PRODUCT
Quick Start Guide

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User Guide

10G-3R Transponder

FRM220-10G-3R

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Version 1.2 December 2021

Introduction

The **FRM220-10G-3R** is a multi-rate, up to 10G 3R optical regeneration device. The "3R" consists of Re-amplification, Re-shaping and Re-timing. The transponder card converts a data signal to the correct wavelength for transmission on a specific channel by supporting SFP+ optics on both line side and client side interfaces. When the FRM220-10G-3R card is placed in the FRM220 rack with SNMP management, the management can view the converter card's status, type, version, fiber link status and alarms. The card can be configured to enable or disable the port, reset the port, provide diagnostic loopback, and set the desired data rate. The fiber optical ports also provide 1+1 optical protection. Automatic optical line Protection Switching is supported for the aggregate fiber port.

This card is specifically designed for four popular protocols that run at near ten gigabit speed. They include 10G Ethernet, 10G Fiber Channel, OC-192(STM-64) and OTU2.

Features

- Supports multiple protocols and data rates from 1 to 10Gbps.
- Repeater functions for re-amplification, re-shaping and re-timing.
- Low cost transponder application.
- Available with redundant fiber support.
- Supports rack management or stand-alone.
- Supports Auto-Laser Shutdown (ALS) and Link Fault Pass through (LFP).
- Supports Loopback test.
- Digital Diagnostic Monitor of supported SFP modules.

The SFP+ sockets support a wide range of optical modules to address any 10 Gigabit 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	
• **Transceiver Type**	SFP, SFP+
• **Connector**	LC
Data Rate	1~10Gbps
Duplex Mode	Full Duplex
Fiber	Depends on SFP(+)
Distance	Depends on SFP(+)
Wavelength	CWDM 1271~1611nm, DWDM 1529.5~1565.5nm
Indications	LED (PWR, SYS, MODE, TEST, FX1, FX2, FX3, FX4)
Power	(Card supports hot-swapping)
• **Input**	12V/1A
• **Consumption**	<10W
Dimensions	155mm (D) x 88mm (W) x 23mm (H)
Weight	120g
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	FX1 LB, FX2 LB, FX3 LB, FX4 LB

Management Features

The **FRM220-10G-3R** has an on-board 8 pole DIP Switch which can be used to configure the device for stand-alone operation when non-managed. When placed in a stand-alone chassis with DB9 console port, these devices also support a text based serial terminal with an easy to use menu system for configuration. 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
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.

Panel

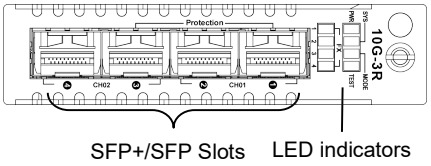


Figure 1. Front Panel of FRM220-10G-3R

Installation

This converter card can be placed in 1-slot CH01, CH01M w/console, 2-slot CH02M w/console, CH02-NMC with NMC or the full 20-slot CH20 chassis.

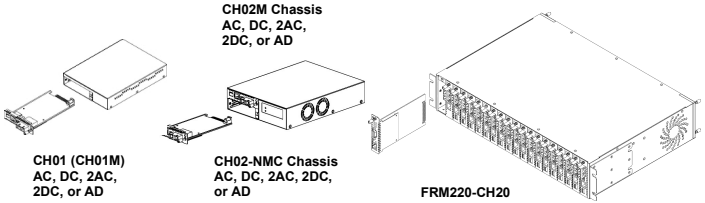
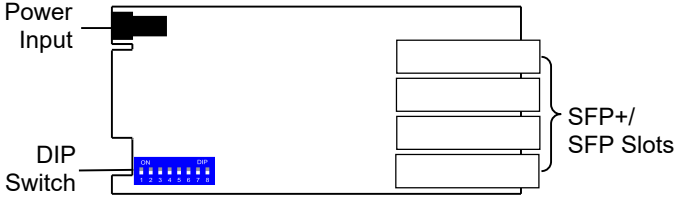


