ENGINEERING
TOMORROW

Selection Guide | VLT® Flow Drive FC 111

Specialized flow drive for fan and pump applications

315 kW

Power range:
0.37 kW to
315 kW

drives.danfoss.com | VLT®

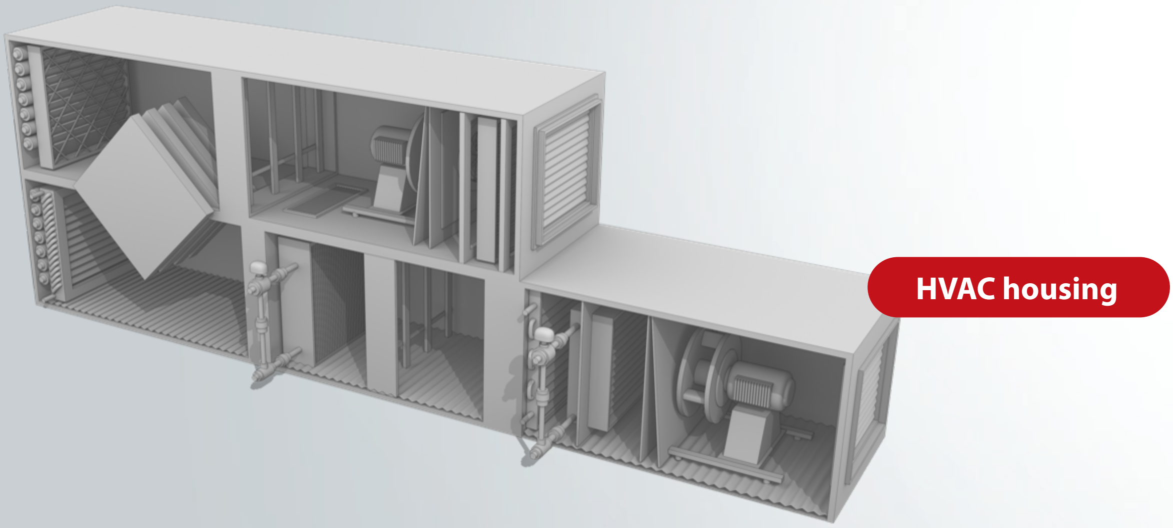
Professional, Reliable, Efficient

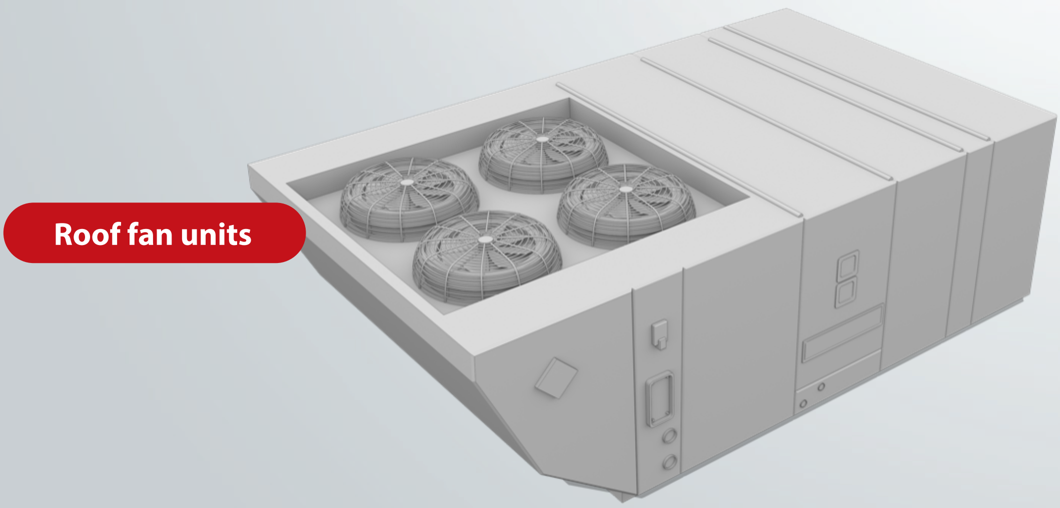
The VLT® Flow Drive FC 111 is a dedicated drive for fan-type pump loads with a focus on fluid control solutions that ensure reliable and efficient performance in gas and liquid control.

