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Proposed DC Power Requirements for Power via MDI

Contribution to the IEEE 802.3 DTE Power via MDI Study Group

September 31, 1999

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1. Introduction

The installation and user benefits provided by being able to power products such as telephones via a LAN are significant and will be important to the successful deployment of these new products. While obvious for products such as telephones, the same benefits are applicable to many products. The range of products that could be supported will only be limited by the maximum power that can be provided. For example, a laptop could be powered via the LAN or a desktop PC could be held up by a centrally located UPS.

With the intent of enfranchising the widest range of products, this contribution focuses on the DC characteristics including safety, foreseeable misuse and power management issues that will allow a wide range of power to be provided via the LAN wiring. The contribution assumes that power could be provided via a single pair of wire or via a phantom powering configuration that would use two or more pairs of wire.

It is also assumed that power could be provided to or from devices such as servers, hubs or routers. For example, a recognized need in IP telephony applications is to power a remotely located hub or switch which could in turn power the telephones connected to it. A conclusion based on this example is that the need to support a wide range of power levels and the ability to power at least one level of intermediate device will be key to the successful mass deployment of products such as LAN based point of sale terminals and telephone systems which will consist of large numbers of terminals. To be economically viable, support for a wide power range and the powering of intermediate devices must not place any economic burdens on the low power systems that will make up the majority of the market.

2. DC Capabilities of Existing LAN Components

To be practical, any methodology used to deliver power via LAN wiring should be compatible with the wiring and connector systems that are in place today. In the sections that follow, the system components are considered in terms of any limitation that they may place on the power that can be delivered to a particular LAN device.

2.1. Wiring

The most common wire used today is 24 AWG Category 3 and 5 cable but some 26 AWG cable is still in use. Based on a maximum length of 100 meters the DC characteristics are;

For 24 AWG and 26 AWG wire the resistance ranges from 8 to 9 ohms or 12 to 14 ohms per 100 meters respectively. The highest resistance is for solid wire, which is also the most commonly used type for the longest sections of a given run. Assuming that 26 AWG wire must be supported, a loop resistance of 18 ohms per 100 meters should be used as a worst case.

- For single conductor, the rated current carrying capacity is 4 and 6 amperes for 26 and 24 AWG wire respectively. While this may seem high, it must be derated significantly to limit the temperature rise when used in bundles. When you consider that bundles of a 100 or more 4 pair cables are common in LAN wiring the derating factor will reduce the practical current to less than 1 A. For example, a bundle of 100 category 5 cables (24 AWG) that supplies 1.5 amps to a device connected to each cable via a phantom powering scheme that uses 4 conductors (0.75 A each), will have in internal temperature rise of 20°C. This temperature rise would place a realistic current limit on most installations.

- Older wiring used in data networks was designed to be used with analog telephone systems and had to carry DC voltages of up to 105 volts with superimposed ring voltages of 90 volts RMS and was rated at 150 volts. Newer wiring is more commonly rated at 350 volts or better.

2.2. Connectors

Specifications for the eight position modular plugs and jacks used in LANs vary widely but even the lower ratings will provide good DC performance.

- Current carrying capacity ratings typically range from 1 to 2.5 amps. Some manufacturers also derate this capacity to as little as 0.2 A as a function of temperature or total current carried by all the contacts in the connector. Assuming an ambient temperature of 50° C, a practical upper limit is 0.75 A per contact.

- Modular connectors were originally designed to withstand the high voltages produced by ringing generators as well as the 1,000 to 1,500 volt lightning surges so in spite of their small size, will handle high voltages. The eight position modular plugs and jacks used for data networks inherited this construction and have regulatory agency ratings of 150 volts.

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