ENGINEERING
TOMORROW

Danfoss

Industrial Product Catalog

VLT® AutomationDrive
Reliable simplicity to keep your business running smoothly

VLT® drives are factory tested insuring the highest level of quality and reliability.

100%
full load
factory tested

GS GLOBAL RESOURCES
Foremost in Machine Performance for Life

GS Global Resources • **1-800-261-8735** • **gsglobalresources.com**
926 Perkins Drive, Mukwonago, WI 53149

We take responsibility for every element of our products. The fact that we develop and produce our own features, hardware, software, power modules, printed circuit boards and accessories is your guarantee of reliable products.

Danfoss Industrial Drives:
Rugged - Reliable - Respected

Efficiency and reliability you can depend upon

The basic urge for Danfoss VLT® Drives is to enable our customers to have easy and efficient control of any application powered by an AC motor.

Controlling an application – a fan, pump, compressor, centrifuge, hoist, etc. – via the power supply provides two important benefits:

- Fully automated operation
- Major energy savings

Energy savings

Energy savings are tied to the technology and the fact that applications need less energy when idle or operating with partial loads. VLT® drives do the trick – and no brand is more energy efficient than VLT® drives.

Fully automated operation

VLT® drives enable a facility to increase it's automation capabilities. Not every application is the same across all industries, but with VLT® drives customized programming, customers can determine what parameters are essential to their specific needs.

One basic technology – millions of versions

That's why our customers always will ask for specific power sizes, features, enclosure classes and fieldbus protocols.

The VLT® concept is to mass produce such highly customized drives from a relatively limited number of components on stock.

Factory built and tested

Having received an order – a drive specified by the customer – our factory builds it and tests it against real motors before shipping.

Factories and competence centres all around the globe, enables Danfoss VLT® Drives to deliver drives that suits your purpose exactly – within a few days.

Throughput modularity

This is possible due to throughput modularity in the design. Components developed for one drive can be mass produced and used in many different types of drives – and the same modularity allows for easy and quick updates and upgrades of your VLT® drive.

Know one and you will know them all

The control panel is such an element. Knowing how to control one drive with the local control panel, you will be able to control all other VLT® drives. Embedded features and different plug-in options make the difference between the different versions.

This catalog presents the majority of our different versions and describes how they are dedicated for specific industries and applications.

Contents

VLT® AutomationDrive

Perfect

for industrial automation, high dynamic applications, and safety installations

The VLT® AutomationDrive is a single drive concept that covers an entire range of applications, which is a major benefit in commissioning, operating and maintaining the equipment.

The modular open-technology platform that VLT® AutomationDrive is built on makes it exceptionally adaptable and programmable. Its configurable, user-friendly interface supports local languages and letters.

Pluggable options

The drive solution can be adapted to any application due to the flexible option structure. Numerous options are available and can be mounted and tested from factory or be plugged in later for change-over or upgrade.

Adapts to the future

The modular concept of VLT® AutomationDrive makes it highly adaptable to future features and options. Modularity offers the benefit of buying on a need-to-have basis without losing future possibilities.

Hot pluggable Control Panel

The Local Control Panel (LCP) can be plugged in directly or connected through a cable for remote commissioning. The LCP can be disconnected during operation and replaced with a blank cover. Settings are easily trans- ferred via the LCP from one drive to another or from a PC to a drive with the VLT® Set-up Software MCT 10.

Feature	Benefit
Reliable	**Maximum uptime**
Ambient temperature 50° C without derating	Less need for cooling or oversizing
Available in IP 00, 20, 21, 54, 55 and 66 enclosures	Suitable for harsh and wash down areas
Resistant to wear and tear	Low lifetime cost
Back-channel cooling for frame D, E and F	Prolonged lifetime of electronics
User-friendly	**Saves commissioning and operating cost**
Plug-and-Play technology	Easy upgrade and change over
Awarded control panel	User-friendly
Intuitive VLT® interface	Saves time
Pluggable cage clamp connectors	Easy connection
Exchangeable languages	User-friendly
Intelligent	
Intelligent warning systems	Warning before controlled stop
Smart Logic Control	Reduces need for PLC capacity
Advanced plug-in features	Easy commissioning
Safe stop	Safety cat. 3 (EN 954-1), PL d (ISO 13849-1), Stop cat. 0 (EN 60204-1)
STO: Safe Torque Off (IEC 61800-5-2)	SIL 2 (IEC 61508) SIL CL 2 (IEC 62061)
Intelligent heat management	Extends life of the drive

Awarded

VLT® AutomationDrive has received the Frost & Sullivan award for innovation and the iF Design Award for its user-friendliness.

Power range

3 x 200 – 240 V . . . . . 1/3 – 50 HP
3 x 380 – 480/500 V . . . .1 /2 to 1200 HP
3 x 525 – 600 V . . . . . 1 – 100 HP
3 x 525 – 690 V . . . . . 11 – 1200 kW

Options

The following options are available:

Fieldbus options

- MCA 101 Profibus
- MCA 104 DeviceNet
- MCA 105 CanOpen
- MCA 120 PROFINET
- MCA 121 Ethernet IP
- MCA 122 Modbus TCP

I/O and feedback options

- MCB 101 General Purpose I/O
- MCB 102 Encoder
- MCB 103 Resolver
- MCB 105 Relay
- MCB 107 24 V input option for control voltage
- MCB 113 Extended Relay Card
- MCB 114 VLT® Sensor Input

VLT®Automation VT Drive PC Software Tools

- MCT 10: Ideal for commissioning and servicing the drive including guided programming of cascade controller, real time clock, smart logic controller and preventive maintenance.
- MCT 31: Harmonics calculations tool.

Safety options

- MCB 108 Safety PLC interface (DC/DC converter)
- MCB 112 ATEX-PTC Thermistor Card

Brake chopper (IGBT) option

Connected to an external brake resistor, the built-in brake chopper limits the load on the intermediate circuit in the case the motor acts as a generator.

Motion Control Options

- MCO 305 Programmable Motion Controller
- MCO 350 Synchronizing Controller
- MCO 351 Positioning Controller
- MCO 352 Center Winder Controller

Power options

- Brake resistors
- Sine-Wave Filters
- dV/dt Filters
- Harmonic Filters (AHF)

Mains supply (L1, L2, L3)	
Supply voltage	200 – 240 V ±10% FC 301: 380 – 480 V ±10% FC 302: 380 – 500 V ±10%, 525 – 600 V ±10% 525 – 690 V ±10%
Supply frequency	50/60 Hz
True Power Factor (λ)	0.92 nominal at rated load
Displacement Power Factor (cos φ) near unity	(> 0.98)
Switching on input supply L1, L2, L3	Maximum 2 times/min.
Output data (U, V, W)	
Output voltage	0–100% of supply voltage
Output frequency	FC 301:0.2 – 590 Hz (1/3 – 100 HP) FC 302:0 – 590 Hz (1/3 – 100 HP) 0 – 590 Hz (125 to 1600 HP) 0 – 300 Hz (Flux mode)
Switching on output	Unlimited
Ramp times	1–3600 sec.

Note: 160% current can be provided for 1 minute.
Higher overload rating is achieved by oversizing the drive.

Digital inputs	
Programmable digital inputs	FC 301: 4 (5) / FC 302: 4 (6)
Logic	PNP or NPN
Voltage level	0–24 VDC

Note: One/two digital inputs can be programmed as digital output for FC 301/FC 302.

Analog input	
Analog inputs	2
Modes	Voltage or current
Voltage level	FC 301: 0 to +10 V FC 302: -10 to +10 V (scaleable)
Current level	0/4 to 20 mA (scaleable)
Pulse/encoder inputs	
Programmable pulse/encoder inputs	FC 301: 1 / FC 302: 2
Voltage level	0 – 24 V DC (PNP positive logic)
Digital output*	
Programmable digital/pulse outputs	FC 301: 1 / FC 302: 2
Voltage level at digital/frequency output	0 – 24 V
Analog output*	
Programmable analog outputs	1
Current range	0/4–20 mA
Relay outputs*	
Programmable relay outputs	FC 301: 1 / FC 302: 2
Cable lengths	
Max. motor cable lengths	FC 301: 150 ft / FC 302: 500 ft (screened/armoured) FC 301: 225 ft / FC 302: 1000 ft (unscreened/unarmoured)

**More analog and digital inputs/outputs can be added by options.*

Other accessories

- IP21/NEMA 1 Kit (convert IP20 to IP21)
- PROFIBUS adapter
- Sub-D9 Connector
- Decoupling plate for fieldbus cables
- USB connection cable to PC
- Panel Through option
- LCP panel mounting kit
- Mounting brackets
- Mains disconnect option

High power options

- IEC Emergency stop with Safety Relay
- Safety Stop with Safety Relay
- RFI Filters
- NAMUR terminals
- RCD
- IRM
- Mains shielding
- Regen terminals

Current and power ratings

	T2 200 – 240 V									T4/T5 380 – 480/500 V									
	kW		HP		Amp.					Amp. HO		Amp. NO							
FC 300	HO	NO	HO	NO	HO	NO	IP 20	IP 21	IP 55	IP 66	≤440 V	>440 V	≤440 V	>440 V	IP 00	IP 20	IP 21	IP 54	IP 55	IP 66
PK25	0.25		0.33		1.8		A1*/A2	A2	A4/A5	A4/A5										
PK37	0.37		0.50		2.4						1.3	1.2	1.3	1.2		A1*/A2	A1*/A2		A4/A5	A4/A5
PK55	0.55		0.75		3.5						1.8	1.6	1.8	1.6						
PK75	0.75		1.00		4.6						2.4	2.1	2.4	2.1						
P1K1	1.1		1.50		6.6						3	2.7	3	2.7						
P1K5	1.5		2.00		7.5						4.1	3.4	4.1	3.4						
P2K2	2.2		3.00		10.6		A2				5.6	4.8	5.6	4.8		A2	A2			
P3K0	3		4.00		12.5		A3	A3	A5	A5	7.2	6.3	7.2	6.3						
P3K7	3.7		5.00		16.7															
P4K0	4.0		5.50								10	8.2	10	8.2		A2	A2		A4/A5	A4/A5
P5K5	5.5	7.5	7.5	10	24.2	30.8	B3	B1	B1	B1	13	11	13	11		A3	A3		A5	A5
P7K5	7.5	11	10	15	30.8	46.2					16	14.5	16	14.5						
P11K	11	15	15	20	46.2	59.4	B4	B2	B2	B2	24	21	32	27		B3	B1		B1	B1
P15K	15	18	20	25	59.4	74.8					32	27	37.5	34						
P18K	18.5	22	25	30	74.8	88	C3	C1	C1	C1	37.5	34	44	40		B4	B2		B2	B2
P22K	22	30	30	40	88	115					44	40	61	52						
P30K	30	37	40	50	115	143	C4	C2	C2	C2	61	52	73	65			C1			
P37K	37	45	50	60	143	170					73	65	90	80		C3			C1	C1
P45K	45	55	60	75							90	80	106	105						
P55K	55	75	75	100							106	105	147	130		C4	C2		C2	C2
P75K	75	90	100	125							147	130	177	160						
N90K	90	110	125	150							177	160	212	190						
N110	110	132	150	200							212	190	260	240	D3h	D3h	D1h	D1h		
N132	132	160	200	250							260	240	315	302						
N160	160	200	250	300							315	302	395	361						
N200	200	250	300	350							395	361	480	443	D4h	D4h	D2h	D2h		
N250	250	315	350	450							480	443	600	540						
P315	315	400	450	550							600	540	658	590						
P355	355	450	500	600							658	590	745	678	E2		E1	E1		
P400	400	500	550	650							695	678	800	730						
P450	450	500	600	650							800	730	880	780						
P500	500	560	650	750							880	780	990	890			F1/F3	F1/F3		
P560	560	630	750	900							990	890	1120	1050						
P630	630	710	900	1000							1120	1050	1260	1160						
P710	710	800	1000	1200							1260	1160	1460	1380			F2/F4	F2/F4		
P800	800	1000	1200	1350							1460	1380	1720	1530						
P900	900	1000																		
P1M0	1000	1200																		
P1M2	1200	1400																		
P1M4	*Consult factory*																			
P1M6																				

IP 00/Chassis | IP 20/Chassis | IP 21/Type 1 | With upgrade kit | IP 54/Type 12 | IP 55/Type 12 | IP 66/NEMA 4X

Dimensions [Inches]

	A2	A2	A3	A4	A5	B1	B2	B3	B4	C1	C2	C3	C4	D1h	D2h	D3h	D4h	E1	E2	F1	F2	F3	F4
H	7.9	10.5		15.3	16.5	19.4	25.5	15.7	17.7	26.8	30.3	21.6	26.0	33.2	41.3	33.2	41.3	33.0	32.8	91.5	91.5	91.5	91.5
W	2.9	3.5	5.1	7.9	9.5			6.5	9.1	12.1	14.5	12.1	14.5	12.8	16.5	9.8	13.8	86.5	67.1	61.8	77.2	85.0	85.0
D	8.1	8.1		6.9	7.9	10.2		9.8		12.2	13.2	13.1		14.9		14.8		28.9	28.9	36.5	36.5	36.5	36.5
H+	14.7							18.7				29.7	37.4										
W+	3.5	5.1						6.5				12.9	15.3										

Adding Brake IGBT, or Mains Option changes the frame size to D5h or D7h. Dimensions for these frames are: D5h: 50.3x12.8x15.0 and D7h: 76.0x16.5x15.2

For 575 V operation T7 drives must be up-sized one size. For example a P90K drive produces 90kW at 690 V, for 575 V operation use a P110 drive to produce 90 kW

					T6 525 – 600 V								T7 525 – 690 V							
	kW		HP		Amp. HO		Amp. NO						Amp. HO		Amp. NO					
FC 300	HO	NO	HO	NO	≤550 V	>550 V	≤550 V	>550 V	IP2 0	IP 21	IP 55	IP 66	550 V	690 V	550 V	690 V	IP 00	IP20	IP21	IP 54/55
PK25	0.25		0.33																	
PK37	0.37		0.50																	
PK55	0.55		0.75																	
PK75	0.75		1.00				1.8	1.7	A3	A3	A5	A5								
P1K1	1.1		1.50				2.6	2.4												
P1K5	1.5		2.00				2.9	2.7												
P2K2	2.2		3.00				4.1	3.9												
P3K0	3		4.00				5.2	4.9												
P3K7	3.7		5.00																	
P4K0	4.0		5.50				6.4	6.1	A3	A3	A5	A5								
P5K5	5.5	7.5	7.5	10			9.5	9												
P7K5	7.5	11	10	15			11.5	11												
P11K	11	15	15	20	19	18	23	22	B3	B1	B1	B1	14	13	19	18		B4	B2	B2
P15K	15	18	20	25	23	22	28	27					19	18	23	22				
P18K	18.5	22	25	30	28	27	36	34	B4	B2	B2	B2	23	22	28	27				
P22K	22	30	30	40	36	34	43	41					28	27	36	34				
P30K	30	37	40	50	43	41	54	52		C1	C1	C1	36	34	43	41			C2	C2
P37K	37	45	50	60	54	52	65	62	C3				43	41	54	52		C3		
P45K	45	55	60	75	65	62	87	83					54	52	65	62				
P55K	55	75	75	100	87	83	105	100	C4	C2	C2	C2	65	62	87	83				
P75K	75	90	100	125	105	100	137	131					87	83	105	100				
N90K	90	110	125	150									113	108	137	131	D3h		D1h	D1h
N110	110	132	150	200									137	131	162	155				
N132	132	160	200	250									162	155	201	192				
N160	160	200	250	300									201	192	253	242	D4h		D2h	D2h
N200	200	250	300	350									253	242	303	290				
N250	250	315	350	450									303	290	360	344				
N315	315	355	450	550									360	344	418	400				
P355	355	400	500	600									395	380	470	450	E2		E1	E1
P400	400	450	550	650									429	410	523	500				
P450	450	500	600	650																
P500	500	560	650	750									523	500	596	570	E2		E1	E1
P560	560	630	750	900									596	570	630	630				
P630	630	710	900	1000									659	630	763	730			F1/F3	F1/F3
P710	710	800	1000	1200									763	730	899	850				
P800	800	1000	1200	1350									889	850	988	945				
P900	900	1000											988	945	1108	1060			F2/F4	F2/F4
P1M0	1000	1200											1108	1060	1317	1260				
P1M2	1200	1400											1317	1260	1479	1415				

VLT®AutomationVTDrive

Perfect

for industrial pumps, fans and blowers, and compressors

Danfoss VLT® Drives' unequalled experience was used to make the AutomationVTDrive the perfect match for AC motor driven applications in modern water and wastewater systems – also for retrofitting.

The AutomationVTDrive is dedicated pumps, blowers and compressors in modern industrial applications. With a wide range of powerful standard and optional features,

The AutomationVTDrive provides the lowest overall cost of ownership for industrial VT applications.

Power range

3 x 200 – 240 V AC. . . . . 1/3 – 60 HP
3 x 380 – 480 V AC. . . . . 1/2 – 1350 HP
3 x 525 – 600 V AC. . . . . 1 – 125 HP
3 x 525 – 690 V AC. . . . . 11 – 1400 kW

Feature	Benefit
Dedicated features	
Modular Product concept with a wide variety of options	Lower initial investment – maximum flexibility field upgradeable possible
Dedicated pump functions	Simplifies programming and commissioning
Smart Logic Controller	Eliminates ancillary equipment reducing installed cost
Pump Cascade Controller	Lower equipment costs
Optional Safe Stop	Lower installed costs safe operation
Integrated DC Link	Eliminates external filter requirements
Intelligent Heat Management	Removes excessive heat promotes longer life
Energy saving	**Less operation cost**
VLT® efficiency	Saves energy
Automatic Energy Optimisation (AEO)	Reduces energy consumption 3% to 8%
Master/follower control	Saves up to 15% energy
Auto Tuning of Staging Speeds	Smoothens the staging and saves energy
Sleep Mode function	Saves energy
Reliable	**Maximum uptime**
NEMA 1, NEMA 12 and NEMA 4X Indoor enclosures	Suitable for harsh wash down environments without the need for customized panels
Ambient temperature rating of 50ºC without derating	Eliminates the need for expensive cooling solutions
Main disconnects and integral fusing	Reduces installed cost by eliminating panel space
Optional, built-in RFI suppression	Eliminates the need for external filtering devices
One Wire Safe Stop	Safe operation less wiring
Password protection	Reduce operator error
User-friendly	**Save initial and operation cost**
Plug and Play Design	Easy upgrade and changeovers
Intuitive user interface	Time saved
Multiple language support	Displays all info in native language
Modular design	Enables fast installation of options
Auto tuning of PI-controllers	Eliminates errors

Options

A wide range of integrated options can be fitted in the drive:

Fieldbus options

- MCA 101 Profibus
- MCA 104 DeviceNet
- MCA 105 CanOpen
- MCA 120 PROFINET
- MCA 121 Ethernet IP
- MCA 122 Modbus TCP

I/O and feedback options

- MCB 101 General Purpose I/O
- MCB 105 Relay
- MCB 107 24 V input option for control voltage
- MCB 114 VLTR Sensor Input

Safety options

- MCB 108 Safety PLC interface (DC/DC converter)
- MCB 112 ATEX-PTC Thermistor Card

Brake chopper (IGBT) option

Connected to an external brake resistor, the built-in brake chopper limits the load on the intermediate circuit in the case the motor acts as a generator.

Power options

- Brake resistors
- Sine-Wave Filters
- dV/dt Filters
- Harmonic Filters (AHF)

24 V DC supply option (MCB 107)

Back-up option to keep the control system alive during mains loss.

Coated PCB available

For harsh environments, according to levels in IEC61721-3-3, standard 3C2, optional 3C3.

High power options

- IEC Emergency stop with Safety Relay
- Safety Stop with Safety Relay
- RFI Filters
- NAMUR terminals
- RCD
- IRM
- Mains shielding
- Regen terminals

Power options

We offer a wide range of external power options for use together with our drive in critical networks or applications:

- VLT® Low Harmonic Drive: Optimum reduction of harmonic distortion with built-in active filter.
- VLT® Advanced Harmonic Filter: For applications where reducing harmonic distortion is critical.
- dV/dt filter: For providing motor isolation protection.
- Sine wave filter (LC filter): For noiseless motor.

FC322 PC software tools

- MCT 10: Ideal for comissioning and servicing the drive including guided programming of cascade controller, real-time clock, smart logic controller, and preventative maintenance
- VLT® Energy Box: Comprehensive energy analysis tool. Energy consumption with and w/o drive can be calculated (drive payback time). Online function for accessing drives energy log.
- MCT 31: Harmonics calculations tool.

Mains supply (L1, L2, L3)	
Supply voltage	200 – 240 V ±10%, 380 – 480 V ±10%, 525 – 600 V ±10%, 525 – 690 V ±10%
Supply frequency	50/60 Hz
Displacement Power Factor (cos φ) near unity	(> 0.98)
True power factor (λ)	≥ 0.9
Switching on input supply L1, L2, L3	1 – 2 times/min.
Output data (U, V,W)	
Output voltage	0 – 100% of supply
Switching on output	Unlimited
Ramp times	0.1 – 3600 sec.
Output frequency (dependent on power size)	590 Hz

Note: VLT® AQUA Drive can provide 110% current for 1 minute.
Higher overload rating is achieved by oversizing the drive.

Digital inputs	
Programmable digital inputs	6*
Logic	PNP or NPN
Voltage level	0 – 24 VDC

** Two of the inputs can be used as digital outputs.*

Analog inputs	
Number of analog inputs	2
Modes	Voltage or current
Voltage level	-10 to +10 V (scaleable)
Current level	0/4 to 20 mA (scaleable)

Pulse inputs	
Programmable pulse inputs	2
Voltage level	0 – 24 VDC (PNP positive logic)
Pulse input accuracy	(0.1 – 110 kHz)

** Two of the digital inputs can be used for pulse inputs.*

Analog output	
Programmable analog outputs	1
Current range at analog output	0/4 – 20 mA

Relay outputs	
Programmable relay outputs	2 (240 VAC, 2 A and 400 VAC, 2 A)

Fieldbus Communication
FC Protocol and Modbus RTU built-in (Optional: Modbus TCP, Profibus, DeviceNet, Ethernet IP)

Ambient temperature
Up to 55° C (50° C without derating)

Dimensions [Inches]

	A2	A2	A3	A4	A5	B1	B2	B3	B4	C1	C2	C3	C4	D1h	D2h	D3h	D4h	E1	E2	F1	F2	F3	F4
H	7.9	10.5		15.3	16.5	19.4	25.5	15.7	17.7	26.8	30.3	21.6	26.0	33.2	41.3	33.2	41.3	33.0	32.8	91.5	91.5	91.5	91.5
W	2.9	3.5	5.1	7.9	9.5			6.5	9.1	12.1	14.5	12.1	14.5	12.8	16.5	9.8	13.8	86.5	67.1	61.8	77.2	85.0	85.0
D	8.1	8.1		6.9	7.9	10.2		9.8		12.2	13.2	13.1		14.9		14.8		28.9	28.9	36.5	36.5	36.5	36.5
H+		14.7						18.7				29.7	37.4										
W+		3.5	5.1					6.5				12.9	15.3										

Adding Brake IGBT, or Mains Option changes the frame size to D5h or D7h. Dimensions for these frames are: D5h: 50.3x12.8x15.0 and D7h: 76.0x16.5x15.2

Current and power ratings

For 575 V operation T7 drives must be up-sized one size. For example a P90K drive produces 90kW at 690 V, for 575 V operation use a P110 drive to produce 90 kW

			T2 200 – 240 V								T4 380 – 480 V										T6 525 – 600 V						T7 525 – 690 V					
			1 ph				3 ph				1 ph				3 ph																	
											Amp.			Amp.								A					A					
FC 322	kW	HP	Amp.	IP 20	IP 55	IP 66	IP 20	IP 21	IP 55	IP 66	≤440 V	>440 V	All IP cl.*	≤440 V	>440 V	IP 00	IP 20	IP 21	IP 54	IP 55	IP 66	≤550 V	>550 V	IP 20	IP 21	IP 55	IP 66	550 V	690 V	IP 00	IP 20	IP 21	IP 54/55
PK25	0.25	0.33	1.8																													
PK37	0.37	0.50	2.4											1.3	1.2																	
PK55	0.55	0.75	3.5											1.8	1.6																	
PK75	0.75	1.00	4.6											2.4	2.1							1.8	1.7									
P1K1	1.1	1.50	6.6	A3	A5	A5	A2	A2	A4/A5	A4/A5				3	2.7		A2	A2				2.6	2.4									
P1K5	1.5	2.00	7.5											4.1	3.4							2.9	2.7	A3	A3	A5	A5					
P2K2	2.2	3.00	10.6		B1	B1								5.6	4.8							4.1	3.9								A3	
P3K0	3	4.00	12.5											7.2	6.3							5.2	4.9									
P3K7	3.7	5.00	16.7				A3	A3	A5	A5																						
P4K0	4.0	5.50												10	8.2		A2	A2				6.4	6.1									
P5K5	5.5	7.50	24.2		B1	B1								13	11		A3	A3		A5	A5	9.5	9	A3	A3	A5	A5					
P7K5	7.5	10	30.8		B2	B2	B3	B1	B1	B1	33	30	B1	16	14.5							11.5	11									
P11K	11	15	46.2								48	41	B2	24	21		B3	B1		B1	B1	19	18	B3	B1	B1	B1	14	13				
P15K	15	20	59.4		C1	C1	B4	B2	B2	B2				32	27							23	22					19	18				
P18K	18	25	74.8								37.5	34	C1	37.5	34							28	27					23	22		B4	B2	B2
P22K	22	30	88		C2	C2	C3	C1	C1	C1				44	40		B4	B2		B2	B2	36	34	B4	B2	B2	B2	28	27				
P30K	30	40	115											61	52							43	41					36	34				
P37K	37	50	143				C4	C2	C2	C2	151	135	C2	73	65							54	52					43	41			C2	C2
P45K	45	60	170											90	80		C3	C1		C1	C1	65	62	C3	C1	C1	C1	54	52				
P55K	55	75												106	105							87	83					65	62			C2 + D1	C2 + D1
P75K	75	100												147	130		C4	C2		C2	C2	105	100	C4	C2	C2	C2	87	83				
N90K	90	125												177	160							137	131					105	100	D3h			
N110	110	150												212	190													137	131				
N132	132	200												260	240		D3h	D1h	D1h									162	155			D1	D1
N160	160	250												315	302													201	192				
N200	200	300												395	361													253	242				
N250	250	350												480	443		D4h	D2h	D2h									303	290	D4h		D2	D2
N315	315	450												600	540													360	344				
P355	355	550												658	590																		
P400	400	600												745	678	E2		E1	E1									418	400	D4h		D2	D2
P450	450	650												800	730													470	450				
P500	500	650												880	780													523	500	E2		E1	E1
P560	560	750												990	890			F1/F3	F1/F3									596	570				
P630	630	900												1120	1050													630	630				
P710	710	1000												1260	1160													763	730			F1/F3	F1/F3
P800	800	1200												1460	1380			F2/	F4									889	850				
P900	900																											988	945				
P1M0	1000													1720	1530			F2/	F4									1108	1060			F2/F4	F2/F4
P1M2	1200																											1317	1260				
P1M4	1400																											1479	1415				

IP 00/Chassis | IP 20/Chassis | IP 21/Type 1 | With upgrade kit | IP 54/Type 12 | IP 55/Type 12 | IP 66/NEMA 4X

VLT® 2800 Series

Perfect

for conveyors, centrifuges, dosing pumps, compressors, and special applications

The VLT® 2800 series has been developed for the low power market. The drive is extremely compact and prepared for side-by-side mounting. The concept is modular with a power module and a control module.

The VLT® 2800 series is designed for stable operation in industrial environments.

Power range

1/3 x 200 – 240 V . . . . .1/2 – 5 HP
3 x 380 – 480 V . . . . . .3/4 – 25 HP
With 160% overload torque (normal overload)

Feature	Benefit
Automatic Motor Tuning	Ensure optimal match between drive and motor Increasing performance
PID-controller	Optimum process control
Interrupt start/stop	High repeatability of positional accuracy
Dry run detection	No need for specific detection equipment
Fieldbus communication	Allows for control and surveillance of the drives from a PC or a PLC Profibus and DeviceNet are available
Reliable	**Maximum uptime**
Built-in RFI filter	Compliance with the EMC standard EN 55011 1A
Enhanced sleep mode	Excellent control for shutting down the pump at low flow
Max. ambient temperature 45° C without derating	No external cooling or oversizing necessary
User-friendly	**Saves commissioning and operating cost**
Quick Menu	Easy to use
Pipe Fill mode	Prevents water hammering
Fieldbus communication	Allows for control and surveillance of the drives from a PC or a PLC Profibus and DeviceNet are available

PC software tools

- MCT 10: Ideal for commissioning and servicing the drive
- MCT 31: Harmonics calculations tool.

RFI filter

The RFI filter ensures that the frequency converter will not disrupt other electrical components that are connected to the mains and might cause operating disruption.

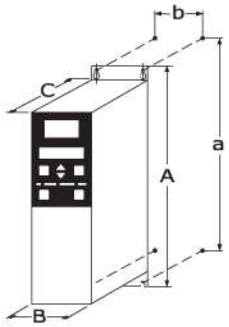
By fitting an RFI 1B filter module between the mains supply and the VLT® 2800, the solution complies with the EMC norm EN 55011-1B.

Specifications

Mains supply (L1, L2, L3)	
Supply voltage	200-240 V ±10%, 380-480 V ±10%
Supply frequency	50/60 Hz
Displacement Power Factor (cos φ) near unity	(> 0.98)
Switching on input supply L1, L2, L3	1–2 times/min.
Output data (U, V, W)	
Output voltage	0–100% of supply voltage
Switching on output	Unlimited
Ramp times	1–3600 sec.
Closed loop	0–132 Hz
Digital inputs	
For start/stop, reset, thermistor, etc.	5
Logic	PNP or NPN
Voltage level	0–24 VDC
Analog input	
No. of analog inputs	2
Voltage level	-10 to +10 V (scaleable)
Current level	0/4 to 20 mA (scaleable)
Pulse inputs	
No. of pulse inputs	2
Voltage level	0 – 24 V DC (PNP positive logic)
Pulse input accuracy	(0.1–110 kHz)
Digital output	
No. of digital outputs	1
Analog output	
Programmable analog outputs	1
Current range	0/4–20 mA
Relay outputs	
No. of relay outputs	1
Fieldbus communication	
RS485	
Ambient temperature	
50°C	

Mains	Type	Power PN,M [kW]	Power HP	Current (Amps) Output Amps	Current (Amps) Input Amps
1 x 220-240 V	2803	0.37	1/2	2.2	5.9
	2805	0.55	3/4	3.2	8.3
	2807	0.75	1	4.2	10.6
	2811	1.1	1.5	6.0	14.5
	2815	1.5	2	6.8	15.2
	2822*	2.2	3	9.6	22.0
	2840*	3.7	5	16.0	31.0
3 x 200-240 V	2803	0.37	1/2	2.2	2.9
	2805	0.55	3/4	3.2	4.0
	2807	0.75	1	4.2	5.1
	2811	1.1	1.5	6.0	7.0
	2815	1.5	2	6.8	7.6
	2822	2.2	3	9.6	8.8
	2840	3.7	5	16.0	14.7
3 x 380-480 V	2805	0.55	3/4	1.7	1.6
	2807	0.75	1	2.1	1.9
	2811	1.1	1.5	3.0	2.6
	2815	1.5	2	3.7	3.2
	2822	2.2	3	5.2	4.7
	2830	3.0	4	7.0	6.1
	2840	4.0	5	9.1	8.1
	2855	5.5	7.5	12	10.6
	2875	7.5	10	16	14.9
	2880	11.0	15	24	24.0
	2881	15.0	20	32	32.0
	2882	18.5	25	37.5	37.5

** Not available with RFI filter*



Cabinet sizes [Inches]

	A	B	C	D
Height				
A	7.87	10.53	10.53	19.88
a	7.51	10.11	10.11	19.29
Width				
B	2.95	3.54	5.51	7.87
b	2.36	2.75	4.72	4.72
Depth				
C	6.61	6.61	6.61	9.6

VLT® Micro Drive

Perfect

for industrial automation and general purpose applications, designed for OEM's

The VLT® Micro Drive is a general purpose drive that can control AC motors up to 30 HP. It's a small robust drive with high efficiency and reliability.

VLT® Micro Drive is a full member of the VLT® family sharing the overall quality of design, reliability and user-friendliness.

Due to high quality components and genuine VLT® solutions, VLT® Micro Drive is extremely reliable.

