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ABB DRIVES

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ABB ACH550 Drives Sizes R1-R4 (1-75HP) Ground Fault Information

This document is intended to address questions regarding how this circuitry works within the drive. In most instances if **Fault #16 Earth Fault** is observed it will relate to the information listed below. It is normally assumed that a drive must have an internal problem if a ground fault is observed. This is not normally the case as the drive is doing exactly what it was designed to do. The design of the circuitry is such that it causes the response of the drive to a ground fault to be extremely sensitive. In most instances the fault will be related to a motor issue or a cabling issue connected to the output section of the drive. There are instances in which the fault could be caused by a power or line side issue. That will not be discussed in detail in this document.
The Ground Fault circuitry is ground fault protection not ground fault detection

- DC Bus and the DC Bus chokes are being monitored directly all of the time by the drive main control board using the ground fault protection circuitry
- Current and voltage should normally be balanced on both sides of the DC Bus and DC Bus chokes (Positive section of the Bus to negative section of the DC Bus)
- Current imbalance and voltage imbalance are measured constantly and dynamically. A voltage spike or rise on the DC Bus and DC Bus chokes is included in this measurement as is a voltage drop. This is what determines a ground fault while the unit is running a motor. What the drive does is to observe common mode voltage of the DC Bus and DC Bus chokes and what level the voltage is. This is what determines a fault.
- A voltage reference or leakage to ground is also measured. This is done while the unit is not running a motor or rather is stopped. This is measured at the output of the IGBT to determine if leakage current is detected. This method is also measured constantly and dynamically so a constant megohm reading value of reference to ground would be inaccurate. Through field experience it has been observed that a motor with a reading at or above 100 Megohms to ground will normally not cause a ground fault while any value below this is capable of causing a ground fault. What the drive does is to observe the output voltage and voltage level of the IGBT to determine this
- Drive response to ground faults is between 25 and 40 microseconds

Listed below are faults normally observed if a motor or a cabling issue is present:

1. Fault #16 Ground Fault which is explained in detail above. This is usually caused by a short to ground in the motor cabling or within the motor winding with reference to ground. If there is any doubt of the motor being the cause of the issue simply disconnect the motor from the VFD output. The VFD should run normally with the motor disconnected
2. Instantaneous Fault #2 DC Bus Over Voltage fault upon attempt at starting a motor on the VFD followed by Alarm #2013 Auto Reset. This is usually caused by a short within the motor windings or between the motor cables but usually not caused by a short to ground
3. Instantaneous Fault #1 Over Current fault upon attempt at starting a motor on the VFD followed by Alarm #2013 Auto Reset. This is usually caused by a short within the motor windings or between the motor cables but usually not caused by a short to ground
4. Instantaneous Fault #4 Short Circuit fault upon an attempt at starting a motor on the VFD. This is usually caused by a short in the motor windings or between the motor cables but usually not caused by a short to ground

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5. Instantaneous Fault #34 Motor Phase fault upon an attempt at starting a motor on the VFD. This will normally only apply if the drive is in Vector Control Mode. This is usually caused by an open section of a motor winding, a disconnected or missing motor phase cable or fuse, or an open thermal motor overload. This is not usually caused by a short to ground

The information listed below is intended to assist with finding the root cause of the faults listed above:
A motor used on a VFD should normally be Megohm tested with a Megohm meter at a level of at least 1000 volts. This test should be performed with the motor and/or cables **DISCONNECTED FROM THE DRIVE OUTPUT**.
This test should not be performed with a regular multimeter in Megohm setting as the meter is incapable of applying adequate voltage to detect a potential problem.
A phase to ground should be tested. B phase to ground should be tested and C phase to ground should be tested. The reading of each phase to ground should be at or above 100 Megohm to ground. Each phase to ground need not be even with one another. If the level is less than 100 Megohm to ground the drive could potentially display a ground fault even though the motor is not completely shorted to ground. It may still be low enough to generate a fault.

A motor should be tested with a multimeter from each motor phase to the other two phases.
For example: A phase should be tested to B phase. B phase should be tested to C phase. C phase should be tested to A phase. The reading of these will be of very low resistance.
The resistance will decrease with each motor size increase. The reading is not what is important. What is important is that all three of the phases are exactly the same as one another. If there is any deviation between them a loose connection or winding issue within the motor is likely.