

# Power Electronics® VFD Troubleshooting Guide and FAQs





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## Drive Selection Help

### How do I select the right PE® VFD or Multi-Vector® drive for my application?

Drive selection is mainly dependent on the answers to the following questions:

1. Will the drive be used to control a travel motion (bridge, trolleys, rotation, etc.) or to control a hoist? Many of our drives are now “pre-programmed” to control either a traverse motion or hoist motors. Our drives that are programmed to control hoist motors will usually have a model number ending in “H”.
2. If the drive will be used to control a hoist motor, does the hoist have a mechanical load brake, or is a closed-loop system (with an encoder) required?
3. What are your motor specifications (HP or kW rating, FLA, RPM, Voltage)?
4. How many speed control settings would you like?
5. Do you require analog speed control?
6. How many other user Auxiliary inputs or controls are required?

Once you have this information, compare your specifications to our [list of products](#). Contact PE® if you require any further help with selecting the correct drive for your application.

### Should I select a drive that is over-sized for my motor rating?

No. Unlike many of our competitors, PE® drives are built so that over-sizing is not necessary. Our drives are built from the ground-up with the demanding requirements of electric overhead cranes and material handling in mind. As long as you select a drive that meets (or slightly exceeds) your motor HP and FLA requirements, our drives are built to handle the size motors specified.

### Will PE® drives work with single-phase motors?

No, our Soft-Starts and VFDs are designed to work with three-phase motors. However, if your facility does not have three-phase power available, PE® VFD drives can be used to convert single-phase line voltage to three-phase output for use with a three-phase motor. In this case, call PE® for special drive sizing concerns.

### Can I use PE® drives with two-speed motors?

Yes. If you have a two-speed motor and you are using one of our Micro-Speed® VFDs for speed control, hook up the PE® drive to the motor's high-speed windings only. Be sure to size the VFD based on the high-speed winding HP/Amp rating. If you plan on using a Smooth-Move® Soft-Start unit, be sure to select the model that works with two speed motors.



## Installation Help

### How are PE® drives supposed to be mounted?

PE® drives are designed to be mounted vertically on an electrical panel (mounted so the print on the device is upright). The heat sink fins in the unit are designed to cool best with that orientation. However, if the drive is mounted in an area where the normal ambient temperatures are much lower than the maximum temperature rating of the unit, it may be mounted in other directions – consult PE® for further help in this scenario.

Mount the drive out of direct sunlight or radiant heat with spacing in an enclosure that allows adequate ventilation of the heat sink (refer to the drive’s manual for Clearance and Wiring specifications).

### What does it mean if P.C. 22 is flashing on the display of my drive?

**Note:** You will only see this code on Ver 2.2 or 4.2 drives (or higher). If the display on your drive alternates between “P.C. 22” and “rOFF” or “cOFF”, this means the drive’s U22 parameter has not yet been set. This is typically the case when you are installing a new drive. The drive will not accept control input, and will not send power to the motor or brake output until U22 is properly set.

#### **IMPORTANT:**

U22 must be set to total motor FLA, and U26 must be set to “ON” or “1” unless separate motor thermal protection is provided by user. Refer to your drive’s manual for more information about the U parameters.

#### **CAUTION: Do not set U22 greater than total motor nameplate amps.**

Before you can enter your motor (or group of motors) FLA value at U22, the unlock code must first be entered at the U0 parameter. This code is **369**. After holding the “Scroll” button to arrive at the U0 parameter, you can enter the unlock code by pressing and holding the increase button until the number displayed scrolls up to 369. If you go past this number, you can press the decrease button to adjust. Once 369 is displayed, you can now poke the scroll button to reach U22 and then use the Increase/Decrease buttons to enter your value. If you have not unlocked the U parameters properly, you will see the word “code” displayed. In that case, return to U0 and re-enter the unlock code.

More information about how to perform the programming steps (including a video of the procedure) can be found [HERE](#).

### How do I perform a Gang-Set® with my drive?

If you have just installed a PE® drive, or if you would like to return your drive to some recommended default values, you can perform a Gang-Set® to help you get up-and-running quickly. When the drive is Gang-Set, each “A” parameter is programmed to a factory chosen value. Since each A parameter is reprogrammed each time a Gang-Set® is initiated, all previous custom adjustments to the “A” parameters will be lost. Therefore, it is recommended that all fine-tuning of individual “A” parameters must be done after a Gang-Set, and not before.

Performing a Gang-Set® is simple and quick. Make sure your drive is in the idle state, and displays either “rOFF” or “cOFF”. From there, press and hold down all three buttons on the drive, until either “Pb” or “Ph” appears. Then use the increase or decrease buttons to choose the desired program using the Gang-Set® descriptions found in your manual.



Next hold the scroll button until you are back to the OFF screen. It's as simple as that! The settings from the Gang-Set® have now been loaded into your drive.

A video of the Gang-Set procedure can be viewed [here](#).

### How can I adjust the motor speed settings of my drive?

Nearly all of the motor speed and acceleration/deceleration settings can be adjusted within the “A” parameter group. The most common adjustments can be performed by changing the following parameters:

**A1:** This is your default acceleration time in seconds. The value of this parameter determines how long it will take for your drive to ramp your motor from zero to full speed.

**A4:** Default deceleration time in seconds. This value determines how long it will take to ramp down from full speed to zero.

