Vacon NXP common DC bus products
providing ultimate flexibility
Vacon offers a comprehensive range of Common DC bus drive products comprising front-end units, inverter units and brake chopper units in the entire power range and voltages from 380 V to 690 V. The drive components are built on proven VACON NX technology and provide the ideal energy sharing solution for a multitude of power systems.

**RELIABLE. ROBUST. PROVEN.**

When your goal is to ensure that all AC drives share energy within your industrial system, and that all energy is effectively utilized and redistributed, then VACON Common DC bus drive solutions are the right choice. Our Common DC bus components are used in a multitude of combinations across a wide spectrum of high-power process industries from the pulp & paper, steel, metal & mining and marine cranes to smaller machines and production lines, which also demand cost-effective solutions.

DC bus systems comprise two main categories: regenerative and non-regenerative. In a regenerative DC bus system the front-end unit is capable of generating power back to the mains network. This kind of system is suitable for processes where braking is needed often and the braking power is relatively high. In a non-regenerative system the braking power is redistributed to the other drives in the system via the common DC bus, and possible excess power can be dissipated as heat using an optional brake chopper unit and brake resistors.

In small production lines or small paper machines where braking is needed less often, a non-regenerative common DC bus system is a cost-efficient solution. In high power applications, it is possible to parallel multiple front-end units.

In addition to the welcome cost savings, you’ll also benefit from reduced power cabling and installation time and reduced overall footprint of your drive system. Your drive line-up tolerance to voltage dips/sags will be improved and the harmonic distortions your drive system will be minimized.

**IN HARMONY WITH THE ENVIRONMENT**

Vacon is committed to being an environmentally responsible company and our energy saving products and solutions are a good example of that. Our Common DC bus portfolio fulfills key international standards and global requirements, including safety and EMC & Harmonics approvals. Likewise, we continue to develop innovative solutions utilizing ie. regenerative energy and smart grid technology to help customers effectively monitor and control energy use and costs.

**VACON AT YOUR SERVICE**

Vacon AC drives are sold in over 100 countries, with production and R&D on 3 continents, sales offices in 27 countries and approximately 90 service centers in over 50 locations worldwide.

Whether you are an original equipment manufacturer (OEM), system integrator, brand label customer or end user, Vacon provides services to help you meet your business targets. Our global service solutions and teams are available 24/7 throughout the product lifecycle with the intent to minimize the total cost of ownership and environmental load.

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**PURE PERFORMANCE**

Speed and torque control must be just right when manufacturing top-class stainless steel products. Vacon AC drives have been successfully implemented in various applications in the demanding metal processing industry.
THE COMPLETE RANGE

Vacon’s common DC bus product portfolio meets all the requirements with a flexible architecture, comprising a selection of active front-ends, non-regenerative front ends, inverters and brake choppers in the entire power range and voltages from 380 V to 690 V.

FLEXIBLE CONFIGURATION, CUSTOMIZED SOLUTIONS

Common DC bus components can be used in a multitude of combinations. In a typical DC bus configuration, the drives that are generating can transfer the energy directly to the drives in motoring mode. Common DC bus drive systems have different kinds of front-end units to meet the requirements of the electricity network and the process where the drives are used. With the right configuration, the drive system can achieve optimal performance and significant energy savings can be made when braking energy is utilized to its full potential.

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.

ACTIVE FRONT-END (AFE)

The AFE unit is a bidirectional (regenerative) power converter for the front-end of a common DC busdrive 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 grid side measurements to operate. AFE units can operate in parallel to provide increased power and/or redundancy without any drive to drive communication between the units. AFE units can also be connected to the same fieldbus with inverters, and controlled and monitored via fieldbus.

