

AC ADJUSTABLE FREQUENCY DRIVES (AFD)

DANFOSS FC 100 SERIES PULSE WIDTH MODULATION (PWM) INVERTER

POWERSAV[®]

VARIABLE SPEED PUMPING SYSTEMS



3-60 HP 208V or 230V/3Ø/60 Hz
2.2-110 KW HP 380V/3Ø/50 or 60 Hz
3-150 HP 460V/3Ø/60 Hz
3-150 HP 575V/3Ø/60 Hz

The Powersav PWM AFD is capable of converting three phase AC line power into variable frequency variable-voltage power for operating three phase AC motors.



OPTIONAL FEATURES

- NEMA 12
- 3-Contactor Manual Bypass

STANDARD FEATURES

- NEMA 1
- Dual 5% Impedance DC Link Reactor
- Output Speed Display in RPM or Frequency
- Output Voltage Display
- Motor Amps Display
- UL, CUL Listed, CE Marked
- Elapsed Time Meter
- kWh Meter
- Electronic Motor Overload Protection
- Start into Rotating Load
- Critical Frequency Avoidance
- Disconnect Switch
- Ground Fault
- Input Fuses
- 100 kA Short Circuit Current Rating

HP	Maximum Continuous Output (Amps)		
	208/230V	460V	575V
3	10.6	4.8	3.9
5	16.7	8.2	6.1
7.5	24.2	11	9
10	30.8	14.5	11
15	46.2	21	17
20	59.4	27	22
25	74.8	34	27
30	88	40	32
40	115	52	41
50	143	65	52
60	170	80	62
75	N/A	105	77
100	N/A	130	108
125	N/A	160	131
150	N/A	190	155

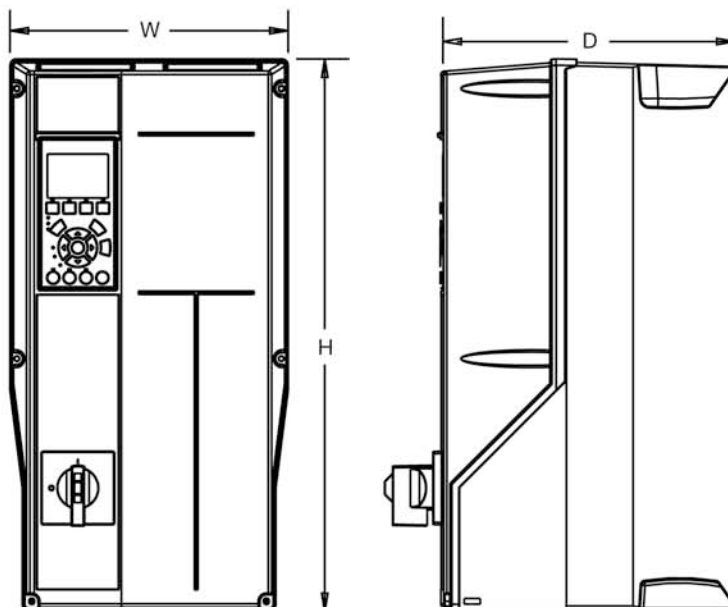
AFD Specifications

Input Voltage	• 208V/230V/380V/460V/575V, 3Ø, 50/60 Hz ±2 Hz
Voltage Tolerance	• ±10%, with no change in output
Ambient Temperature	• -10°C to 40°C (14°F to 104°F)
Humidity	• To 95% non-condensing
Altitude	• 3,300 feet above sea level
Displacement Power Factor	• >.98 at all speeds/loads
Adjustments	<ul style="list-style-type: none"> • Minimum/maximum frequency limits • Acceleration/Deceleration, 1 to 3600 seconds • Current Limit, 0 to 110% • Four critical bypass frequencies with adjustable bandwidths • Programmable analog and digital outputs
Drive Protection	<ul style="list-style-type: none"> • Phase to phase short circuit • Phase to ground short circuit • AFD over temperature sensor • Rotating motor start • Overload current vs. time function
Display	<ul style="list-style-type: none"> • Over voltage • Under voltage • Overcurrent • Overload • Over temperature • Ground Fault • Output Speed • Motor Amps • Output Motor Volts • GPM • Inverter Fault • kWh • Elapsed Time
Agency Approval	• UL and CUL listed
Warranty	• 18 months parts and labor from date of shipment

