Selecting DC Sources for Telecommunications Equipment Test Systems

Application Note

Overview

When selecting DC sources for test systems for telecommunications equipment one must take industry standards on DC power into consideration. DC power distribution buses of +24, -48 and, to a lesser extent, -60 volts for reliably power telecommunications equipment installations are well proven over many years of being in use. These are not tightly regulated voltage levels. Due to a number of factors the actual voltage range extends considerably above and below these stated levels as defined by industry standards, including the North American International Electrotechnical Commission (IEC) 60950 and the European Telecommunications Standards Institute (ETSI) 300-132-2. During test the system DC power supply must be able to likewise provide the appropriate voltage extremes for powering the telecommunications equipment.

Problem

These extended voltage limits need to be taken into consideration to validate equipment performance under appropriate worst case corner conditions when testing during design validation and manufacturing. This in turn dictates voltage, current and power requirements need to be carefully considered when selecting an appropriate DC source to address these requirements. Furthermore, if a given test system needs to test equipment for up to more than one DC bus value, the extended range of voltage and current needed at the maximum power demand needs to considered as well. This can all add up to needing considerable test system rack space for DC power.

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Solution

Agilent N5700 and N8700 series DC sources offer a wide choice of power and voltage levels in a common family. They feature exceptional power density and are directly stackable, saving valuable test system rack space. Their energy efficient design reduces the facility's electrical and cooling demands. Units can be connected in series or parallel for even greater output power. This DC power supply family offers excellent value and is ideal for testing DC powered telecommunications equipment.

24 V, -48 V, and -60 V DC power distribution buses for telecommunications

The low voltage DC buses have evolved to provide telecommunications systems with safe and reliable battery backed-up power, assuring network operation even during prolonged AC power outages. A representative system is depicted in Figure 1.

The nominal voltages are in large part derived from being a multiple of a 12 V, 6 cell lead-acid battery. Having the battery directly match the DC distribution bus voltage provides efficient power distribution with battery back up.

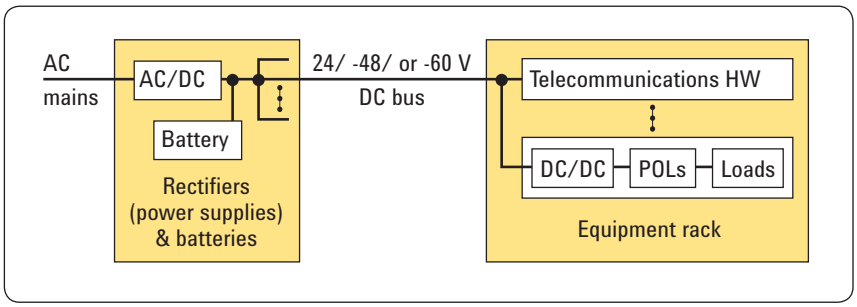

Figure 1. Telecommunications low voltage DC power distribution

Ranges of voltages for the traditional telecommunications DC mains

While the stated DC buses are 24, -48, or -60 V, the actual value depends on the state of battery charge. Generally recognized voltages for a lead-acid cell's nominal and maximum charged and discharged levels determine the normal limits of operation. Also, industry standards, such as ETSI 300-132-2, call out for extended limits for abnormal operation for -48 V and -60 V buses. Applying these conditions and extrapolating downward for a +24 V bus yields the ranges of voltages listed in Table 1.

The -48 V bus is generally the most favored and widely used for existing and new installations. One preference is it meets the 60 V DC maximum criteria for Safety Extra Low Voltage (SELV) operation. Most often -48 V equipment is also offered in a 24 V version as well. The -60 V bus is still in use in Europe but as it exceeds SELV requirements, the more unified -48 V bus is preferred, especially for new installations.