Figure 2. Slide-in Card mounting of FRM220-10G-3R

DIP Settings

DIP Switch On PCB



Transmission Protocol Mode & Date Rate

Transmission Protocol Mode	Data Rate	DIP Switch Pins					
		1	2	3	4	5	6
Ethernet	10GE	OFF	OFF	OFF	OFF	OFF	OFF
	1GE	**ON**	OFF	OFF	OFF	OFF	OFF
	2500Base-X	OFF	**ON**	OFF	OFF	OFF	OFF
SONET/SDH	OC192/STM64	OFF	OFF	OFF	**ON**	OFF	OFF
	OC48/STM16	**ON**	OFF	OFF	**ON**	OFF	OFF
	OC24	OFF	**ON**	OFF	**ON**	OFF	OFF
	OC12/STM4	**ON**	**ON**	OFF	**ON**	OFF	OFF
Fiber Channel	10G	OFF	OFF	OFF	OFF	**ON**	OFF
	8G	**ON**	OFF	OFF	OFF	**ON**	OFF
	4G	OFF	**ON**	OFF	OFF	**ON**	OFF
	2G	**ON**	**ON**	OFF	OFF	**ON**	OFF
	1G	OFF	OFF	**ON**	OFF	**ON**	OFF
CPRI	x20	OFF	OFF	OFF	**ON**	**ON**	OFF
	x16	**ON**	OFF	OFF	**ON**	**ON**	OFF
	x10	OFF	**ON**	OFF	**ON**	**ON**	OFF
	x8	**ON**	**ON**	OFF	**ON**	**ON**	OFF
	x5	OFF	OFF	**ON**	**ON**	**ON**	OFF
	x4	**ON**	OFF	**ON**	**ON**	**ON**	OFF
	x2	OFF	**ON**	**ON**	**ON**	**ON**	OFF
	x1	**ON**	**ON**	**ON**	**ON**	**ON**	OFF
OBSAI	x8	OFF	OFF	OFF	OFF	OFF	**ON**
	x4	**ON**	OFF	OFF	OFF	OFF	**ON**
	x2	OFF	**ON**	OFF	OFF	OFF	**ON**
	x1	**ON**	**ON**	OFF	OFF	OFF	**ON**
OTU	10GE OTU2e	OFF	OFF	OFF	**ON**	OFF	**ON**
	10GE OTU1e	**ON**	OFF	OFF	**ON**	OFF	**ON**
	STM64 OTU2	OFF	**ON**	OFF	**ON**	OFF	**ON**
	STM16 OTU1	**ON**	**ON**	OFF	**ON**	OFF	**ON**
	10GFC OTU2	OFF	OFF	**ON**	**ON**	OFF	**ON**
ODU	10GE ODU2e	OFF	OFF	OFF	OFF	**ON**	**ON**
	10GE ODU1e	**ON**	OFF	OFF	OFF	**ON**	**ON**
	STM64 ODU2	OFF	**ON**	OFF	OFF	**ON**	**ON**
	STM16 ODU1	**ON**	**ON**	OFF	OFF	**ON**	**ON**
SDI/Other	HD-SDI	OFF	OFF	OFF	**ON**	**ON**	**ON**
	HD-SDI/1.001	**ON**	OFF	OFF	**ON**	**ON**	**ON**
	3G-SDI	OFF	**ON**	OFF	**ON**	**ON**	**ON**
	3G-SDI/1.001	**ON**	**ON**	OFF	**ON**	**ON**	**ON**
	6G-SDI	OFF	OFF	**ON**	**ON**	**ON**	**ON**
	6G-SDI/1.001	**ON**	OFF	**ON**	**ON**	**ON**	**ON**
	12G-SDI	OFF	**ON**	**ON**	**ON**	**ON**	**ON**
	12G-SDI/1.001	**ON**	**ON**	**ON**	**ON**	**ON**	**ON**

Working Mode & Function Setting

Working Mode	Function Setting	DIP Switch Pins	
		7	8
Protection Mode	Auto-Revert	OFF	OFF
	Non-Revert	OFF	**ON**
Dual Channel Mode	LFP Disable	**ON**	OFF
	LFP Enable	**ON**	**ON**

Note: All of these settings 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.)

