



Variable Torque Drives for Industry

VLT® HVAC Drive



Danfoss VLT[®] HVAC Drive FC 102 Series solutions

Complete Range of Drives

- From 1½ to 1350 HP
- NEMA/UL Type 1 and Type 12 enclosures

Intelligent Control and Comfort

- VLT HVAC Drives precisely maintain exact flow required
- VLT HVAC Intelligent Control with four auto-tuning, multi-input, multi-control PIDs

Energy Savings

- Energy savings of 50 to 70% are common when compared with constant flow systems
- When compared with other methods of flow control, savings to 40% are typical

Power Factor

- Near unity displacement power factor
- True power factor of >.90 at full load
- Power factor higher than that of the motor
- Power factor constant regardless of speed and load

Harmonics Control

- All VLT HVAC Drives have dual DC-link reactors, which provide a reduction in input harmonics equal to a 5% AC line reactor without the voltage drop and efficiency losses associated with AC line reactors

EMI/RFI Control

- All VLT HVAC Drives are designed to contain and control EMI and RFI to stringent European standard EN 61800-3
- Additional filtering options are available for even the most sensitive installations

Reduction in Maintenance Costs

- Inherent soft start eliminates the stress on belts, compressors and other driven equipment caused by across-the-line motor starting
- The need to trim impellers on oversized pumps may be eliminated
- Any oversized system can be fine tuned by setting the maximum speed to the maximum desired flow rate

Specifications and dimensions subject to change without notice.

VLT® HVAC Drive specifications

Input Voltages (select model based on input voltage.....	200–240, 380–480, 525–600
Motor Voltages.....	200, 208, 220, 230, 240, 380, 400, 415, 440, 460 or 575 VAC
Input Voltage Range for Full Output.....	Nominal $\pm 10\%$
Input Voltage without Tripping.....	164–299, 313–538 or 394–690 VAC
Input Frequency.....	50 or 60 Hz, ± 2 Hz
Output Frequency.....	Selectable 0 to 1000 Hz
Drive Efficiency.....	97% or greater at full load and nominal motor speed
Input Section.....	Full wave three phase bridge rectifier
Output Section.....	Insulated gate bipolar transistors (IGBT)
Input Displacement Power Factor (cos ϕ).....	>98% at all speeds and loads
Total Power Factor.....	>.90 at full load
Switching on Input.....	1–2 times/min.
Follower Signal.....	0 to 5 V DC, 0 to 10 V DC, 0 to 20 mA, 4 to 20 mA fully selectable, direct and inverse acting
Lost Analog Reference Action.....	Selectable to go to a preset speed, go to maximum speed, stay at last speed, stop, turn off, or stop and trip
Time Delay for Lost Analog Reference Action.....	1 to 99 sec.
Output Current Limit Setting.....	Adjustable to 110% of drive rating
Switching on Output.....	Unlimited
Current Limit Timer.....	0 to 60 sec. or infinite
Adjustable accel/decel ramp times.....	1–3600 sec.
Adjustable Maximum Speed.....	From minimum speed setting to 120 Hz
Adjustable Minimum Speed.....	From maximum speed setting to 0 Hz
Adjustable Acceleration/Deceleration Times.....	To 3,600 sec. to base speed
Adjustable Auto Restart Time Delay.....	0 to 600 sec.
Starting Torque.....	Constant torque until commanded speed reached
Breakaway Torque Time (1.6 times drive rated current).....	0.0 to 0.5 sec.
Preset Speeds.....	16
Frequency Stepovers.....	4
Accel/Decel Rates.....	4
Programmable Digital Inputs.....	6 (2 can be used as digital outs)
Programmable Analog Inputs.....	2; selectable voltage or current
Programmable Analog Outputs.....	1; 0/4 to 20 mA
Programmable Relay Outputs.....	2; standard Form C, 240–400 VAC, 2A (3 additional optional)
Start Voltage.....	0 to 10%
Delayed Start.....	0 to 120 sec.
DC Braking.....	0 to 60 sec., 0–50% rated current
Automatic Restart Attempts.....	0 to 20 or infinite
Automatic Restart Time Delay.....	0 to 600 sec. between each attempt
Relay ON Delay and Relay OFF Delay.....	0 to 600 sec.
Drive and Options Enclosures.....	NEMA/UL Type Types 1 and 12
Ambient Operating Temperature Range.....	14°F to 113°F (-10°C to 45° C)
Humidity.....	95%, non-condensing
Maximum Elevation without Derate.....	3,300 ft. (1000 m)
Short Circuit Current Rating.....	100,000 amps

