PRODUCT
Quick Start Guide

CTC Union Technologies Co.,Ltd.
Far Eastern Vienna Technology Center
(Neihu Technology Park)
8F, No. 60 Zhouzi St., Neihu, Taipei 114,
Taiwan

T +886-2-26591021
F +886-2-26590237
E sales@ctcu.com
info@ctcu.com
marketing@ctcu.com
H www.ctcu.com

ISO 9001 Quality System Certified

User Guide

1-CH E1/T1 + 100M Ethernet Fiber Multiplexer

FRM220-FOM01 and FRM220-FOM01-SFP

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Introduction

FRM220-FOM01 is a single channel E1/T1 fiber multiplexer with an additional wire speed 100M Ethernet trunk, constructed as a one slot wide card for FRM220 series. When **FRM220-FOM01** card is placed in FRM220 rack with NMC, the management can view the multiplexer card's status, type, version, fiber link status and alarms. The card can be configured to enable or disable the port, reset the port, and provide local or remote diagnostic loopback.

The optical aggregate of this multiplexer employs either fixed transceiver or industry standard pluggable optics (SFP) that operate at OC3/STM-1 data rates (155M) depending on model. The aggregate can be chosen to support any of the following:

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

Features

- 1 channel unframed E1/T1 plus wire speed 10/100Base-TX Ethernet
- Auto MDI/MDIX, Auto-Negotiation or Force mode
- Supports flow control
- Supports 9k Jumbo packets
- Supports Link Fault Pass through (LFP)
- Supports Digital Diagnostics Monitoring Interface (DDMI with SFP model)
- Loopback tests for E1/T1 and fiber port
- Supports Dying Gasp (senses remote power failure)
- Supports local and remote In-band management
- Stand-alone monitor and configuration by menu driven serial console port
- Supports On-Line F/W upgrade (via FRM220-NMC management)

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

E1/T1 Interface

▪ Framing	Unframed (transparent)
▪ Bit Rate	E1:2.048 Mb/s , T1: 1.544Mb/s
▪ Line Code	E1:AMI/HDB3, T1: AMI/B8ZS
▪ Line Impedance	E1: Unbalanced 75 ohms (BNC cable) E1: Balanced 120 ohms (RJ48C) T1: Balanced 100 ohms (RJ48C)
▪ Rx sensitivity	Short haul
▪ "Pulse" Amplitude	Nominal 2.37V+/-10% for 75 ohms Nominal 3.00V+/-10% for 120 ohms
▪ "Zero" Amplitude	Nominal +/-0.3V
▪ Internal Timing	+/-50 ppm
▪ Jitter Performance	According to ITU-T G.823
▪ Performance Monitor	According to ITU-T G.821
▪ Standards	ITU-T G.703, G.704, G.706 and G.732
▪ I/F Connector	RJ-45, BNC(via RJ-45 to BNC adapter cables)
▪ Test Loops	LLB (Local Loop Back) RLB (Remote Loop Back)

Ethernet Interface

▪ Interface Type	10/100Base-TX
▪ Connector	RJ-45
▪ Standards	IEEE 802.3, 802.3u
▪ Duplex modes	Full/Half
▪ Test Loops	None

Miscellaneous

▪ Indicators	Fx Link, E1/T1 Mode/Link/Loopback test, LAN Link/Speed.
▪ Power Input	AC adapter, 12VDC
▪ Dimensions	88 x 21 x 139mm(HxWxD)
▪ Temperature	0 ~ 60℃ (Operating), -10 ~ 70℃ (Storage)
▪ Humidity	10 ~ 90% RH (non-condensing)
▪ Certifications	CE (EMC&LVD), FCC, RoHS

Management Features

FRM220-FOM01 has no jumpers or DIP switches, making it completely software configurable. When placed in a stand-alone chassis, this device supports a text based serial terminal with an easy to use menu system for configuration. When placed in a managed chassis, **FOM01** is configured and monitored through chassis NMC (network management controller) via console, Telnet, Web HTTP or SNMP.

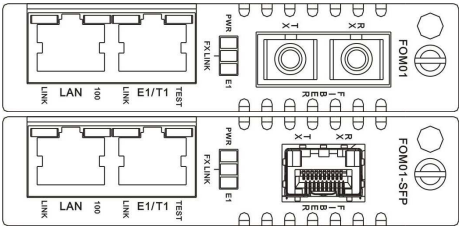
1. Stand-alone - with serial console and menu driven settings
2. Rack management - When placed in NMC managed rack, all other settings are overridden by NMC management.

