



# TECH TIP

VICON TECHNICAL SERVICES GROUP

**Subject:** RS422 Data Standard  
**Product:** Various  
**Number:** 1400-0001-43-00  
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This Tech Tip is designed to acquaint the reader with the basic fundamentals of RS422 data, one of the three most common types of serial data standards in use today for system component inter-communications.

## RS422 or EIA-422

RS422 serial communication is more suited to long distance applications than RS232. Typical operating distance, without signal regeneration, is 4000 feet (1200 meters). See cable recommendations at the end of this document.

RS422 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 millivolts to produce a valid signal. The difference between the +5 vdc and the +200 mvdc allows for signal attenuation over a distance.

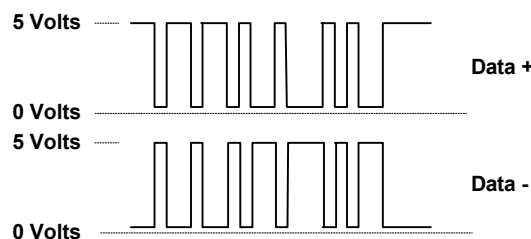
Two wires (one pair, twisted), as well as a signal ground conductor, are required for communications in one direction. Bi-directional communications would therefore require two pairs plus signal ground (a dual pair, twisted, each pair individually shielded, cable). Although the data level is determined 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 -*, or, as in the case of Vicon Industries, *Command Out +* and *Command Out -* refer to the signals generated in a Video Matrix Central Processing Unit (CPU) for control of peripheral devices (keypads or receiver-drivers). The terms *Response Out +* and *Response Out -* are those signals generated from a peripheral device back to the CPU.

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.

RS422 is generally used for point-to-point communication. Paralleling multiple devices on the same RS422 bus is not recommended. The RS422 is subject to loading when more than one device is placed on the bus. The integrity of the signal can no longer be guaranteed and equipment performance can diminish and become intermittent.

The "RS" stands for "Recommended Standard". The standard, however, only dictates logic levels. Connector styles and pin configurations vary by manufacturer and application. The most common connectors used for this standard are the DB-9 and DB-25 types but others, terminal boards or the RJ45, may be found throughout the industry.



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.

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 (see Tech Tip 1400-0001-06-01, Vicon RS422 Data at [www.vicon-cctv.com](http://www.vicon-cctv.com)).*

Identifying the polarity of a wire pair is as simple as connecting a dc voltmeter to the pair. If the voltage reading is positive, the wire that is connected to the red meter lead is the Data + wire and the wire connected to the black lead is Data -. *Please see Tech Tip 1400-0001-24-00, RS422 DataQuickTester at [www.vicon-cctv.com](http://www.vicon-cctv.com).*

With data present across the pair of wires, measuring the differential with a dc voltmeter will usually indicate an approximate voltage of +2.4 to +3.6 vdc. These levels are only approximate because, as the voltmeter is trying to average a changing voltage, the reading will fluctuate constantly. These voltage levels can vary significantly depending on cable length, amount of data activity, and baud rate. With an absence of data, the differential will be on the order of +4.5 vdc with no fluctuation.

Some cable types with the correct electrical characteristics for RS422 are:

Belden™ 8723

West-Penn Wire/CDT™ D510

Alpha Wire™ 2466C

Other manufacturer's cable meeting equivalent specifications of the cables mentioned above are suitable also. The part numbers listed are non-plenum use only. Check local building codes prior to ordering and installing cable.