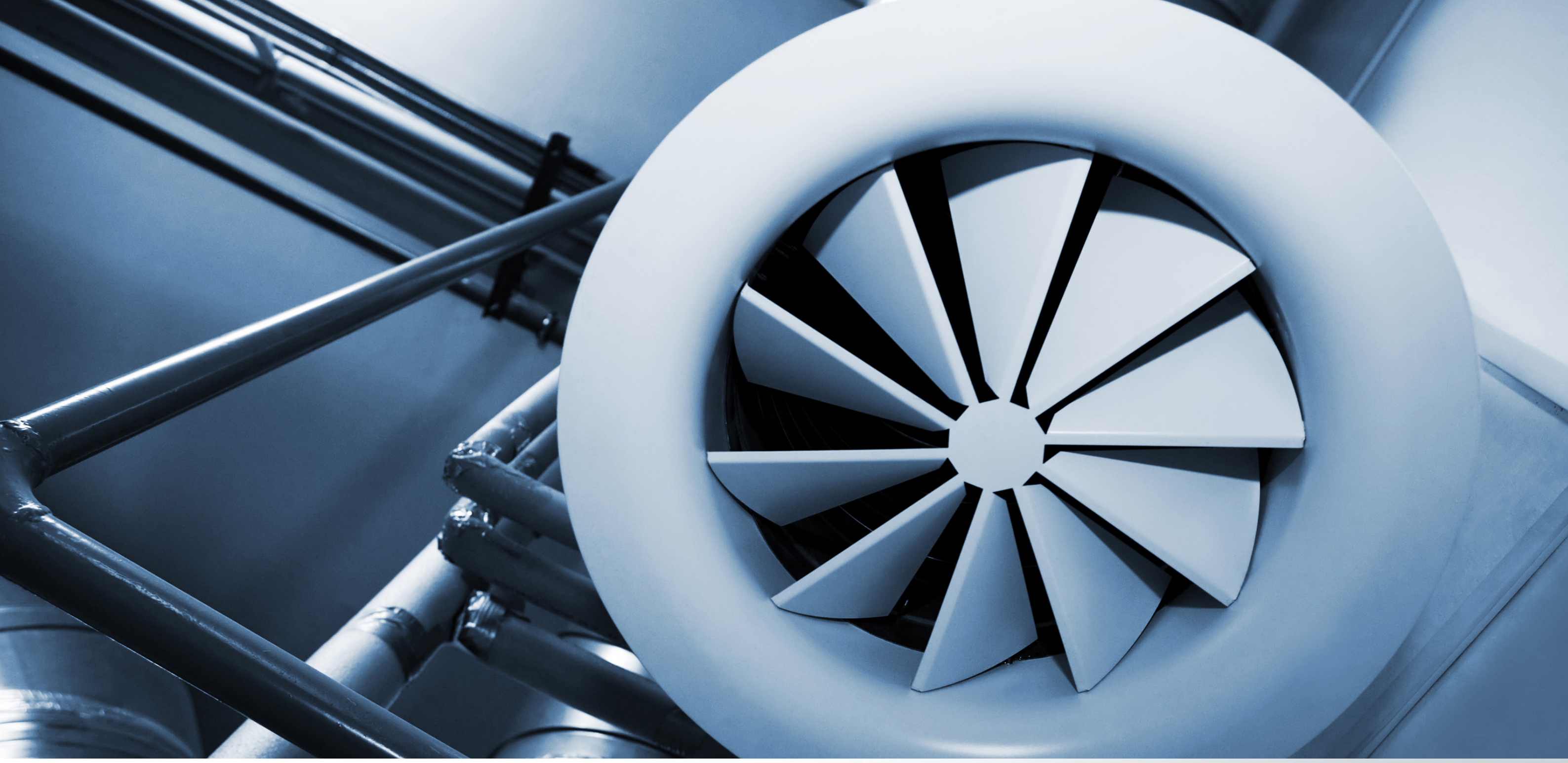
As the world's first manufacturer of mass-produced drives, Danfoss has many years of experience in drive design and manufacturing, which has provided us with a valuable wealth of experience in designing and developing the VLT® Flow Drive to provide the highest quality and most efficient fluid control drives available on the market.

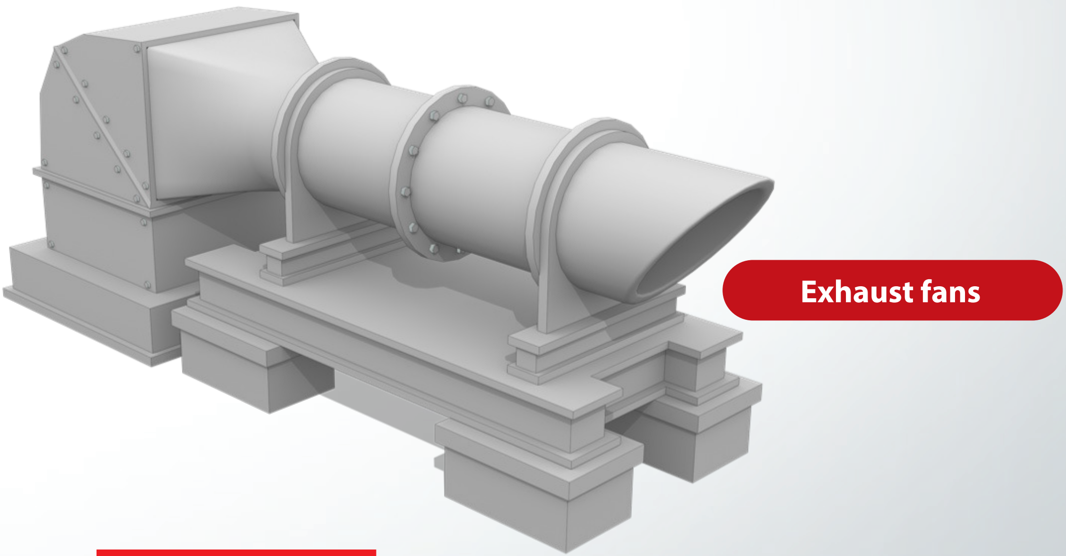
As a global market leader in HVAC and water applications, Danfoss has accumulated a wealth of application knowledge to provide customers with tailored control solutions that improve overall system performance and optmize system energy consumption. According to statistics, Danfoss drives installed worldwide save around 285 million MWh of energy per year.

VLT® Flow Drive FC 111 provides optimized and efficient control for motors from 0.37 kW to 315 kW. The control provides professional functional support for various types of fans and pumps, and can be applied to air-conditioning fans, compressors, various pumps and other loads, providing reliable products for OEM and panel manufacturers.