Panel

There are 2 x RJ-45 connectors, one for E1/T1 channel (USOC RJ48C connection to balanced E1 or T1) and one for Ethernet. Do not mix them up.

The optical aggregate utilizes SFP cage or fixed transceiver. SFP used must support 155M (OC3/STM1) data rates and be MSA compliant.

The single LAN connector (RJ-45) supports 10/100Base Ethernet connection with auto-negotiation and auto-MDIX.



▪ Figure 1. Front Panel of FRM220-FOM01 and FOM01-SFP

Installation

Note: Unless **FOM01** is placed in 20 slot or 2 slot chassis with NMC, this multiplexer card can only be placed in the CH01M or CH02M as stand-alone.

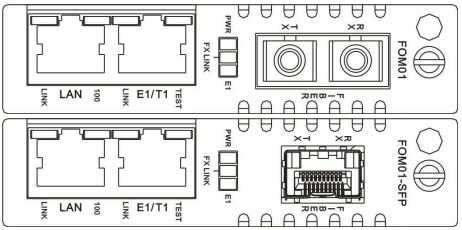
FRM220-CH20
aka. FMUX20

CH01M-AD Chassis
Internal AC+ DC
w/ console port

▪ Figure 2. Slide-in Card mounting of **FRM220-FOM01**

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

LED Indicators



▪ Figure 3. Panel LED indicators of **FRM220-FOM01**

LED		*State*	*Status*
PWR	(Green)	On	Unit is powered normally
		Off	Unit is powered off or bad
FX LINK	(Green)	On	Optical Fiber Linked
		Off	Optical Fiber no link
E1	(Green)	On	E1 Mode, 75 Ohm
		Flash	E1 Mode, 120 Ohm
		Off	T1 Mode, 100 Ohm
E1/T1 LINK	(Green)	On	E1/T1 Signal Present
		Off	E1/T1 LOS
E1/T1 TEST	(Amber)	On	E1/T1 Loop Back Test active
		Off	Normal
LAN LINK	(Green)	On	Ethernet UTP has link
		Flash	Ethernet UTP has link and traffic
		Off	No UTP link
LAN 100	(Green)	On	Speed is 100M
		Off	Speed is 10M

Console Management

When placed in the 1-slot CH01M 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. **FOM01** with CH01M uses the DB9 serial connector labeled "CONSOLE" and a DB9M to DB9F one-to-one cable to connect to the PC COM port. Connect the DB9F labeled "CONSOLE" to the COM port of the management PC. When placed in CH02M chassis, connect console to CH02M's DB9F and slide the switch to the right slot number.

Settings

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

Connect the serial cable directly to CH01M's DB9F. 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-FOM01 Manager Ver:1.00   ***
                  ****************************************
    [Local ]  Version:[1.000-1.000-0.000-1.200] [ FOM01-SFP ] [CH01M]
<1> Device  Service     [ On    ]
<2> Fiber   Status and Configuration
<3> E1/T1   Status and Configuration
<4> LAN     Status and Configuration
<5> Store   Configuration
<6> Default Configuration
<P> Setting Password
<T> Switch To Remote Menu   [ Absent  ]
Please select an item.
```

Example of Main Menu Console Screen, FRM220-FOM01

Notice: All of these settings 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 Description

<1> Device Status – under this menu will be the device service status.
<2> Fiber – this menu provides access to the fiber optical related functions including link status, port activation, loop back tests and viewing of SFP DD functions.
<3> E1/T1 – Sets the E1/T1 mode and then provides status and configuration for the E1/T1 channel, including service activation, line code setting, and loop back functions.
<4> LAN – The LAN sub-menu provides status and port setting for auto/forced, flow control and Link Fault Pass thru (LFP).
<5> Store – This key-in provides saving all settings.
<6> Default – The key-in will return the device to factory default settings.
<P> Setting Password – Protect against unauthorized access.
<T> Remote – when a fiber link exists between the local and remote **FOM01** (in-band is active), using this will 'toggle' between local and remote management.

Device Status

```
                ****************************************
                ***  CTC UNION TECHNOLOGIES CO.,LTD  ***
                ***  FRM220-FOM01 Manager Ver:1.00   ***
                ****************************************
    [Local ]  Version:[1.000-1.000-0.000-1.200] [ FOM01-SFP ] [CH01M]

------------------------------------------------------------------------
Device Service Select:
<1>: Service On   <2>: Service Off
<ESC> Go to previous menu. Please select an item.
```

<1> Service On – Use this item to place the entire FOM01 IS (in service or On).
<2> Service Off – Use this item to place the entire FOM01 OOS (out of service or Off).
<ESC> Escape – Go back to the main menu.

Fiber

From the main menu, select item number 2 to access the fiber status menu.

