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Zhone IMACS Technical Note TN040610

April 6, 2010

Grounding for IMACS 600/800/900 Chassis: 120/240VAC and -48VDC Power Sources

Purpose:

Proper grounding of IMACS equipment is essential for proper system operation and equipment protection as well as personal safety. Low voltage, integrated circuit devices found in communications equipment like the IMACS are vulnerable to damage from lightning activity, power line anomalies, and parasitic coupling by radio frequencies. Good grounding and bonding of all system components to a single point of ground (SPG) reference minimizes the difference of potential that can develop between components in a system and among equipments nodes at an equipment site.

Common system grounding faults are disconnected or “floating” grounds and multiple grounding paths at different potentials. Such conditions can be hazardous. Ground loops occur when there is more than one ground connection path between two pieces of equipment which don’t require high current through them to produce a significant voltage drop. These duplicate ground paths can form the equivalent of a loop antenna which very efficiently picks up radio frequency interference currents. Lead resistance (native impedance of copper wire) transforms these currents into voltage fluctuations. As a consequence of ground-loop induced voltages, the ground reference in the system is no longer a stable potential, so transmission and equipment signals ride on the noise. The noise becomes a spurious component part of the program signal.

Proper Grounding Practices:

The low voltage sensitivity of newer electronic telecommunications equipment requires, in general, that the chassis frame ground and equipment power ground be effectively equalized to prevent ground current loops or voltage transients that can damage the telecommunications equipment and risk personal safety. To ensure effective ground equalization, the telecommunications equipment ground reference system should be directly bonded to the electrical service’s ground system. This equalized reference point is at the site’s equipment master ground bus (MGB) and building’s main electrical service’s panel neutral/ground bus bar which is connected to the building earth ground system.

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Additionally, a ground loop potential also occurs when there is more than one connection path between two pieces of telecommunications equipment through interconnecting cabling. Analog and digital cabling interconnections are common wiring conditions which provide potential multiple grounding paths among telecommunication equipment. A potential difference in the cable's ground reference of as little as 0.1 ohms causes a current to flow through the interconnections. Using a star topology scheme when grounding interconnect cabling among telecommunications equipment eliminates multiple grounding paths and greatly reduces induced noise potential from electro-magnetic force (EMF) and radio frequency interference (RFI). This is accomplished by terminating the ground reference wire or cable shield of the interconnecting cable at the source end connector and by floating the ground reference wire or shield at the sink end connector.

The IMACS equipment, like most telecommunications equipment systems, provides separate grounding points for a variety of telecommunication service requirements. These separate requirements are as follows:

1. Chassis grounding (also called safety ground)
2. Grounding for data communications circuits
3. Grounding for analog communications and signaling circuits

In telecommunications networks designed with legacy electrical interfaces for communications links, these ground reference points were an integral part of the network design. This has been the case with analog and digital interconnect cabling between equipment at different ground reference potentials. With the advent of fiber optic equipment and opto-coupling devices for interconnect cabling both of which eliminate grounding faults, the considerations and implementation of system ground reference have been greatly simplified in telecommunications networks.

IMACS Grounding Practices:

Each IMACS chassis (600, 800 and 900) has three separate grounding path connections:

1. Chassis/Frame Grounding
2. Common system ground for data communications circuits (COM)
3. Return ground for analog signaling circuits (VN+)

The power connector strip on an IMACS chassis consists of the following connections:

(*Refer to Plate #1: from left to right for 600 and 800 chassis. The 900 chassis can have two configurations. Refer to the next diagram or simply follow the stenciling on the unit itself.*)

