RDCFOU USERS MANUAL

UNIVERSAL INDUSTRIAL FIBER-OPTICS TO SERIAL CONVERTER
FIELD SELECTABLE FOR RS-232, RS-422, AND RS-485 (2 OR 4-WIRE)
## (DEFAULT FACTORY SETTING: RS-232 MODE)

Quick Index:

1.   INTRODUCTION

The rdcFOu is the most productive industrial-grade fiber optic serial converter you can find. It helps you do your job faster and better. Installing and stocking a single product allows you the flexibility to support devices with any combination of RS-232, RS-422, and RS-485 ports; with any combination of 62.5/125, 100/140, or 50/125 µm fibers; and with either 9vdc, 12vdc, 24vdc or even AC power. Even if your field devices change, the rdcFOu can be reconfigured to keep up.

1.1.   Product Overview

The rdcFOu is designed specifically for use in industrial panel applications. It provides the following unique combination of features:

*   Fiber optics provides an intrinsically 100% galvanically isolated, noise-free, lightning immune data communications signal. The rdcFOu uses high-quality Hewlett-Packard components to communicate up to 4km at 820nm over 62.5/125, 100/140, or 50/125 µm fibers. ST or SMA connectors are available.

*   Unlike self-powered (parasitic) fiber optic units which draw limited power from an RS-232 interface, the fully powered rdcFOu offers 100% predictable performance 24-hours a day, 365 days a year.

*   The serial port is a removable 5-screw compression terminal for industrial sized field wires.

*   Optionally, the serial port of the rdcFOu can have 2500v optical/galvanic isolation from the power supply. This is critical with most DC powered systems.

*   For rapid troubleshooting and to simplify installation, the top screw terminal include both a place for your RS-485 terminating resistor and a fiber

optic test signal to force the fiber optic transmitter on. Visible even with the naked
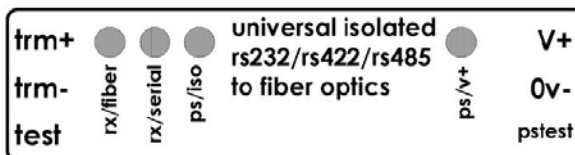
eye, this allows a quick check of glass optic fiber continuity.

- For rapid troubleshooting, there are LED indicators for data transmission and power status .

- Wide power supply range (9 to 36vdc) allows use with 9v, 12v, 24v supplies or direct from 12v or 24v battery systems. Optional model rdcFOu-hv supports 38 to 58vdc for use with 48vdc power systems. For 110vac or 230vac operation, any common 9v or 12vdc wall transformer can be used.
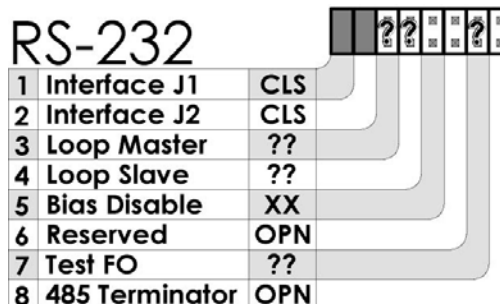
1.2. User Interface

The rdcFOu is designed for user-friendly application. Green LED **ps/v+** lights when external power is properly applied. Green LED **ps/iso** (1) lights when the internal isolating DC-to-DC converter is working properly. This isolation provides over 10,000,000 ohms of resistance between the power supply and serial interface to eliminate ground loops. Yellow LED **rx/serial** lights when any data is received on the serial interface. Yellow LED **rx/fiber** lights when any data is received on the fiber optic interface. Terminals **V+** and **0v-** are the DC power supply inputs. Terminal **pstest** is a well-regulated 5vdc output with reference to 0v- and can be used to draw up to 100mA of 5vdc power (2) for other uses. Terminals **trm+** and **trm-** allow addition of an external terminating resistor for the RS 485/422 receiver pair (3). Terminal **test** can be used to force the fiber optic transmitter on to test your fibers (see *Testing Your Fiber Optic* below for more details)

