RdcFoms-DIO User Manual
Industrial Fiber Optic Media Converter (Single Mode to multi-mode)
with Digital I/O

1.   Product Overview

The RDC Single Mode to Multi-Mode Fiber Optic Converter provides transparent conversion between fiber optic devices that utilize multi-mode and single-mode fiber. An additional digital I/O port allows digital signals to be tapped or introduced into the fiber network.

Fiber optics intrinsically provides a 100% galvanically isolated, noise-free, lightning immune data signal. Signals in single mode fiber can travel over a much longer distance than with multi-mode fiber. This makes multi-mode fiber suitable for short premises installation and single mode fiber for longer "metropolitan distances"

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

❑ 2.5 KV isolation between Digital I/O port and Power Port.

❑ Intrinsic isolation between fiber ports and other ports.

❑ LED indicators for main power, transmit and receive for Digital I/O ports.

❑ Wide power supply range (9 to 48 Vdc)

❑ Long fiber transmission distance (11 km for Single-Mode, 4 km for Multi-Mode)

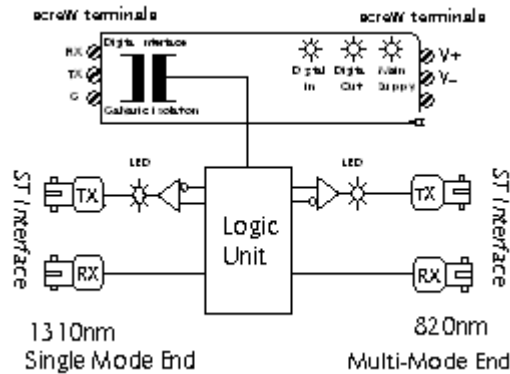❑ Up to 6 mA of current drive for Digital I/O

2. Operation Overview

Fig 1. Functional block diagram

The product operates in either Dual Direction Mode (DDM) or Dual Conversion Mode (DCM). The details of these modes are described in Section 5. As can be seen in Figure 1, all data through the fiber ports as well as the digital I/O port congregate at the Logic Unit. The Logic Unit will route the data based on the settings at the DIP switch. Its location is shown in Figure 2 below.
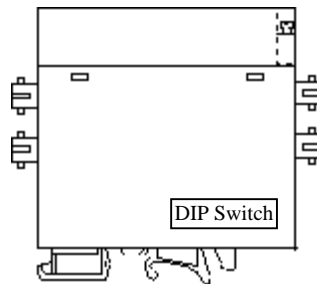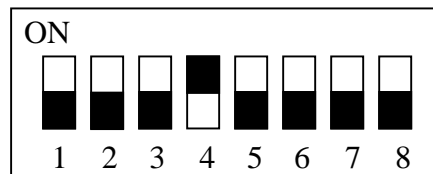

Fig 2. Location of DIP switch

Fig 3. DIP switch (Default Settings)

From Figure 3, pushing the switch up turns it on. The functions of the individual switches are listed in Table 1.

Switch No.	Description
1	Mode Selection. (ON = DCM)
2	Multi-Mode (MM) Selection *
3	Single-Mode (SM) Selction *
4	Digital Mode (DIO) Selection * (Default Setting)
5	Loopback (LOOP). For DCM only, no effect in DDM mode.
6	Digital In Invert (INV DI) (ON = Invert)
7	Digital Out Invert (INV DO) (ON = Invert)
8	Not in use.

Table 1.   Switch Functions

*   Only one out of these 3 switches should be up. In DDM, it implies which port is disabled. In DCM, it implies which port is the signal source.

Not all combinations are supported. The allowable combinations are shown in Section 5. In the event that an unsupported is combination set, all ouputs (Digital and Fiber) will be set to logic high and no operation is supported.

3.   Setup

The unit is able to accept any voltage between 9 to 48 Vdc. For the fiber optic ports, ensure that a transmitting port goes to another receiving port. The Digital I/O port is capable of interfacing directly to another TTL/CMOS compatible device.

4.   LED Indicators

The yellow LED indicators indicate the state of the corresponding ports. It should not be assumed that a solid yellow colour would imply that a string of data is passing through.