**A12:** This is usually your default low speed setting, in Hz.

**A13-A16:** Speed settings associated with inputs S2-S5, respectively.

More information about basic programming procedures, as well as a more complete list of the “A” parameters can be found [HERE](#). You can also refer to your drive's manual for more information about the other parameter groups.





## General Troubleshooting

### What is the unlock code for PE® drives?

To prevent accidental or unintentional changes, Micro-Speed® drives require a code to be entered at the L0 and U0 parameters before any adjustments are allowed in the respective “L” or “U” parameter groups. (Also, the C and CL parameter groups are locked on MX™ and MV™ units.)

#### **The unlock code is 369.**

Before changes can be made in the L or U parameter groups, you must enter this code when you are at either parameter L0 or U0. When you are at this parameter, change the default value of “0” to the unlock code by pressing and holding the increase button until the number displayed scrolls up to 369. If you go past the code number, you can press the decrease button to adjust. Once 369 is on the display, you can now poke the scroll button to get to the parameter you wish to change, and then proceed to make the desired change to the parameter value using the Increase or Decrease buttons. If the previous steps were not performed correctly, you will see “CodE” on the display when you try to change the parameter value. This means the parameter group was not unlocked correctly, and you will need to repeat the above steps. A demonstration of how to unlock the U parameter group can be viewed in the video shown [here](#).

There is another type of “Lock” on PE drives, where the LCD display will say “LOC” if you try to change any of the parameters (even the “A” parameter group, which is normally unlocked). If you see this code, start from the “rOFF” or “cOFF” home screen, and press and hold both the Increase and Decrease buttons simultaneously. After a few seconds, the LCD display will read L–U. Use the increase or decrease buttons to change the setting to either “LOC” to lock the unit, or “UnL” to unlock it.

[Call or contact PE®](#) if you need any further assistance.

### What is typical behavior of a PE® drive when a trip event occurs?

#### **How the Micro-Speed® Smart-Move, Micro-Speed® CX™, and Micro-Speed® MV™ drives respond to a trip condition:**

When a trip condition occurs, four events will happen:

1. The Smart-Move, Micro-Speed® CX™ or Micro-Speed® MX/MV™ removes power to the motor, and will stop accepting control input from pendant/radio.
2. The brake outputs, B1 and B2, will open. This will bring the crane motion to a stop using the brakes.
3. An event code will be displayed on the drive display. Event codes begin with the letter “F” and are followed by a number.
4. The event code will be stored at E1—if there was a previous event code, it will be pushed to E2 and so on. If an event code was in E4 it will then be pushed out of memory.



## How do I begin to troubleshoot a PE® Variable Speed Drive?

All of the products manufactured by Power Electronics® have similar programming and the event codes are also very similar across the Micro-Speed® Product Lines.

The first thing to do is check the fuses and Event Codes on your unit. If the fuses are blown, **do not just replace them** with new fuses. Just replacing them may make a problem worse or damage the drive. Check for wiring or other shorts first. When a problem arises, such as excessive current draw, often the unit will protect itself by shutting down, then displaying and recording an Event Code. The code reveals information about the most recent condition. See the FAQ named [What is typical behavior of a PE® drive when a trip event occurs?](#) for more information.

If the fuses are okay and the drive can power up (display is on), check for an Event Code to be displayed on the screen and check the Event Code FAQ's below, as well as the troubleshooting steps listed in your manual. If you do not have an F-code displayed, check the "E1-E4" parameters to see the Event Codes which may have recently been displayed. To do this, press and hold the "SCROLL" button until "E" is displayed, then let go of the "SCROLL" button. "E1" will be displayed briefly, then it will display the most recent F-code recorded (newer models – Version 2.1 and higher – will also display a number in front of the F-code, indicating the number of times that particular trip has occurred). To view the previous Event Codes (in order of occurrence), tap the scroll button to read the next three recorded Event Codes at E2, E3 and E4 respectively. **The presence of F-codes does not necessarily mean that the unit has been damaged.**

Refer to the Event Code list below to help diagnose and troubleshoot issues with your system.

To exit from the "E" parameters, press and hold the scroll button again until "cOFF" or "rOFF" is displayed then let go.

## How can I see the event code history on my drive?

### Automatic storage of event codes

The Micro-Speed® Smart-Move, Micro-Speed® CX™ and Micro-Speed® MX/MV™ models all automatically store the last four different types of event codes the drive has seen. They are stored in the Diagnostics memory locations E1, E2, E3, E4. Memory location E1 contains the most recent trip code (newer models also have a number in front of the code, indicating the number of times that type of trip has occurred). This history can help diagnosis a problem – including motor and other mechanical conditions.

## How can I use the drive's event codes to help me diagnose and fix system issues?

### Interpreting Event Codes

When a trip occurs, one of the codes listed below will be displayed, and action should be taken to correct the cause. The list of event codes on this site and in your manual will explain each trip condition, and give some possible causes. If the recommended changes do not relieve the problem, then please contact the factory for further assistance. If calling, it will be helpful to have a complete list of the recorded event codes (E1-E4) available along with the model and serial number of the product in question.