LED Indicators

LED	*Color*	*State*	*Status*
PWR	Green	On	Power on
		Flash (1 sec On/ 1 sec Off)	Device is disabled
		Off	No power
SYS	Green	On	Normal
		Flash	Starting firmware upgrade
		Off	System fail
MOD E	Green	On	Protection Mode
		Off	Dual Channel Mode
TEST	Red	On	Loopback Test Mode
		Off	Normal
FX1 ~ FX4	Green	On	CDR SYNC
		Flash (0.5 sec On/ 0.5 sec Off)	Link is up
		Flash (0.1 sec On/ 0.1 sec Off)	Under Loopback testing
		Flash (3 sec On/ 0.2 sec Off)	Working path (For FX2 & FX3 link)
		Off	Link loss / RX power lower

Note: In protection mode, FX4 LED is always off.

Console Management

When placed in the 1-slot CH01M 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 or Win7.

Settings

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

Connect the serial cable to the CH01M or CH02M's DB9. Run the terminal emulation program. When prompted with Password, enter “admin”. Then, press [Enter] to display the "Main Menu" screen. The following is an example.

```
                 ****************************************
                 ***  CTC UNION TECHNOLOGIES CO.,LTD   ***
                 ***   FRM220-10G-3R                   ***
                 ****************************************
            Ver:[1.000-1.000-0.000-0.000]      [CH-01M   ]

                 [ SFP 1 ]      [ SFP 2 ]      [ SFP 3 ]
-------------------------------------------------------------------------
 Present        No             No             No
 Link           DOWN           DOWN           DOWN
 CDR            Unlocked       Unlocked       Unlocked
 DDM            No             No             No
 Tx Fault       Failure        Failure        Failure

        < 1 > Port Active     [Enable ]
        < 2 > Work Mode       [Protection]
        < 3 > Protection Function
        < 4 > Fiber Configuration
        < 5 > Loopback Test Function
        < 6 > Device Configuration
        < 7 > Semi-Active     [Enable ]

        < R > Device Reset
        < D > Set To Default
        < S > Store Parameters
        < U > Firmware Upgrade with Xmodem
        < P > Password Setup

        [ ESC ] Logout
```

Figure 3. Main Menu Console Screen

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 "s" from the main menu to save the parameters in non-volatile RAM (NVR). To revert to previous settings before saving, press "r" to reset (reload previously saved parameters).

Explanation of Settings:
1. Port Active: This will enable or disable the card. When inactive, no transmissions will be able to occur.
2. Work Mode: Select Protection or Dual Channel work mode.
3. Protection/Dual Channel Function: Select working path and data rate under Protection/Dual Channel work mode.
4. Fiber Configuration: Set up Auto Laser Shutdown and Link Fault Pass Through and view SFP DDMI information.
5. Loopback Test Function: Enable or disable Loopback test function.
6. Device Configuration: Read the current temperature of the chip.
7. Semi Active: This function works under Protection “Auto-Revert” & “Non-Revert” mode. When enabled, Secondary path will be blocked when Primary path works and vice versa. In short, one path is allowed for transmissions when enabled.

R. Device Reset: Parameter settings in NVR will be reloaded.
D. Set to Default: Restores all settings to factory default.
S. Store Parameters: Saves the setting parameters into non-volatile RAM (NVR)
U. Firmware Upgrade with Xmodem: Upgrade the Firmware image.
P. Password Setup: Set up a new login password.

Auto Laser Shutdown

Automatic Laser Shutdown (ALS) is a technique used to automatically shut down the output power of the transmitter in case of fiber break according to ITU-T G.664. This is a safety feature that prevents dangerous levels of laser light from leaking out of a broken fiber, provided ALS is provisioned on both ends of the fiber pair. The sequence of events is as follows. If a fiber is cut, the receiver will detect a Loss Of Signal (LOS). The ALS agent will turn off the transmitter. The receiver at the far end will then detect an LOS and its ALS agent will turn off the transmitter. In this way the entire fiber will go dark.

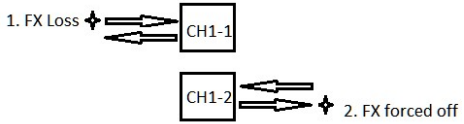
Link Fault Pass-through

Link Fault Pass Through (LFP) is a diagnostic feature that allows network personnel to visually identify a fault on a network segment.

For example, when enabled for CH1-1, if the transponder on CH1-1 side has a received FX link loss, the transponder will disconnect the transmit link on FX out of CH1-2. Any device on the CH1-2 side will know there is a linkage error.

