RDC485IR3 USERS MANUAL

RS-485 TWO-WIRE ISOLATED REPEATER

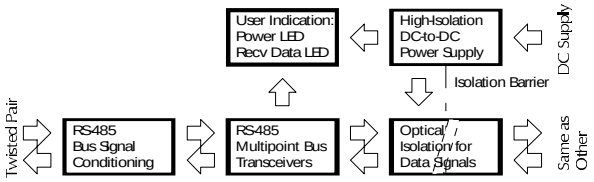
SUMMARY

RS-485 has become one of the most common data communication standards in "open" multi-vendor automation projects. More robust than RS-232 and more flexible than RS-422, it allows a single master device to communicate with multiple slave devices.

This manual is supplemented by an application note titled *Using Isolated RS-485 Repeaters*, which is more of an RS-485 tutorial and introduction to repeaters.

The following sections describe:

1. FUNCTIONAL DESCRIPTION



1.1. Isolated Power Supply

High isolation DC-to-DC converters convert an external DC supply (5vdc or 9-36vdc) to two isolated 5vDC supplies. One supply powers RS-485 port-A and the other powers RS-485 port-B.

1.2. Optical Isolation for Data Signals

Digital opto-couplers are used to move the data signals between the two sides of the repeater. These are superior to the more common analog opto-couplers, as they add little distortion and therefore support high baud rates. The isolated power supplies and optical data signals together complete the 3-port galvanic isolation required.

1.3. RS-485 Bus Transceiver

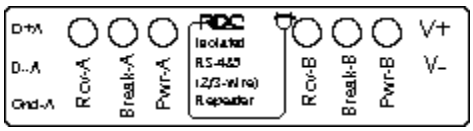
Line interface driver/receiver chips convert the field signals to standard TTL-level signals. Since 2-wire RS-485 is a bi-directional bus, it requires the transmitter/receiver circuit to switch between transmit and receive as appropriate - the rdc485ir3 uses a unique and effective method to do this with 100% transparency.

1.4. Segment Fault Isolation (For "FI" models only)

Repeaters do have a potential "bad habit" - during a bus fault on one segment, they may "repeat" that fault as a false signal on the good segment. The preferred behavior is for the repeater to "isolate" the fault and still allow the good segment to operate.

The line fault conditions include any open-circuit and any combination of line shorts to each other including ground.

1.5. User Indication



The face of the rdc485ir3 is shown above. Each side of the repeater has 3 LED's. Green LED's (Pwr-A & Pwr-B) light showing isolated power is available from the isolated DC-to-DC converters. Yellow LED's (Rcv-A & Rcv-B) light when data is received. Red LED's (Break-A & Break-B) light when the fault detection circuit detects an invalid RS-485 bus condition.

1.6. Signal Conditioning

For normal operation, the rdc485ir3 has 3 jumpers installed on each side to terminate and bias the RS-485 interface. These are only removed when more than two (2) units of rdc485ir3 are connected to the same RS-485 wire pair. For example, if 4 units of rdc485ir3 connect to a wire pair, at least 2 of them must have all 3 jumpers removed (see the application note titled *Using Isolated RS-485 Repeaters*). Both ports have transient suppression diodes rated at 500w or higher.

2. ABSOLUTE TERMINAL NAMES

Due to a lack of naming conventions, wiring multi-vendor RS-485 devices often involves wiring "apples" to "oranges". It may even require some bench-top experimentation. While the word "experimentation" sounds bad, it is often required when integrating multi-vendor systems. The RS-485 interface cannot be damaged by reverse wiring or short-circuits to ground.

2.1. Per EIA-485

EIA-485 defines the labels "A" and "B" to be used as follows: Voltage of A shall be negative in respect to B for a binary 1. Sounds simple? Unfortunately, there are two common logics. Computer systems treat 0v and 5v as 0 and 1 respectively, while many transistor circuits (and general telecommunications) treat 0v and 5v as 1 and 0 respectively. For whatever reason, the most common RS-485 chips label the terminals assuming 5v is 0 and 0v is 1 -- backwards to common usage in intelligent devices. To avoid the issue, many vendors select other naming conventions.

2.2. Determining terminal names

RDC names it's A/B terminals as "-" and "+" respectively. Another common naming conventions is to label them as "X"/"not X", where X is a name like DAT or BUS, and the "not" condition is marked either by a bar over the name or a leading "*". An example would be "DAT+/DAT-" or "DAT/*DAT". Generally the "--" and "not" terminals correspond to "A", but vendors are free to label them opposite here as well.

A direct method to determine the absolute A/B terminals would be helpful. If your asynchronous device outputs a voltage when idle, then the terminal with the higher voltage is "+". Unfortunately, most devices will

show no measurable voltage difference between their terminals; slave devices are normally in receive mode and do not affect the terminal voltage.

3. INSTALLATION

3.1. Plan your wiring

For 2-wire RS-485, all "+" terminals connect to one wire of the pair, and all "-" terminals to the other wire. As a convention, RDC suggests choosing the darker wire (or solid color) for "+" and lighter color (or striped) for "-". Since the bus is bi-directional, all terminals "+" and "-" both transmit and receive when appropriate. *Remember, RS-485 is NOT a loop.*

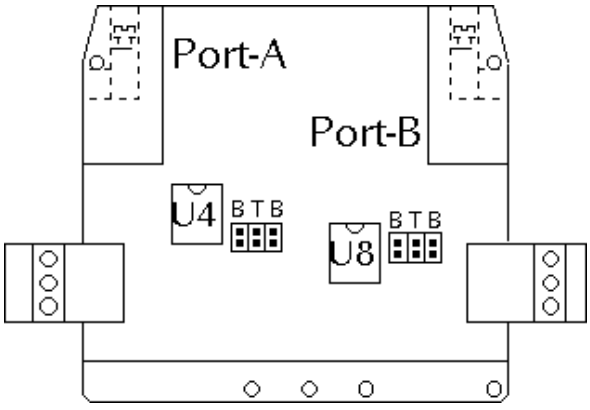
On the rdc485ir3, the top terminals are physically labeled D+A, D-A, Gnd-A. On the removable terminals this may be labeled just "+", "-", "SG", or as "R+", "R-", "SG". Note that the important thing is the "+" and "-" in the names. The D+A top terminal and the "+" terminal are internally connected, so you can easily use 2 wire lugs on the Port A side - great when you are doing a multi-drop bus without stubs.

