Variable Torque Drives for Industry

VLT® HVAC Drive

VLT®
THE REAL DRIVE

Variable Frequency Drive, Series VLT HVAC

(EMB) Electro-Mechanical Controlled Bypass

- NEMA __1__
- Voltage_460V___
- BACnet, Seimens, Johnson Controls. Modbus RTU Imbedded
- **EMB2** control package will be provided. This package includes the following features:
- 3-Contactor
- Main Disconnect Switch and Main Drive Fusing 100kA SCCR
- Drive-Off-Bypass selector
- 100,000kA SCCR

Warranty

- Standard 18 months from shipment, inclusive warranty includes parts, labor, travel and expenses.

Delivery (weekday delivery only)

- __4_ to _6__ weeks based on factory loading at time of release

Notes/Exclusions

- All load cable from the VFD to the motors must be VFD rated (armor shielded cable).
- BACnet is BLT(BACnet Testing Labs) tested and certified, standard device type B-ASC (BACnet Applications Specified Controller). The interface supports all BIBBs defined by the BACnet standard profile for a B-ASC.
- BACnet NO separate Gateways/Integrator modules, LAN etc. required.
- Control wiring, power wiring, installation is by others.
- Required with each drive is at least (3) separate conduits, one each of the following input power, control wiring and output wiring.
- If cables run longer than 150 ft. Contact Tower Tech.
- LC output filter for load side filtration included.
- Harmonic reducing devices, harmonic testing and filters are not included.
- Isolation transformers, phase shifting transformers, temperature controls, static pressure controls, mounting and wiring, etc. are not included.
- VFDs are shipped loose for field installation

Standard Features Included in all VFD'S

- Danfoss VFDs are OSHPD pre-approved, # OSP-0087-10 for Seismic certification.
- Digital keypad, hot-pluggable with memory
- Operates without keypad in place
- Keypad can be easily remote mounted-Simple and flexible menu structure
- Intelligent HVAC controller
- Advanced Firefighter's Override
- Real-time Clock
- Conformal Coating – Class 3C2
- High breakaway current
- VVC Plus Output switching Pattern
- LC Output Filter
- Automatic High Ambient Derate
- Internal 5% Dual DC-link reactor
- Built-in Motor protection
- Automatic switching frequency Modulation (ASF)
- Protected from input or output switching
- Four auto-tuning, multi-input, multi-control PIDs
- Electronic thermal motor overload protection
- Critical Frequency avoidance
- RS-485 serial communication circuit
- USB Port
- Built-in EIA-485 Interface
- Automatic Motor Adaptations (AMA)
- Simplified Automatic Energy Optimization (AEO)
- Energy Monitoring
- Preventive maintenance scheduling
- Auto ramping
- Flying start
- Sleep mode
- Run-permissive circuit
- Safety Interlock
- Cascade controller
- UL & C-UL Listed
- CE Marked
- 24VDC switch mode power supply
- UL Plenum rated
- Common Run/Stop
- Johnson Metasys N2, Modbus, Siemens Apogee FLN and BACnet protocol software are incorporated in the standard drive.

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 ±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

Specifications

(Basic unit without extensions)

Main 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%
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.
Harmonic disturbance	Meets EN 61000-3-12

Output data (U, V, W)	
Output voltage	0 – 100% of supply voltage
Output frequency	0–1000 Hz
Switching on output	Unlimited
Ramp times	1 – 3600 sec.

Digital inputs	
Programmable digital inputs	6*
Changeable to digital output	2 (terminal 27, 29)
Logic	PNP or NPN
Voltage level	0 – 24 V DC
Maximum voltage on input	28 V DC
Input resistance, Ri	Approx. 4 kΩ
Scan interval	5 ms

** 2 can be used as digital outputs*

Analog inputs	
Analogue inputs	2
Modes	Voltage or current
Voltage level	0 to +10 V (scaleable)
Current level	0/4 to 20 mA (scaleable)
Accuracy of analog inputs	Max. error: 0.5% of full scale

Pulse inputs	
Programmable pulse inputs	2*
Voltage level	0 – 24 V DC (PNP positive logic)
Pulse input accuracy (0.1 – 1 kHz)	Max. error: 0.1% of full scale

** Utilize some of the digital inputs*

Digital outputs	
Programmable digital/pulse outputs	2
Voltage level at digital/frequency output	0 – 24 V DC
Max. output current (sink or source)	40 mA
Maximum output frequency at frequency output	0 to 32 kHz
Accuracy on frequency output	Max. error: 0.1% of full scale

Analogue output	
Programmable analogue outputs	1
Current range at analogue output	0/4 – 20 mA
Max. load to common at analogue output (clamp 30)	500 Ω
Accuracy on analogue output	Max. error: 1% of full scale

Control card	
USB interface	1.1 (Full Speed)
USB plug	Type "B"
RS485 interface	Up to 115 kBaud
Max. load (10 V)	15 mA
Max. load (24 V)	200 mA

Relay output	
Programmable relay outputs	2
Max. terminal load (AC) on 1-3 (break), 1-2 (make), 4-6 (break) power card	240 V AC, 2 A
Max. terminal load (AC) on 4-5 (make) power card	400 V AC, 2 A
Min. terminal load on 1-3 (break), 1-2 (make), 4-6 (break), 4-5 (make) power card	24 V DC 10 mA, 24 V AC 20 mA

Surroundings/external	
Enclosure	IP: 00/20/21/54/5566 UL Type: Chassis/1/12/4x Outdoor
Vibration test	1.0 g (D, E & F-enclosures: 0.7 g)
Max. relative humidity	5% – 95% (IEC 721-3-3; Class 3K3 (non-condensing) during operation
Ambient temperature	Max. 50° C w/o derating
Galvanic isolation of all	I/O supplies according to PELV
Aggressive environment	Designed for coated/uncoated 3C3/3C2 (IEC 60721-3-3)

Fieldbus communication	
Standard built-in: FC Protocol N2 Metasys FLN Apogee Modbus RTU BACnet (embedded)	Optional: LonWorks (MCA 108) BACnet (MCA 109) Profibus (MCA 101) DeviceNet (MCA 104)

Protection mode for longest possible up-time
– 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.
– The frequency converter is protected against short-circuits on motor terminals U, V, W.
– The frequency converter is protected against earth faults on motor terminals U, V, W.
– Protection against mains phase loss

Global Marine

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.

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	• 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)	• 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.