TECH TIP

VICON TECHNICAL SERVICES GROUP

This Tech Tip is designed to acquaint the reader with the basic fundamentals of RS485 data, one of the three most common types of serial data standards in use today for system component inter-communications.

RS485 or EIA-485

RS485 is another serial standard suited to long distances of up to 4000 feet (1200 meters). Like RS422, RS485 uses a balanced differential pair of wires to increase noise immunity over long distances. Voltage levels used are +5 volts dc and the lower voltage is just slightly above ground potential. The data signal is converted by a differential amplifier to two equal but opposite polarity signals. These two signals are then applied to the two wires in the communications pair. The differential signal, along with the twisting of the wire pair, accounts for the excellent noise immunity characteristics. The applied voltage levels have an approximate five volt swing but the difference voltage, as measured between the two individual wires, only needs to be greater than 200 mill volts to produce a valid signal.

When there is no data present in RS422, the positive side of the wire pair will be at a "1" level, or +5 vdc and the negative side will be at a "0" level, or 0.0 vdc. Only two states are available. In RS485, however, there is a third state, called a "tri-state" when no data is present. In effect, when the RS485 is in the tri-state mode, the driver is disconnected from the line. This makes both sides of the wire pair at approximately the same level with respect to ground.

The tri-state level of the RS485 allows the balanced transmission line to operate in a multidrop configuration with up to 32 nodes on the line. RS485 can be operated in a 4-wire mode (two individual pairs) or in a 2-wire mode (one pair). In the 2-wire mode, one pair of wires, with a signal ground, is used for both transmit and receive. With no data present, all nodes are in the "receive" condition.

In the 4-wire mode, two wires (one pair, twisted), as well as a signal ground conductor, are required for communications in one direction. Bi-directional communications would therefore require two pairs plus signal ground (a dual pair, twisted, each pair individually shielded, cable). Although the data level is determined by the difference in voltage between the two wires, the signal ground insures that both the transmitting end and the receiving end have the same reference.

Signal names are usually applied to the positive and negative wires for identification. Names such as *Data +* and *Data –* are typically used.

At the receiving end of the balanced pair, the circuits monitor the voltage level. Voltages >200mv are determined to be one particular logic state while voltages <200mv will represent the opposite state.

With RS485, the circuit pair is terminated at each end but not at nodes in the middle of the circuit. Proper circuit termination becomes a factor when the circuit operates at higher data rates and over long wiring runs. Termination is usually accomplished by placing a 120-ohm resistor across the pair at the circuit ends.
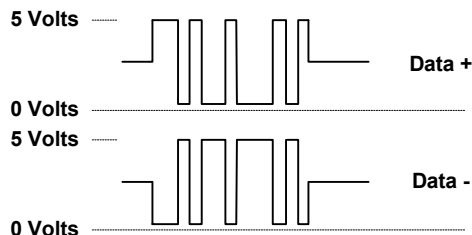
As can be seen by the above illustration, or as viewed on an oscilloscope, the data patterns for both the positive and negative sides of the line are equal but opposite in polarity with respect to ground. During the absence of data, both sides are at neither the maximum positive nor the maximum negative potentials.

The standard only dictates the logic levels. Connector styles and pin configurations vary by manufacturer and application. Almost any type of connector may be used for this standard, including the DB9 and DB25 types as well as others, terminal boards or the RJ-series, RJ11, RJ45, etc.

A "Standard" is different than a "Protocol". A standard is a means of transporting information and a protocol is the encoding process of the information being transported. Vicon Industries uses a variety of communication protocols for different products and applications. *Be sure to verify the types of protocols to be used for the intended application*