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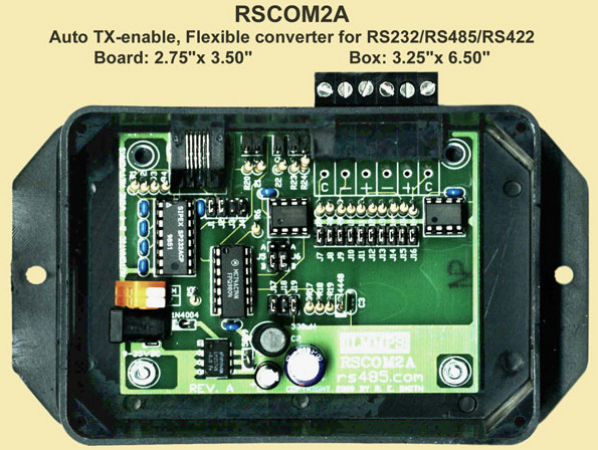
Using the RSCOM2A RS-422/485 Interface with the CR205

Application Note #15

Overview

The RSCOM2A, board pictured at right, is a fast Async bi-directional RS232 <=> RS485 interface converter for 2-wire, half-duplex applications, with an automatic TX enable circuit, that will operate at data rates up to 115.2Kbps. The unit can also be used in 4-wire RS485/RS422 application (point-to-point or multi-drop, full-duplex). The unit has jumpers for bias, termination, RS232 DTE/DCE selection, and operating mode settings. The unit has edge mounted LED indicators, a removable screw terminal connector, and uses SN75LBC184P limited slew rate transceivers (1/2 unit load) with built-in transient protection.



This Application Note will provide guidelines for using the RSCOM2A with the Campbell Scientific CR205 dataloggers.

Please also review the document ***The Art and Science of RS-485*** for information regarding grounding, line termination, idle state biasing and other key issues related to deploying a reliable RS-485/RS-422 network. This document is available in the support directory of our website at www.canarysystems.com

Power Requirements

The RSCOM2A is a low-power device, typically drawing 10-30mA. For units that are connected to CR205's it can be powered from the **Battery+** and **Battery**- terminals of the CR205.

Jumper Settings

The wiring diagrams will detail the jumper settings for each mode of operation, following is a list of the RSCOM2A jumpers and brief description.

Jumper	Description
J1, J2	Install for Computer connection (DTE operation).
J3, J4	Install for connecting to CR205 (DCE operation).
J5, J6	Mode jumpers, see table following.
J7	Connect TX/RX -/+ COM to Ground (default).
J8, J9	Connect (2) 240 ohm termination resistors across TX/RX -/+ (default).
J10	Connect 620 ohm idle state bias resistor from GND to TX-/RX- (default).
J11	Connect 620 ohm idle state bias resistor from VCC to TX+/RX+ (default).
J12,J13	Connect (2) 240 ohm termination resistors across RX+/RX- (default).
J14	Connect 620 ohm idle state bias resistor from GND to RX- (default).
J15	Connect 620 ohm idle state bias resistor from VCC to RX+ (default).
J16	Connect RX-/RX+ COM to Ground (default).
J17	Set speed of auto transmit enable (default).
J18	Set speed for faster auto transmit enable (no jumper by default).
J19	Disable auto transmit enable (default).

Mode Jumper Settings

J5	J6	J19	MODE
B	B	I	RS-422 (4-wire, single node)
A	B	R	RS-485 (2-wire)
A	A	R	RS-485 (Loopback)
B	B	R	RS-422 (4-wire, multidrop)

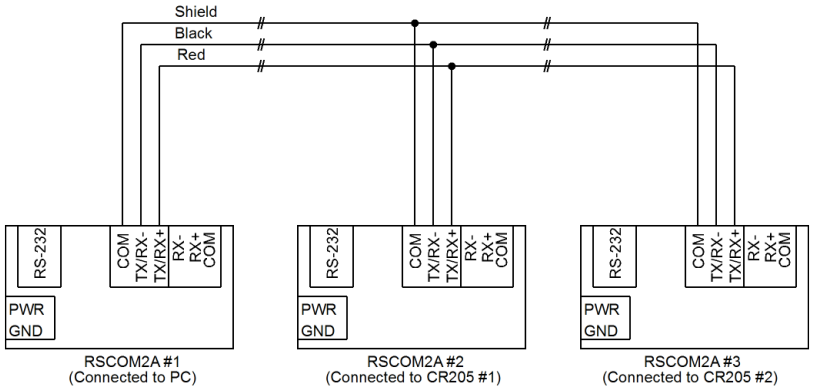
Key:
A = Install A, **B** = Install B, **I** = Install, **R** = Remove

Wiring

It is recommended to use cabling designed for RS-485 applications, such as Belden 9841 (RS-485) or Belden 9842 (RS-422), these offer low capacitance twisted pairs with integral shield and drain wire.