RoHS compliant

The VLT® Micro Drive is manufactured with respect for the environment, and it complies with the RoHS Directive.

Power range

1 phase 200–240 V AC. . . . . 1/4 – 3 HP
3 phase 200–240 V AC. . . . . 1/3 – 5 HP
3 phase 380–480 V AC. . . . . 1/2 – 30 HP

Feature	Benefit
User friendly	
Minimum commissioning	Saves time
Mount – connect – go!	Minimum effort – minimum time
Copy settings via local control panel	Easy programming of multiple drives
Intuitive parameter structure	Minimal manual reading
Complies with VLT® software	Saves commissioning time
Self-protecting features	Lean operation
Process PI-controller	No need for external controller
Automatic Motor Tuning	Ensure optimal match between drive and motor
150% motor torque up to 1 minute	Plenty of brake-away and acceleration torque
Flying start (catch a spinning motor)	Doesn't trip when started on a spinning (freewheeling) motor
Electronic Thermal Relay (ETR)	Replaces external motor protection
Smart Logic Controller	Often makes PLC unnecessary
Built-in RFI filter	Saves cost and space
Energy saving	**Less operation cost**
Energy efficiency 98%	Minimises heat loss
Automatic Energy Optimization (AEO)	Saves 5-15% energy in HVAC applications
Reliable	**Maximum uptime**
Earth fault protection	Protects the drive
Over temperature protection	Protects the motor and drive
Short circuit protection	Protects the drive
Optimum heat dissipation	Longer lifetime
Unique cooling concept with no forced air flow over electronics	Problem-free operation in harsh environments
High quality electronics	Low lifetime cost
High quality capacitors	Tolerates uneven mains supply
All drives full load tested from factory	High reliability
Dust resistant	Increased lifetime
RoHS compliant	Protects the environment
Designed for WEEE	Protects the environment

Coated PCB standard
For harsh environments.

Power options
Danfoss VLT® Drives offers a range of external power options for use together with our drives in critical networks or applications:

- VLT® Advanced Harmonic Filter: For applications where reducing harmonic distortion is critical.
- Built - In Brake Chopper in 2 HP and above.

PC software tools
- MCT 10: Ideal for comissioning and servicing the drive including guided programming of cascade controller, real-time clock, smart logic controller, and preventative maintenance
- VLT® Energy Box: Comprehensive energy analysis tool, shows the drive payback time.
- MCT 31: Harmonics calculations tool.

Cabinet sizes
(mounting flange incl.)

[inches]	M1	M2	M3	M4	M5
Height	5.9	6.92	9.41	11.49	13.18
Width	2.76	2.95	3.54	4.92	6.49
Depth	5.82	6.61	7.63	9.48	9.76

.25" with Potentiometer

Specifications

Mains supply (L1, L2, L3)	
Supply voltage	1 x 200 – 240 V ± 10%, 3 x 200 – 240 V ± 10% 3 x 380 – 480 V ± 10%
Supply frequency	50/60 Hz
Displacement Power Factor (cos φ) near unity	(> 0.98)
Switching on input supply L1, L2, L3	1–2 times/min.
Output data (U, V, W)	
Output voltage	0 – 100% of supply voltage
Output frequency	0 – 200 Hz (VVC+ mode), 0 – 400 Hz (U/f mode)
Switching on output	Unlimited
Ramp times	0.05 – 3600 sec
Digital inputs	
Programmable digital inputs	5
Logic	PNP or NPN
Voltage level	0 – 24 VDC
Pulse inputs	
Programmable pulse inputs	1*
Voltage level	0 – 24 V DC (PNP positive logic)
Pulse input frequency	20 – 5000 Hz
Analog input	
Analog inputs	2
Modes	1 current/1 voltage or current
Voltage level	0 – 10 V (scaleable)
Current level	0/4 to 20 mA (scaleable)
Analog output	
Programmable analog outputs	1
Current range at analog output	0/4–20 mA
Relay outputs	
Programmable relay outputs	1 (240 VAC, 2 A)
Approvals	
CE, C-tick, UL	
Fieldbus communication	
FC Protocol, Modbus RTU	

** One of the digital inputs can be used for pulse inputs.*

Ordering numbers

		200 – 240 VAC			440 – 480 VAC	
Power [kW]	HP	Output (Amps)	1 ph.	3 ph.	Output (Amps)	3 ph.
0.18	1/4	1.2	132F 0001			
0.25	1/3	1.5		132F 0008		
0.37	1/2	2.2	132F 0002	132F 0009	1.1	132F 0017
0.75	1	4.2	132F 0003	132F 0010	2.1	132F 0018
1.5	2	6.8	132F 0005	132F 0012	3.4	132F 0020
2.2	3	9.6	132F 0007	132F 0014	4.8	132F 0022
3.0	4				6.3	132F 0024
3.7	5	15.2		132F 0016	8.2	132F 0026
5.5	7.5				11	132F 0028
7.5	10				14	132F 0030
11.0	15		Micro drives from 2 HP and up have built in brake chopper		21	132F 0058
15.0	20				27	132F 0059
18.5	25				34	132F 0060
22.0	30				40	132F 0061

VLT® Control panel LCP 11 ..... Without potentiometer: 132B0100
VLT® Control panel LCP 12 ..... With potentiometer: 132B0101

VLT® Decentral Drive FCD 302

Perfect

for applications with: conveyors, wash-down areas, and with a large number of drives

The VLT® Decentral Drive FCD 302 is the newest member of the VLT® FCD 300 family, based on the VLT® AutomationDrive FC 302 platform. It combines the key features of both products in a completely re-designed enclosure, made for best fit on direct machine mounting.

Simplicity and robustness have been taken into consideration during the design of the new VLT® Decentral Drive FCD 302. The results are a real user-friendly product with high performance and the highest degree of environmental protection.

De-central drives are meant for decentralized mounting right on the equipment where the need for space-consuming control cabinets, air conditioning and construction is eliminated. Also with the drives placed near - or directly on - the motor, there is no need for long screened motor cables.

One-box concept

All options are built-in as part of the core unit reducing the number of boxes to be mounted and connections to be terminated during installation. Consequently labor costs in mounting hours and risk of failures are dramatically reduced.

Power range

3 x 380 – 480 VAC. . . . . 1/2 - 4 HP

Feature	Benefit
Reliable	**Maximum uptime**
Special painting treatment and smooth surface	Easy cleaning; no dirt trap
Pluggable twin-part design (installation box and electronic part)	Easy and fast service
Integrated lockable service switch available	Local disconnection possible
User-friendly	**Saves commissioning and operating cost**
Adapts to any brand of motor and geared motor, induction as well as permanent magnet motors	Easy and flexible installation
Integrated power and fieldbus looping terminals	Cable savings
Visible LEDs	Quick status check
Set-up and controlled through pluggable control panel, fieldbus communication and MCT10 PC software	Easy commissioning
Awarded control panel with on-board manual	Easy operation
Screwless spring-loaded terminals	Easy and fast connection
Integrated USB port	Direct connection to PC
Intelligent	**Built-in feature**
Smart Logic Control	Reduces need for PLC capacity
Safe Stop, STO: Safe Torque Off	Reduces the need for extra components
Intelligent warning systems	Warning before controlled stop

Enclosure

- IP 66 standard black
- IP 66 standard white
- IP 69K hygienic white

(all enclosures are rated as Type 4X)

Integrated 24 V supply
24 V DC control supply is provided by the drive. Separate supply terminals have been made available for remote I/Os and devices.

Power looping
The new FCD 302 facilitates internal power looping. 6 Terminals for #10 AWG power cable inside the enclosure allows connection of multiple units in the same power branch-circuit.

Ethernet switch
Two RJ-45 ports are available in the drive for easy daisy chaining of Ethernet communication.

Fieldbus options
- PROFIBUS DP
- PROFINET
- Ethernet/IP

Application options
- Encoder
- Resolver

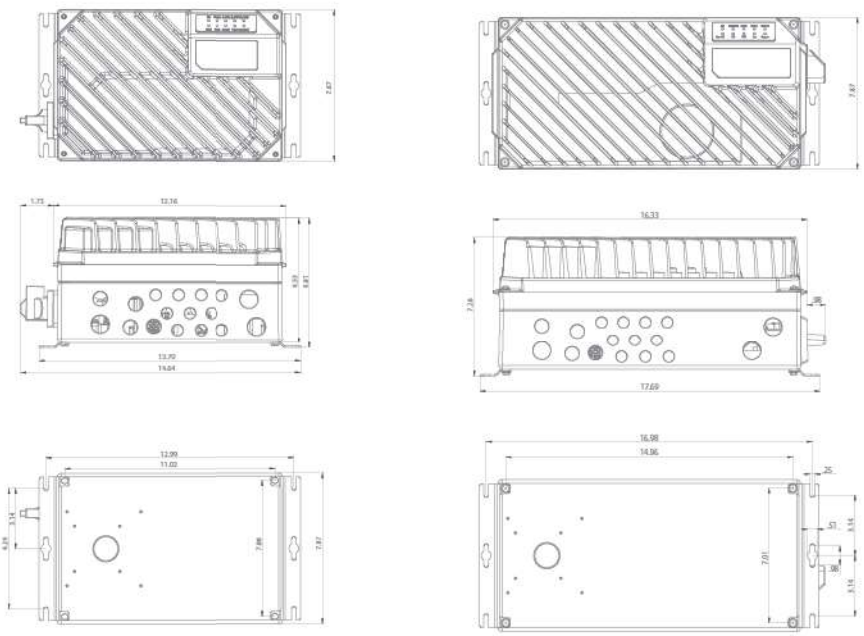
Hardware options
- Mounting brackets
- Service switch
- Internal circuit breaker
- M12 sensor plugs
- 24 V DC input for control supply
- Brake chopper
- Electromechanical brake control and supply

Dimensions
Small frame size
(0.37 – 2.2 kW/0.5 – 3.0 HP)
Large frame size
(0.37 – 3 kW/0.5 – 4.0 HP)

Mains supply (L1, L2, L3)	
Supply voltage	380 – 480 V ±10%
Supply frequency	50/60 Hz
True Power Factor (λ)	0.92 nominal at rated load
Displacement Power Factor (cos ϕ)	(>0.98)
Switching on input supply	2 times/min.
Output data (U, V, W)	
Output voltage	0 – 100% of supply
Output frequency	0 – 590 Hz 0 – 300 Hz (Flux mode)
Switching on output	Unlimited
Ramp times	0.01 – 3600 sec.
Digital inputs	
Programmable digital inputs	4 (6)
Logic	PNP or NPN
Voltage level	0 – 24 V DC

Note: One/two digital inputs can be programmed as digital output

Analog inputs	
Number of analog inputs	2
Modes	Voltage or current
Voltage level	-10 to +10 V (scaleable)
Current level	0/4 – 20 mA (scaleable)
Pulse/encoder inputs	
Programmable pulse/encoder inputs	2
Voltage level	0 – 24 V DC (PNP positive logic)
Digital output	
Programmable digital/pulse outputs	2
Voltage level at digital/frequency output	0 – 24 V
Analog output	
Programmable analog outputs	1
Current range	0/4 – 20 mA
Relay outputs	
Programmable relay outputs	2
Integrated 24 V supply	
Max. load	600 mA



All measurements are in inches

VLT® Decentral FCD 300

Perfect

for applications with: material handling in food & beverage industry, wash-down areas, and many more

The VLT® Decentral FCD 300 is a complete frequency converter designed for decentral mounting. It can be mounted on the machine or a wall near the motor, or directly on the motor itself.

The VLT® Decentral FCD 300 comes in very robust enclosure, with a special painting treatment to withstand harsh environments and typical cleaning agents used in wash-down areas. Its design offers a smooth cleaning-friendly surface.

The decentral design reduces the need for central control panels and eliminates the need for space-consuming motor control cabinets. The need for long screened motor cables is significantly reduced.

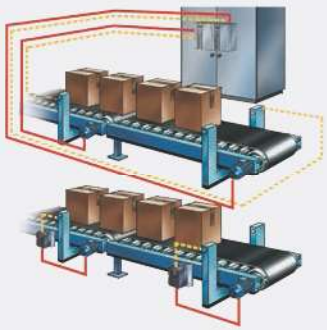
Feature	Benefit
Reliable	**Maximum uptime**
Special surface treatment as protection against aggressive environments	Easy cleaning; no dirt trap
Twin part design (installation box and electronic part)	Easy and fast service
Integrated lockable service switch available	Local disconnection possible
Full protection is offered	Protects the motor and drive
User-friendly	**Saves commissioning and operating cost**
Adapts to any brand of motor and geared motor	Easy and flexible installation
Designed for power and fieldbus looping	Cable savings
Visible LEDs	Quick status check
Set-up and controlled through a remote control panel or fieldbus communication and dedicated MCT 10 set-up software	Easy commissioning

Power range

3 x 380 – 480 VAC . . . . . 1/2 - 5 HP

Enclosure

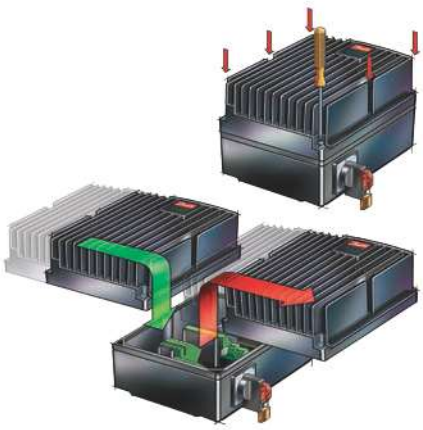
IP 66/Type 4X (indoor)



Central Vs. Decentral concept

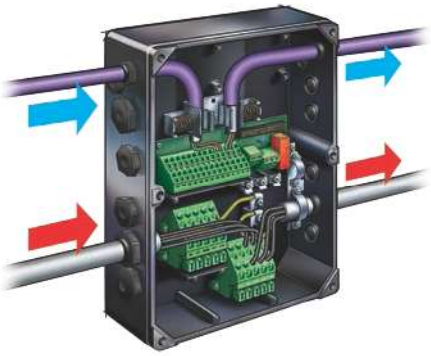
Robust cleaning-friendly surface

Hot pluggable LCP



Plug-and-drive

The bottom section contains maintenance-free Cage Clamp connectors and looping facilities for power and fieldbus cables. Once installed, commissioning and upgrading can be performed in no time by plugging in another control lid.



Flexible installation

The FCD 300 series facilitates internal power line and fieldbus looping. Terminals for 4 mm² power cables inside the enclosure allows connection of up to 10+ units.

Available options

- Service switch
- Connector for control panel
- M12 connectors for external sensors
- Han 10E motor connector
- Brake chopper and resistor
- 24 V external back up of control and communication
- External electromechanical brake control and supply

Specifications

Mains supply (L1, L2, L3)	
Supply voltage	3 x 380/400/415/440/480 V ±10%
Supply frequency	50/60 Hz
Max. imbalance on supply voltage	±2.0% of rated supply voltage
Switching on input supply	2 times/min.
Power Factor (cos φ)	0.9 /1.0 at rated load
Output data (U, V, W)	
Output voltage	0–100% of supply
Overload torque	160% for 60 sec.
Switching on output	Unlimited
Ramp times	0.02 - 3600 sec.
Output frequency	0.2 - 132 Hz, 1 - 590 Hz
Digital inputs	
Programmable digital inputs	5
Voltage level	0–24 V DC (PNP positive logic)
Analog inputs	
Analog inputs	2 (1 voltage, 1 current)
Voltage level/Current level	0– ±10 V DC / 0/4–20 mA (scaleables)
Pulse inputs	
Programmable pulse inputs	2 (24 V DC)
Max. frequency	110 kHz (push-pull) / 5 kHz (open collector)
Analog output	
Programmable analog output	1
Current range	0/4–20 mA
Digital output	
Programmable digital/frequency output	1
Voltage/frequency level	24 V DC/10 kHz (max.)
Relay output	
Programmable relay output	1
Max. terminal load	250 V AC, 2 A, 500 VA
Fieldbus communication	
FC Protocol, Modbus RTU, Metasys N2	Built-in
Profibus DP, DeviceNet, AS-interface	Optional (integrated)
Externals	
Vibration test	1.0 g (IEC 60068)
Max. relative humidity	95 % (IEC 60068-2-3)
Ambient temperature	Max. 40°C (24 hour average max. 35°C)
Min. ambient temperature in full operation	0°C
Min. ambient temperature at reduced performance	-10°C
Approvals	CE, UL, C-tick, ATEX*

** Contact Danfoss for details*

Technical data

VLT® Decentral FCD		303	305	307	311	315	322	330	335*
Output current (3 x 380 – 480 V)	$I_{INV\ (60s)}$ [A]	1.4	1.8	2.2	3.0	3.7	5.2	7.0	7.6
	$I_{MAX\ (60s)}$ [A]	2.2	2.9	3.5	4.8	5.9	8.3	11.2	11.4
Output power (400 V)	S_{INV} [KVA]	1.0	1.2	1.5	2.0	2.6	3.6	4.8	5.3
Typical shaft output	$P_{M,N}$ [kW]	0.37	0.55	0.75	1.1	1.5	2.2	3.0	3.3
	$P_{M,N}$ [HP]	0.5	0.75	1.0	1.5	2.0	3.0	4.0	5.0
Mechanical dimensions H x W x D (mm)	Motor mounting	244 x 192 x 142					300 x 258 x 151		
	Stand alone	300 x 192 x 145					367 x 258 x 154		

* t_{amb} max. 35° C

VLT® DriveMotor FCM 300

Perfect

for air handling unit fan wheels, pumps, simple conveyors

The VLT® FCM 300 Series is an integrated drive-motor solution which combines a VLT® frequency converter and a high standard quality motor in a single product.

The frequency converter is attached in place of the motor terminal box and it is no higher than the standard terminal box nor wider or longer than the motor.

Incorporated to a high standard quality motor, the VLT® DriveMotor FCM 300 is also available in a multitude of variants, individualized to meet customer requirements.

On the motor

The VLT® electronic motor control together with the motor totally eliminates motor cables and thereby minimises EMC problems. Heat from the drive is dissipated together with the motor heat.

Power range

3 x 380 – 480 VAC . . . . . 3/4 - 10 HP

Enclosure

IP 55 (standard)
IP 65/IP 66 (optional)

Feature	Benefit
Reliable	**Maximum uptime**
Robust enclosure	Withstands harsh environments
No power cable length limitation	Increased flexibility
Thermal protection	Total motor-inverter protection
Straightforward EMC compliance	No problem with electromagnetic interferences
User-friendly	**Saves commissioning and operating cost**
Motor and drive perfectly matched to each other	Saves commissioning time
No panel space required – the DriveMotor is placed on the machine	Saves space
Flexible mounting – foot/flange/face/ foot-flange/foot-face	Meets customer requirements
Retrofit without mechanical changes	Easy service
Set-up and controlled through a remote control panel or fieldbus communication and dedicated MCT 10 set-up software	Easy commissioning

Motor type

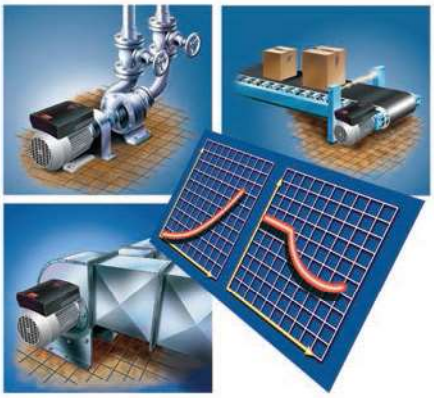
2-pole
4-pole

Mounting versions

B03 foot
B05 flange
B35 foot + flange
B14 face
B34 foot + face

Control panel

A Local Control Panel is available for operating, setup and diagnostics. The LCP can be handheld or mounted in a panel front (IP65).



Sleep Mode

In Sleep Mode the motor will stop in a no load situation. When the load returns, the frequency converter will restart the motor.

Also available:

Forced ventilation

For constant operation at low speed without torque reduction.

Motor drain holes

For applications where formation of condensate water might occur.

Sensorless Pump Control – OEM version

Offers precise pressure (head) control without using a pressure transmitter.

Specifications

Mains supply (L1, L2, L3)	
Supply voltage	3 x 380/400/415/440/460/480V ±10%
Supply frequency	50/60 Hz
Power factor (cos φ)	Max. 0.9/1.0 at rated load
Max. imbalance of supply voltage	±2% of rated supply voltage
Switching on supply input	Once every 2 minutes
Control Characteristics (frequency converter)	
Frequency range	0 – 132 Hz
Overload torque	160% for 60 sec.
Resolution on output frequency	0.1%
System response time	30 msec. ±10 msec.
Speed accuracy	±15 RPM (open loop, CT mode, 4-pole motor 150 – 1500 RPM)
Digital inputs	
Programmable digital inputs	4
Voltage level	0 – 24 V DC (PNP positive logic)
Analog inputs	
Analog inputs	2 (1 voltage, 1 current)
Voltage/current level	0 – 10 V DC / 0/4 – 20 mA (scaleables)
Pulse input	
Programmable pulse input	1 (24 V DC)
Max. frequency	70 kHz (push-pull) / 8 kHz (open collector)
Analog/digital output	
Programmable analog/digital output	1
Current/voltage range	0/4 – 20 mA / 24 V DC
Relay output	
Programmable relay output	1
Max. terminal load	250 V AC, 2 A, 500 VA
Fieldbus communication	
FC Protocol, Modbus RTU	Built-in
Profibus DP	Optional (integrated)
Externals	
Vibration test	1.0 g (IEC 60068)
Max. relative humidity	95% (IEC 60068-2-3)
Ambient temperature	Max. 40° C (24 hour average max. 35° C)
Min. ambient temperature in full operation	0°C
Min. ambient temperature at reduced performance	-10° C

Technical data

FCM	305	307	311	315	322	330	340	355	375
Motor output									
[HP]	0.75	1.0	1.5	2.0	3.0	4.0	5.0	7.5	10.0
[kW]	0.55	0.75	1.1	1.5	2.2	3.0	4.0	5.5	7.5
Motor torque									
2-pole [Nm] 1)	1.8	2.4	3.5	4.8	7.0	9.5	12.6	17.5	24.0
4-pole [Nm] 2)	3.5	4.8	7.0	9.6	14.0	19.1	25.4	35.0	48.0
Frame size									
[mm]	80	80	90	90	100	100	112	132	132
Input current [A] 380 V									
2-pole	1.5	1.8	2.3	3.4	4.5	5.0	8.0	12.0	15.0
4-pole	1.4	1.7	2.5	3.3	4.7	6.4	8.0	11.0	15.5
Input current [A] 480 V									
2-pole	1.2	1.4	1.8	2.7	3.6	4.0	6.3	9.5	11.9
4-pole	1.1	1.3	2.0	2.6	3.7	5.1	6.3	8.7	12.3

1) at 400 V, 3000 RPM, 2) at 400 V, 1500 RPM

VLT® OneGearDrive

VLT® OneGearDrive Standard™

VLT® OneGearDrive Hygienic™

Perfect

for dry and wet areas, or clean room production areas

The compact design of the VLT® OneGearDrive makes it predestined for use in Material Handling and conveying systems. The drive has been designed especially for use in the food and beverage industry, although this new generation of transmission product offers significant benefits in all conveyor drive applications.

Compared to traditional systems the VLT® OneGearDrive covers most applications with one physical drive size and only three gear variants. Reducing the need for excessive inventory and easing engineering thanks to uniform mechanical dimensions. The high-efficiency bevel gearing with permanent-magnet three-phase synchronous motor offers high energy efficiency - up to 35% power savings compared to other bevel and worm gear systems.

The VLT® OneGearDrive comes in two versions. The OneGearDrive Standard™ For use in dry production areas. The OneGearDrive Hygienic™For use in wet areas, aseptic areas with high cleaning intensity and Clean Room production areas.

In both versions the complete smooth, easy to clean surface without cooling fins prevents pockets of dirt from forming and allows cleansing agents to drain off freely. The fanless motor avoids the risk of air-borne germs and dirt particles being drawn in and then expelled back into the surrounding air.

Feature	Benefit
High-efficiency bevel gear drive	High break away torque
High system efficiency incl. frequency converter	Energy Efficiency - up to 35% power savings compared to other bevel and worm gear systems
Permanent-magnet three-phase synchronous motor	Better than Super Premium Efficiency class IE4
Motor without cooling fins and fans	Ensure a measurable reduction of airborne germs
10-pole motor for continuous duty S1	High torque available
Available hollow shaft diameters: 30, 35 and 40 mm / 1¼, 1 7/16 and 1½ inches	Flexible adaption to customer standards
Completely smooth enclosure leaves no crevices or dirt traps	Easy to clean Safe production
Motor and resolver connection with Danfoss CleanConnect® stainless steel circular connector (OGD Hygienic)	Safe connection in wet areas Fast replacement High clean-ability
Motor, resolver and brake connections via terminal box with CageClamp® technology (OGD Standard)	Fast, reliable connection Lower installation cost
Aseptic coating (standard for OGD Hygienic, optional for OGD Standard)	Resistant to cleansing agents and disinfectants (pH 2..12)
Optional Antibac® antibacterial coating	Reduced cleaning time and costs
Surface coating and food grade lubricants compliant with FDA and NSF requirements (OGD Hygienic)	Reliable and direct use In product handling areas. In conveying applications - 35000 operating hours
High degrees of protection: – IP 67 and IP 69K (OGD Hygienic) – IP 65 and IP 67 (OGD Standard)	Unrestricted use in wash down areas High protection in wash down areas
In combination with VLT® AutomationDrive FC 302 or VLT® Decentral Drive FCD 302	
System voltage 380 ... 500 V +/-10%	Widely usable
System frequency 50/60 Hz	Available as central and decentral solution
Output frequency 0 – 250 Hz	Wide speed control range
Operation with or without speed feedback (resolver option)	Open loop operation for typical conveyor applications Resolver option allows closed loop operation and synchronous / positioning applications

Product range

- Power rating ..... 2 – 4 HP
- Max speed ..... 3000 RPM @ 250 Hz
- Frequency ..... max. 250 Hz
- Current ..... max. 7.2 A

Constants

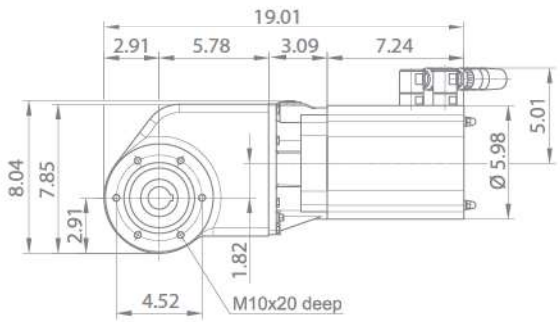
- Torque ..... kt ≈ 1,7 Nm/A
- Voltage ..... kc = 120 V/1000 rpm

VLT® OneGearDrive Hygienic™

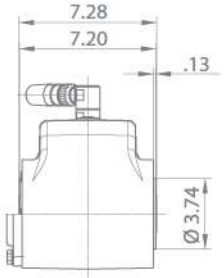
The OneGearDrive Hygienic™ complies with the requirements for best cleaning and hygienic design – with certification according to EHEDG (European Hygienic Engineering & Design Group).

It is certified as usable for clean rooms and aseptic filling by IPA (Fraunhofer institute) according to the dedicated "Air Cleanliness Classification" DIN EN ISO 14644-1.

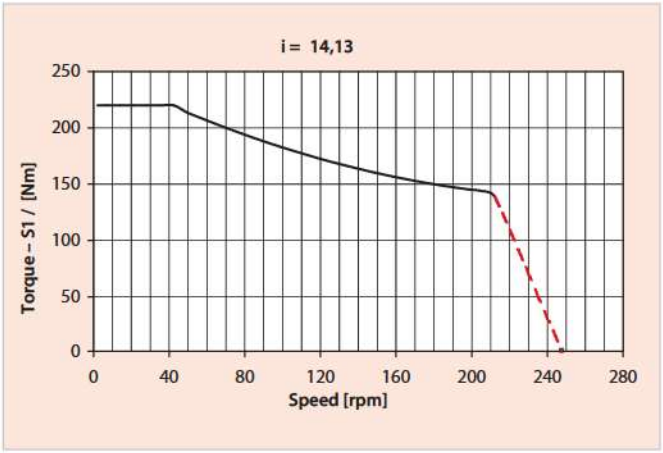
The OneGearDrive is designed to be integrated in the plant equipment and to withstand the same cleaning agents and physical cleaning as the rest of the aseptic production equipment.

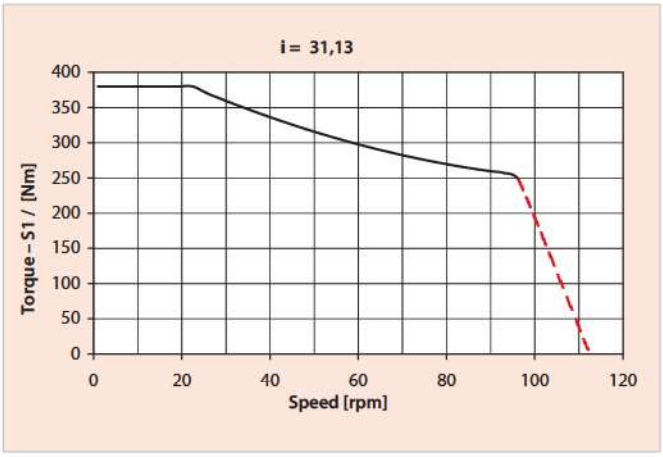


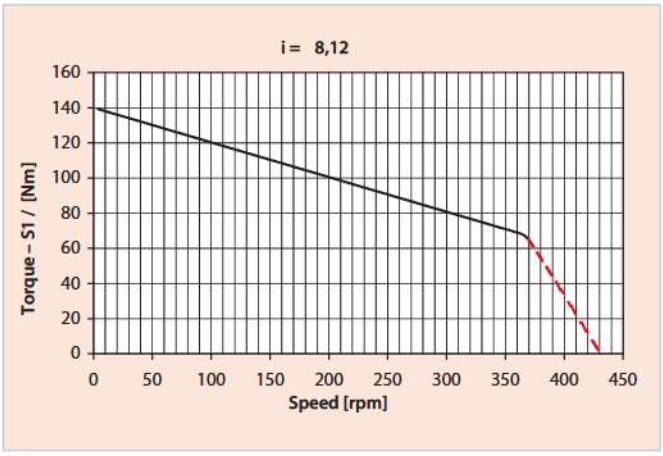
Dimensions of Danfoss VLT® OneGearDrive Hygienic™



Speed/ torque characteristics for gear ratios i = 31.13; i = 14.13 and i = 8.12 (max 3.0 kW)







VLT® Soft Starter MCD 500

Perfect

for pumps, conveyors, fans, mixers, compressors, centrifuges, mills, saws, and more

VLT® Soft Starter MCD 500 is a total motor starting solution. Current transformers measure motor current and provide feedback for controlled motor ramp profiles.

AAC, Adaptive Acceleration Control, automatically employs the best starting and stopping profile for the application.

Adaptive Acceleration Control means, that for each start and stop, the soft starter compares and adapts the process to the chosen profile fitting to the application.

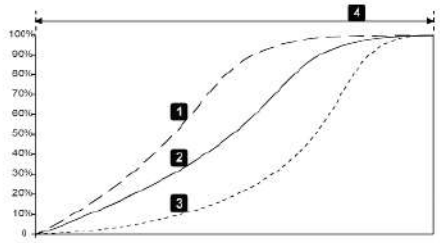
VLT® Soft Starter MCD 500 has a four line graphical display and a logic keypad making programming easy. Advanced setup is possible displaying operational status.

Three menu systems: Quick Menu, Application Setup and Main Menu provide optimum programming approach.