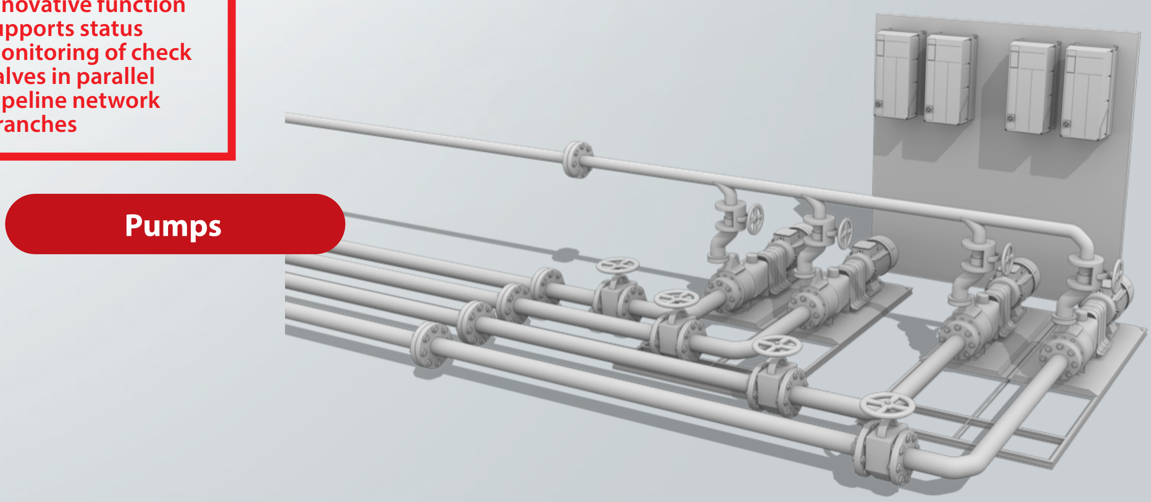






Check valve monitoring

Innovative function supports status monitoring of check valves in parallel pipeline network branches



Suitable for a wide range of fan and pump applications

From AHUs in buildings to tunnel fans, and from residential secondary pump water systems to public municipal water and large wastewater systems, the VLT® Flow Drive FC 111 is suitable for a wide range of general-purpose fans, pump loads and compressor loads, providing equipment manufacturers and subcontractors with the functions they need.

Fire override mode
In this mode, the drive continuously supplies the load with operating energy, regardless of control signals, warnings or alarms. This mode can help keep fire escape routes free of smoke, stairwells under positive pressure conditions, and applications such as car park exhaust fans, smoke extraction and essential service functions operating safely and continuously.

Fire mode is clearly indicated on the display to prevent any confusion. Once set, the drive will continue to operate without self-protection, even if permanent damage may occur in the event of overheating or overloading. Its vital goal is to keep the motor running even if it means self-destruction.

Frequency jump
Set this parameter to avoid system resonance bands, thereby avoiding system damage caused by resonance. It also reduces wear and noise caused by system vibrations.

Belt monitoring
By detecting motor speed and current, the drive determines the contact status of the motor with the fan and can sound an alarm in the event of a broken belt to avoid serious losses.

Flying start
The drive detects the speed and direction of a freely rotating fan or pump and synchronizes it at a matching speed. This prevents violent starts and wear on the equipment.

Sleep mode
When sleep mode is enabled, the drive automatically detects no- or low-flow conditions and stops the motor. When sleep mode is active, the drive continuously monitors the condition and restarts the motor when the load is restored. This keeps the power supply from being interrupted and minimizes energy consumption, reduces noise and extends the lifetime of the entire system.

Compressor control
This function is suitable for compressor applications and provides special support for the specific requirements for ramping up and ramping down during the compressor start-up and stopping processes.

Flow compensation
When the pressure sensor cannot be placed at the end of the system, adjustments can be made through this function to ensure that the end flow rate reaches the ideal control value.

End of curve control
Assists in monitoring the network for leaks. For example, extremely high flow from the pump when the set pressure is not reached indicates an abnormal system condition.

Dry pump control
Assists in monitoring network status. For example, the user will be prompted to check the system when the pump is running at high speed and in an unusual state of very low power consumption.

Check valve monitoring (new)
The non-return valve is an essential part of the system in the secondary pump water supply. The correct position of the flap of the check valve affects the efficiency of the water system. Danfoss' unique non-return valve test provides the operator with the basis for determining the position of the valve. This avoids potential losses due to poor valve flap sealing.

Synchronous motor control
The VLT® Flow Drive FC 111 full range supports permanent magnet synchronous motor control and can drive synchronous motors with IPM and SPM. The user is free to select a high-performance motor for the system.

1 DC choke

Full-power built-in DC choke to suppress DC circuit ripple and reduce power cable requirements

