

Ducted Systems Technical Services: Service Tips Letter

Letter: ST-014-22

Date: October 5, 2022

To: S1 HVAC Branch and Distributor Principal, Sales Manager, Service Manager, Parts Manager, Warranty Manager, Delegated Administrator, Ducted Systems Technical Services, DS Parts/S1, ES Americas, ADTI Channel, Account Representatives, Marketing, Sales, Warranty teams.

Subject: **DC BUS Over-Voltage Error Codes.**

Product/s: **Variable Frequency Drives on Norman Built Equipment**

Summary: This letter provides information regarding Variable Frequency Drives (VFD's) and what creates an over-voltage event on the DC BUS. We wish to use this as an educational platform to allow customers to better understand what causes this and what pathways are available to the endline customer.

Johnson Controls (JCI) has utilized multiple brands and types of variable frequency drives (VFD's) to control a motor's operation and increase performance. The practice of using them in this manner has been a standardized method for decades. Johnson Controls has seen an increase in requests when it comes to the multiple drive brands we offer and error code lockouts. Primarily a DC BUS over-voltage at stop or start.

What is a DC BUS and an over-voltage event?

A DC BUS is commonly used as a term in the industry to outline a protocol and or circuit path that will serve or be shared by multiple components. These components will always rely on a direct current voltage input to operate. In our products, the drives use it as a power distribution network to actively engage a motor or system. An over-voltage event will lead to products resulting in a lockout of some form requiring a manual or an automatic reset. When an over-voltage event occurs, meaning the maximum value voltage has been exceeded for the threshold of the BUS. Each VFD manufacturer sets its threshold based on the components used.

What can cause an over-voltage event?

This can be caused by what is known as a voltage transient. This can occur in an intentional or unpredictable nature. When a site is having this occur in an unpredictable nature, the factors are most likely caused by an infrequent or exterior-based surge like heavy inductive loads, or weather patterns impacting a grid or site (lighting, storms, etc.) and are largely infrequent in nature. A generated cause is more in the relation of repeatable source or predictable in nature. (IE: scheduled generator operation, motor deficiencies, incoming power concerns, degraded site conditions from age of property or power grid, etc.).

Results of a DC-BUS Over-voltage:

When this occurs, most drives can react within a fraction of a second and as soon as 1.0 Nanosecond (ns). Most VFD's have intellectual components that will register and react to the change and perform a safety lockout to prevent the drive from operating. This occurs because microprocessors have become increasingly sensitive over the past decade as components became more accurate and/or efficient.

The lockout's primary intent for most designs was environmental protection of the microprocessors. But as the product's designs and components changed to meet industry standards, most power grids or exterior power generation equipment have not followed the same trajectory.

Types of predictable causes for a DC BUS over-voltage:

Input Voltage Spikes:

Voltage transients that occur in a frequent nature in the form of voltage spikes or incoming voltage dips can result in a DC BUS over-voltage event. This always occurs from the power source entering the equipment and can generate built-up voltage that will reach closer and closer to the drives error threshold for the DC BUS. Some meters will not be able to detect this and may require a power study or special equipment to identify.

Overhauling loads:

Overhauling loads are when a significant amount of high inertia in motor torque has occurred during operation causing the motor to regenerate voltage. This means the motor's movement causes the drive to decelerate quicker than its current output, resulting in the motor reversing rotation for a brief period. When this occurs, the motor sends voltage back to the drive's DC BUS. In the event a site has this occur, it is best to verify all parameters are set per the guidelines of the unit by contacting Technical Services. If it is determined to have correct parameters it may be a result of the application or use of the system.

Deceleration and acceleration time may be adjusted for a test period to see if a resolution is created for that application. These changes will need to be made with a representative of Technical Services.

In the event it is still occurring, it may be advised to contact a certified electrician to review the possible need for exterior components to be added like an output reactor, dynamic brake resistor, or a regenerative drive. Items like these cannot be advised or recommended by JCI and require a certified electrician or engineer to review and recommend what will be best for your application.

Cyclical Loading:

Cyclical loading can be identified when a fan cannot speed up or slow down as fast as the VFD can increase or reduce its output. By doing this the drive receives a cyclical regeneration back to the DC bus that the drive may not be able to shed, absorb, or dissipate. Intellispeed products are not affected by this, but it has been found on Variable Air Volume (VAV) units using 3rd party device controls rather than the OEM controllers and drives. This type of equipment operation is not advised or approved by Johnson Controls.

How can Johnson Controls assist in these cases?

Johnson Controls will continue to work with customers on a case-by-case basis to determine a cause for the DC BUS over-voltage error codes. Once a possible cause is identified to be exterior to the design of the product. Our recommendation will be limited to suggesting the customer contact a certified electrician and or engineer to resolve site concerns. These parties will review the incoming power or application-based causes to the equipment. You may also have a detailed power study performed on the site to assist with these reviews. These parties should be able to review and provide recommendations on how to correct the scenario that fits your application with appropriate resolutions.

Johnson Controls is not authorized to provide any assistance with selection or recommendation of any components that are not tested or approved by our engineering or development teams for our products.

We also advise that all JCI manufactured equipment maintain their components that are in direct relation to the nomenclature and design of the product (IE: fan control type, VFD components, etc.). Johnson Controls cannot and will not authorize removal, alternate component selection, or bypassing of these products.

Warm regards,

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