NON-REGENERATIVE FRONT-END (NFE)

The NFE unit is an 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, thus no external pre-charging is needed. This unit is suitable as a rectifying device when a normal level of harmonics is accepted and no regeneration to the mains is required. NFE units can be paralleled to increase power without any drive to drive communication 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 for powers up to 75 kW (FR4-FR8) and externally located 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.
**VACon NXP Control**

VACon NXP offers a high-performance control platform for all demanding drive applications. The micro controller provides both exceptional processing and calculation power. The VACon NXP supports both induction and permanent magnet motors in open and closed loop control modes. The VACon NXP features built-in PLC functionality without the need for any additional hardware. VACon NCA1131-3 Engineering can be used to improve performance and create cost savings by integrating custom-specific functionality into the drive. The same control board is used in all NXP drives, allowing the maximum utilization of NXP control features over a wide power and voltage range.

**Option Boards**

Our NXP Control provides exceptional modularity by offering five (A, B, C, D and E) plug-in extension slots. Fieldbus boards, encoder boards as well as wide range of IO boards can simply be plugged-in at any time without the need to remove any other components. A listing of all options boards is provided on page 13.

**Fieldbus Options**

Your VACon NXP is easily integrated into a plant’s automation system by using plug-in fieldbus option boards including Profibus DP, Modbus RTU, DeviceNet and CANopen. Fieldbus technology ensures increased control and monitoring of the process equipment with reduced cabling – ideal for industries where the need to ensure that products are produced under the right conditions is of paramount importance. An external +24 V supply option enables communication with the control unit even if the main supply is switched off. Fast drive-to-drive communication is possible using VAcon’s fast SystemBus fiber optic communication.

Profibus DP • DeviceNet • Modbus RTU • CANopen

**Ethernet Connectivity**

VACon NXP is the smart drive of choice, as there is no need to purchase additional communication tools. Ethernet connectivity allows remote drive access for monitoring, configuring and troubleshooting. VACon’s Ethernet protocols such as Profinet IO, Ethernet IP and Modbus/TCP are available for all NXP drives. New Ethernet protocols are being continuously developed.

Modbus/TCP • Profinet IO • Ethernet IP

**Safe Torque Off, Safe Stop 1**

Safe Torque Off (STO) is available for all NXP drives. It prevents the drive from generating torque on the motor shaft and prevents unintentional start-ups. The function also corresponds to an uncontrolled stop in accordance with stop category 0, EN60204-1. Safe Stop 1 (SS1) initiates the motor deceleration and initiates the STO function after an application specific time delay. The function also corresponds to a controlled stop in accordance with stop category 1, EN60204-1.

The advantage of the integrated STO and SS1 safety options compared to standard safety technology using electromechanical switchgear is the elimination of separate components and the effort required to wire and service them, while still maintaining the required level of safety at work.

**Atex Certified Thermistor Input**

VAcon has developed an Atex approved thermistor input, as an integrated option. Certified and compliant with the European ATEX directive 94/9/EC, the integrated thermistor input is specially designed for the temperature supervision of motors that are placed in areas in which potentially explosive gas, vapor, mist or air mixtures are present and areas with combustible dust. Typical industries requiring such supervision include chemical, petrochemical, marine, metal, mechanical, mining, and oil drilling.

If over-heating is detected, the drive immediately stops feeding energy to the motor. As no external components are needed, the cabling is minimized, improving reliability and saving on both space and costs.

**DC Cooling Fans**

VACon NXP high-performance air-cooled products are equipped with DC fans. This significantly increases the reliability and lifetime of the fan also fulfilling the ERP2015 directive on decreasing fan losses. Likewise, the DC-DC supply board component ratings fulfill industrial requirement levels.

**Conformal Coating**

To increase performance and durability, conformally coated printed circuit boards (PCBs, also known as varnished boards) are provided as standard for power modules.

The upgraded PCB’s offer reliable protection against dust and moisture and extend the lifetime of the drive and critical components.
COMMISSIONING MADE EASY

USER-FRIENDLY KEYPAD
Vacon has ensured that the user interface is intuitive to use. You will enjoy the keypad’s well-structured menu system that allows for fast commissioning and trouble-free operation.