2 No forced air flow

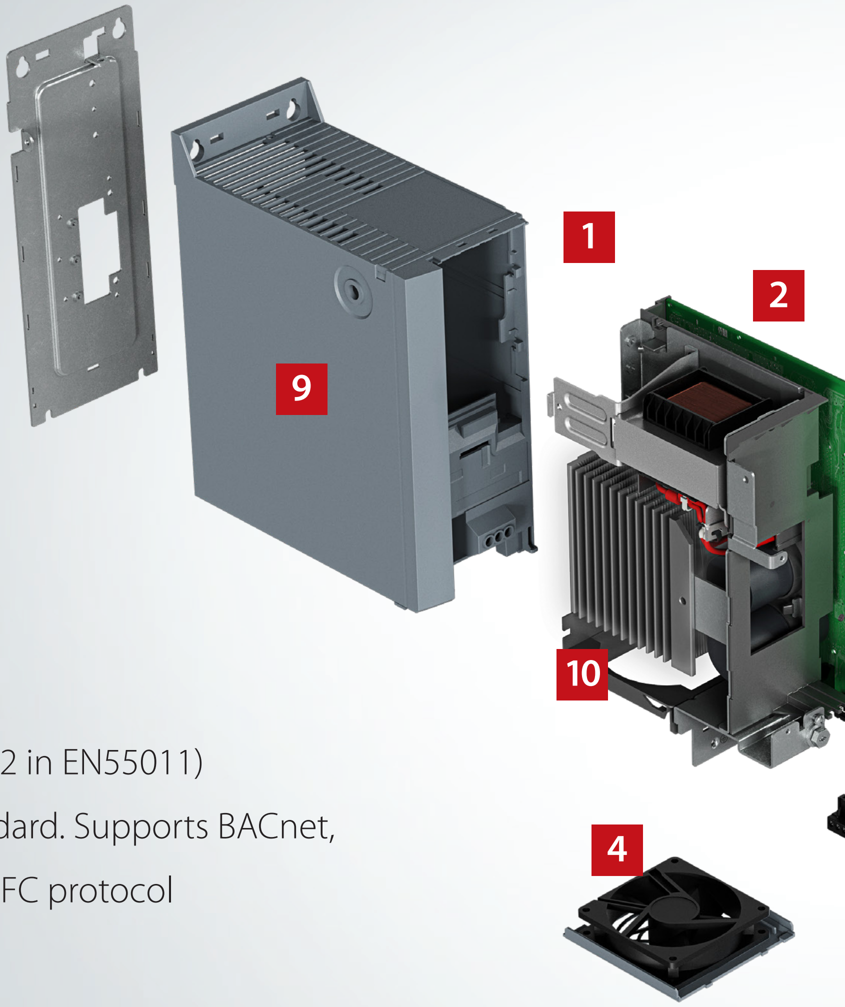
No forced air flow through the PCB, reducing the risk of adverse environmental applications and extending equipment life

3 Reinforced coating

All PCB boards are 3C3-coated for increased reliability in harsh environments (IEC60721-3-3)

4 Variable speed fan

Built-in variable speed fan, which adjusts itself to the load rate, reducing noise and energy consumption (above 1.5 kW)



5 EMC filter

EMC filter class C3 (equivalent to class A2 in EN55011)

6 Includes RS485 communication as standard. Supports BACnet, Modbus RTU, N2 Metasys, FLN Apogee, FC protocol

7 I/Os and functions

- 4DI / 2AI / 2AO / 2RO
- 2AO can be switched to digital output

8 Local Control Panel (LCP)

- Graphical and numerical keypads

9 RFI switch

Cuts off RFI filters when applied to RFI power supplies

10 Heat dissipation duct

The highly efficient heat sink and heat dissipation duct design concept uses the conditions of the drive itself to dissipate heat without increasing energy consumption.

Powerful built-in features

- **Built-in Macro Functions**

  A number of standard application functions are built-in, allowing for easy control of open loop, closed loop, secondary water supply and more.

- **Built-in PID Controller**

  Supports process control for closed loop control of process parameters such as temperature and pressure.

- **Built-in RFI Filter**

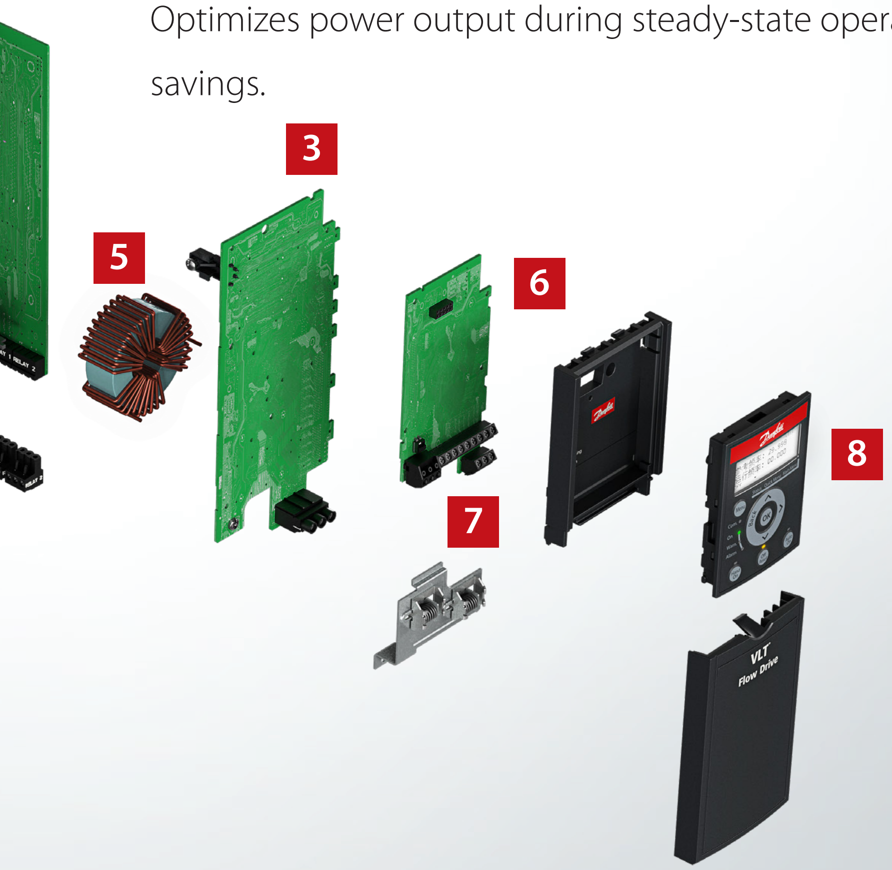
  Suppresses RF interference and can be used in sensitive environments.

- **Built-in Smart Logic Controller**

  Automatically builds control logic using the logic functions provided by the drive.

- **Built-in AEO Function**

  Optimizes power output during steady-state operation for an additional 3–5% energy savings.