Power range

21 – 1600 A . . . . . 10 – 1000 HP
(1.2 MW inside Delta Connection)
Versions for 200 – 690 VAC

Feature	Benefit
AAC Adaptive Acceleration Control	Automatically adapts to the chosen starting and stopping profile
Adjustable bus bars allow for both top and bottom entry (360–1600 A, 200–1000 HP)	Space saving, less cable cost and easy retrofitting
DC injection braking distributed evenly over three phases	Less installation cost and less stress on the motor
Inside Delta (6-wire connection)	Smaller soft starter can be selected for the application
Log menus, 99 events and trip log provide information on events, trips and performance	Eases analysis of the application
Auto Reset	Less down-time
Jog (slow-speed operation)	Application flexibility
Second-order thermal model	Allows motors to be used to their full potential without damage from overloading
Internal bypass contactors (21–215 A, 10 – 150 HP)	Saves space and wiring compared to external bypass Very little heat dissipates when running. Eliminates costly external fans, wiring or bypass contactors
Auto-start/stop clock	Application flexibility
Compact size – amongst the smallest in their class	Saves space in cabinets and other application setups
4-line graphical display	Optimum programming approach and setup for viewing operational status
Multiple programming setup (Standard Menu, Extended Menu, Quick Set)	Simplifies the programming, but still holding to maximum flexibility
Multiple languages	Serving the whole world



AAC Profiles

Fully featured Soft Starter for motors up to 1100 HP

- Total motor starting solution
- Advanced start, stop and protection features
- Adaptive Acceleration Control
- Inside Delta connection
- 4-line graphical display
- Multiple programming setup menus

Optional

- Modules for serial communication:
  - DeviceNet
  - Profibus
  - Modbus RTU
  - USB
- Remote operator kit
- PC software:
  - WinMaster
  - MCT10

- Start/stop, reset
- LED for start, run, trip
- Trip codes
- Current display
- Motor temperature display
- 4 – 20 mA output

Specifications

Mains voltage (L1, L2, L3)	
MCD5-xxxx-T5	200 VAC ~ 525 VAC (± 10%)
MCD5-xxxx-T7	380 VAC ~ 690 VAC (± 10%)
MCD5-xxxx-T7	380 VAC ~ 600 VAC (± 10%) (inside delta connection)
Control voltage (terminals A4, A5, A6)	
CV1 (A5, A6)	24 VAC/VDC (± 20%)
CV2 (A5, A6)	110~120 VAC (+ 10% / - 15%)
CV2 (A4, A6)	220~240 VAC (+ 10% / - 15%)
Mains frequency	50/60 Hz (± 10%)
Rated insulation voltage to earth	600 VAC
Rated impulse withstand voltage	4 kV
Form designation	Bypassed or continuous, semiconductor motor starter form 1
Short circuit capability	
Coordination with semiconductor fuses	Type 2
Coordination with HRC fuses	Type 1
MCD500-0021B to 0215B	Prospective current of 65 kA
MCD500-0245C	Prospective current of 85 kA
MCD500-1200C to 1600C	Prospective current of 100 kA
Electromagnetic capability (compliant with EU Directive 89/336/EEC)	
EMC Emissions (Terminals 13 & 14)	IEC 60947-4-2 Class B and Lloyds Marine No. 1 Specification
EMC Immunity	IEC 60947-4-2
Outputs	
Relay Outputs	10A @ 250 VAC resistive, 5A @ 250 VAC AC15 pf 0.3
Programmable Outputs	
Relay A (13, 14)	Normally open
Relay B (21, 22, 24)	Changeover
Relay C (33, 34)	Normally open
Analog Output (07, 08)	0 – 20 mA or 4 – 20 mA (selectable)
Maximum load	600 Ω (12 VDC @ 20 mA) (accuracy ± 5%)
24 VDC Output (16, 08) Maximum load	200 mA (accuracy ± 10%)
Environmental	
Protection MCD5-0021B ~ MCD5-0105B	IP 20 & NEMA, UL Indoor Type 1
Protection MCD5-0131B ~ MCD5-1600C	IP 00, UL Indoor Open Type
Operating temperature	-10° C to 60° C, above 40° C with derating
Storage temperature	-25° C to + 60° C
Operating Altitude	0 – 1000 m, above 1000 m with derating
Humidity	5% to 95% Relative Humidity
Pollution degree	Pollution Degree 3
Heat Dissipation	
During start	4.5 watts per ampere

Dimensions

Current rating [A]	Weight [lbs]	Height [in]	Width [in]	Depth [in]	Frame size
21. 37. 43 and 53	9.3	11.6	5.9	7.2	G1
68	9.9				
84, 89 and 105	10.8			8.4	
131, 141, 195 and 215	32.8	17.2	10.8	9.8	G2
245	52.7	18.1	15.4	11	G3
360, 380 and 428	110.5	27.1	16.9	11.9	G4
595, 619, 790 and 927	117.1				
1200, 1410 and 1600	264.6	33.7	23	14.3	G5

VLT® Compact Starter MCD 200

Perfect

for pumps, fans, mixers, compressors, conveyors, and many more

The VLT® Compact Starter MCD 200 from Danfoss includes two families of soft starters in the power range from 10 - 150 HP.

The series offer easy DIN rail mount-ing for sizes up to 40 HP, 2-wire or 3-wire start/stop control and excellent starting duty (4 x Ie for 6 seconds).

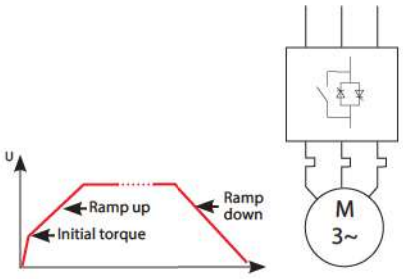
Heavy starting ratings at 4x Ie for 20 seconds.

Compatible with grounded delta power systems.

Power range
10 – 150 HP

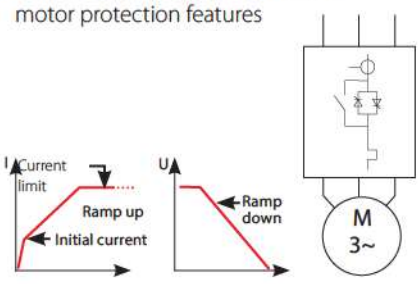
Feature	Benefit
Small footprint and compact size	Saves panel space
Built-in bypass	Minimizes installation cost and eliminates power loss Reduces heat build up. Savings in components, cooling, wiring and labor
Advanced accessoires	Allows enhanced functionality
Advanced SCR Control Algorithms balances output waveform	Allowing more starts per hour, accepting higher load
User friendly	**Save commissioning and operating cost**
Easy to install and use	Saves time
Easy DIN rail mounting for sizes up to 30 kW	Saves time and space
Reliable	**Maximum uptime**
Essential motor protections (MCD 202)	Reduces overall project investment
Max. ambient temperature 50° C without derating	No external cooling or oversizing necessary

MCD 201



MCD 202

MCD 202 provides enhanced soft start functionality and various motor protection features



Soft Starter for motors up to 150 HP

- Total motor starting solution
- Start, stop and protection features
- Local programming keypad and display

Optional

- Modules for serial communication:
  - DeviceNet
  - Profibus
  - Modbus RTU
  - USB
- Remote operator kit
- PC software
- Pump application module

Remote operation kit

Remote Operator and display with 4–20 mA analog output proportional to motor current (MCD 202)
Serial communication: Modbus RTU, AS-i, Profibus and DeviceNet.
PC-based MCD set-up software.

Specifications

Mains supply (l1, L2, L3)	
Supply voltage	3 X 200 - 480 VAC (T6 model)
Supply frequency	45 – 66 Hz
Control voltage	CV1 - 24 VAC / VDC CV3 - 110 -240 VAC & 380-440 VAC
Control inputs	
Control inputs	Start, Stop Reset upsh button on the unit
Relay outputs	
Relay outputs	1 x main contactor 1 x programmable* (Trip or Run)
Protections, MCD 201	
	Phase sequence Supply fault Shorted SCR
Protections, MCD 202	
	Motor thermistor input Motor temperature – thermal model Phase imbalance Phase sequence Excess start time Supply fault Shorted SCR
LED indications	
Indications	Ready/Fault Run
Ambient operating temperature	
Ambient temperature	-5 to 60°C (above 40°C without derating)
Standards approvals	
Approvals	CE, UL, C-UL, CCC, C-tick, Lloyds

Cabinet sizes

Power range (400 V)	10-40 HP	50-75 HP	100-150 HP
Height [inches]	7.99	8.46	9.44
Width [inches]	3.85	5.7	7.95
Depth [inches]	6.49	7.59	8.42

VLT® Soft Starter MCD 100

Perfect

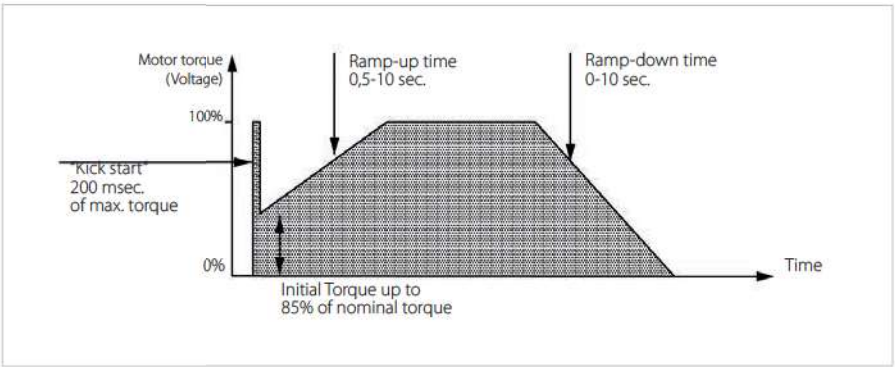
for smaller compressors, conveyor systems, and pumps

MCD 100 is a cost effective and extremely compact soft starter for AC motors.

A true "fit and forget" soft starter for DIN rail mount MCD 100 provides basic soft start and stop function.

- A robust semiconductor design – selection can be based on motor power which ensures easy selection.
- Can be used for an almost unlimited number of starts per hour without derating.
- A universal control voltage (24-480 V AC/ V DC) – simplifies selection and keeps stock at a minimum.
- A "fit and forget" contactor design – simplifies installation and reduces required panel space.
- Digitally controlled rotary switches – secures precise settings and simplifies installation.
- Ratings for heavy duty as standard – simplifies installation and reduces the risk of breakdown

Feature	Benefit
Small footprint and compact size	Saves panel space
Selection can be based on motor power	Easy selection
Universal control voltage	Simplifies selection Keeps stock at a minimum
"Fit and forget" contactor design	Simplifies installation Reduces required panel space
User friendly	**Save commissioning and operating cost**
Easy to install and use	Saves time
Digitally controlled rotary switches	Secures precise settings and simplifies installation
Easy DIN rail mounting for sizes up to 15 HP	Saves time and space
Reliable	**Maximum uptime**
Robust semiconductor design	Reliable operation
Almost unlimited number of starts per hour without derating	Prevents unauthorized changes
Max. ambient temperature 50° C without derating	No external cooling or oversizing necessary



Timed voltage ramp

- Micro Soft Start Controller for motors up to 15 HP
- Extremely robust SCR design with heavy ratings as standard
- Unlimited number of starts per hour
- Contactor style design for easy selection, installation and commissioning

Power range

- MCD 100-001 . . . . .2 HP
- MCD 100-007 . . . . .10 HP
- MCD 100-011 . . . . .15 HP

All sizes are rated for line voltage up to 600 V AC.

Specifications

Mains supply (L1, L2, L3)	
MCD 100	3 x 208 VAC ~ 600 VAC (+10% / -15%)
Supply frequency (at start)	45 Hz – 66 Hz
Control circuit (A1, A2)	
MCD 100	24 – 480 VAC/VDC (-15% +10%)
Environmental	
Degree of protection MCD 100	IP 20
Operating temperatures	-5° C/+40° C (60° C with de-rating)
Pollution Degree	Pollution Degree 3
EMC Emission	
Equipment class (EMC)	Class A
Conducted radio frequency emission	
0.15 MHz – 0.5 MHz	< 90 dB (µV)
0.5 MHz – 5 MHz	< 76 dB (µV)
5 MHz – 30 MHz	80-60 dB (µV)
Radiated radio frequency emission	
30 MHz – 230 MHz	< 30 dB (µV/m)
230 MHz – 1000 MHz	< 37 dB (µV/m)

This product has been designed for Class A equipment. Use of the product in domestic environments may cause radio interference, in wich case the user may be required to employ additional mitigation methods.

EMC Immunity	
Electro static discharge	4 kV contact discharge, 8 kV air discharge
Radio-frequency electromagnetic field	
0.15 MHz – 1000 MHz	140 dB (µV)
Rated impulse withstand voltage (Fast transients 5/50 ns – Burst)	4 kV line to earth
Rated insulation voltage (Surges 1.2/50 µs – 8/20 µs)	4 kV line to earth, 2 kV line to line
Voltage dip and short time interruption	100 ms (at 40% nominal voltage)
Short Circuit	
Rated short-circuit current MCD 100-001	Normal fuses: 25 A gL/gG
SCR I2t rating for semiconductor fuses	72 A2s
Rated short-circuit current MCD 100-007	Normal fuses: 50 A gL/gG
SCR I2t rating for semiconductor fuses	1800 A2s
Rated short-circuit current MCD 100-011	Normal fuses: 80 A gL/gG
SCR I2t rating for semiconductor fuses	6300 A2s
Heat Dissipation	
MCD 100-001	Max. 4 watts
MCD 100-007 to MCD 100-011	2 watts/Ampere
Standards Approvals	
UL/C-UL	UL508
CE	IEC 60947-4-2

Dimensions

Model	Power size (HP)	Rated current (Amps)	Dimensions (in) H x W x D	Approvals
MCD100	2	3 A: 5-5:10 (AC 53b)	4.01 x 0.88 x 4.88	UL, CSA, CE
	10	15 A: 8-3: 100-3000 (AC 53a)	4.33 x 1.77 x 5.03	
	15	25 A: 6-5:100-480 (AC 53a)	4.33 x 3.54 x 5.03	

VLT® Low Harmonic Drive

Optimized

for VLT® Automation VT Drive and VLT® AutomationDrive FC 302

The Danfoss VLT® Low Harmonic Drive is the first solution combining an active filter and a drive in one package.

The VLT® Low Harmonic Drive continuously regulates harmonic suppression according to the load and grid conditions without affecting the connected motor.

The Total Harmonic Current Distortion is reduced to less then 3% at ideal conditions and to less than 5% at heavy distortion grids with up to 2% phase unbalance. As individual harmonics also fulfil toughest harmonic requirements, the VLT® Low Harmonic Drive meets all present harmonic standards and recommendations.

Unique features such as sleep mode and back channel cooling offers unmatched energy efficiency for Low Harmonic Drives.

The VLT® Low Harmonic Drive requires the same set-up and installation as a standard VLT® drive and out of the box it ensures optimum harmonic performance.

The VLT® Low Harmonic Drive has the same modular build-up as our standard high power drives and shares similar features: Built-in RFI filters, coated PCB and user-friendly programming.

Feature	Benefit
Reliable	**Maximum uptime**
No increased winding stress on motor	Longer motor lifetime Less initial cost (no output filter needed)
100% factory tested Coated PCBs	Low failure rate
Innovative cooling concept	Prolonged lifetime of electronics
User-friendly	**Saves commissioning and operating cost**
No extra wiring and set-up needed	Easy comissioning and low initial costs
Modular design	Easy serviceability
Full readout of grid conditions	Reduces needed harmonic testing
Energy saving	**Lower operation costs**
High efficiency Sleep mode and progressive switching freq.	Low running expenses
Independent of grid and load changes	Increased transformer efficiency Reduced cable losses

Voltage range

- 380 – 480 V AC 50 – 60 Hz

Power Range

150 – 850 HP High Overload/
250 – 1000 HP Normal Overload
(Matching drive frames D, E and F)

Enclosure

- IP 21/NEMA 1
- IP 54/NEMA 12

Options

The following options are available:

- RFI filters
- Disconnect
- Fuses
- Mains shielding
- Feedback and I/O options
- Fieldbus options
- dV/dt filters
- Sine wave filters

PC software

VLT® MCT 10 Setup Software

VLT® MCT 10 offers advanced programming functionality for all Danfoss drive products, greatly reducing programming and set-up time.

VLT® MCT 10 Basic (available free of charge from www.danfossdrives.com) allows access to a finite number of drives with limited functionality. The advanced edition, offering a higher level of functionality, is available from your Danfoss sales partner.

VLT® MCT 31 Harmonics Calculation Software

With VLT® MCT 31, you can determine whether harmonics will be an issue in your installation when drives are added.

VLT® MCT 31 estimates the benefits of adding various harmonic mitigation solutions from the Danfoss product portfolio and calculates system harmonic distortion. Furthermore the software provides quick indication of whether the installation complies with the most recognized harmonic norms and recommendations.

From www.danfossdrives.com you can download the free tool VLT® Harmonic Calculation MCT 31 – the most up-to-date version of the calculation software.

Specifications

THiD* at: – 40% load – 70% load – 100% load	 < 5,5% < 3,5% < 3%
Efficiency* at: – 40% load – 70% load – 100% load	 > 93% > 95% > 96%
True power factor* at: – 40% load – 70% load – 100% load	 > 98% > 98% > 98%
Ambient temperature	40° C without derating
Cooling	Back-channel air cooling

** Measured at balanced grid without pre-distortion*

Norms and recommendations	Compliance
IEEE519	Yes
IEC61000-3-4 (above 75 A)	Yes

380 – 460 VAC

Normal Overload			High Overload			Frame	Dimensions	Weight	
Power		Current	Power		Current		H x W x D		
kW	HP	[A]	kW	HP	[A]		IP 21	kg	lbs
160	250	315	132	200	260	D13	1740 x 1020 x 380 mm 68.5 x 49.6 x 14.9 inches	306.6	676
200	300	395	160	250	315			306.6	676
250	350	480	200	300	395			306.6	676
315	450	600	250	350	480	E9	2000 x 1200 x 500 mm 78.7 x 56.7 x 19.7 inches	676.2	1491
355	500	658	315	450	600			676.2	1491
400	625	745	355	500	658			676.2	1491
450	700	800	400	625	695			676.2	1491
500	780	880	450	700	800	F18	2200 x 2800 x 600 mm 86.6 x 145.6 x 23.6 inches	1899	4187
560	875	990	500	780	880			1899	4187
630	985	1120	560	875	990			1899	4187
710	1100	1260	630	985	1120			1899	4187

VLT® 12-pulse drive

Robust and cost effective harmonic solution for the higher power range. The Danfoss VLT® 12-pulse drive offers reduced harmonics for demanding industry applications above 350 HP.

The VLT® 12-pulse is a high efficiency variable frequency converter which is built with the same modular design as the popular 6-pulse VLT® drives. It is offered with similar drive options and accessories and can be configured according to customer need.

Together with the needed 30°-phase shifting transformer the solution provides durability and reliability at a low cost.

Under ideal grid conditions the solution eliminates the 5th, 7th, 17th and 19th harmonics and results in a THiD of around 12% at full load.

The needed transformer makes this solution ideal for applications where stepping down from medium voltage is required or where isolation from the grid is needed.

The Danfoss VLT® 12-pulse drive provides harmonic reduction without adding capacitive or inductive com-ponents which often require network analysis to avoid potential system resonance problems.

Feature	Benefit
Reliable	**Maximum uptime**
Maintenance free	No running expenses
Durability	Long lifetime
Coated PCBs	Environmental robustness
100% factory tested	Low failure rate
Back-channel cooling	Prolonged lifetime of electronics
Design	**Easy operation and user-friendly set-up**
Modular design	Easy serviceability
Same easy programming as a 6-pulse drive	User-friendly operation
Standard award-winning control panel (LCP) Available in 27 languages	Effective commissioning and operation

Power Range

- 350 - 1400 HP

Voltage Range

- 380 -500 VAC
- 525 - 690 VAC

Enclosure

- IP 21/NEMA Type 1
- IP 54/NEMA Type 12

Options

The following options are available:

- RFI filters
- Disconnect
- Fuses
- Mains shielding
- Feedback and I/O options
- Fieldbus options
- dV/dt filters
- Sine wave filters

PC software

VLT® MCT 10 Setup Software

VLT® MCT 10 offers advanced programming functionality for all Danfoss drive products, greatly reducing programming and set-up time.

VLT® MCT 10 Basic (available free of charge on www.danfossdrives.com) allows access to a finite number of drives with limited functionality. The advanced edition, offering a higher level of functionality, is available from your Danfoss sales partner.

VLT® MCT 31 Harmonics Calculation Software

With VLT® MCT 31 you can determine whether harmonics will be an issue in your installation when drives are added.

VLT® MCT 31 estimates the benefits of adding various harmonic mitigation solutions from the Danfoss product portfolio and calculates system harmonic distortion.

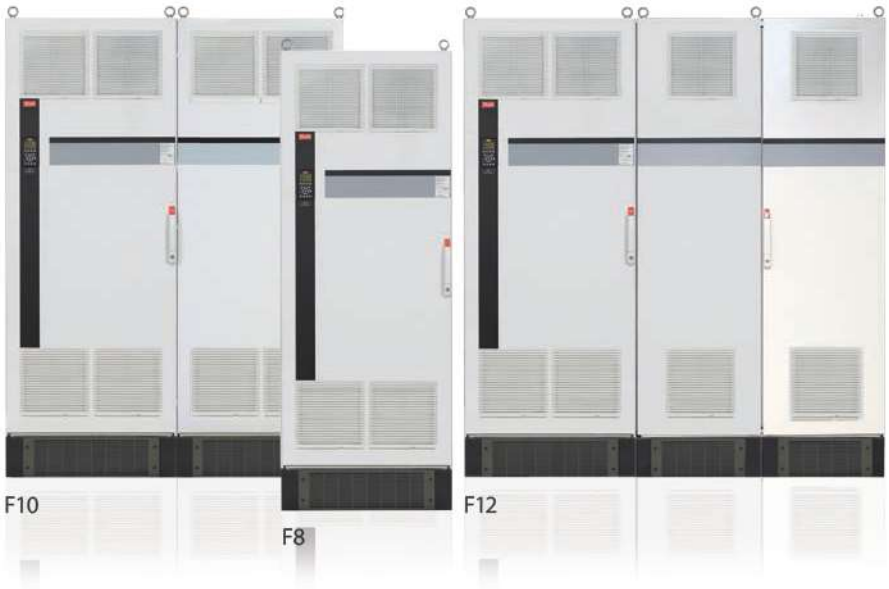
From www.danfossdrives.com you can download the free tool VLT® Harmonic Calculation MCT 31.

Specifications

THiD* at: – 40% load – 70% load – 100% load	 20% 14% 12%
Efficiency* at: – 40% load – 70% load – 100% load	 95% 97% 98%
True power factor* at: – 40% load – 70% load – 100% load	 91% 95% 97%
Ambient temperature	45° C without derating
Cooling	Back-channel air cooling

** Measured at balanced grid without pre-distortion*

Norms and recommendations	Compliance
IEEE519	Depends on grid and load conditions
IEC61000-3-4 (above 75 A)	Yes



460 V AC				690 V AC					
Normal Overload		High Overload		Normal Overload		High Overload		Frame	Dimensions HxWxD IP 21 [in]
Power [HP]	Current [A]	Power [HP]	Current [A]	Power [kW]	Current [A]	Power [kW]	Current [A]		
450	540	350	443	400	450	355	380	F8	89.76 x 31.49 x 23.89
500	590	450	540	500	500	400	410		
550	678	500	590	560	570	500	500	F9 w. options cabinet	89.76 x 55.11 x 23.89
600	730	550	678	630	630	560	570		
650	780	600	730	710	730	630	630	F10	89.76 x 62.99 x 23.89
750	890	650	780	800	850	710	730		
900	1050	750	890	900	945	800	850	F11 w. options cabinet	89.76 x 86.61 x 23.89
1000	1160	900	1050						
1200	1380	1000	1160	1000	1060	900	945	F12	89.76 x 89.76 x 23.89
1350	1530	1200	1380	1200	1260	1000	1160	F13 w. options cabinet	89.76 x 102.36 x 23.89
				1400	1415	1200	1260		

VLT® Advanced Active Filter AAF 006

Perfect

for industrial automation, high dynamic applications and safety installations

A flexible and adaptable solution for central or de-central harmonic mitigation.

Danfoss Advanced Active Filters can compensate for individual VLT® drives or can be installed as a compact stand-alone solution at a common point of coupling, compensating for several loads simultaneously.

The filter ensures optimal harmonic suppression independent of the number of loads and their individual load profile. In addition the active filter corrects the power factor and balances the phase load providing an optimal energy utilization.

This improves the system efficiency and increases the grid robustness to avoid downtime.

The extensive re-use of proven VLT® components and the modular construction ensures a high reliability and at the same time offers high energy efficiency, back channel cooling and high enclosure grades without size encrease.

Feature	Benefit
Reliable	**Maximum uptime**
100% factory tested Coated PCBs >90% components re-used from proven VLT® FC series	Low failure rate
Innovative cooling concept	Prolonged lifetime of electronics
User-friendly and flexible	**Saves commissioning and operating cost**
Innovative programming possibilities	Low running expenses
Modular design	Easy serviceability
Wide range of options	Low initial investment High degree of customisation
Energy saving	**Lower operation costs**
High efficiency Sleep mode and progressive switching freq. Power factor correction	Low running expenses

The VLT® Advanced Active Filter is easily controlled via the user-friendly LCP, sharing design and programming structure with the VLT® drives series.

Without dismounting existing installation, the VLT® Advanced Active Filters are easily retrofitted to the existing installation, where harmonics are increased because of enlarged employment of non-linear loads such as variable speed drives.

Voltage range

380 – 480 V AC 50 – 60 Hz

Current range

190 A, 250 A, 310 A, 400 A.
Up to 4 units can be paralleled for higher power.

Enclosure degree

- IP 21/NEMA Type 1
- IP 54/NEMA Type 12

Options

The following options are available:

- RFI filters
- Disconnect
- Fuses
- Mains shielding

PC software

VLT® MCT 10 Setup Software

VLT® MCT 10 offers advanced programming functionality for all Danfoss drive products, greatly reducing programming and set-up time.

VLT® MCT 10 Basic (available free of charge from www.danfossdrives.com) allows access to a finite number of drives with limited functionality.
The advanced edition, offering a higher level of functionality, is available from your Danfoss sales partner.

VLT® MCT 31 Harmonics Calculation Software

With VLT® MCT 31, you can determine whether harmonics will be an issue in your installation when drives are added.

VLT® MCT 31 estimates the benefits of adding various harmonic mitigation solutions from the Danfoss product portfolio and calculates system harmonic distortion. Furthermore the software provides quick indication of whether the installation complies with the most recognized harmonic norms and recommendations.

From www.danfossdrives.com you can down-load the free tool VLT® Harmonic Calculation MCT 31 – the most up-to-date version of the calculation software.

Specifications

THiD* at: – 40% load – 70% load – 100% load	 < 7% < 5,5% < 5%
Efficiency* at: – 40% load – 70% load – 100% load	 > 95% > 98% > 98%
True power factor* at: – 40% load – 70% load – 100% load	 > 0,98 > 0,98 > 0,98
Ambient temperature	45° C
Cooling	Back-channel air cooling

** Measured at balanced grid without pre-distortion and with VLT® drive matching full load demand*

Norms and recommendations	Compliance
IEEE519	Application and load dependent

380 – 480 V AC					
Total Current [A]	Max. Reactive [A]	Max. Harmonic [A]	Frame	Dimensions H x W x D mm [Inches]	Weight Kg [Lbs]
190	190	170	D14	1740 x 600 x 380 [68,2 x 33,5 x 15,0]	283 [623]
250	250	225	E1	2000 x 600 x 500 [78,7 x 33,5 x 19,4]	476 [1047]
310	310	280			
400	400	360			498 [1096]

Total Current [A]	Max. individual harmonic compensation [A]							
	I_5	I_7	I_{11}	I_{13}	I_{17}	I_{19}	I_{23}	I_{25}
190	119	85	55	48	34	31	27	24
250	158	113	72	63	45	40	36	32
310	196	140	90	78	56	50	45	40
400	252	180	115	100	72	65	58	50

VLT® Advanced Harmonic Filter

Perfect

for industrial automation, high dynamic applications and safety installations

Optimized harmonic performance with the VLT® FC series up to 350 HP.

The Danfoss Advanced Harmonic Filters have been specially designed to match the Danfoss frequency converters for unmatched performance and design.

Compared to traditional harmonic trap filters they offer a smaller foot print and higher harmonic reduction.

The solution is available in two variants, AHF 005 and AHF 010. When connected in front of a Danfoss VLT® frequency converter, the harmonic current distortion generated back to the mains is reduced to 5% and 10% Total Harmonic Current Distortion at full load.

With a >98% efficiency the passive Advanced Harmonic Filters offer cost effective and very robust harmonic solutions specifically for power up to 350 HP.

As stand-alone options the advanced harmonic filters feature a compact housing that is easily integrated into existing panel space. This makes them well-suited for retrofit applications with limited adjustments of the frequency converter.

Feature	Benefit
Reliable	**Maximum uptime**
100% factory tested Based on proven and tested filter concept	Low failure rate
Energy saving	**Lower operation costs**
High efficiency Electrically matched to the individual VLT® FC drives	Low running expenses
Design	**Compact and aesthetic enclosure**
Innovative coil design Side-by-side mounting Optimized for mounting in panels	Smaller footprint Less wall space needed
Easy commissioning	Low commissioning costs
Enclosure size and color matches	Danfoss look and feel

Line Voltage

- 380 – 415 V AC (50 and 60 Hz)
- 440 – 480 V AC (60 Hz)
- 500 – 525V (50 Hz)*
- 690 V (50 Hz)*

Filter current

- 10 A – 480 A (380 – 415 V, 50/60 Hz)
- 10 A – 436 A (440 – 480 V, 60 Hz)
- (Modules can be paralleled for higher power)

Enclosure degree

- IP 20/IP 00

Options

The following options are available:

- P 21/NEMA 1 kit

PC software

VLT® MCT 10 Setup Software

VLT® MCT 10 offers advanced programming functionality for all Danfoss drive products, greatly reducing programming and set-up time.

VLT® MCT 10 Basic (available free of charge from www.danfossdrives.com) allows access to a finite number of drives with limited functionality.

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VLT® MCT 31 Harmonics Calculation Software

With VLT® MCT 31, you can determine whether harmonics will be an issue in your installation when drives are added.

VLT® MCT 31 estimates the benefits of adding various harmonic mitigation solutions from the Danfoss product portfolio and calculates system harmonic distortion. Furthermore the software provides quick indication of whether the installation complies with the most recognized harmonic norms and recommendations.

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Specifications

	AHF 010	AHF 005
THiD* at: – 40% load – 70% load – 100% load	 ~ 12% ~ 11% < 10%	 ~ 7% ~ 6% < 5%
Efficiency* at 100% load	>98.5%	
True power factor* at: – 40% load – 70% load – 100% load	 ~ 81% ~ 96% > 99%	 ~ 80% ~ 95% > 98%
Ambient temperature	45° C without derating	
Cooling	Back-channel air cooling	

** Measured at balanced grid without pre-distortion*

Norms and recommendations	Compliance
IEEE519	AHF 005 Yes AHF 010 Determined by Grid and load conditions
IEC61000-3-2 (up to 16 A)	Yes
IEC61000-3-12 (between 16 and 75 A)	Yes
IEC61000-3-4 (above 75 A)	Yes

Enclosures

380–415 V 50/60 Hz	440–480 V 60 Hz	Enclosure Type	
Current [A]	Current [A]	AHF010	AHF005
10	10	X1	X1
14	14	X1	X1
22	19	X2	X2
29	25	X2	X2
34	31	X3	X3
40	36	X3	X3
55	48	X3	X3
66	60	X4	X4
82	73	X4	X4
96	95	X5	X5
133	118	X5	X5
171	154	X6	X6
204	183	X6	X6
251	231	X7	X7
304	291	X7	X7
325	355	X7	X7
381	380	X7	X8
480	436	X7	X8

Dimensions

Enclosure Type	Dimensions in inches		
	A (height)	B (width)	C (depth)
X1	31.07	7.48	8.11
X2	17.71	9.13	9.76
X3	23.38	14.88	9.52
X4	24.56	14.88	13.11
X5	29.09	16.45	13.11
X6	30.62	16.45	23.46
X7	35.78	18.42	17.67
X8	35.86	18.42	21.37

VLT® Common Mode Filters

Effective

kit to reduce electromagnetic interference

High-frequency common-mode core kit reduce electromagnetic interference and eliminate bearing damage by electrical discharge.

High-frequency common-mode (HF-CM) cores are special nanocrystalline magnetic cores which have superior filtering performance compared to regular ferrite cores. They act like a common-mode inductor (between phases and ground).

Installed around the three motor phases (U, V, W), they reduce high-frequency common-mode currents. As a result, high-frequency electromagnetic interference from the motor cable is reduced. However, the core kit should not be used as the sole mitigation measure, and even when the cores are used, the EMC installation rules shall be followed.

