

OVERVIEW

Diagnosing the cause of Earth Ground (EG) Faults in a life safety application can be frustrating. This application note helps you diagnose the cause of Earth Ground Faults quickly.

Earth Ground Faults Explained

Earth Ground Fault detection alerts the user that earth ground is connected to either a positive voltage or DC common in the system, either as a direct short or through a resistance. **An earth ground fault, as related to the life safety industry, does not indicate a missing or inadequate earth ground connection to the power supply.**

Depending on the equipment connected, a single earth ground connection to the field wiring by itself may not cause any problems, aside from the fault indication. Because of this, the temptation may be to just disable Earth Ground Fault detection, eliminating the fault. In some cases, as we will discuss later, this is the only option available. However, it is usually in the integrator's best interest to determine and repair the cause of the Earth Ground Fault to prevent future problems.

Figure 1 illustrates a possible state a power system could be left in if an Earth Ground Fault is ignored. The system in this state may operate properly with no symptoms of the short from Load 1 common to earth ground. The problem arises if another field wire shorts to earth ground, either via wire insulation chafing, a cut wire, or an internal failure in a load device that causes a connection to earth ground.

In Figure 2, the positive wire going to Load 2 has shorted to earth ground as well. This causes a direct short between Load 2 positive and DC common (on Load 1), which will rupture the fuse on Load 2, removing power from that device.

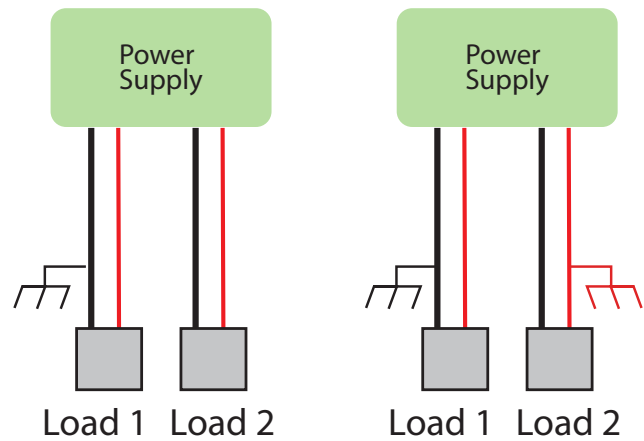


Figure 1

Figure 2

How Earth Ground Fault Detection Works

Most panels or power supplies in the life safety industry that detect Earth Ground Faults use the same basic method. This involves placing a small bias voltage on earth ground in reference to the equipment being powered, and monitoring that voltage. Figure 3 shows a simplified diagram.

In this circuit, under normal conditions the voltage at Sense will be 6V with respect to DC Common. If earth ground shorts to any DC common lead in the system, the Sense voltage will go to 0V. If earth ground shorts to a +12V or +24V source, the Sense voltage will go to 12V or 24V respectively.

Keep in mind also that even a partial short through a resistance can cause an earth ground fault by driving the Sense voltage either up or down. The voltages, circuitry, and trip points for earth ground fault all vary manufacturer to manufacturer, or even product to product. The method of monitoring the sense voltage can also vary. However the same basic principle applies to most any Earth Ground Fault detection circuit.

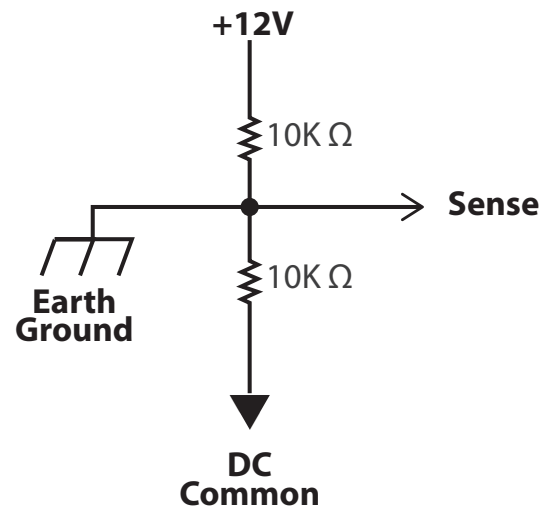


Figure 3

Causes of Earth Ground Faults

Earth Ground Faults can be caused by any of the following conditions:

Multiple Earth Ground Detection Circuits Enabled

It is important that only one Earth Ground Fault detection is enabled in a system. This means that only a single power supply, panel (including fire, access, mass notification, etc), or other device should have EG Fault detection enabled. Enabling more than one device for EG Fault detection will affect the Sense voltage on Earth Ground, either immediately putting the system into EG Fault, or affecting the sensitivity of the EG fault set points, possibly causing intermittent faults later. This includes single enclosures with multiple FPO power supplies - only one of the FPO power supplies in an enclosure should have EG Fault enabled.

Network or Computer Connections

Often, computer or network connections will trigger an EG Fault condition while connected. If the connection is temporary for troubleshooting or programming purposes, the EG fault may be disregarded. If the connection is permanent, or the temporary EG fault condition is unacceptable, EG Fault detection should be disabled.

Field Wiring or Load Device Problem

The most common cause of Earth Ground faults is due to field wiring problems or problems with the device being powered. Field wiring problems can be caused by partial or full shorts in the wiring due to chafing of the insulation, wiring that has come disconnected and is touching earth ground, terminal or wire nut connections where one or more strands are separated from the connection and touching earth ground, one or more wires that are pinched or cut, or other similar causes.

Load devices are also common causes for EG Faults, either because the device is defective or because of the design of the device. Defective devices include maglocks or strikes whose internal windings have shorted to the casing of the lock, electronic devices such as readers with internal shorts or partial shorts to earth ground (either mechanical or electrical), or other similar faults. Some load devices just cannot be used with EG Fault detection due to their design. Often these devices have internal connections to EG by design, either for transient protection, communication line shielding, EMI reduction for FCC or other compliance, or other reasons. In these cases the only option is to disable Earth Ground Fault detection.

Troubleshooting Earth Ground Faults

Finding the cause of an Earth Ground fault quickly requires an orderly troubleshooting procedure. The procedure involves temporarily removing connections until the EG Fault is gone, repairing the cause, then reconnecting all wiring. The following steps are recommended:

1. Verify that EG Fault detection is only enabled on one device in the system. Check all power supply boards and panels for EG Fault detection.
2. Temporarily remove any network or computer (USB, RS-232, etc) connections from the system.
3. Begin removing field wiring from the system, either individually, or in groups. Most LifeSafety Power terminal blocks are removable. If removing a terminal block causes the EG fault to go away, replace the terminal block and begin removing individual wires from the terminal block until the wire causing the fault is determined. Once the wire causing the fault is located, the cause of the short must be located and repaired. The short could be in the wiring itself or in the load device. Keep in mind that EG Fault detection monitors the entire system, so if removing the wires to a device such as a door controller causes the EG Fault to go away, the fault could be with the door controller itself, or any of the devices connected to the door controller (lock, reader, REX, etc) or their wiring.
4. Once the wire can be reconnected without the EG Fault coming back, begin connecting wires or terminal blocks one at a time to the system to check for other EG Faults. Once all wiring is reconnected, restore any network or computer connections.
5. If all field wiring is removed and the EG fault remains, verify that there are no physical connections causing the fault (i.e. stray wire or metal touching the underside of one of the PC boards, etc). If no cause is found, contact LifeSafety Power for further assistance.

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