```
                ****************************************
                ***  CTC UNION TECHNOLOGIES CO.,LTD  ***
                ***  FRM220-FOM01 Manager Ver:1.00   ***
                ****************************************
    [Local ]  Version:[1.000-1.000-0.000-1.200] [ FOM01-SFP ] [CH01M    ]

<< Fiber Status and Configuration >>
    OP Link  [ Up   ]   Remote PWR  [   OK    ]
    OP Small Form Pluggable:[ Yes ] Digital Diagnostic Function:[ Yes ]
<1> Loop Back Test Mode [ Disable ]

 Vendor Name            :[FIBERXON INC.    ]
 Vendor Part Number     :[FTM-3125C-L40    ]
 Fiber Type             :[Single  ]
 Tx Wave Length         :[1310 nm ]
 RX Wave Length         :[1310 nm ]
 Link Length            :[0040 Km ]
 Tx Power               :[ -11 dBm]
 Rx Power               :[ -41 dBm]
 Rx Sensitivity         :[ -52 dBm]
 Temperature            :[  39 C  ]

<ESC> Go to previous menu. Please select an item.
```

Note: Tx Power, Rx Power, Rx Sensitivity and Temperature are only available in SFP modules that support optional DOM (digital optical monitoring) or DD function.

<1> Loop Back Test Mode – Use this menu item to activate one of the loop back modes for the fiber link. Refer to page 10 for available loop back modes.

```
------------------------------------------------------------------------
Fiber Port Loop Back Test Function Select:
<1>: Disable   <2>: LLB <3>: RLB
<ESC> Go to previous menu. Please select an item.
```


E1/T1

From the main menu, select item number 3 to access the E1/T1 status menu.

```
    [Local ]  Version:[1.000-1.000-0.000-1.200] [ FOM01-SFP ] [CH01M     ]

<< E1/T1 Status and Configuration >>
<1> Termination Type    [ E1/75 /BNC ]  Link     [ Up     ]
<2> E1/T1 Service       [ On         ]  BVP Error[ Normal ]
<3> Line Code           [ HDB3       ]
<4> Loop Back Test Mode [ Disable    ]

<ESC> Go to previous menu. Please select an item.
```

<1> Termination Type – Use this item to set the transmission mode. The modes available are E1 75, E1 120, or T1 100.
<2> E1/T1 Service – Enable or disable the transmission on this channel.
<3> Line Code – Set the appropriate line coding for the application.

<4> Loop Back Test Mode - Refer to page 10 for available loop back modes.

```
    [Local ]  Version:[1.000-1.000-0.000-1.200] [ FOM01-SFP ] [CH01M     ]

<< E1/T1 Status and Configuration >>
<1> Termination Type    [ E1/75 /BNC ]  Link     [ Up     ]
<2> E1/T1 Service       [ On         ]  BVP Error[ Normal ]
<3> Line Code           [ HDB3       ]
<4> Loop Back Test Mode [ Disable    ]

<ESC> Go to previous menu. Please select an item.

------------------------------------------------------------------------
E1 /T1  Loop Back Test Function Select:
<1>: Disable   <2>: LLB <3>: RLB
<ESC> Go to previous menu. Please select an item.
```

Note: Both E1 and T1 support AMI (Alternate Mark Inversion) line coding. However, in most cases, E1 will use HDB3 and T1 will use B8ZS line coding.

LAN

From the main menu, select item number 4 to access the LAN status menu.

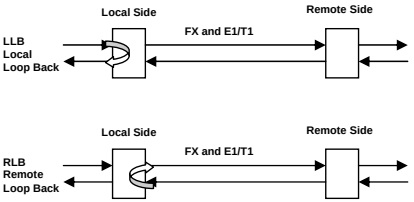
```
                ****************************************
                ***  CTC UNION TECHNOLOGIES CO.,LTD  ***
                ***  FRM220-FOM01 Manager Ver:1.00   ***
                ****************************************
    [Local ]  Version:[1.000-1.000-0.000-1.200] [ FOM01-SFP ] [CH01M    ]

<< LAN Status and Configuration >>
<1> LAN Service       [ On     ]    Link  [ Up   ]
<2> Negotiation       [ Auto   ]
<3> Speed             [ 100    ]    Status[ 100  ]
<4> Duplex            [ Full   ]    Status[ Full ]
<5> Link Fault Pass Through Function [ Disable ]



<ESC> Go to previous menu. Please select an item.
```

<1> LAN Service – Enable or disable the transmission on the LAN trunk.
<2> Negotiation – This LAN port supports both auto-negotiation per IEE802.3u and manual forced mode. When in 'auto', the speed and duplex settings are ignored.
<3> Speed – When using manual forced mode, the speed of the LAN can be configured to either 10M or 100M.
<4> Duplex – When using manual forced mode, the duplex of the LAN can be configured to either FULL or HALF duplex.
<5> LFP – The link fault pass through function allows a link failure to propagate over the Ethernet trunk. If enabled, an Ethernet link loss on this **FOM01** will force a link down on the remote **FOM01** LAN port.