- **Automatic Motor Adaption AMA**

  Optimizes the performance of the drive and motor in VVC+ mode.

- **Commissioning Software**

  Using the MCT 10 free software shared among the Danfoss VLT family of products makes commissioning easy and allows you to save parameters for easy management.

General Specifications (Standard Features)

Specifications

Mains supply (L1, L2, L3)	
Supply voltage	380–480 V ±10%
Supply frequency	50/60 Hz ±5%
Displacement power factor (cos ϕ)	> 0.98
Switching on the L1, L2, L3 power supply	0.37–7.5 kW max. 2 times/min.
	11–90 kW max. 1 time/min.
	110–315 kW max. 1 time/2 mins.
Harmonic disturbance	Complies with EN 61000-3-12
Output data (U, V, W)	
Output voltage	0–100% of supply voltage
Output frequency	0–500 Hz (U/f mode)
	0–200 Hz (VVC+ mode AM motor)
	0–400 Hz (VVC+ mode PM motor)
Switching on the output	Unlimited
Ramp time	0.01–3600 seconds
Digital input	
Programmable digital inputs	4
Logic	PNP or NPN
Voltage level	0–24 V DC
Maximum input voltage	28 V DC
Input resistance, Ri	Approx. 4 kΩ
Scan interval	1 ms
Analog input	
Analog inputs	2
Modes	Voltage or current
Voltage level	0 to +10 V (adjustable)
Current level	0/4 to 20 mA (adjustable)
Accuracy of analog inputs	Max. error is 0.5% of full scale
Digital output	
Programmable digital outputs	4
Voltage level at digital/ frequency output	0–24 V DC
Max. output current (sink or source)	40 mA
Accuracy of frequency output	Max. error: 1% of full scale

* Terminals 42 and 45 can be programmed as analog outputs.

Analog output	
Programmable analog outputs	2
Current range at analog output	0/4–20 mA
Common max. negative for analog output (bit 30)	500 Ω
Accuracy on analog output	Max. error: 0.4% of full range
Relay output	
Programmable relay output	2
Maximum terminal load (AC/DC) on 01–02 (NO), 04–05 (NO)	250 V AC/3 A and 24 V DC 0.1 A
Maximum terminal load (AC/DC) on 01–03 (NC),04–06 (NC)	250 V AC/3 A and 24 V DC 10 mA
Control card	
RS485 interface	Up to 115 kbps can be set
10 V output max. load	25 mA
24 V output max. load	80 mA
Environment/external	
Enclosure	IP 20/frame
	(IP21 kit optional)
Vibration test	1.0 g
Max. relative humidity	5%–95% (IEC 721-3-3; Class 3K3 in operating environment, non-condensing)
Maximum ambient temperature (no derating)	40°C (0.37–22 kW, 90 kW)
	45°C (30–75 kW, 110–315 kW)
Complete high and low pressure insulation	I/O supply voltage according to PELV
Aggressive environments	Standard coating 3C3
	(IEC 60721-3-3)
Fieldbus communication	
Standard built-in:	BACnet
	Modbus RTU
	N2 Metasys
	FLN Apogee
	FC protocol

Protection mode for longest possible up-time

– Electronic thermal motor overload protection.

– Monitoring the temperature of the heat sink ensures that the drive trips when the temperature reaches 95°C ± 5°C.

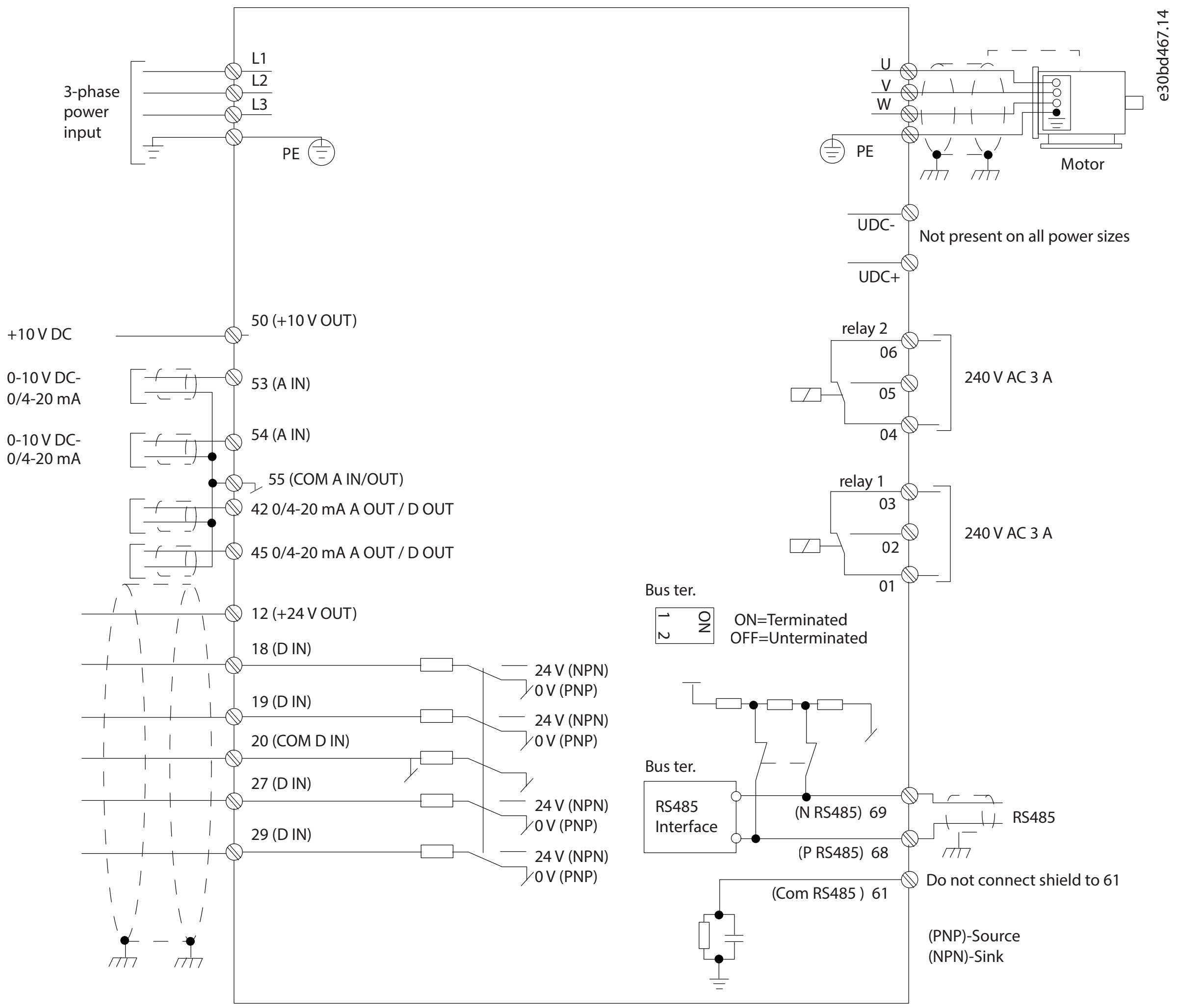
– The drive is protected against short circuits on motor terminals U, V, and W.