## How can I reset my drive after an event code is displayed?

### Resetting the drive after a trip

The drive will not accept any control input while an event code is displayed. The event code can be cleared by resetting the drive. The method by which the Micro-Speed® Smart-Move, Micro-Speed® CX™, or Micro-Speed® MX/MV™ drives may be reset is determined by a specific programming parameter. For the Smart-Move® and CX™ models, it is parameter L27; and for the MX/MV™ models, it is parameter C10. By default, all of the drives are programmed to reset when the directional button on the pendant station is toggled (press-release). No matter what method is programmed in the above parameters, you can always perform a reset by removing power from the drive (disconnect mainline) and then wait for the charge light to go off, then turning on the line power feeding the drive.

**\*\*Please Note\*\*** that the F2 code does not reset like most other event codes. If an F2 code is triggered, the drive will need to remain powered on, and may need several minutes to allow for the motor to cool. After sufficient time has passed, the drive will need to be reset one last time - this is the normal functionality of this code.



## Event Code Help (F1 - F47)

### What does F0 indicate?

#### **F0 – No F-Code Recorded**

**Code Meaning:** This value will be seen when checking the stored event codes (in parameters E1-E4) if no fault was stored, or after the memory was cleared. See [How do I begin to troubleshoot a PE Variable Speed Drive?](#) for more information about checking the event code history.

### What troubleshooting steps should I perform if I see F1?

#### **F1: Current Trip**

**Code Meaning:** Current has risen to over 300% of the rated output current. The current trip is a common fault and has many potential causes. Observing how the drive and the machine it is driving act at the moment this trip occurs will help the user in diagnosing the cause of the fault. **CAUTION:** Continued starting into a condition that causes F1's could damage the drive!

Use the following questions and recommended troubleshooting steps as a guide to help you resolve the issue:

#### **Does the drive trip out with an F1 code immediately (before moving the motor)?**

**If yes,** check the following potential causes:

1. **An output semiconductor in the drive is shorted.** An output semiconductor short can be tested for by disconnecting the motor leads from the drive and running the drive at some speed. The drive will trip out with no motor attached if there is an output short. If you DO see an F1 code in this case, the drive will need to be sent back to the factory for repair. If you DO NOT see an F1 code while running the drive with no motor leads, continue checking the following potential causes.
2. **Motor problems.** Specifically, check the following: **A)** The motor bearings (Can the motor shaft rotate freely?) **B)** A short in the motor (Check for shorts in the motor leads, leg to leg, and leg to ground.) **C)** Verify the motor windings are wired correctly (Are you properly hooked up for 230 or 460V?) **D)** Verify the motor is the correct voltage/Hz (Call PE® if you have a 120Hz motor.) **E)** Check to see if the current rating of the motor (or group of motors) is too large for the drive. **F)** Does the motor have internal brakes that receive power from the three motor leads? This type of motor should not be used with inverters unless the brake power leads can be brought out separately and powered from the line and not the drive.
3. **Mechanical brake not operating properly.** Make sure that any mechanical brake that is used is releasing cleanly without any dragging. Some motors have internal brakes; make sure these are also operating.
4. **Large current draw when accelerating.** The voltage boost setting A8 (C74 on the MX™ drives) may be too high and/or if the ramp down option is off, the pulse start boost setting (L31) may be too high. Solution: Lower the setting(s).
5. **Mechanical binding.** Solution: Investigate source of binding and fix.



### Does an F1 occur when accelerating?

If **yes**, it may be that the *motor is slipping* so excessively that torque is not efficiently produced. In this case, it is suggested to increase the acceleration time A1. If increasing the acceleration is unacceptable or does not work, try increasing the voltage boost (A8/C74 on MX™ drives). Increase it gradually in steps of about 0.5%. If raising the voltage boost helped but didn't completely solve the problem, try gradually lowering the voltage peak function (L21). Do not lower the voltage peak function to less than 90% of its nominal rating. Recall that the nominal voltage peak setting is  $(\text{Incoming Line Voltage}) \times (\text{full Hz of motor}) / (\text{Full motor voltage})$ .

### Does an F1 occur when decelerating?

If **yes**, then we suggest first observing whether the trip occurs when decelerating between speeds, decelerating to a stop, or decelerating during a reverse plug condition. The three deceleration parameters A4, A5, and A6 govern these three rates (respectively) and increasing the appropriate parameters may alleviate the problem. One could also set A5 and A6 to their maximum value and just increase A4 gradually to obtain a setting that will work. If increasing the time is unacceptable or does not work, try changing the voltage boost A8.

### Does F1 occur while travelling a constant speed, or when a certain speed is reached?

If **yes**, perform the following recommended steps:

1. If the fault occurs *while the motor is running at a constant speed*, then the load on the hook may be swinging. Increasing the acceleration and deceleration times may also help reduce the swinging which may be causing motor problems.
2. If the fault occurs *when a certain speed (in Hz) is reached*, verify that the drive is hooked up to the correct windings on your motor (e.g. make sure if you have a 460V motor that you are not hooked up to the 230V windings).
3. Verify that your motor is a 60Hz motor. If it is a 120 Hz motor (or some other frequency), contact PE<sup>®</sup> for assistance with setting the output parameters correctly.

### Does the drive ramp up in frequency, but the motor does not turn, and then an F1 occurs?

If **yes**, one should check the following potential sources:

1. Verify that any mechanical brake that is used is releasing cleanly.
2. Verify that there is no mechanical binding in the system
3. Verify that the motor is wired properly and not single-phasing.