```
------------------------------------------------------------------------
Link Fault Pass Through Function :
<1>: Disable          <2>: Enable
<ESC> Go to previous menu. Please select an item.
```

Loop back Testing (LBT):

The loop back capability of **FRM220-FOM01** is useful for debugging a dysfunctional link, or when commissioning a link. The optical channel and the TDM channel (E1/T1) support local and remote loop back functions. Loop back is enabled via management terminal console. When placed in a managed FRM220-CH20 chassis, the loop back can be controlled by NMC manager in FRM220 chassis.



- Figure 4. Fiber and E1/T1 Loop back modes for **FRM220-FOM01**

E1 Signal Pin Assignment

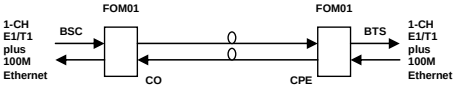
Pin	Pair	Signal	Color
1	R	RX Ring	Orange/White
2	T	RX Tip	White/Orange
3		reserved	White/Green
4	R1	TX Ring	Blue/White
5	T1	TX Tip	White/Blue
6		reserved	Green/White
7		shield	White/Brown
8		shield	Brown/White

The 8P8C connector wiring for balanced E1 follows the Universal Service Order Code (USOC) RJ48C (registered jack) standardization.

Applications

FRM220-FOM01, E1/T1 fiber multiplexer, works in point-to-point applications, either as a stand-alone or when placed in FRM220-CH20 managed rack.

Mobile back haul with Voice & Data



- Figure 5. Typical application for **FRM220-FOM01**

Set local and remote multiplexers to the right E1/T1 transport and enable the port. Configure the LAN port for proper connection, either with auto-negotiation or by manual forced mode. An in-band management channel will transparently carry configuration data from remote side equipment back to the central side for remote management.

For normal operation, ensure that all Loop Backs are disabled for optical and TDM.

Branch office connection

If you have available dark fiber, **FRM220-FOM0**1 makes an excellent inter-office connect. The E1 channel can each carry 30 voice trunk lines between your main and branch offices' PBX equipment. The full wire speed Ethernet trunk can provide an excellent LAN-to-LAN connection at 100M speed.

SDH alternative

In a point-to-point application where only a single E1 or T1 plus full 100M Ethernet over a single fiber pair are required, **FRM220-FOM01** is a cost effective alternative to expensive SDH or SONET equipment.

Upgrading

FRM220-FOM01 card may be firmware upgraded when it is placed in 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 and then on to the line card(s).

Quick Procedure

Place the line card's upgrade code on the TFTP server (either f/w or FPGA code or both). Make sure you know the case sensitive file name. Connect to 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

```
                    << 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
   <5> : FRM220-DATAPORT                   <6> : FRM220-E1/T1
   <7> : FRM220-1000EDS/1000ES-2F          <8> : FRM220-1000ES-1/1000E-
1/2F
   <9> : FRM220-10/100IS-2                 <A> : FRM220-1000TS/1000T
   <B> : FRM220-3R-2.7G-2S/3S              <C> : FRM220-5E1/ET100T
   <D> : FRM220-5E1/ET100S                 <E> : FRM220-Eoe1
   <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> : FTEC                              <N> : 2R-4G/2S/3S
   <O> : FRM220-3R-10G-SXX                 <P> : FRM220-3R-10G-SXX CDR
   <Q> : FRM220-FOM01                      <R> : FRM220-FOM01 FPGA
  <ESC>: Previous Menu
```

Select the line card type (**FOM01** or **FOM01 FPGA**), the slot number and local unit. Enter filename and lastly enter "1" to start the upgrade or any other key to abort.

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

About SFP Units

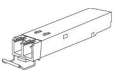
FRM220-FOM01-SFP accepts any SFP unit that complies with the MSA standard and supports an OC3/STM-1 data rate, which in **FOM01** is 155.52Mbps. Do NOT try to use 'copper' interface type SFP modules. The optical transmission of **FOM01** is a proprietary scrambled NRZ coding. Follow all ESD precautions 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.

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.



- Figure 6. Bale Clasp SFP with bale open