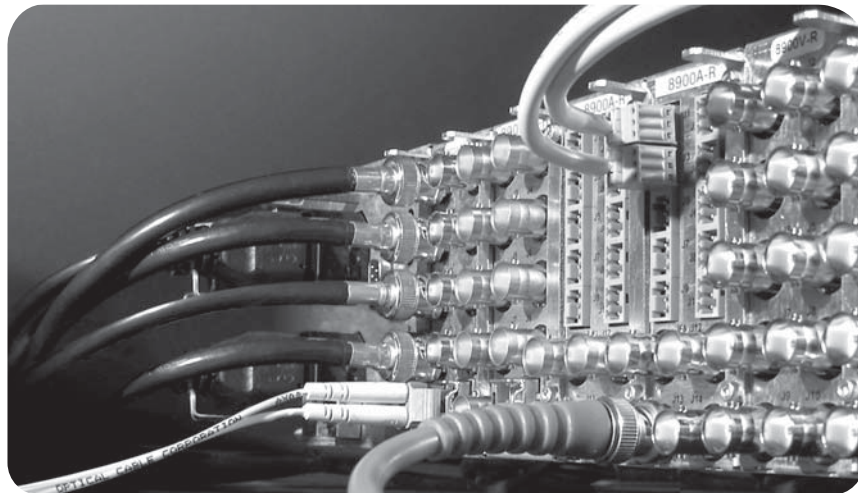


8939FCA/FCB

FIBER OPTIC MUX/DEMUX MODULE



Instruction Manual

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8939FCA/FCB

FIBER OPTIC MUX/DEMUX MODULE

Instruction Manual

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For further information on the Grass Valley product take back system please contact Grass Valley at + 800 80 80 20 20 or +33 1 48 25 20 20 from most other countries. In the U.S. and Canada please call 800-547-8949, and ask to be connected to the EH&S Department. Additional information concerning the program can be found at: www.grassvalley.com/about/environmental-policy

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Preface

About This Manual

This manual describes the features of a specific 8900 module in the GeckoFlex Signal Processing System families. As part of this module family, it is subject to Safety and Regulatory Compliance described in the GeckoFlex 8900 Series frame documentation (see the *GeckoFlex Frames 8900FX/FF/FFN Signal Processing System Instruction Manual*).

All Modular product manuals can be found on-line in PDF format at this link:

www.grassvalley.com/docs/modular

8939FCA/8939FCB Fiber Optic Mux/Demux Modules

Introduction

This manual covers installation and operation of the 8939FCA and 8939FCB Fiber Optic Mux/Demux modules.

For purposes of this manual, the Grass Valley 8943CF (4 Channel Electrical to Fiber) and 8943FC (4 Channel Fiber to Electrical) Converter modules are used to demonstrate the use of the 8939FCA and 8939FCB modules. These modules handle signals with bit rates up to 3 Gb/s.

Note The first generation Grass Valley 8935CF (4 Channel Electrical to Fiber) and 8935FC (4 Channel Fiber to Electrical) Converter modules can also be used with the 8939FCA and 8939FCB modules. These modules handle signals with bit rates up to 1.5 Gb/s. Status reporting on these modules may vary.

Module Features

The 8939FCA and 8939FCB modules are bi-directional optical CWDM (Coarse Wavelength Division Multiplexing) multiplexer/demultiplexer modules for the 2 RU GeckoFlex frame. Each module can multiplex and demultiplex up to 9 fiber channels over one fiber.

The following features are available with each module:

- Optical multiplexer/demultiplexer for combining signals on a single fiber.
- Provides up to 8:1 or 1:8 multiplexing/demultiplexing using CWDM technology.
- Provides an expansion port (EXP) to accept a ninth 1310nm signal for 9:1 multiplexing.
- Up to ten 8939FCA or 8939FCB modules (or any mix depending on the application) can be housed in a GeckoFlex frame, providing up to 80 channels of optical multiplexing or demultiplexing per 2 RU frame.
- The module is a passive optical device for reliable service.

Installation

Each 8939FCA and 8939FCB model consists of a single passive rear module that can only be installed in the rear of a GeckoFlex frame.

Installation of the 8939 rear module is a process of:

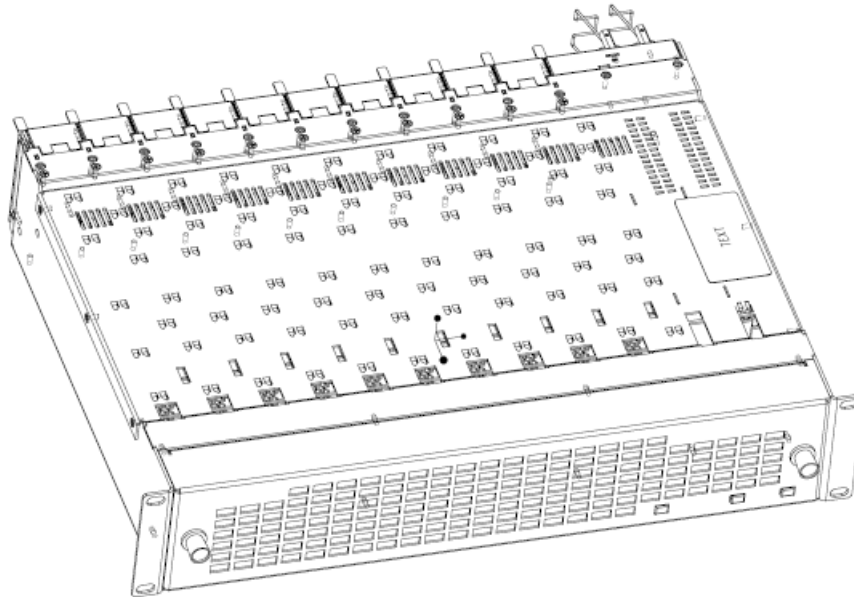
1. Placing the 8939 module in an unused rear frame slot,
2. Cleaning all fiber optic connectors and cable end faces with required cleaning kit (see [Fiber Optic Cleaning Requirement on page 11](#)), and
3. Cabling the signal ports.

All GeckoFlex front and rear modules can be inserted and removed from an GeckoFlex frame with power on.

Module Placement in the GeckoFlex Frame

There are ten front and rear cell locations in the 2 RU GeckoFlex frame ([Figure 1](#)) to accommodate either audio, analog and digital video modules.

Figure 1. GeckoFlex Frame



Module Installation Precautions

Please read and follow the precautions listed below before installing the 8939FCA and 8939FCB rear modules:

- Use standard anti-static procedures during installation. As modules can be installed or removed when the GeckoFlex frame is powered up, before removing the cover, please use an anti-static bracelet tied to a metal part of the frame.
- When installing or removing a rear module, loosen or tighten the screws holding the retainer clips to the frame manually with the retainer clip tool provided inside the front cover of the frame or use a 2 mm (5/64") hex screwdriver. Please do not use an electric screwdriver.