2.   INTERNAL JUMPER SETTINGS
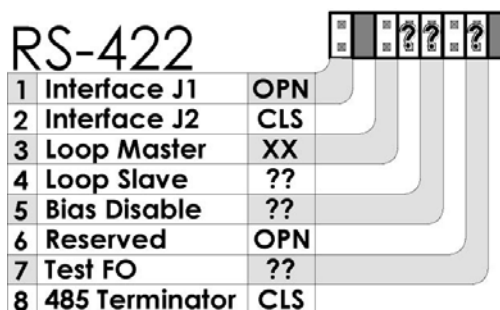
2.1.   For RS-232 Interface

J1 and **Interface J2** must both be closed/on to select RS-232. **Loop Master** and **Loop Slave** should be open/off for normal point-to-point operation (see *Application Example : Multi-Drop Loop* below for more details). **Bias Disable** is ignored in RS-232 mode. **485 Terminator** and **Reserved** must be open/off for RS-232. **Test FO** is open/off for normal operation (see *Testing Your Fiber Optic* section below for more details).

RS-232		
1	Interface J1	CLS
2	Interface J2	CLS
3	Loop Master	??
4	Loop Slave	??
5	Bias Disable	XX
6	Reserved	OPN
7	Test FO	??
8	485 Terminator	OPN

(1)   ps/iso LED is installed only in the galvanically isolated models (like rdcFOu-dv-2p-st-c)

(2)   48vdc model (rdcFOu-hv) is about 4.5vdc. Drawing too much power causes the rdcFOu to function poorly.

(3)   To use tmr+ and tmr-, make sure you disable the internal 120 ohm terminating resistors.

2.2. For RS-422 Interface

J1 must be open/off and **Interface J2** must be closed/on to select RS-422. **Loop Master** is ignored for RS 422 - only RS-232 supports Loop Master. **Loop Slave** should be open/off for normal point-to-point operation (see *Application Example : Multi-Drop Loop* below for more details). For RS-422 **Bias Disable** is normally open/off to enable the 470 ohm pull-up and pull-down bias resistors on the receive wire. These bias resistors prevent noise if the

	RS-422	
1	Interface J1	OPN
2	Interface J2	CLS
3	Loop Master	XX
4	Loop Slave	??
5	Bias Disable	??
6	Reserved	OPN
7	Test FO	??
8	485 Terminator	CLS

remote RS-422 device is powered off or disconnected. Set Bias Disable to closed/on to disable these resistors. For RS-422 **485 Terminator** is normally closed/on to enable the rdcFOu's internal 120 ohm terminating resistor. Set 485 terminator to open/off to disable this resistor and/or use an externally mounted terminating resistor. **Reserved** must be open/off for RS422. **Test FO** is open/off for normal operation (see *Testing Your Fiber Optic* below for more details).
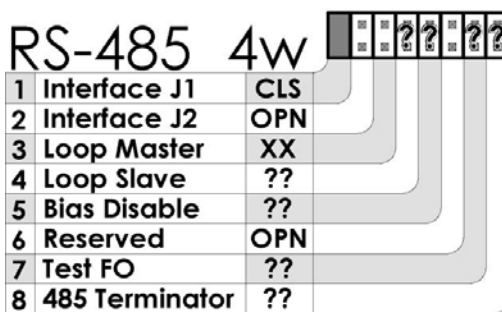
2.3. For RS-485 Interface (2-wire)

Interface J1 and **Interface J2** must both be open/off to select RS-485 two-wire. **Loop Master** is ignored for RS-485- only RS-232 supports Loop Master. **Loop Slave** should be open/off for normal point-to-point operation (see *Application Example : Multi-Drop Loop* below for more details). For RS-485 **Bias Disable** is normally open/off to enable the 470 ohm pull-up and pull-down bias resistors on the

	RS-485 2w	
1	Interface J1	OPN
2	Interface J2	OPN
3	Loop Master	XX
4	Loop Slave	??
5	Bias Disable	??
6	Reserved	OPN
7	Test FO	??
8	485 Terminator	??