Feature	Benefit
High-performance nanocrystalline magnetic material	Effective reduction of electrical discharges in the motor bearings Reduces bearing wear-out, maintenance costs and down-time Reduces high-frequency electromagnetic interference from the motor cable
Oval shape Scalable solution: longer cables handled by stacking more cores	Easy to install in restricted places such as the VLT® enclosure or the motor terminal box
Only 4 core sizes cover the entire VLT® power range	Easy logistics, fast delivery and comprehensible product program Allows the addition to a service tool-kit
Low investment	Cost-effective alternative to, for example, sine-wave filters if the only phenomena to be mitigated is bearing wear-out through electrical discharge

Prevent motor bearing currents

The most important function is to reduce high-frequency currents associated with electrical discharges in the motor currents. These discharges contribute to the premature wear-out and failure of motor bearings. By reducing or even eliminating discharges, the wear-out of the bearings is reduced and the lifetime extended. Thus, maintenance and down-time costs are lowered.

Ideal for retrofitting

Bearing current problems are most often discovered after commissioning. Therefore, the cores have an oval shape which makes them ideal for retrofitting and for installation in restricted places.

Only 4 variants cover the entire VLT® product range making it possible to carry these valuable aids in a service tool kit.

A flexible solution

The cores can be combined with other output filters, and especially in combination with dV/dt filters they offer a low cost solution for protection of both motor bearings and insulation.

Product range

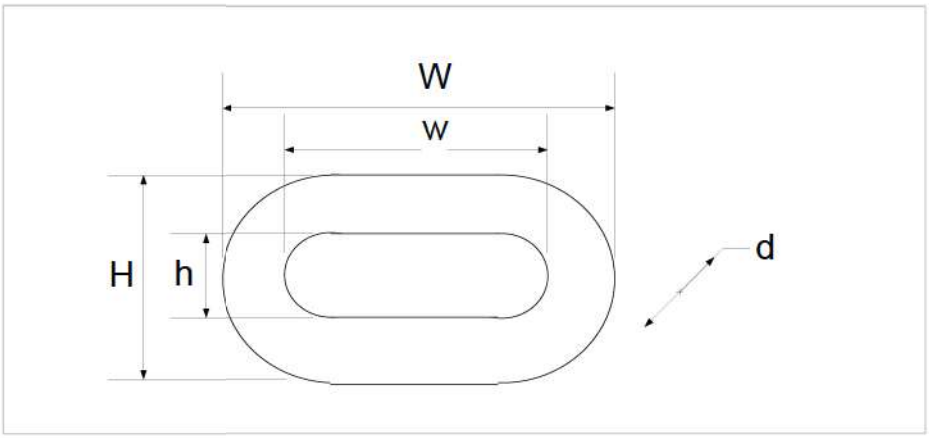
- Available for all power sizes from 1/4 – 1900 HP
- 4 core sizes cover the entire VLT® power range

HF-CM selector

The cores can be installed at the frequency converter's output terminals (U, V, W) or in the motor terminal box. When installed at the frequency converter's terminals, the HF-CM kit reduces bearing stress and high-frequency electromagnetic interference from the motor cable. The number of cores depends on motor cable length and frequency converter voltage. A selection table is shown to the right.

Cable length [inches]	A and B frame		C frame		D frame		E and F frame	
	T5	T7	T5	T7	T5	T7	T5	T7
150	2	4	2	2	2	4	2	2
350	4	4	2	4	4	4	2	4
500	4	6	4	4	4	4	4	4
1000*	4	6	4	4	4	6	4	4

** Longer cable lengths are easily handled by stacking more HF-CM cores.*



Ordering numbers and dimensions

Ordering numbers for the core kits (2 cores per package) are given in the table below.

VLT* Frame Size	Core dimension [mm]					Weight	Packaging dimension
	W	w	H	h	d	[lbs]	[inches]
A and B	2.36	1.69	1.57	0.98	0.87	0.55	5.12 x 3.94 x 2.76
C	4.02	2.72	2.40	1.10	1.46	3.52	7.48 x 3.94 x 2.76
D	7.44	5.63	4.96	3.15	1.46	5.4	9.25 x 7.48 x 5.51
E and F	12.01	9.80	5.79	3.74	1.46	10.03	11.42 x 10.24 x 4.33

Installation

The HF-CM cores are easy to install: Simply pass the three motor phase leads (U, V, W) through the cores.

VLT® Power Option Sine-wave Filter

Perfect

match for applications with older motors, aggressive environments, frequent braking, 690 V with general purpose motors, motor cable lengths above 500 feet

Sine-wave output filters are low-pass filters that suppress the switching frequency component from the drive and smooth out the phase-to-phase output voltage of the drive to become sinusoidal. This reduces the motor insulation stress and bearing currents.

Sine-wave output filters are low-pass filters that suppress the switching frequency component from the drive and smooth out the phase-to-phase output voltage of the drive to become sinusoidal. This reduces the motor insulation stress and bearing currents.

By supplying the motor with a sinusoidal voltage waveform, the switching acoustic noise from the motor is also eliminated.

Thermal losses and bearing currents

The sinusoidal voltage supply to the motor reduces hysteresis thermal losses in the motor. Since the motor insulation lifetime is dependent on the motor temperature, the sine-wave filter prolongs the lifetime of the motor.

The sinusoidal motor terminal voltage from the sine-wave filter furthermore has the advantage of suppressing any bearing currents in the motor. This reduces the risk of flashover in the motor bearings and thereby also contributes to extended motor lifetime and increased service intervals.

Feature	Benefit
Supplies the motor with a sinusoidal voltage waveform	Prevents flashover in motor windings
Eliminates over-voltages and voltage spikes caused by cable reflections	Protects the motor insulation against premature aging
Reduces electromagnetic interference by eliminating pulse reflection caused by current ringing in the motor cable. This allows the use of unshielded motor cables in some applications.	Trouble-free operation
Eliminates acoustic noise in motor	Noiseless motor operation
Reduces high frequent losses in motor	Prolongs service interval of motor

Quality and Design

All filters are designed and tested for operation with the VLT® AutomationDrive. They are rated for the nominal switching frequency of the VLT® FC series and therefore no derating of the drive is needed.

The enclosure is designed to match the look and quality of the VLT® FC series drives.

Advantages

- Compatible with all control principles including flux and VVC+
- Parallel filter installation is possible for applications in the high power range

Range

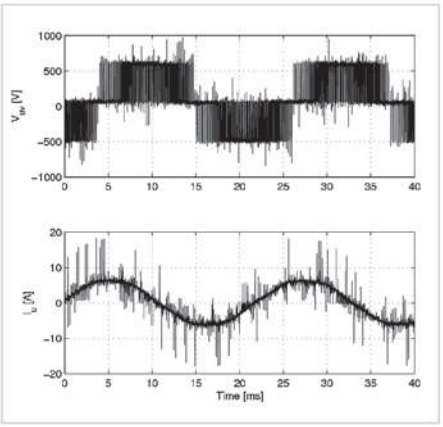
3 x 200 – 500 V, 2.5 – 800 A
3 x 525 – 690 V, 13 – 660 A

Enclosures

- IP 00 and IP 20 wall-mounted enclosure up to 75 A (500 V)/ 13 A (690 V)
- IP 23 floor-standing enclosure from 115 A (500 V)/28 A (690 V)

Mounting

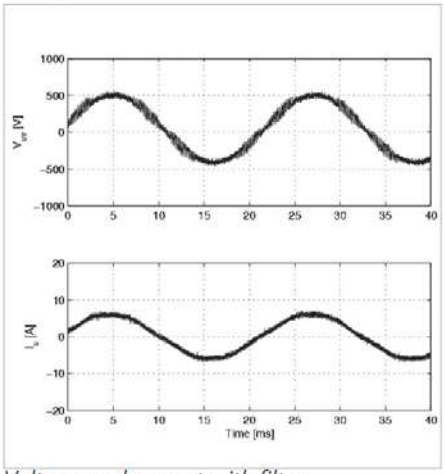
- Side by side mount with the drive up to 75 A (500 V)



Voltage and current without filter

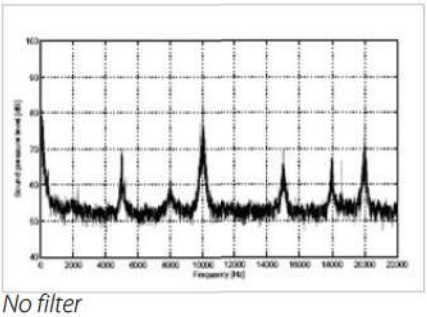
Specifications

Voltage rating	3 x 200 – 500 V and 3 x 525 – 690 V
Nominal current I_N @ 50 Hz	2.5 – 800A for higher power modules can be paralleled
Motor frequency	0 – 60 Hz without derating 100/120 Hz (up to 10 A) with derating
Ambient temperature	-25° to 45°C without derating
Min. switching frequency	f_{min} 1,5 kHz – 5 kHz depending on filter type
Max. switching frequency	f_{max} 8 kHz
Overload capacity	160% for 60 sec every 10 min.
Enclosure degree	IP 00/IP 20/IP 23 (ref. page 1)
Approvals	CE, UL508

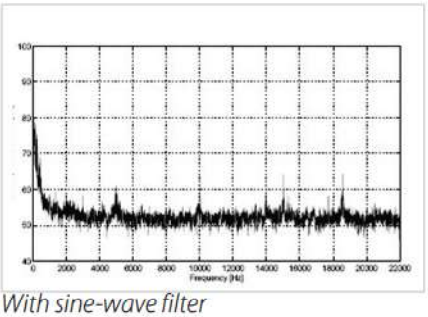


Voltage and current with filter

Relative sound pressure measurements from the motor with and without sine-wave filter



No filter



With sine-wave filter

Performance Criteria	dV/dt filters	Sine-wave filters
Motor insulation stress	Up to 100 m (350 ft) cable (shielded/unshielded) complies with the requirements of IEC60034-17* (general purpose motors). Above this cable length the risk of "double pulsing" increases.	Provides a sinusoidal phase-to-phase motor terminal voltage. Complies with IEC-60034-17* and NEMA-MG1 requirements for general purpose motors with cables up to 500 m (1650 ft) (1 km (3,250 ft) for frame size D and above).
Motor bearing stress	Slightly reduced, mainly in high power motors.	Reduces bearing currents caused by circulating currents. Does not reduce common-mode currents (shaft currents).
EMC performance	Eliminates motor cable ringing. Does not change the emission class. Does not allow longer motor cables as specified for the frequency converter's built-in RFI filter.	Eliminates motor cable ringing. Does not change the emission class. Does not allow longer motor cables as specified for the frequency converter's built-in RFI filter.
Max. motor cable length	100 m ... 150 m (350 – 500 ft) With guaranteed EMC performance: 150 m (500 ft) screened Without guaranteed EMC performance: 150 m (500 ft) unscreened	With guaranteed EMC performance: 150 m (500 ft) shielded and 300 m (1000 ft) unshielded (only conducted emissions). Without guaranteed EMC performance: up to 500 m (1650 ft) (1 km (3250 ft) for frame size D and above).
Acoustic motor switching noise	Does not eliminate acoustic switching noise from the motor.	Eliminates acoustic switching noise from the motor caused by magnetostriction.
Relative size	15 – 50% (depending on power size).	100%
Relative price	50%	100%

**Not 690 V*

VLT® Power Option dV/dt Filter

Perfect

match for applications with: short motor cables up to 500 ft, older motors, aggressive environments, or frequent braking

dV/dt filters reduce the dV/dt values on the motor terminal phase-to-phase voltage – an issue that is important for short motor cables.

dV/dt filters are differential-mode filters which reduce motor terminal phase-to-phase peak voltages spikes and reduce the rise time to a level that lowers the stress on the insulation of motor windings.

Compared to sine-wave filters, the dV/dt filters have a cut-off frequency above the switching frequency. The voltage at the motor terminals is still PWM pulse shaped, but the rise time and Vpeak are reduced. They are smaller, weigh less and have a lower price compared to sine-wave filters. Furthermore, because of the smaller inductance and capacitance, the dV/dt filters introduce a negligible reactance between inverter and motor and are therefore suitable for high dynamic applications.

Superior compared to output chokes

Output chokes cause undamped oscillations at the motor terminals which increase the risk of double pulsing and over-voltages higher than twice the DC link voltage.

Feature	Benefit
Reduces dV/dt stresses	Increases motor service interval
Lowers the magnetic interference propagation on surrounding cables and equipment	Trouble-free operation
Low voltage drop makes dV/dt filters the ideal solution for highly dynamic applications with flux vector regulation	Small size and cost compared to sine-wave filters

The dV/dt filters are low-pass L-C filters with a well defined cut-off frequency. Therefore the ringing oscillations at the motor terminals are damped and there is a reduced risk of double pulsing and voltage peaks.

Quality and Design

All dV/dt filters are designed and tested for operation with the VLT® AutomationDrive FC 302, VLT® AQUA Drive FC 202, and the VLT® HVAC Drive FC 102. They are designed to match the look and quality of the VLT® FC series drives.

Advantages

- Compatible with all control principles, including flux and WC+
- Parallel filter installation is possible for applications in the high power range

Range

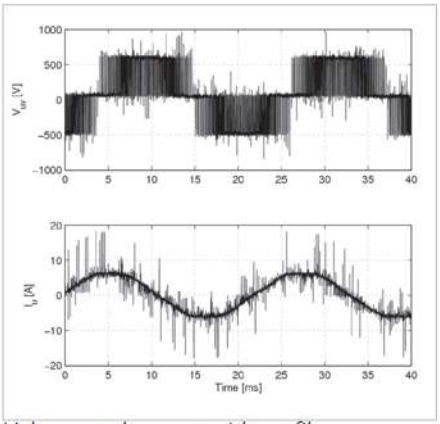
3 x 200 – 690 V (up to 880 A)

Enclosures

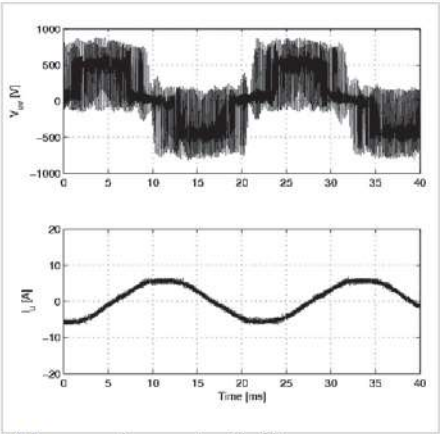
- IP 00 and IP 20/23 enclosure in the entire power range.
- IP 54/NEMA 12 enclosure available up to 180 A.

Mounting

- Side by side mounting with the drive
- Filters wall mounted up to 480 A (380 V) and floor mounted above that size



Voltage and current without filter

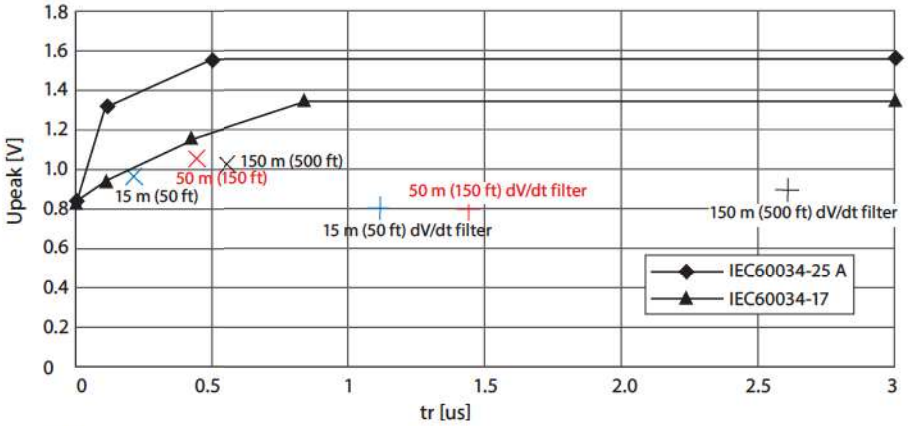


Voltage and current with filter

Specifications

Voltage rating	3 x 200 – 690 V
Nominal current I_N @ 50 Hz	44 – 880 A @ 200 – 380 V, 40 – 780 A @ 460 V 32 – 630 A @ 600 V and 27 – 630 A @ 690 V for higher power modules can be paralleled
Motor frequency	0 – 60 Hz without derating Max. 100 Hz (with derating)
Ambient temperature	-25° to 45° C without derating
Max. switching frequency	f_{sw} 1,5 kHz – 4 kHz depending on filter type
Mounting	Side-by-side
Overload capacity	160% for 60 sec every 10 min.
Enclosure degree	IP 00, IP 20/23 and IP 54
Approvals	CE, UL508

dV/dt limit curves



The dV/dt value decreases with the motor cable length whereas the peak voltage increases. Therefore it is recommended to use sine-wave filters in installations with motor cable lengths above 150 m (500 ft).

Performance Criteria	dV/dt filters	Sine-wave filters
Motor insulation stress	Up to 100 m (350 ft) cable (shielded/unshielded) complies with the requirements of IEC60034-17* (general purpose motors). Above this cable length the risk of "double pulsing" increases.	Provides a sinusoidal phase-to-phase motor terminal voltage. Complies with IEC-60034-17* and NEMA-MG1 requirements for general purpose motors with cables up to 500 m (1650 ft) (1 km (3,250 ft) for frame size D and above).
Motor bearing stress	Slightly reduced, mainly in high power motors.	Reduces bearing currents caused by circulating currents. Does not reduce common-mode currents (shaft currents).
EMC performance	Eliminates motor cable ringing. Does not change the emission class. Does not allow longer motor cables as specified for the frequency converter's built-in RFI filter.	Eliminates motor cable ringing. Does not change the emission class. Does not allow longer motor cables as specified for the frequency converter's built-in RFI filter.
Max. motor cable length	100 m ... 150 m (350 - 500 feet) With guaranteed EMC performance: 150 m (500 feet) screened Without guaranteed EMC performance: 150 m (500 feet) unscreened	With guaranteed EMC performance: 150 m (500 ft) shielded and 300 m (1000 ft) unshielded (only conducted emissions). Without guaranteed EMC performance: up to 500 m (1650 ft) (1 km (3,250 ft) for frame size D and above).
Acoustic motor switching noise	Does not eliminate acoustic switching noise from the motor.	Eliminates acoustic switching noise from the motor caused by magnetostriction.
Relative size	15 – 50% (depending on power size).	100%
Relative price	50%	100%

Not 690 V

VLT® Motion Control Tool MCT 10

Perfect

tool for
– Commissioning
– Servicing
– Programming

The VLT® Motion Control Tool, MCT 10, is ideal for commissioning and servicing the drive including guided programming of cascade controller, real-time clock, smart logic controller and preventive maintenance.

The setup software provides easy control of details as well as a general overview of systems, large or small.

The tool handles all drive series, VLT® Advanced Active Filters and VLT® Soft Starter related data.

More efficient service organization

- Scope & logging: analyze problems easily
- Read out alarms, warnings and fault log in one view.
- Compare saved project with on-line drive
- Update drive or option firmware. One tool handling all

More efficient commissioning

- Off-line commissioning off site
- Save/send/mail projects anywhere
- Easy field-bus handling, multiple drives in project file. Enables service organization to be more efficient

Feature	Benefit
One PC tool for all tasks	Save time
"Explorer-like" view	Easy to use
Option programming	Save time
Online and offline commissioning	Flexible and save cost
Scope & logging	Easy and fast analyzing – less downtime
Alarm history	Easy fault finding
Multiple interfaces	Easy connection
USB connection	Easy connection
Flexible Ethernet connection	Easy connection – save time (utilizing all Danfoss Ethernet based fieldbus options)

Basic version

- Off –line commissioning (max. 4 drives)
- Scope & Graph (max. 2 channels)
- Multiple fieldbus support
- Alarm history in saved projects
- MCO 305 support
- Graphical Smart Logic Controller
- Graphical Clock functions, Timebased Actions, Preventive Maintenance and Basic Cascade Controller (FC 102/FC 202 only)
- Update drive support to support new firmware (future compatible)
- FC drive conversion (FC 102/FC 202 & FC 300 series)

Advanced version

- Basic version functionality +
- No limitation in number of drives
- Scope & Graph (max. 8 channels)
- Real Time Logging from drive
- Motor Database
- Graphical Sensorless pump control
- Graphical Extended Cascade Controller
- Full Customer Specific Initialization File support (to be supported in January)
- Full drive password protection support (To be supported in January)

Fieldbusses

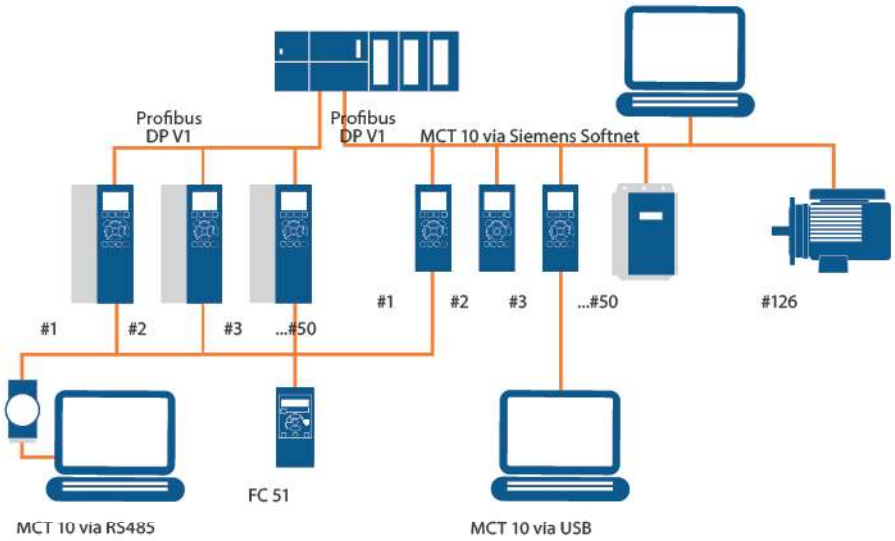
- ProfiBus DP-V1
- RS485
- USB
- Ethernet-TSC

Internet download

http://www.danfossdrives.com

System requirements

- MS Windows® NT 4.0, 2000, XP, Vista or 7
- Pentium III 350 MHz or better
- 512 MB RAM or better
- 200 MB free hard disk space
- CD-ROM drive
- VGA or XGA graphic adapter



VLT® MCT 31
Harmonics Calculation Software

Perfect

tool for application specific simulations, various power supply sources, norm compliance indication, project documentation

With VLT® MCT 31, you can determine whether harmonics will be an issue in your installation when drives are added. VLT® MCT 31 estimates the benefits of adding various harmonic mitigation solutions from the Danfoss product portfolio and calculates system harmonic distortion.

Save money and reduce running costs

On the basis that it is better to avoid a problem rather than cure one after it happens, it is preferable to calculate the effect of installing non-linear loads before doing so, to estimate the degree of harmonic distortion that may result. Trying to achieve this on a spreadsheet basis can be time consuming and inaccurate.

To help, Danfoss offers free to download, the VLT® Harmonic Calculation Tool MCT 31, a simple to use and fast software tool for calculating the harmonic disruption from your existing or intended drives installation.

A fast estimate is vital as, in this case, more is not better, simply more costly, so the MCT 31 can help save money when selecting harmonic mitigation solutions. Simply over-specifying a harmonic mitigation solution will lead to unnecessary initial cost escalation and increased running expenses.

Feature	Benefit
Explore-like view	Easy to use
Simple simulation model with less parameters	Easy to use and fast simulation – saves time
Configurable for various Power supply sources	Matching all customer needs
One tool supporting all Danfoss harmonic mitigation solutions	Matching all customer needs
Configurable Norm compliance indication	Save time
User configurable Report gation solutions	Project documentation
Simulate the setup before installation	Saves time and money. Prevent problems appear later

Calculate the harmonic disturbance

The MCT 31 tool can easily be used to evaluate the expected grid quality and includes a range of passive and active counter-measures which can be selected to ease system stress.

The power quality impact of electronic devices can be estimated in the frequency range up to 2.5 kHz, depending on the system configuration and standard limits.

The analysis includes indication of compliance with various standards and recommendations.

The Windows-like interface of the MCT 31 tool makes possible intuitive operation of the software. It is built with a focus on user-friendliness and the complexity is limited to system parameters that are normally accessible.

The Danfoss VLT® frequency converter and mitigation equipment data is already pre-loaded, allowing fast data entry.

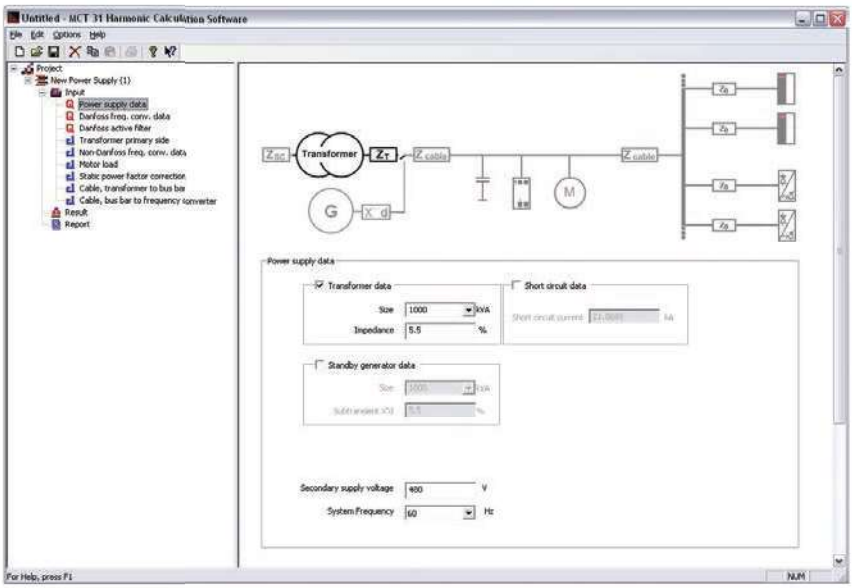
Your local Danfoss consultant will be very happy to provide all the assistance you need to evaluate your power quality and guide the selection of the correct mitigation for your circumstances.

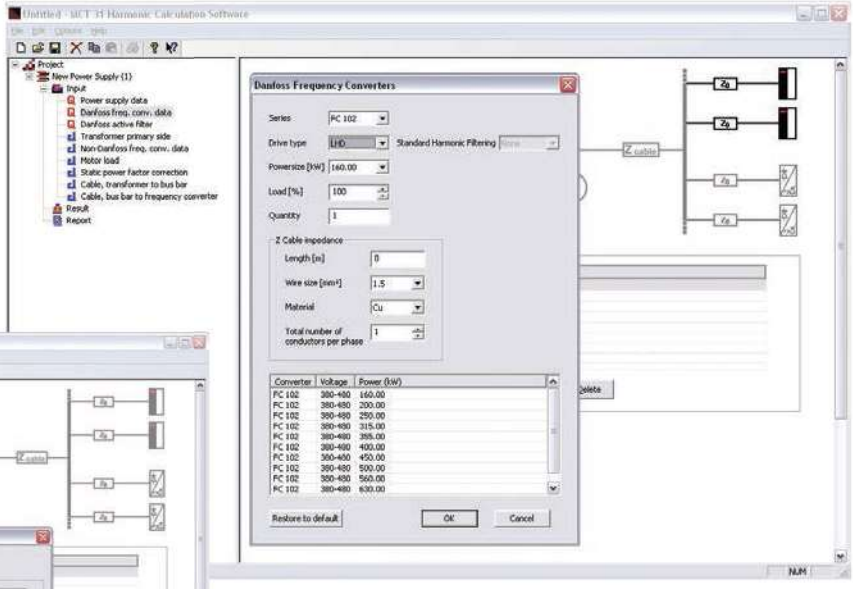
Internet download

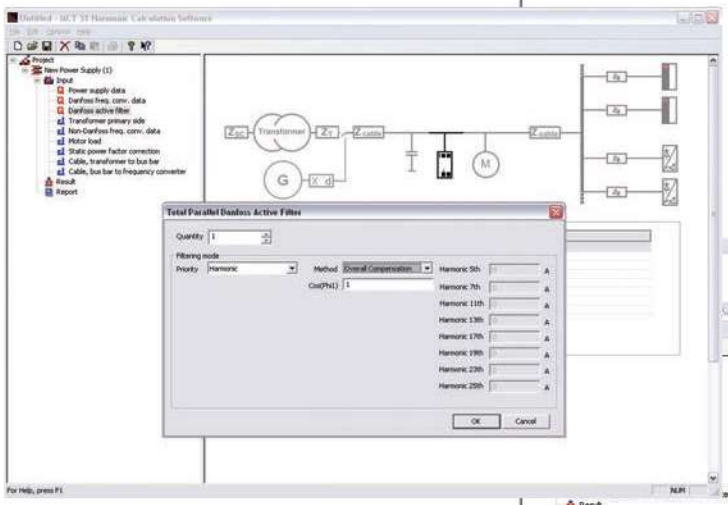
http://www.danfossdrives.com

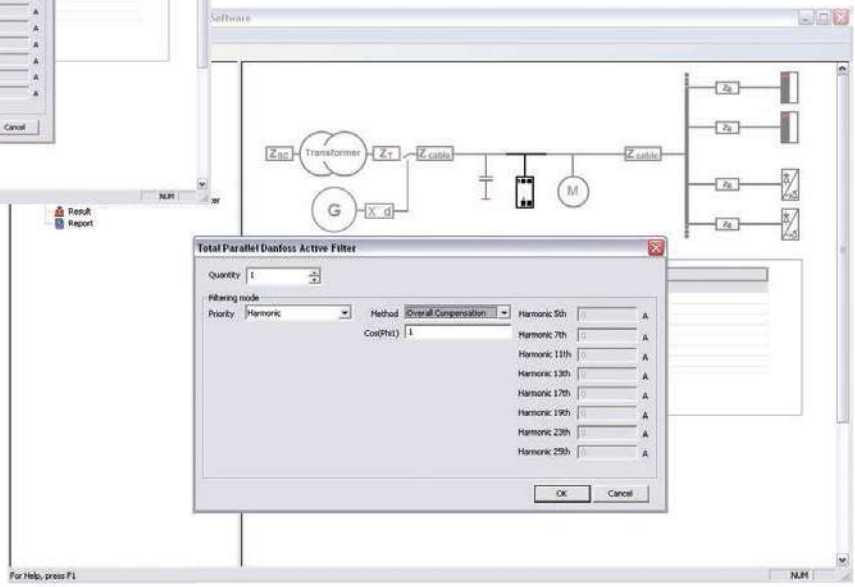
System requirements

- MS WindowsR NT 4.0, 2000, XP, Vista or 7
- Pentium III 350 MHz or better
- 512 MB RAM or better
- 200 MB free hard disk space
- CD-ROM drive
- VGA or XGA graphic adapter









VLT® Energy Box

Perfect

tool for:
– Obtaining energy savings
– Calculating pay-back time

With VLT® Energy Box software you can both theoretically in project face estimate and afterwards physically validate your real energy savings and reductions in your carbon footprint – from your desk.

VLT® Energy Box makes energy consumption calculations of fan, pump and cooling tower applications driven by VLT® Drives from Danfoss and compares it with alternative methods of flow control.

The program compares the total operation costs of various traditional systems compared to operation of the same system with a VLT® HVAC Drive.

With VLT® Energy Box software you can both theoretically in project face estimate and afterwards physically validate your real energy savings and reductions in your carbon footprint – also from your desk. The VLT® Energy Box communicates with the drives through the USB/RS485 protocol and can read all data about duty cycles and energy consumptions.

Data about duty cycles and energy consumptions can be requested remotely from the VLT® HVAC Drive, making it easy to monitor your energy savings and return on investment. Monitoring via fieldbus often makes energy meters omissible.

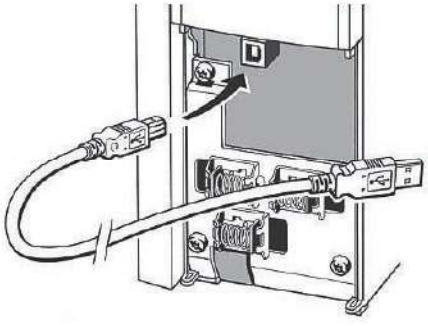
Feature	Benefit
Estimate savings	– Make purchase decision easy
Calculates pay back based on investments and annual costs	– Economical overview
Generates a report	– Easy communication
Special cooling tower mode based on climate data	– Easy calculation
Possible to adjust climate region to local conditions	– More accurate calculations
Download of energy data from the drive via serial communication and USB	– Facilitates the drives payback function – Visualize actual load profile
Covers several projects and systems in same file	– Generation of common project report

The software allows you to upload real trend and energy data, to present multiple systems in one report and to calculate energy consumption for cooling towers.