- Removable panel with plug-in connection
- Graphical and text keypad with multiple language support
- Text display multi-monitoring function
- Parameter backup and copy function with the panel’s internal memory
- Vacon’s Startup Wizard ensures a hassle-free setup. Choose the language, application type and main parameters during the first power-up.

SOFTWARE MODULARITY
Vacon's handy All-in-One application package has seven built-in software applications, which can be selected with one parameter. In addition to the All-in-One package, Vacon offers several segment specific and advanced applications such as System Interface, Marine, Lift and Shaft Synchronisation for more demanding uses.

Vacon’s NCDrive is used for setting, copying, storing, printing, monitoring and controlling parameters. The Vacon NCDrive communicates with the drive via the following interfaces: RS-232, Ethernet TCP/IP, CAN (fast multiple drive monitoring), CANopen (remote monitoring). The drive can be set, copied, stored, printed, monitored through the following interfaces: RS-232, Ethernet TCP/IP, CAN (fast multiple drive monitoring), CANopen (remote monitoring).

Vacon NCDrive also includes a handy Datalogger function, which offers you the possibility to track failure modes and perform root cause analysis.

Vacon PC-tools can be downloaded from www.vacon.com

INDEPENDENT PARALLELING
Benefit from Vacon’s patented independent paralleling configuration of (A)FE front-end units.

- High redundancy
- No drive-to-drive communication needed
- Automatic load sharing
- NFE units can also be independently paralleled

380-500 VAC INVERTER MODULES

<table>
<thead>
<tr>
<th>Code</th>
<th>Frames</th>
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525-690 VAC INVERTER MODULES

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INDEPENDENT PARALLELING
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- High redundancy
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### DIMENSIONS & WEIGHTS

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* only as inverter unit
### Technical Data

#### Input voltage U in (aC) Front-end modules
- 300-500 VAC (525-690 VAC) –10%...+10% (according to EN60204-1)

#### Input voltage U in (DC) Front-end and brake chopper modules
- 440-600 VDC / 700 VDC

#### Output voltage U out (aC) Inverter
- Nominal output voltage supply, formed by rectification of the electronic converter's alternating voltage in basic frequency, must be less than 50 peak to peak

#### Control connections

##### Control performance
- Open loop control and closed loop control (Operating point 0%...100% of nominal speed)

##### Switching frequency
- Max. 5 kHz (Factory default) / 3 kHz (by order)

##### Overshooting point
- t0; t1; Factory default 3 kHz

##### Acceleration time
- t0; 3000 sec

##### Deceleration time
- t1; 3000 sec

##### Braking
- DC brake: 3% of Tp

#### Ambient conditions

##### Ambient operating temperature
- –20°C...+60°C

##### Min. ambient temperature
- –40°C

##### Storage temperature
- –40°C...+70°C

##### Relative humidity
- 0%...95% RH, non-condensing, non-corrosive, no dripping water

##### Altitude
- – chemical vapours

##### Air quality:
- EN50178, EN60068-2-27

##### Cooling air required
- FR4: 70 m³/h
- FR6: 425 m³/h
- FR7: 425 m³/h
- FR8: 650 m³/h

##### Cooling capacity required
- approximately 2%


##### En/IEC 61800-5-2 Safe Stop 1 (SS1) SIL2,

##### En/IEC 61800-5-2 Safe Torque off (STo) SIL2,

##### Overvoltage protection
- nX_5: 2...5 kHz; Factory default 1.5 kHz
- nX_6: 1...6 kHz; Factory default 3.6 kHz

##### Speed control
- 0.01%, dynamic 0.2% sec, torque lin. <2%, torque rise time ~2 ms

- Closed loop vector control (entire speed range):

- open loop vector control (5-150% of base speed):

- Closed loop vector control (entire speed range):

- closed loop vector control (5-150% of base speed):

#### Signals

##### Switching capacity
- 24 VDC / 8 A, 250 VaC / 8 A, 125 VDC / 0.4 A

##### Communication options

##### Communication cards (SOP, DP)
- OPT-C5 Profibus DP (D9-type connector)
- OPT-C4 LonWorks
- OPT-C2 RS-485 (Multiprotocol)