– The drive is protected against ground faults on motor terminals U, V, and W.

– Protection against mains phase loss.

Example diagram of connections with terminal function descriptions

The numbers in the figures refer to the terminals on the drive.



Terminal number	Instructions
L1	Power input terminals
L2	Power input terminals
L3	Power input terminals
PE	Ground terminals
50	Analog 10 V signal
53	Analog input 1
54	Analog input 2
55	Analog common
42	Analog output 1
45	Analog output 2
12	Digital quantity 24 V DC signal
18	Digital input, default function: Start
19	Digital input
27	Digital input, default function: free-parking (inverse)
29	Digital input, default function: point-to-point

Terminal number	Instructions
U	Motor output terminals
V	Motor output terminals
W	Motor output terminals
PE	Ground terminals
UDC-	Load share terminals -, 0.37–22 kW
UDC+	Load share terminals +, 0.37–22 kW
06	Relay 2, off
05	Relay 2, on
04	Relay 2, common terminal
03	Relay1, off
02	Relay1, on
01	Relay1, common terminal
69	RS485 communication-
68	RS485 communication+
61	Serial communication common terminal

Product Model Code

[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]					
FC- 111	**PXXX**	**T4**	**P20**	**H2**	**X**	**G**	**C**	**X**	**XX**	**SXXXX**	**AX**	**BX**	**CXXXX**	**DX**

[1] Product range	
FC-111	VLT® Flow Drive FC 111

[2] Power[1]	
PK37	0.37 kW
PK75	0.75 kW
P1K5	1.5 kW
P2K2	2.2 kW
P3K0	3 kW
P4K0	4 kW
P5K5	5.5 kW
P7K5	7.5 kW
P11K	11 kW
P15K	15 kW
P18K	18.5 kW
P22K	22 kW
P30K	30 kW
P37K	37 kW
P45K	45 kW
P55K	55 kW
P75K	75 kW
P90K	90 kW
P110	110 kW
P132	132 kW
P160	160 kW
P200	200 kW
P250	250 kW
P315	315 kW

[3] Input voltage	
T4	3 x 380~480 V AC

[4] Enclosure size	
P20	IP20 with back plate
E20	IP20

[5] RFI (EMC) filter	
H2	Class C3 RFI filter

[6] Brake unit	
X	None

[7] Local control panel	
X	No LCP[2]

[8] Coating	
C	Reinforced coating as standard

[9] Power input	
D	Standard load share terminals, 0.37–22 kW
X	None

Notes:
1) The rated power is nominal power based on standard overload output;
2) The control panel is a separate ordering option, graphical LCP (VLT® Control Panel LCP 32) ordering code132B9221, digital LCP31 ordering code 132B0200;
3) Other items without notes are factory default and do not need to be selected;
4) Products are delivered with the latest software as standard.

Electrical parameters

3×380–480 V AC

Enclosure	IP20	H1	H1	H1	H2	H2	H2	H3	H3	H4
		PK37	PK75	P1K5	P2K2	P3K0	P4K0	P5K5	P7K5	P11K
Typical shaft output power	(kW)	0.37	0.75	1.5	2.2	3	4	5.5	7.5	11
Typical shaft output power	(HP)	0.5	1	2	3	4	5	7.5	10	15
Output current	Continuous (A)	1.2	2.2	3.7	5.3	7.2	9	12	15.5	23
	Intermittent [1] (A)	1.3	2.4	4.1	5.8	7.9	9.9	13.2	17.1	25.3
Max. cable size in terminals (mains, motor)	mm^2	4								16
Maximum input current	Continuous (A)	1.2	2.1	3.5	4.7	6.3	8.3	11.2	15.1	22.1
	Intermittent [1] (A)	1.3	2.3	3.9	5.2	6.9	9.1	12.3	16.6	24.3
Max. external input fuses (mains)	(A)	10			16			25		50
Environment										
Estimated power loss, typical [2]	(W)	15	21	57	58	83	118	131	198	274
Weight IP20	(kg)	2	2	2.1	3.3	3.3	3.4	4.3	4.5	7.9
Efficiency, typical [3]	(%)	97.3	97.6	97.2	97.9	97.8	97.6	98	97.8	97.9