For the DIO port, when the Digital In LED is lit, it implies that a logic high (5 V) is present. When its off, it implies that a logic low (0V) is present. The Digital Out LED works in the opposite way as the Digital In LED. That means that when it is lit, its in the logic low (0 V) state and when its off, its in the logic high (5 V) state.

For the fiber ports, the corresponding LED will be lit when the port is in the "on" state. (i.e. sending light)

The green LED indicates whether power is supplied to the unit.

5. Modes of Operation

The unit can be configured to operate in Dual Direction Mode (DDM) or Dual Conversion Mode (DCM).

Switch 1 of the DIP determines the operating mode. When its "ON", the unit is running in DCM. Otherwise, the unit is running in DDM.

In both modes, the signal from one fiber port to another is always the same. That is because no fiber signal inversion is allowed. When it comes to the conversion of signals between the digital I/O and fiber ports, some options are available because of the digital inversion option.

For ease of use, the logic unit will translate a logic high digital input to a fiber port "ON" and vice verse. (Positive Logic). This is true if no digital inversion is enabled.

If the digital input is inverted, then, a logic high will NOT cause a fiber port to be in the "ON" state (Negative Logic). However, an "ON" state detected at the fiber input will still be translated to a logic high if the digital output is not inverted.

Sections 5.1 and 5.2 will describe the various options in DDM and DCM respectively.

5.1 Dual Direction Mode

In DDM, one port is disabled, thereby enabling full duplex communication between the other two ports.

Setting either switches 2, 3 or 4 to "ON" will disable the corresponding port as shown in Table 2 below.

Switch	Description	Operation when "ON"
2	Multimode (MM)	Multimode disabled, full duplex communication between SM and DIO
3	Singlemode (SM)	Singlemode disabled, full duplex communication between MM and DIO
4	Digital I/O (DIO)	Digital I/O disabled, full duplex communication between MM and SM, Digital Inversion is disabled.

Table 2. Operation modes in DDM

Note that either switch 2, 3 or 4 should be "ON" at one time. Any other combination is not supported.

In DDM, the loopback (LB) option (Switch 5) is not supported and hence has no effect.

The digital input and output can be inverted. This means that a logic high at the input is interpreted as logic low when Digital In Inversion (Switch 6) is set "ON" and vice versa. When the Digital Out Inversion (Switch 7) is set "ON", then the digital output will be inverted. Obviously, when the Digital I/O is disabled, switches 6 and 7 will have no effect.

For a list of supported combinations, refer to Appendix A at the end of this manual.

5.2 Dual Conversion Mode

In DCM, one port will act as the signal source. This means that the signal that is received at the source port will be sent to the output of the two remaining ports. In the meantime, the inputs of the two remaining ports are disabled.

Setting either switches 2, 3 or 4 to "ON" will set the corresponding port to be the source port as shown in Table 3 below.

Switch	Description	Operation when "ON"
2	Multimode (MM)	Multimode as source, signal at MM port will be repeated to SM and DIO ports. SM and DIO inputs have no effect.
3	Singlemode (SM)	Singlemode as source, signal at SM port wil be repeated to MM and DIO ports. MM and DIO inputs have no effect.
4	Digital I/O (DIO)	Digital I/O as source, signal at Digital I/O port will be repeated to MM and SM ports. MM and SM inputs have no effect.

Table 3. Operation modes in DCM

Note that either switch 2, 3 or 4 should be "ON" at one time. Any other combination is not supported.

In DCM, the loopback (LB) option (Switch 5) allows the signal at the source port's input to be repeated at the source port's output. For the fiber ports as a source, the loopback signal is exactly the same as the input signal.

For the digital I/O port as a source, its possible to invert the loopback signal by setting switch 7 (INV DO) to "ON". In fact, its possible to invert both the digital input and output at the same time by setting switches 6 (INV DI) and 7 to "ON". This will cause no change to the loopback signal but will cause the fiber ports to operate in the negative logic as described in Section 5.

For a list of supported combinations, refer to Appendix A at the end of this manual.

