

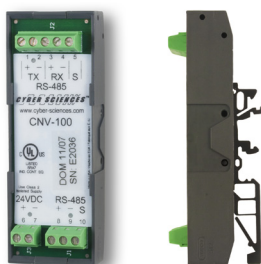
## TECHNICAL NOTE

# Mixing RS-485 2-Wire / 4-Wire Systems Using CNV-100

### Summary

The RS-485 standard defines a multi-point data communications interface using a balanced-pair (plus common) called "2-wire." However, many devices use a 4-wire implementation, introducing potential interoperability problems.

This document illustrates examples of mixing 2-wire and 4-wire devices using the Cyber Sciences CNV-100 converter.



CNV-100 RS-485 2-Wire to 4-Wire Converter

### Introduction

The ANSI EIA/TIA-485 standard, more commonly known as RS-485, specifies electrical characteristics for multi-point, balanced differential data communications systems. The Modbus® protocol is one of many that uses the RS-485 interface as its physical layer for serial data communications. Others include Profibus®, BACnet and simple ASCII.

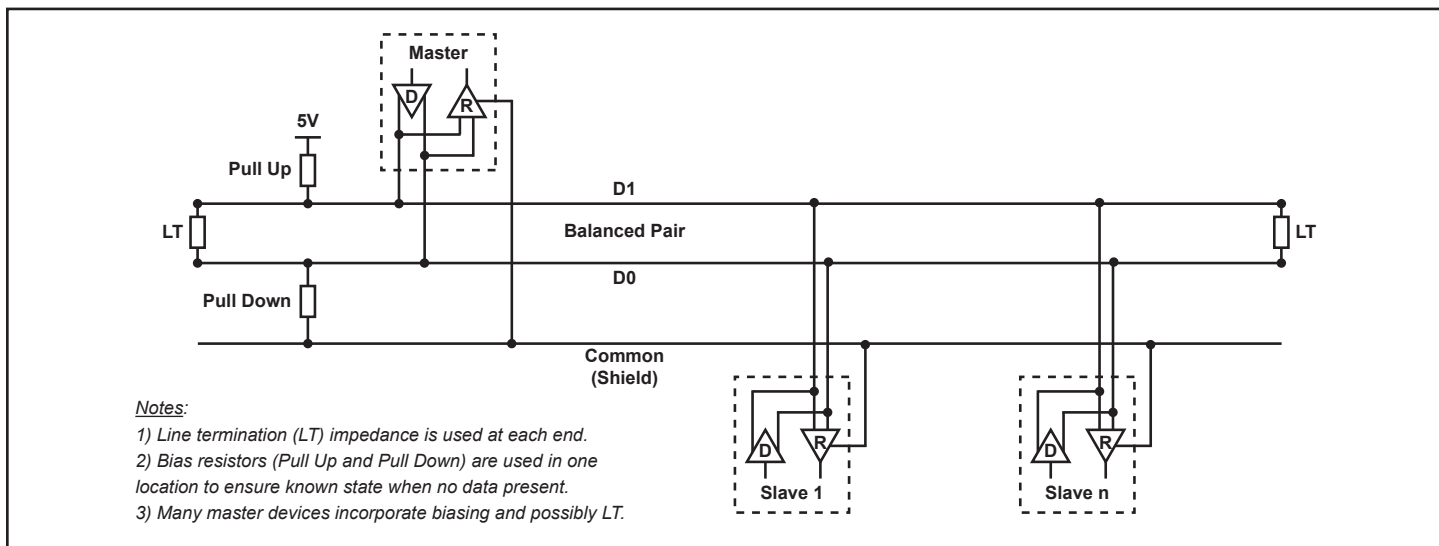
### Topology

The general topology for an RS-485 network consists of a balanced pair and a common, as shown below. At any given time, only one driver has the right to transmit. Note that although this topology is called "2-wire," a third wire (shield) is typically used as a common reference.

In addition, many devices implement RS-485 using 4 wires plus common ("RS-485 4-wire") using two balanced pairs instead of one, separating the transmit and receive lines. Mixing 2-wire and 4-wire devices in the same system requires a thorough understanding of device characteristics and proper engineering of the network. Alternatively, a converter made for this purpose may be used.

### Mixing 2-Wire and 4-Wire Devices

To simplify the connection of 2-wire and 4-wire devices in the same system, Cyber Sciences offers the CNV-100 RS-485 2-wire to 4-wire converter. This device is pre-engineered to allow mixing of 2-wire and 4-wire RS-485 devices in a variety of configurations.