receive wire. These bias resistors are critical for proper bus operation - but only 1 or 2 rdcFOu can have these bias resistors enabled on one bus segment (normally set in the same rdcFOu with the terminator enabled). All other rdcFOu should have the Bias Disable set to closed/on to disable these bias resistors. For RS-485 **485 Terminator** is normally closed/on to enable the rdcFOu's internal 120 ohm terminating resistor - but only the 2 ends of the bus segment should have the terminating resistors enabled. Set 485 terminator to open/off to disable this resistor and/or use an externally mounted terminating resistor. **Reserved** must be open/off for RS-485. **Test FO** is open/off for normal operation (see *Testing Your Fiber Optic* below for more details).
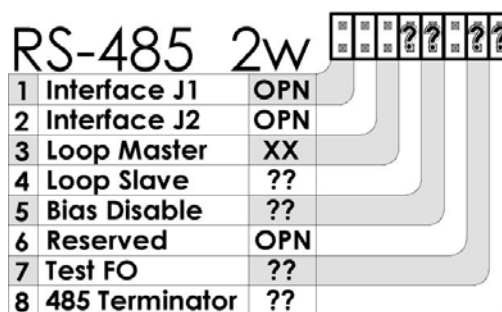
2.4. For RS-485 Interface (4-wire)

The rdcFOu supports 4-wire RS-485 for full-duplex operation or what some vendors call "multi-drop RS-422". All jumper settings are the same as RS-485 2-wire except **Interface J1** must be closed/on and **Interface J2** must be open/off. In 2-wire mode, the serial receiver is disabled during serial transmission (half-duplex operation) whereas it will still be active in the 4-wire mode (half-duplex operation).

	RS-485 4w	
1	Interface J1	CLS
2	Interface J2	OPN
3	Loop Master	XX
4	Loop Slave	??
5	Bias Disable	??
6	Reserved	OPN
7	Test FO	??
8	485 Terminator	??

3.   INTERFACE WIRING

3.1.   Fiber Optics Connection:

The rdcFOu has either 2 ST-compatible bayonet connectors (option -st) or 2 SMA threaded connectors (option -sma). Note that all fiber optic cables need gentle handling and have a specified minimum bend radius. Please refer to your cable specs for details, but you should plan on providing space to neatly coil a 6 inch or 15cm loop diameter of extra fiber. The rdcFOu's transmit (TX) connector is connected to the receive (RX) connector of the remote device, and the rdcFOu's receiver (RX) connector is connected to the transmitter (TX) connector of the remote device,

3.2.   RS-232 wiring

For RS-232, only a 3-wire cable is required (Rxd, Txd, and SG) for most applications. To avoid future problems, you are wise to short DTR & DSR and RTS & CTS in the 9-pin or 25-pin connector. That way you are fully protected if any future software wants to monitor either DSR or CTS control signal inputs. For an rdcFOu configured as a **Loop Master** you must connect the devices RTS output to the rdcFOu's R+ terminal.
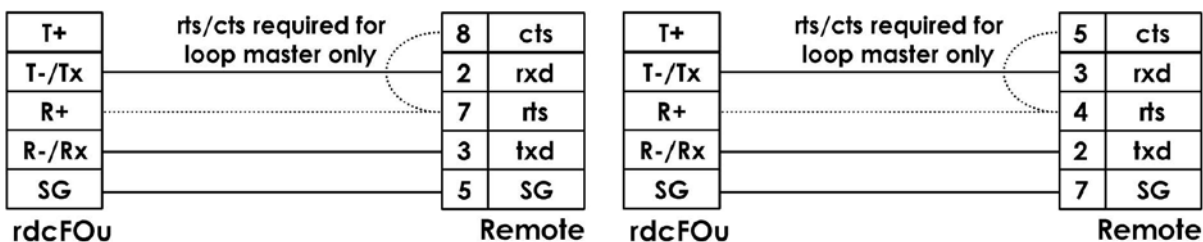
RS-232 to 9-pin DTE RS-232 to 25-pin DTE

3.3.   RS-422 & RS-485 wiring

For galvanically isolated rdcFOu the signal ground (SG) must be connected even for RS-422 and RS-485. For non-isolated rdcFOu, the signal ground should be left unconnected and the 0v- terminal will be used as the signal ground and voltage reference.
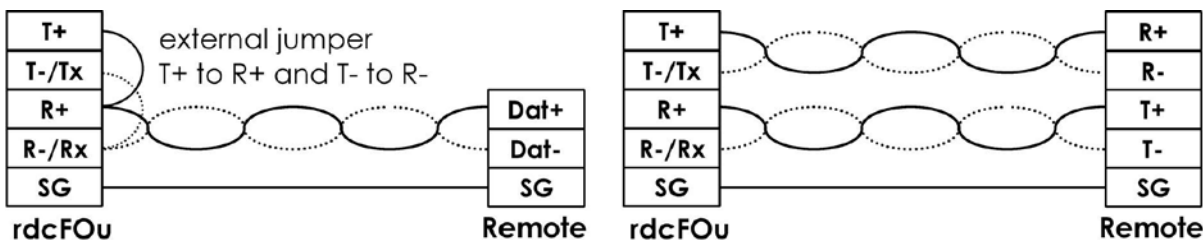
RS-485 2-wire RS-422 or RS-485 4-wire

