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# User Guide

## DS3/E3 Fiber Modem

### FRM220-DS3/E3



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### Introduction

The **FRM220-DS3/E3** is fiber modem that works in pairs to transparently extend DS3, E3 or STS-1 transmissions over optical fiber. By utilizing pluggable SFP transceivers, these converters may be easily deployed on multimode or single mode fiber, at a distance up to 120km, or over a single core fiber using BiDi (WDM) SFP modules. The **DS3/E3** connections utilize industry standard BNC connections for transmit and receive via coaxial cables. When the **FRM220-DS3/E3** card is used standalone in a single slot chassis, DIP switches may be used for configuration and loopback control. When placed in a single slot chassis with console port, an easy to maneuver user menu is available via terminal to configure, monitor, and run diagnostic loop back functions. The EOC (embedded operations channel) allows in-band management to control the remotely connected modem over a working fiber link. When the **FRM220-DS3/E3** card is placed in the FRM220 rack with SNMP management, the management can view the local and remote converter cards' status, type, version, fiber link status and alarms. The card can be configured to enable or disable the port, reset the port, configure the protocol, and provide diagnostic loopback.

This card is specifically designed for either ANSI DS3 or ITU-T E3 transparent transmissions. The copper side transmission applies a jitter attenuator.

The SFP socket supports a wide range of optical modules to address any fiber network situation.

- Single-mode
- Multi-mode
- Single fiber bi-directional
- Coarse and Dense Wave Division Multiplexing (CWDM and DWDM)

**WARNING:** Fiber optic equipment may emit laser or infrared light that can injure your eyes. Never look into an optical fiber or connector port. Always assume that fiber optic cables are connected to a laser light source.

## Specifications

- **Optical Interface**
- **Connector** SFP cage
- **Data rate** 155.52Mbps
- **Duplex mode** Full duplex
- **Fiber** Depends on SFP
- **Distance** Depends on SFP
- **Wavelength** Depends on SFP
- **Coaxial Interface**
- **DS3** 44.736Mbps B3ZS line coding
- **E3** 34.368Mbps HDB3 line coding
- **STS-1** 51.84Mbps B3ZS line coding
- **Impedance** 75 Ω
- **Indications** LED (PWR, Fiber Link, Test, System, Coax Link, Coax AIS)
- **Power** (Card supports hot-swapping)
- **Input** Card : 12VDC, Standalone : AC, DC options
- **Consumption** <8W
- **Dimensions** 155 x 88 x 23mm (D x W x H)
- **Weight** 110g
- **Temperature** 0 ~ 50°C (Operating), -10 ~ 70°C (Storage)
- **Humidity** 10 ~ 90% non-condensing
- **Certification** CE, FCC, LVD, RoHS
- **MTBF** 65000 hrs (25°C)
- **Test Loops** Coax and Fiber

## Management Features

The FRM220-DS3/E3 has a DIP Switch which can be used to configure the device for stand-alone operation. When placed in a stand-alone chassis with DB9 port, these devices support a text based serial terminal with menu. When placed in a managed chassis, the card is configured and monitored through the chassis NMC (network management controller) via console, Telnet, Web HTTP or SNMP.

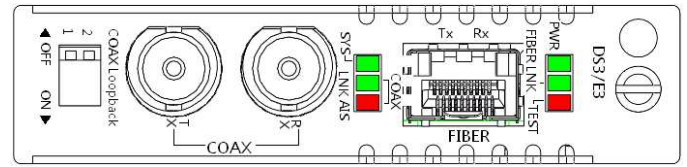
1. Stand-alone - Simple DIP settings, "set and forget"
2. Stand-alone - with serial console, menu driven, overrides DIP settings
3. Rack management - When placed in NMC managed rack, all other settings are overridden by the NMC management.

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## Panel

- Figure 1. Front Panel of FRM220-DS3/E3



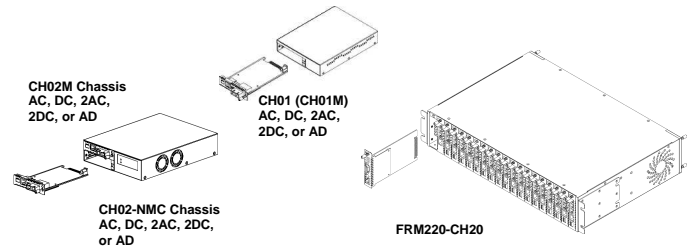
FRM220-DS3/E3  
Fiber Modem

There are four areas of interest to the operator on the face of the DS3/E3; (1) a pair of BNC connectors provide the DS3, E3 or STS-1 electrical connections; (2) an SFP cage supports pluggable optical transceiver; (3) LED indicators display the status of the card, coax and fiber; (4) a 2-pole DIP switch can initiate loop back diagnostics.