Complete financial analysis

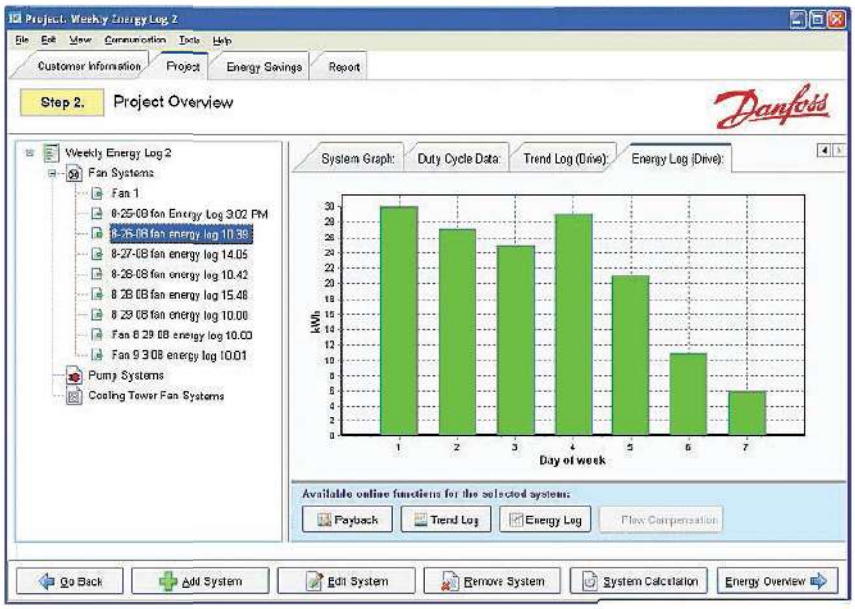
VLT® Energy Box provides a complete financial analysis including:

- Initial cost for the drive system and the alternative system
- Installation and hardware costs
- Annual maintenance costs and any utility company incentives for installation of energy conservation products
- Payback time and accumulated savings are calculated



No nonsense

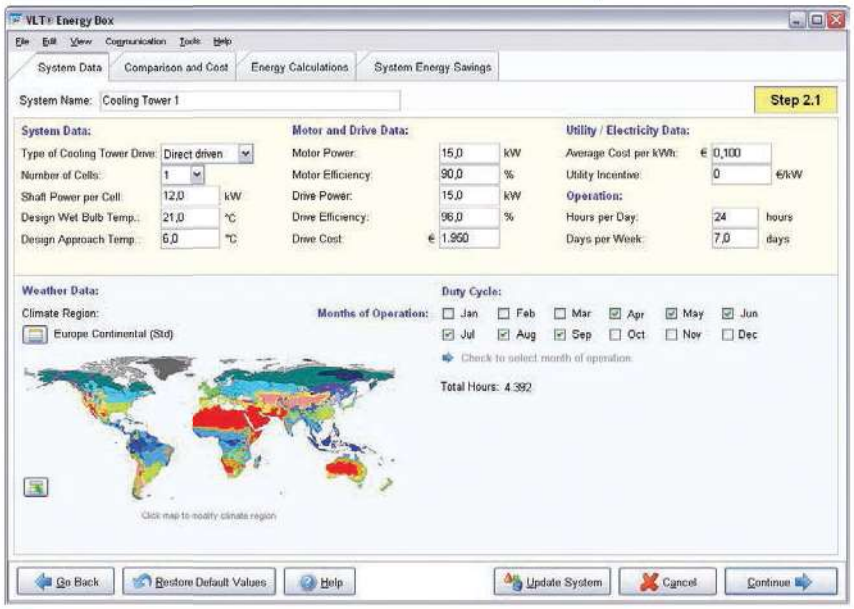
Since VLT® Energy Box both estimates and afterwards measures the real energy savings, it is a very trustworthy means for calculating projects involving many fans, pumps and cooling towers. You can simply install a single VLT® HVAC Drive and check the actual savings to exactly calculate the benefits from installing VLT® HVAC Drives on the other applications.



Considers local conditions

VLT® Energy Box use local weather data in its calculations for cooling towers.

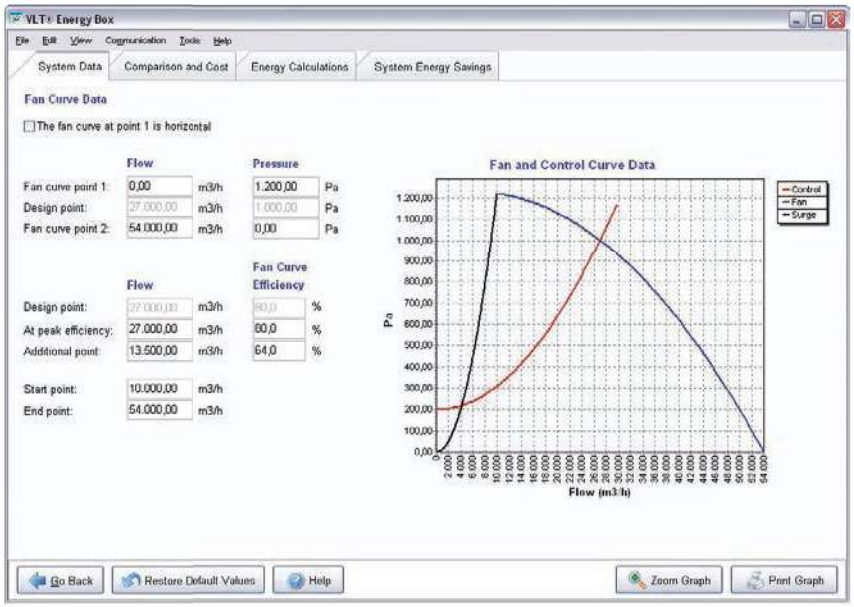
Data from weather zones around the Globe are pre-installed, but the user is free to adjust these data according to local conditions.



Specify the curve

Energy Box offers an advanced mode to specify the fan or pump curve in more detail.

The fan or pump (equipment) curve can be adjusted to match almost any shape. Choose flow and pressure points to generate an equipment curve similar to the published fan or pump curve over the relevant section of the curve using the mechanical flow control method. The program will not allow calculations in regions that are in a surge region or beyond the end of the curve.



Service and support
VLT® DrivePro™

Service

24

hours a day 7 days a week

Service you can rely on 24/7 – worldwide

Sales and Service
Contacts worldwide. Helping to optimize your productivity, improve your maintenance, and control your finances.

- 24/7 availability
- Local hotlines, local language and local stock

The Danfoss service organization is present in more than 100 countries – ready to respond whenever and wherever you need, around the clock, 7 days a week.

Find your local expert team on www.danfossdrives.com

Professional Drives Support

DrivePro Service Plans provide a complete drives support solution, freeing customers' time and resources to focus on their core business activities.

DrivePro services deliver increased efficiency and productivity of variable speed systems. DrivePro coverage plans provide a fixed-cost solution against unforeseen risks and quick response in the event of a malfunction. The nationwide network of DrivePro professionals ensures support is available locally.

Danfoss customers also have full access to the DrivePro call center. One toll- free call provides direct access to the Danfoss factory technical support specialists, 8:00 to 5:00 CST and emergency support 24 hours per day, 365 days a year.

DrivePro Service Plans

DrivePro-Extended Warranty purchased with the drive provides the industry's longest coverage, up to six years.

DrivePro-SC Service Contract ensures long-term service coverage beyond the warranty period for drives up to 10 years old.

DrivePro-tection provides an additional measure of security by covering accidental drive damage such as lightning strikes.

DrivePro-SU Start-Up ensures maximum utilization and efficiency of Danfoss drives.

DrivePro Depot Repair Service provides professional reconditioning and factory testing of Danfoss drives at a flat rate.

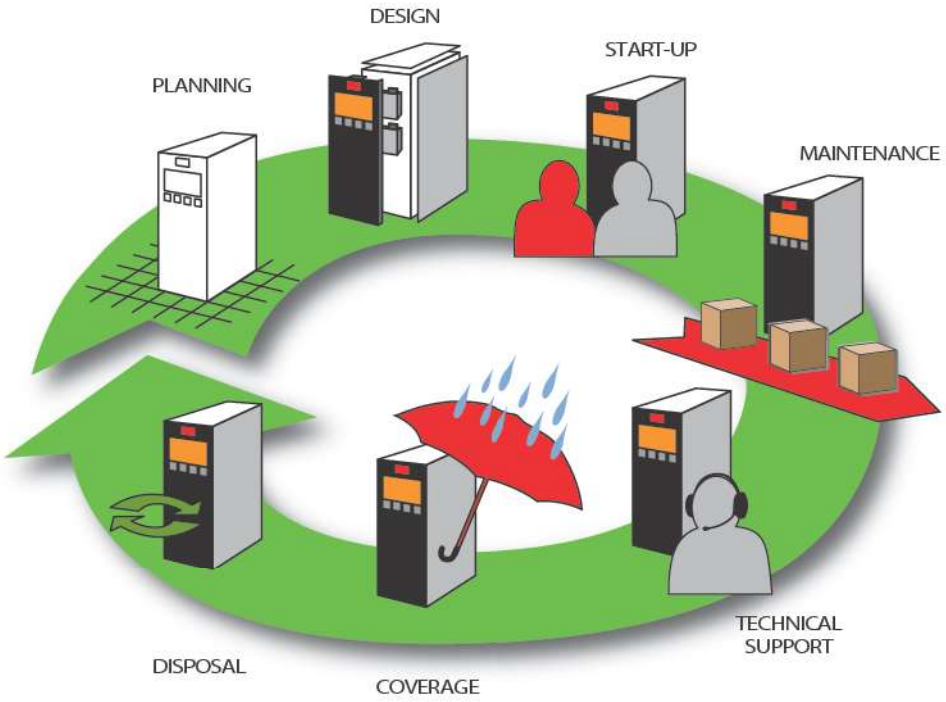
DrivePro Spare Parts ensure Danfoss drives high performance levels are retained after repairs or maintenance work is completed.

DrivePro PLUS drive replacement contracts provide a quick, turn-key solution for replacing aging drives that are no longer economical to repair. Professional installation, startup service and extended warranty are included.

DrivePro SmartStep provides a comprehensive and affordable migration program for customers with large numbers of legacy model or multiple brand drives. This program combines the benefits of the latest technology Danfoss drives with professional installation, startup and coverage for a fixed periodic fee. SmartStep is a very flexible and sensible way to upgrade drive systems on a budget.

DrivePro EnLease provides end customers with alternative financing for drives and services.

DrivePro-PM Preventive Maintenance provides scheduled service to optimize the variable speed system performance and ensure the longest possible drive life.



VLT® DrivePro™ SmartStep

Replace equipment proactively for total peace of mind

Upgrade sensibly

DrivePro™ SmartStep is a comprehensive replacement and service support program for customers to assure optimal efficiency and maximum uptime.
It's a turn-key program to replace older drives, backed by professional service support.

DrivePro™ SmartStep advantages

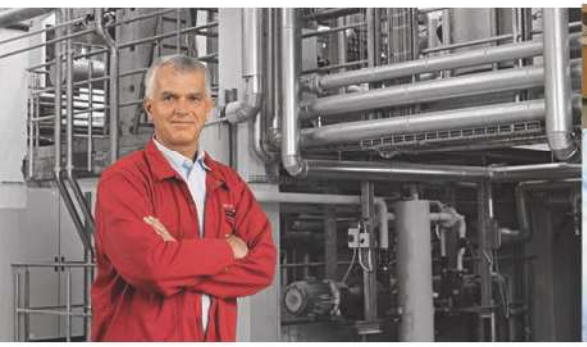
Professional drive installation and start-up Flexible replacement plan
Extended Warranty coverage

Designed for success

- Minimize down-time costs
- Maximize system reliability
- Provides the latest drive technology & performance
- Fits replacement drives within your budget

Available for application areas such as:

- Food & Beverage
- Industrial Automation
- Material Handling
- Oil & Gas



Danfoss DrivePro–tection provides the solution

Emergency response expense threatens your budget.

Downtime expense and hassle of many types of accidental drive damage are minimized.

One call provides quick and complete response from the leaders in variable frequency drive technology and support.

DrivePro-tection

DrivePro-tection coverage is available at the time of drive purchase for periods up to six years.

Coverage is also available for older, installed drives up to 10 years from date of manufacture. Contact Danfoss for details.

Coverage

- Line anomalies—including lightning strikes
- Load anomalies
- Accidental exposure to moisture or corrosives
- Accidental collision or other physical damage
- Defects in product material or workmanship
- Normal product wear

Product misapplication, vandalism, facility disasters, chronic problems due to the application and shipping damage are not included

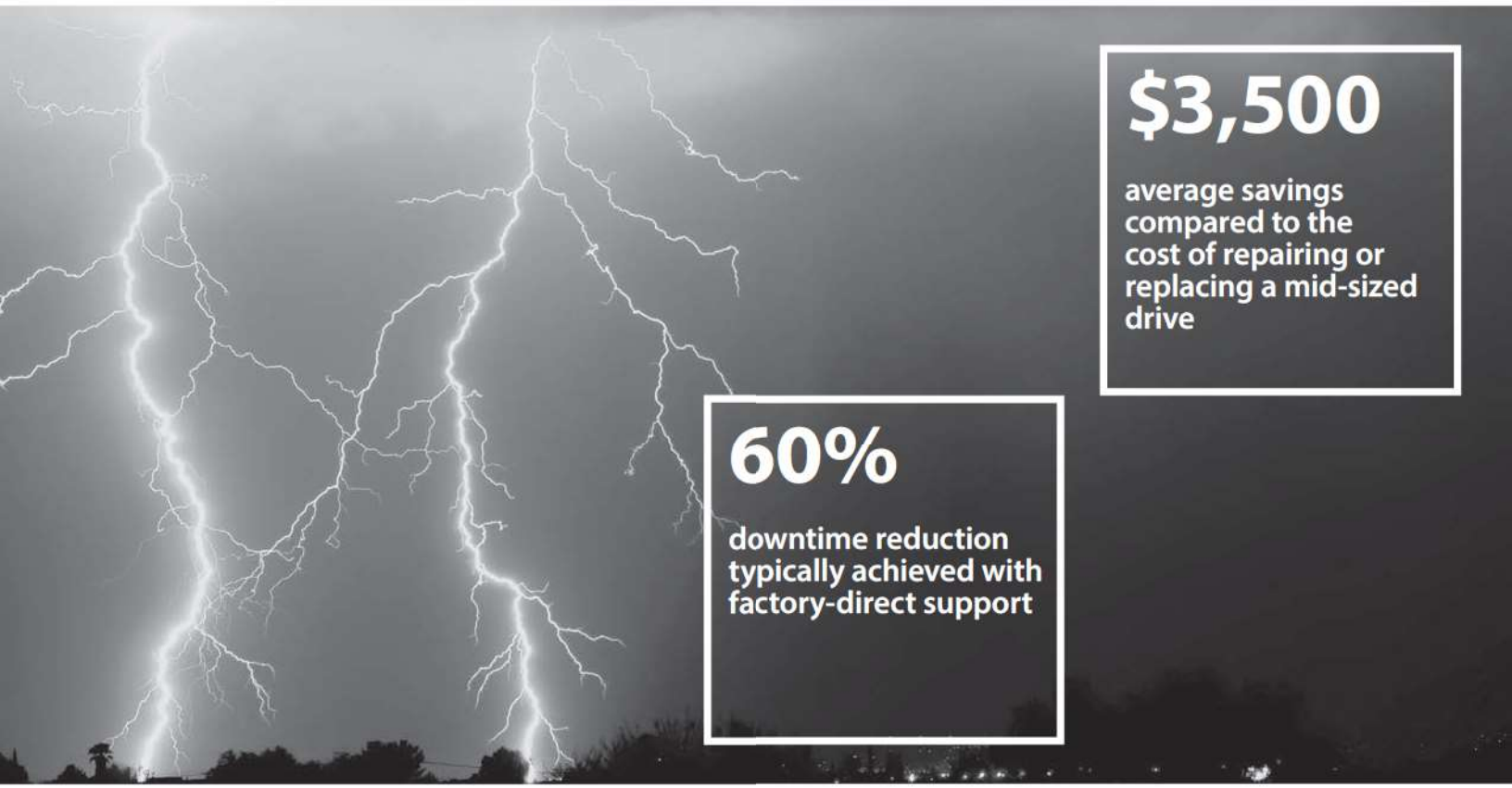
Support

Depot Repair is provided at a Danfoss North America factory repair facility

- Replacement drive material
- Drive repair labor
- Return freight

Onsite support available on a charge/call basis

Onsite Service DrivePro-tection contracts available for some Industrial applications. Contact Danfoss DrivePro sales for details.



Configure your VLT® drive

The Drive Configurator gives you the possibility to configure (select) the right drive for your purpose. You don't have to consider if the combinations are valid, while the configurator only gives you valid selections.

Drive Configurator

The Danfoss Drive Configurator is an advanced but easy-to-use tool to configure the Danfoss VLT® frequency converter that exactly matches your requirements.

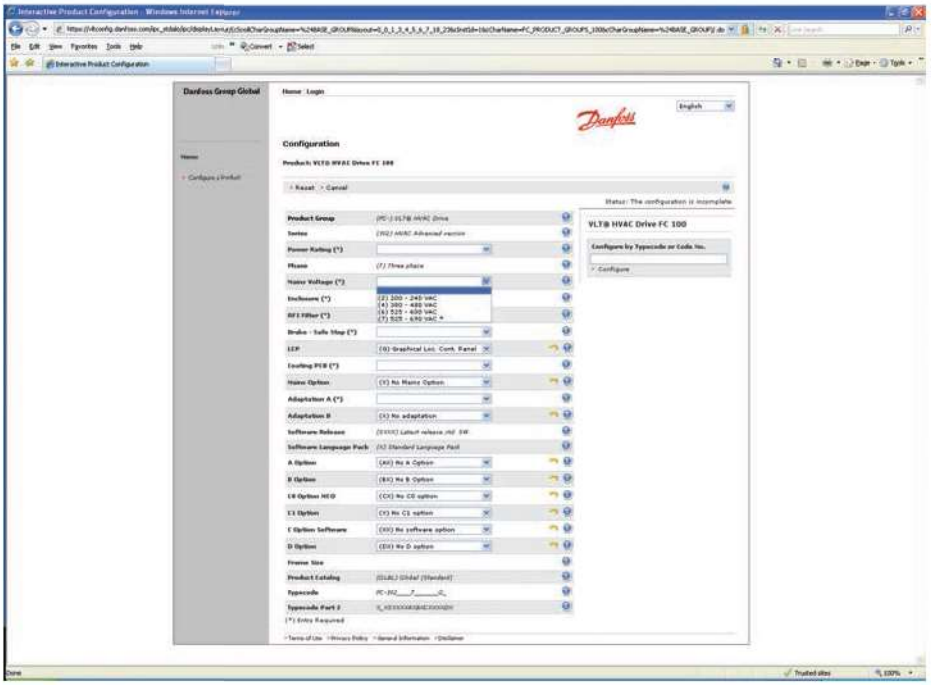
The Drive Configurator generates the unique article number for the drive you need, preventing errors during order entry.

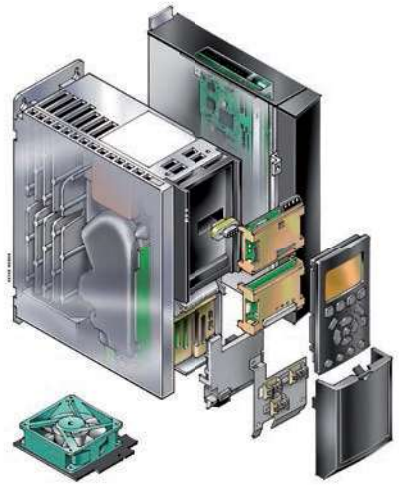
"Decoding" is also available: Enter a Typecode and the Drive Configurator will decode the configuration and show configuration for your drive.

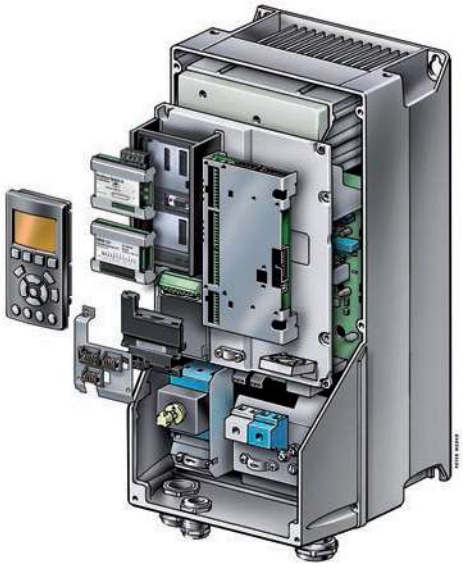
"Reverse engineering" is also supported: Enter an article number and the Drive Configurator will display the exact configuration for the drive in question, including all options and special features. A further advantage of using the Drive Configurator is that it tells you exactly which options and features are avaible and so prevents you selecting conflicting or nonsensical combinations.

If you need to replace an obsolete product, just enter the article number of the older VLT® and the Drive Configurator will provide details of the appropriate newer generation replacement.

Last but by no means least, the Drive Configurator provides quick access to the available spare parts and accessories for both current and obsolete products.







ENGINEERING TOMORROW

What VLT® is all About

Danfoss VLT Drives is the world leader among dedicated drives providers – and still gaining market share.

Environmentally responsible

VLT® products are manufactured with respect for the safety and well-being of people and the environment.

All activities are planned and performed taking into account the individual employee, the work environment and the external environment. Production takes place with a minimum of noise, smoke or other pollution and environmentally safe disposal of the products is pre-prepared.

UN Global Compact

Danfoss has signed the UN Global Compact on social and environmental responsibility and our companies act responsibly towards local societies.

EU Directives

All factories are certified according to ISO 14001 standard. All products fulfil the EU Directives for General Product Safety and the Machinery directive. Danfoss VLT® Drives is, in all product series, implementing the EU Directive concerning Hazardous Substances in Electrical and Electrical Equipment (RoHS) and is designing all new product series according to the EU Directive on Waste Electrical and Electronic Equipment (WEEE).

Impact on energy savings

One year's energy savings from our annual production of VLT® drives will save the energy equivalent to the energy production from a major power plant. Better process control at the same time improves product quality and reduces waste and wear on equipment.

Dedicated to drives

Dedication has been a key word since 1968, when Danfoss introduced the world's first mass produced variable speed drive for AC motors – and named it VLT®.

Twenty five hundred employees develop, manufacture, sell and service drives and soft starters in more than one hundred countries, focused only on drives and soft starters.

Intelligent and innovative

Developers at Danfoss VLT® Drives have fully adopted modular principles in development as well as design, production and configuration.

Tomorrow's features are developed in parallel using dedicated technology platforms. This allows the development of all elements to take place in parallel, at the same time reducing time to market and ensuring that customers always enjoy the benefits of the latest features.

Rely on the experts

We take responsibility for every element of our products. The fact that we develop and produce our own features, hardware, software, power modules, printed circuit boards, and accessories is your guarantee of reliable products.

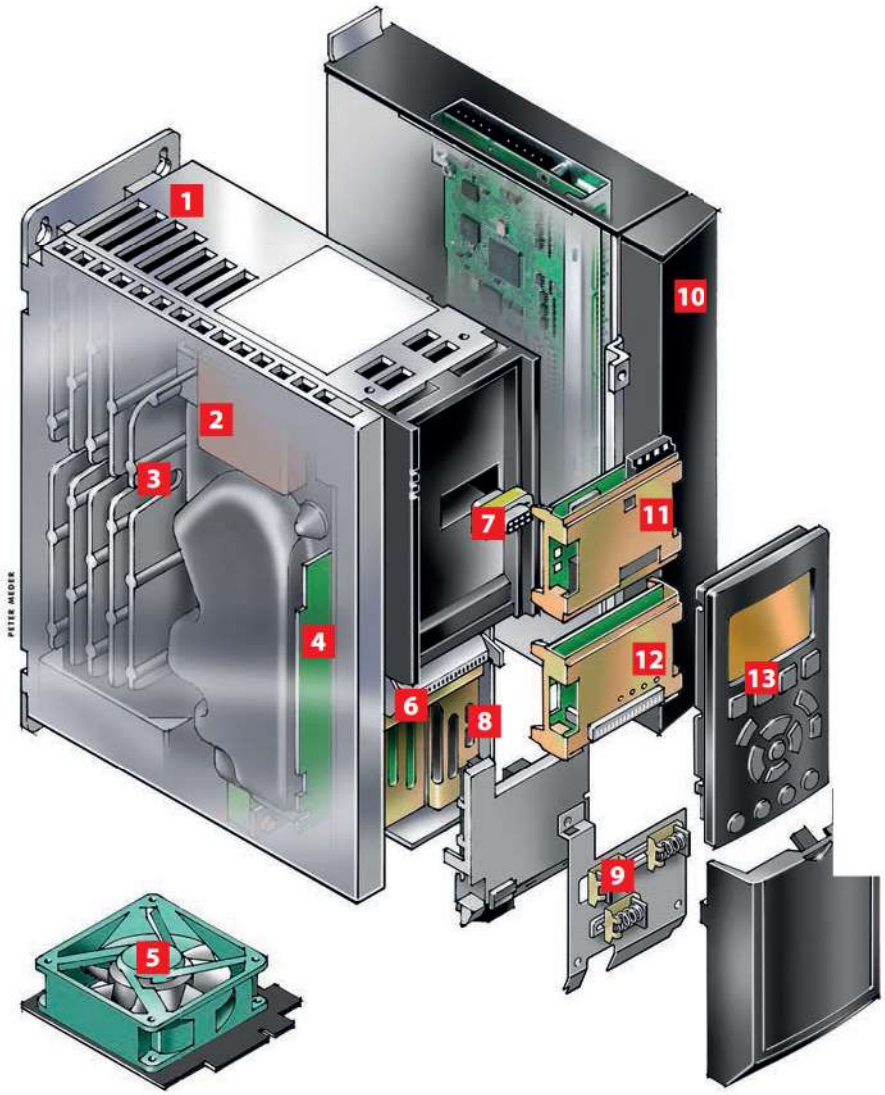
Local backup – globally

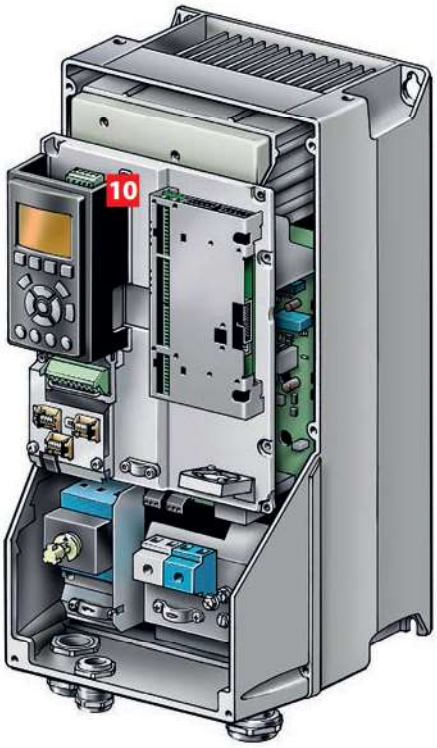
VLT® motor controllers are operating in applications all over the world and Danfoss VLT® Drives' experts located in more than 100 countries are ready to support our customers with application advice and service wherever they may be.

Danfoss VLT® Drives experts don't stop until the customer's drive challenges are solved.

Danfoss Drives, 4401 N. Bell School Rd., Loves Park, IL 61111, Tel. +1 (815) 639-8600 (main),

Modular design platform





1 Enclosure

Meets requirements for enclosure class Protected Chassis (IP 20). Optional NEMA 1 (IP 21), NEMA 12 (IP 55), NEMA12 (IP 54) and NEMA 4X (IP 66) available.

2 DC coil

Built-in DC coil ensures very low harmonic disturbance of the power supply, in accordance with IEC-1000-3-2. Compact design means no need for external modules.

3 Cold plate technology

Built on a solid aluminum base that is integrated with the back panel to provide high mechanical stability, efficient cooling and the option of cold plate operation.

4 Conformal coating

Available with a coated circuit board that makes the drive perfect for operation in harsh environments.

5 Removable fan

The fan can be quickly removed and remounted for easy cleaning.

6 Safety

The VLT® AutomationDrive FC 302 comes standard with the Safe Stop functionality suitable for Category 3 installations in accordance with EN 954-1 is standard on the VLT AutomationDrive FC 302 and optional on the VLT AutomationVT Drive FC 322. This feature prevents the drive from starting unintentionally. Profisafe is available as an option.

7 Hot-pluggable LCP

The Local Control Panel (LCP) can be plugged in or unplugged during operation. Settings are easily transferred via the control panel from one drive to another or from a PC with MCT 10 setup software.

8 24 V

24 V supply keeps the VLT® AutomationDrive logic "alive" when the AC power supply is removed.

9 Control terminals

Specially developed spring-loaded cage clamps enhance reliability and facilitate easy commissioning and service. Optional screw terminals available.

Save energy, space, time and costs

Danfoss' unequalled experience was used to make the VLT® AutomationDrive Series the perfect match for industrial applications. You will find our dedicated sales and service staff all over the world, 24 hours a day. With a wide range of powerful standard and optional features, the VLT AutomationDrive Series provides the lowest overall cost of ownership of any drive available.

Save energy

- High efficiency (>98%)
- Sleep mode shuts off pumps when demand is low
- Automatic energy optimization produces typical savings of 3–5% (up to 15% possible)
- Flow compensation of setpoint
- Unique cooling concept

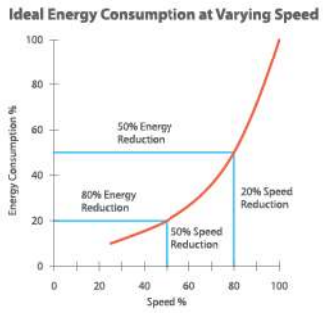
Save space

- Compact, modular design
- Built-in DC-link reactors for harmonic suppression—no need for external AC input line reactors
- Optional, integrated RFI filters throughout the power range
- Integrated disconnects and fusing

Energy savings using a VLT AutomationDrive are achieved with even a modest reduction in speed.

Save time

- Intuitive user interface with the new, award-winning local control panel (LCP)
- One drive type for the full power range
- Modular VLT design enables fast installation of options
- Automatic motor adaptation streamlines installation by automatically tuning the drive to the motor without spinning it or requiring the load to be decoupled
- Robust design and efficient monitoring significantly reduce maintenance requirements



Save costs

Protect your system with a series of pump-specific features:

- Cascade controller
- Dry pump detection
- End of curve detection
- Motor alternation
- 2-step ramps (initial ramp)
- Pipe fill mode
- Real-time clock
- Password protection
- Overload trip protection
- Smart logic controller
- User-selectable variable or constant torque operation
- NEMA/UL Type 12 (IP 54/55) and NEMA 4X/IP66 enclosures can eliminate the need for separate panels

10 Advanced option

Free programmable Motion Controller MCO 305 with optional software for synchronizing, positioning and other advance applications using the VLT AutomationDrive FC 301 and FC 302.

Advanced Cascade control for up to 8 pumps available for VLT AutomationVT Drive FC 322.

11 Fieldbus option

Options for Fieldbus communication include Profibus, DeviceNet, CanOpen, Ethernet IP and Modbus TCP IP provide for tight system integration with a variety of industrial PLCs.

12 Application option

- Optional cards expand system I/O capabilities by providing modules for:
- I/O Expansion
- Encoder or Resolver Inputs
- Additional Relays
- Safe PLC Interface
- Expanded Cascade Control
- Motor Thermistor Input

13 Display options

Input from our extensive user group significantly influenced the design and function of the new generation Local Control Panel (LCP). The removable LCP now comes with an improved user interface. Choose between six built-in languages (including Chinese) or have it customized with any language you like. Two of the languages can be changed by the user.

The info button accesses virtually all information contained in the printed operation manual.

The Automatic Motor Adaptation (AMA), Quick Setup menu and large graphic display make commissioning and operation convenient and easy.

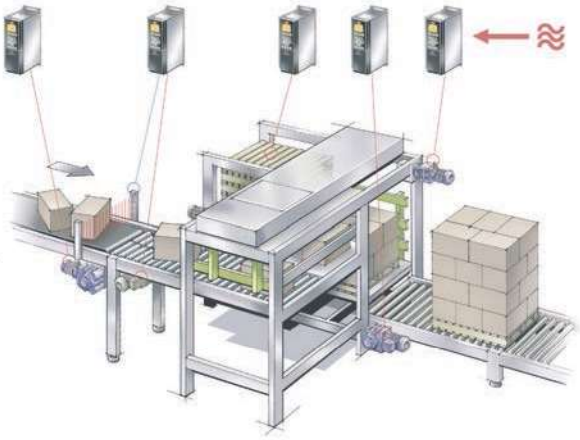
The LCP also comes with a choice of numerical display, graphical display or blind cover.

