Opto 22 Technical Note

TN9604 Applying Transformer-Isolated Analog Modules

In industrial environments, there are often situations that call for maximum isolation between an analog signal from the field and an electronic control system. In order to meet the special requirements in this type of situation, Opto 22 manufactures a series of analog input and output modules that offer complete isolation between the field signal and all circuitry on the control side. For first generation analog modules, as used with Optomux and Pamux equipment, totally isolated versions are recognizable by the addition of a "T" suffix on the part number. An example of this would be the AD3 4-20 mA input, and the AD3T isolated 4-20 mA input. All Generation 4 and SNAP analog modules feature complete isolation. A list of Opto 22 Generation 1 analog modules available with complete isolation is available from Opto 22.

All Opto 22 analog modules feature optical isolation between the module and the logic circuitry. The totally isolated "T" modules also offer isolation between the field and the logic power supply rails. This isolation is accomplished by using a miniature transformer between the internal circuitry of the module, and the logic power supply. This, in conjunction with the optical isolator between the module and the logic circuitry, means that there is no direct electrical connection between the field signal and the control logic. In a conventional Opto 22 analog module, there may be direct connections from the field signal to the positive and negative logic power supply through internal components in the module. Additionally, many modules use the logic power supply "common" reference as their own common reference. Thus, the modules do not feature true "channel-to-channel" isolation.

In many cases, the use of a standard, non-isolated Opto 22 analog modules is permissible. This is normally the case when the field device features complete isolation, or when the common reference of the logic power supply is the same as the common reference for the field device supply. An example of the latter would be the installation of the logic equipment and the "field" equipment in the same control enclosure, sharing the same DC power supply. Any situation in which the field and logic devices are widely separated—where the field device is not isolated, where there is more than one power supply in use, or any situation where the possibility of a ground loop exists—is a candidate for the use of a completely isolated Opto 22 "T" style analog module. Because there is no electrical connection from the field side of the module to the control system's logic circuitry or power supply, the possibility of forming a ground loop is eliminated.

Most Opto 22 "T" series analog input and output modules may be applied in the same way the conventional modules would be applied. They are designed to provide up to 4,000 V_{rms} between modules on the mounting rack, and/or between the module and the mounting rack power supply. Voltage and current I/O modules may require special wiring to retain maximum effectiveness, however. "T" series voltage input and output modules, like the AD6T, should be considered to be differential devices; the negative terminal on the module should not be considered to be common, and should not be connected to any point other than the negative or common terminal on the field device. This prohibition especially extends to cross-connection of terminals between modules. Such cross-connection will result in the loss of channel-to-channel isolation! Likewise, 0–20 mA or 4–20 mA modules such as the DA3T and AD3T should not share a loop supply between modules where channel-to-channel isolation is critical.