## Installation

- Figure 2. Slide-in Card mounting of FRM220-DS3/E3

Note: This converter card can be placed in any of the FRM220 series rack or slot chassis including CH01, CH01M, CH-02M, CH02-NMC, the CH08 8-slot chassis or the full 20-slot CH-20 chassis. There is no limitation on the number of cards that can be placed in the 20-slot chassis.

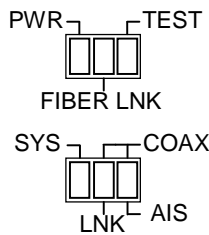


Follow all ESD precautions when handling the card and SFP+ modules.

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## LED Indicators



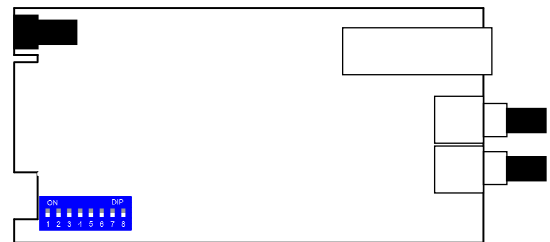
LED	State	Status
PWR (Green)	On	Power on
	Flash	During System Init or Upgrade
	Off	No Power
FIBER LNK (Green)	On	Line Side Fiber link
	Off	Line Side Fiber no link
Test (Red)	On	A Loop Back test is active
	Off	Normal operation
SYS (Green)	On	System is OK
	Off	System fault
COAX LNK (Green)	On	DS3/E3 link
	Off	DS3/E3 no link
COAX AIS (Red)	On	Coax is receiving AIS
	Off	Coax normal

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## DIP Settings

DIP Switch On PCB



SW #	SW Status	Function	
-1,-2	1	2	Coax side type: DS3 (44.736 MHz)
	OFF	OFF	Coax side type: STS-1 (51.84 MHz)
	OFF	ON	Coax side type: E3 (34.368 MHz)
	ON	OFF	Reserved (Set to DS3)
	ON	ON	Reserved (Set to DS3)
-3	OFF	LIU Receive LOS transmit AIS: Disable	
	ON	LIU Receive LOS transmit AIS: Enable	
-4	OFF	Fiber Auto Laser Shutdown: Disable	
	ON	Fiber Auto Laser Shutdown: Enable	
-5		Reserved.	
-6		Reserved.	
-7	OFF	Setting source: DIP switch	
	ON	Setting source: EEPROM **	
-8	OFF	Front panel loopback: Disable	
	ON	Front panel loopback: Enable	

\*\* When card is placed in single slot chassis with console port management, this switch must be ON or the management settings won't be followed. Place this switch OFF is only DIP switch settings are followed.

Notice: All of these settings (DIP and Console) are ignored if the card is placed in the FRM220-CH20 with NMC/SNMP management. The card will follow the settings done via the chassis management. (Refer to NMC operation manual for details on managing all cards.)

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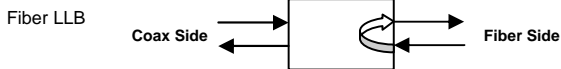
## Loop back Testing (LBT):

The loop back capability of the **FRM220-DS3/E3** is useful for debugging a dysfunctional link, or when commissioning a link. The **DS3/E3** model features a front panel mounted 2-pole DIP switch. This switch enables loop back for coaxial only. Loop back functions can also be enabled by using a serial terminal connected to the 9 pin D-Sub on the CH01M. If placed in a managed chassis, the chassis management system can access the card and perform all loop back functions through Telnet, web manager or SNMP.

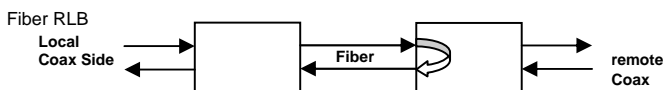
### Loop Back Types

Two major loop back types are supported; Fiber Loop Back and Coaxial Loop Back.

#### Fiber Loop Back

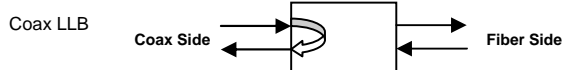


In the fiber local loop back (LLB) mode, the **DS3/E3** modem will initiate a loop back of the fiber by taking the Rx fiber signal and looping out the fiber Tx.

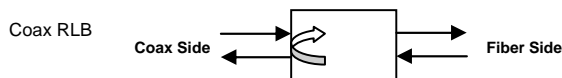


In the fiber remote loop back (RLB) mode, the local **DS3/E3** modem will use the embedded operations channel (EoC) to inform the remote **DS3/E3** modem to initiate a remote loop back of the fiber by taking its Rx fiber signal and looping out the fiber Tx.

