PRODUCT
Quick Start Guide

User Guide

10G 3R Transponder
FRM220-10G-SXX (H/W ver.1.1)

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Version 1.1 October 29, 2012 (Update)

Introduction

FRM220-10G-SXX is a 3-port 3R optical regeneration device with clock data recovery (CDR). 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 XFP, and/or SFP+ optics on both line side and client side interfaces. When **FRM220-10G-SXX** card is placed in **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 client or line side diagnostic loopback, Link Fault Forwarding, and set the desired data rate.

This card is specifically designed for popular protocols that run at near ten gigabit speed. Version 1.1 H/W supports Ethernet 1G (1.25G) and 10G (10.3125G), Fiber Channel 1(1.0625G), 2(2.125G), 4(4.25G), 8(8.5G) & 10G(10.5187G), 16x CPRI(9.8304G), OC-192/STM-64(9.95328G) and G.709 OTU2(10.709225G).

With its single SFP+ and dual XFP sockets, this converter can be configured to support SFP+ to XFP, XFP to XFP, and SFP+ to two XFP with 1+1 fiber protection.

The XFP and/or SFP+ sockets support a wide range of optical modules to address any 10 Gigabit network application.

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** 2-XFP and 1-SFP+ cage
  - **Data rate** 1Gbps ~ 10Gb/s (selectable fixed rates)
  - **Duplex mode** Full duplex
  - **Fiber** Depends on XFP/SFP+
  - **Distance** Depends on XFP/SFP+
  - **Wavelength** Depends on XFP/SFP+
  - **Voltage** 3.3V for SFP+ / 5V, -5.2V, 3.3V, 1.8V for XFP
  - **Clock** SFP+ requires no reference clock
    XFP with or without reference clock
- **Indications** LED (PWR, SYS, Line Link, Pri/Sec Link, Locked, Test)
- **Power** (Card supports hot-swapping)
  - **Input** Card : 12VDC, Standalone : AC, DC options
  - **Consumption** <12W
- **Dimensions** 155 x 88 x 23mm (D x W x H)
- **Weight** 150g
- **Temperature** 0 ~ 50°C (Operating), 0 ~ 70°C (Storage)
- **Humidity** 10 ~ 90% non-condensing
- **Certification** CE, FCC, LVD, RoHS
- **MTBF** 75000 hrs (25°C)
- **Test Loops** Line LB, Primary LB, Secondary LB

Management Features

FRM220-10G-SXX has an embedded processor which can be used to configure the device for stand-alone operation. When placed in a stand-alone chassis with DB9 console port, these devices 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 local console or remote Telnet, Web HTTP or SNMP.

1. Stand-alone - with serial console, menu driven
2. Rack management - When placed in NMC managed rack, all other settings are overridden by the NMC management.
3. Due to their power requirements and high heat dissipation, CTC Union recommends placing no more than 10 cards in CH20 rack with empty space between each card.

Panel

- Figure 1. Front Panel of FRM220-10G-SXX

FRM220-10G-SXX SFP+ to XFP 1+1 protection
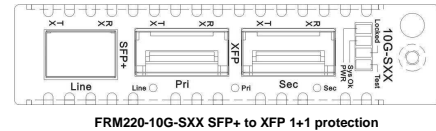
Operation Modes

10G-SXX is constructed with three ports and is programmable to send bi-direction data between any two ports as follows:

Manual Primary – data is routed between the line side SFP+ and the primary XFP. Use this mode for SFP+ to XFP conversion.
Manual Secondary – data is routed between the line side SFP+ and the secondary XFP. Use this mode for SFP+ to XFP conversion also.
Primary-Secondary – data is routed between the primary and secondary XFP. Use this mode for XFP to XFP conversion.

**1+1 modes** (from SFP+ to either primary or secondary XFP)
Auto – automatic protection switching, revertive
Semi-auto – automatic protection switching, non-revertive.

