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[RS-485 Problem Solver](#) - Trouble Shooting Guide Walks You Step by Step

## RS422/485 Application Note

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### Introduction

RS-422 and RS-485 are hardware specifications. Software protocol is not discussed in either specification. It is up to the system designer to define a protocol suitable for their system. This chapter we will not attempt to define a protocol standard, but will explain some of the issues that should be considered by the system designer, whether writing or purchasing software.

### RS-422 Systems

RS-422 system software differs little from the familiar point-to-point RS-232 communication systems. RS-422 is often used to simply extend the distance between nodes over the capabilities of RS-232. RS-422 can also be used as the master node in a four-wire master-slave network described later in this chapter. When selecting or writing software for RS-422 systems the designer should be aware of the signals being used by the hardware in the system. Many RS-422 systems do not implement the hardware handshake lines often found in RS-232 systems due to the cost of running additional conductors over long distances.

### RS-485 Driver Control

The principle difference between RS-422 and RS-485 is that the RS-485 driver can be put into a high impedance, tristate mode, which allows other drivers to transmit over the same pair of wires. There are two methods of tristating an RS-485 driver. The first method is to use a control line, often the RTS handshake line, to enable and disable the driver. This requires that the host software raise the RTS line before beginning a transmission to enable the driver, then lower the RTS line after the completion of the transmission. Since only a single RS-485 driver can be enabled on a network at one time it is important that the driver is disabled as quickly as possible after transmission to avoid two drivers trying to control the lines simultaneously, a condition called line contention. Under some operating systems it can be difficult to lower RTS in a timely manner and this method of driver control should be avoided altogether.

The second method of RS-485 driver control we refer to as Automatic Send Data Control. This type of control involves special circuitry that senses when data is being transmitted and automatically enables the driver as well as disabling the driver within one character length of the end of transmission. This is the preferred method of driver control since it reduces software overhead and the number of potential pitfalls for the programmer.

### RS-485 Receiver Control

The RS-485 receiver also has an enable signal. Since RS-485 systems

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### Recommended Reading

- RS-422/485 Application Note
- Industrial Bus Compatibility Chart
- Data Line Isolation Theory
- Tips for Using Port Powered Converters
- Basics of the RS-485 Standard
- System Design With Port Powered Converters

### Glossary Terms

- Interface Converter
- Multidrop
- Optical Isolation
- RS-232
- RS-422
- RS-485



using a two-wire configuration connect the driver to receiver in a loopback fashion, this feature is often used to disable the receiver during transmission to prevent the echo of local data. Another approach is to leave the RS-485 receiver enabled and monitor the loopback data for errors which would indicate that line contention has occurred. Although a good loopback signal does not guaranty data integrity it does offer a degree of error detection.

### **Master-Slave Systems**

A master-slave type system has one node that issues commands to each of the "slave" nodes and processes responses. Slave nodes will not typically transmit data without a request from the master node, and do not communicate with each other. Each slave must have a unique address so that it can be addressed independent of other nodes. These type systems can be configured as two-wire or four-wire. Four-wire systems often use an RS-422 master (the driver is always enabled) and RS-485 slaves to reduce system complexity.

#### *Four Wire Master-Slave Systems*

This configuration reduces software complexity at the host since the driver and receiver are always enabled, at the expense of installing two extra conductors in the system. The Master node simply prefixes commands with the appropriate address of the slave. There is no data echo or turn around delays to consider. Since each of the slave transmitters share the same pair of wires, care must be taken that the master never requests data from multiple nodes simultaneously or data collisions will result.

#### *Two Wire Master-Slave Systems*

Two wire configurations add a small amount of complexity to the system. The RS-485 driver must be tristated when not in use to allow other nodes to use the shared pair of wires. The time delay between the end of a transmission and the tristate condition becomes a very important parameter in this type system. If a slave attempts to reply before the master has tristated the line, a collision will occur and data will be lost. The system designer must know the response time or turn around delay of each of the slave nodes and assure that the master will tristate its driver within that amount of time. B&B Electronics' Automatic Send Data control circuits tristate the driver within one character length of the end of a transmission.

### **Multi-Master RS-485 Systems**

Each node in a multi-master type RS-485 system can initiate its own transmission creating the potential for data collisions. This type system requires the designer to implement a more sophisticated method of error detection, including methods such as line contention detection, acknowledgement of transmissions and a system for resending corrupted data.

### **Systems with Port Powered Converters**

RS-232 to RS-422 or RS-485 converters that derive their power from the RS-232 port are becoming more common in data systems. A good programming practice is to set unused handshake outputs to a high voltage state in systems using any type of RS-232 to RS-422 or RS-485 converter. This will assure the best possible operating conditions for all converters used.

[Chapter 6: Selecting RS-485 Devices](#)

[Chapter 7: Sources of Further Information](#)

[Appendix A: EIA Specification Summary](#)

[Appendix B: EIA Standard RS-423 Data Transmission](#)

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