

# VFD for D-Series (DSV/DSH) Air-cooled Self-Contained Units, and C-Series (CSV) Water-Cooled Self-Contained Units, C-Gen



Installation Guide

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# Important!

## Read before proceeding!


### General safety guidelines


This equipment is a relatively complicated apparatus. During rigging, installation, operation, maintenance, or service, individuals may be exposed to certain components or conditions including, but not limited to: heavy objects, refrigerants, materials under pressure, rotating components, and both high and low voltage. Each of these items has the potential, if misused or handled improperly, to cause bodily injury or death. It is the obligation and responsibility of rigging, installation, and operating/service personnel to identify and recognize these inherent hazards, protect themselves, and proceed safely in completing their tasks. Failure to comply with any of these requirements could result in serious damage to the equipment and the property in which it is situated, as well as severe personal injury or death to themselves and people at the site.


This document is intended for use by owner-authorized rigging, installation, and operating/service personnel. It is expected that these individuals possess independent training that will enable them to perform their assigned tasks properly and safely. It is essential that, prior to performing any task on this equipment, this individual shall have read and understood the on-product labels, this document and any referenced materials. This individual shall also be familiar with and comply with all applicable industry and governmental standards and regulations pertaining to the task in question.

### Safety symbols

The following symbols are used in this document to alert the reader to specific situations:


Indicates a possible hazardous situation which will result in death or serious injury if proper care is not taken.


Indicates a potentially hazardous situation which will result in possible injuries or damage to equipment if proper care is not taken.


Identifies a hazard which could lead to damage to the machine, damage to other equipment and/or environmental pollution if proper care is not taken or instructions are not followed.

- ① **Note:** Highlights additional information useful to the technician in completing the work being performed properly.

## WARNING

External wiring, unless specified as an optional connection in the manufacturer's product line, is not to be connected inside the control cabinet. Devices such as relays, switches, transducers and controls and any external wiring must not be installed inside the micro panel. All wiring must be in accordance with the manufacturer's published specifications and must be performed only by a qualified electrician. The manufacturer will NOT be responsible for damage/problems resulting from improper connections to the controls or application of improper control signals. Failure to follow this warning will void the manufacturer's warranty and cause serious damage to property or personal injury.

### Changeability of this document

In complying with the manufacturer's policy for continuous product improvement, the information contained in this document is subject to change without notice. There is no commitment to update or provide current information automatically to the manual or product owner. Updated manuals, if applicable, can be obtained by contacting the nearest sales office.

It is the responsibility of rigging, lifting, and operating/ service personnel to verify the applicability of these documents to the equipment. If there is any question regarding the applicability of these documents, rigging, lifting, and operating/service personnel should verify whether the equipment has been modified and if current literature is available from the owner of the equipment prior to performing any work on the equipment.

### Revision notes

Affected section		Date implemented
Page 6	Associated literature section updated	September 2020
Page 18	Table 1 updated with additional parameter	September 2020
Page 19	Table 2 updated with additional parameter	September 2020
Whole document	Minor updates and clarifications	September 2020

### Associated literature

Manual description	Form number
D-Series Vertical (DSV060C-300C) Air-Cooled Self-Contained Units, C Generation with Smart Equipment Controller Installation, Operation, and Maintenance Manual	145.29-IOM4
D-Series Horizontal (DSH024C-120C) Air-Cooled Self-Contained Units, C Generation with Smart Equipment Controller Installation, Operation, and Maintenance Manual	145.32-IOM5
C-Series Vertical (CSV) Water-Cooled Self-Contained Units, C-Generation, R-410A, Model CSV060C-300C	145.15-IOM8

## Technical support

If Technical Support is required, contact the Product Technical Support team at 877-329-7430 or AppliedDXTechSupport@jci.com.

