Ducted Systems Technical Services: Service Tips Letter

Letter: ST-012-23

Date: May 5, 2023

To: Field Service Techs and Installers

Subject: **Collection of Service Tips Letters Concerning Delta VFD Programming**

Product: Commercial Built Products with a Delta Variable Frequency Drive (VFD)

Summary: Collection of Service Tips Letters ST-006-2019, ST-014-2019, ST-010-2020, ST-011-2021, and Document 08182020 Rev 6.

Based on customer feedback, we have placed the past Service Tips letters concerning the Delta VFD programming into one Service Tip Letter.

We feel that by the collecting the above-mentioned service tips and document into one Service Tips Letter, our customers would have easier and faster access, to all the information, in the process of Delta VFD programming.

The following pages contain the service tips and document mentioned above.

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DX Ducted Systems
Technical Services
Service Tips Letter

Letter: **ST-006-2019**

Date: April 17, 2019

To: Field Service Techs and Installers

Subject: **Additional Information - Variable Frequency Drive Power**

Product: **Concerns** Light Commercial

Summary: All Light Commercial products with a Variable Frequency Drive (VFD)

References: NFPA 70, National Electrical Code
Mitsubishi, FR-D700 Instruction Manual

Disclaimer: JCI warrants that the Service/Products will perform substantially in conformance with its Documentation. JCI shall not be liable for warranty nonconformance caused by misuse or negligence or willful misconduct.

Based on customer feedback on ST-004- 2019, we have added more data crucial for contractor understanding of the scope of this field issue. We are opting to issue a new letter with these additions.

Situation:
With the addition of a Variable Frequency Drive (VFD) to a wide range of products, it is necessary to determine the power supply of the system before installing the product. Some power supplies may require field installation of additional equipment to ensure proper operation of the VFD.

Reasons for additional equipment requirements include:

- VFDs convert AC volts to DC volts.
- VFDs reference ground with respect to each leg of voltage.
- Utility power distribution systems must have a ground connection on the secondary side of the transformer.
- Wye transformers have the ground connection at the center of the Wye, resulting in an equal voltage from any power leg to ground with respect to any other power leg.
- It isn't possible to have equal reference to ground in a Grounded Delta system.
- Delta systems are grounded using one of two methods:
  - At the corner of the delta (aka 'Grounded B Phase')
  - At the center of one of the windings (aka 'Wild Leg or High Leg').
- Delta systems can result in unbalanced voltages on the inputs to the VFD, causing unbalanced current flow in the conductors carrying power to the VFD, which can result in over-amping on those conductors when the motor is near its Full Load Amps.
- Delta systems will need to be identified and may require special attention as described below.

Technical Information:
The type of power supply can be identified by measuring the incoming voltage with a voltmeter. The following measurements will help in determining the type of power supply. All measurements referenced are approximate, your actual field measurements may vary slightly from the numbers provided in this letter. Three different power supply types are discussed below.

1. 3 Phase Wye Power Supply

This type of power supply is the most commonly found and can be detected by measuring incoming power readings as follows:

208V systems	**460 V systems**
L1 to ground - ≈ 120 volts	L1 to ground - ≈ 277volts
L2 to ground - ≈ 120 volts	L2 to ground - ≈ 277volts
L3 to ground - ≈ 120 volts	L3 to ground - ≈ 277volts

The 3 Phase Wye power supply will not require further modification to allow the VFD to function properly. However, 208v systems will require Parameter 19 to be changed from 230 to 208.

2. Corner Grounded Delta Power Supply

This type of power supply can be detected by measuring incoming power supply readings as follows:

240 V systems	**480 V systems**
L1 to ground - ≈ 230 volts	L1 to ground - ≈ 460 volts
L2 to ground - ≈ 0 volts	L2 to ground - ≈ 0 volts
L3 to ground - ≈ 230 volts	L3 to ground - ≈ 460 volts

Note: The leg that reads 0 volts to ground is normally L2. With a Corner Grounded Delta, 2 legs will read voltages to ground that are the same or almost the same and one leg will read 0 volts to ground. This is the "B-Phase."

Installation of a special transformer is required to operate the VFD in conjunction with Corner Grounded Delta Power Supply. Contact a qualified commercial electrician. Refer to Application Conditions section below for details.

