

RDC422IC USERS MANUAL

ISOLATED RS-232 TO RS-422 CONVERTER

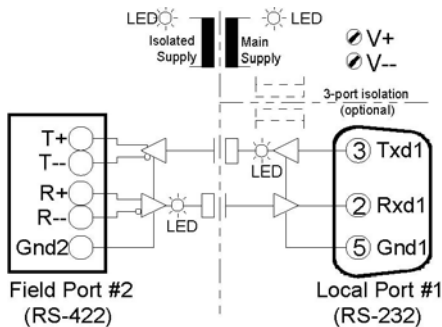
1. INTRODUCTION

1.1. Product Overview

For robust operation, the RDC422IC is the finest choice for your industrial applications. It provides the following unique combination of features:

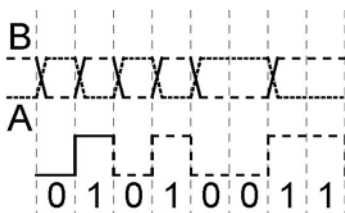
- ❑ The RDC422IC converts "3-wire" RS-232 (TXD/RXD with signal ground) into "4-wire" RS-422 (T+, T-, R+, R-, with signal ground). The signal is full duplex at speeds up to 115kbps.
- ❑ 2.5kv optical/galvanic isolation is provided between the RS-422 and RS-232 data lines (power supply is 3kv test, optical is 5kv test)
- ❑ With a floating field signal ground, cable runs up to 1000m can be guaranteed. With quality, low-capacitance cable like Beldon 1420A (at 42pF/m) this can often extend up to 3000m.
- ❑ For rapid troubleshooting, LED indicators are provided for transmit and receive data signals.
- ❑ DIN rail mounting and DC power supply ranges of 5 Vdc and 9 – 36 Vdc allow simple installation within your industrial panels.

1.2. Block Diagram



2. WHAT IS RS-422?

RS-422 is a full-duplex, point-to-point data communication standard. It uses two twisted wire pairs; one pair to transmit and one pair to receive. Data is transmitted by a differential voltage signal. **The two wires in a pair are not a loop** -- both are really '+' signals sourcing current to a third "virtual" ground conductor. For example, here is the differential signal for an ASCII character 'I'.



Though labels vary from vendor to vendor, the EIA/RS-422 standard labels one wire A and the other B. Data is represented by the relative voltage of A to B. When $V_A < V_B$, then the data is a binary 1.

When $V_A > V_B$, then the data is a binary 0. An idle line without data will be in the binary 1 state. This differential voltage signal is quite robust and not susceptible to noise or minor shifts in signal reference ground.

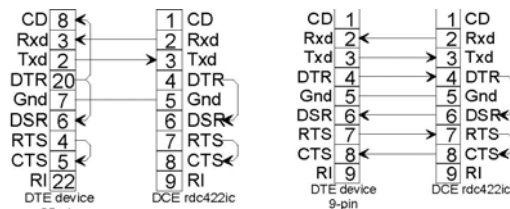
Although some vendors refer to "multi-drop" RS-422, the EIA/RS-422 standard only supports one transmitter per wire. These vendors are using 4-wire RS-485, but keeping the RS-422 name (perhaps due to product history).

3. INSTALLATION

3.1. RS-232 (option -dd and -cd)

For these options the RDC422IC RS-232 port is a 9-pin DCE port. Since the DTR and RTS signals are not required, they are internally connected to the outgoing DSR and CTS pins. A simple 9-pin ribbon cable or modem cable can be used and you will still have DTR/DSR and RTS/CTS looped back if required.

Alternatively, any cable with 3-wires Txd, Rxd, and SGnd can be used. Connection of DTR/DSR, RTS/CTS, or CD is only required if your device software requires and active DSR, CTS, and/or CD signal to operate.



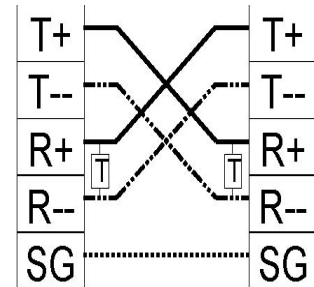
device w/9-pin DTE port device w/25-pin DTE port

3.2. RS-422 (option -cc and -cd)

The "C" terminals of the rdc422ic are labeled T+, T-, R+, R-, and SG whereas the "D-shell" pin out is shown at section 5 at the end of this manual. The "+" terminals correspond to the "B" terminals and the "-" terminals correspond to the "A" terminals. The "+" terminals are named "+" because when the data communications line is idling, they will have a higher voltage than the "-" terminals. *Remember that even though they are labeled + and -, they are not a "loop".*

Due to a lack of naming conventions, wiring any RS-422 device may require some bench-top experimentation. While the word "experimentation" sounds bad, it is often required when integrating multi-vendor systems. **The RS-422 interface cannot be damaged by reverse wiring or short-circuits to ground.**

RS-422 4-wire has 2 unidirectional wire pairs connected as shown. (For clarity, the "twists" in the pairs are not shown.) Transmit (T) terminals of one device must connect to the receive (R) terminals of the other device. Also the "+" terminals connect to "+" terminals, and likewise "-" connect to "-". Note that termination (T) is required at both receiver pairs.