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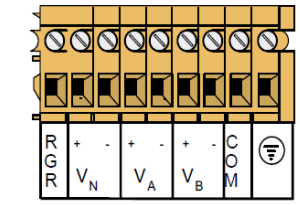
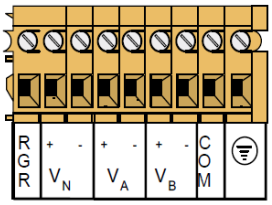
1) RGR for connection to an optional, external ringer generator PSU.
2) VN+ for the -48VDC Return lead to an external DC power source for voice only.
3) VN- for the -48VDC Power lead to an external DC power source for voice only.
4) VA- for the -48VDC Power lead to an external DC power source for S1 P/S.
5) VA+ for the -48VDC Return lead to an external DC power source for S1 P/S.
6) VB+ for the -48VDC Return lead to an external DC power source for S2 P/S.
7) VB- for the -48VDC Power lead to an external DC power source for S2 P/S.
8) COM for data and digital circuit reference grounding
9) Chassis/Frame grounding, also called earth/safety ground.

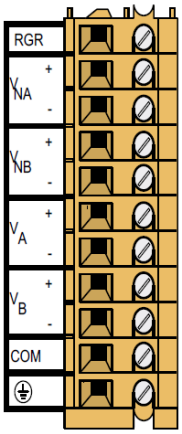
[Plate #1]



Front-Loading Chassis
Power Supplies on Side

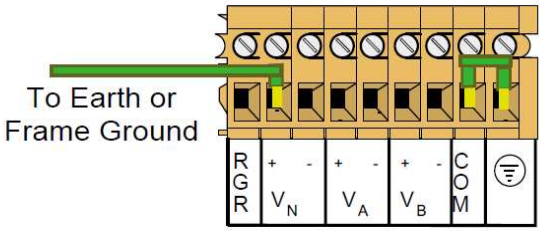


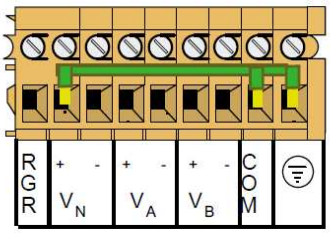
Two-Sided Chassis



Front-Loading Chassis
Power Supplies on Top

Recommended IMACS grounding as illustrated in the IMACS Reference Guide (May 2008; Document Part Number: 830-01716-02), chapters 3.6, 3.7, and 3.8.





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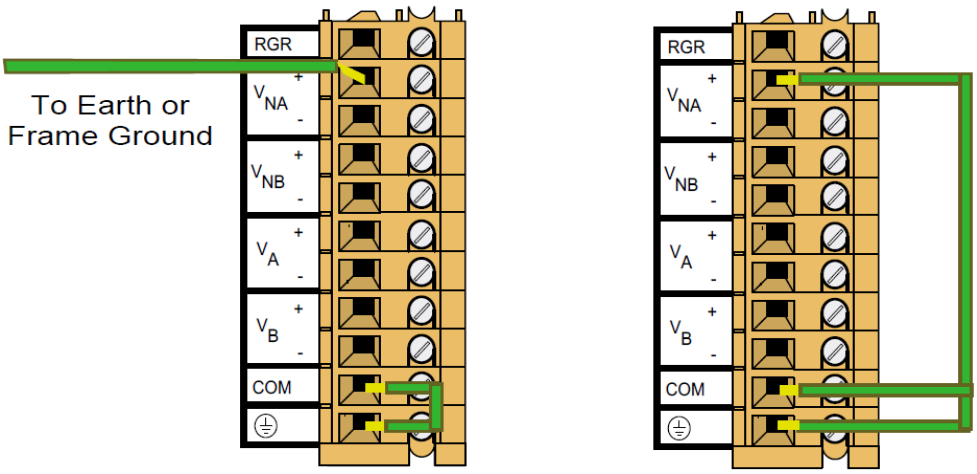

Note: The latest hardware revision of the IMACS 800 chassis (891830) has an optional chassis/frame grounding termination point on the lower back side of the chassis. A mounting bracket hole, 10-32 x1/4" screw size, has an unpainted 3/4" diameter surface (unpainted) allowing for #6 AWG lug connection.