If these check out, increasing the voltage boost A8 and voltage peak functions may help. Try changing the voltage boost gradually by first increasing its value, and if that does not work then by decreasing. Then try lowering the voltage peak function and see how the machine works. Do not lower the voltage peak function to less than 90% of its nominal rating. Recall that the nominal voltage peak setting is  $(\text{Incoming Line Voltage}) \times (\text{full Hz of motor}) / (\text{Full motor voltage})$ . Try



increasing and decreasing the voltage boost again for best results. If the ramp down option is off (such as in a hoist operation), then one may try the pulse start option to jar the mechanism loose.

**On a HOIST**, sometimes *the load brake will stick* and cause the motor to lockup. The drive seems to ramp up and then trip out. In this case, try the pulse start option first (L31, L32), and then try the voltage boost and voltage peak functions. The proper hoist load brake functionality should always be checked prior to continued operation.

## What else can cause F1?

**If you have reviewed and performed the steps in the relevant questions above**, you can also investigate the following potential causes of an F1 code:

1. Sometimes *electrical noise* can be induced on the motor leads from other wires that run alongside them, such as brake leads. When the brake operates, the noise from the arcing in the brake contactor can trip out the drive. This failure can be ruled out if the drive does not fault out at the instant the brake contactor switches. Solution: Run motor leads in a conduit separate from other leads.
2. (Ramp mode only) *If the F1s happen after reversing direction or stopping, then quickly starting again*—for instance when inching/spotting. The trip may be due to starting into a spinning motor. Solution: Don't start into a spinning motor. If the motor is spinning because the brake is setting slow, then use the dead time parameter (L26 on CX/MSM) to increase amount of time the brake has to set before the drive will start again.
3. (Coast mode only) *If the F1s happen after reversing direction or stopping, then quickly starting again*—for instance when inching/spotting. A slow mechanical brake on a Hoist may not be able to stop the motor before the Micro-Speed® is signaled to begin powering the motor again. This effectively causes the Micro-Speed® to start into a spinning motor. Solution: Increase the dead time parameter (L26 on CX/MSM) to increase amount of time the rotor has to lose its magnetic field. Usually 1.5 seconds is more than sufficient.
4. *Residual magnetic field in rotor*. The drive may trip out if the drive begins to power the motor too soon after it has stopped (this cause is rare). Solution: Increase the dead time parameter to increase the amount of time the rotor has to lose its magnetic field. Usually 1.5 seconds is more than sufficient.
5. *Some mechanical device in the drive train is not made for use with a variable frequency drive*. For instance, some mechanical soft-starting devices or clutches will not operate when driven at less than full speed. On a hoist, sometime s the load brake may be installed incorrectly.
6. *The load is too large* for your motor/drive system. Solution: Reduce load or increase motor and drive capacity.
7. Certain kinds of Nema type D motors produce a lot of *slip at low frequencies* and may not budge a load until it ramps up to a fairly high frequency, sometimes 30Hz or more, at which point the drive will trip out. This slip cannot be completely eliminated, but it can be reduced. First try lowering the voltage peak function (L21) and see how the machine works. Do not lower the voltage peak function to less than 90% of its nominal rating. Recall that the nominal voltage peak setting is (Incoming Line Voltage) x (full Hz of motor)/(full motor voltage). Then try changing the voltage boost gradually, first by increasing and if that does not work then by decreasing (increasing is usually the most effective method in this case).

Call PE® for further assistance if needed.



## What troubleshooting steps should I perform if I see F2?

### F2 (All Drives ver. 2.2 or 4.2 or higher): Motor Thermal Trip/I<sup>2</sup>T Trip

**Code Meaning:** I<sup>2</sup>T Current Trip – the motor temperature is beyond rated capacity. The unit will reset after the motor has time to cool off.

Further Information/Troubleshooting Tips:

**Unlike most other event codes, the F2 code cannot be manually cleared** by resetting the drive or turning the power to the drive off then on. The drive needs to be powered on while the motor is cooling off – this way the drive will calculate how much time has passed in order to let the motors cool off properly. After some time has passed with the drive on, try clearing the F-code as usual.

If you feel the drive is tripping with F2 codes unnecessarily (nuisance trip), check the following:

1. Verify that the proper FLA of your motors/group of motors has been entered into the U22 setting.
2. Check if your motor is rated for 120 Hz. If it is, call PE® for information about changing the drive parameters to work properly with a 120Hz motor.
3. Check that your Voltage boost setting (A8) is not set too high.
4. Holding the increase button while your drive is running will show you the current draw of the motors. If you see that the current draw is high, check to see if there are any sources of binding (E.g. Verify that your brakes are not dragging, or that there is any other source of mechanical binding).

**NOTE:** On some older MX/MV drives, an F2 code was used to signify a Weight Limit Trip (over torque). On newer drives, this code has been changed to F27. If you have older MX/MV drive model, see [What troubleshooting steps should I perform if I see F27?](#) for more information.

Call PE® for further assistance if needed.