##### Communication cards (OPC)
- OPT-C1 Modbus / TCP (Ethernet)

##### Communication cards (SOP)
- OPT-AF Safe disable EN954-1, cat 3

##### Communication cards (OPC)
- OPT-B1 Selectable I/O

##### Communication cards (SOP)
- OPT-B2 Relay output

##### Communication cards (SOP)
- OPT-A4 Encoder HTX type (Encoder + acceleration)

##### Communication cards (SOP)
- OPT-A3 Automotive I/O

##### Communication cards (SOP)
- OPT-A2 Safety I/O

##### Communication cards (SOP)
- OPT-A1 Binary input +10 V

- Options

#### Optional I/O cards

- OPT-A1 Analog input

- OPT-A2 Analog output

- OPT-A3 Analog measurement

- OPT-A2 Relay output (NO/NC)

- OPT-A1 Binary input +10 V

- OPT-A1 Digital input +10 V

- OPT-A2 Digital input +10 V

#### Standard Features & Options

##### Standard features

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<th>Feature</th>
<th>A</th>
<th>B</th>
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**Notes:**
- Optional I/O cards
- Standard I/O channels
- with OPT-AF board
**VACON NX INVERTER**

- **Product generation**: NX
- **Module type**: A
- **Nominal current**: 400 A
- **Nominal supply voltage**: 525-649 VAC / 625-800 VDC
- **Control keypad**: A
- **Enclosure class**: IP65
- **EMC emission level**: EN61800-3
- **Delivery include**: N/A (no brake chopper)
- **Nominal supply voltage**: 525-649 VAC / 625-800 VDC
- **Hardware modifications**: Module type - S Boards
- **Nominal current**: 4 A

**VACON NX ACTIVE FRONT-END**

- **Product generation**: NX
- **Module type**: A
- **Nominal current**: 400 A
- **Nominal supply voltage**: 525-649 VAC / 625-800 VDC
- **Control keypad**: A
- **Enclosure class**: IP65
- **EMC emission level**: EN61800-3
- **Delivery include**: N/A (no brake chopper)
- **Nominal supply voltage**: 525-649 VAC / 625-800 VDC
- **Hardware modifications**: Module type - S Boards
- **Nominal current**: 4 A

**VACON NX NON-REGENERATIVE FRONT-END**

- **Product generation**: NX
- **Module type**: A
- **Nominal current**: 400 A
- **Nominal supply voltage**: 525-649 VAC / 625-800 VDC
- **Control keypad**: A
- **Enclosure class**: IP65
- **EMC emission level**: EN61800-3
- **Delivery include**: N/A (no brake chopper)
- **Nominal supply voltage**: 525-649 VAC / 625-800 VDC
- **Hardware modifications**: Module type - S Boards
- **Nominal current**: 4 A

**VACON NX BRAKE CHOPPER UNIT**

- **Product generation**: NX
- **Module type**: A
- **Nominal current**: 400 A
- **Nominal supply voltage**: 525-649 VAC / 625-800 VDC
- **Control keypad**: A
- **Enclosure class**: IP65
- **EMC emission level**: EN61800-3
- **Delivery include**: N/A (no brake chopper)
- **Nominal supply voltage**: 525-649 VAC / 625-800 VDC
- **Hardware modifications**: Module type - S Boards
- **Nominal current**: 4 A
Vacon is driven by a passion to develop, manufacture and sell the best AC drives and inverters in the world — and to provide efficient life-cycle services for its customers. Our AC drives offer optimum process control and energy efficiency for electric motors. Vacon inverters are a key component in producing energy from renewable sources. We have R&D and production units in Finland, the USA, China and Italy, and sales & service offices in 27 countries. In 2011, Vacon had revenues of EUR 380.9 million and globally employed 1,500 people. The shares of Vacon Plc (VAC1V) are quoted on the main list of the Helsinki stock exchange.