PRODUCT
Quick Start Guide

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ISO 9001 Quality System Certified

User Guide

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

FRM220-FOM04

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Introduction

The **FRM220-FOM04** is a 4 channel E1/T1 fiber multiplexer with an additional wire speed 100M Ethernet trunk, plus order wire and clear channel RS-232, constructed as a two slot wide card for the FRM220 series. When the **FRM220-FOM04** card is placed in the FRM220 rack with NMC, 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, and provide local or remote diagnostic loopback.

The 1+1 redundant optical aggregate of this multiplexer employs industry standard pluggable optics (SFP) that operate at OC3/STM-1 data rates (155M). The SFP modules 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

- 4 channels 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)
- One clear channel RS232 up to 250Kbps(Async)
- 1+1 fiber protection, with less than 50ms switch time
- Supports Digital Diagnostics Monitoring Interface (DDMI)
- AIS on signal loss of E1/T1 and/or fiber port
- Loopback tests for E1/T1, RS232, and fiber ports
- 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 Order wire Ear / Microphone port
- Supports On-Line F/W upgrade

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 Interfaces

▪ 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 (RJ-45) T1: Balanced 100 ohms (RJ-45)
▪ 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 Connectors	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	OP1 Link, OP2 link, E1/T1 Mode/Link/Loopback test, Order wire phone indicator, LAN Link/Speed.
▪ Power Input	AC adapter, 12VDC
▪ Dimensions	88 x 42 x 139mm(DxWxH)
▪ Temperature	0 ~ 60℃ (Operating), -10 ~ 70℃ (Stor age)
▪ Humidity	10 ~ 90% RH (non-condensing)
▪ Certifications	CE (EMC&LVD), FCC, RoHS

Management Features

The **FRM220-FOM04** has no jumpers or DIP Switches and is completely software configurable. When placed in a stand-alone chassis, this device support a text based serial terminal with an easy to use menu system for configuration. When placed in a managed chassis, the **FOM04** is configured and monitored through the 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 the NMC management.

Panel

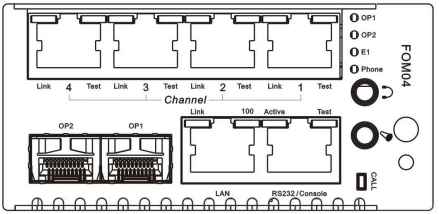
There are 4 x RJ-45 connectors for channels 1~4 that provide USOC RJ-48C connection to balanced E1 or T1.

The optical aggregate utilizes SFP cages for 1+1 optical protection. The 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.

The clear channel RS-232 and the configuration console port share an RJ-45 and require a special (provided) breakout cable (RJ-45 to 2xDB9F).

The order wire feature uses a pair of 3.5mm jacks for separate head/microphone sets. A 'Call' pushbutton allows an operator to signal the remote unit.



▪ Figure 1. Front Panel of FRM220-FOM04

Installation

Note: Because the FOM04 requires 2-slots, this multiplexer card can only be placed in the CH02, CH02M or the full CH20 chassis. Do not place in CH02-NMC.

FRM220-CH20
aka. FMUX20

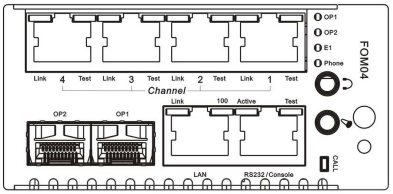
CH02M-AD Chassis
Internal AC+ DC
w/ console port

CH02 Chassis
w/ external AC to
DC adapter

▪ Figure 2. Slide-in Card mounting of FRM220-FOM04

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

LED Indicators



LED		*State*	*Status*
OP1	(Green)	On	Optical Fiber 1 Linked
		Flash	Link and active path
		Off	Optical Fiber 1 no link
OP2	(Green)	On	Optical Fiber 2 Linked
		Flash	Link and active path
		Off	Optical Fiber 2 no link
E1	(Green)	On	E1 Mode, 75 Ohm
		Flash	E1 Mode, 120 Ohm
		Off	T1 Mode (100 Ohm)
Phone	(Green)	Flash	Phone Ringing
Ch-Link (1 ~ 4)	(Green)	On	E1/T1 Signal Present
		Off	E1/T1 LOS
Ch-Test (1 ~ 4)	(Amber)	On	E1/T1 Loop Back Test active
		Off	Normal
LAN Link	(Green)	On	Ethernet UTP has link
		Off	No UTP link
LAN 100	(Green)	On	Speed is 100M
		Off	Speed is 10M
RS-232 Active	(Green)	Flash	RS-232 Data port active
		Off	RS-232 Data port inactive
RS-232 Test	(Amber)	On	RS-232 Loop Back Test active
			Normal

Console Management

When placed in the 2-slot CH02 or 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. The **FOM04** uses a special 2 x DB9 to RJ-45 console adapter cable when placed in CH02. Both the serial terminal console and as the clear data channel RS-232 share this connector. Connect the DB9F labeled "CON" to the COM port of the management PC. When placed in the CH02M chassis, connect console to the CH02M's DB9M and slide the switch to slot#2.