3. High Leg Power Supply

Also known as wild-leg or stinger-leg, a High Leg power supply is a less common power supply, but does occur in older power systems. Typical voltage readings for this type of power supply readings are:

208/230 V systems	**460 V systems**
L1 to ground - ≈ 120 volts	L1 to ground - ≈ 277volts
L2 to ground - ≈ 208 volts	L2 to ground - ≈ 415 volts
L3 to ground - ≈ 120 volts	L3 to ground - ≈ 277 volts

Note: Higher voltages are present on one leg with normal voltages on the other 2 legs. Always place the High-Leg on L2 of JCI Commercial equipment.

Application Conditions:
Some application conditions may require field installation of a larger VFD or a method of balancing input voltages to ensure correct operation. In conditions that require a different drive model to survive the voltage imbalance, the use of a special transformer, aka. “line reactors” can be used to get voltage back into balance so original VFD can be used and survive the voltage variations that could cause failure of the drive. Line reactors have their requirements as well, which means they have to be properly sized.

Installation of a special transformer “aka Line reactor” may be required to operate the VFD in conjunction with High-Leg power supplies. Contact a qualified commercial electrician to have the device sized correctly. The device must be securely grounded and the addition of a grounding ring on the motor is required. As the line reactor balances voltages, noise is generated resulting in induced voltage onto the motor armature. The induced voltage seeks a pathway to ground and finds it through the bearings of the motor. This creates a condition called “electrical discharge machining”, resulting in a small arc of electricity (during motor operation) in the race of the bearing causing it to fail prematurely as the arc actually blows away part of the bearing race.

Summary:
Understanding the application and installation requirements at the front of the job is required for proper and successful installation of a Variable Frequency Drive (VFD) in a wide range of products.

Knowledge of the power supply system specified and being used before installing the product is required. Some power supplies may require you to add additional equipment to ensure proper operation of the VFD.

Notification of this requirement with customers, engineers, end users is imperative. If line reactors are not used and the option of a larger drive is the desired remedy, then internal wiring may need to be upsized and fused internally in the cabinet in alignment with National Electric Code (NEC) to achieve this as it will be installed after the fact. A licensed, qualified electrician must be used for this task.

DX Ducted Systems
Technical Services
Service Tips Letter

Letter: ST-014-2020

Date: September 29, 2020

To: Field Service Techs and Installers

Subject: **Delta VFD Parameters Nuisance Codes**

Product: Commercial Built Products with a Delta Variable Frequency Drive (VFD)

References: ST-006-2019 and ST-10-2020

Effective: January 1, 2020 Expires: January 1, 2021

Summary: This letter is to provide information on an emerging issue in regard to Delta VFD Parameter Settings for systems encountering nuisance fault codes and failures.

We have received a limited number of calls regarding the recently implemented Delta VFD and its parameters. It was determined that some application factors and conditions may cause nuisance failures. To assist with these nuisance failures, we have created a list of parameters that may need to be adjusted while we review this issue. It is also advised to contact Product Technical Support at 877-874-7378 to ensure the changes are ok for your system and its application prior to making them. As we gather data on these occurrences, we will revise this letter as needed. Thank you for your patience in this matter.

Delta Parameters:

2.35 – The factory default is 0, it may be needed to have a field change of 1 to allow the drive to restart after a power loss, if the enable fan command still exists and the VFD relay contacts are still closed.

06.06 – The factory default is 2 to allow the VFD to trip in the event the motor exhibits over amping. It can be changed to a 1 to have the VFD limit the output to the motor to prevent over amping and prevent the drive from displaying OT1.

06.49 – The factory default is 0, if changed to 1 it will allow the VFD to restart if exhibiting a low voltage fault. (LvA, LvD, LvS, LvN)

07.06 – The factory default is 0, If it is changed to 1 it will allow the drive to restart after a momentary power loss.