3×380–480 V AC

Enclosure	IP20	H4	H5	H5	H11	H11	H11	H12	H12	H12
		P15K	P18K	P22K	P30K	P37K	P45K	P55K	P75K	P90K
Standard shaft output power	(kW)	15	18.5	22	30	37	45	55	75	90
Standard shaft output power	(HP)	20	25	30	40	50	60	70	100	125
Output current	Continuous (A)	31	37	42.5	61	73	90	106	147	177
	Intermittent [1] (A)	34	40.7	46.8	67.1	80.3	99	116	161	194
Max. cable size in terminals (mains, motor)	mm^2	16			50			50	95	120
Maximum input current	Continuous (A)	29.9	35.2	41.5	57	70	84	103	140	166
	Intermittent [1] (A)	32.9	38.7	45.7	62.7	77	92.4	113	154	182
Max. external input fuses (mains)	(A)	50	65		80	100	125	150	200	250
Environment										
Estimated power loss, typical [2]	(W)	379	403	468	630	848	1175	1250	1507	1781
Weight IP20	(kg)	7.9	9.5	9.5	22.4	22.5	22.6	37.3	38.7	40.7
Efficiency, typical [3]	(%)	97.8	98.1	97.9	98.1	98	97.7	98	98.2	98.3

Note:
[1] Intermittent current is 110% of the rated current for a maximum duration of 1 minute;
[2, 3] Typical values for power loss and efficiency are the system values of the drive at the default switching frequency and nameplate current.

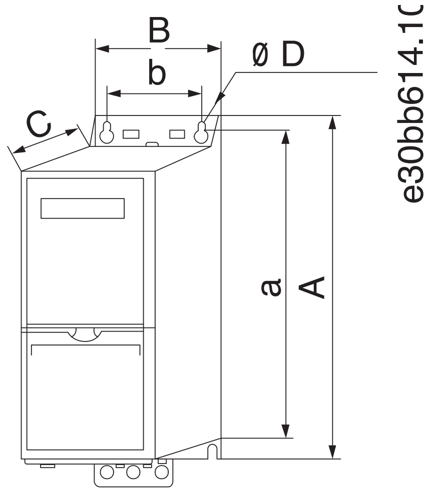
Electrical parameters

3×380–480 V AC

Enclosure	IP20	H13	H13	H13	H14	H14	H14
		P110	**P132**	**P160**	**P200**	**P250**	**P315**
Standard shaft output power	(kW)	110	132	160	200	250	315
Standard shaft output power	(HP)	150	175	250	300	350	450
Output current	Continuous (A)	212	260	315	395	480	588
	Intermittent [1] (A)	233	286	347	435	528	647
Max. cable size in terminals (mains, motor)	mm^2	2x95			2x185		
Maximum input current	Continuous (A)	204	251	304	381	463	567
	Intermittent [1] (A)	224	276	334	419	509	623
Max. external input fuses (mains)	(A)	315	350	400	550	630	800
Environment							
Estimated power loss, typical [2]	(W)	2559	2954	3770	4116	5137	6674
Weight IP20	(kg)	98			164		
Efficiency, typical [3]	(%)	98					

Note:
[1] Intermittent current is 110% of the rated current for a maximum duration of 1 minute;
[2, 3] Typical values for power loss and efficiency are the system values of the drive at the default switching frequency and nameplate current.

Dimensions



Enclosure/ IP rating	Power	Height (mm)			Width (mm)		Depth (mm)	Hole diameter (mm)	Installation space [3] (mm)
	3×380–480 V AC	A	A1 [1]	a	B	b / b1 [2]	C	D	
H1 / IP20	0.37–1.5 kW	195	273	183	75	56	168	4.5	100
H2 / IP20	2.2–4 kW	227	303	212	90	65	190	5.5	100
H3 / IP20	5.5–7.5 kW	255	329	240	100	74	206	5.5	100
H4 / IP20	11–15 kW	296	359	275	135	105	241	7	100
H5 / IP20	18.5–22 kW	334	402	314	150	120	255	7	100
H11 / IP20	30–45 kW	515	545	495	233	200	241	8.5	200
H12 / IP20	55–90 kW	550	610.5	521	308	270	323	8.5	200
H13 / IP20	110–160 kW	889	909	844	250	180/200	375	11	225
H14 / IP20	200–315 kW	1096	1122	1051	350	280/271	375	11	225

Comments:
[1] A1 is the height of the enclosure with decoupling plate.
[2] b1 is the lower mounting hole dimension and, if not listed separately, the same distance as the upper mounting hole.
[3] Refers to the space above and below the drive, which can be installed without gaps on the left and right sides.
(If the IP21 option kit is added as an option, a distance of 50 mm between the units should be maintained.)

IP21 upgrade kit

Enclosure size	IP21 kit
H1	132B0212
H2	132B0213
H3	132B0214
H4	132B0215
H5	132B0216
H11	132B0376
H12	132B0377

Control panel and mounting kit

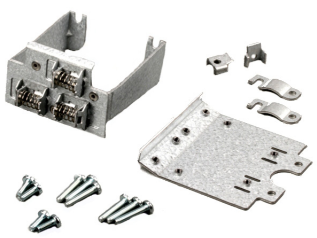
Local control panel

- Graphical control panel in 8 languages, including Chinese, English and German; Order no.: 132B9221;
- Multi-line text display with full parameter content;
- Status indicators for clear status display;
- Supports copying parameters, and parameters can be uploaded and downloaded;
- Supports factory reset using the keyboard;
- Supports password locking for the keypad;
- Flexibility and convenience with on-board plugging and unplugging.