General RS-485 network topology ("2-wire")

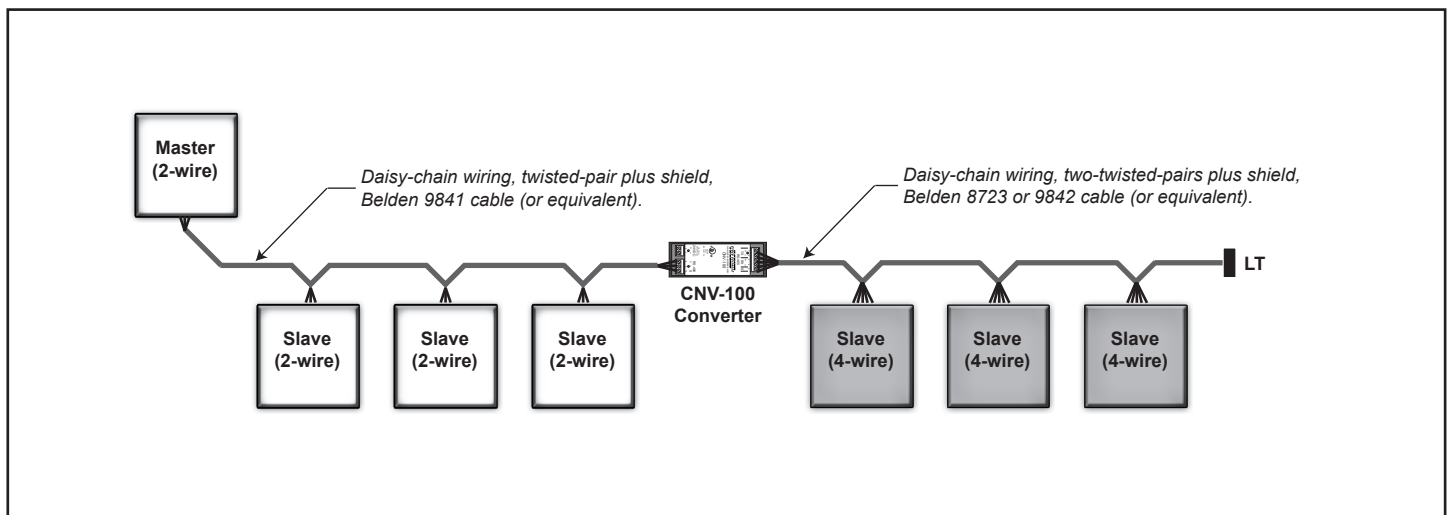
**CONVERTING 2-WIRE TO 4-WIRE  
(OR VICE-VERSA)**

**CNV-100 RS-485 Converter**

The CNV-100 converter can be used to connect RS-485 2-wire devices or networks to 4-wire devices or networks. The CNV-100 is suitable for any protocol that adheres to the RS-485 standard. The CNV-100 has been tested on Modbus networks operating at speeds of 9600, 19200, and 38400 bps. Other speeds are *not* supported. No configuration or adjustment of the unit is required.