The LFP function can be individually enabled in one direction or the other, or can be enabled in both directions, such as when the transponder is physically between two switches.

The LFP function can immediately inform network administrators the problem of the link media and provide efficient solution to monitor the network, which can minimize the down time caused by the link problem.



LFP action with CH1-1 enabled

Digital Diagnostics in SFP/SFP+

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 or SFP+, such as optical output power, optical input power, temperature, etc.

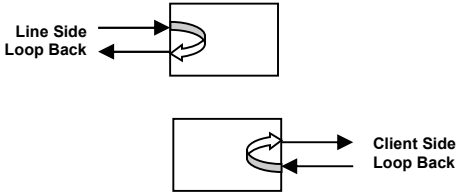
```
                 ****************************************
                 ***  CTC UNION TECHNOLOGIES CO.,LTD  ***
                 ***  FRM220-10G-3R                   ***
                 ****************************************
              Ver:[1.000-1.000-0.000-0.000]      [CH-01M   ]


<< Optical D/D Function Status >>

< 1 > LOS Alarm By Rx Power    [Disable]


 Vendor Name        :[CTC UNION         ]
 Vendor Part Number :[SFM-1000-SR85     ]
 Optical Type       :[ Multi   ]
 Wave Length        :[ 0850 nm ]

 Link Length        :[ 0080  m ]
 Tx Power           :[ -03 dBm ]
 Rx Power           :[ -40 dBm ]
 Rx Sensitivity     :[ -10 dBm ]
 Temperature        :[  33 C   ]


  [ ESC ] Go to previous menu. Please select an item.
```

Figure 4. ***Example of reading Digital Diagnostics in SFP***

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.

Loopback Testing (LBT)

The loop back capability of the **FRM220-10G-3R** is useful for debugging a dysfunctional link, or when commissioning a site. In loopback mode, the signal is routed into the CDR circuitry and then routed back to the signal source.



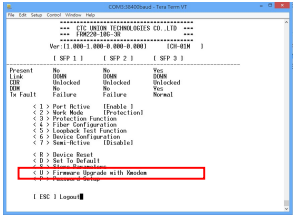
FRM220-10G-3R model can do loop back through one of the management interfaces i.e. local console or NMC. The loop back function is enabled by using a serial terminal connected to the 9 pin D-Sub on CH01M or CH02M, via the terminal menu system. If placed in FRM220-CH20 with NMC/SNMP, the chassis management system can access the card and perform all setting functions.

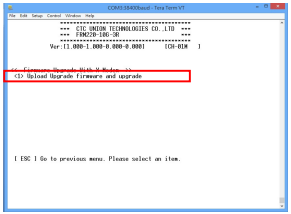
Stand-alone Firmware Upgrading

The **FRM220-10G-3R** card may be firmware upgraded using XMODEM when placed in CH01M or CH02M. The user may use serial terminal such as a notebook computer that has an RS232 port or via a commonly available USB to RS232 adapter. Then, use a serial terminal that can support XMODEM such as TeraTerm to start Firmware upgrade process.

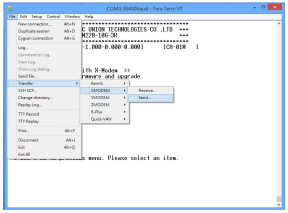
Quick Procedure

1. In the Main Menu, Key in “U” to enter Firmware upgrade page. Then, Key in “1” to start uploading Firmware.

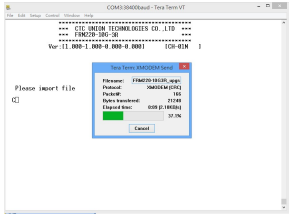




2. Send Firmware file via Xmodem and select the Firmware file that you want to upload.



3. Start upgrading new Firmware image.



4. Check the Firmware version after completing the Firmware upgrade process.

```
*****************************************
***    CTC UNION TECHNOLOGIES CO.,LTD   ***
***    FRM220-10G-3R                    ***
*****************************************
Ver:[1.000-0.001-0.000-0.000]       [CH-01M   ]
```

NMC Firmware Upgrading

The **FRM220-10G-3R** card may be firmware upgraded when it is placed in the FRM220 with NMC management card. The 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