Note On newer 751- version GeckoFlex frames, a Rear Retainer Clip removal tool and 2 extra retainer clips and screws for installing them are provided on the inside of the frame cover.

- Make every effort to leave the screws holding the retainer clips in place (do not remove them completely). They are very small and can easily drop into other equipment causing a shorting hazard. (Two turns of the screw should be enough to loosen the screws, 3 turns or more will remove it.)
- When installing a rear module, tighten the screws on the retainer clips just until snug. Do not apply more force than is necessary to seat the rear module. The retainer clip screw torque specification is given in the **Mechanical** specifications in [Table 1 on page 28](#).
- If using a fiber optic SFP device, handle it carefully, use anti-static precautions, and read the [Fiber Optic Cleaning Requirement](#) below before cabling.

Fiber Optic Cleaning Requirement

Before making any fiber optic cable mating connections and after every de-mating cycle, use an industry standard fiber optic cleaning kit, including oil-free compressed air, to clean the fiber connectors and the connectorized fiber end faces. This helps ensure optimum performance of the fiber optic interface. Industry standard fiber optic cleaning kits can be purchased on the web and in electronics stores.

8939FCA and 8939FCB Installation

Each rear module or blank rear adapter cover is held in place by two rear retainer strips as shown in [Figure 2](#).

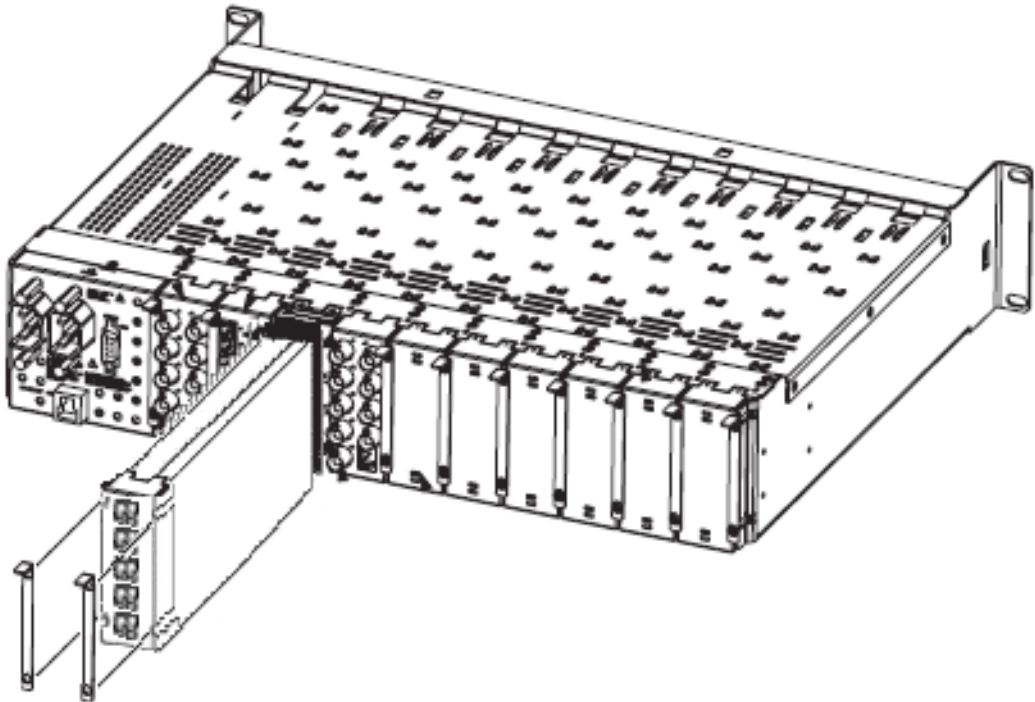
To install an 8939FCA or 8939FCB module into the frame, follow these steps:

1. Loosen (but do not remove completely) the two screws holding each retainer strip to the frame with a 2 mm (5/64") hex screwdriver. Pull up on the retainer to remove it, leaving the screws in place.

CAUTION Be careful to leave the screws in place as they can be easily lost or fall into equipment below the frame creating a shorting hazard.

2. Remove the blank cover using the retainer removal tool included on the inside cover of the frame or needlenose pliers.
3. Insert the 8939FCA or 8939FCB module into the empty slot by lining up the metal card guides on the top and bottom of the module with the card guides in the frame.
4. Once the module is firmly in place, replace each retainer strip over the two screws on both sides of the module and push down to seat it.
5. Tighten the screws for each retainer just until they are snug. Do not force or torque the screws too tightly. The retainer should not bend or bow. The screw torque specification is given in [Table 1 on page 28](#).

Figure 2. Installing 8939FCA or 8939FCB



Cabling

Note Before making any fiber optic cable mating connections and after every de-mating cycle, use an industry standard fiber optic cleaning kit to clean the fiber connectors and the connectorized fiber end faces. Refer to [Fiber Optic Cleaning Requirement on page 11](#).

Cabling is done on the rear fiber connections of the 8939FCA and 8939FCB modules. Each module is bi-directional and can act as a multiplexer or demultiplexer in any combination. For common usage applications for the 8939FCA or 8939FCB modules, refer to [8939FCA and 8939FCB Applications on page 16](#).

The modules only accept fiber inputs corresponding to the specific wavelengths labeled on the rear connectors. The fiber inputs can come from any Grass Valley device that meets the specifications as described in [Specifications on page 28](#).

CAUTION This is a Class IIa laser device. Use caution when cabling as fiber optic lasers are present. Follow standard fiber optic laser safety recommendations when handling these modules.

8939FCA Modules

The currently shipping 8939FCA module backplane is shown in [Figure 3 on page 14](#) with the CWDM frequencies labeled for each channel. Earlier versions of the 8939FCA module shipped with the backplane shown in [Figure 4 on page 14](#).

CAUTION Note that the COM and EXP ports in the older version do not have protective coverings. Use caution when cabling as these are laser outputs.

The 8939FCA has eight fiber channels (CH 1 – CH 8), each handling a specific frequency as silkscreened on the module.

The COM port is the fiber link between other 8939FCA and 8939FCB modules. The single fiber connection can be up to 50 kilometers in length. Cable lengths may require attenuation between COM ports in some instances. Refer to [Attenuation Requirements on page 15](#).

The EXP fiber port is used with devices with a 1310nm input or output. This expansion port can accept or deliver an additional 1310nm wavelength signal from GeckoFlex fiber-ready modules that are equipped with a fiber optic SFP device.

Three different fiber optic receiver, transmitter, and transceiver SFP devices can be installed on Grass Valley fiber-ready front modules to match the required application.