4.   TESTING YOUR OPTIC FIBER:

There are two method you can use to test your fiber optics system. First, you can short the top-plate terminal labeled **test** to signal ground. On the non-isolated rdcFOu this could be the **0v**terminal. On the galvanically isolated rdcFOu this must be the signal ground (SG) terminal of the serial interface. Second, you can close/on J7 **Test FO** inside the rdcFOu. Either method forces the fiber optic transmitter on constantly - using about 3 times the normal supply current to do it. The light from the transmitter can easily be seen with the naked eye. Use this to test your optic fiber. At the remote end, you can easily see which fiber in a multi-fiber cable is emitting the light, and if connected to the remote device, its "Receive" LED should light.

5.   APPLICATION EXAMPLES

5.1.   Standard Point-to-Point Connection

When most industrial people use fiber optics, they use it in a point-to-point connection. The fiber is functioning like a common modem or line driver. The example shown here also highlights the flexibility of the rdcFOu - 2 identical units can be used to support RS-232 at one end and multidrop RS-485 at the other. Plus the maintenance department only needs to stock a single third "spare" unit. At the computer end, the rdcFOu could be powered either by a 12vdc feed from the computer or by a common 110vac to 9vdc wall-transformer (power pack). At the PLC end, the rdcFOu can be powered from the existing 24vdc panel supply or UPS battery.
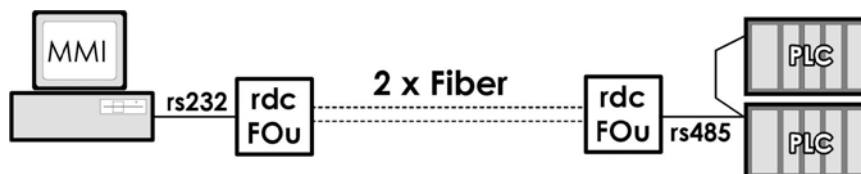
5.2. Multi-Drop Fiber Loop Design (Half-Duplex)

Connecting multiple rdcFOu in a loop is often an easy way to handle multi-drop protocols like Modbus. However, since a single point of failure (or panel powered off) anywhere around the loop brings the whole loop down, this is only a safe design for small sites. Setting internal jumper 4 **Loop Slave** closed/on causes the rdcFOu to "echo" all fiber data received around the loop. So if a Modbus poll is received, this poll is both repeated out the serial interface and echoed onto the next rdcFOu, where it is also repeated out the serial interface and echoed on around the loop until every slave attached has seen the poll. Any slave response is likewise echoed around the loop back to the master. The rdcFOu at the master device *must use an RS-232 interface* (RS-422 and RS-485 NOT supported), *must support RTS/CTS* half-duplex modem-style handshaking, and must have internal jumper 3 **Loop Master** closed/on. The rdcFOu Loop Master is a half-duplex device with RTS "modem" control. When RTS is high/active, the rdcFOu is a transmit-only device and ignores any fiber data received (remember all the Loop Slaves - including the last one - echo the master's poll around the loop). When RTS is low/inactive, the rdcFOu is a receive-only device and is ready to receive any slave responses.
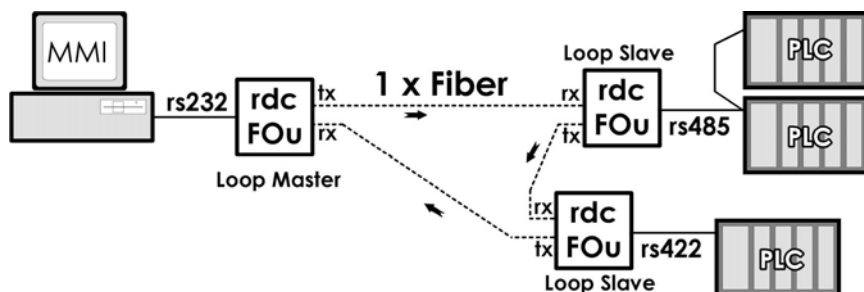
5.3. Robust 'Star Multi-Drop Design (Full-Duplex)