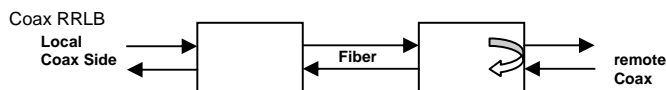
#### Coaxial Loop Back



In the coaxial local loop back (LLB) mode, the **DS3/E3** modem will initiate a loop back of the coaxial signals by taking the Rx coaxial signal and looping out the coaxial Tx.



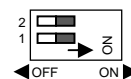
In the coaxial remote loop back (RLB) mode, the **DS3/E3** modem will initiate a remote loop back of the coaxial signals by taking the Tx coaxial signal and looping back to the coaxial Rx. This loop back performs basically the same as a fiber local loop back however it includes the LIU in the loop back circuit.



In the coaxial request remote loop back (RRLB) mode, the local **DS3/E3** modem will use the embedded operations channel (EoC) to inform the remote **DS3/E3** modem to initiate a remote loop back of the coaxial by taking its Tx coaxial signal and looping back towards the local unit.

#### Front Panel Loop Back Switch (for coaxial only)

Switch Status		Function
1	2	
OFF	OFF	All loopback OFF
OFF	ON	LLB
ON	OFF	RLB
ON	ON	RRLB



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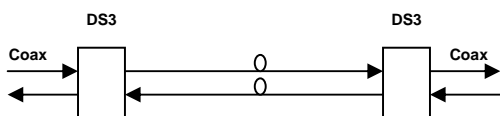
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## Applications

The **FRM220-DS3/E3** fiber modem works in point-to-point applications, either as a stand-alone or when placed in the FRM220-CH20 managed rack.

### Fiber Extension



Set local and remote modems to the correct protocol either by local DIP or through management. The type setting is the only setting required.

For normal operation, ensure that the Loop Back switches are both in the OFF position.

### Console Management

When placed in the 1 or 2-slot CH02M chassis, this card can be locally managed by connecting a simple serial terminal such as a notebook computer that has an RS232 port or via a commonly available USB to RS232 adapter. In Windows XP, HyperTerminal™ is an application available for emulating a serial terminal. You can also search for TeraTerm or PuTTY which are free alternatives, especially if the operating system is Vista, Win7 or Win8.

### Settings

Baud Rate: 38,400  
Data bits: 8  
Parity bits: none  
Stop bits: 1  
Handshaking: none  
Emulation: VT-100

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Connect the serial cable to the CH01M's DB9. Run the terminal emulation program. With power on, press [ESC] or [Enter] to display the "Main Menu" screen. The following is an example.

```

*****
*** CTC UNION TECHNOLOGIES CO.,LTD. ***
*** FRM220-DS3E3 Manager ***
*****
[Local ] Ver:[ 1.000-1.001-0.000-0.004 ] [ CH-01M ]

User Name : admin
Password :
    
```

Example of Login Menu Console Screen, FRM220-DS3/E3

The factory default username and password are both 'admin' (with no quotes).

```

*****
*** CTC UNION TECHNOLOGIES CO.,LTD. ***
*** FRM220-DS3E3 Manager ***
*****
[Local ] Ver:[ 1.000-1.001-0.000-0.004 ] [ CH-01M ]

<1> Device Status and Configuration
<2> Fiber Status and Configuration
<3> Coax Status and Configuration
<4> Loopback Test Mode
<5> Performance
<6> Store Parameters
<P> Set Password
<T> Switch To Remote Menu [ Present ]

<ESC> Logout
    
```

### Operation

Select any of the menu items by keying in the menu item number or letter. Use the [ESC] to return to a previous menu. Any setting is immediately applied to the transponder's circuitry. After all of the parameter settings have been selected, press "6" from the main menu to save the parameters in non-volatile RAM (NVR).

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## Explanation of Settings

<1> **Device Status and Configuration:** Under this menu will be found the device enable or disable, the factory default, and card reset functions. This menu also contains the upgrade items for FPGA and CPU. Local, stand-alone upgrade is supported by serial terminal and Xmodem transfer protocol.

<2> **Fiber Status and Configuration:** Under this menu will be found the status and settings for the Fx port. Status is shown for fiber link, Far End Fault (FEF), confirmation of inserted SFP and special DOM reading of supported SFP. Setting has the option to enable ALS (auto laser shutdown).

<3> **Coax Status and Configuration:** Under this menu will be found the status and settings for the Coaxial port. Status is shown for link state and AIS (alarm indication signal) state. Two settings are applied under this menu, the most important is the type selection, DS3, E3 or STS-1. For the AIS setting, when enabled, the coaxial Tx will transmit AIS in the event of fiber receive LoS.

<4> **Loopback Test Mode:** This menu provides access to the coaxial and fiber loopback modes. Please refer to page 6 for details of loop back modes.