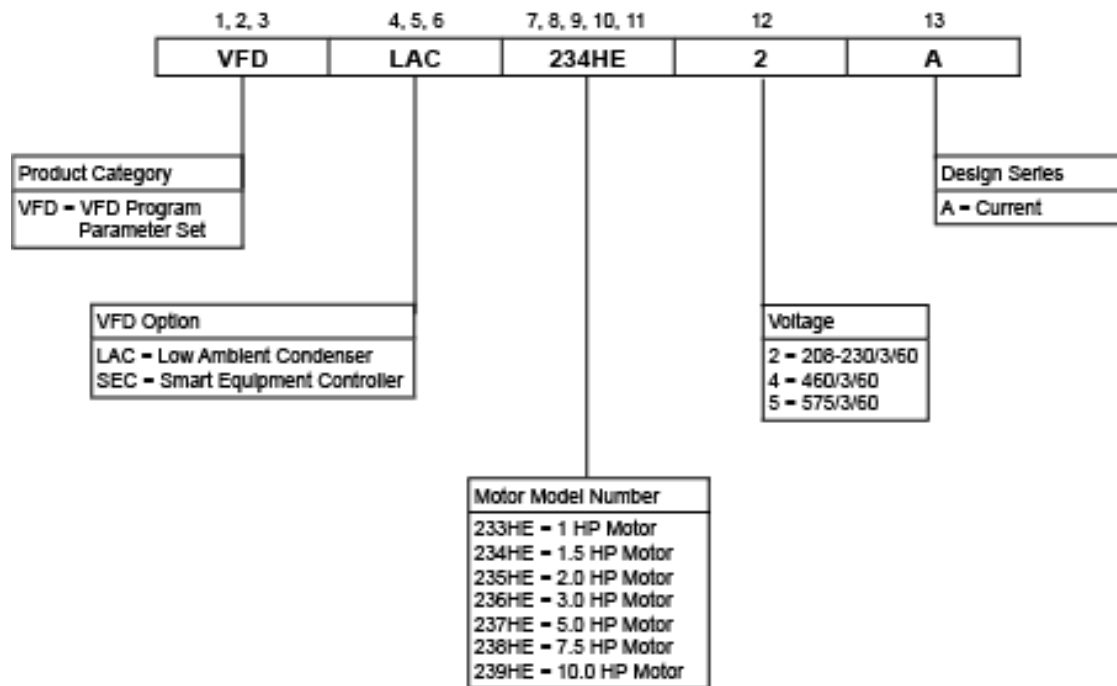
## Replacement parts

For replacement parts, contact your local Source1 Dealer.

Source1 Parts Phone Number: 800-536-6112

Source 1 Parts Website: <http://www.source1parts.com>

## VFD Nomenclature



① **Note:** LAC option is not available on 575V.

# Installation

## CAUTION

Do not enter Setup mode when powering on the VFD.

Do not change parameters 4009 and 4011 for the VAV option on DSH, DSV, or CSV C-gen units. These 2 parameters are used for B-gen units only (Simplicity 1A not SEC.)

For these units, use the Smart Equipment (SE) controller to set the VAV setpoint.

## WARNING

Prior to installing or servicing the unit, ensure proper lockout/tagout (LOTO) procedures are followed per OSHA safety regulations (29 CFR 1910.147 and 29 CFR 1910.333). Failure to disconnect power supply may result in electrical shock or even death.

Always wait for at least 5 minutes after disconnecting the power before servicing the unit.

## Background

All D-Series and C-Series units that are 8 tons or larger have a Variable Frequency Drive (VFD) installed.

There are 2 controlled fan method VFD options for D-series. SZVAV differential pressure transducer and IntelliSpeed™ (2, 3 or 4 speed) fan control.

There are 3 controlled fan method VFD options for C-series. SZVAV, MZVAV differential pressure transducer and IntelliSpeed™ (2 speed) fan control.



### **Note:**

Refer to the nomenclature breakdown in the appropriate DSV, DSH, or CSV Installation, Operation, and Maintenance (IOM) manual and also the nameplate of the unit to determine the Controlled Fan Method. The tenth digit of the nomenclature (ID Motor) identifies which method the unit has.

Use the nomenclature to select the low ambient condenser option.

### SZVAV option in D-Series / MZVAV option in C-Series

For C/D-Series units with the SZVAV or MZVAV option, the supplied VFD allows the operator to set the external static (0.0–5.0 "WC), as measured from a supply duct location determined by field installer and/or as per field specifications. The VFD controls the frequency (speed) of the evaporator fan motor in order to meet the desired external static (ESP) setpoint. The VFD controls amp draw of the motor and does not allow the motor draw more than FLA amps.

-  **Note:** Do not run the evaporator fan motor below 30Hz, as coil freeze-up and nuisance lockouts may occur. The unit is factory set to minimum 30 Hz output with the exception of the Low Ambient Condenser VFD, which is set to 15 Hz.
-  **Note:** The unit does not carry a failsafe circuit to bypass the VFD and run the evaporator fan in the event of a VFD malfunction.



The unit does not carry a failsafe circuit bypass for the evaporator fan in the event of a VFD malfunction. During a VFD failure, the evaporator fan becomes nonoperational. If there is a demand for cooling, the unit compressors continue to run until the low pressure safety switch trips.

## Factory shipped

Units that are 8 tons or larger ship with a VFD controller factory installed and wired in the evaporator (air handler) corner post. See the dimensional drawings in the IOM for the location.

## DSV models

The DSV units ship factory split (condenser and evaporator) and require assembly in the field. The motor is pre-wired to the VFD in the factory.

