



Application Note

Is RS-485 a Two Wire Interface?

Document No. 8448 • 13 January 2017

Is RS-485 a Two-Wire Connection?

Is RS-485 a two-wire or a three-wire system? It is most definitely a three wire system (four plus one wire with respect to full-duplex operation). The TIA standard (ANSI/TIA/EIA-485-A, page 15, A.4.1) requires the presence of a common return path between all circuit grounds along the balanced line for proper operation.

The TIA standard defines a maximum common mode voltage range from -7V to +12V on the signal lines A and B, measured against C (common ground). A TIA/EIA-485 system however with only two wires A and B (C generator and C' receiver commons not connected) can result in an unpredictable common mode voltage superimposed on the interface lines A and B, caused either by electrostatic charging or electromagnetic interference.

A 2-wire system often may work though due to idle-line fail-safe resistors at the receiver inputs, which can be considered as a loosely coupled common ground. Nevertheless this operation mode cannot be recommended - what is working flawless in the laboratory may not work reliable under real conditions in an industrial environment.

Where do we get the third wire? Many times inner and/or outer cable shields are used as the third (fifth) wire. When using a twisted pair Ethernet cable as RS-485 transmission line, two or more wires are available for common ground.

ANSI/TIA/EIA-485-A
Interconnect Application

G = Generator • R = Receiver • RT = Termination Resistor
 A/A' = Generator/Receiver Interface Point
 B/B' = Generator/Receiver Interface Point
 C/C' = Generator/Receiver Common

www.ekf.com/s/su1/img/rs485_common_ground.pdf

Useful External Documents

Wikipedia	RS-485 Three-wire connection https://en.wikipedia.org/wiki/RS-485#Three-wire_connection
Article/ Blog	RS485 Cables – Why you need 3 wires for 2 (two) wire RS485 • http://www.chipkin.com/rs485-cables-why-you-need-3-wires-for-2-two-wire-rs485/
Application Note	AN960 • RS-485/RS-422 Circuit Implementation Guide • www.analog.com/static/imported-files/application_notes/AN-960.pdf
RS-485	ANSI/TIA/EIA-485-A Standard • Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems • www.tiaonline.org

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