DC bus (VDC)	Abnormal low (VDC)	Normal low (VDC)	Nominal (VDC)	Normal high (VDC)	Abnormal high
+24	0 to 20.0	20.0	26.5	28.5	28.5 to 30.0
-48	0 to -40.0	-40.0	-53.0	-57.0	-57.0 to -60.0
-60	0 to -50.0	-50.0	-66.3	-72.0	-72.0 to -75.0

Table 1. Representative voltage ranges for traditional telecommunications DC mains

DC sources for testing DC powered telecommunications equipment

Table 1 serves as a useful guideline for establishing appropriate voltage requirements for selecting DC sources for powering and testing DC powered telecommunications equipment. DC sources should be able to furnish up to 30 V, 60 V, or 75 V for equipment to be powered from a +24 V, -48 V, or -60 V buses, respectively, to meet the range of steady state conditions called out by industry standards.

The Agilent N5700 and N8700 series DC sources, pictured in Figures 2 and 3, are a common family ideally suited for test systems for DC powered telecommunications equipment. While offered in a wide range of voltages from 6 V to 600 V, currents up to 400 A, and power levels from 750 W to 5.2 KW, a select summary of models particularly well suited for DC powered telecommunications equipment testing is shown in Table 2.

Key features for testing DC power telecommunications equipment include:

- 1U and 2U tall units feature high power density. Unlike some other DC sources relying on air from above or below, these units are directly stackable, saving considerable rack space.
- Energy efficient design with AC input Power Factor Correction (PFC) reduces demand for power and cooling within a facility.
- A wide range of available voltage, current and power levels assures matching specific needs for powering the Equipment Under Test (EUT)
- Like units can be connected in parallel or series for extended voltages and currents, and greater power
- A complete set of protection features protects both the DC source and expensive EUTs from potential damage in case of an overload or other faults
- Built-in current and voltage measurement determine EUT power consumption
- LXI compliant, with LAN, USB, and GP-IB interfaces, and handy Web-based graphical interface as standard, provide flexibility for the test application

Figure 2. Agilent N8700 series DC sources (3.3 KW and 5 KW)

Figure 3. Agilent N5700 series DC sources (750 W and 1,500 W)

Model	Voltage (VDC)	Current (ADC)	Power (Watts)	Model	Voltage (VDC)	Current (ADC)	Power (Watts)
N5745A	30	25	750	N8735A	30	110	3,300
N5746A	40	19	760	N8736A	40	85	3,400
N5747A	60	12.5	750	N8737A	60	55	3,300
N5748A	80	9.5	760	N8738A	80	42	3,360
N5765A	30	50	1,500	N8755A	30	170	5,100
N5766A	40	38	1,520	N8756A	40	125	5,000
N5767A	60	25	1,500	N8757A	60	85	5,100
N5768A	80	19	1,520	N8758A	80	65	5,200

Table 2. Agilent N5700 and N 8700 series DC sources for telecommunications

Summary

DC power distribution buses of +24, -48 or -60 V DC have been in widespread use in telecommunications equipment installations for many years. As these buses are nearly always backed up directly with a battery of appropriate voltage, the normal operating voltage limits are determined by the battery's state of charge for normal operation. Industry standards for powering telecommunications equipment extend these voltage limits out further, to allow for abnormal operating conditions that may exist as well.

It is important to consider these extended voltage limits in design validation and manufacturing testing, to assure specified equipment performance is met under appropriate worst case corner conditions. The DC sources for these test systems must likewise be capable of furnishing the necessary ranges of voltage, current and power for all equipment being tested. Agilent's N5700 and N8700 series DC sources offer a wide range of voltage and current combinations, excellent power density, and a full set of system features, making them an excellent value ideally suited for test systems for DC powered telecommunications equipment.

For more information visit the following Agilent websites:

N8700 family of power supplies:
www.agilent.com/find/N8700

N5700 family of power supplies:
www.agilent.com/find/N5700

Related Literature

Title	Pub number
Agilent N8700 Series System DC Power Supplies, Datasheet	5990-3881EN
Agilent N5700 Series System DC Power Supplies, Datasheet	5989-1330EN
10 Practical Tips You Need to Know About Your Power Products, Application Note	5965-8239E

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