To assemble the DSV model in the field:

1. Plug the low voltage wiring, shipped wired to the VFD, to the SE Controller.
2. Connect the low voltage wires from VFD unit (24VDC) to the evaporator fan VFD relay (EVFDR). The EVFDR relay acts as a switch to turn on the VFD.
3. Connect two 1/4 inch Q.C. to common and normally open positions (red wire to "C," orange wire to "NO").

The VFD switch runs on 24VDC.



Do not cross 24VAC and 24VDC wiring on EVFDR relay.

## DSH models

The VFD controller on DSH units is factory wired. The evaporator fan power conductors are factory wired to the distribution block. The control wiring for field split applications needs to be field provided and routed from condenser to evaporator.

## CSV models

The CSV units ship factory assembled except for the CSV240 which can optionally be split and the CSV300C which ships split (condenser and evaporator) and requires assembly in the field. The motor is pre-wired to the VFD in the factory.

To assemble the CSV300C model in the field:

1. Plug the low voltage wiring, shipped wired to the VFD, to the SE Controller.
2. Connect the low voltage wires from VFD unit (24VDC) to the evaporator fan VFD relay (EVFDR). The EVFDR relay acts as a switch to turn on the VFD.
3. Connect two 1/4 inch Q.C. to common and normally open positions (red wire to "C," orange wire to "NO").

The VFD switch runs on 24VDC.

## CAUTION

Do not cross 24VAC and 24VDC wiring on EVFDR relay.

## VAV units

### Differential pressure transducer

**Figure 1: Label on unit/VFD for VAV with pressure transducer**



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For VAV option units, the differential pressure transducer (0-5" W.C) is factory wired and mounted inside the VFD control box. The transducer senses gage pressure (static) and converts this pressure difference to an analog signal. The unit is wired for 0-5VDC output for DSV, DSH, or CSV C-gen units.

The transducer is supplied with two 1/4-inch OD pressure fittings and accepts field provided 1/4-inch push-on tubing for lengths of up to 300 feet. The positive (HIGH) and negative (LOW) pressure ports are indicated on the transducer. Connect unit RETURN AIR tubing to negative (LOW) fitting and SUPPLY AIR tubing to positive (HIGH) fitting.

**Note:**

Do not enter Setup mode when powering on the VFD.

Do not change parameters 4009 and 4011 for the VAV option on DSH, DSV, or CSV C-gen units. These 2 parameters are used for B-gen units only (Simplicity 1A, not SEC.)

For these units, use the Smart Equipment (SE) controller to set the VAV setpoint.

## CAUTION

Do not adjust the VFD setpoint to greater than the maximum design pressures of the duct system or the unit.

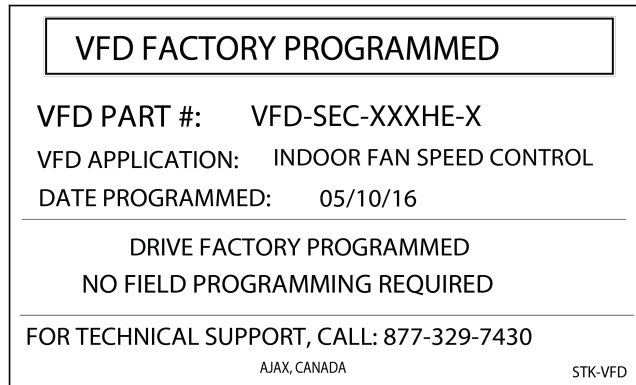
**Note:**

- Only use 24VAC from SE controller to the differential pressure transducer (Term. Exc.)

- Set S1 jumper on VFD, AI1, to Volts
- The VFD is enabled by the Evaporator Fan VFD Relay (EVFDR)

## IntelliSpeed™ fan control (8-25T)

**Figure 2: Label on unit/VFD for IntelliSpeed™ fan control**



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**ⓘ Note:**

Figure 2 is an example of a label.

The IntelliSpeed™ fan control is available on all 8 ton and larger DSH, DSV, and CSV units.

**Table 1: Fan speed % vs. compressor stage**

	Stage 1	Stage 2	Stage 3	Stage 4
<b>DSH024C-DSH060C</b>	100%	N/A	N/A	N/A
<b>DSH096C</b>	50%	60%	100%	N/A
<b>DSH120C</b>	50%	60%	75%	100%
<b>DSV060C</b>	100%	N/A	N/A	N/A
<b>DSV096C-144C</b>	50%	60%	100%	N/A
<b>DSV180C-300C</b>	50%	60%	75%	100%
<b>CSV060C</b>	100%	N/A	N/A	N/A
<b>CSV096C-300C</b>	60%	100%	N/A	N/A

## VFD keypad

The VFD requires a keypad to program the VFD. The keypad is not required to operate the unit when the VFD is programmed. The keypad is required during initial startup of the unit. Each unit comes with a factory installed and programmed remote keypad and short Ethernet clip on connector. An Ethernet communication cable is supplied by the factory. You can use a single keypad to program multiple units. Consult with your sales office to order additional keypads. A copy of the factory default settings is saved to the keypad memory available for restore if needed.