VLT® AutomationDrive Series
One drive to run a complete production line

The VLT® AutomationDrive series is a single drive concept that controls all operations from simple pump and fan to the most sophisticated motion control applications on any machine or production line. The standard versions cover a wide range of functions such as PLC functionality, automatic fine-tuning of motor control and self-analysis of performance.

Positioning, synchronizing, load estimation and even servo performance are also available.

All versions share an identical user interface, so once you've operated one, you can use them all.

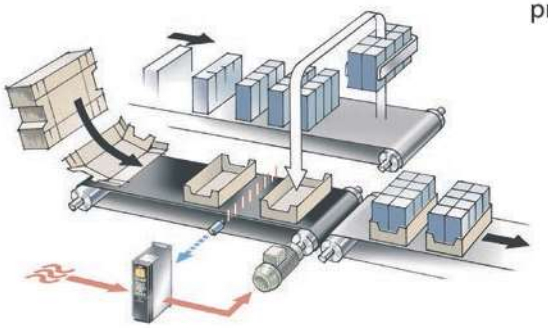


Add flexibility to precision

The new VLT® AutomationDrive lets you alter production speed without rebuilding the conveyor. The Precise Pulse Stop feature ensures that products are always where they should be on the line.

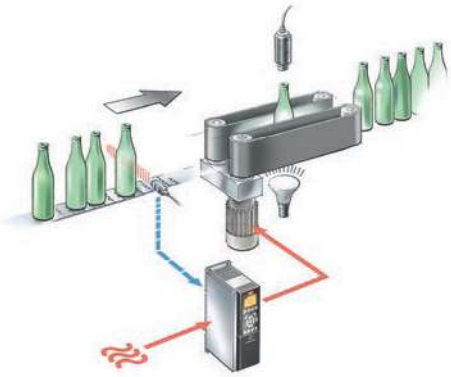
Accelerate or slow the entire line

Production speed can be changed at any time, even if the application involves several parts. The Precise Pulse Reference feature ensures that all conveyors are in sync by designating a master conveyor, which all other conveyors follow.



Benefits:

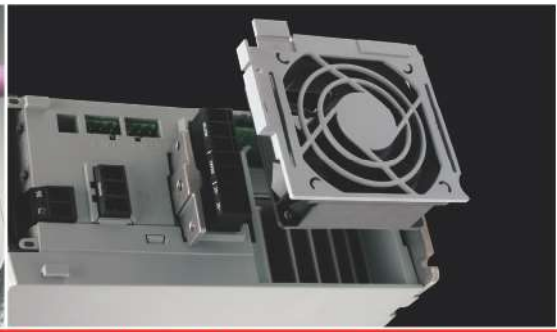
- The conveyor can be stopped at a precise location using an open loop system independent of production speed.
- Precise Pulse Stop compensates for the speed of the object when it passes the stop sensor. This results in a precise stop, regardless of production speed.



The bottle is beneath the inspection camera at the exact moment the flash is activated. The VLT AutomationDrive ensures that production speed is adapted, even in complex operations along the entire production line.

Press, place, and release—that's all it takes for a reliable control cable connection that never needs servicing.

The VLT® AutomationDrive supports all PROFIdrive profiles for automation.



The fan is easily removed for cleaning of the heatsink.

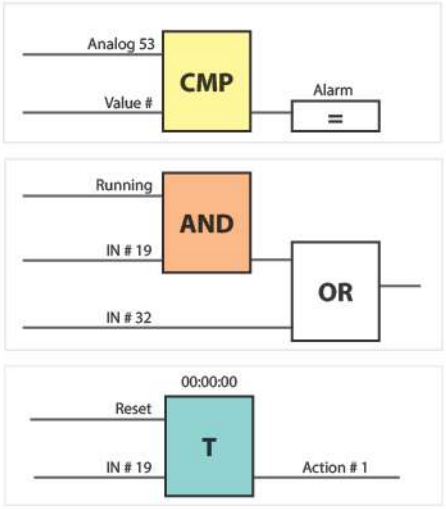
Built-in Smart Logic Controller

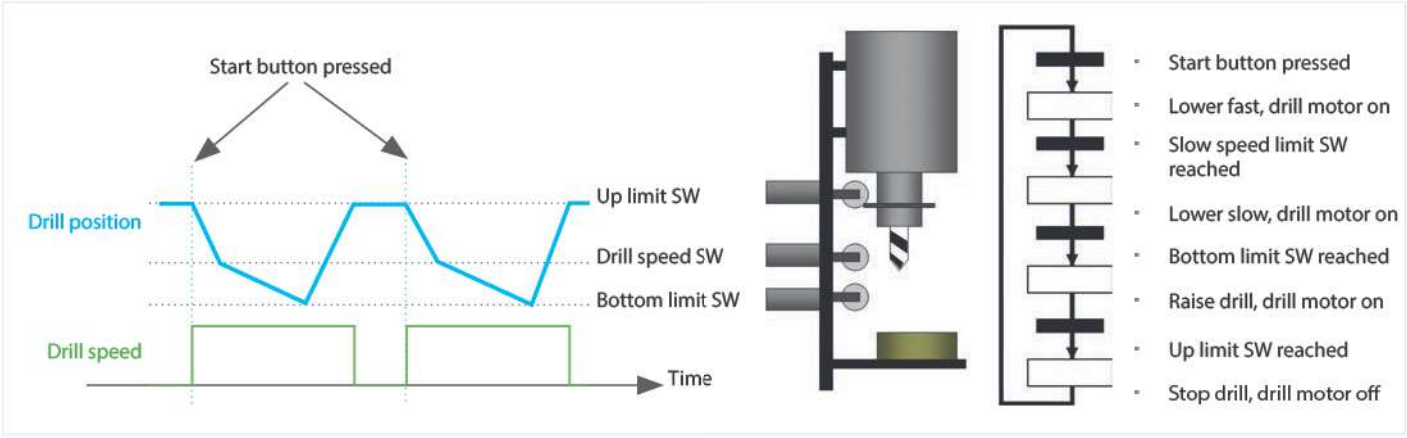
The smart logic controller is a simple way to keep your drive, motor and application working together. The controller is programmed to monitor a specific process event. When the monitored event occurs a specific action can be programmed to execute. Up to 20 different events can be monitored before looping back to step one.

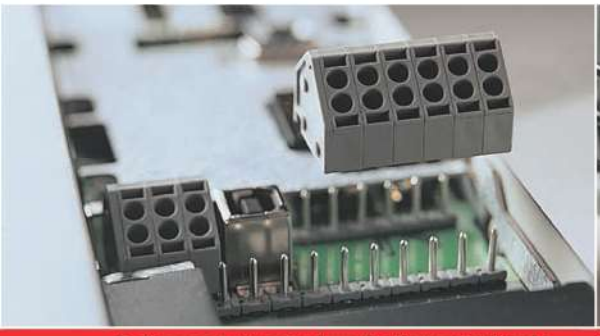
The smart logic controller is able to monitor any parameter that can be defined in either a "true" or "false" state.

This includes not only digital ommands, but also logic expressions, allowing even sensor outputs to influence the operation. Temperature, pressure, flow, time, load, frequency, voltage and other parameters combined with the arithmetic comparators like ">", "<", "=", logic operations like "or", "and", "not", along with timer and counter functions allow the installer to form a series of logical statements that greatly integrates the drive into the manufacturing process.

That's why Danfoss calls it a "logic" controller; because you can program the controller to react to almost any event you choose.







To disconnect wires, simply unplug the terminal blocks.

Plug-and-play is the way with the AutomationDrive. Even the power supply, sensor cables and looping connections are convenient plugs.

The fieldbus option plugs in beneath the front panel. It can be turned upside down to allow for cable entry on top.

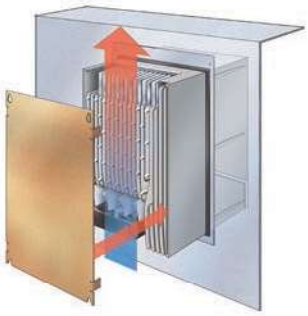
Intelligent heat management
Two cooling methods for different needs

Total separation between cooling air and electronics allows for solutions where heat is removed outside cabinets.

With VLT® AutomationDrive Series, a flanged heatsink kit is available for mounting the drive in the backplate of a cabinet.

Forced convection cooling

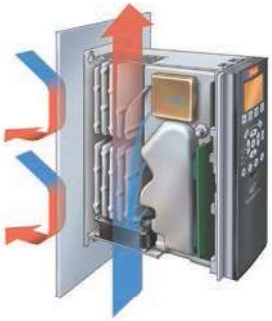
A fan blows cold air through the cooling ribs of the aluminum base. The channel is easily cleaned without touching electronics.



Flanged heatsink

Cold plate cooling

External cooling is possible through the back side of the aluminum base.



Wall mounted with forced cooling through the heatsink.

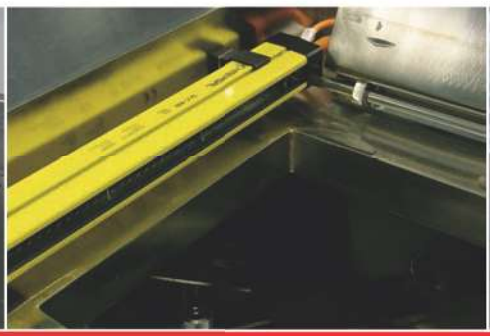
A smart, dedicated kit allows D1 and D2 enclosures to be mounted in Rittal cabinets so cool air removes 85% of excess heat without contact to the electronics.

VLT® Motion Controller MCO 305

The MCO 305 is an integrated Motion Controller that can be provided with embedded firmware for simple synchronizing, positioning, and center winding applications. Integrating this option into the VLT AutomationDrive FC 301 or FC 302 transforms the drive into a highly intelligent system providing accurate dynamic motion control for the most sophisticated applications.

The MCO 305 option utilizing the MCT 10 programming tools provides complete programming capabilities allowing the user to completely customize the VLT AutomationDrive for the most demanding applications.

DC coils reduce harmonic noise and protect the drive.



Safety installations can be connected directly to the VLT® AutomationDrive.

Cold plate.

Award-winning, user-friendly interface

1 Graphical display

- Informative overview
- Six lines of display
- Graphical or numerical display of information
- Readout in user-selectable engineering units
- Select from up to 27 languages as standard
- Backlit for increased visibility

2 Quick Menus

- Danfoss-defined Quick Menu
- My Personal Menu allows users to define their own menus of commonly accessed parameters
- Changes Made Menu displays the parameters to which changes have been made
- Function Setup Menu provides quick setup for specific applications
- Logging Menu provides access to operation history

3 Illumination

- Illuminated LEDs indicate which function is active

4 Menu structure

- Based on the field-proven matrix system used in previous VLT® Series drives
- Menu shortcuts access specific functions
- Edit and operate in different setups simultaneously

5 Other benefits

- The keypad is removable during operation
- Upload/download setups between drives using the keypad
- Remote mounting kit available for panel installation
- Hand / off / auto buttons for easy switching between manual and automatic control

6 Additional buttons

- Info: an "onboard manual" that provides specific information about each parameter
- Cancel: exits current parameter without saving changes
- Alarm log: easy access to a list of all previous alarm conditions

The VLT® AutomationDrive has an award-winning Local Control Panel (LCP) that was designed based on user feedback.

With a well-structured menu system, the VLT® AutomationDrive ensures fast commissioning and easy access to its many powerful functions.

design award winner

Built for a variety of applications with a wide range of advanced features

Quicker handling of small loads

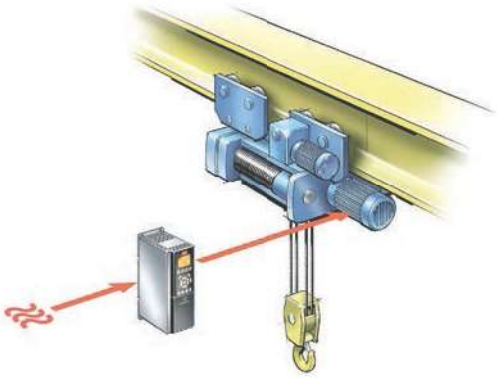
Equipment is typically sized to handle a maximum load, and speed is usually determined by this maximum load.

The ability to change speed automatically allows equipment to operate at a partial or minimum load. The drive estimates the load and maximizes production speed.

Reliable, accurate load handling

Changing conditions influence the operation of cranes and other equipment. Depending on position and load, a crane tends to shake when stopping or starting, because it's calibrated to an average load.

The VLT® AutomationDrive estimates motor currents generated by actual loads and compensates to make the crane start and stop smoothly just where it should. The same benefits apply to hoists and elevators.



Gentle on goods—and brakes

When stopped, the AutomationDrive will slow a hoist to zero before activating the mechanical brake. This results in gentler handling, and virtually eliminates wear on the brake.

Benefits:

- Low torque ripple gives smooth operation
- Precise load estimation allows for precise positioning regardless of load
- Load estimation saves time and speeds up production safely and intelligently
- Full holding torque capability at 0 RPM gives a smooth ride and reduces mechanical wear on gears and brakes, minimizing maintenance and maximizing production up-time

NEMA 4X (IP 66) for harsh environments

All VLT® AutomationDrives have manganic phosphor rear bodies. The backs of NEMA 4X (IP 66) enclosures are dip-coated with epoxy or polyester spray finish (60–100 µm). The cover is powder coated (80–100 µm).

The silicone gasket is tested with various detergents.

Small footprint

Throughout the entire power range, all sizes of VLT® AutomationDrives are even smaller than comparable previous drives. No dimension has increased, and volumes are typically 20% smaller.

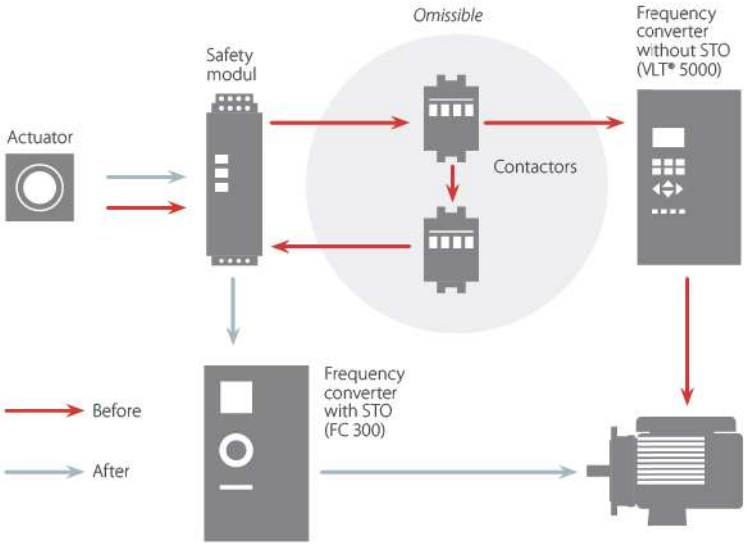
The VLT® AutomationDrive provides crane and hoist applications with smooth, precise operation while reducing wear and tear on driven equipment.

Coated control boards are avilable for harsh environments.

One-wire safety

The VLT® AutomationDrive FC 302 and the VLT® AutomationVT Drive (optionally) are equipped with with safe stop functionality suitable for category 3 installations as defined by EN 954-1. This standard feature prevents a drive from starting accidentally. The safe stop terminal can be used to "safe coast" the motor - the stop function satisfies stop category 3 EN 60204-1.

Expensive and bulky external components can be omitted, wiring simplified, and downtime minimized with this solution. The safety signals can be transferred via discrete signals wiring (in compact machinery) or safe bus communication (in extended manufacturing plants).



Two contactors can be omitted in safety installations due to the safety functionality in VLT® AutomationDrive.

Since it's approved for safety category 3 applications, the VLT® AutomationDrive and AutomationVT Drive is a perfect match for the Pilz safety relay. The electrical connection is extremely simple—just one wire.

The VLT® AutomationDrive and AutomationVT Drive is approved for providing safe stop in category 3 installations without the need for feedback signals from the drive to the safety relay.

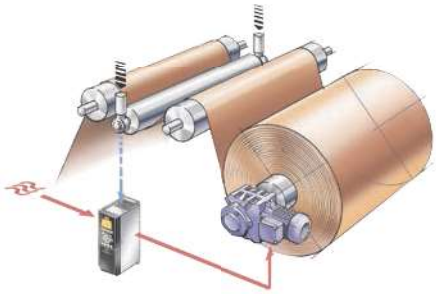
600 & 690 V

Both the VLT AutomationDrive and VLT AutomationVT Drive can be ordered for either 575 volt or 690 volt applications found in the petrochemical, gas supply, mining and forestry markets. The 690 volt version is available to 1.4 MW of power.

When torque is the issue

In all winders, the torque required to accelerate and decelerate an application varies with the load. With center winders the required torque even varies with the dimension of the roll. Torque mode with high-precision torque control is needed.

It is essential in winding operations to fully control the tension of the material being wound. To maintain tangential tension independently of the line speed and roll diameter, the drive is able to dynamically follow a wide range of torque references.



Designed with the user in mind

The VLT® AutomationDrive maximizes system reliability with built-in protection:

- System overloads
- Motor failures
- Motor and drive overheating
- Voltage disturbances
- Power surges
- Loss of phase
- Phase-to-phase and phase-to-ground short circuit
- Ground fault
- Switching on input/output
- Electrical disturbances
- Overvoltage
- Overcurrent
- Undervoltage
- External fault
- Overtemperature

Minimize motor noise and heating with ASFM

With the ASFM (Adjustable Switching Frequency Modulation) function, the switching frequency is adjusted automatically in relation to the speed of the motor. As speed is reduced, the switching frequency increases to ensure optimally low motor noise and reduce motor heating.

Output protection for longer motor life

VLT® AutomationDrives incorporate both DC-link reactors and motor output protection as standard design features. This provides short circuit protection and allows unlimited switching on the output without damage to the drive, eliminating the need for additional output reactors or switch interlocks.

The DC-link reactors improve overall efficiency by increasing the power factor and lowering the ripple current in the bus voltage providing an almost threefold increase in capacitor and drive life. As a result, motor operation is smooth and quiet and longer motor life can be expected.

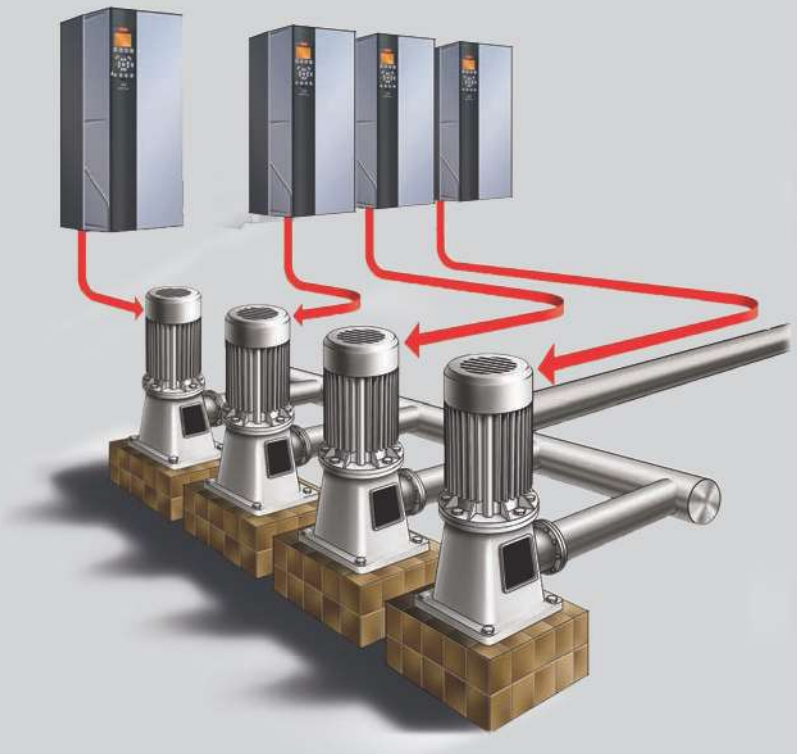
Hall effect current transducers measure current flowing on all three motor phases. This provides highly responsive and accurate feedback to the VLT control circuit for optimum motor protection and performance.

Cascade Controllers

Provide additional relays for staging of additional pumps:

- MCO 101 extended cascade controller controls up to five pumps
- MCO 102 advanced cascade controller controls up to eight pumps

Cascade controller option cards extend the capabilities of the VLT® AutomationVT Drive FC 322, allowing the control of up to eight parallel pumps configured to appear to the sytem as a single larger pump. Individual pumps are automatically turned on (staged) and turned off (destaged) as needed to satisfy the required system output for flow or pressure. The speed of the pumps is also controlled to provide a continuous range of system output. Available as a factory-installed option or a field-installed accessory, cascade controller option cards provide constant pressure or level control while reducing water hammer and energy consumption. They also eliminate the need for PLCs and external controllers.

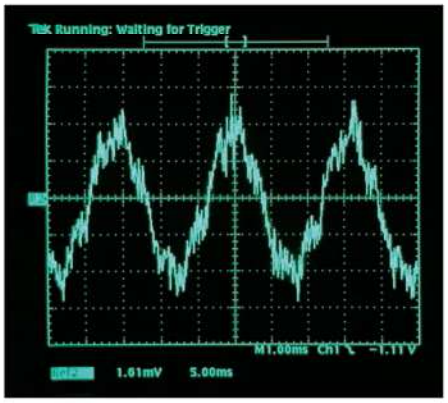


A typical AutomationVT Drive FC 322 installation utilizing the Cascade Controller option in conjunction with three additional AutomationVT Drives FC 322 to operate one to four pumps as demand requires.

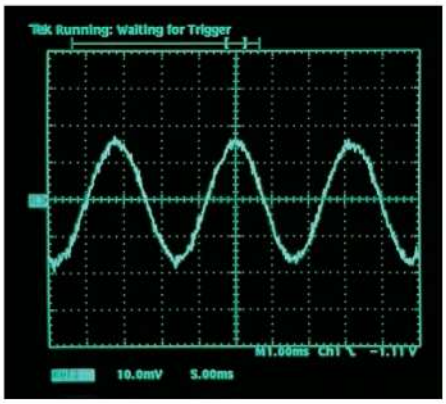
VVC^{PLUS} output switching pattern

Unique digital VVC^{PLUS} voltage vector control provides:

- A nearly perfect output sine wave that reduces the overshooting and undershooting of voltage and current generated by standard PWM drives
- Fully rated motor voltage at rated frequency
- Increased efficiency for both drive and motor
- Full motor performance without derating; no additional heating of motor windings
- Motor cable lengths up to 1000' standard



Brand "X" PWM scope trace (top) compared to smoother VVC^{PLUS} scope trace (bottom).



Reduced installation cost

Dual DC-link reactors reduce the input RMS current to less than or equal to the output current. This greatly reduces the cable size requirement and the subsequent cost of installation.

Minimal harmonic distortion/ maximum power factor

DC-link reactors reduce the harmonic distortion currents that a variable frequency drive injects back into the AC line. The properly sized reactors in a VLT AutomationDrive can reduce line harmonic currents by up to 40% of the fundamental current. This eliminates the need and cost of additional AC line reactors and their resultant line voltage reduction.

Thermal protection for the drive and motor

The ETR (Electronic Thermal Relay) is an open loop method built into the VLT AutomationDrive software to guard against motor overheating, requiring no additional sensors or wiring. This function is UL recognized (Class 20) as an effective guard against motor thermal overload.

The VLT AutomationDrive has built-in thermal protection and also accepts thermistor signal input from the motor to create closed loop thermal protection for the entire system.

Input line protection from extreme running conditions

Short circuit

The VLT AutomationDrive incorporates 3 hall effect sensors, one in each of the three motor phases to protect against short circuits. A short circuit between two output phases (or to ground) will shut down the drive as soon as the current exceeds the maximum value.

Line disturbances and transients

To protect itself from AC line voltage disturbances, the drive monitors all three phases and interrupts drive operation in the event of phase loss or imbalance. Transients on the AC line are suppressed by MOVs as well as zener diodes for extreme transients. Danfoss VLT AutomationDrives meet VDE 0160 (European standard—2.3 x line voltage for 1.3 msec) for transient protection.

Voltage sags and surges

The VLT AutomationDrive is designed for a wide range of operating conditions. The 480 volt drive will operate from 342–528 VAC. The 230 volt drives will operate on 180–264 VAC. 575 volt drives will operate on 495–660 VAC and 690 volt drives will operate on 472–759 VAC. Full rated motor voltage and torque can be delivered with voltage dips down to 10% under nominal AC line voltage. During an AC line drop-out, the VLT AutomationDrive continues until the intermediate circuit voltage drops below the minimum stop level, which is typically 15% below the VLT AutomationDrive's lowest rated supply voltage.

Ground fault

The VLT AutomationDrive provides complete protection from potentially damaging ground fault conditions on both the supply side and the motor side.

Options & accessories

Slot A

All options are built in and tested at the factory

VLT® PROFIBUS DP V1 MCA 101

Operating the frequency converter via a fieldbus lets you reduce the cost of your system, communicate faster and more efficiently, and benefit from an easier user interface

- PROFIBUS DP V1 gives you wide compatibility, a high level of availability, support for all major PLC vendors, and compatibility with future versions
- Fast, efficient communication, transparent installation, advanced diagnosis and parameter access with auto configuration of process data via GSD-file
- A-cyclic parameterization using PROFIBUS DP V1, PROFIdrive or Danfoss FC profile state machines, PROFIBUS DP V1, Master Class 1 and 2

Ordering number	VLT® AutomationVT Drive	VLT® AutomationDrive	
	FC 322	FC 301	FC 302
130B1100 uncoated 130B1200 coated	●	●	●

VLT® DeviceNet MCA 104

DeviceNet offers robust, efficient data handling thanks to advanced producer/consumer technology.

- This modern communications model offers key capabilities that let you effectively determine what information is needed and when
- You will also benefit from ODVA's strong conformance testing policies, which ensure that products are interoperable

Ordering number	VLT® AutomationVT Drive	VLT® AutomationDrive	
	FC 322	FC 301	FC 302
130B1102 uncoated 130B1202 coated	●	●	●

VLT® CAN Open MCA 105

High flexibility and low cost are two of the "cornerstones" for CAN Open. The CAN Open option for the AutomationDrive is fully equipped with both high priority access to control and status of the Drive (PDO Communication) and access to all parameters through acyclic data (SDO Communication).

For interoperability the option has implemented the DSP402 AC drive profile. This all guarantees standardized handling, interoperability, low cost, and seamless integration with the MCO 305 Motion Controllers bus structure for master/slave applications.

Ordering number	VLT® AutomationVT Drive	VLT® AutomationDrive	
	FC 322	FC 301	FC 302
130B1103 uncoated 130B1205 coated		●	●

VLT® EtherNet IP MCA 121

EtherNet will become the future standard for communication at the factory floor. The EtherNet Option is based on the newest technology available for industrial use and handles even the most demanding requirements. EtherNet/IP extends commercial off-the-shelf EtherNet to the Common Industrial Protocol (CIP™)—the same upper-layer protocol and object model found in DeviceNet.

The VLT® MCA 121 offers advanced features as:

- Built-in high performance switch enabling line-topology, and eliminating the need for external switches
- Advanced switch and diagnoses functions
- Built-in web server
- E-mail client for service notification

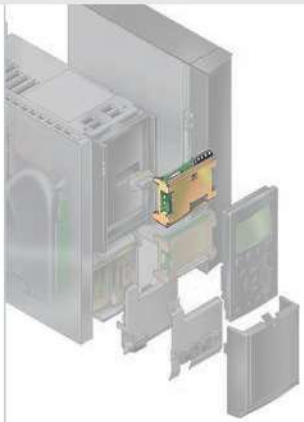
Ordering number	VLT® AutomationVT Drive	VLT® AutomationDrive	
	FC 322	FC 301	FC 302
130B1119 uncoated 130B1219 coated	●	●	●

VLT® Modbus TCP MCA 122

VLT® Modbus TCP was introduced in 1998 and is today one of the most developed, proven, and complete industrial Ethernet network solutions available for manufacturing automation.

Application protocols:

- Modbus TCP for controlling and parameter setting
- HTTP (Hypertext Transfer Protocol) for diagnosis via built-in web server
- SMTP (Simple Mail Transfer Protocol) for e-mail notification
- DHCP (Dynamic Host Configuration Protocol) automatic IP address configuration
- FTP (File Transfer Protocol) file up– and download
- TCP/IP (legacy TCP/IP) transparent Socket Channel connection to MCT 10

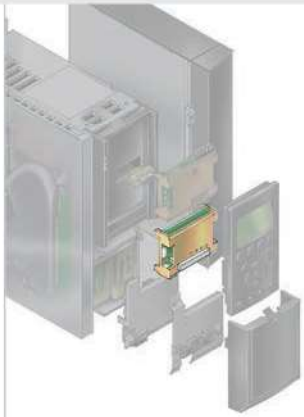


Ordering number	VLT® AutomationVT Drive	VLT® AutomationDrive	
	FC 322	FC 301	FC 302
130B1196 uncoated 130B1296 coated	●	●	●

VLT® General Purpose I/O MCB 101

I/O option offers an extended number of control inputs and outputs.

- 3 digital inputs 0-24 V: Logic '0' < 5 V; Logic '1' > 10V
- 2 analog inputs 0-10 V: Resolution 10 bit plus sign
- 2 digital outputs NPN/PNP push pull
- 1 analog output 0/4-20 mA
- Spring loaded connection
- Separate parameter settings



Ordering number	VLT® AutomationVT Drive	VLT® AutomationDrive	
	FC 322	FC 301	FC 302
130B1125 uncoated 130B1212 coated	●	●	●

VLT® Encoder Input MCB 102

A universal option for connection of encoder feedback from either a motor or a process. Feedback for asynchronous or brushless servo (Permanent Magnet) motors.

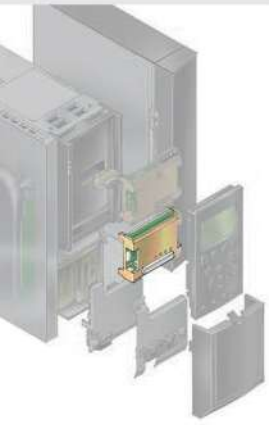
- Encoder module supports:
  - Incremental encoders
  - SinCos encoders as Hyperface®
- Power supply for encoders
- RS422 interface
- Plug-and-play principle
- Fit to all FC 300 AutomationDrives
- Connection to all standard 5 V incremental encoders
- Spring-loaded connection

Ordering number	VLT® AutomationVT Drive	VLT® AutomationDrive	
	FC 322	FC 301	FC 302
130B1115 uncoated 130B1203 coated		●	●

Options & accessories

Slot B

All options are built in and tested at the factory



VLT® Resolver Input MCB 103

Supports resolver feedback from brushless servo motors, and feedback for flux vector controlled asynchronous motors in rough environment.

- Primary Voltage..... 2 -8 Vrms
- Primary Frequency..... 2.0 kHz – 15 kHz
- Primary current max..... 50 mA rms
- Secondary input voltage..... 4 Vrms
- Spring loaded connection
- Separate parameter settings

Ordering number	VLT® AutomationVT Drive	VLT® AutomationDrive	
	FC 322	FC 301	FC 302
130B1127 uncoated 130B1227 coated		●	●

VLT® Relay Option MCB 105

Lets you extend relay functions with 3 additional relay outputs.

Max. terminal load:

- AC-1 Resistive load ..... 240 V AC 2 A
- AC-15 Inductive load @cos fi 0.4 .....240 V AC 0.2 A
- DC-1 Resistive load ..... 24 V DC 1 A
- DC-13 Inductive load @cos fi 0.4 .....24 V DC 0.1 A

Min. terminal load:

- DC 5 V..... 10 mA
- Max switch rate at rated load/min. load ..... 6 min^{-1}/20 sec^{-1}
- Plug-and-play principle, fits into slot B
- Protects control cable connection
- Spring-loaded control wire connection
- Selection of relay functions in normal parameter settings

Ordering number	VLT® AutomationVT Drive	VLT® AutomationDrive	
	FC 322	FC 301	FC 302
130B1110 uncoated 130B1210 coated	●	●	●

VLT® Safe PLC I/O MCB 108

The FC 302 provides a safety input based on a single pole 24 V DC input.