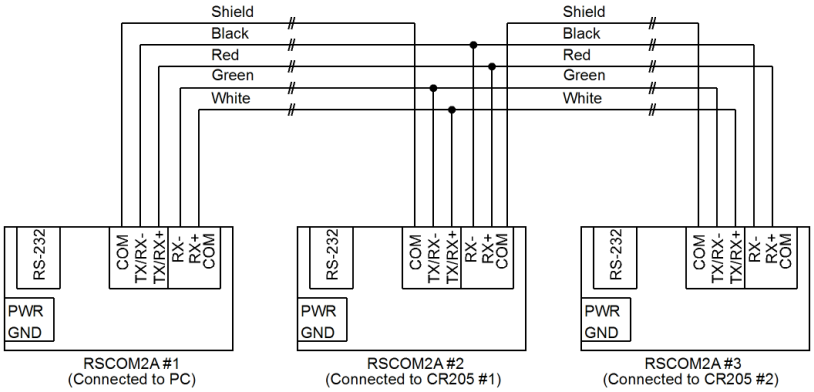
Wiring between the RSCOM2A and CR205 is straightforward, simply connect the 2 devices using the supplied RJ-11<->RS-232 cable, with a gender changer. Following are various wiring configurations for RS-485 and RS-422, including RSCOM2A jumper settings.

RS-485 (2-wire) with PC/RSCOM2A



Note: Make sure J5 is set to A, J6 is set to B and J19 is installed for all RSCOM2A's. Make sure J1-J4 are set appropriately.

RS-422 (4-wire) with PC/RSCOM2A



Note: Make sure J5 is set to B, J6 is set to B and J19 is REMOVED for all RSCOM2A's EXCEPT the unit connected to the PC. Make sure J1-J4 are set appropriately.

Line Termination

Generally speaking it is recommended to terminate the transmit/receive pairs at either end of the network. The jumpers J8, J9 are for adjusting the termination of the TX/RX -/+ pair, the jumpers J12, J13 are for terminating the RX-/+ pair. With both jumpers installed the line will be terminated with 120 ohms, each jumper connects a 240 ohm resistor across its respective pair, in parallel this equates to 120 ohms.

Idle State Biasing

Idle state biasing is designed to reduce "chatter" during inactive periods, whether time between switching from transmit to receive or vice versa, or when the line is idle. The RSCOM2A by default pulls each – line to Ground with a 620 ohm resistor and pulls each + line to +5V with a 620 ohm resistor. This has the side-effect of incurring additional loading on the lines. The jumpers J10 and J11 provide pull-up/down for the TX/RX -/+ pair, the jumpers J14, J15 provide pull-up/down for the RX -/+ pair. Generally speaking you will want to remove all jumpers except for the units located at the ends, another strategy is to pull all jumpers except for those from the unit closest to the middle of the network.

RS-485 (2-wire) Vs. RS-422 (4-wire)

RS-485 is a 2-wire half-duplex system of communication, it works well for most applications. However, if the cable runs are long or there are a large number of drops then it is recommended to use RS-422, which uses 4-wire communication, a pair for transmit and a pair for receive. In a 2-wire system the communication link is being switched between transmit and receive with each byte being sent and received, with long cables and a large number of drops this can create problems due to signal propagation delays and other issues, such as dielectric absorption, the tendency of the cable insulation to absorb and degrade the signals. A 4-wire system avoids some of these problems because each pair is used for communication in one direction, they are not being switched between transmit and receive.

RS-485 is rated for 115.2kbps at 4000' (1200m) of cable, this assumes quality cable, a relatively noise-free environment and minimal differences in ground potential. The CR205 communicates at 9600bps so there is additional latitude to extend the network even to distances of 10000' without the use of repeaters or isolators. The key to determining which type of communications to use, the settings of the hardware and whether additional equipment will be required will be to test the equipment in the intended environment.

MultiLogger Software Configuration

These devices are essentially transparent devices, they utilize no intrinsic addressing to access each node and the connected CR205. The PakBus protocol utilized by MultiLogger and the CR205 provides for addressing and communication with each node. It is imperative that each CR205 be configured with a unique address, these addresses are set using the Campbell Scientific PakCom software.