Figure 3. Current 8939FCA Backplane

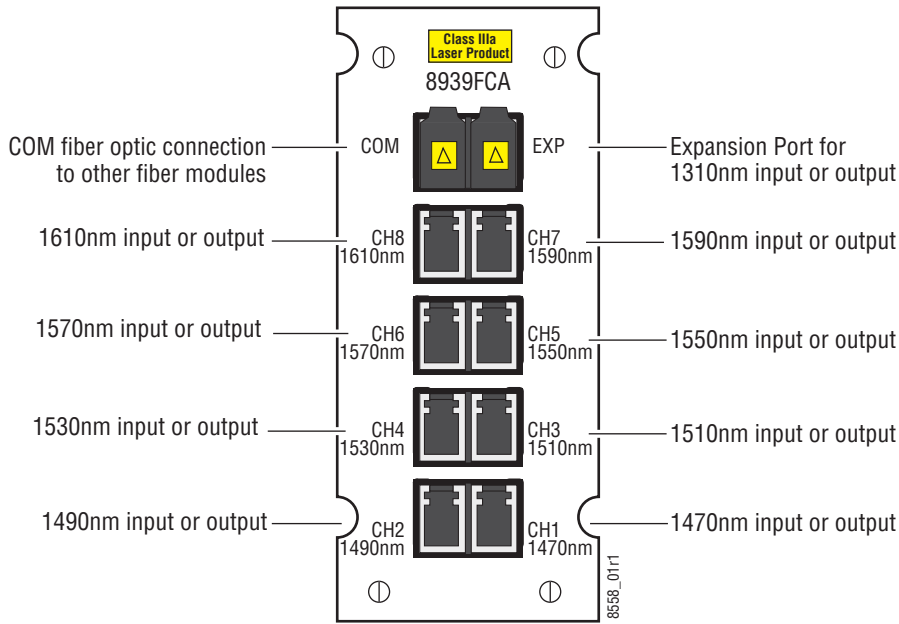
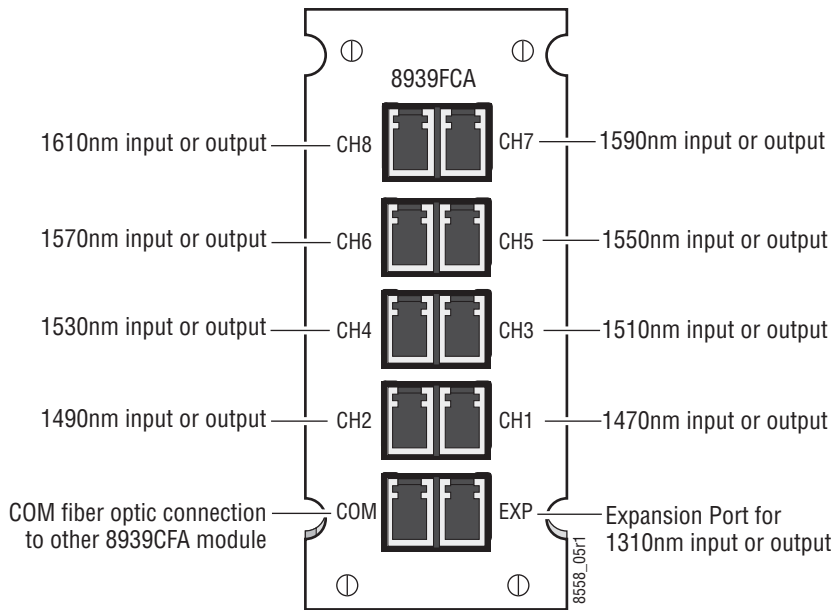


Figure 4. Earlier Version 8939FCA Backplane

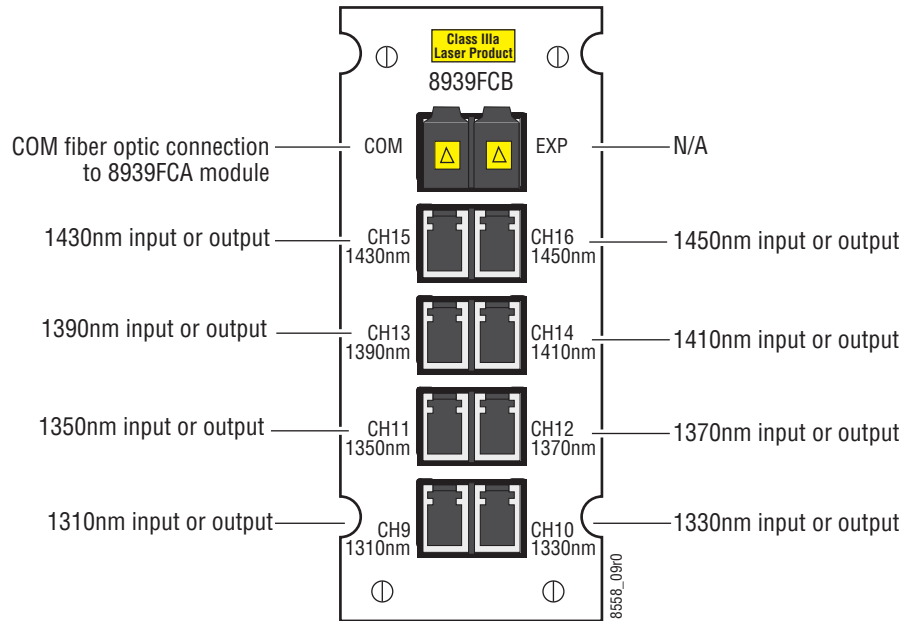


8939FCB Modules

The pinouts for the 8939FCB module are shown in [Figure 5](#). The 8939FCB has eight fiber channels (CH 9 – CH 16), each handling a specific CWDM frequency as silkscreened on the module.

Refer to [8939FCA Modules on page 13](#) for cabling the COM and EXP ports.

Figure 5. Current 8939FCB Backplane



Attenuation Requirements

Some shorter length cable runs will require attenuation to prevent over-driving the receiver causing bit errors to occur on the fiber link. Use the following guidelines for adding attenuation:

- The 1310nm Dual Transmitter (SFP-1310-SDTX) requires no attenuation between the EXP ports at any cable lengths.
- CWDM SFP devices used with 8939FCA modules for a mux/demux configuration with cable runs from 0-12 km (7.5 miles), must be attenuated by 3 dB between 8939FCA COM ports.
- All CWDM SFP devices used in a point-to-point configuration with a cable run from 0-20 km (12.4 miles), must be attenuated by 5 dB between fiber transmitter and receiver connections.

8939FCA and 8939FCB Applications

Before using the 8939FCA and/or the 8939FCB, it is useful to understand some basic configurations that utilize the full capabilities of the CWDM fiber module series. The 8939FCA/FCB passive modules are excellent for the following applications:

- Transporting multiple SD-SDI or HD-SDI video signals over a limited fiber cable capacity.
- When reducing infrastructure costs (cabling, electrical power consumption, space, etc.) is required – multiplexed video over fiber gives an 8:1 ratio on cabling and support equipment.
- Fiber transport is commonly used in any application where HD-SDI signals are found.