To clone a VFD on another unit, refer to the upload/download procedure in the *ACS320 drives User Manual* (pg.72-74). ABB Code 3AUA0000062599.

**Figure 3: VFD keypad**



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Figure 4: VFD keypad and Ethernet connector (CSV/DSH shown)



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**Figure 5: Internally routed ethernet cable**



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① **Note:** (On DSV only, keypad is mounted in condenser post)

## Installation

For units utilizing the VAV option, install a field supplied 1/4-inch push-on tube to the return air side of the unit. Pass the tube through the opening on the side of the corner post adjacent to the VFD controls, and connect to the negative (LOW) side fitting.

Install a field supplied Pitot tube in the supply duct as required, run 1/4-inch push-on tube to the corner post opening, and connect to the positive (HIGH) side fitting. Where possible, it is recommended to have the pitot tube located a minimum of 6ft away from the supply discharge and located centrally in the supply duct.

**Figure 6: Connecting negative and positive side fittings**



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Check that the tubes are secure inside the duct and firmly connected to transducer fitting. If they are not, the unit will not operate as intended.

## Install grille cover

When the unit is wired and the push-on tubing is connected to the transducer, attach the grille cover using the screws provided, with angled blades point upward at the top.

**Figure 7: VFD grille cover**



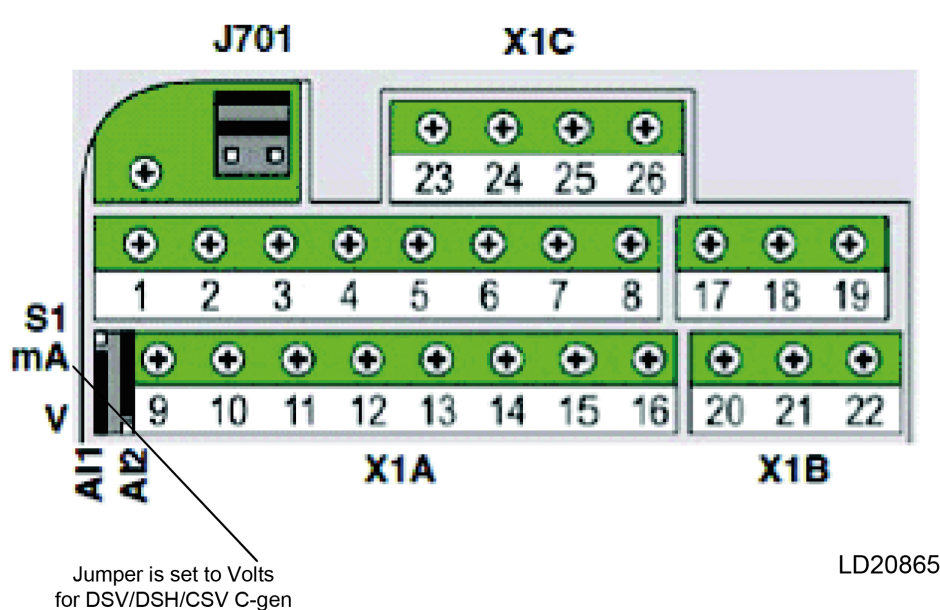
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# Operation

## Input/output

Figure 8: Input/output diagram



Jumper required between 10, 11

① **Note:** S1 is set to mA on "B" Generations.

## Parameter tables

In the parameter menu, set the following parameters listed in the following parameters tables to operate the VFD controller correctly. For troubleshooting, check that the parameters match.

## Display

In AUTO MODE, the following parameters display on control display:

1. 30–60Hz is the output frequency to the motor. The minimum factory set frequency allowed is 30 Hz.
2. 0.0–Nominal Motor Amps. The maximum amps draw is factory set, and is set to nominal amp draw of motor used.
3. 0.0–5.0 "WC is the actual reading from the pressure transducer.
4. The setpoint value is displayed in the upper-right corner. Values range from 0% to 100%. That is the actual setpoint for the controller. The setpoint can be 0%, which is 0.0 "WC or 100%, which is 5.0"WC.