- For the majority of applications this input enables the user to implement safety in a cost-effective way. For application that works with more advanced products like Safety PLC, Lightcurtains etc., the new Safe PLC interface enables the connection of a two wire safety link
- The Safe PLC Interface allows the Safe PLC to interrupt on the plus or the minus link without interfering the sense signal of the Safe PLC

Ordering number	VLT® AutomationVT Drive	VLT® AutomationDrive	
	FC 322	FC 301	FC 302
130B1120 uncoated 130B1220 coated			●

VLT® Analog I/O Option MCB 109

This Analog input/output option is easily fitted in the drive for upgrading to advanced performance and control using the additional in/outputs.This option also upgrades the drive with a battery back-up supply for the clock built into the unit. This provides stable use of all frequency converter clock functions as timed actions etc.

- 3 analog inputs, each configurable as both voltage and temperature input
- Connection of 0-10 V analog signals as well as PT1000 and NI1000 temperature inputs
- 3 analog outputs each configurable as 0-10 V outputs
- Incl. Back-up supply for the standard clock function in the frequency converter

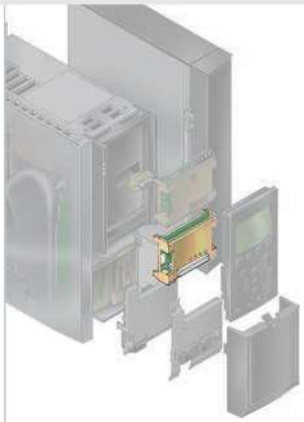
The back-up battery typically lasts for 10 years, depending on environment.

Ordering number	VLT® AutomationVT Drive	VLT® AutomationDrive	
	FC 322	FC 301	FC 302
130B1143 uncoated 130B1243 coated	●		

VLT® PTC Thermistor Card MCB 112

With the MCB 112 PTC Thermistor Card, the Danfoss VLT® AutomationDrive FC 302 now offers improved surveillance of the motor condition compared to the built-in ETR function and thermistor terminal.

- Protects the motor from overheating
- ATEX approved for use in potentially explosive atmospheres
- Uses Safe Stop function, which is approved in accordance with Cat. 3 EN954-1



Ordering number	VLT® AutomationVT Drive	VLT® AutomationDrive	
	FC 322	FC 301	FC 302
NA uncoated 130B1137 coated			●

VLT® Sensor Input Card MCB 114

The option protects the motor from being overheated by monitoring the bearings and windings temperature in the motor. The limits as well as the action are adjustable and the individual sensor temperature is visible as a read out in the display or by field bus.

- Protects the motor from overheating
- Three self-detecting sensor inputs for 2 or 3 wire PT100/PT1000 sensors
- One additional analog input 4-20mA

Ordering number	VLT® AutomationVT Drive	VLT® AutomationDrive	
	FC 322	FC 301	FC 302
130B1172 uncoated 130B1272 coated	●		

VLT® Extended Cascade Controller MCO 101

Easily fitted and upgrades the built-in cascade controller to operate more pumps and more advanced pump control in master/follower mode.

- Up to 6 pumps in standard cascade setup
- Up to 5 pumps in master/follower setup
- Technical specification: See MCB 105 Relay Option

Ordering number	VLT® AutomationVT Drive	VLT® AutomationDrive	
	FC 322	FC 301	FC 302
130B1118 uncoated 130B1218 coated	●		

USB extension

USB extension for IP 55 and IP 66 enclosures. Makes the USB connector available outside the drive. The USB extension is designed for mounting in a cable gland in the bottom of the drive, which makes PC communication very easy even in drives with high IP rating.

USB extension for A5-B1 enclosures,
350 mm cable 130B1155
USB extension for B2-C enclosures,
650 mm cable 130B1156

Ordering number	VLT® AutomationVT Drive	VLT® AutomationDrive	
	FC 322	FC 301	FC 302
130B1155 350 mm cable	●	●	●
130B1156 650 mm cable	●	●	●

Options & accessories

Slot C

VLT® Advanced Cascade Controller MCO 102

Easily fitted and upgrades the built-in cascade controller to operate up to 8 pumps and more advanced pump control in master/follower mode.

The same cascade controller hardware goes for for the entire power range up to 1.2 MW.

- Up to 8 pumps in standard cascade setup
- Up to 8 pumps in master/follower setup

Ordering number	VLT® AutomationVT Drive	VLT® AutomationDrive	
	FC 322	FC 301	FC 302
130B1154 uncoated 130B1254 coated	●		

VLT® Extended Relay Card MCB 113

The Extended Relay Card MCB 113 adds inputs/ outputs to VLT® AutomationDrive for increased flexibility.

- 7 digital inputs
- 2 analog outputs
- 4 SPDT relays
- Meets NAMUR recommendations
- Galvanic isolation capability

Ordering number	VLT® AutomationVT Drive	VLT® AutomationDrive	
	FC 322	FC 301	FC 302
130B1164 uncoated 130B1264 coated		●	●

VLT® Motion Control MCO 305

An integrated programmable Motion Controller for VLT® AutomationDrive FC 301 and FC 302; it adds fuctionality and flexibility to the already very comprehensive standard functionality of these drives.

MCO 305 is optimized for all types of positioning and synchronizing applications.

- Basic features: Synchronization (electronic shaft), Positioning and electronic Cam control
- 2 inputs supporting both incremental and absolute encoders
- 1 encoder output (virtual master function)
- 10 digital inputs
- 8 digital outputs
- Sending and receiving data via fieldbus interface (requires fieldbus option)
- PC software tools for programming and commissioning

Ordering number	VLT® AutomationVT Drive	VLT® AutomationDrive	
	FC 322	FC 301	FC 302
130B1134 uncoated 130B1234 coated		●	●

VLT® Synchronizing Control MCO 350

The Synchronizing Controller option for VLT® AutomationDrive expands the functional properties of the converter in synchronizing applications. It replaces traditional mechanical solutions.

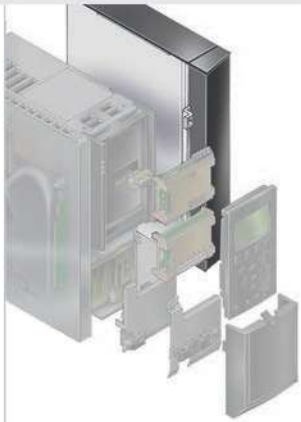
- Display of actual synchronizing error on frequency converter control panel
- Speed synchronizing
- Position (angle) synchronizing with or without marker correction
- On-line adjustable gear ratio
- On-line adjustable position (angle) offset
- Encoder output with virtual master function for synchronization of multiple followers
- Homing

Ordering number	VLT® AutomationVT Drive	VLT® AutomationDrive	
	FC 322	FC 301	FC 302
130B1152 uncoated 130B1252 coated		●	●

VLT® Positioning Control MCO 351

The Positioning Controller option offers a host of user-friendly benefits for positioning applications in many industries. They are based on a range of thought-through and innovative features.

- Direct positioning via Fieldbus
- Relative positioning
- Absolute positioning
- Touch probe positioning
- End limit handling (software and hardware)
- Mechanical brake handling (programmable hold delay)
- Error handling
- Jog speed/manual operation
- Marker related positioning
- Home function



Ordering number	VLT® AutomationVT Drive	VLT® AutomationDrive	
	FC 322	FC 301	FC 302
130B1153 uncoated 130B1253 coated		●	●

VLT® Center Winder MCO 352

With the closed loop center winder control material is evenly wound up regardless of the production speed.

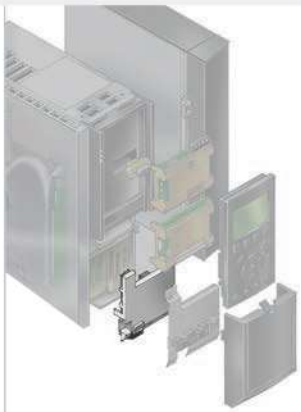
- Follows line speed
- Diameter calculator adjusts winder reference
- Tension PID adjusts reference

Ordering number	VLT® AutomationVT Drive	VLT® AutomationDrive	
	FC 322	FC 301	FC 302
130B1165 uncoated 130B1266 coated		●	●

VLT® 24 V DC Supply Option MCB 107

The option is used to connect an external DC supply to keep the control section and any installed option active by mains power down.

- Input voltage range .....24 V DC +/- 15% (max. 37 V in 10 sec.)
- Max. input current ..... 2.2 A
- Max. cable length ..... 75 m
- Input capitance load .....< 10 uF
- Power-up delay .....< 0.6 s
- Easy to install in drives in existing machines
- Keep the control board and options active by power cut
- Keep fieldbuses active by power cuts



Ordering number	VLT® AutomationVT Drive	VLT® AutomationDrive	
	FC 322	FC 301	FC 302
130B1108 uncoated 130B1108 coated	●	●	●

Options & accessories

LCP

LCP 102 Graphical Local Control Panel

- Multi-language display
- Status messages
- Quick menu for easy commissioning
- Parameter setting and explanation of parameter function
- Adjusting of parameters
- Full parameter backup and copy function
- Alarm logging
- Info button – explains the function of the selected item on display
- Hand-operated start/stop, or Automatic mode selection
- Reset function
- Trend graph

Ordering number	VLT® AutomationVT Drive	VLT® AutomationDrive	
	FC 322	FC 301	FC 302
130B1107	●	●	●

LCP 101 Numerical Local Control Panel

The numerical control panel offers an excellent MMI interface to the drive.

- Status messages
- Quick menu for easy commissioning
- Parameter setting and adjusting
- Hand-operated start/stop function or Automatic mode select
- Reset function

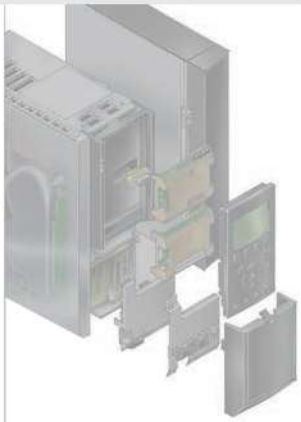
Ordering number	VLT® AutomationVT Drive	VLT® AutomationDrive	
	FC 322	FC 301	FC 302
130B1124	●	●	●

LCP Panel Mounting Kit

Ordering number	VLT® AutomationVT Drive	VLT® AutomationDrive	
	FC 322	FC 301	FC 302
130B1113 – Incl. graphical LCP, fasteners, 3 m cable and gasket	●	●	●
130B1114 – Incl. numerical LCP, fasteners and gasket	●	●	●
130B1117 – Mounting kit for all LCP's including fasteners, 3 m cable and gasket	●	●	●
130B1129 – LCP front mounting IP55/IP66	●	●	●
130B1170 – Panel Mouting Kit for all LCP w.o. cable	●	●	●

Profibus Adapter Sub-D9 Connector

For use with option A



The adapter makes linking of fieldbus connections pluggable.

Ordering number	VLT® AutomationVT Drive	VLT® AutomationDrive	
	FC 322	FC 301	FC 302
130B1112	●	●	●

Decoupling Plate for Fieldbus Cables

For use with option A

Strengthens fieldbus mounting.

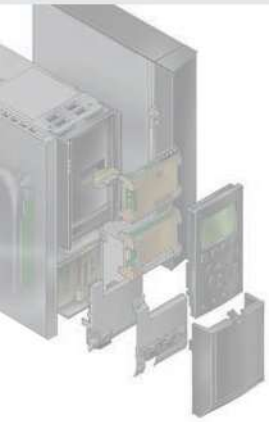
Ordering number	VLT® AutomationVT Drive	VLT® AutomationDrive	
	FC 322	FC 301	FC 302
130B0524 To be used only for IP 20/NEMA type 1 units up to 7.5 kW	●	●	●

IP 21/Type 1 (NEMA1) Kit

The IP 21/Type 1 (NEMA1) kit is used for installation of VLT® drives in dry environments. The enclosure kits are available for frame sizes A1, A2, A3, B3, B4, C3 and C4

- Supports VLT® drives from 1.1 to 90 kW
- Used on standard VLT® drive with or without mounted option modules
- IP 41 on top side
- PG 16 and PG 21 holes for glands

Ordering number	VLT® AutomationVT Drive	VLT® AutomationDrive	
	FC 322	FC 301	FC 302
130B1121 For frame size A1	●	●	●
130B1122 For frame size A2	●	●	●
130B1123 For frame size A3	●	●	●
130B1187 For frame size B3	●	●	●
130B1189 For frame size B4	●	●	●
130B1191 For frame size C3	●	●	●
130B1193 For frame size C4	●	●	●



VLT® Brake Resistors

Energy generated during braking is absorbed by the resistors, protecting electrical components from heating up. Danfoss brake resistors cover the full power range.

- Quick braking of heavy load
- Braking energy is only absorbed into the brake resistor
- External mounting makes it possible to use the generated heat
- All necessary approvals are available

Ordering number	VLT® AutomationVT Drive	VLT® AutomationDrive	
	FC 322	FC 301	FC 302
See relevant Design Guide	●	●	●

VLT® Harmonic Filter AHF 005/010 MCE

Easy, effective harmonic distortion reduction by connecting the AHF 005/010 harmonic filter in front of a Danfoss frequency converter.

- AHF 005 reduces total harmonic current distortion to 5%
- AHF 010 reduces total harmonic current distortion to 10%

- Small compact housing that fits into a panel
- Easy to use in retrofit applications
- User-friendly start-up – no adjustment necessary
- No routine maintenance required

Ordering number	VLT® AutomationVT Drive	VLT® AutomationDrive	
	FC 322	FC 301	FC 302
See relevant Design Guide	●	●	●

VLT® Sine-Wave Filters MCC 101

Sine-wave filters are placed between the frequency converter and the motor to optimize the motor power current. It provides a sinusoidal phase-to-phase motor voltage. The filters reduce motor insulation stress, acoustic noise from the motor, and bearing currents (especially in large motors).

- Reduce motor insulation stress
- Reduce acoustic noise from the motor
- Reduce bearing currents (especially in large motors)
- Enables use of longer motor cables
- Reduce losses in the motor
- Prolongs service lifetime

Ordering number	VLT® AutomationVT Drive	VLT® AutomationDrive	
	FC 322	FC 301	FC 302
See relevant Design Guide	●	●	●

VLT® dV/dt filter MCC 102

VLT® dV/dt filters are placed between the frequency converter and the motor to eliminate very fast voltage changes. The motor terminal phase-to-phase voltage is still pulse shaped but its dV/dt values are reduced.

- These filters reduce stress on the motor's insulation and are recommended in applications with older motors, aggressive environments or frequent braking which cause increased DC link voltage.

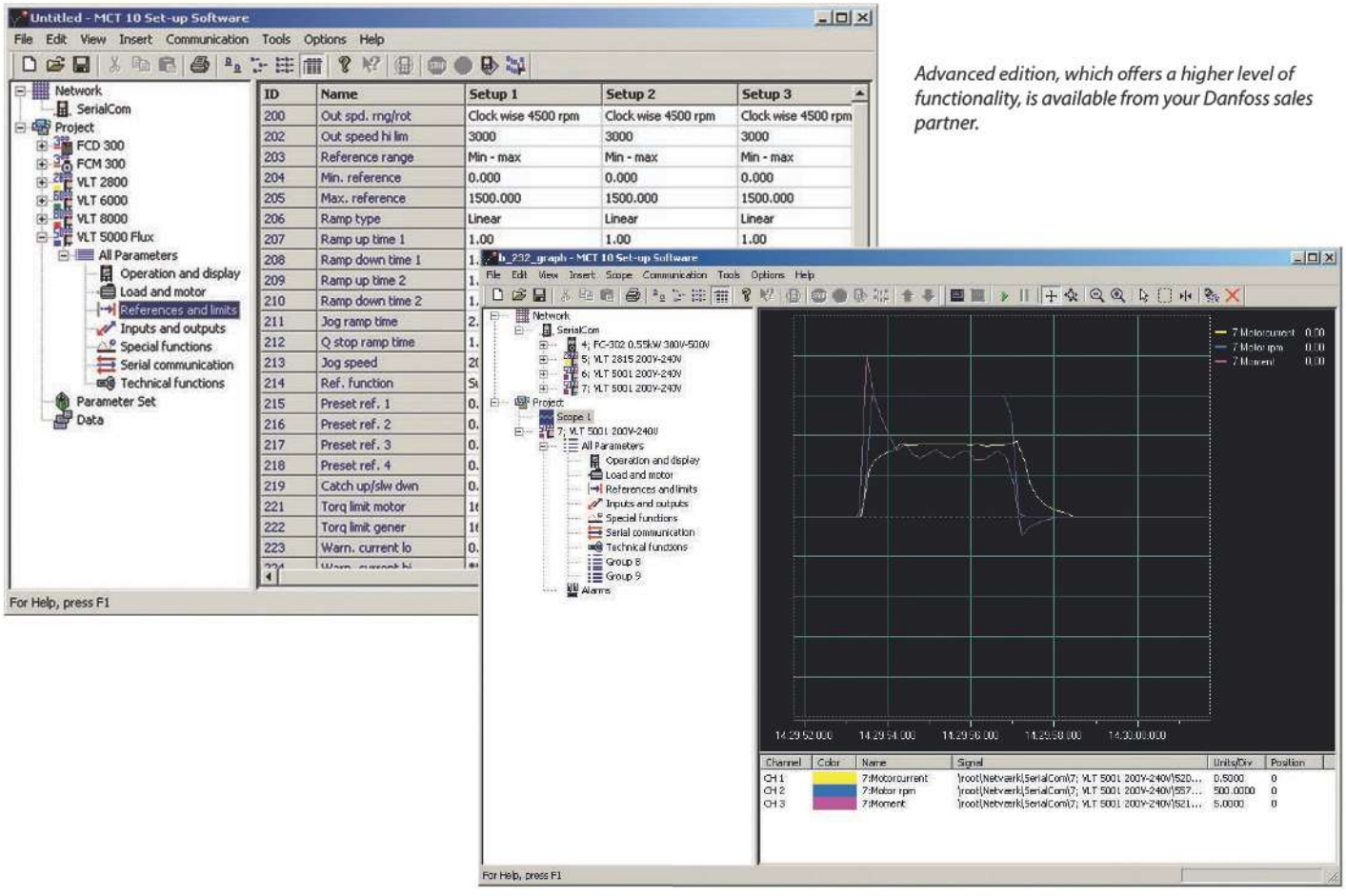
Ordering number	VLT® AutomationVT Drive	VLT® AutomationDrive	
	FC 322	FC 301	FC 302
See relevant Design Guide	●	●	●

MCT 10 (Motion Control Tools)

Offering advanced programming functionality for all Danfoss VLT® drive products, MCT 10 greatly reduces programming and commissioning times. Drives are managed in a standard folder-based user interface that's familiar and easy to understand. Parameter settings for each drive are contained in a single file, simplifying setup and the duplication of parameter sets between drives.

- SyncPos programming
- On-line and off-line commissioning
- On-board help files for each drive parameter
- Logging of alarms and warnings for improved system performance and documentation
- MCT 10 Conversion Wizards simplify drive conversion projects
- Real-time data collection using the MCT 10 Scope function
- Access to the VLT® AutomationDrive's internal data buffer, providing up to four channels of high speed (down to 1 millisec) data collection
- Simplified programming of the VLT® AutomationDrive's Smart Logic Controller using graphical programming tools
- Drive upgrade tools

MCT 10 Basic version is available free of charge from the Danfoss web site. The Advanced edition, which offers a higher level of functionality, is available from your Danfoss sales partner.



FC 301 & FC 302 general specifications

Mains supply:

Supply Terminals (6-Pulse)	L1, L2, L3
Supply Terminals (12-Pulse)	L1-1, L2-1, L3-1, L1-2, L2-2, L3-2
Supply voltage	200-240V ±10%
Supply voltage	FC 301: 380-480V / FC 302: 380-500V ±10%
Supply voltage	FC 302: 525-600V ±10%
Supply voltage	FC 302: 525-690V ±10%

Mains voltage low / mains drop-out:

During low mains voltage or a mains drop-out, the FC continues until the intermediate circuit voltage drops below the minimum stop level, which corresponds typically to 15% below the frequency converter's lowest rated supply voltage. Power-up and full torque cannot be expected at mains voltage lower than 10% below the frequency converter's lowest rated supply voltage.

Supply frequency	50/60Hz ±5%
Max. imbalance temporary between mains phases	3.0 % of rated supply voltage
True Power Factor (λ)	≥ 0.9 nominal at rated load
Displacement Power Factor (cos ø)	near unity (> 0.98)
Switching on input supply L1, L2, L3 (power-ups) ≤ 7.5kW	maximum 2 times/min.
Switching on input supply L1, L2, L3 (power-ups) 11-75 kW	maximum 1 time/min.
Switching on input supply L1, L2, L3 (power-ups) ≥ 90kW	maximum 1 time/2 min.
Environment according to EN60664-1	overvoltage category III/pollution degree 2

The unit is suitable for use on a circuit capable of delivering not more than 100,000 RMS symmetrical Amperes, 240/500/600/690V maximum.

Motor output (U, V, W):

Output voltage	0 - 100% of supply voltage
Output frequency (0.25-75kW)	FC 301: 0.2 - 590Hz / FC 302: 0 - 590Hz
Output frequency (90-1000kW)	0 - 590[1)]Hz
Output frequency in Flux Mode (FC 302 only)	0 - 300Hz
Switching on output	Unlimited
Ramp times	0.01 - 3600sec.

1) Voltage and power dependent

FC 301 & FC 302 general specifications

Torque characteristics:

Starting torque (Constant torque)	maximum 160% for 60 sec.[1)]
Starting torque	maximum 180% up to 0.5 sec.[1)]
Overload torque (Constant torque)	maximum 160% for 60 sec.[1)]
Starting torque (Variable torque)	maximum 110% for 60 sec.[1)]
Overload torque (Variable torque)	maximum 110% for 60 sec.

Pulse	Pause
160%/1min	91.8%/10 min
150%/1min	93.5%/10 min
110%/1min	98.9%/10 min

Table 4.1 Overload capability

Pulse	Pause
160%/60 s	0%/94 s
150%/60 s	0%/75 s
110%/60 s	0%/60 s

Table 4.2 Overload capability

Torque rise time in VVC+ (independent of fsw)	10 ms
Torque rise time in FLUX (for 5 kHz fsw)	1 ms

1) Percentage relates to the nominal torque.

2) The torque response time depends on application and load but as a general rule, the torque step from 0 to reference is 4-5 x torque rise time.

Cable lengths and cross sections for control cables[1)]:

Max. motor cable length, screened	FC 301: 50m/FC 301 (A1): 25m/ FC 302: 150m
Max. motor cable length, unscreened	FC 301: 75m/FC 301 (A1): 50 m/ FC 302: 300m
Maximum cross section to control terminals, flexible/ rigid wire without cable end sleeves	1.5mm2/16 AWG
Maximum cross section to control terminals, flexible wire with cable end sleeves	1mm2/18 AWG
Maximum cross section to control terminals, flexible wire with cable end sleeves with collar	0.5mm2/20 AWG
Minimum cross section to control terminals	0.25mm2/ 24AWG

1) For power cables, see electrical data tables.

Protection and Features:

- Electronic thermal motor protection against overload.
- Temperature monitoring of the heatsink ensures that the frequency converter trips if the temperature reaches a predefined level. An overload temperature cannot be reset until the temperature of the heatsink is below the values stated in the tables on the following pages (Guideline–temperatures may vary for different power sizes, frame sizes, enclosure ratings etc.).
- The frequency converter is protected against short-circuits on motor terminals U, V, W.
- If a mains phase is missing, the frequency converter trips or issues a warning (depending on the load).
- Monitoring of the intermediate circuit voltage ensures that the frequency converter trips if the intermediate circuit voltage is too low or too high.
- The frequency converter constantly checks for critical levels of internal temperature, load current, high voltage on the intermediate circuit and low motor speeds. As a response to a critical level, the frequency converter can adjust the switching frequency and/ or change the switching pattern in order to ensure the performance of the frequency converter.

FC 301 & FC 302 general specifications

Digital inputs:	
Programmable digital inputs	FC 301: 4 (5)[1] / FC 302: 4 (6)[1]
Terminal number	18, 19, 27[1], 29[1], 32, 33,
Logic	PNP or NPN
Voltage level	0 - 24V DC
Voltage level, logic'0' PNP	< 5V DC
Voltage level, logic'1' PNP	> 10V DC
Voltage level, logic '0' NPN[2]	> 19V DC
Voltage level, logic '1' NPN[2]	< 14V DC
Maximum voltage on input	28V DC
Pulse frequency range	0 - 110kHz
(Duty cycle) Min. pulse width	4.5ms
Input resistance, Ri	approx.4 kΩ

Safe Stop Terminal 37, [3] (Terminal 37 is fixed PNP logic):	
Voltage level	0 - 24V DC
Voltage level, logic'0' PNP	< 4V DC
Voltage level, logic'1' PNP	>20V DC
Maximum voltage on input	28V DC
Typical input current at 24V	50mA rms
Typical input current at 20V	60mA rms
Input capacitance	400nF

All digital inputs are galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

1) Terminals 27 and 29 can also be programmed as output.

2) Except safe stop input Terminal 37.

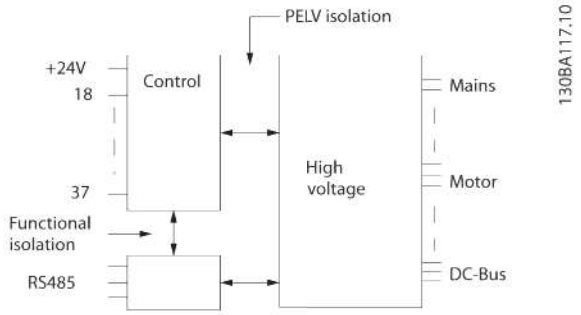
3) When using a contactor with a DC coil inside in combination with Safe Stop, it is important to make a return way for the current from the coil when turning it off. This can be done by using a freewheel diode (or, alternatively, a 30 or 50V MOV for quicker response time) across the coil. Typical contactors can be bought with this diode.

Analog inputs:	
Number of analog inputs	2
Terminal number	53, 54
Modes	Voltage or current
Mode select	Switch S201 and switch S202
Voltage mode	Switch S201/switch S202 = OFF (U)
Voltage level	FC 301: 0 to + 10/ FC 302: -10 to +10V (scaleable)
Input resistance, Ri	approx. 10 kΩ
Max. voltage	± 20V
Current mode	Switch S201/switch S202 = ON (I)

FC 301 & FC 302 general specifications

Current level	0/4 to 20 mA (scaleable)
Input resistance, Ri	approx. 200 Ω
Max. current	30 mA
Resolution for analog inputs	10 bit (+ sign)
Accuracy of analog inputs	Max. error 0.5% of full scale
Bandwidth	FC 301: 20 Hz/ FC 302: 100 Hz

The analog inputs are galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.



Pulse/encoder inputs:

Programmable pulse/encoder inputs	2/1
Terminal number pulse/encoder	29[1], 33[2] / 32[3], 33[3]
Max. frequency at terminal 29, 32, 33	110kHz (Push-pull driven)
Max. frequency at terminal 29, 32, 33	5kHz (open collector)
Min. frequency at terminal 29, 32, 33	4Hz
Voltage level	see section on Digital input
Maximum voltage on input	28V DC
Input resistance, Ri	approx. 4kΩ
Pulse input accuracy (0.1 - 1kHz)	Max. error: 0.1% of full scale
Encoder input accuracy (1 - 11 kHz)	Max. error: 0.05 % of full scale

The pulse and encoder inputs (terminals 29, 32, 33) are galvanically isolated from the supply voltage (PELV) and other highvoltage terminals.

1) FC 302 only

2) Pulse inputs are 29 and 33

3) Encoder inputs: 32 = A, and 33 = B

FC 301 & FC 302 general specifications

Analog output:

Number of programmable analog outputs	1
Terminal number	42
Current range at analog output	0/4 - 20mA
Max. load GND - analog output	500Ω
Accuracy on analog output	Max. error: 0.5% of full scale
Resolution on analog output	12 bit

The analog output is galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

Control card, RS-485 serial communication:

Terminal number	68 (P,TX+, RX+), 69 (N,TX-, RX-)
Terminal number 61	Common for terminals 68 and 69

The RS-485 serial communication circuit is functionally separated from other central circuits and galvanically isolated from the supply voltage (PELV).

Digital output:

Programmable digital/pulse outputs	2
Terminal number	27, 29 [1)]
Voltage level at digital/frequency output	0 - 24V
Max. output current (sink or source)	40mA
Max. load at frequency output	1kΩ
Max. capacitive load at frequency output	10nF
Minimum output frequency at frequency output	0Hz
Maximum output frequency at frequency output	32kHz
Accuracy of frequency output	Max. error: 0.1 % of full scale
Resolution of frequency outputs	12 bit

1) Terminal 27 and 29 can also be programmed as input. The digital output is galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

Control card, 24V DC output:

Terminal number	12, 13
Output voltage	24V +1, -3 V
Max. load	FC 301: 130mA/ FC 302: 200mA

The 24V DC supply is galvanically isolated from the supply voltage (PELV), but has the same potential as the analog and digital inputs and outputs.

FC 301 & FC 302 general specifications

Relay outputs:

Programmable relay outputs	FC 301all kW: 1 / FC 302 all kW: 2
Relay 01 Terminal number	1-3 (break), 1-2 (make)
Max. terminal load (AC-1)[1)] on 1-3 (NC), 1-2 (NO) (Resistive load)	240V AC, 2A
Max. terminal load (AC-15)[1)] (Inductive load @ cosφ 0.4)	240V AC, 0.2A
Max. terminal load (DC-1)[1)] on 1-2 (NO), 1-3 (NC) (Resistive load)	60V DC, 1A
Max. terminal load (DC-13)[1)] (Inductive load)	24V DC, 0.1A
Relay 02 (FC 302 only) Terminal number	4-6 (break), 4-5 (make)
Max. terminal load (AC-1)[1)] on 4-5 (NO) (Resistive load)[2)3)] Overvoltage cat. II	400V AC, 2A
Max. terminal load (AC-15)[1)] on 4-5 (NO) (Inductive load @ cosφ 0.4)	240V AC, 0.2A
Max. terminal load (DC-1)[1)] on 4-5 (NO) (Resistive load)	80V DC, 2A
Max. terminal load (DC-13)[1)] on 4-5 (NO) (Inductive load)	24V DC, 0.1A
Max. terminal load (AC-1)[1)] on 4-6 (NC) (Resistive load)	240V AC, 2A
Max. terminal load (AC-15)[1)] on 4-6 (NC) (Inductive load @ cosφ 0.4)	240V AC, 0.2A
Max. terminal load (DC-1)[1)] on 4-6 (NC) (Resistive load)	50V DC, 2A
Max. terminal load (DC-13)[1)] on 4-6 (NC) (Inductive load)	24V DC, 0.1A
Min. terminal load on 1-3 (NC), 1-2 (NO), 4-6 (NC), 4-5 (NO)	24V DC 10mA, 24V AC 20mA
Environment according to EN 60664-1	overvoltage category III/pollution degree 2

1) IEC 60947 part 4 and 5

The relay contacts are galvanically isolated from the rest of the circuit by reinforced isolation (PELV).

2) Overvoltage Category II

3) UL applications 300V AC2A

Control card, 10V DC output:

Terminal number	50
Output voltage	10.5V ±0.5V
Max. load	15mA

The 10V DC supply is galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

Control characteristics:

Resolution of output frequency at 0 - 1000Hz	± 0.003Hz
Repeat accuracy of Precise start/stop (terminals 18, 19)	≤± 0.1ms
System response time (terminals 18, 19, 27, 29, 32, 33)	≤ 2ms
Speed control range (open loop)	1:100 of synchronous speed
Speed control range (closed loop)	1:1000 of synchronous speed
Speed accuracy (open loop)	30 - 4000rpm: error ±8rpm
Speed accuracy (closed loop), depending on resolution of feedback device	0 - 6000rpm: error ±0.15rpm
Torque control accuracy (speed feedback)	max error±5% of rated torque

All control characteristics are based on a 4-pole asynchronous motor

FC 301 & FC 302 general specifications

Control card performance:	
Scan interval	FC 301: 5 ms / FC 302: 1 ms

Surroundings:	
Frame size A1, A2, A3 and A5	IP 20, IP 55, IP 66
Frame size B1, B2, C1 and C2	IP 21, IP 55, IP 66
Frame size B3, B4, C3 and C4	IP 20
Frame size D1, D2 , E1, F1, F2, F3 and F4	IP 21, IP 54
Frame size D3, D4 and E2	IP 00
Enclosure kit available ≤ 7.5 kW	IP21/TYPE 1/IP 4X top
Vibration test, frame size A, B and C	1.0 g RMS
Vibration test, frame size D, E and F	1 g
Max. relative humidity	5% - 95%(IEC 60 721-3-3; Class 3K3 (non-condensing) during operation
Aggressive environment (IEC 60068-2-43) H2S test	class Kd
Test method according to IEC 60068-2-43 H2S (10 days)	
Ambient temperature, frame size A, B and C	Max. 50 °C
Ambient temperature, frame size D, E and F	Max. 45 °C
Derating for high ambient temperature, see section on special conditions	
Minimum ambient temperature during full-scale operation	0 °C
Minimum ambient temperature at reduced performance	- 10 °C
Temperature during storage/transport	-25 - +65/70 °C
Maximum altitude above sea level	1000 m
Derating for high altitude, see section on special conditions	
EMC standards, Emission	EN 61800-3, EN 61000-6-3/4, EN 55011
EMC standards, Immunity	EN 61800-3, EN 61000-6-1/2, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6

Control card, USB serial communication:	
USB standard	1.1 (Full speed)
USB plug	USB type B "device" plug

Connection to PC is carried out via a standard host/device USB cable.