User benefits

Drive Feature	User Benefit
Hot-pluggable local control panel (LCP) keypad with memory	Four drive setups can be uploaded to the LCP keypad and saved. To program multiple drives, upload the parameter settings to the keypad, then place that keypad on each of the other drives and download these same settings to every other drive.
Operates without an LCP in place	Assures tamper-proof operation. Drive status shown even with the keypad removed.
LCP can be easily remote mounted	The standard keypad can be remotely mounted 10 feet from the drive with a standard 9-pin cable. The remotely mounted keypad is gasketed and carries a NEMA/UL Type 12 and NEMA/UL Type 3R rating.
Simple and flexible menu structure	Many installations require nothing more than scrolling through the twelve "QUICK MENU" items to confirm that these defaults are correct. Users can also select up to 20 parameters to be included in a "PERSONAL MENU" for easy access.
USB Port	PC access to drive parameters without disconnecting the keypad or interrupting communications.
Built-in EIA-485 interface	Fully equipped for serial communication. Up to 31 drives can be connected to one serial bus up to 5,000 feet long.
Automatic Motor Adaptation (AMA)	Measures motor stator resistance and reactance without turning the motor or decoupling the load. The drive then automatically uses this information to optimize performance and efficiency.
Simplified Automatic Energy Optimization (AEO)	Eliminates the need to select a V/Hz pattern. AEO continually monitors the motor's speed and load and adjusts the applied voltage to maximize energy savings. Even at full speed, voltage will be reduced if the load is less than 100%. This automatically compensates for oversized motors or systems that are not fully loaded.
Energy Monitoring	Real energy savings are always available without the additional expense of external equipment.
Real-Time Clock	Adds sophisticated performance to basic control schemes for increased comfort and energy savings.
High breakaway current	Up to 160% breakaway current available for high friction loads.

User benefits

Drive Feature	User Benefit
VVC ^{PLUS} Output Switching Pattern	Superior Voltage Vector Control provides high efficiency and full motor performance.
Automatic High Ambient Derate	If the ambient temperature exceeds the normal limit, the drive can be set to warn of its overtemperature and continue to run, keeping the application functional. To control its temperature, the drive will reduce the output carrier frequency and then, if necessary, reduce the output current.
Dual DC-link reactors	Non-saturating reactors provide better harmonic performance than a 5% AC line or saturating DC reactor.
Built-in protection	<ul style="list-style-type: none"> • Motor pre-heat • Overload and thermistor input • No flow, broken belt, dry pump and end-of-curve detection Eliminate the need for external protection devices while maximizing the life of the motor and other system components.
Automatic Switching Frequency Modulation (ASFM)	<ul style="list-style-type: none"> • Adjusts the carrier frequency based on the load • Provides a quiet motor at critical low flow conditions • Provides full rated output without derate at high load
Protected from input or output switching	Input or output can be disconnected while the drive is running without the need for interlocks to protect the drive.
Full torque to base speed	Direct drive fans run without derating. The full output torque can be set to coincide with the maximum design operating speed of the driven equipment, up to 60 Hz.
Auto ramping	Ensures no-trip acceleration and deceleration.
Flying start	Allows starting into a “windmilling” fan at any speed, in either direction.
Sleep mode	Automatically stops the drive when its speed drops below the “sleep” level for a specified time, and automatically restarts when the speed command exceeds the “wake” level. Provides increased energy savings without separate controllers.
Run-permissive circuit	The ability to accept a “system ready” signal assures that dampers or other auxiliary equipment are in the proper state for drive operation.
Safety Interlock	Provides external fault indication.
UL and C-UL Listed	All drives and options sold for US and Canadian applications carry this safety certification.
CE Marked	All drives carry the CE mark for sale into international markets.