3.3. Default Configuration:

The rdc422ic is configured to run in 4-wire mode. On the left side of the PCB, a series of resistors can be seen as labeled from R4 to R9. R4 and R6 (both 470Ω) act as the biasing resistors for T+ and T- respectively. R5 (terminating resistor for T+ and T-) is not installed because a terminating resistor is expected at the other end. R7 and R9 (both 1KΩ) act as the biasing resistors for R+ and R- respectively while R8 (120Ω) is the terminating resistor for the receive pair.

The biasing resistors will force a floating or open-circuit receive pair to an idle/1 state (i.e. a known state) so as to eliminate problems caused by the powering down of remote devices, cable disconnections and broken wires. These situations may generate a great deal of noise and if not prevented, may cause a very high interrupt load on the receiving device -- and even system failure. If the bias resistors ever cause a problem due to the remote device design, cut the links that are directly beneath the corresponding resistors with a sharp-nosed wire cutter.

3.4. Planning the panel wiring:

Power Supply: The 12v and 24v models are fully protected from reverse wiring and will sustain no damage. The 5v model is partially protected and if a fuse is installed in the V+ supply wire, should not be damaged.

RS-422 Fuses: RS-422 field wires may be protected by 250mA fuses. RS-422 interface ICs are internally protected from short-circuits. These fuses protect the system from over-voltages caused by mis-wiring or a failure of the lightning protection system.

RS-422 Lightning Protection: If required, the RS-422 field wires should be protected by standard lightning protection devices. RDC suggests 15v or 16v surge protection. While many vendors suggest clamping surges to 6v or 7v, this ignores that modern RS-422 devices can work normally up to +12 volts. Clamping at too low of a voltage can lead to the RS-422 drivers operating at near short-circuit conditions and driving at full current, causing over-heating of the device and/or power supply and shortens the product's life.

4. TECHNICAL SPECIFICATION

4.1. Port Description

- 4.1.1. **Port 1;** 3-wire RS-232; Signals: Txd, Rxd, SG; Working voltage ±10vdc; Max surge ±25vdc
- 4.1.2. **Port 2;** 4-wire RS-422; Signals: T+, T-, R+, R-, SG; Working voltage range 0 to +5vdc; Max voltage range -7 to +12vd; Max surge ±25vdc
- 4.1.3. **Duplex;** Operation can be either half or full duplex; No configuration required
- 4.1.4. **Speed;** Up to 115K baud; operates independent of baud rate; No configuration required
- 4.1.5. **Character Setting;** Operates with any combination of parity, data, stop, and start bits

4.2. Isolation (Per ISO/IEC 9549)

- 4.2.1. **RS-232 to RS-422;** 2.5Kv (optical, 5Kv test)
- 4.2.2. **RS-422 to Supply;** 2.5Kv (galvanic, 3Kv test)
- 4.2.3. **RS-232 to Supply;** 2-port model has no isolation; 3-port model has 500v isolation.
- 4.2.4. **Casing;** dielectric strength per DIN VDE 0303/part 2 is 400kV/cm

4.3. Power Supply

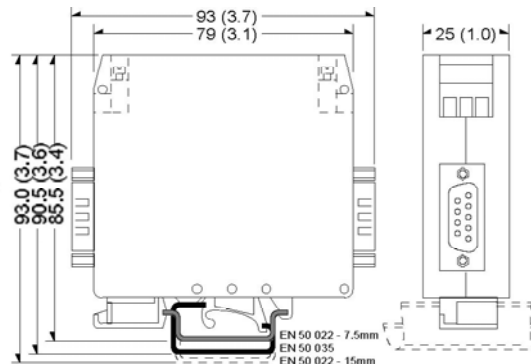
- 4.3.1. **Model rdc422ic-5v;** 5vdc ±5%; Max 150 mA
- 4.3.2. **Model rdc422ic-dv;** 9 – 36 Vdc, Max 45 mA @ 24 Vdc

4.4. Environmental

- 4.4.1. **Ambient Operating Temperature;** -20C to +65C
- 4.4.2. **Ambient Storage Temperature;** -40C to +100C
- 4.4.3. **Relative Humidity;** 10 to 90%, non condensing
- 4.4.4. **Casing;** fungus and termite resistant
- 4.4.5. **Casing; flame characteristics;** self-extinguishing per UL 94 V2

4.5. Mechanical Dimensions

- 4.5.1. **Height; Width; Depth** (See drawing).
- 4.5.2. **Weight;** 130g.
- 4.5.3. **Terminal Capacity;** 2.5mm strand (12 AWG)
- 4.5.4. **Mounting Rail;** DIN EN 50022 (35mm sym) DIN EN 50025 (32mm asym)



5. D-Shell Connector Details for RS-422 (4-wire)

| Function | Pin |
|----------|-----|
| T+ | 2 |
| T- | 3 |
| R+ | 1 |
| R- | 4 |
| SG | 5 |