Installation

- Figure 2. Slide-in Card mounting of FRM220-10G
Note: Due to higher current requirements and excessive heat dissipation, this converter card can only be placed in CH-02M, CH02-NMC or the CH-20 chassis.
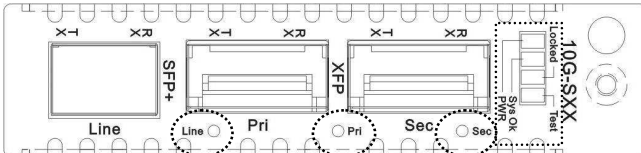

CH02M Chassis
AC, DC, 2AC, 2DC, or AD

CH02-NMC Chassis
AC, DC, 2AC, 2DC, or AD

FRM220-CH20
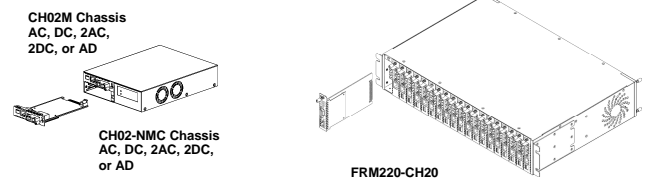
Follow all ESD precautions when handling the card and XFP/SFP+ modules.

LED Indicators

LED		State	Status
PWR	(Green)	On	Power on
		Flash	During upgrade
		Off	No Power
SysOK	(Green)	On	System is OK
		Off	System fault
Locked	(Green)	On	Line and Client CDR clock locked
		Off	Line or Client CDR clock not locked
Test	(Red)	On	Loop Back test active
		Off	Normal
Line (link)	(Green)	On	Line (SFP+) has link
		Off	Line (SFP+) no link
Pri (link)	(Green)	On	Client Primary Fiber link
		Off	Client Primary Fiber no link
Sec (link)	(Green)	On	Client Secondary Fiber link
		Off	Client Secondary Fiber no link

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.

Console Management

When placed in the 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 your 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 CH02M's DB9. Run the terminal emulation program. About 35 seconds after being powered on, the 10G-SXX will display the main menu as shown in the following example.

```
****************************************
***  CTC UNION TECHNOLOGIES CO.,LTD  ***
***  FRM220-10G Manager    Ver:1.01  ***
****************************************
   Model:[FRM220-10G-SXX]  Ver:[1.100-1.001-0.000-0.000]   [CH-01M  ]
   Line   Side Link:    [Down]         CDR Lock     [Unlock ]
   Primary Side Link:   [Down]         CDR Lock     [Unlock ]
   Second  Side Link:   [Down]         CDR Lock     [Unlock ]
<1> Port Active:        [Enable ]      System Status [OK     ]
<2> Operating Mode:     [Auto    ]     Select Port  [Primary    ]
<3> Baud Rate Select:   [10G Ethernet ]
<4> Loopback Function
<5> Link Fault Pass-Through
<6> Auto Laser Shutdown
<7> Port Reset
<8> Main Board State
<9> Line  Side Built-In Self Test
<A> Client Side Built-In Self Test
<D> Digital Diagnostic
<F> Factory Default
<S> Store Parameters
Please select an item.
```

Example of Main Menu Console Screen, **FRM220-10G-SXX**

Notice: All settings done by console menu are ignored if the card is placed in 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.)

Main Menu 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 "7" to port 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. **Operating Mode**: Auto, semi-auto, manual primary, manual secondary, and 1+1 protection mode settings are available. Refer to page 3 for more.
3. **Baud Rate Select**: This will bring up the data rate selection list. Select the required 3R recovery speed by choosing the protocol.
4. **Loopback Function**: This brings up the loop back sub menu for Line, Primary and Secondary port loop back.
5. **Link Fault Pass-Through**: Open the sub menu for LFP functions
6. **Auto Laser Shutdown**: Open the sub-menu for ALS functions
7. **Port Reset**: This will cause the parameters settings in NVR to be reloaded.
8. **Main Board State**: View the chip temperature on the main board.
9. **Line Side Built-In Self Test**: Provides BER traffic generator and pattern testing utility for testing line side optics.
A. **Client Side Built-In Self Test**: Provides BER traffic generator and pattern testing utility for testing client side optics.
D. **Digital Diagnostics**: Enables user to read the serial data stored in XFP/SFP+ modules.
F. **Factory Default**: Restores all settings to factory default.
S. **Store Parameters**: Saves the setting parameters into non-volatile RAM (NVR)

Operating Mode:

```
Fiber Detect Mode:
<0> Auto   <1> SM Auto   <2> Manual Pri   <3> Manual Sec  <4> Manual Pri
to Sec
<ESC> Go to previous menu.
Please select an item.
```

These operating modes are selected when the converter is being used as a 1+1 protection on XFP. Auto is a revertive mode, semi-auto is non-revertive. The other modes are all manual. Refer to page 3 for a description of each mode.