6. **Technical Specification**

6.1 <u>Interface</u> : Single mode 1310nm
: Multi-mode 820nm
: Digital I/O TTL / CMOS compatible
: (up to 6 mA of drive)

6.2 <u>Connector</u> : Single mode ST(bayonet)
: Multi-mode ST(bayonet)
: Digital I/O 3-way Screw Terminal
: Power Supply 3-way Screw Terminal

6.3 Loss <u>Budget</u> : 17dB max @1310nm on 9/125um cable
: 15dB max @820nm on 62.5/125um cable.

6.4 <u>Power Supply</u>

6.4.1 Operating Voltage : 9 to 48 Vdc
6.4.2 Max Power : 2.4 W Max
6.4.3 User Indications : Green LED for main power supply

6.5 <u>Isolation</u>

6.5.1 DIO and Supply : 2.5 KV
6.5.2 Intrinsic isolation at Fiber Ports

6.6 <u>Communication</u>

6.6.1 Maximum Speed : Up to 115 kbps
6.6.2 Character Setting : Transparent, no configuration required
6.6.3 User Indications : Yellow LED indicators for fiber ports transmit
: and digital I/O transmit and receive
6.6.4 Practical Distance : Up to 11 km for singlemode side
: Up to 4 km for multimode side

6.7 <u>Environmental</u>

6.7.1 Operating Temp : -20C to +65C
6.7.2 Storage Temp : -40C to +100C
6.7.3 Relative Humidity : 10-90%, non condensing
6.7.4 Casing : nylon polymide, fungus and termite resistant
: self-extinguishing per UL 94 V2

6.8 Mechanical Dimensions

6.8.1 Height, Width, Depth : (See drawing)
6.8.2 Weight : Approx.: 130g
6.8.3 Terminal Capacity : 2.5mm(12AWG)
6.8.4 Mounting Rail : DIN EN 50022(35mm sym)
               : DIN EN50025 (32mm sym)
               : Note: removal from a DIN EN50025 rail is difficult.
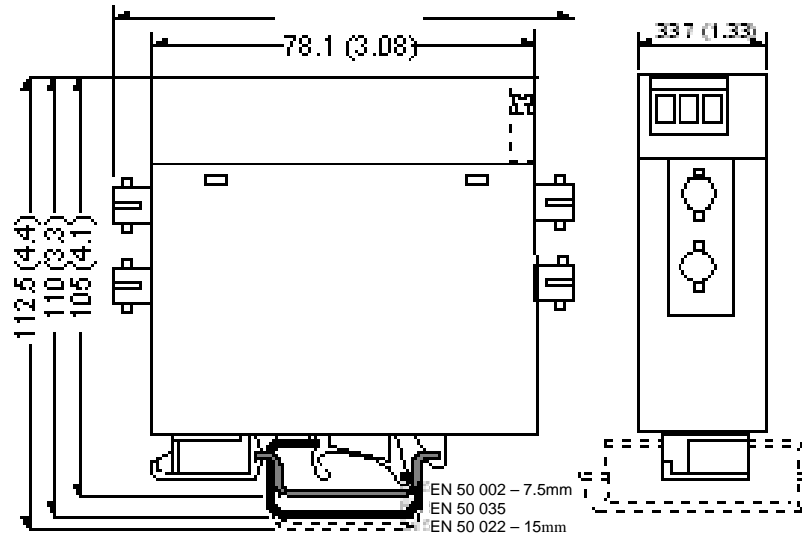
Appendix A

No.	Mode	Operation	Loopback	Digital In Inverted	Digital Out Inverted	Remarks
1	Dual Direction Mode	MM / SM				Digital Input has no effect, Digital Output is logic high.
2	(No Loopback)	MM / Digital				SM Input has no effect, SM Output is low.
3				O		
4					O	
5				O	O	
6		SM / Digital				MM Input has no effect, MM Output is low.
7				O		
8					O	
9				O	O	
10	Dual Conversion Mode	MM Input as Source				Digital and SM Inputs have no effect.
11					O	If LB is disabled, MM Output is logic high.
12			O			
13			O		O	
14		SM Input as Source				Digital and MM Inputs have no effect.
15					O	If LB is disabled, SM Output is logic high.
16			O			
17			O		O	
18		Digital As Source				MM and SM Inputs have no effect.
19				O		If LB is disabled, Digital Output is logic low.
20			O			
21			O	O		
22			O		O	
23			O	O	O	

O = Supported