**Table 2: DSH/DSV/CSV only factory parameters for multi-speed evaporator application - 208/230V and 460 VAC (ABB ACS320)**

Name	Value	Unit	
99	Start-up data		
01	Language	English	
02	Applic macro	HVAC default	
05	Motor nom volt	Drive dependent	V
06	Motor nom curr	Drive dependent	A
07	Motor nom freq	60	Hz
08	Motor nom speed	Drive dependent	rpm
09	Motor nom power	Drive dependent	hp
10	Start/stop/dir		
01	Ext1 commands	DI1	
02	Ext2 commands	DI1	
11	Reference select		
01	Keypad ref sel	Ref1 (Hz/rpm)	
02	Ext1/ext2 sel	Ext2	
03	Ref1 select	KEYPAD	
04	Ref1 min	0	Hz
05	Ref1 max	60	Hz
06	Ref2 select	AI1	
07	Ref2 min	0	
08	Ref2 max	100	
13	Analogue inputs		
01	Minimum AI1	20	%
02	Maximum AI1	100	%
14	Relay outputs		
01	Relay output 1	FLT/alarm	
16	System controls		
01	Run enable	DI1	
08	Start enable 1	Not sel	
09	Start enable 2	Not sel	
20	Limits		
03	Max current	Drive dependent	A
07	Minimum freq	30	Hz
08	Maximum freq	60	Hz
34	Panel display		
01	Signal1 param	Output freq	
02	Signal1 min	0	Hz
03	Signal1 max	60	Hz
04	Output1 DSP form	+0.0	
05	Output1 unit	Hz	
06	Output1 min	0	
07	Output1 max	60	
08	Signal2 param	Current	
09	Signal2 min A	0	

**Table 2: DSH/DSV/CSV only factory parameters for multi-speed evaporator application - 208/230V and 460 VAC (ABB ACS320)**

Name	Value	Unit
10	Signal2 max A	0
11	Output2 DSP form	Direct
12	Output2 unit	A

**Table 3: DSH/DSV only factory parameters for low ambient condenser application - 208/230V and 460 VAC (ABB ACS320)**

Name	Value	Unit	
99	Start-up data		
01	Language	English	
02	Applic macro	Condenser	
05	Motor nom volt	Drive dependent	V
06	Motor nom curr	Drive dependent	A
07	Motor nom freq	60	Hz
08	Motor nom speed	Drive dependent	rpm
09	Motor nom power	Drive dependent	hp
10	Start/stop/dir		
01	Ext1 commamds	Not sel	
02	Ext2 commands	DI1	
03	Direction	Forward	
11	Reference select		
01	Keypad ref sel	Ref1 (Hz/rpm)	
02	Ext1/ext2 sel	Ext2	
03	Ref1 select	Keypad	
04	Ref1 min	0	Hz
05	Ref1 max	60	Hz
06	Ref2 select	Pid1out	
07	Ref2 min	0	%
08	Ref2 max	100	%
13	Analogue inputs		
01	Minimum AI1	0	%
02	Maximum AI1	100	%
14	Relay outputs		
01	Relay output 1	FLT/ALARM	
16	System controls		
01	Run enable	DI1	
08	Start enable 1	DI1	
09	Start enable 2	Not sel	
20	Limits		
03	Max current	Drive dependent	A
07	Minimum freq	15	Hz
08	Maximum freq	60	Hz
34	Panel display		
01	Signal1 param	Output freq	
02	Signal1 min	0	Hz
03	Signal1 max	60	Hz
05	Output1 unit	Hz	
08	Signal2 param	Pid 1 setpnt	

**Table 3: DSH/DSV only factory parameters for low ambient condenser application - 208/230V and 460 VAC (ABB ACS320)**

Name	Value	Unit
09	Signal2 min A	0
11	Output2 DSP form	Direct
40	Process pid set 1	
04	Pid deriv filter	1
05	Error value inv	Yes
06	Units	PSI
08	0%	0
09	100% value	750
10	Set point sel	Internal
11	Internal setpnt	320
16	Act1 input	AI1