The 8939FCA and 8939FCB can act as a multiplexer or demultiplexer or as a combination of both due to the bi-directionality of the passive optic device.

Note Refer to [Attenuation Requirements on page 15](#) to determine if attenuation is needed in your application depending on the length of cable run between 8939FCA or 8939FCB COM ports.

The following three CWDM configuration examples using the 8943CF and 8943FC modules (handling up to 3 Gb/s) are given in this manual:

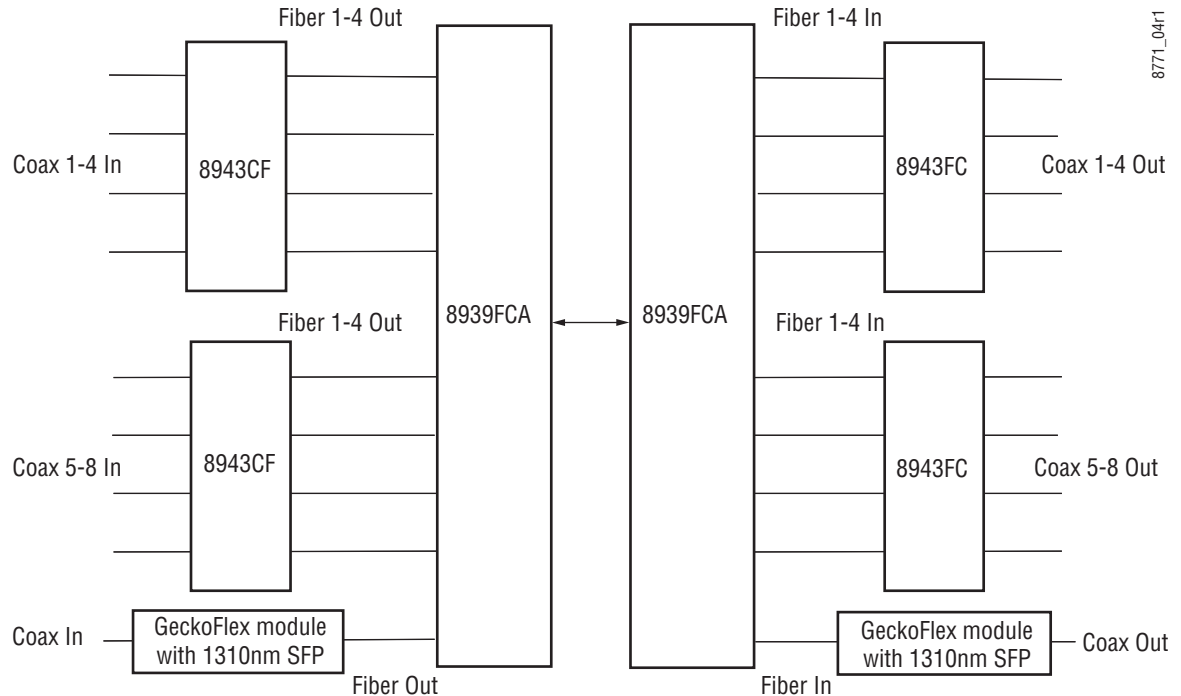
- CWDM Configuration for 9 Channels ([page 17](#))
- CWDM 16 Channel Configuration ([page 20](#))
- Bi-Directional Application ([page 24](#))

Note As mentioned earlier, this manual uses the 8943CF 4 Channel Electrical to Fiber and 8943FC 4 Channel Fiber to Electrical Converter modules for examples throughout the manual as they handle a higher bit rate of 3 Gb/s. 8935CF and 8935FC 4 Channel converter modules can also be used in the same configuration and can handle bit rates up to 1.5 Gb/s. However, status reporting for the 8935 modules may vary.

CWDM Configuration for 9 Channels

One use of CWDM involves the ability to multiplex and demultiplex up to 9 channels of video in as shown in the block diagram in [Figure 6](#).

Figure 6. CWDM Block Diagram for 9 Channel Configuration



To utilize this application, the following Grass Valley modules are needed:

- Two 8943CF 4 Channel Electrical to Fiber Converter modules with one of each type of CWDM SFP devices. Refer to the 8943CF Instruction Manual for complete SFP device installation instructions.
- Two 8943FC 4 Channel Fiber to Electrical Converter modules with one of each type of CWDM SFP devices. Refer to the 8943FC Instruction Manual for for complete SFP device installation instructions.
- Two fiber-ready Grass Valley GeckoFlex modules with 1310nm SFP devices. Refer to the specific fiber-ready module Instruction Manual for for complete SFP device installation instructions.

As shown in the detailed block diagram in [Figure 7 on page 19](#), two 8943CF (Electrical to Fiber converters) at Location A are used to feed 8 channels of video to an 8939FCA.

To utilize this application, one of each of the following four CWDM SFP device types must be installed on the two 8943CF modules:

- SFP-CWDM-1 Dual Transmitter (1490nm and 1470nm frequencies)
- SFP-CWDM-2 Dual Transmitter (1510nm and 1530nm frequencies)
- SFP-CWDM-3 Dual Transmitter (1550nm and 1570nm frequencies)
- SFP-CWDM-4 Dual Transmitter (1590nm and 1610nm frequencies)