<5> **Performance:** This menu provides access to the ES (error seconds) counter. The ES counter will increment when fiber signal is lost. The Coax ES counter will increment when the coaxial has signal loss. Pressing "1" will clear the counters.

<6> **Store Parameters:** Saves the setting parameters into non-volatile RAM (NVR)

<P> **Set Password:** You must key-in the old password, then a new password twice to change the password.

<T> **Switch To Remote Menu [ Present ]:** When fiber is linked to a remote device it will be displayed as "Present". It is then possible to switch (toggle) to the remote device and do remote configuration. The same menu applies to the remote unit.

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## SFP DD

Modern optical SFP transceivers support digital diagnostics monitoring (DDM) functions according to the industry-standard SFF-8472. This feature is also known as digital optical monitoring (DOM) and gives the end user the ability to monitor real-time parameters of the SFP, such as optical output power, optical receive power, temperature, etc.

### Example of reading Digital Diagnostics in SFP

```
*****
*** CTC UNION TECHNOLOGIES CO.,LTD. ***
*** FRM220-DS3E3 Manager ***
*****
[Local ] Ver:[ 1.000-1.001-0.000-0.004 ] [ CH-01M ]

<< Fiber D/D Function Status >>
Vendor Name      :[ CTC UNION      ]
Vendor Part Number :[ SFS-5020-WB-DD ]
Fiber Type       :[ Single ]
Tx Wave Length   :[ 1550 nm ]
RX Wave Length   :[ 1310 nm ]
Link Length      :[ 0020 km ]
Tx Power         :[ -11 dBm ]
Rx Power         :[ -18 dBm ]
Rx Sensitivity   :[ 00 dBm ]
Temperature      :[ 52 C ]

<ESC> Go to previous menu.
```

Parameters are read from any MSA (Multisource Agreement) compliant SFP module. Extended information is only available in modules which support D/D or DOM function.

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## Upgrading

The FRM220-DS3/E3 card may be firmware upgraded via the serial port when it is placed in the single slot chassis with console port. The firmware image transfer mechanism uses Xmodem protocol. When placed in FRM220 with NMC management card, user may use a local console connection to the NMC, a remote Telnet (IP) connection, or a Web based (HTTP) connection with any available browser. The NMC communicates to all cards through a serial RS485 control bus. The upgrade code is transferred to the NMC by way of TFTP server.

### Quick Procedure

Upgrade code is packaged by CTC Union with two free, open source tools; TeraTerm Pro (supports Xmodem) and TFTP32 (a TFTP server). Neither program requires installation in Windows system. The line card's upgrade code is placed in the same folder as the tools. This example uses direct local access with Xmodem. Do console setting steps on page 7. From the main menu choose:

<1> Device Status and Configuration

Then:

<4> CPU Upgrade

Then:

Press [1], Start to Upgrade MCU AP firmware.

```
*****
*** CTC UNION TECHNOLOGIES CO.,LTD. ***
*** FRM220-DS3E3 Manager ***
*****
[Local ] Ver:[ 1.000-1.001-0.000-0.004 ] [ CH-01M ]

<< Device Status and Configuration >>
<1> Device Service      [ On ]
<2> Default Config
<3> Port Reset
<4> CPU Upgrade
<5> FPGA Upgrade

.....
.....CCCC
```

At this point, the CPU code has already been erased. If power cycled, the console will again display CCCC, waiting for Xmodem file transfer. Use the terminal to transfer the file. Upgrade takes about 30 seconds.

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## About SFP Units

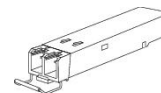
The FRM220-DS3/E3 accepts any SFP unit that complies with the MSA standard and supports 155M data rate. Follow all ESD precautions when handling the card and pluggable modules. Fiber optic components and cables are very sensitive to dirt, dust and mishandling, especially in high-speed networks. Dirty or mistreated fiber may cause errors and an unwanted degradation of signal quality. Remove the dust caps on SFP only when ready to plug in optical cables.

When selecting SFP optical modules, make sure the modules are able to support the required data rates. We have found that most gigabit SFP can support the lower 155M data rate.

### Installation

CTC Union supplied SFP modules are of the Bale Clasp type. The bale clasp pluggable module has a bale clasp that secures the module into the SFP cage.

- Inserting a Bale Clasp SFP Module into the cage  
Step 1 Close the bale clasp upward before inserting the pluggable module.  
Step 2 Line up the SFP module with the port, and slide it into the cage.
- Removing a Bale Clasp SFP Module  
Step 1 Open the bale clasp on the SFP module. Press the clasp downward with your index finger.  
Step 2 Grasp the SFP module between your thumb and index finger and carefully remove it from the SFP cage.



Bale Clasp type SFP with bale open

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