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 the CH02M's DB9M. 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-FOM04 Manager Ver:1.00   ***
                  ****************************************
    [Local ]  Version:[1.100-1.000-0.000-1.000]   [Standalone   ]
<1> Device  Status and Configuration
<2> Fiber   Status and Configuration
<3> E1/T1   Status and Configuration
<4> LAN     Status and Configuration
<5> RS232   Status and Configuration
<6> Phone   Status and Configuration
<P> Setting Password
<T> Switch To Remote Tab [ Present]
Please select an item.
```

Example of Main Menu Console Screen, FRM220-FOM04

Notice: 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.)

Main Menu Description

<1> Device Status – under this menu will be the device service and store parameter sub menus.
<2> Fiber – this menu provides access to the fiber optical related functions including link status, port activation, working channel, loop back tests and viewing of SFP DD functions.
<3> E1/T1 – Sets the E1/T1 mode and then provides status and configuration for each of the 4 E1/T1 channels, 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> RS-232 – This sub-menu provides the service activation and loop back functions for the clear channel RS-232 port.
<6> Phone – The phone sub-menu shows current call status and also provides a 'soft' calling function.
<P> Setting Password – Protect against unauthorized access.
<T> Remote – when a fiber link exists between the local and remote **FOM04** (in-band is active), using this will 'toggle' between local and remote management.

Device Status and Configuration

```
                ****************************************
                ***  CTC UNION TECHNOLOGIES CO.,LTD  ***
                ***  FRM220-FOM04 Manager Ver:1.00   ***
                ****************************************
    [Local ]  Version:[1.100-1.000-0.000-1.000]   [Standalone   ]

<< Device Status and Configuration >>
<1> Device Service      [ On    ]
<2> Store Parameters
<3> Default Configuration

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

<1> Device Service – Use this item to place the entire FOM04 either OOS (out of service or Off) or IS (in service or On).
<2> Store Parameters – Following configuration changes made, return to this menu item to save changes.
<3> Default Configuration – Restore the unit to factory default settings.

Fiber

```
                ****************************************
                ***  CTC UNION TECHNOLOGIES CO.,LTD  ***
                ***  FRM220-FOM04 Manager Ver:1.00   ***
                ****************************************
    [Local ]  Version:[1.100-1.000-0.000-1.000]   [Standalone   ]

<< Fiber Status and Configuration >>
    Fiber Link  [ Down ]   Remote PWR  [ OK      ]
    OP1 Rx Link [ OK   ]   OP2 Rx Link [ Down    ]
    OP1 Small Form Pluggable:[ Yes ] Digital Diagnostic Function:[ Yes ]
    OP2 Small Form Pluggable:[ No  ] Digital Diagnostic Function:[ No  ]
<1> Fiber Working Channel   Working  [  OP1 ]  Standby [ OP2 ]
<2> Loop Back Test Mode [ Disable ]
<3> Go to the OP1 D/D Function menu.
<4> Go to the OP2 D/D Function menu.
```

<1> Fiber Working Channel – If 1+1 fiber protection is available, this menu item can be used to force the active working path.
<2> 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.
<3~4> OP D/D Function – View detailed information about the installed SFP modules in the **FOM04**. Below is an example:

```
                ****************************************
                ***  CTC UNION TECHNOLOGIES CO.,LTD  ***
                ***  FRM220-FOM04 Manager Ver:1.00   ***
                ****************************************
    [Local ]  Version:[1.100-1.000-0.000-1.000]   [Standalone   ]

<< OP1 D/D Function Status >>

 Vendor Name           :[CTC UNION        ]
 Vendor Part Number    :[SFS-5030-L31-DDI ]
 Fiber Type            :[Single  ]
 Tx Wave Length        :[1310 nm ]
 RX Wave Length        :[1310 nm ]
 Link Length           :[0030 Km ]
 Tx Power              :[ -11 dBm]
 Rx Power              :[ -41 dBm]
 Rx Sensitivity        :[  -52 dBm]
 Temperature           :[  24 C  ]
<ESC> Go to previous menu.
```

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.