## What troubleshooting steps should I perform if I see F3?

### F3 (MSM or CX models): Braking Resistor On Too Long

**Code Meaning:** The braking resistor has been on too long.

Further Information/Troubleshooting Tips:

1. *The resistance of the external resistor may be too large.* The resistance is considered too large if it more than 110% of the value determined by PE® (especially applicable if you not using the recommended PE® resistor bank). If this is the case, replace the resistor with one that agrees with the specification. **Never use a resistor that has fewer ohms than the specification requires!**
2. *The line voltage is too high.* Make sure that the incoming line voltage is within specifications.
3. *A transistor may be shorted in the drive.* To check this, detach the motor and run the drive at some speed. While running, check the DC voltage across the open resistor (CAUTION: As much as 800 volts may be present!) If the



transistor is working properly, there should only be a few volts present at most. If not, return the drive to the factory for repair.

4. **On a hoist**, this trip may indicate that *the load brake is slipping excessively or that it has failed completely*. Examine the load brake and make any adjustments or repairs as necessary.

### F3 (MMX or MMV™ models): Low Bus Voltage

**Code Meaning:** The voltage across the main buss capacitors has dropped below a preset level while the drive is running. This could indicate fluctuating input power.

Further Information/Troubleshooting Tips:

If you are seeing this trip, it might be beneficial to measure or record the line power coming in, since fluctuating line power is usually the cause. If voltage fluctuation is happening too quickly to measure with a standard DMM, a recording meter may be necessary. By default, you will only see this trip if the line power drops below approximately 80% of the expected line power for an extended length of time.

### What troubleshooting steps should I perform if I see F4?

#### F4 (All Drives): Low Bus Voltage

**Code Meaning:** The voltage across the main buss capacitors has dropped below a preset level. **This fault is a normal occurrence every time power is removed from the device.** This fault is not saved in the diagnostic memory E1-E4 since the drive will not operate while displaying F4 as long as the low voltage condition persists. This also saves the memory E1-E4 for other, more severe fault codes. This means that an F4 code is a normal occurrence and typically does not suggest a problem on its own. Check the diagnostic memory locations E1-E4 for other event codes if further troubleshooting is necessary.

Further Information/Troubleshooting Tips:

**Q1:** Are you seeing this trip NOT while powering down, but while trying to run normally? If Yes, then check the following potential causes:

1. *The Line Voltage is too low.* If your drive has just been installed and this fault is displayed, the unit is probably set for use with a higher 3-phase line voltage than that to which it is presently wired.
2. If you are seeing an F4 code just prior to moving, there may be *a problem with your mainline power* (check that your mainline contactor is closing properly on all three phases).
3. *Damage to the drive.* In this event the F4 fault code will always be displayed every time the unit is powered up. Contact PE® for repair/replacement options.

Call PE® for further assistance if needed.





## What troubleshooting steps should I perform if I see F5?

### F5 (All Drives): Over Voltage Trip

**Code Meaning:** The voltage across the main buss capacitors has increased above a preset level.

Further Information/Troubleshooting Tips:

**Q1:** When does this trip happen? Look for the appropriate answer to this question in bold below and follow the respective troubleshooting steps as necessary.

1. **If the drive has just been installed and the fault is displayed:** The supplied voltage may be too high. Supply the correct line voltage or replace the misapplied drive with a proper voltage drive.
2. **If the trip happens when accelerating or as it goes into a higher frequency:** Make sure that your motor is the correct Hz. *If your motor is rated for something other than 60 Hz, call PE® for information about changing the drive parameters to work properly with your motor.*
3. **If the trip happens when decelerating or while trying to ramp down from a high speed:** This scenario often indicates that **A) *the drive is decelerating too fast.*** Solution: Increase the deceleration time between speeds at A4, increase the time for decelerating to a stop (A5), and increase the time for decelerating when reverse-plugging (A6). You may only need to increase the deceleration time that is the shortest out of the values at A4-A6 to get the drive to function properly. It is usually easier to start by increasing both A5 and A6 incrementally and then gradually increasing A4 to get proper operation. If the deceleration rates are already fairly high, and you continue to see the F5 code when decelerating, this may point to **B) *a problem with the braking resistors*** – either they have gone bad, are not hooked up properly, or they may not be sufficient for your application. Call PE® for further help with appropriate regeneration resistor sizing.
4. **If the trip happens at low speeds, or while “inching”:** An F5 trip can be caused by *load swing*. Solution: Lower your accel/decel rates into and from your low speeds to help reduce load swing. In this situation, another possible cause is if *the drive is starting into a moving motor*. Solution: Make sure the motor has stopped before it is allowed to power the motor, such as restarting a hoist in the down direction before the hoist has stopped from a previous down direction command.
5. **If your drive operates a hoist motor, and you see F5 while lowering a load:** This scenario often indicates that the load brake is slipping too much, allowing regen into the drive. In this case, check to see if the load brake can be adjusted to reduce slippage. In some cases, adding a small regen. resistor can help as well. Call PE® for further help in this case.

If you have performed the above steps, and are still experiencing F5 codes, check if your incoming voltage is high. In this case, lowering your high speed setting and accel/decel rates may help avoid this trip.

Call PE® for further assistance if needed.



## What troubleshooting steps should I perform if I see F6 or F7?

### **F6 or F7 (All Drives): Auxiliary 1 (F6) or Auxiliary 2 (F7) Trip**

**Code Meaning:** An external device (overload, limit switch, etc.) has tripped, sending a signal to the AX1 or AX2 terminal – triggering the drive to trip according to the user-established programming.