LCP Panel Mounting Kit

- Allows for easy installation of the local control panel on the cabinet door;
- Ordering number: 132B0201 including fasteners, 3 m cable and gasket;
- IP54 (front);
- Thumbscrews for tool-free installation;
- Includes 3 m industrial grade cable (also available separately);
- Easy to install.

Decoupling plate



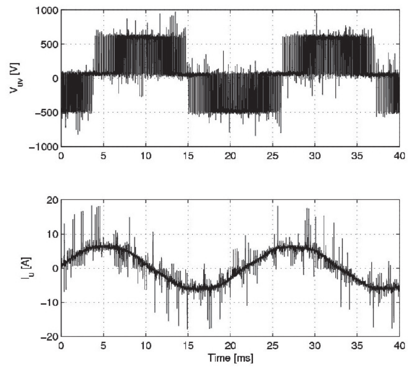
- Provides good ground protection for the control panel cable;
- Must be purchased separately. Different models are shown in the table below.

Enclosure size	H1/H2	H3	H4/H5	H11	H12 (55/75 kW)	H12 (90 kW)
Decoupling plate	132B0202	132B0204	132B0205	132B0284	132B0285	132B1213

Filters

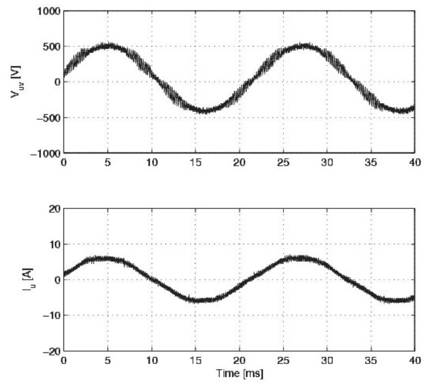
While the drive regulates the motor frequency, it also changes the waveform on the input side of the motor and on the grid, changing the motor input voltage from a sinusoidal wave to a square wave in the form of a pulse (see figure on the right). The power measurement also produces harmonic distortion by rectifying the drawn power.
For a motor, the change in waveform not only leads to increased noise and heat generation, but in severe cases can also lead to problems with the motor windings. Changes in the waveform on the power supply side often cause problems with other co-sourced loads.
How can this be mitigated?

When the output filter is not used. Voltage and current at the motor side.



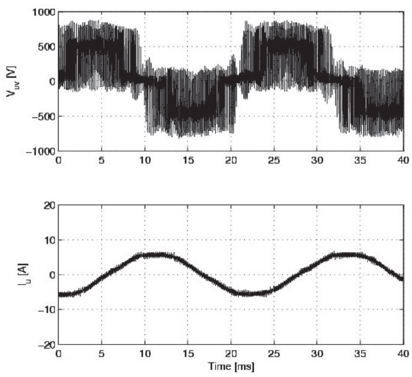
The Sine-Wave Filter is a differential-mode low-pass filter for the drive output that suppresses the switching frequency components of the drive and smooths the phase-to-phase output voltage of the drive into a sinusoidal form.
Configuring a sine-wave filter reduces the insulation pressure and bearing currents of the motor and reduces motor noise.
When the system is equipped with a sine-wave filter, the voltage/current waveform on the motor side is as shown in the figure on the right.

Voltage and current at the motor end when using sine-wave filters.



The dU/dt filter is a differential mode low-pass filter, used at the output end of the drive, which can reduce the phase-to-phase voltage peak at the motor terminals and reduce the rise time to a certain level, thereby reducing the insulation stress of the motor windings.
The dU/dt filter is small in size and lightweight, making it suitable for high dynamic applications.
When the dU/dt filter is added to the system, the voltage/current waveform on the motor side is as shown in the figure on the right.

Voltage and current at the motor side when using dU/dt filters.



Harmonic filters are used at the input end of the drive and are selected to reduce harmonic current distortion at the power supply side caused by the operation of the drive, thereby reducing harmonics.
MyDrive® Harmonics is a harmonics simulation tool for Windows systems that helps users calculate and analyse system harmonic distortion and configure harmonic mitigation strategies based on Danfoss products.

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A better tomorrow is **driven by drives**

Danfoss Drives is a world leader in variable speed control of electric motors.
We offer you unparalleled competitive edge through quality, application-optimized products and a comprehensive range of product lifecycle services.

You can rely on us to share your goals. Striving for the best possible performance in your applications is our focus. We achieve this by providing the innovative products and application know-how required to optimize efficiency, enhance usability, and reduce complexity.

From supplying individual drive components to planning and delivering complete drive systems; our experts are ready to support you all the way.

You will find it easy to do business with us. Online, and locally in more than 50 countries, our experts are never far away, reacting fast when you need them.

You gain the benefit of decades of experience, since 1968. Our low voltage and medium voltage AC drives are used with all major motor brands and technologies in power sizes from small to large.

VACON® drives combine innovation and high durability for the sustainable industries of tomorrow.

For long lifetime, top performance, and full-throttle process throughput, equip your demanding process industries and marine applications with VACON® single or system drives.

- Marine and Offshore
- Oil and Gas
- Metals
- Mining and Minerals
- Pulp and Paper
- Energy
- Elevators and Escalators
- Chemical
- Other heavy-duty industries

VLT® drives play a key role in rapid urbanization through an uninterrupted cold chain, fresh food supply, building comfort, clean water and environmental protection.

Outmaneuvering other precision drives, they excel, with remarkable fit, functionality and diverse connectivity.

- Food and Beverage
- Water and Wastewater
- HVAC
- Refrigeration
- Material Handling
- Textile

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