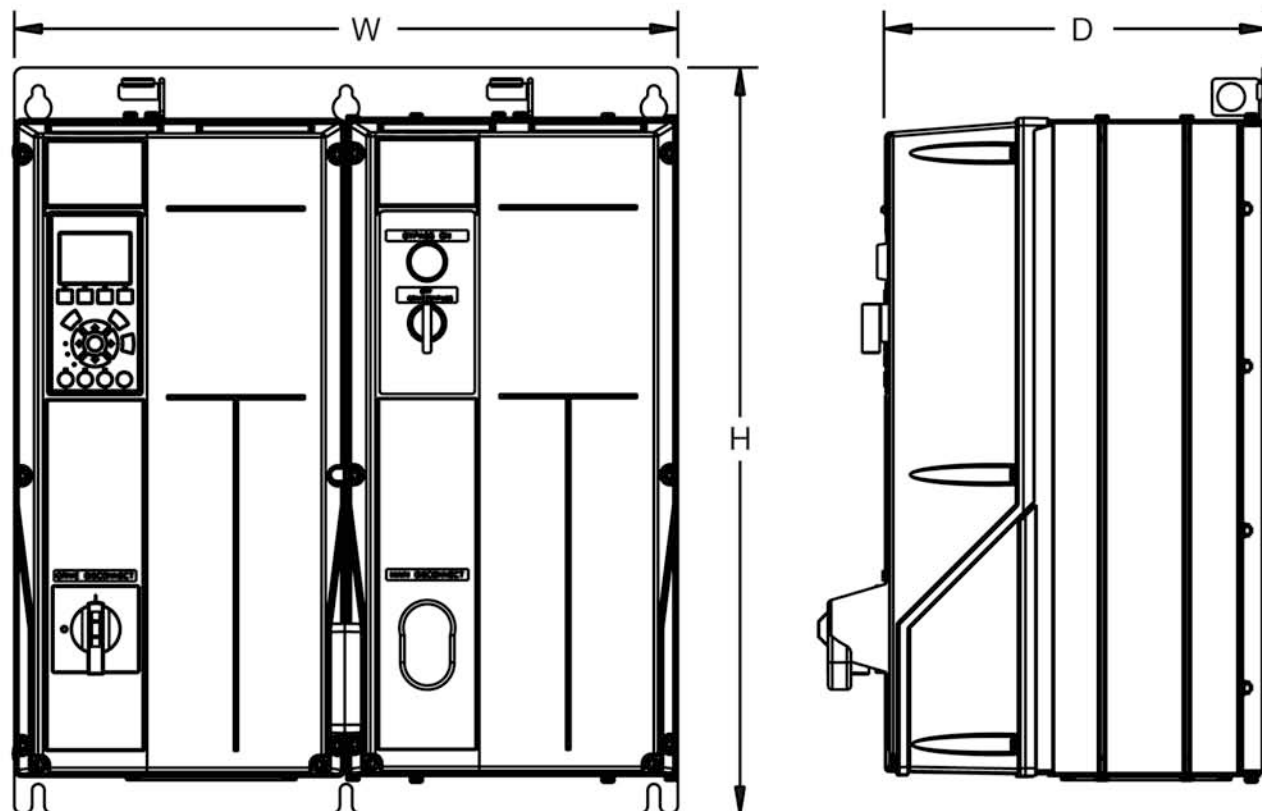
DIMENSIONAL DRAWINGS STANDARD DRIVE

208/230V	460V	575V	H	W	D	WT.
2-5 HP	3-10 HP	3-10 HP	19.11	5.21	9.63	43
7.5-15 HP	15-25 HP	15-25 HP	18.89	9.53	12.12	56
20 HP	30-40 HP	30-40 HP	25.59	9.53	12.04	78
25-40 HP	50-75 HP	50-75 HP	26.90	12.1	14.13	103
50-60 HP	100-125 HP	100-125 HP	30.20	14.6	14.93	297
—	150 HP	150 HP	45.60	16.5	14.70	325

NOTE: All dimensions are in inches, weights are in pounds. All are approximate.



DIMENSIONAL DRAWING **DRIVE WITH MANUAL BYPASS**



208/230V	460V	575V	H	W	D	WT.
2-5 HP	3-10 HP	3-10 HP	31.74	8.27	9.73	90
7.5-15 HP	15-25 HP	15-25 HP	21.48	19.09	12.86	158
20 HP	30-40 HP	30-40 HP	28.17	19.09	12.81	229
25-30 HP	50-75 HP	5-75 HP	29.94	24.37	14.87	465
40-60 HP	100-125 HP	100-125 HP	33.49	29.24	16.22	390

NOTE: All dimensions are in inches, weights are in pounds. All are approximate.

Powersav AFD Specification

GENERAL

The adjustable frequency drive(s) shall be the VLT® HVAC Drive FC 100 Series manufactured by Danfoss.

VFD shall be tested to UL 508C. The appropriate UL label shall be applied. When the VFDs are to be located in Canada, C-UL certifications shall apply. VFD shall be manufactured in ISO 9001, 2000 certified facilities.

The VFD shall have UL Type 1 or UL Type 12 ratings as standard.

The VFD shall be UL listed for a short circuit current rating of 100 kA and labeled with this rating.

The VFD shall include an input full-wave bridge rectifier and maintain a fundamental (displacement) power factor near unity regardless of speed or load.

The VFD shall have a dual 5% impedance DC link reactor on the positive and negative rails of the DC bus to minimize power line harmonics and protect the VFD from power line transients. The chokes shall be non-saturating. Swinging chokes that do not provide full harmonic filtering throughout the entire load range are not acceptable.