DX Ducted Systems
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Letter: ST-010-2020

Date: May 29, 2020

To: Field Service Techs and Installersrs

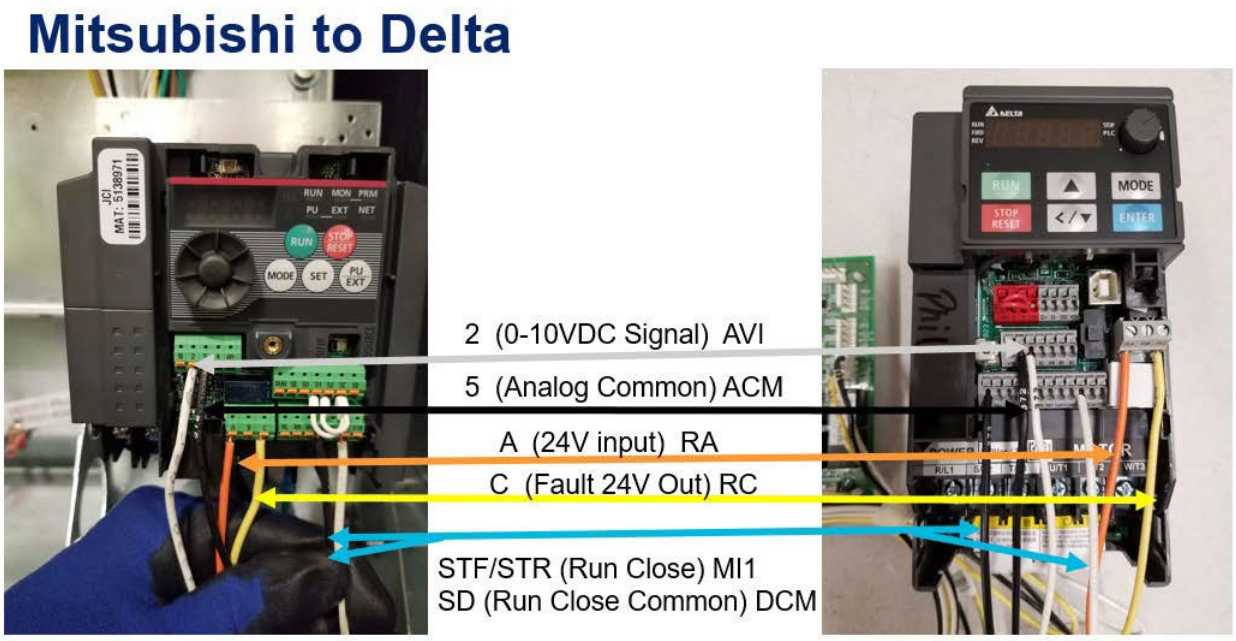
Subject: **Delta Variable Frequency Drives (VFD)**

Product: Commercial

Summary: Mitsubishi VFD to the Delta VFD

1. Recently, Johnson Controls changed VFD's from a Mitsubishi D700 series to a Delta MS300 series. The wiring from a Mitsubishi VFD to a Delta VFD is as follows:

Mitsubishi Terminal Code	Drive Control Wire	Wire Color	Delta Terminal Code
A C	24V input Fault 24V Out	Orange Yellow	RA RC
2 5	0-10 VDC Signal Analog Common	White Black	AVI ACM
STF SD	Run Close Run Close Common	White Black	MI1 DCM



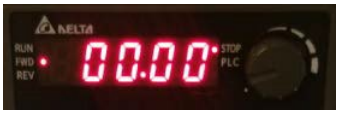
2. The Parameters are as follows:

Description	Delta Parameters	Mitsubishi Parameters
Carrier Frequency	00-17	N/A
Source of the master frequency command (AUTO)	00-20	N/A
Source of the operation command (AUTO)	00-21	N/A
Stop method	00-22	250
Digital keypad STOP function	00-32	N/A
Output frequency of motor	01-01	1
Output voltage of motor	01-02	19
Output Frequency Minimum	01-07	2
Accel Time	01-12	7
Decel Time	01-13	8
Zero Speed Setting	01-34	N/A
AVI voltage lowest point	03-03	N/A
Positive/negative bias mode (AVI)	03-07	N/A
Analog input Gain (AVI)	03-11	N/A
Full-load current of induction motor (A)	05-01	9
Rated power of induction motor (kW)	05-02	N/A
Rated speed of induction motor (rpm)	05-03	N/A
Over-current stall prevention during operation	06-04	22
Over-torque Detection Selection	06-06	N/A
Over-torque Detection level	06-07	N/A
Over-torque Detection Time	06-08	N/A
Treatment of restart after Fault	07-10	N/A
Restart Times after fault	07-11	67

3. The Parameters may be adjusted after entering the Passcode:

Enter Password to Unlock VFD
Pressing the ENTER button will ring up the first segment of the parameter display.