Model Numbers

Max. Nominal Output		230V		380V		460V		575V	
HP	KW	Model Number	Max. Amps	Model Number	Max. Amps	Model Number	Max. Amps	Model Number	Max. Amps
1.5	1.1	FC-102P1K1T2	6.6	FC-102P1K1T4	3	FC-102P1K1T4	3	FC-102P1K1T6	2.4
2	1.5	FC-102P1K5T2	7.5	FC-102P1K5T4	4.1	FC-102P1K5T4	3.4	FC-102P1K5T6	2.7
3	2.2	FC-102P2K2T2	10.6	FC-102P2K2T4	5.6	FC-102P2K2T4	4.8	FC-102P2K2T6	3.9
5	3.7/4	FC-102P3K7T2	16.7	FC-102P4K0T4	10	FC-102P4K0T4	8.2	FC-102P4K0T6	6.1
7.5	5.5	FC-102P5K5T2	24.2	FC-102P5K5T4	13	FC-102P5K5T4	11	FC-102P5K5T6	9
10	7.5	FC-102P7K5T2	30.8	FC-102P7K5T4	16	FC-102P7K5T4	14	FC-102P7K5T6	11
15	11	FC-102P11KT2	46.2	FC-102P11KT4	24	FC-102P11KT4	21	FC-102P11KT6	18.4
20	15	FC-102P15KT2	59.4	FC-102P15KT4	32	FC-102P15KT4	27	FC-102P15KT6	22
25	18.5	FC-102P18KT2	74.8	FC-102P18KT4	37.5	FC-102P18KT4	34	FC-102P18KT6	27
30	22	FC-102P22KT2	88	FC-102P22KT4	44	FC-102P22KT4	40	FC-102P22KT6	34
40	30	FC-102P30KT2	115	FC-102P30KT4	61	FC-102P30KT4	52	FC-102P30KT6	41
50	37	FC-102P37KT2	143	FC-102P37KT4	73	FC-102P37KT4	65	FC-102P37KT6	52
60	45	FC-102P45KT2	170	FC-102P45KT4	90	FC-102P45KT4	77	FC-102P45KT6	62
75	55	N/A	N/A	FC-102P55KT4	106	FC-102P55KT4	106	FC-102P55KT6	83
100	75	N/A	N/A	FC-102P75KT4	147	FC-102P75KT4	130	FC-102P75KT6	100
125	90	N/A	N/A	FC-102P90KT4	177	FC-102P90KT4	160	FC-102P90KT6	131
150	110	N/A	N/A	FC-102P110T4	212	FC-102P110T4	190	FC-102P110T7	155
200	132	N/A	N/A	FC-102P132T4	260	FC-102P132T4	240	FC-102P132T7	192
250	160	N/A	N/A	FC-102P160T4	315	FC-102P180T4	302	FC-102P180T7	242
300	200	N/A	N/A	FC-102P200T4	395	FC-102P200T4	361	FC-102P200T7	290
350	250	N/A	N/A	FC-102P250T4	480	FC-102P250T4	443	FC-102P250T7	344
450	315	N/A	N/A	FC-102P315T4	600	FC-102P315T4	540	FC-102P315T7	400
500	355	N/A	N/A	FC-102P355T4	658	FC-102P355T4	590	FC-102P355T7	450
550/600	400	N/A	N/A	FC-102P400T4	745	FC-102P400T4	678	FC-102P400T7	500
600	450	N/A	N/A	FC-102P450T4	800	FC-102P450T4	730	FC-102P450T7	570
650	500	N/A	N/A	N/A	N/A	N/A	N/A	FC-102P450T7	630

Max drive output current rating of drive must always equal or exceed nameplate running amps of motor(s).

Above current ratings are for drives only. Packaged solutions follow UL/NEC horsepower current ratings.