The USB connection is galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

The USB ground connection is not galvanically isolated from protection earth. Use only an isolated laptop as PC connection to the USB connector on the frequency converter.

FC 322 general specifications

Protection and Features:

- Electronic thermal motor protection against overload.
- Temperature monitoring of the heatsink ensures that the frequency converter trips if the temperature reaches 95 °C ± 5°C. An overload temperature cannot be reset until the temperature of the heatsink is below 70 °C ± 5°C (Guideline - these temperatures may vary for different power sizes, enclosures etc.). VLT AutomationVT Drive has an auto derating function to avoid it's heatsink reaching 95 °C.
- The frequency converter is protected against short-circuits on motor terminals U, V, W.
- If a mains phase is missing, the frequency converter trips or issues a warning (depending on the load).
- Monitoring of the intermediate circuit voltage ensures that the frequency converter trips if the intermediate circuit voltage is too low or too high.
- The frequency converter is protected against earth faults on motor terminals U, V, W.

Mains supply (L1, L2, L3):

Supply voltage	200-240 V ±10%
Supply voltage	380-480 V ±10%
Supply voltage	525-600 V ±10%
Supply voltage	525-690 V ±10%

Mains voltage low / mains drop-out:

During low mains voltage or a mains drop-out, the FC continues until the intermediate circuit voltage drops below the minimum stop level, which corresponds typically to 15% below the FC's lowest rated supply voltage. Power-up and full torque cannot be expected at mains voltage lower than 10% below the FC's lowest rated supply voltage.

Supply frequency	50/60 Hz +4/-6%

The frequency converter power supply is tested in accordance with IEC61000-4-28, 50 Hz +4/-6%.

Max. imbalance temporary between mains phases	3.0 % of rated supply voltage
True Power Factor ()	≥ 0.9 nominal at rated load
Displacement Power Factor (cos) near unity	(> 0.98)
Switching on input supply L1, L2, L3 (power-ups) ≤ enclosure type A	maximum 2 times/min.
Switching on input supply L1, L2, L3 (power-ups) ≥ enclosure type B, C	maximum 1 time/min.
Switching on input supply L1, L2, L3 (power-ups) ≥ enclosure type D, E, F	maximum 1 time/2 min.
Environment according to EN60664-1	overvoltage category III/pollution degree 2

The unit is suitable for use on a circuit capable of delivering not more than 100.000 RMS symmetrical Amperes, 240/480 V maximum.

Motor output (U, V, W):

Output voltage	0 - 100% of supply voltage
Output frequency	0 - 590 Hz*
Switching on output	Unlimited
Ramp times	1 - 3600 sec.

** Dependent on power size.*

FC 322 general specifications

Torque characteristics:	
Starting torque (Constant torque)	maximum 110% for 1 min.*
Starting torque	maximum 135% up to 0.5 sec.*
Overload torque (Constant torque)	maximum 110% for 1 min.*

**Percentage relates to VLT AutomationVT Drive's nominal torque.*

Cable lengths and cross sections:	
Max. motor cable length, screened/armoured	VLT AutomationVT Drive: 150 m
Max. motor cable length, unscreened/unarmoured	VLT AutomationVT Drive: 300 m
Max. cross section to motor, mains, load sharing and brake *	
Maximum cross section to control terminals, rigid wire	1.5 mm^2/16 AWG (2 x 0.75 mm^2)
Maximum cross section to control terminals, flexible cable	1 mm^2/18 AWG
Maximum cross section to control terminals, cable with enclosed core	0.5 mm^2/20 AWG
Minimum cross section to control terminals	0.25 mm^2

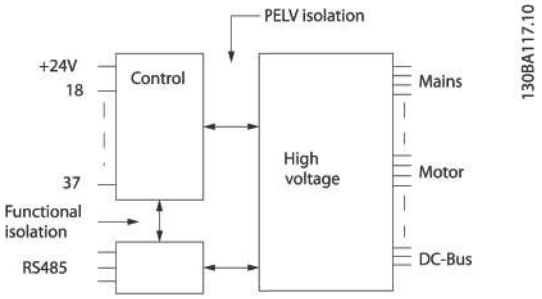
Control card, RS-485 serial communication:	
Terminal number	68 (P,TX+, RX+), 69 (N,TX-, RX-)
Terminal number 61	Common for terminals 68 and 69

The RS-485 serial communication circuit is functionally separated from other central circuits and galvanically isolated from the supply voltage (PELV).

Analog inputs:	
Number of analog inputs	2
Terminal number	53, 54
Modes	Voltage or current
Mode select	Switch S201 and switch S202
Voltage mode	Switch S201/switch S202 = OFF (U)
Voltage level	: 0 to + 10 V (scaleable)
Input resistance, Ri	approx. 10 k<?>
Max. voltage	± 20 V
Current mode	Switch S201/switch S202 = ON (I)
Current level	0/4 to 20 mA (scaleable)
Input resistance, Ri	approx. 200 <?>
Max. current	30 mA
Resolution for analog inputs	10 bit (+ sign)
Accuracy of analog inputs	Max. error 0.5% of full scale
Bandwidth	: 200 Hz

The analog inputs are galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

FC 322 general specifications



Analog output:	
Number of programmable analog outputs	1
Terminal number	42
Current range at analog output	0/4 - 20 mA
Max. resistor load to common at analog output	500 <?>
Accuracy on analog output Max. error	: 0.8 % of full scale
Resolution on analog output	8 bit

The analog output is galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

Digital inputs:	
Programmable digital inputs	4 (6)
Terminal number	18, 19, 27 [1], 29 [1], 32, 33,
Logic	PNP or NPN
Voltage level	0 - 24 V DC
Voltage level, logic'0' PNP	< 5 V DC
Voltage level, logic'1' PNP	> 10 V DC
Voltage level, logic '0' NPN	> 19 V DC
Voltage level, logic '1' NPN	< 14 V DC
Maximum voltage on input	28 V DC
Input resistance, Ri	approx. 4 k

All digital inputs are galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

1) Terminals 27 and 29 can also be programmed as output.

Digital output:	
Programmable digital/pulse outputs	2
Terminal number	27, 29 [1]
Voltage level at digital/frequency output	0 - 24 V
Max. output current (sink or source)	40 mA
Max. load at frequency output	1 k<?>

FC 322 general specifications

Max. capacitive load at frequency output	10 nF
Minimum output frequency at frequency output	0 Hz
Maximum output frequency at frequency output	32 kHz
Accuracy of frequency output	Max. error: 0.1 % of full scale
Resolution of frequency outputs	12 bit

1) Terminal 27 and 29 can also be programmed as input.

The digital output is galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

Pulse inputs:

Programmable pulse inputs	2
Terminal number pulse	29, 33
Max. frequency at terminal, 29, 33	110 kHz (Push-pull driven)
Max. frequency at terminal, 29, 33	5 kHz (open collector)
Min. frequency at terminal 29, 33	4 Hz
Voltage level	see section on Digital input
Maximum voltage on input	28 V DC
Input resistance, Ri	approx. 4 k<?>
Pulse input accuracy (0.1 - 1 kHz)	Max. error: 0.1% of full scale

Control card, 24 V DC output:

Terminal number	12, 13
Max. load	: 200 mA

The 24 V DC supply is galvanically isolated from the supply voltage (PELV), but has the same potential as the analog and digital inputs and outputs.

Relay outputs:

Programmable relay outputs	2
Relay 01 Terminal number	1-3 (break), 1-2 (make)
Max. terminal load (AC-1)[1] on 1-3 (NC), 1-2 (NO) (Resistive load)	240 V AC, 2 A
Max. terminal load (AC-15)[1] (Inductive load @ cos 0.4)	240 V AC, 0.2 A
Max. terminal load (DC-1)[1] on 1-2 (NO), 1-3 (NC) (Resistive load)	60 V DC, 1A
Max. terminal load (DC-13)[1] (Inductive load)	24 V DC, 0.1A
Relay 02 Terminal number	4-6 (break), 4-5 (make)
Max. terminal load (AC-1)[1] on 4-5 (NO) (Resistive load)[2][3]	400 V AC, 2 A
Max. terminal load (AC-15)[1] on 4-5 (NO) (Inductive load @ cos 0.4)	240 V AC, 0.2 A
Max. terminal load (DC-1)[1] on 4-5 (NO) (Resistive load)	80 V DC, 2 A
Max. terminal load (DC-13)[1] on 4-5 (NO) (Inductive load)	24 V DC, 0.1A
Max. terminal load (AC-1)[1] on 4-6 (NC) (Resistive load)	240 V AC, 2 A

FC 322 general specifications

Max. terminal load (AC-15)[1)] on 4-6 (NC) (Inductive load @ cos 0.4)	240 V AC, 0.2A
Max. terminal load (DC-1)[1)] on 4-6 (NC) (Resistive load)	50 V DC, 2 A
Max. terminal load (DC-13)[1)] on 4-6 (NC) (Inductive load)	24 V DC, 0.1 A
Min. terminal load on 1-3 (NC), 1-2 (NO), 4-6 (NC), 4-5 (NO)	24 V DC 10 mA, 24 V AC 20 mA
Environment according to EN 60664-1	overvoltage category III/pollution degree 2

1) IEC 60947 part 4 and 5

The relay contacts are galvanically isolated from the rest of the circuit by reinforced isolation (PELV).

2) Overvoltage Category II

3) UL applications 300 V AC 2A

Control card, 10 V DC output:

Terminal number	50
Output voltage	10.5 V ±0.5 V
Max. load	25 mA

The 10 V DC supply is galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

Control characteristics:

Resolution of output frequency at 0 - 1000 Hz	: +/- 0.003 Hz
System response time (terminals 18, 19, 27, 29, 32, 33)	: ≤ 2 ms
Speed control range (open loop)	1:100 of synchronous speed
Speed accuracy (open loop)	30 - 4000 rpm: Maximum error of ±8 rpm

All control characteristics are based on a 4-pole asynchronous motor

Surroundings:

Enclosure type A	IP 20/Chassis, IP 21kit/Type 1, IP55/Type12, IP 66
Enclosure type B1/B2	IP 21/Type 1, IP55/Type12, IP 66
Enclosure type B3/B4	IP20/Chassis
Enclosure type C1/C2	IP 21/Type 1, IP55/Type 12, IP66
Enclosure type C3/C4	IP20/Chassis
Enclosure type D1/D2/E1	IP21/Type 1, IP54/Type12
Enclosure type D3/D4/E2	IP00/Chassis
Enclosure kit available ≤ enclosure type A	IP21/TYPE 1/IP 4X top
Vibration test enclosure A/B/C	1.0 g
Vibration test enclosure D/E/F	0.7 g
Max. relative humidity	5% - 95%(IEC 721-3-3; Class 3K3 (non-condensing) during operation
Aggressive environment (IEC 721-3-3), uncoated	class 3C2
Aggressive environment (IEC 721-3-3), coated	class 3C3
Test method according to IEC 60068-2-43 H2S (10 days)	
Ambient temperature	Max. 50 °C

Derating for high ambient temperature, see section on special conditions

FC 322 general specifications

Minimum ambient temperature during full-scale operation	0 °C
Minimum ambient temperature at reduced performance	- 10 °C
Temperature during storage/transport	-25 - +65/70 °C
Maximum altitude above sea level without derating	1000 m
Maximum altitude above sea level with derating	3000 m
Derating for high altitude, see section on special conditions	
EMC standards, Emission	EN 61800-3, EN 61000-6-3/4, EN 55011, IEC 61800-3
EMC standards, Immunity	EN 61800-3, EN 61000-6-1/2, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6

Control card performance:

Scan interval	: 5 ms

Control card, USB serial communication:

USB standard	1.1 (Full speed)
USB plug	USB type B "device" plug

Connection to PC is carried out via a standard host/device USB cable.

The USB connection is galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

The USB connection is not galvanically isolated from protection earth. Use only isolated laptop/PC as connection to the USB connector on VLT Automation VT Drive or an isolated USB cable/converter.

Enclosures

Cabinet sizes

Dimensions shown in inches.

Chassis (IP20, IP00)

Frame Size	A1	A2	A3	B3	B4	C3	C4	D3H	D4H	E2
Height	7.9	10.6	10.6	16.5	17.7	25.0	31.7	33.2	41.3	59.0
Width	3.0	3.5	5.1	6.5	9.1	12.1	14.6	9.8	13.8	23.0
Depth	8.1	8.1	8.1	9.8	9.8	13.1	13.1	14.8	14.8	19.4

NEMA 1, NEMA 12, NEMA 4X (IP21, IP55, IP54, IP66)

Frame Size	A2	A3	A4	A5	B1	B2	C1	D1H	D2H	E1	F1	F3
Height	14.6	14.6	15.4	16.5	19.4	25.6	26.8	33.2	41.3	78.7	89.8	89.8
Width	3.5	5.1	7.9	9.5	9.5	9.5	12.1	12.8	16.5	23.6	55.1	78.6
Depth	8.1	8.1	7.0	7.9	10.2	10.3	12.2	14.9	14.9	19.4	23.9	23.9

Current and power by enclosure size

	3 Phase 200-230 Vac						3 Phase 380-480 Vac (FC 322 & FC 301) 380-500 Vac (FC 302 only)					
	NO 110% (FC 322)			HO 160% (FC 301 & FC 302)			NO 110% (FC 322)			HO 160% (FC 301 & FC 302)		
	Output Current Amps	Shaft Output KW	Shaft Output HP	Output Current Amps	Shaft Output KW	Shaft Output HP	Output Current Amps (480 V)	Shaft Output KW	Shaft Output HP	Output Current Amps (480 V)	Shaft Output KW	Shaft Output HP
PK25	1.8	0.25	1/3	1.8	0.25	1/3						
PK37	2.4	0.37	1/2	2.4	0.37	1/2	1.2	0.37	1/2	1.2	0.37	1/2
PK55	3.5	0.55	3/4	3.5	0.55	3/4	1.6	0.55	3/4	1.6	0.55	3/4
PK75	4.6	0.75	1	4.6	0.75	1	2.1	0.75	1	2.1	0.75	1
P1K1	6.6	1.1	1-1/2	6.6	1.1	1-1/2	2.7	1.1	1-1/2	2.7	1.1	1-1/2
P1K5	7.5	1.5	2	7.5	1.5	2	3.4	1.5	2	3.4	1.5	2
P2K2	10.6	2.2	3	10.6	2.2	3	4.8	2.2	3	4.8	2.2	3
P3K0	12.5	3.0	4	12.5	3.0	4	6.3	3.0	4	6.3	3.0	4
P3K7	16.7	3.7	5	16.7	3.7	5						
P4K0							8.2	4.0	5	8.2	4.0	5
P5K5	24.2	5.5	7-1/2	24.2	5.5	7-1/2	11.0	5.5	7-1/2	11.0	5.5	7-1/2
P7K5	30.8	7.5	10	30.8	7.5	10	14.5	7.5	10	14.5	7.5	10
P11K	46.2	11.0	15	46.2	11.0	15	21.0	11.0	15	21.0	11.0	15
P15K	59.4	15.0	20	59.4	15.0	20	27.0	15.0	20	27.0	15.0	20
P18K	74.8	18.5	25	74.8	18.5	25	34.0	18.5	25	34.0	18.5	25
P22K	88.0	22.0	30	88.0	22.0	30	41.0	22.0	30	41.0	22.0	30
P30K	115.0	30.0	40	115.0	30.0	40	52.0	30.0	40	52.0	30.0	40
P37K	143.0	37.0	50	143.0	37.0	50	65.0	37.0	50	65.0	37.0	50
P45K	170.0	45.0	60				80.0	45.0	60	80.0	45.0	60
P55K							105.0	55.0	75	105.0	55.0	75
P75K							130.0	75.0	100	130.0	75.0	100
N90K							160.0	90.0	125	160.0	90.0	125
N110							190.0	110.0	150	190.0	110.0	150
N132							240.0	132.0	200	240.0	132.0	200
N160							303.0	160.0	250	303.0	160.0	250
N200							361.0	200.0	300	361.0	200.0	300
N250							443.0	250.0	350	443.0	250.0	350
P315							540.0	315.0	450	540.0	315.0	450
P355							590.0	355.0	500	590.0	355.0	500
P400							678.0	400.0	550	678.0	400.0	550
P450							730.0	450.0	600	730.0	450.0	600
P500							780.0	500.0	650	780.0	500.0	650
P560							890.0	560.0	750	890.0	560.0	750
P630							1050.0	630.0	900	1050.0	630.0	900
P710							1160.0	710.0	1000	1160.0	710.0	1000
P800							1380.0	800.0	1200	1380.0	800.0	1200
P900												
P1M0							1530.0	1000.0	1350			
P1M2												
P1M4												

Frame sizes

A	B	C	D	E

	3 Phase 525-600 Vac (FC 322 & FC 302)						3 Phase 525-690 Vac (FC 322 & FC 302)			
	NO 110% (FC 322)			HO 160% (FC 302)			NO 110% (FC 322)		HO 160% (FC 302)	
	Output Current Amps (575 V)	Shaft Output KW	Shaft Output HP	Output Current Amps (575V)	Shaft Output KW	Shaft Output HP	Output Current Amps (690 V)	Shaft Output KW	Output Current Amps (690 V)	Shaft Output KW
PK25										
PK37										
PK55										
PK75	1.7	0.75	1	1.7	0.75	1				
P1K1	2.4	1.1	1-1/2	2.4	1.1	1-1/2				
P1K5	2.7	1.5	2	2.7	1.5	2				
P2K2	3.9	2.2	3	3.9	2.2	3				
P3K0	4.9	3.0	4	4.9	3.0	4				
P3K7										
P4K0	6.1	4.0	5	6.1	4.0	5				
P5K5	9.0	5.5	7-1/2	9.0	5.5	7-1/2				
P7K5	11.0	7.5	10	11.0	7.5	10				
P11K	18.0	11.0	15	18.0	11.0	15	18.0	11.0	18.0	11.0
P15K	22.0	15.0	20	22.0	15.0	20	22.0	15.0	22.0	15.0
P18K	27.0	18.5	25	27.0	18.5	25	27.0	18.5	27.0	18.5
P22K	34.0	22.0	30	34.0	22.0	30	34.0	22.0	34.0	22.0
P30K	41.0	30.0	40	41.0	30.0	40	41.0	30.0	41.0	30.0
P37K	52.0	37.0	50	52.0	37.0	50	46.0	37.0	46.0	37.0
P45K	62.0	45.0	60	62.0	45.0	60	54.0	45.0	54.0	45.0
P55K	83.0	55.0	75	83.0	55.0	75	73.0	55.0	73.0	55.0
P75K	100.0	75.0	100	100.0	75.0	100	86.0	75.0	86.0	75.0
N90K	131.0	90.0	125				108.0	90.0	108.0	90.0
N110							131.0	110.0	131.0	110.0
N132							155.0	132.0	155.0	132.0
N160							192.0	160.0	192.0	160.0
N200							242.0	200.0	242.0	200.0
N250							290.0	250.0	290.0	250.0
P315							344.0	315.0	344.0	315.0
P355									380.0	355.0
P400							410.0	400.0	410.0	400.0
P450							450.0	450.0		
P500							500.0	500.0	500.0	500.0
P560							570.0	560.0	570.0	560.0
P630							630.0	630.0	630.0	630.0
P710							730.0	710.0	730.0	710.0
P800							850.0	800.0	850.0	800.0
P900							945.0	900.0	945.0	900.0
P1M0							1060.0	1000.0	1060.0	1000.0
P1M2							1260.0	1200.0	1260.0	1200.0
P1M4							1415.0	1400.0		

One drive. Three performance levels.

	FC 301	FC 302	FC 322
Operating			
Power Range 200-240 Vac [HP]	1/3 to 50	1/3 to 50	1/3 to 60
Power Range 380-480 Vac [HP]	1/2 to 100	na	1/2 to 1350
Power Range 380-500 Vac [HP]	na	1/2 to 1200	na
Power Range 525-600 Vac [HP]	na	1 to 100	1 to 125
Power Range 525-690 Vac [KW]	na	11 to 1000	11 to 1400
Ambient Temperature C *(average for 24 hours without de-rating)*	50	50	50
Ambient Temperature with de-rating	55	55	55
Variable Switching Frequency 1-16 Khz	√	√	√
Cable Length			
Shielded/Unshielded	50/75 m	150/300 m	150/300 m
RFI EN55011 class A2 industry	<5 m	<5 m	<5 m
RFI EN55011 class A1 industry	<50 m	<150 m	<150 m
RFI EN55011 class B domestic	<10 m	<50 m	<50 m
Control Modes			
Voltage Vector Control (VVC+)	√	√	√
Flux Vector Control	na	√	na
Permanent Magnet Motor	na	√	na
Automatic Energy Optimization (AEO)	√	√	√
Flying Start	na	√	√
Over Voltage Control (OVC)	√	√	√
Controlled Ramps	√	√	√
Linear & S Ramps	√	√	√
Process PID Control	√	√	√
Precise Start/Stop	√	√	√
Digital Potentiometer	√	√	na
Preset References	√	√	√
Enclosure Styles			
Chassis (IP00)	√	√	√
Protected Chassis (IP20)	√	√	√
NEMA 1 (IP21)	√	√	√
NEMA 12 (IP55/54)	√	√	√
NEMA 4X Indoor (IP66)	√	√	√
Special Functions			
Smart Logic Controller	√	√	√
Logic Rule Control	√	√	√
Safe Stop Functionality (EN 954-1 cat 3)	na	std	opt
Real Time Clock	na	na	√
Automatic Motor Adaptation	√	√	√

	FC 301	FC 302	FC 322
Interface			
Numeric Keypad	opt	opt	opt
Graphical Keypad	std	std	std
Info/Help Function	√	√	√
Personal Menu	√	√	√
Regional Settings	√	√	√
Multi-Lingual Support	√	√	√
Change made Restore Previous Setting	√	√	√
Password Protection	√	√	√
Std Input/Output			
Analog Inputs	2	2	2
Analog Outputs	1	1	1
Digital Inputs	5	6	6
Digital Ouptuts	1	2	2
Relay Outputs	1	2	2
Communications			
RS-485 (built in)	√	√	√
protocol (built in)	Modbus RTU or FC Protocol		
USB Port (built in)	√	√	√
Optional Profibus	√	√	√
Optional DeviceNet	√	√	√
Optional CanOpen	√	√	na
Optional Ethernet	√	√	√
Optional Modbus TCP/IP	√	√	√
I/O Expansion			
Analog Inputs	2	2	3
Analog Outputs	1	1	3
Digital Inputs	3	3	3
Digital Ouptuts	2	2	2
Relay Outputs	3	3	3
Encoder	1	1	na
Resolver	1	1	na
Safe PLC Interface	na	1	na
Thermistor Input	na	√	√
Extended Cascade Control	na	na	√
Other Functions			
Advanced Cascade Control	na	na	√
Programmable Motion Control	√	√	na
Positioning Control	√	√	na
Synchronizing Control	√	√	na
Center Winding Control	√	√	na
SALT	na	√	na

Ordering type code for VLT® AutomationDrives

[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]
FC									X	X	SXXX							

[1] Application	
301	VLT® AutomationDrive FC 301
302	VLT® AutomationDrive FC 302
322	VLT® AutomationVT Drive FC 322

[2] Power Size	
PK25	1/3 HP 0.25 KW
P1M4	1400 KW
	See pages 14 and 15 for complete list of power sizes available by voltage.

[3] AC Line Voltage	
T2	3Ø 200 - 240 VAC
T4	3Ø 380 - 480 VAC (FC 322)
T5	3Ø 380 – 500 VAC (FC 302)
T6	3Ø 525 - 600 VAC (FC 302)
T7	3Ø 525 – 690 VAC

[4] Enclosure	
For cabinet mounting:	
E00	IP00 (enclosure D3, D4)
Z20	IP20 (enclosure A1, FC 301 only)
E20	IP20 (enclosure A2, A3, B3, B4, C3, C4)
Standalone:	
E21	IP21 NEMA 1 (enclosure B1, B2, C1, C2, D1, D2)
E54	IP54 NEMA 12 (enclosure D1, D2)
E55	IP55 (enclosure D1, D2)
E66	IP66 (enclosure A5, B1, B2, C1, C2)
Special design:	
C00	IP00 (enclosure E00–air duct in stainless steel)
P20	IP20 (enclosure B4, C3, C4–rear heat sink)
E2M	IP21 (enclosure D1, D2,–protective cover)
P21	IP21 (enclosure as E21–rear heat sink)
E5M	IP54 (enclosure D1, D2,–protective cover)
P55	IP55 (enclosure as E55–rear heat sink)

[5] RFI filter	
H1	RFI-Filter Class A1/B
H2	INo RFI-Filter, Class A2
H3	RFI-Filter Class A1
H4	RFI-Filter, Class A1
H6	RFI-Filter for Marine
HE	Integral Class A2 filter with residual current monitor
HX	No RFI-Filter (only 600V)

[6] Braking & Safety	
X	No brake IGBT
B	Brake IGBT mounted
R	Regen Terminals
T	Safe stop without brake
U	With brake and safe stop

[7] Display (Local Control Panel)	
X	Blank faceplate, no LCP installed
G	LCP 102 – Numeric LCP installed
N	LCP 101 – Graphic LCP installed

[8] Conformal Coating	
X	No conformal coating
C	Conformal coating on all PCBs

[9] Mains Input	
X	No option
1	Mains disconnect
3	Mains disconnect & fuses
5	Mains disconnect, fuses and loadsharing
7	Fuses
8	Mains disconnect and load sharing
A	Fuses & load sharing terminals
D	Load sharing terminals

[12] LCP Language Pack	
X	Standard language pack

[13] Fieldbus	
AX	No Fieldbus Option Installed
A0	Profibus MCA101 Option Card
A4	DeviceNet MCA104 Option Card
A6	CAN Open MCA105 Option Card
A8	EtherCat MCA124 Option Card
AL	Profinet MCA120 Option Card
AN	Ethernet IP MCA121 Option Card
AQ	Modbus TCP/IP MCA122 Option Card

[14] Application Option	
BX	No application option
B2	PTC Thermistor Input MCB112 Option Card (FC-302 Only)
BK	General Purpose I/O MCB101 Option Card
BO	Analog I/O plus Battery Backup MCB109 (FC 322 Only)
BP	Relay Expansion MCB105 Option Card
BR	Encoder Input MCB102 Option Card
BU	Resolver Input MCB103 Option Card
BY	Extended Cascade Control MCO101 (FC 322 Only)
BZ	SAFE PLC Interface MCB108 Option Card

[15] Motion Control	
CX	No motion control option
C4	Motion Control MCO 305 Option Card

[16] Motion Control Output	
X	No motion control output option
5	Advanced Cascade Control MCO 102 (FC 322 Only)
R	Extended Relay MCB 113 Option Card (FC 302 Only)

[17] Motion Control Software	
XX	No Motion Control Software *Note: C4 option in [15] selected with no motion software in [17] will require programming by a qualified individual*
10	Software for Synchronizing Control MCO 350*
11	Software for Positioning Control MCO 351* ** Must select C4 in block [15]*

[18] Voltage Input	
DX	No DC Input Option Installed
D0	24 Vdc MCB 107 Option Card

Not all combinations are valid. Consult your Danfoss Representative for valid combinations.

ENGINEERING
TOMORROW

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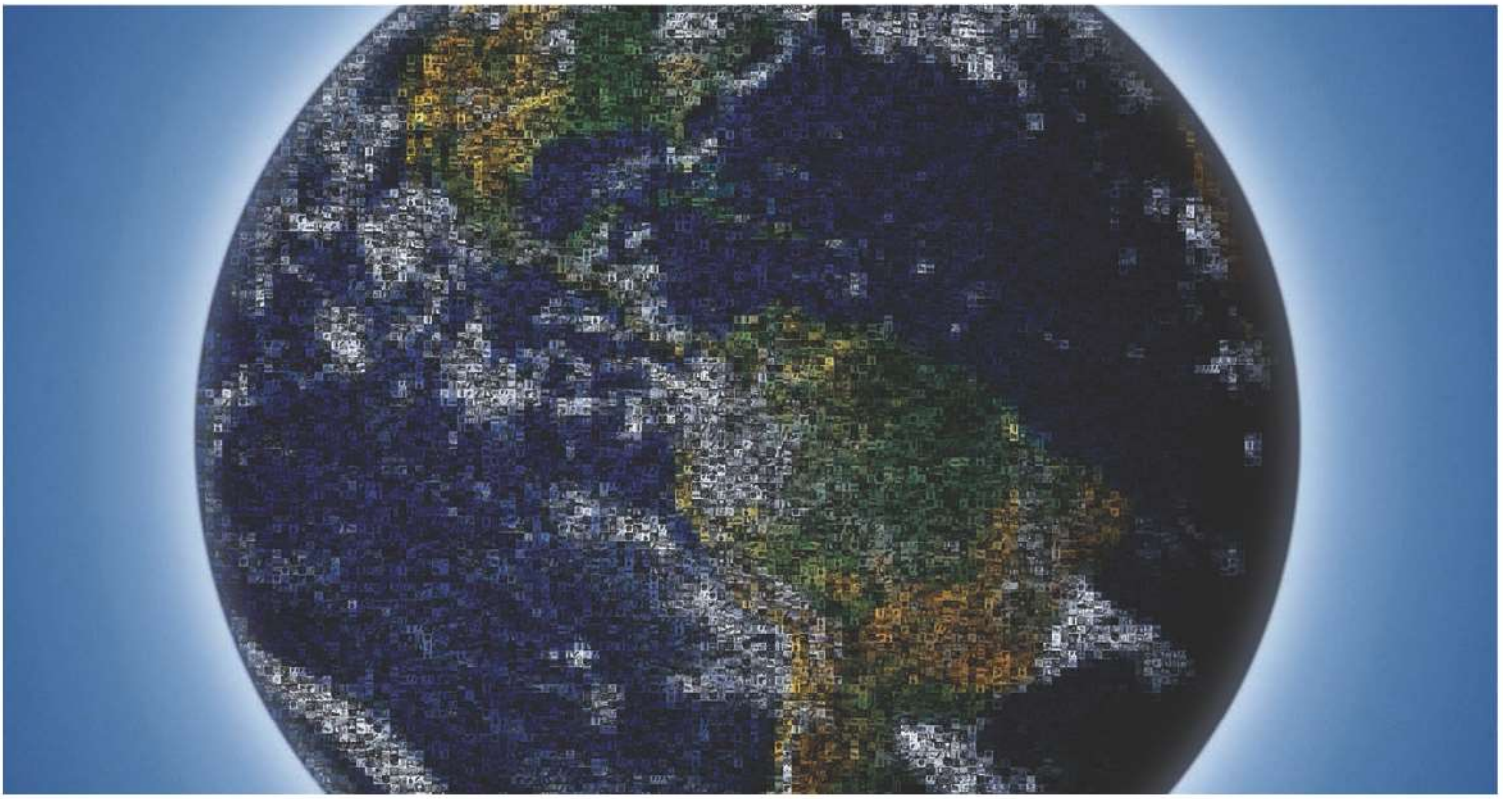

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As a world leader in components and solutions, Danfoss meets our customers' challenges through "EnVisioneering." This approach expresses our views on engineering innovation, energy efficiency, environmental responsibility and sustainable business growth that creates strong customer partnerships. This vision is realized through a global production, sales, and service network focused on refrigeration, air conditioning, heating and water, and motion control. Through EnVisioneering, Danfoss is Making Modern Living Possible.

Danfoss "EnVisioneering":

- Engineered solutions to improve performance and profitability
- Energy efficiency to meet higher standards and to lower operating costs
- Environmental sustainability to provide a financial and social payback
- Engaged partnerships to foster trust, reliability, and technological superiority

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