Press ENTER a second time and the second segment parameter point appears.



Press the UP arrow to 00.07

Press **ENTER** and 0 is displayed.

Press the UP arrow to **1234**

Press **ENTER** to accept the password. Display will show **END** then revert to 00.07

Password is now entered and all parameters will be visible and can be changed.

***If the unit is going off on Alarm code “Ot1”, you can change parameter 06.06 to 1.

This will not allow the VFD to Over Torque (Ot1), but your Hertz will be limited to the maximum Amp draw of the unit.

Press the **Mode** button and “**0**0.” will appear.

Press the UP arrow to **06.**

Then press **ENTER**. “06.00” Will be displayed.

Press the UP arrow to **06.** “06.06” will be displayed.

Then press ENTER. “2” will be displayed.

Press the DOWN arrow to 1.
Press ENTER.

Now turn off power to the unit. Only turn power back on after a minimum of 30 seconds.

4. The following link will provide additional guidance;

   https://www.dropbox.com/s/aiqd4954cty2m11/Delta%20Password%201234.mp4?dl=0

Ducted Systems Technical Services: Service Tips Letter

Letter: ST-011-21

Date: August 20, 2021 Effective: August 20, 2021 Expires: January 1, 2023

To: Field Service Techs and Installers

Subject: **Delta VFD Parameters Update and Nuisance Codes Revision**

Product/s: Commercial Built Products With a Delta Variable Frequency Drive (VFD)

References: ST-006-2019, ST-10-2020, and ST-14-2020

Summary: This letter is a final revision to ST-14-2020 to provide information regarding Delta VFD Parameter Settings for systems encountering nuisance fault codes and failures. Along with what the factory will be implementing in changes to its default settings.

We have received a limited number of calls regarding the recently implemented Delta VFD and its parameters. It was determined that some application factors and site conditions may cause nuisance failures and fault codes. To assist with these field-generated nuisance failures, we have created a list of parameters that the factory will update and implement starting September 1st, 2021. For equipment before the implementation date, it is advised to contact Product Technical Support at 877-874-7378 to ensure the changes are ok for your system and its application prior to making them.

We have also worked with Delta to add a new parameter for sites with power issues entering the unit. The power supply introduced into the drive would then generate an “OVS” alarm, and the delta drive responds by locking out all operations until power is cycled. The new parameter is listed below, along with a brief description of how to enable it. This change allows the drive to restart itself once the OVS alarm has ended but will still hold the alarm on the screen to notify field technicians.

Delta Parameters:

01-07 – Will be changed from 25 to 0.5. Paired with 01-11, the motor can ramp up to 25Hz slower under inadequate duct design applications. This in turn will also reduce motor "jerking," some sites have reported.

01-11– This will be changed from the Delta default of 0 to 25. This will return our traditional setting of limiting the drive's minimum frequency to 25hz across all products as the output frequency lower limit.

2.35 – The factory default is 0, and it may be needed to have a field change of 1 to allow the drive to restart after a power loss if the enable fan command still exists and the VFD relay contacts are still closed. The factory will not change this setting.

06.06 – The factory default will be changed to 1 from 2. This allows the VFD to trip in the event the motor exhibits over amping and protect the motor and drive. The updated change will enable the VFD to limit the output instead of shutting down on an alarm. The code will still present itself on the drive, but no longer shut the unit down. To remedy it, it is best to calculate the system airflow by following the instructions of the unit's installation manual. You should then make the necessary sheave adjustments while reviewing its ductwork application.

06.49 – The factory default was 0 and has been changed to 1. This will allow the VFD to restart if exhibiting a low voltage fault. (LvA, LvD, LvS, LvN)

07.06 – The factory default will be changed to 1 from its original 0. It will allow the drive to restart after a momentary power loss occurs.

07-28 – Delta has provided this new parameter, and it will be set from the factory at 0. Please set it to 12000 to enable it if it's required for your site.

This new setting will allow all drives built after August 1st, 2021, to restart automatically once an "OVS" event ends without manual intervention. If a site is having a DC overvoltage issue, they may adjust this parameter to 12000 to activate this function. **It will not allow the drive to run during an overvoltage event to protect the entire product.**