#### Further Information/Troubleshooting Tips:

Determine the reason the external devices have tripped and repair if necessary. If this trip occurs during installation, double-check wiring and the operation of the attached devices. Also check that the Auxiliary Trip Modes (L28 on most drives) has been programmed appropriately. Keep in mind the drive can be set to trip when power is removed or when power is supplied to the Aux terminals.

**NOTE:** If you have two drives running in tandem, you may often see an F6 or F7 code because the drives have been programmed to trip using the Aux inputs if the other drive is not ready. In this case, be sure to clear the F – codes on both drives in order to resume operation.

Call PE® for further assistance if needed.

## What troubleshooting steps should I perform if I see F8?

### **F8 (All Drives): “A” Parameters Out of Spec.**

**Code Meaning:** Internal memory used by the drive has lost data.

#### Further Information/Troubleshooting Tips:

This code often indicates that at least one A parameter has accidentally been programmed in a way such that it is logically incompatible with other “A” parameter settings. Try reprogramming the “A” parameters individually or by performing a Gang-Set.

Call PE® for further assistance if needed.

## What troubleshooting steps should I perform if I see F9?

### **F9 (All Drives): CPU Error**

**Code Meaning:** Failure of drive CPU.

#### Further Information/Troubleshooting Tips:

**Solution:** Return unit to factory for repair. Call PE® for further assistance.



## What troubleshooting steps should I perform if I see F10?

### **F10 (All Drives): Memory Error**

**Code Meaning:** Parameter memory chip on the logic board is not operating properly.

Further Information/Troubleshooting Tips:

Try reprogramming the “A” parameters individually or by performing a Gang-Set.

Call PE® for further assistance if needed.

## What troubleshooting steps should I perform if I see F11?

### **F11 (All Drives): Timer**

**Code Meaning:** The motor has run longer than that allotted by the timer setting at L24.

Further Information/Troubleshooting Tips:

1. Cause: Unattended motor driven device stalled or jammed. Solution: Investigate why motor stalled and correct problem. Perhaps the load was heavy enough to cause the motor not to turn in low speed due to excessive slip. Increasing the voltage boost (A8) or low speed setting (A12) might help.
2. Cause: Programmer accidentally enabled the timer. Solution: Disable the timer by setting L24 to zero.
3. Cause: Timer set for too short of a period. Solution: Increase time set in L24.

Call PE® for further assistance if needed.

## What troubleshooting steps should I perform if I see F12?

### **F12 (All Drives): Hardware failure**

**Code Meaning:** An internal hardware component has failed within the drive.

Further Information/Troubleshooting Tips:

Solution: Return unit to factory for repair. Call PE® for further assistance.



## What troubleshooting steps should I perform if I see F13?

### **F13 (All Drives): Overload**

**Code Meaning:** The overload device has tripped disconnecting the ST terminal from the common of the control voltage. If no overload device is used in your application, it is necessary to install a jumper connecting the COM terminal to the ST terminal.

Further Information/Troubleshooting Tips:

Cause: The overload device has tripped. Solution: Investigate why overload tripped and correct problem. Reset the overload, if it doesn't reset automatically, and reset the drive to clear the F13 code. The drive will continue to display F13 until the overload device has been reset and a connection from ST to the common is re-established.

Call PE® for further assistance.

## What troubleshooting steps should I perform if I see F14?

### **F14 (MMX/MMV™ Only): Output Phase Loss**

**Code Meaning:** This code will display if a line to the motor is lost or fusing opened between the motor and the drive. Also, a loose encoder coupling can cause the VFD to over-compensate. This may cause the current to fall so low as to appear to be a lost phase.

Further Information/Troubleshooting Tips:

1. To verify the lines to the motor, check each line with a clamp meter to check for current while running. If one line is low or does not have current, test all connections and wires on that line. If the motor lines all test fine, check the encoder with the following steps.
2. Check the encoder coupling. Make sure it is not loose and make sure the encoder does not tilt or wobble while the motor is being driven. Tighten couplings and brackets as necessary. If the physical elements of the encoder appear fine, check the wiring next.
3. Measure the DC voltage from the drive to the encoder at 0V and V+. If no voltage can be measured there, remove the leads from those terminals and re-measure. If a voltage is present when no leads are connected, verify the wiring for your encoder and test again.
4. If F14 is coming up only when going into high speed, check to see if your motor is a 60 Hz motor. If your motor is rated for something other than 60 Hz, call PE® for help with adjusting the necessary parameters.

Call PE® for further assistance.



## What troubleshooting steps should I perform if I see F17?

### **F17 (MMV™ Only): Encoder Tracking**

**Code Meaning:** The motor is not running as the drive is commanding.

Further Information/Troubleshooting Tips:

This is a code that will only appear on older drive models. First check the encoder coupling. Make sure it is not loose and make sure the encoder does not tilt or wobble while the motor is being driven. Tighten couplings and brackets as necessary. If the physical elements of the encoder appear fine, and you are still seeing this code, call PE® for further assistance.

## What troubleshooting steps should I perform if I see F18 or F19?

### **F18 & F19 (MMV™ Only): Encoder Phase A or Phase B**

**Code Meaning:** Power loss in phase A (F18) or phase B (F19) wiring from the encoder and/or main power loss to the encoder.