**Table 4: DSH/DSV/CSV only factory parameters and signals for 575V evaporator settings (ABB ACS250)**

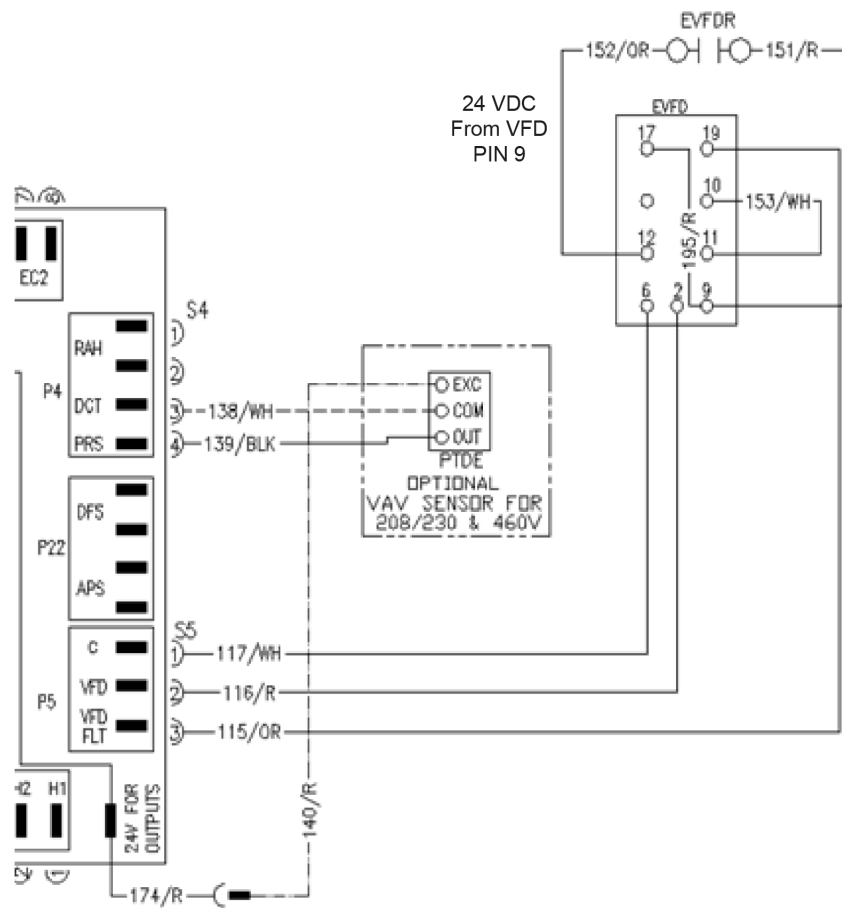
Name	Value	Unit
99	Start-up data	
02	Applic macro	1
05	Motor nom volt	Drive dependent
06	Motor nom curr	Drive dependent
07	Motor nom freq	Drive dependent
08	Motor nom speed	Drive dependent
11	Reference select	
03	Primary command	0: Terminal control
13	Analogue inputs	
00	Analog input 1	U 0 - 10
14	Relay outputs	
01	User relay output	12: Drive tripped
20	Limits	
17	Maximum motoring	100
	Current limit	%
26	Motor control	
03	V/F mode voltage boost	Auto
SEC Parameters (DSH120C, DSV180C-DSV300C)		
1ClgStg% - 50% (CV IntelliSpeed 1 stg cool)		
2ClgStg% - 60% (CV IntelliSpeed 2 stg cool)		
3ClgStg% - 75% (CV IntelliSpeed 3 stg cool)		
4ClgStg% - 100% (CV IntelliSpeed 4 stg cool)		
SEC Parameters (DSH096C, DSV096C-DSV144C)		
1ClgStg% - 50% (CV IntelliSpeed 1 stg cool)		
2ClgStg% - 60% (CV IntelliSpeed 2 stg cool)		
3ClgStg% - 100% (CV IntelliSpeed 3 stg cool)		
SEC Parameters (CSV096C-300C)		
1ClgStg% - 60% (CV IntelliSpeed 1 stg cool)		
2ClgStg% - 100% (CV IntelliSpeed 2 stg cool)		