Baud Rate Selection:

```
Baud rate select:
<0> 10G Ethernet  <1> 10G Fiber-CH  <2> OC-192/STM-64
<3> G.709 OTU2    <4> 1X Fiber-CH   <5> 2X Fiber-CH
<6> 4X Fiber-CH   <7> 8X Fiber-CH   <8> 1G Ethernet
<9> 16x CPRI
<ESC> Go to previous menu.
Please select an item.
```

These data rates are rather obvious. 10G and 1G Ethernet are supported as is SDH and Fiber Channel 1, 2, 4, 8 and 10.

Loop Back (see page 8)

```
<0> All Port Loopback: [Disable]
<1> Line     Loopback: [Disable]
<2> Primary  Loopback: [Disable]
<3> Second   Loopback: [Disable]
<ESC> Go to previous menu.
Please select an item.
```

The converter can set loop back on any port or even all ports at once.

Mainboard Status: reads the VSC8242 chip temperature

```
   MainBoard Status
 Junction Temperature: [ +062 C  ]
<ESC> Go to previous menu.
Please select an item.
```

The chip is designed to run very hot, but if it gets too hot, data errors may result.

Loop Back Testing (LBT):

The loop back capability of **FRM220-10G** is useful for debugging a dysfunctional link, or when commissioning a site. In loopback mode, the signal is routed into the CDR (Clock Data Recovery) circuitry and then routed back to the signal source. **FRM220-10G-SXX** model features loop back for each of the three fiber ports, Line, Primary and Secondary. Loop back may be enabled via management terminal console. When placed in a managed FRM220-CH20 chassis, the loop back can be controlled by the NMC manager in FRM220 chassis.

10G Fiber Loop Back
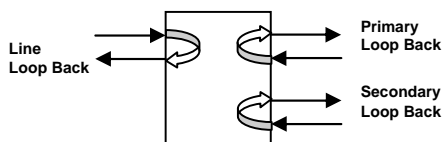
Take care when performing loop back functions, especially with Ethernet and Fiber Channel. Looping could have adverse effects on the transport medium.

BIST (Built-in Self Test)

FRM220-10G-SXX model features a built-in self test utility which can be run from local serial console. By combining a pattern generator with line/client pattern checker and error counter, **10G-SXX** can provide some basic optical tests without requiring expensive external test equipment. The generated signal is a pseudo-random binary sequence chosen from one of four patterns (PRBS 7, 9, 23 or 31). The transmitted pattern may be sent normally or inverted, from either line or client side. The checked pattern may also be normal or inverted. An error counter is maintained and can also be cleared.

Before running BIST, make sure the generator and checker are linked, either through a selected loop back or from point-to-point devices. The set the BIST generator to 'enabled' and monitor the 'error counter'. To stop testing, set the generator to 'disable'.

Applications

FRM220-10G 3R repeater works in point-to-point applications, either as a stand-alone or when placed in FRM220-CH20 managed rack.
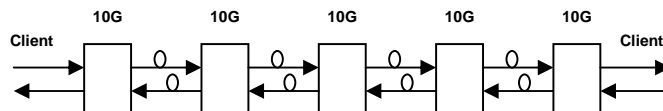
Extension Repeater
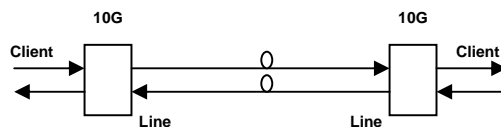
Set local and remote 3R repeater to the protocol's data rate either by local terminal or through network management. The rate setting is the only setting required.

For normal operation, ensure that no Loop Back is configured.

Multiple Repeaters

Set all 3R repeaters to the protocol's data rate either by local terminal or through network management. The rate setting is the only setting required.

For normal operation, ensure that no Loop Back is configured.

Since **FRM220-10G 3R** transponder has a clock recovery function, it is able to repeat indefinitely and still maintain data integrity.

CWDM Transponder

FRM220-10G 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 for different protocols.

In the CWDM/DWDM 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.