E1/T1

```
    [Local ]  Version:[1.100-1.000-0.000-1.000]   [Standalone   ]

<< E1/T1 Status and Configuration >>
<1> E1/T1 Termination Type    [ E1/75 /BNC  ]
<2> E1/T1 Channel 1 Status and Configuration
<3> E1/T1 Channel 2 Status and Configuration
<4> E1/T1 Channel 3 Status and Configuration
<5> E1/T1 Channel 4 Status and Configuration


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

<1> E1/T1 Termination Type – Use this item to set the transmission mode for all 4 channels. The modes available are E1 75, E1 120, or T1 100.
<2~5> E1/T1 Channel – There are sub-menus for each channel. This sub-menu supports the Service activation, Line code setting, and diagnostic loop backs.

```
    [Local ]  Version:[1.001-1.001-1.011-0.000]   [Standalone   ]

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


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

<1> E1/T1 Service – Enable or disable the transmission on this channel.
<2> Line Code – Set the appropriate line coding for the application.
<3> Loop Back Test Mode - Refer to page 10 for available loop back modes.

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

```
                ****************************************
                ***  CTC UNION TECHNOLOGIES CO.,LTD  ***
                ***  FRM220-FOM04 Manager Ver:1.00   ***
                ****************************************
    [Local ]  Version:[1.100-1.000-0.000-1.000]   [Standalone   ]

<< 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 ]
```

<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 **FOM04** will force a link down on the remote **FOM04** LAN port.

RS232

Not to be confused with the management console port, this RS-232 data port provides a clear RS-232 asynchronous channel over the fiber link.

```
    [Local ]  Version:[1.100-1.000-0.000-1.000]   [Standalone   ]

<< RS-232  Status and Configuration >>
<1> RS-232 Service            [ On      ]   Rx Active [ Off ]
<2> RS-232 Loop Back Test Mode [ Disable ]
```

<1> RS-232 Service – Enable or disable the transmission on this channel.
<2> Loop Back Test Mode - Refer to page 10 for available loop back modes.

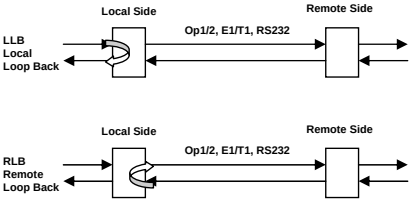
Order Wire

```
    [Local ]  Version:[1.100-1.000-0.000-1.000]   [Standalone   ]

<< Phone Status and Configuration >>
<1> Phone  Service       [ On      ]
<2> Phone  Call Out

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

<1> Phone Service – Enable or disable the transmission on this channel.
<2> Phone Call Out – This is a 'soft' dial out method which does the same function as actually physically pressing the 'Call' button.

Loop back Testing (LBT):

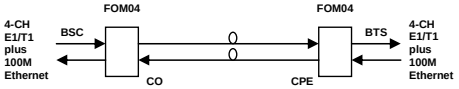
The loop back capability of the **FRM220-FOM04** is useful for debugging a dysfunctional link, or when commissioning a site. The optical channel, the four TDM channels (E1/T1) and the clear channel RS-232 support local and remote loop back functions. Loop back is enabled via management terminal console. When placed in a managed FRM220-CH20 chassis, the loop back can be controlled by the NMC manager in FRM220 chassis.



Applications

The **FRM220-FOM04**, E1/T1 fiber multiplexer, works in point-to-point applications, either as a stand-alone or when placed in the **FRM220-CH20** managed rack.

Mobile back haul with Voice & Data



Set local and remote multiplexers to the right E1/T1 transport and enable all ports. Configure the LAN ports for proper connection, either with auto-negotiation or by manual forced mode. An additional RS-232 clear channel can be used to carry console 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, TDM and Data.

Branch office connection

If you have available dark fiber, the **FRM220-FOM04** makes an excellent inter-office connect. The E1 channels 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 4 x E1 or T1 plus full 100M Ethernet over a single fiber pair are required, the **FRM220-FOM04** is a cost effective alternative to expensive SDH or SONET equipment.

Upgrading

The **FRM220-FOM04** 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 and then on to the line card(s).

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. 3.14 ***
                ****************************************
                        << 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-FMUX04E
    <M> : FRM220-FTEC
  <ESC>: Previous Menu
```

Select the line card type (**FOM04**), 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

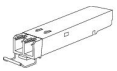
The **FRM220-FOM04** accepts any SFP unit that complies with the MSA standard and supports an OC3/STM-1 data rate, which in the **FOM04** is 155.52Mbps. Do NOT try to use 'copper' interface type SFP modules. The optical transmission of the **FOM04** is a proprietary scrambled coding. Follow all ESD precautions 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.



Bale Clasp type SFP with bale open