**Bridging 2-wire and 4-wire networks  
(2-wire master)**

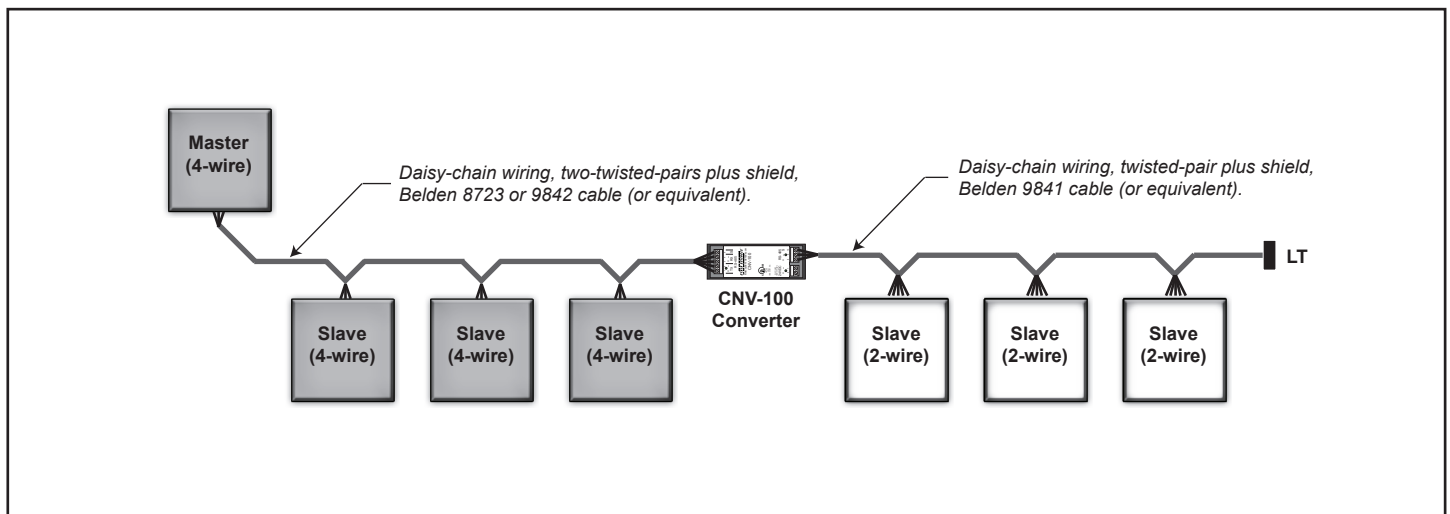
The drawing below shows how the CNV-100 can be used to bridge 2-wire and 4-wire networks (where the master is a 2-wire device).



*Bridging a 2-wire network (2-wire master) and a 4-wire network*

**Bridging 4-wire and 2-wire networks  
(4-wire master)**

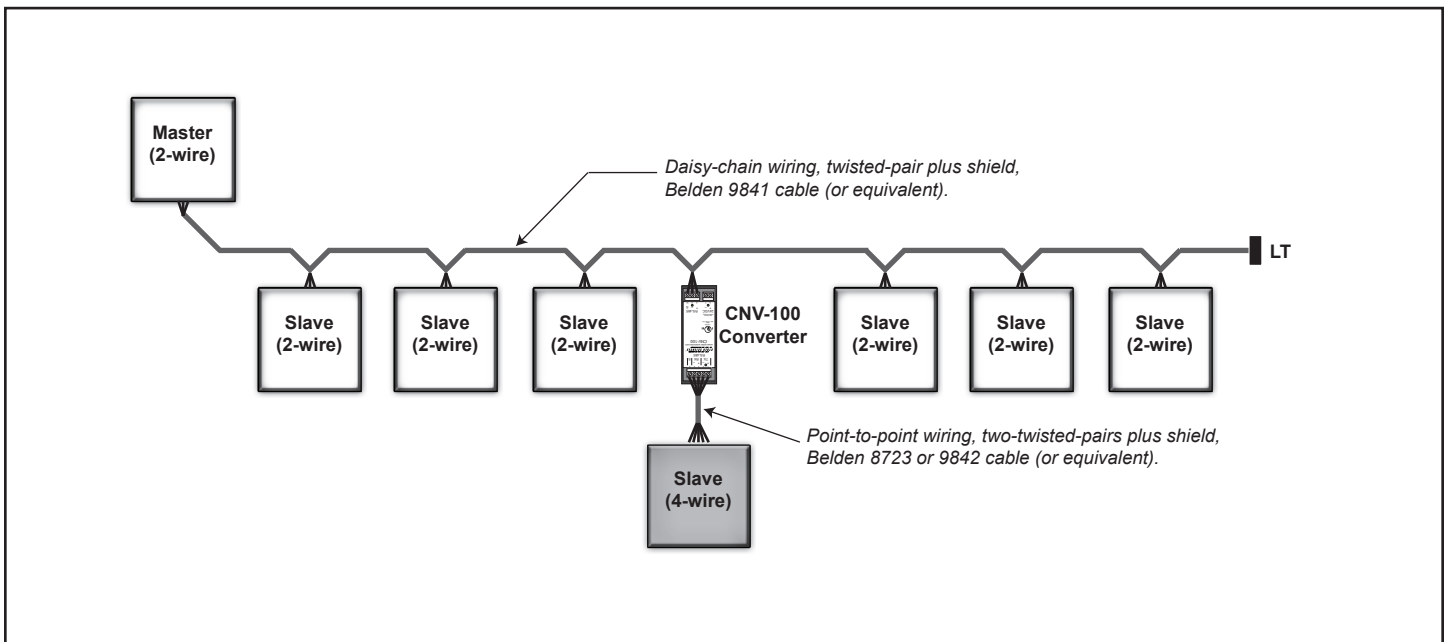
The drawing below shows how the CNV-100 can be used to bridge 4-wire and 2-wire networks (where the master is a 4-wire device).