**Table 5: DSH/DSV/CSV only drive dependent parameters group 99**

VFD program part #	Voltage	HP	Motor nominal current FLA	Motor nominal speed RPM
VFD-LAC-233HE-2	208-230/3/60	1.0	3.10	1760
VFD-LAC-233HE-4	460/3/60		1.50	
VFD-LAC-234HE-2	208-230/3/60	1.50	4.50	1755
VFD-LAC-234HE-4	460/3/60		2.20	
VFD-LAC-235HE-2	208-230/3/60	2.00	5.80	1750
VFD-LAC-235HE-4	460/3/60		2.90	
VFD-LAC-236HE-2	208-230/3/60	3.00	8.50	1765
VFD-LAC-236HE-4	460/3/60		4.20	
VFD-LAC-237HE-2	208-230/3/60	5.00	14.00	1750
VFD-LAC-237HE-4	460/3/60		6.60	
VFD-LAC-238HE-2	208-230/3/60	7.50	20.40	1770
VFD-LAC-238HE-4	460/3/60		9.70	
VFD-LAC-239HE-2	208-230/3/60	10.00	26.00	1770
VFD-LAC-239HE-4	460/3/60		12.50	
VFD-SEC-233HE-2	208-230/3/60	1.00	3.10	1760
VFD-SEC-233HE-4	460/3/60		1.50	
VFD-SEC-233HE-5	575/3/60		1.20	
VFD-SEC-234HE-2	208-230/3/60	1.50	4.50	1755
VFD-SEC-234HE-4	460/3/60		2.20	
VFD-SEC-234HE-5	575/3/60		1.80	
VFD-SEC-235HE-2	208-230/3/60	2.00	5.80	1750
VFD-SEC-235HE-4	460/3/60		2.90	
VFD-SEC-235HE-5	575/3/60		2.30	
VFD-SEC-236HE-2	208-230/3/60	3.00	8.50	1765
VFD-SEC-236HE-4	460/3/60		4.20	
VFD-SEC-236HE-5	575/3/60		3.40	
VFD-SEC-237HE-2	208-230/3/60	5.00	14.00	1750
VFD-SEC-237HE-4	460/3/60		6.60	
VFD-SEC-237HE-5	575/3/60		5.30	
VFD-SEC-238HE-2	208-230/3/60	7.50	20.4	1770
VFD-SEC-238HE-4	460/3/60		9.7	
VFD-SEC-238HE-5	575/3/60		8.0	

# VFD option schematics

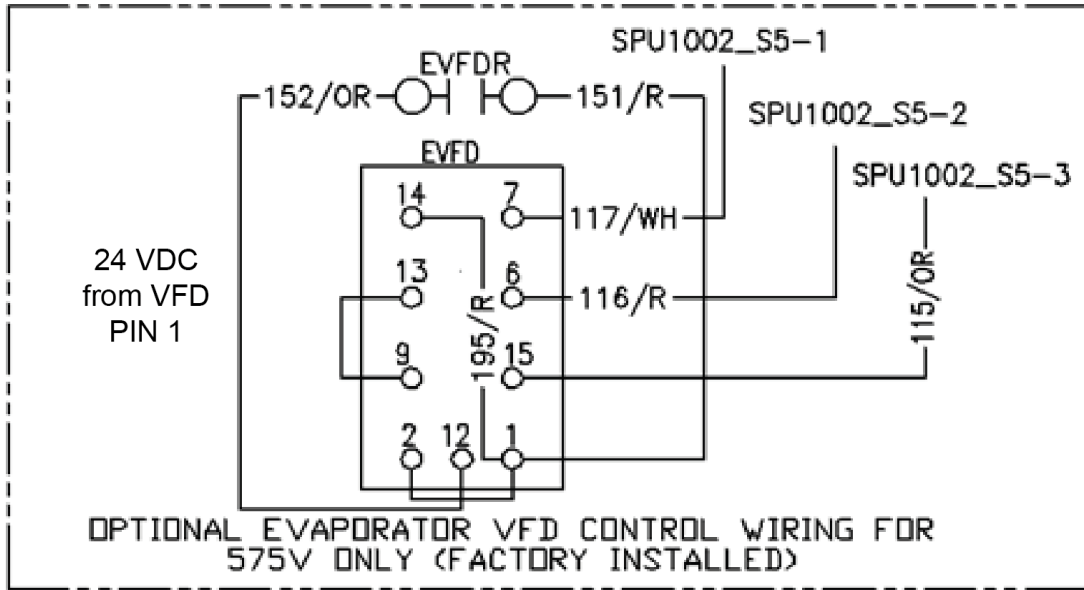
**Figure 9: Evaporator VFD low voltage wiring schematic with optional VAV sensor, for 24VDC (208/230/460V)**



LEGENDS:	
PTDC	PRESSURE TRANSDUCER CONDENSER
PTDE	PRESSURE TRANSDUCER EVAPORATOR
COFS	OPTIONAL CONDENSATE OVERFLOW SWITCH
EC1	SUCTION LINE 1 (COMP1) TEMPERATURE SENSOR
EC2	SUCTION LINE 2 (COMP2) TEMPERATURE SENSOR
EC3	SUCTION LINE 2 (COMP2) TEMPERATURE SENSOR
EC4	SUCTION LINE 1 (COMP1) TEMPERATURE SENSOR
SE-SPUI002	2 STAGE SMART EQUIPMENT CONTROL BOARD
SE-SPUI012	2 STAGE SMART EQUIPMENT CONTROL BOARD WITH COMMUNICATION CARD
SE-SPUI004	4 STAGE EXPAND CONTROL BOARD
HP1	HIGH PRESSURE SWITCH (COMP 1)
LP1	LOW PRESSURE SWITCH (COMP 1)
HP2	HIGH PRESSURE SWITCH (COMP 2)
LP2	LOW PRESSURE SWITCH (COMP 2)
SAT	STANDARD SUPPLY AIR TEMPERATURE (FIELD INSTALLED)
RAT	STANDARD RETURN AIR TEMPERATURE (FIELD INSTALLED)
DAT	OPTIONAL OUTSIDE AIR TEMPERATURE (FIELD INSTALLED)
SOL1	COMPRESSOR1 SOLENOID
SOL2	COMPRESSOR2 SOLENOID
TBV	BYPASS VFD TERMINAL
EVFD	EVAPORATOR VFD
CVFD	COMPRESSOR VFD
EVFDR	EVAPORATOR VFD RELAY
CVFDR	COMPRESSOR VFD RELAY
3WMV	3 WAY MODULATING VALVE
M1	COND. FAN MOTOR CONTACTOR
M2	COMP1. CONTACTOR
M3	COMP2. CONTACTOR
M4	COND. VFD BYPASS CONTACTOR