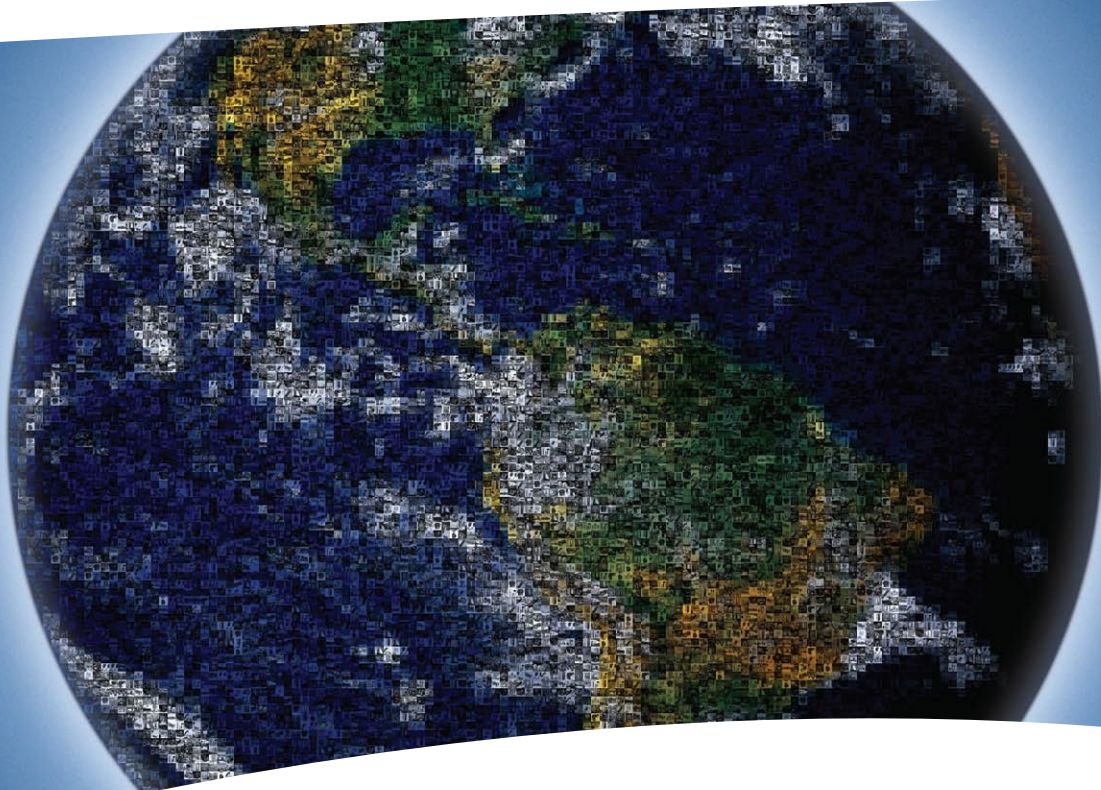
Dimensions

Enclosure Styles

	NEMA 1		NEMA12	NEMA 1 and NEMA 12							
	A2	A3	A5	B1	B2	C1	C2	D1	D2	E1	
Drive Only	Height	14.8	14.8	16.5	18.9	25.6	26.9	30.2	47.6 / 55.5*	62.6 / 68.5*	78.7
	Width	3.5	5.2	9.5	9.5	9.5	12.1	14.6	16.5	16.5	22.8
	Depth	8.2**	8.2**	7.9	10.2	10.2	12.2	13	14.7	14.7	19.4
Drive w/ Fuses or Fused Disconnect	Height	19.1	19.1	16.5	18.9	25.6	26.9	30.2	47.5	62.4	78.7
	Width	5.2	5.2	9.5	9.5	9.5	12.1	14.6	16.5	16.5	22.8
	Depth	8.2	8.2	7.9	10.2	10.2	12.2	13	14.7	14.7	19.4
	w/ disconnect	9.6	9.6	9.4	12	12	14.1	14.9	16.4	16.4	21.2

* Height for wall mount / height when mounted on pedestal
 ** Depth increased by .55" when an option A or B card is added





EnVisioneering

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 create 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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