A more robust "multi-drop" design uses multiple rdcFOu near the Master in an RS-485 bus. A master poll is repeated out each of the central rdcFOu units. Unlike with the "Loop" design, there is no internal jumper settings required nor will a single fiber failure or remote power loss shutdown the entire system. However the master device *must support RS422 or RS-485 (2 or 4-wire)*. If your Master device has an RS-232 port, the RobustDC rdc485ic makes an ideal RS-232 to RS-485 converter. Using RS-485 4-wire at the master is more efficient since the central rdcFOu will NOT repeat the slave responses back out to the remote slaves - only the Mas-ter device see the slave responses. Also, the central rdcFOu can be configured for RS-485 4-wire whether the master device has an RS-422 or an RS-485 4-wire interface.
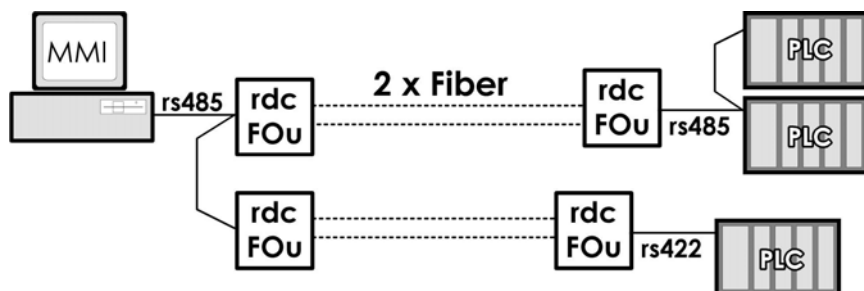
6. TECHNICAL SPECIFICATION

6.1. Port Description

6.1.1. **RS-232**; Working voltage range ±9vdc; Max voltage range ±15vdc; Max surge ±25vdc

6.1.2. **RS-422, RS-485**; Working voltage range +12/-7vdc; Max voltage range ±15vdc; Max surge ±25vdc

6.1.3. **Fiber Optics**; 820nm over 62.5/125, 100/140, or 50/125 µm fibers. ST or SMA connectors.

6.1.4. **Speed**; Tested to 115K baud; No configuration required

6.1.5. **Character Setting**; any combination of parity, data, stop, and start bits; No configuration required

6.2. Isolation (Per ISO/IEC 9549)

6.2.1. **Fiber Optics**; intrinsic full isolation

6.2.2. **RS-232 to Supply**; ; model "-1p" none ; model "-2p" 2500v (galvanic, 3Kv test)

6.2.3. **Casing**; dielectric strength per DIN VDE 0303/part 2 is 400kV/cm

6.3. Power Supply

6.3.1. **rdcFOu-5v**; regulated 5vdc ±5%; 1watt (nominal 200mA)

6.3.2. **rdcFOu-dv**; unregulated 9 to 36 vdc; 1.5 watt (nominal 60mA at 24vdc)

6.3.3. **rdcFOu-hv**; unregulated 38 to 58 vdc; 1.5 watt (nominal 30mA at 48vdc)

6.4. Environmental

6.4.1. **Ambient Operating Temp**; -40°C to +65°C

6.4.2. **Ambient Storage Temp**; -40°C to +100°C

6.4.3. **Relative Humidity**; 10-90%, non condensing

6.4.4. **Casing**; fungus and termite resistant

6.4.5. **Casing**; **flame characteristics**: self-extinguishing per UL 94 V2

6.5. Mechanical Dimensions

6.5.1. **Height; Width; Depth**

6.5.2. **Weight**; less than 130g.

6.5.3. **Terminal Capacity** 2.5mm (12 AWG)

6.5.4. **Mounting Rail**;
DIN EN 50022 (35mm sym)
DIN EN 50025 (32mm asym)
Note: removal from a DIN EN 50025 rail is difficult.