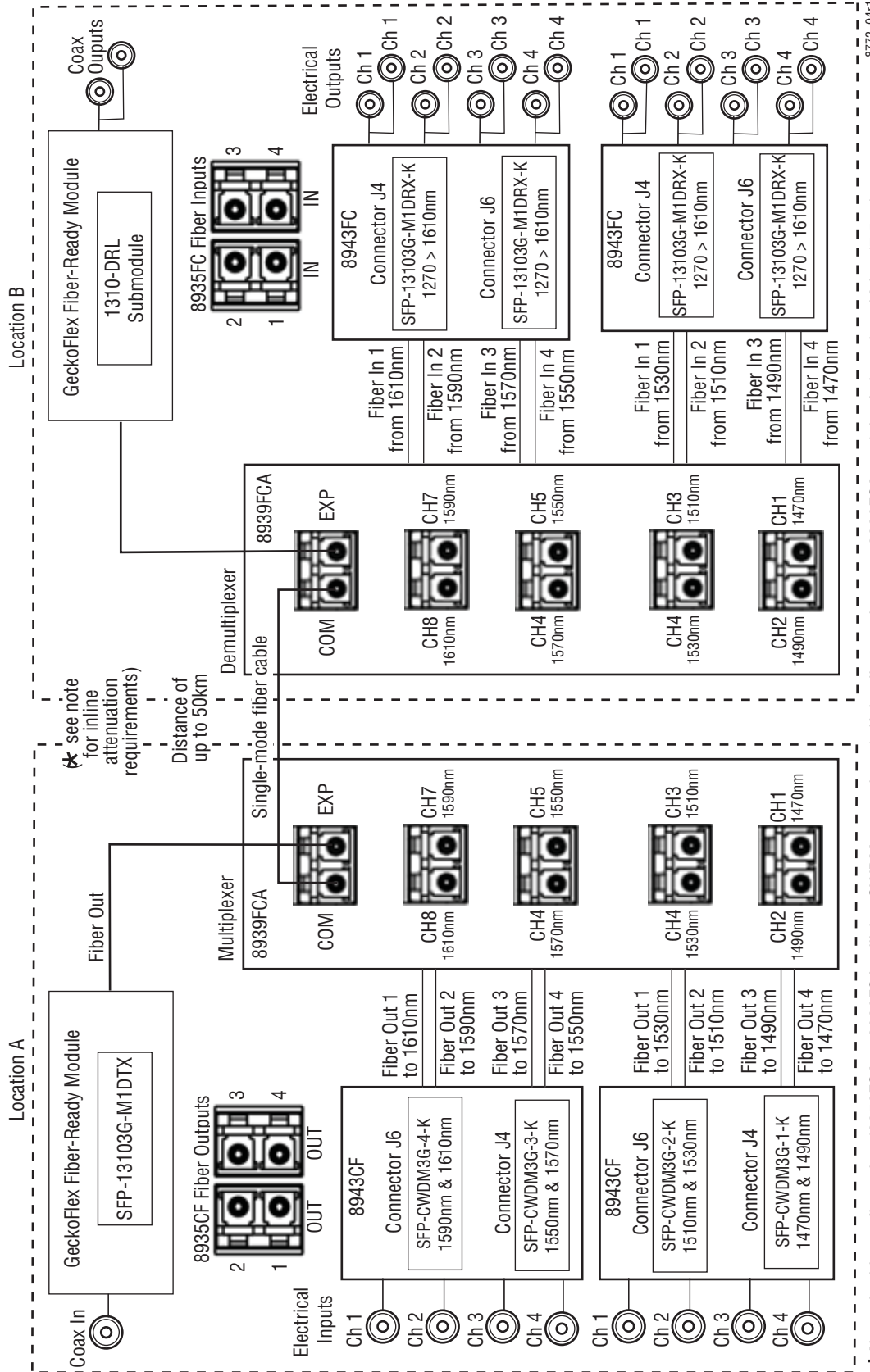
Note The four SFP devices can be installed in any location on the two 8943CF modules as long as the outputs are cabled to the correct frequency input on the 8939FCA.

The 1310nm fiber output from a Grass Valley GeckoFlex module is cabled to the EXP (Expansion) port on the 8939FCA.

The 8939FCA module multiplexes these 9 frequencies down to a single output from the COM port. A single fiber cable carries these 9 video fiber channels to the COM port of the 8939FCA at Location B.

The 8939FCA at Location B acts as a demultiplexer accepting the incoming fiber signals and outputting electrical outputs from the 8943FC (fiber to electrical) modules, each with two SFP-DRX-1-K Dual Receiver SFP devices installed and a Grass Valley fiber-ready module. The SFP-DRX-1 SFP device will accept input frequencies from 1270nm to 1610nm.

Figure 7. 9 Channel Mux/Demux Application



★Note: In this configuration (8959FCA to 8939FCA utilizing CWDM transmitters), if the distance between 8939FCA modules is less than 12 km (7.5 m), a 3 dB attenuator must be installed somewhere between the COM ports on the 8939FCA modules to prevent overdriving the receiver causing bit errors to occur on the link.

CWDM 16 Channel Configuration

The 8943CF and 8943FC 4 Channel Converter modules can also be used with two 8939FCA and two 8939FCB modules to provide 16 channels of video over a single fiber connection.

As shown in the simple block diagram in [Figure 8 on page 21](#), the two 8939FCB module COM ports can be connected to the corresponding 8939FCA module EXP ports to provide another eight channels of video, for a total of 16 channels over one fiber.

Multiplexing 8939FCA/FCB

The multiplexing 8939FCA is fed signals from two 8943CF modules with fiber optic SFP devices with frequencies pairs from 1470nm to 1610nm (CH1 – CH8).

The multiplexing 8939FCB is fed signals in a similar manner as the 8939FCA from two 8943CF module with fiber optic SFP devices with frequencies pairs from 1310nm to 1450nm (CH9 – CH16).

The multiplexing 8939FCB COM port is then connected to the EXP port of the multiplexing 8939FCA allowing the 16 channels to be sent out the COM port of the 8939FCA over fiber to the demultiplexing 8939FCA COM port.

