Why telecom equipment use 48vdc

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It is considered a "compromise voltage" by being high enough to enable relatively low signal loss transmissions over large distances, and yet low enough to be a "safe low voltage".

Telecom and wireless networks typically operate on 48 volt DC power. But unlike traditional 12 and 24 volt systems which have the minus (-) side of the battery connected to ground (i.e. called negative ground systems), telecom batteries have the plus (+) side of the battery connected to ground, called a positive ground system, also designated as "negative 48 volt". In this configuration, the minus side of the battery becomes the "hot" conductor and the + is no longer hot, rather it"s at zero potential as it is connected to ground and referred to as the "common" or "return" wire. Despite its complexity and propensity for confusion, described below, "neg" 48 volt is the common choice in DC power for wireless networks.

Why is the positive side of the DC circuit connected to ground in telecom applications versus negative ground used, as used, in automotive and other industrial dc systems?

This positive ground configuration does not cause polarity to change, plus (+) is still plus and carries a positive charge with respect to the negative (-) terminal or minus. Many a short circuits have occurred when installers assume that when changing to positive ground, polarity changes as a result, not true! Regardless of ground reference, connecting (+) plus to (-) minus will still result in either a short circuit or reverse polarity to equipment.

Another factor that can cause confusion (and potentially sparks) is use of red & black colored wires. In negative ground systems, red is universally understood as hot and +, in positive ground, this "red wire" is no longer hot, but is still +. So you can imagine an installer standing there with a black wire in one hand and red wire in the other looking at the input terminals on a "neg 48-volt" transmitter that are marked "HOT" and "RTN" asking himself "What goes where?" Answer is: black to plus and red to minus, which is a bit counter-intuitive. Thus, we recommend a common color be used for both conductors and the wires labeled with the polarity.

Another word of caution on system integrations that mix positive and negative ground equipment, Ground Isolation must be maintained between these operating system to prevent short circuits and equipment compatibility issues. In addition, there is the issue of continuity between chassis ground and system ground; they can be common or may be isolated (called a floating ground).

Application AssistanceNewmar provides power systems that accommodate positive and negative ground configurations. Our technical staff is well versed in these applications and can provide guidance in configuring and wiring. Please consult with us should you have any questions about system configurations. We’re always here to help!

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Annie PaquetteOctober 04, 2019

The original telephone systems of the Bell Telephone company were powered from a -48VDC infrastructure out of their central office locations. In the late 1800’s, most homes of were not yet wired for electricity; in fact, communications beat power to the home in much of the United States. The reason Bell selected -48VDC is because it provides enough in power to support a signal, but not enough to be dangerous. Today it is generally accepted by safety regulations and electrical code that anything operating at or below 50V DC is a safe low-voltage circuit, and -48VDC is still the standard in communications facilities serving up both wired and wireless services.

In fact, -48VDC allows telecom operators to use 12-volt lead-acid batteries wired in series to act as a backup power source in the event of a power failure. Negative 48VDC (-48V), or positive grounded, was selected for use by Bell when it was found to be superior to positive voltage. It prevents electrochemical reactions from destroying buried copper cables and rendering them useless if they happen to get wet. Negative voltage also protects against sulfation on battery terminals. Generally regarded to be more energy efficient, it bypasses the single and dual power conversion processes found in most AC UPS units.

The central office (CO) and wireless switches are run by a combination of AC powered rectifiers and batteries. The batteries are rated at 48 volts DC and the rectifiers supply 52 volts DC. The rectifiers keep the batteries charged and power the CO equipment while the electric company power flows. If the power fails, the batteries, which are "floating,” seamlessly take over the load. The communications equipment doesn"t notice the difference, and everything keeps operating. When the power comes back, the rectifiers take over again and continue operating. In some ways, the entire facility is a large uninterruptible power supply.

Telecommunications equipment draws a lot of current and all of the wires and conductors are very large. Other applications for -48V DC include powering cell towers, local cable TV vaults, and legacy central offices of the various incumbent local exchange carriers (ILECS). Many of these ILECS have been bought back by AT& T. The gear deployed in these instances is typically supplied by Alcatel-Lucent, Juniper, Nokia, Ericsson, Cisco, and Huawei. All of them offer the option of relying on -48V DC power supplies to keep the voice and data traffic moving across the networks.

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