Place the line card's upgrade code on the TFTP server. Make sure you know the case sensitive file name. Connect to the FRM220-NMC by local console or by remote Telnet connection. From the main menu choose:

<L> SNMP System Configuration Setup

Then:

<U> Upgrade Line Card Menu

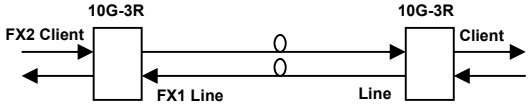
```
                ****************************************
                *** CTC UNION TECHNOLOGIES CO., LTD. ***
                *** FRM220 NMC             VER. 2.01 ***
                ****************************************
                      << Upgrade Line Card Menu >>
          Target IP        : 59.125.162.252
          Target Gateway   : 59.125.162.241
          TFTP Server IP   : 59.125.162.243

  Please select a card type:
  <1> : FRM220-10/100I and FMC-10/100I    <3> : FRM220-10G-3R
  <2> : FRM220-FXO/FXS                    <4> : FRM220-155MS
  <5> : FRM220-DATAPORT                   <6> : FRM220-E1/T1
  <7> : FRM220-1000EDS/1000ES-2F  <8> : FRM220-1000ES-1/1000E-1/1000E-2F
  <9> : FRM220-10/100IS-2                 <A> : FRM220-1000TS/1000T
  <B> : FRM220-3R-2.7G-2S/3S              <C> : FRM220-5E1/ET100T
  <D> : 5E1/ET100S                        <E> : FRM220-4G-3R
  <F> : E1/Data                           <G> : FRM220-16G-3R
 <ESC>: Previous Menu
  The card type = FRM220-10G-3R
  Please enter the slot number '2'~'20' or 'all': 3
  The slot number = 3
  Please select <1>: Local <2>: Remote Unit <3>: Remote B Unit
                <ESC>: Previous menu.
```

Select the line card type (FRM220-10G-3R) and local unit. Enter filename.

The upgrade should complete in only a couple of minutes. DO NOT disconnect or pullout/insert any other cards during the upgrade process.

Applications

The FRM220-10G-3R repeater works in point-to-point applications, either as a stand-alone or when placed in the FRM220-CH20 managed rack.

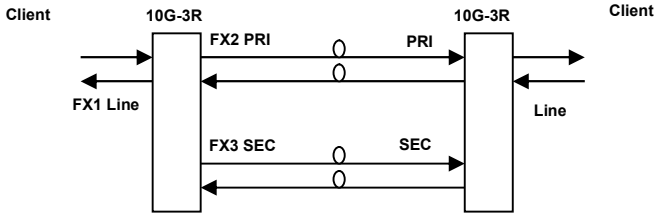


Extension Repeater

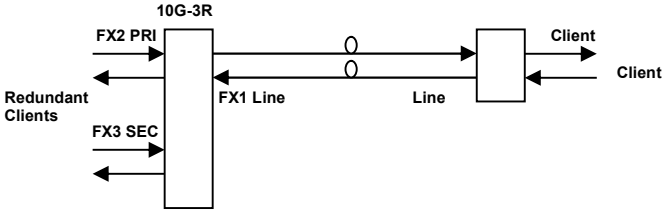
Set local and remote 3R repeater to the protocol's data rate either by local DIP or through management. The rate setting is the only setting required.

Protection

The **FRM220-10G-3R** has the ability to provide 1+1, auto revertive and non-revertive protection for single input, repeater/media converter applications on each trunk. This first application of protection is line side protection. In this setup, the line connector actually faces the client.



The second application provides for redundant clients and automatic fall over.



CWDM Transponder

The **FRM220-10G-3R** functions primarily as a repeater or a media converter. As a repeater for long-haul applications, the signal is fully regenerated at the trunk. Clock Data Recovery (CDR) helps in reshaping, retiming, and regenerating (3R) the output signal at a number of pre-assigned frequencies or protocols.

Dual Channel

In the CWDM/DWDM (Dual Channel) application, the 3R transponder acts as a fiber-to-fiber repeater and optical frequency converter between the client side equipment and the Optical Multiplexer/De-multiplexer. You can set the transponder to the protocol's data rate either by local DIP or through management.