It is also critical that the Signal Ground be properly connected. If your RS-485 bus does not have the 3rd ground wire, then you should at least connect the Signal Ground of the connected port of the rdc485ir3 to the nearest device's digital ground.

3.2. Placing your bus terminators:

Each RS-485 segment requires a 120 ohm terminating resister at each end - assuming your cable has a characteristic impedance of 120 ohms. Therefore an RS-485 system with a repeater will require at least 4 terminating resisters. (see the application note titled *Using Isolated RS-485 Repeaters*).

Below is a drawing of the rdc485ir3 showing the location of the jumpers for Port-A and Port-B. Those label "B" are the bias jumpers, and the terminating resistor is labeled "T".



3.3. Planning the panel wiring:

Power Supply: The rdc485ir3-dv (9 to 36vdc) is fully protected from reverse wiring and will sustain no damage. The rdc485ir3-dv (5vdc +- 5%) model is partially protected and if a fuse is installed in the V+ supply wire, should not sustain any damage.

RS-485 Fuses: RS-485 field wires should be protected by 250mA fuses. RS-485 interface ICs are internally protected from short-circuits. These fuses protect the system from over-voltages caused by mis-wiring - for example wiring 110vac to the bus.

RS-485 Lightning Protection: If required, the RS-485 field wires should be protected by standard lightning protection devices. RDC suggests 15v or 16v surge protection. While many venders suggest clamping surges to 6v or 7v, this disregards that RS-485 can work up to +12 volts. Clamping at too low of a voltage can lead to the RS-485 drivers operating at near short-circuit conditions and driving at the full current. This can cause over-heating of device and/or power supply.

3.4. Physical installation

The unit mounts on a standard DIN rail as listed in the specification.

TECHNICAL SPECIFICATION

3.5. RS-485 port Description

3.5.1. 2-wire Signals; D+A, D-A, and Gnd-A, D+B, D-B, and Gnd-B

3.5.2. **Duplex**; half duplex. direction automatic.

3.5.3. **Line Voltage**; -7v to +12v permits ±7vdc ground difference between devices.

3.5.4. **Bias**; 470Ω pull-up (D+A, D+B) 470Ω pull-down (D-A,D-B) jumper selectable.

3.5.5. **Bus Termination**; 120Ω jumper selectable.

3.5.6. **Official maximum Bus Length**; 1000m per EIA-485, 500m per ISO 8482

3.5.7. **Practical maximum Bus Length**; 3000m with high-quality cable and other conditions.

3.5.8. **Maximum Speed**; At least 115Kbps

3.6. Isolation

3.6.1. **Power Supply,** between input supply and data signals; full galvanic isolation; 3kV test voltage

3.6.2. **Data,** between RS-485 port A and port B; optical isolation; 5kV test voltage

3.6.3. **Encapsulant**: 14,000v per mm (for "cf" option)

3.6.4. **Overall rating at least 2500v**

3.7. Power Supply

3.7.1. **5v Model**; 5 Vdc +/- 10% (About 175 mA)

3.7.2. **9-36v Model**; 1.2watt (About 50mA @ 24 Vdc)

3.8. Environmental

3.8.1. **Ambient operating temperature**; -20C to +65C

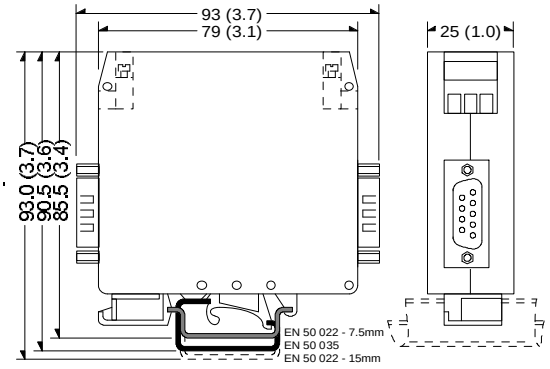
3.8.2. **Ambient storage temperature**; -40C to +100C

3.8.3. **Relative Humidity**; 10 to 95% RH, non condensing

3.8.4. **Casing; fungus and termite resistance**; Good.

3.8.5. **Casing; flame characteristics**: self-extinguishing.

3.9. Mechanical Dimensions



3.9.1. **Height; Width; Depth** (See drawing).

3.9.2. **Weight**; 130g.

3.9.3. **Terminal Capacity**;
2.5mm strand (12 AWG)
4.0mm solid (12 AWG).

3.9.4. **Mounting Rail**;
DIN EN 50022 (35mm "symetrical")
DIN EN 50025 (32mm "asymetrical")

Note: it fits best on the DIN 50022 style rail.

DB9 Pinouts for "-dd" option

DB9 Female Side
Pin 2 and pin 6 = T+
Pin 3 and pin 7 = T-
Pin 5 and pin 9 = Gnd

DB9 Male Side
Pin 2 and pin 6 = T+
Pin 3 and pin 7 = T-
Pin 5 and pin 9 = Gnd