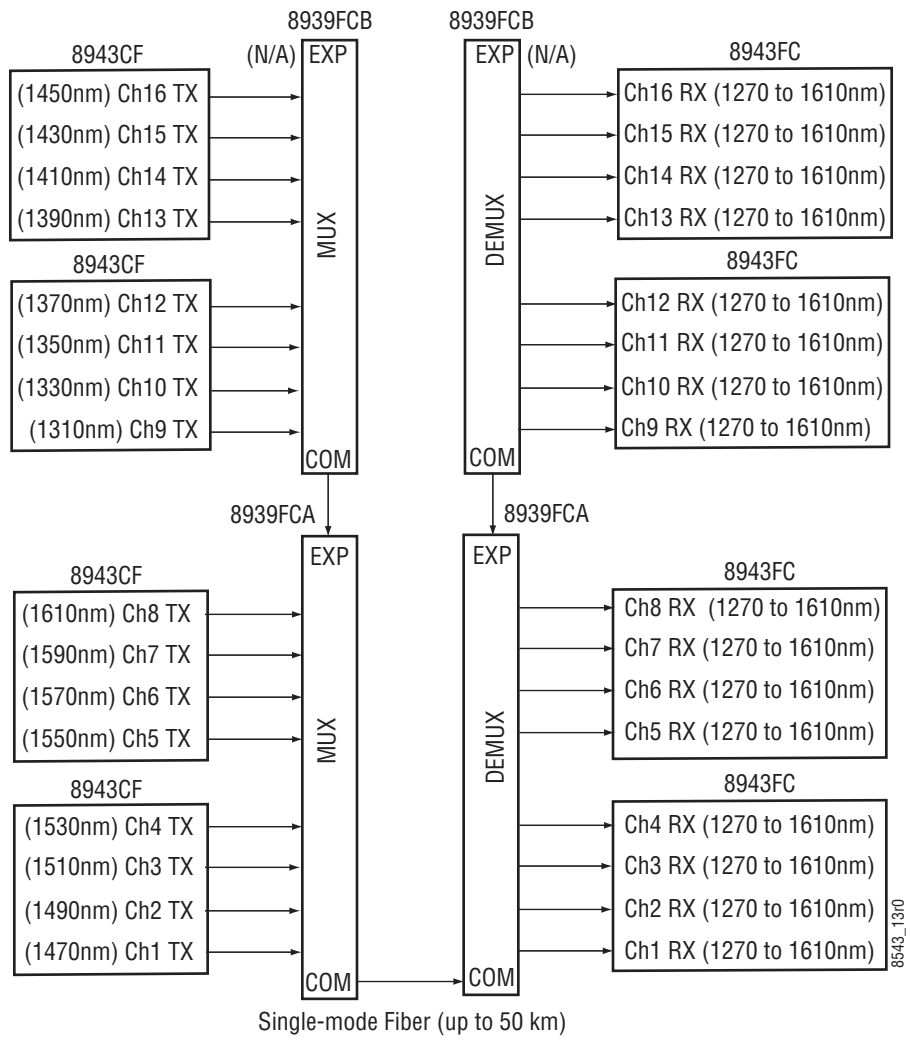
Demultiplexing 8939FCA/FCB

The demultiplexing 8939FCA COM port accepts the 16 channels over a single fiber. The 8939FCA EXP port is connected to the COM port of the demultiplexing 8939FCB allowing the 16 channels of fiber to be separated by the optical filtering in both modules and sent to the corresponding frequency output ports on the 8939FCA and 8939FCB.

These fiber outputs are connected to four 8943FC 4 Channel Fiber to Electrical modules each with two CWDM fiber receiver SFP devices installed that will accept bit rates of 1270nm to 1610nm.

The 8939FCA/FCB outputs must be cabled to the fiber inputs on the 8943FC modules so that all electrical output channels match the electrical input channels. The 8943FC modules make the original electrical inputs available on the electrical outputs of the module.

Figure 8. 8939FCA and 8939FCB Simple Block Diagram



To utilize a 16 channel configuration using 8939FCA and 8939FCB modules, follow the setup below.

Use the same configuration for the 8943CFs to the 8939FCA as shown in [CWDM Configuration for 9 Channels on page 17](#). You will be using the 8939FCA EXP ports to connect to the 8939FCB COM port instead of a 1310nm GeckoFlex fiber-ready module.

Refer to the detailed diagram of the channel 1-8 8939FCA configuration in [Figure 7 on page 19](#). For channels 1-8, two 8943CF modules must feed the multiplexing 8939FCA with two of the following fiber optic SFP devices installed:

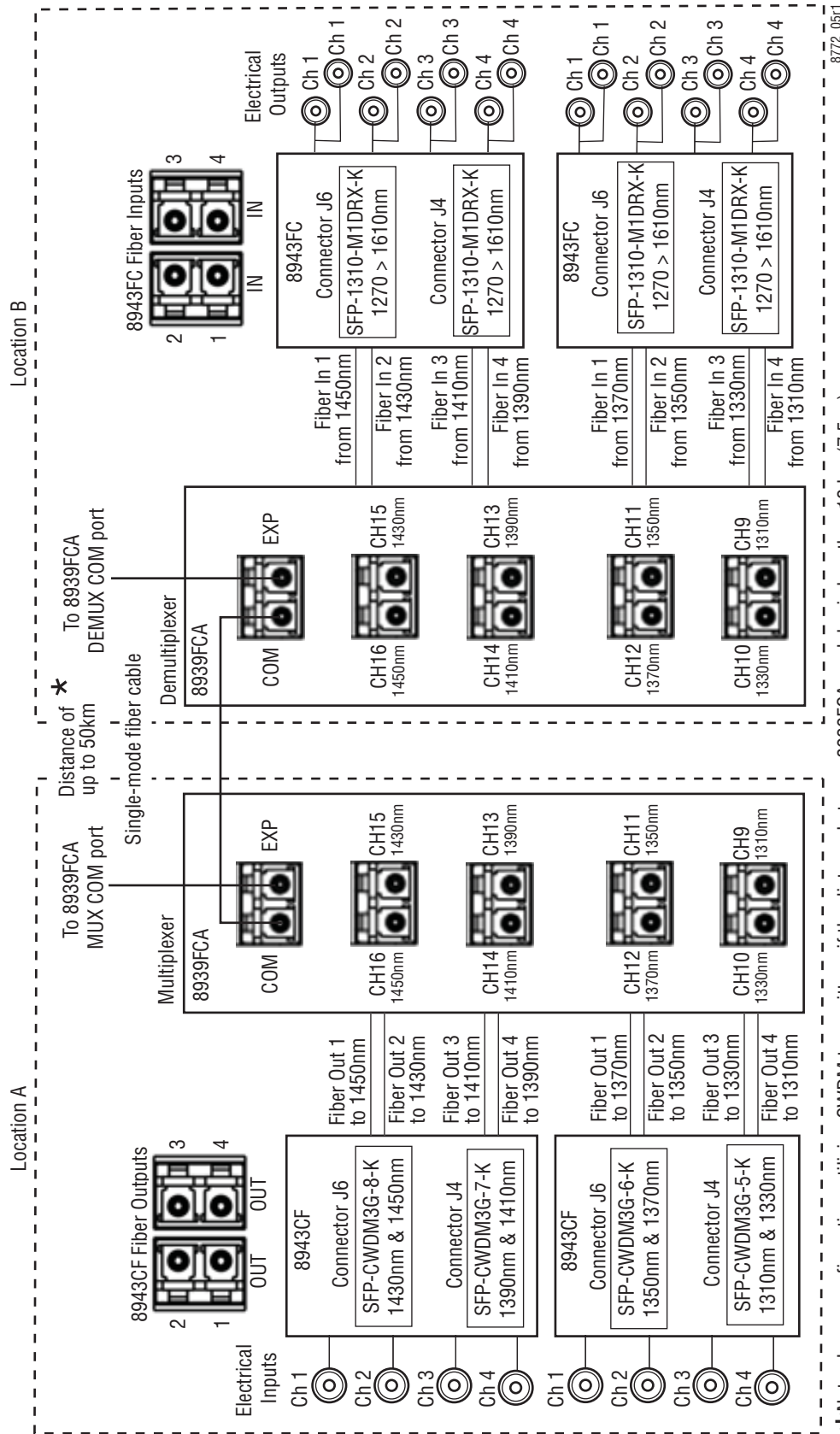
- SFP-CWDM3G-1-K Dual Transmitter (1490nm/1470nm frequencies)
- SFP-CWDM3G-2-K Dual Transmitter (1510nm/1530nm frequencies)
- SFP-CWDM3G-3-K Dual Transmitter (1550nm/1570nm frequencies)
- SFP-CWDM3G-4-K Dual Transmitter (1590nm/1610nm frequencies)

Refer to the detailed diagram of the channel 9-16 in [Figure 9 on page 23](#). For channels 9-16, two 8943CF modules must feed the multiplexing 8939FCB with two of the following fiber optic SFP devices installed:

- SFP-CWDM3G-5-K Dual Transmitter (1310nm/1330nm frequencies)
- SFP-CWDM3G-6-K Dual Transmitter (1350nm/1370nm frequencies)
- SFP-CWDM3G-7-K Dual Transmitter (1390nm/1410nm frequencies)
- SFP-CWDM3G-8-K Dual Transmitter (1430nm/1450nm frequencies)

The four 8943FC 4 Channel Fiber to Electrical modules receiving the fiber from the demultiplexing 8939FCA and 8939FCB should have SFP-13103G-M1DRX-K Dual Receivers SFP devices installed in all SFP locations. These SFP devices will receive frequencies from 1270nm to 1610nm. For clarity, the fiber outputs are cabled to the same channel as the original coax input.