The VFD's full load output current rating shall meet or exceed NEC Table 430-150. The VFD shall be able to provide full rated output current continuously, 110% of rated current for 60 seconds and 120% of rated torque for up to 0.5 seconds while starting.

Galvanic isolation shall be provided between the VFD's power circuitry and control circuitry to ensure operator safety and to protect connected electronic control equipment from damage caused by voltage spikes, current surges, and ground loop currents. VFDs not including either galvanic or optical isolation on both analog I/O and discrete digital I/O shall include additional isolation modules.

All VFDs shall contain integral EMI filters to attenuate radio frequency interference conducted to the AC power line.

PROTECTIVE FEATURES

A minimum of Class 20 I²t electronic motor overload protection for single motor applications shall be provided. Overload protection shall automatically compensate for changes in motor speed.

Protection against input transients, loss of AC line phase, output short circuit, output ground fault, over voltage, under voltage, VFD over temperature and motor over temperature. The VFD shall display all faults in plain English language. Codes are not acceptable.

Protect VFD from input phase loss. The VFD should be able to protect itself from damage and indicate the phase loss condition. During an input phase loss condition, the VFD shall be able to be programmed to either trip off while displaying an alarm, issue a warning while running at reduced output capacity, or issue a warning while running at full commanded speed. This function is independent of which input power phase is lost.

Protect from under voltage. The VFD shall provide full rated output with an input voltage as low as 90% of the nominal. The VFD will continue to operate with reduced output, without faulting, with an input voltage as low as 70% of the nominal voltage.

Protect from over voltage. The VFD shall continue to operate without faulting with a momentary input voltage as high as 130% of the nominal voltage.

The VFD shall incorporate a programmable motor preheat feature to keep the motor warm and prevent condensation build up in the motor when it is stopped in a damp environment by providing the motor stator with a controlled level of current.

VFD shall include current sensors on all three output phases to accurately measure motor current, protect the VFD from output short circuits, output ground faults, and act as a motor overload. If an output phase loss is detected, the VFD will trip off and identify which of the output phases is low or lost.

The VFD shall store in memory the last 10 alarms. A description of the alarm, and the date and time of the alarm shall be recorded.

INTERFACE FEATURES

Hand, Off and Auto keys shall be provided to start and stop the VFD and determine the source of the speed reference. It shall be possible to either

disable these keys or password protect them from undesired operation.

There shall be an "Info" key on the keypad. The Info key shall include "on-line" context sensitive assistance for programming and troubleshooting.

Password protected keypad with alphanumeric, graphical, backlit display can be remotely mounted. Two levels of password protection shall be provided to guard against unauthorized parameter changes.

To set up multiple VFDs, it shall be possible to upload all setup parameters to the VFD's keypad, place that keypad on all other VFDs in turn and download the setup parameters to each VFD. To facilitate setting up VFDs of various sizes, it shall be possible to download from the keypad only size independent parameters. Keypad shall provide visual indication of copy status.

Four dedicated, programmable digital inputs shall be provided for interfacing with the systems control and safety interlock circuitry.

Two terminals shall be programmable to act either as digital outputs or additional digital inputs.

Two programmable relay outputs, Form C 240 V AC, 2 A, shall be provided for remote indication of VFD status.

Two programmable analog inputs shall be provided that can be either direct-or-reverse acting.

- Each shall be independently selectable to be used with either an analog voltage or current signal.
- The maximum and minimum range of each shall be able to be independently scalable from 0 to 10 V dc and 0 to 20 mA.

One programmable analog current output (0/4 to 20 mA) shall be provided for indication of VFD status. This output shall be programmable to show the reference or feedback signal supplied to the VFD and for VFD output frequency, current and power. It shall be possible to scale the minimum and maximum values of this output.

The VFD shall include a standard EIA-485 communications port with capabilities to be connected to the following serial communication protocols at no additional cost and without a need to install any additional hardware or software in the VFD:

- Johnson Controls Metasys N2
- Modbus RTU
- Siemens P1

VFD shall have standard USB port for direct connection of Personal Computer (PC) to the VFD. The manufacturer shall provide no-charge PC software to allow complete setup and access of the VFD and logs of VFD operation through the USB port. It shall be possible to communicate to the VFD through this USB port without interrupting VFD communications to the building management system.

Four programmable critical frequency lockout ranges to prevent the VFD from operating the load at a speed that causes vibration in the driven equipment shall be provided. Semi-automatic setting of lockout ranges shall simplify the set-up.

SERVICE CONDITIONS

- -10 to 45°C (14 to 113°F) through 125 HP @ 460 and 600 volt, through 60 HP @ 208 volt
- -10 to 40°C (14 to 104°F) 150 HP and larger
- 0 to 95% relative humidity, non-condensing.
- Elevation to 3,300 feet without derating.
- AC line voltage variation, -10 to +10% of nominal with full output.

WARRANTY

All AFDs shall be warranted for a period of 18 months after shipment. This warranty shall cover parts and labor.

START-UP ASSISTANCE (OPTIONAL)

The manufacturer shall provide start-up assistance in the form of a factory-trained service technician.

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