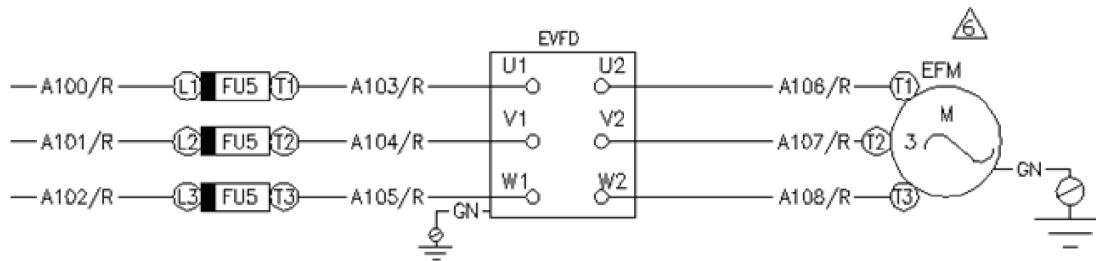
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**Figure 10: Evaporator VFD low voltage wiring schematic, for 24VDC (575V)**



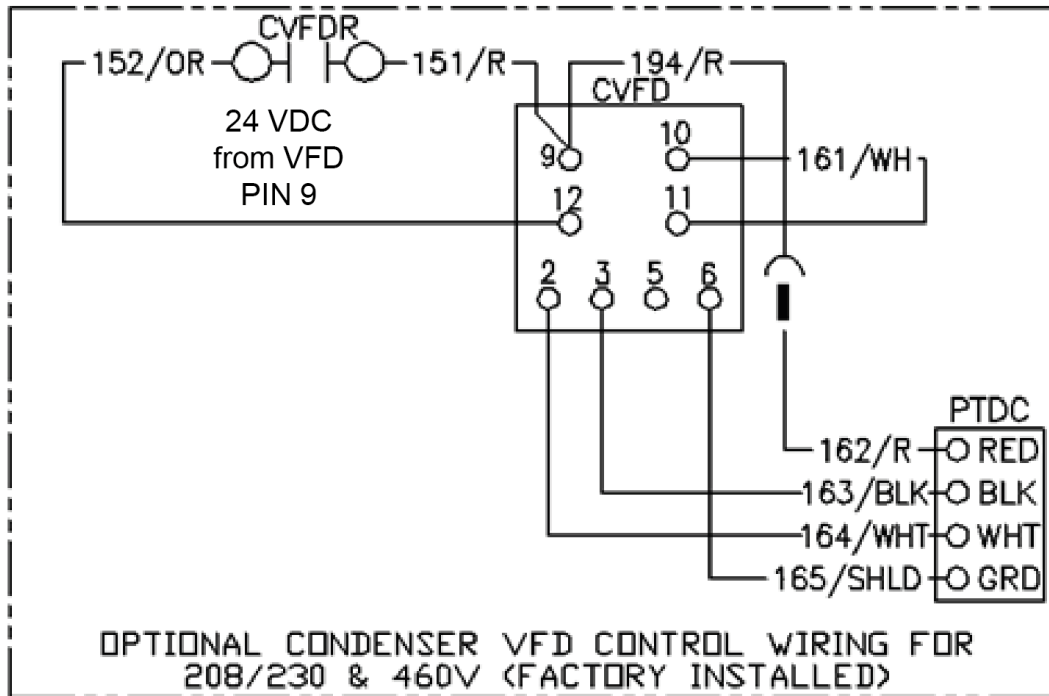
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**Figure 11: Evaporator high voltage power schematic for all units (208/230/460/575V)**



LD28644

Figure 12: Condenser VFD low voltage wiring schematic, for 24VDC (208/230/460V)  
(DSH048C-120C and DSV060C-300C)



LD28647