*Bridging a 4-wire network (4-wire master) and a 2-wire network*

**Connecting 4-wire devices to a 2-wire network**

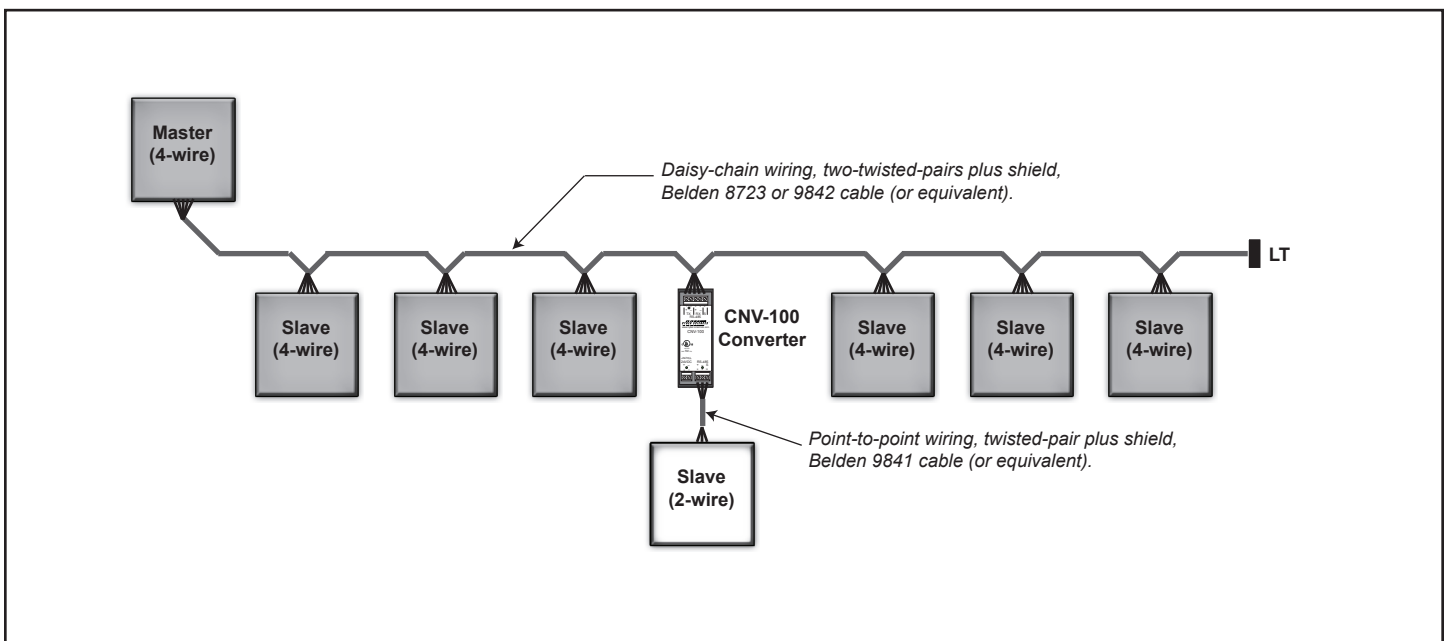
The drawing below shows how the CNV-100 can be used to connect a 4-wire device to a 2-wire network (2-wire master).



Connecting 4-wire device(s) to a 2-wire network (2-wire master)