Further Information/Troubleshooting Tips:

1. Check the encoder coupling. Make sure it is not loose and make sure the encoder does not tilt or wobble while the motor is being driven. Tighten couplings and brackets as necessary. If the physical elements of the encoder appear fine, check the wiring next.
2. Measure the DC voltage from the drive to the encoder at 0V and +V. If no voltage can be measured there, remove the leads from those terminals and re-measure. If a voltage is present when no leads are connected, verify the wiring for your encoder and test again.
3. If voltage is present at 0V and +V, measure for DC voltage across terminals A+/A- (for F18) and B+/B- (for F19). You should have voltage similar to the voltage across 0V and +V (it may be positive or negative). If you do not see the appropriate voltage on the phase terminals, verify the wiring and connections for your encoder and test again. If the wiring is correct, and the problem persists, you may have a problematic encoder.

Call PE® for further assistance.



## What troubleshooting steps should I perform if I see F20?

### **F20 (MMX/MMV™ Only): Heat sink too hot**

**Code Meaning:** The drive heat sink temperature has risen above a predetermined value.

Further Information/Troubleshooting Tips:

1. Make sure your cabinet is properly cooled. If the electrical panel is mounted in an area where ambient temperatures can reach higher than the maximum temperature rating of the unit, an enclosure air conditioner is recommended.
2. If your electrical panel has fans or air conditioning, make sure they are working properly.
3. PE® drives are designed to be mounted vertically on an electrical panel (mounted so the print on the device is upright). The heat sink fins in the unit are designed to cool best with that orientation. If the drive is mounted with another orientation, you may need to add fans or air conditioning to the panel—even if the normal ambient temperatures are much lower than the maximum temperature rating of the unit.

Call PE® for further assistance.

## What troubleshooting steps should I perform if I see F21?

### **F21 (MMX/MMV™ Only): Begin Brake Test**

**Code Meaning:** Occurs if beginning brake test fails. This means slipping was detected during the initial brake test.

Further Information/Troubleshooting Tips:

1. If your motor is in a place where a lot of dust or residue could build up on the brakes, this may be the cause of slipping when the drive performs this test. Try running the drive in test mode (U49) to let the brake set a time or two and clear off any potential dust/residue. Consult PE® if you are not familiar with how to run the drive in test mode.
2. Perform diagnostic/maintenance procedures on your motor brake per the manufacturers specifications. Tighten, adjust or fix the brake as necessary to eliminate all possible sources of brake slippage.
3. If you have performed the above steps and are still seeing the F21 code, Consult PE® for adjustment help.

## What troubleshooting steps should I perform if I see F22?

### **F22 (MMX/MMV™ Only): CPU Fault**

**Code Meaning:** Failure of the drive CPU.

Further Information/Troubleshooting Tips:



## What troubleshooting steps should I perform if I see F23?

### **F23 (MMX/MMV™ Only): Brake Control Circuit Open**

**Code Meaning:** The braking control circuit shows an open condition.

Further Information/Troubleshooting Tips:

1. The brake control output circuit may be wired incorrectly, open or missing. Solution: Consult the wiring diagrams in the drive manual and verify brake wiring.
2. The brake fuse relay is open. Solution: Replace fuse (spare on the pc board) PE® part # 15D102 or Littelfuse #31205 – 5 amp fast blow or equivalent.
3. Consult PE® for further help.

## What troubleshooting steps should I perform if I see F24?

### **F24 (MMV™ Only): Drive Output Leads**

**Code Meaning:** The drive performs an initial motor continuity check at the beginning of every start. If one or more phase is lost, this code will appear.

Further Information/Troubleshooting Tips:

1. Test all connections and wires out to your motor. If you have an overload relay wired between the drive and the motor, check all of the connections on the relay.
2. Test your motor by measuring resistance leg to leg to validate balance, and check each leg to ground with a meter capable of reading resistance in the mega-ohm range. Make any motor repairs as needed.

Call PE® for further assistance.

## What troubleshooting steps should I perform if I see F25?

### **F25 (MMV™ Only): Extra Encoder Pulses**

**Code Meaning:** The drive is receiving too many encoder pulses – may be noise.

Further Information/Troubleshooting Tips:

First make sure that the setting at U30 matches your encoder pulse output, and change as necessary. Next check that your encoder is wired correctly and also make sure the encoder is properly grounded. Consult the documentation or manual for your encoder as necessary. If you are still seeing this code, it may be helpful to run the drive in test mode (U49) with U48 set to 17 to detect noise levels, and to see if there are specific times when the noise is occurring. If the

noise appears when the brake is setting/releasing, your brake contactors may be causing interference with the encoder. Isolate and shield encoder wiring if possible to reduce sources of EMF noise. Call PE® for further assistance.

## What troubleshooting steps should I perform if I see F26?

### **F26 (MMX/MMV™ Only): Brake relay failure**

**Code Meaning:** The drive has experienced an internal brake control relay failure.

Further Information/Troubleshooting Tips:

Solution: Return unit to factory for repair. Call PE® for further assistance.

## What troubleshooting steps should I perform if I see F27?

### **F27 (MMX/MMV™ Only): Weight Limit Trip (Over Torque)**

**Code Meaning:** This code is associated with the Over-Torque settings programmed at C110-C117.

Further Information/Troubleshooting Tips:

Consult the manual for assistance with programming the C110-C117 parameters to set up appropriate load trip (over-torque) settings. Call PE® if further assistance is needed.

