that controls the frequency of AC power output to the motor, and does not use feedback devices.

WIN-trAC® — Windows-based software program that provides a simple and unique way to configure, monitor diagnose and mange drive applications.

WIN-trAC® PRO — Expanded version of WIN-trAC for use with multiple drive applications.

NOTES

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