**Connecting 2-wire devices to a 4-wire network**

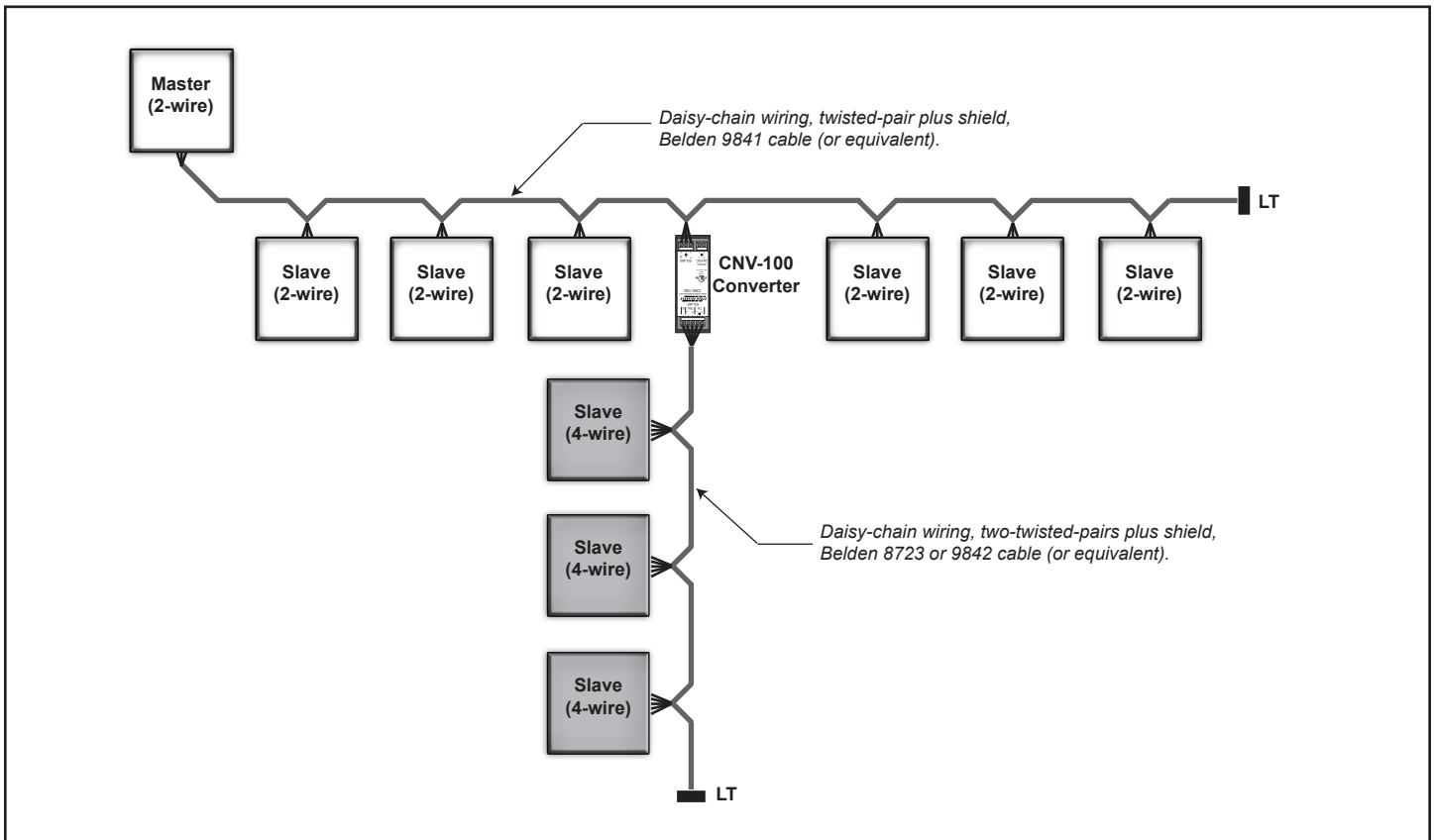
The drawing below shows how the CNV-100 can be used to connect a 2-wire device to a 4-wire network (4-wire master).



Connecting 2-wire device(s) to a 4-wire network (4-wire master)

**Hybrid system: connecting multiple 4-wire devices to a 2-wire network**

The drawing below shows how the CNV-100 can be used to connect multiple 4-wire devices to a 2-wire network (2-wire master). Since the CNV-100 is separately powered (24 Vdc), the same distance/speed limitations are applicable for the 4-wire portion as the 2-wire segment.



Hybrid system example: 2-wire network (2-wire master) with T-connection of 4-wire network

**SUMMARY**

**Summary**

The RS-485 standard electrical interface serves as a basis for Modbus protocol and others for serial data communications networks, and both 2-wire and 4-wire implementations are supported. This can introduce interoperability problems unless special care is taken during system design. The CNV-100 converter from Cyber Sciences can be applied in a variety of system architectures to ensure reliable operation.

For custom applications not specifically covered in this document, or for help in designing the system architecture that best meets your requirements, please contact Cyber Sciences.

**References**

*Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems*, ANSI/TIA/EIA-485-A-1998

*MODBUS over Serial Line Specification and Implementation Guide, V1.02*, Modbus-IDA.org. Dec 20, 2006.

**For More Information**

*CNV-100 Instruction Bulletin (IB-CNV-01)*

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