Figure 9. 8939FCB Configuration

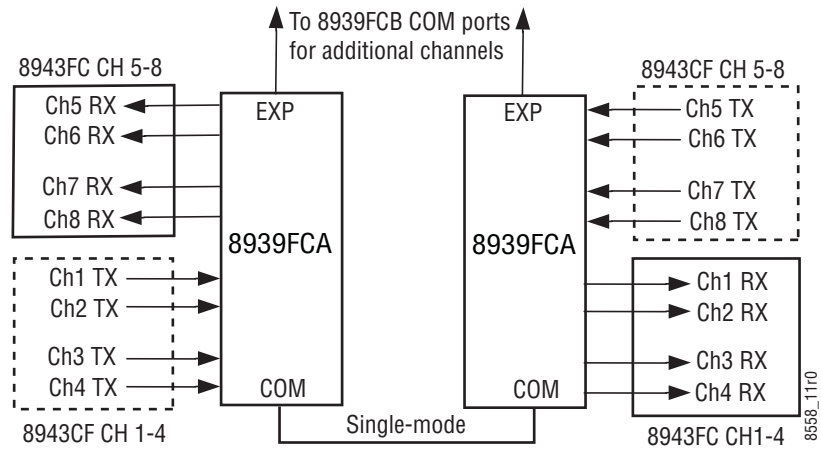


Bi-directional Application

This section illustrates how the 8939FCA and/or 8939FCB can be used in a bi-directional application. Four channels (1-4) can mux/demux four signals in one direction while the other four channels (5-8) on the same modules can mux/demux four signals in the opposite direction. When the 8939FCB COM port is connected to the 8939FCA via the EXP port, the module can mux and demux up to 16 channels in two directions in any combination.

A block diagram of the 8939FCA in a simple bi-directional application is shown in Figure 10. For more channels (9-16), connect the 8939FCA EXP to the 8939FCB COM port.

Figure 10. Bi-directional Simple Block Diagram



To utilize this application example, the following Grass Valley modules are needed in two locations:

- One 8943CF 4 Channel Electrical to Fiber Converter modules and one 8943FC Fiber to Electrical module
- Two 8939FCA modules

As shown in the detailed block diagram in [Figure 11 on page 26](#), an 8943CF (4 Channel Electrical to Fiber converter) and an 8943FC (4 Channel Fiber to Electrical converter) at Location A are used to send 4 channels of video to an 8939FCA. To utilize this application, one of each of the following four CWDM SFP device types must be installed on the two 8943CF modules:

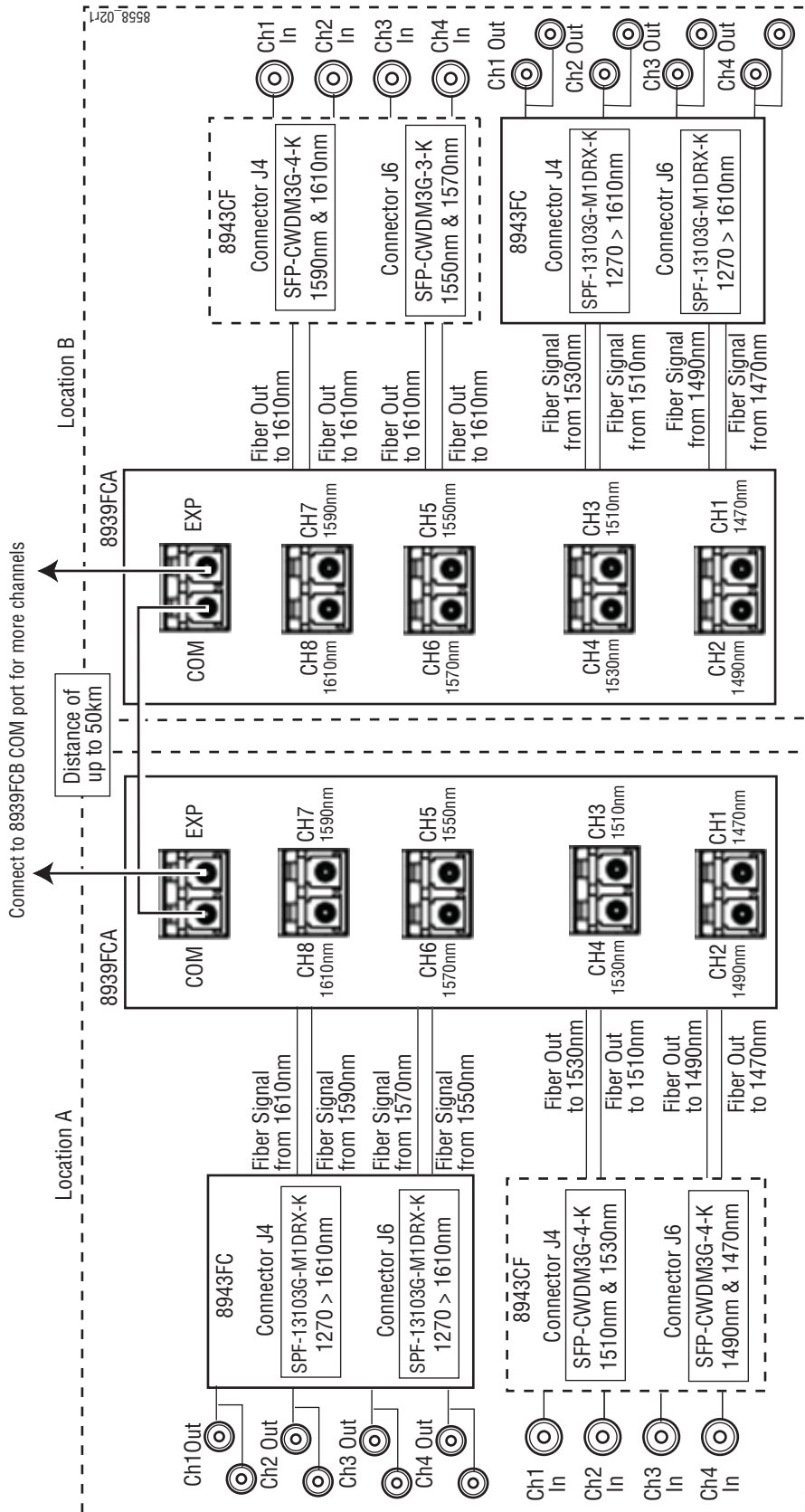
- SFP-CWDM3G-1-K Dual Transmitter (1490nm/1470nm frequencies)
- SFP-CWDM-2 Dual Transmitter (1510nm/1530nm frequencies)
- SFP-CWDM-3 Dual Transmitter (1550nm/1570nm frequencies)
- SFP-CWDM-4 Dual Transmitter (1590nm/1610nm frequencies)

Note The four SFP devices can be installed in any location on the two 8943CF modules as long as the outputs are cabled to the correct frequency input on the 8939FCA.