FRM220-CH20 20-slot chassis
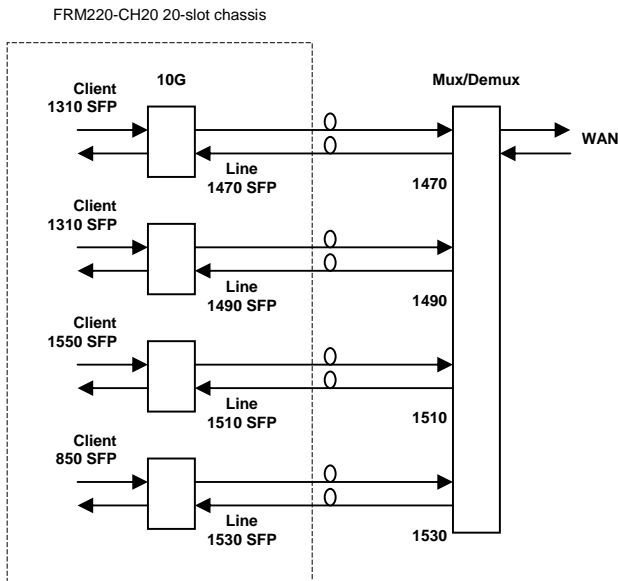
Set the transponder to the protocol's data rate either by local terminal or through management. The rate setting is the only setting required.

Digital Optical Monitoring

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 input power, temperature, etc.

Example of reading Digital Diagnostics in XFP

```
*****************************************
***   CTC UNION TECHNOLOGIES CO.,LTD   ***
***   FRM220-10G Manager    Ver:1.01   ***
*****************************************
   XFP/SFP+ Digital Diagnostic
<1> Line Side Digital Diagnostic:   [Have]
<2> Client Side Digital Diagnostic: [Have]
------------------------------------------------
  Line Side:
  Vendor Name           :[FINISAR CORP.    ]
  Vendor Part Number    :[FTLX8511D3       ]
  Fiber Type            :[Multi  ]
  Tx Wave Length        :[0850 nm ]
  RX Wave Length        :[0850 nm ]
  Link Length           :[0082  m ]
  Tx Power              :[  -03 dBm]
  Rx Power              :[  -13 dBm]
  Rx Sensitivity        :[   00 dBm]
  Temperature           :[   42 C  ]
<ESC> Go to previous menu.
```

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

Additional SFP+/XFP requirements:
1. All voltage types supported.
2. With or without reference clock.
3. SFP+ supporting multi-rates
4. XFP narrow band specific for 1,2,4,8G FC or 10GE/FC/SDH

Upgrading

The **FRM220-10G** 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 TTL 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-SERIAL
<2> : FRM220-FXO/FXS                   <4> : FRM220-155MS
 %< Snip ...
<F> : FRM220-3R-10G/SS/SX/XX           <G> : FRM220-3R-10G/SS/SX/XX CDR
<H> : FRM220-MUX/DEMUX                 <I> : FRM220-E1/DATA
<J> : FRM220-FOM04                     <K> : FRM220-FOM04 FPGA
<M> : FRM220-FTEC                      <N> : FRM220-2R-4G/2S/3S
<O> : FRM220-10G/SXX/SX/XX             <P> : FRM220-10/100I-2E
<R> : FRM220-FSW103                    <S> : FRM220-FOM01
<T> : FRM220-1002ES                    <U> : FRM220-ET100
<ESC>: Previous Menu
 The card type = FRM220-10G/SXX/SX/XX
 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 (3R-10G) 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.

About XFP/SFP+ Units

The **FRM220-10G** accepts any XFP or SFP+ unit that complies with the MSA standard. It will also accept "multiple voltage" XFPs and should not be a problem for any new XFP. 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 XFP/SFP+ only when ready to plug in optical cables.

When selecting XFP/SFP+ optical modules, make sure the modules are able to support the required data rates. A 10G XFP/SFP+ should be able to support 10G Ethernet, OC-192/STM-64, or 10G Fiber Channel.

Installation

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

- Inserting a Bale Clasp XFP/SFP+ Module into the cage
  Step 1 Close the bale clasp upward before inserting the pluggable module.
  Step 2 Line up the XFP/SFP+ module with the port, and slide it into the cage.

- Removing a Bale Clasp XFP/SFP+ Module
  Step 1 Open the bale clasp on the XFP/SFP+ module. Press the clasp downward with your index finger.
  Step 2 Grasp the XFP/SFP+ module between your thumb and index finger and carefully remove it from the XFP/SFP+ cage.
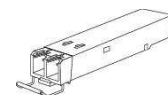
Bale Clasp type SFP+ with bale open