## What troubleshooting steps should I perform if I see F28?

### **F28 (MMX/MMV™ Only): Power Supply Failure**

**Code Meaning:** A failure is detected in the power supplies, the drive cooling fans, and/or charging contactor. This code can also occur during loss of a single line fuse.

Further Information/Troubleshooting Tips:

1. Check the function of the heat sink cooling fans (on larger drives that have cooling fans, the fans are normally on while the drive is powered).
2. Listen for the charging contactor to engage during drive reset.
3. Check all panel fuses and replace any blown fuses as necessary.

Call PE® if further assistance is needed.



## What troubleshooting steps should I perform if I see F33?

### **F33 (MMV™ Only): Tracking Error**

**Code Meaning:** There is a discrepancy between the drive output speed and the feedback from the encoder.

Further Information/Troubleshooting Tips:

1. Check the physical aspects of the motor encoder. For example, check that the encoder bracket and coupling is tight, or if the encoder is on a shaft that is driven by gears, check that your gears are meshing correctly. Also make sure that the encoder is not being pulled or misaligned while the motor is running. Make adjustments to the encoder coupling and brackets as necessary.
2. Perform an encoder test by setting U48 to 1 and running in test mode at U49. While running at full speed, you should see a clean readout of 1.00. If you do not see this value you may have an encoder issue.
3. Make sure that your brake is fully releasing and there is no binding from the brake.
4. Is the F33 code only happening when going into high speed? If so, check if your motor is rated for 120 Hz. If it is, call PE® for information about changing the drive parameters to work properly with a 120Hz motor.
5. Check your control input using E8. Make sure that the UP signal is tied to the Forward input terminal, and the DOWN command is tied to the Reverse input. If this is backwards, you will have to change the Forward/Reverse wires, and also reverse one pair of encoder wires (e.g. swap either A+/A- or B+/B-). Lastly you will also have to swap two T-leads to your motor to reverse the motor direction.

Call PE® for further assistance if needed.

## What troubleshooting steps should I perform if I see F34?

### **F34 (MMV™ Only): Encoder tracking error during Zip-Up® function**

**Code Meaning:** There is a discrepancy between the drive output speed and the feedback from the encoder while running in Zip mode.

Further Information/Troubleshooting Tips:

1. Reduce the Zip speed setting at C124 (Zip-Up® speed) and C129 (Zip-Down® speed).
2. Perform troubleshooting steps for the related code F33.

Call PE® for further assistance.



## What troubleshooting steps should I perform if I see F35 or F36?

### **F35 or F36 (MMV™ Only): Encoder Speed**

**Code Meaning:** The encoder is running too fast in the Up (F35) or Down (F36) direction.

Further Information/Troubleshooting Tips:

1. Check your control input using E8. Make sure that the UP signal is tied to the Forward input terminal, and the DOWN command is tied to the Reverse input. If this is backwards, you will have to change the Forward/Reverse wires, and also reverse one pair of encoder wires (e.g. swap either A+/A- or B+/B-). Lastly you will also have to swap two T-leads to your motor to reverse the motor direction.
2. Is the F-code only happening when going into high speed? If so, check if your motor is rated for 120 Hz. If it is, call PE® for information about changing the drive parameters to work properly with a 120Hz (or any other non-60Hz) motor.
3. It may help to increase the CL6 (for F35) or CL7 (for F36) parameter by several Hz.

Call PE® for further assistance.

## What troubleshooting steps should I perform if I see F45?

### **F45 (MMV™ Only): Binding**

**Code Meaning:** Failed motion test after the begin brake test. May be caused by a slow reaction of a DC brake.

Further Information/Troubleshooting Tips:

1. Was this drive just installed? Make sure that you complete the motor tuning procedure before attempting to run the drive.
2. If this drive was running properly previously, and you are now starting to see F45 codes, something is causing a binding after the brake is signaled to release (or the brakes may not actually be releasing at all). Check the crane's physical elements for sources of binding (check bearings, gears, misalignment, etc.).
3. If you cannot locate a physical source of binding, consult PE® for adjustment help.



## What troubleshooting steps should I perform if I see F46?

### **F46 (MMV™ Only): No movement**

**Code Meaning:** The encoder is not moving.

Further Information/Troubleshooting Tips:

1. Check to see if the encoder coupling has come loose. Tighten or fix as necessary.
2. Check that your encoder is properly grounded. Consult the documentation or manual for your encoder as necessary.
3. Run the drive in test mode (U49) with U48 set to 17 to detect noise levels, and to see if there are specific times when the noise is occurring. If the noise appears when the brake is setting/releasing, your brake contactors may be causing interference with the encoder. Isolate and shield encoder wiring if possible to reduce sources of EMF noise.

Call PE® for further assistance.

## What troubleshooting steps should I perform if I see F47?

### **F47 (MMV™ Only): Encoder Problem**

**Code Meaning:** The encoder is missing pulses.

Further Information/Troubleshooting Tips:

1. Check to see if the encoder coupling has come loose. Tighten or fix as necessary.
2. Check that your encoder is properly grounded. Consult the documentation or manual for your encoder as necessary.
3. Run the drive in test mode (U49) with U48 set to 14 (and subsequently 15) to detect missing pulses. Check the wiring on the phase with the missing pulses.

Call PE® for further assistance.