The 8939FCA module multiplexes these 8 frequencies down to a single output from the COM port. A single fiber cable carries these 8 video fiber channels to the COM port of the 8939FCA at Location B.

The 8939FCA at Location B acts as a demultiplexer and outputs 8 fiber video channels to two 8943FC (fiber to electrical) modules, each with two SFP-DRX-1 Dual Receiver SFP devices installed and a Grass Valley fiber-ready module. The SFP-DRX-1 SFP device will accept input frequencies from 1270nm to 1610nm.

Figure 11. Bi-directional Application



★Note: In this configuration (8959CFA to 8939CFA utilizing CWDM transmitters), if the distance between 8939CFA modules is less than 12 km (7.5 m), a 3 dB attenuator must be installed somewhere between the COM ports on the 8939CFA modules to prevent overdriving the receiver causing bit errors to occur on the link.

Configuration and Monitoring

The 8939FCA and 8939FCB modules require no configuration and as they are passive modules. They are only monitored for their presence in the frame, slots 3, 4, 7, and 8 in this example shown in [Figure 12](#).

Figure 12. 8939FCA/FCB Presence in Frame

Bay3 Rack Frame-1

- [Status](#)
- [Configuration](#)
- [Connections](#)
- [Frame Alarm Reporting](#)
- [LED Reporting](#)
- [SNMP Reporting](#)
- [Power Supply/Demand](#)
- [1 Media Slot 1](#)
- [2 Media Slot 2](#)
- [3 Media Slot 3](#)
- [4 Media Slot 4](#)
- [5 Media Slot 5](#)
- [6 Media Slot 6](#)
- [7 Media Slot 7](#)
- [8 Media Slot 8](#)
- [9 Media Slot 9](#)
- [10 Media Slot 10](#)
- [11 8900NET](#)
- [12 Power Supply 1](#)
- [13 Power Supply 2](#)

Status

Model: 8900FFN Description: Module Frame
 Frame Location: not assigned
 Frame Health Alarm ALARM Temperature Status PASS
 Power Status PASS

Empty	Empty	Module	Module	Empty	Empty	Module	Module	Empty	Empty	Net Card	Power Supply	Empty
-------	-------	--------	--------	-------	-------	--------	--------	-------	-------	----------	--------------	-------

Front Cover No Cover

Properties

Vendor Thomson, Grass Valley Software Version 4.3.0
 Media Slots 10 Network Config Network configuration stored on frame

Selecting the link to the 8939 module web page will report an empty slot as shown for the module in slot 4 shown in [Figure 13](#).

Figure 13. 8939FCA Module Web Page

Status

Model: [empty] Description: [empty]
 Frame Location: Modular Lab , Slot: 4
 Input Signal Name: not assigned
 Slot Status: NO COMM

```

    graph LR
        A[Input Signal(s)] --> B[Internal State]
        C[Reference Signal] --> B
        B --> D[Output Signal(s)]
    
```

Properties

Specifications

Table 1 gives the specifications for the 8939FCA and the 8939FCB modules..

Table 1. 8939FCA/FCB Specifications

Parameter	Value
Performance	
8939FCA 8 Channel CWDM channels	Ch 1: 1470nm Ch 2: 1490nm Ch 3: 1510nm Ch 4: 1530nm Ch 5: 1550nm Ch 6: 1570nm Ch 7: 1590nm Ch 8: 1610nm
8939FCB 8 Channel CWDM channels	Ch 9: 1310nm Ch 10: 1330nm Ch 11: 1350nm Ch 12: 1370nm Ch 13: 1390nm Ch 14: 1410nm Ch 15: 1430nm Ch 16: 1450nm
8 channel insertion loss	2.25 dB maximum
8 channel link loss	4 dB maximum
8 channel uniformity	1.25 dB
Expansion Port	
Wavelength coverage	FCA: 1270nm >1450nm FCB:
Insertion loss	1.25 dB maximum
Adjacent channel isolation	35 dB typical
Non-adjacent channel isolation	50 dB
Polarization dependent loss	0.1 dB
Optical return loss	50 dB minimum
Optical ripple	0.5 dB maximum
Thermal stability	0.005nm/degrees C
Mechanical	
Frame type	GeckoFlex
Number of slots required	1 rear slot
Rear module retainer clip screw torque	4-5 inch-lb./0.45-0.6Nm
Environmental	
Storage temperature	Refer to GeckoFlex Frames 8900FX/FF/FFN Signal Processing Systems Instruction Manual at www.grassvalley.com/docs/modular
Operating ambient temperature	
Power rating and size	0.0 W (passive) -single slot one piece rear mount

Table 2. Optional Dual Transmitter/Transceiver Specifications

Model Numbers	SFP-13103G-M1DTX-K SFP-13103G-M1DTX SFP-13103G-M2DTX	SFP-CWDM3G-1-K SFP-CWDM3G-1	SFP-CWDM3G-2-K SFP-CWDM3G-2	SFP-CWDM3G-3-K SFP-CWDM3G-3	SFP-CWDM3G-4-K SFP-CWDM3G-4	SFP-13103G-M1TRX-K SFP-13103G-M1TRX SFP-13103G-M2TRX
Wavelength 1	1310nm	1470nm	1510nm	1550nm	1590nm	1310nm
Wavelength 2	1310nm	1490nm	1530nm	1570nm	1610nm	N/A
Model Numbers		SFP-CWDM3G-5-K SFP-CWDM3G-5	SFP-CWDM3G-6-K SFP-CWDM3G-6	SFP-CWDM3G-7-K SFP-CWDM3G-7	SFP-CWDM3G-8-K SFP-CWDM3G-8	
Wavelength 1		1310nm	1350nm	1390nm	1430nm	
Wavelength 2		1330nm	1370nm	1410nm	1450nm	
Transmit Channels	2	2	2	2	2	1
Optical connectors	LC					
Fiber support	Single-mode					
Data Rate	143 Mb/s to 2.9 Gb/s					
Power Output @ 2.97 Gb/s, 360 Mb/s, and 270 Mb/s	TX power: -7 to +2dBm (± 3dB)	TX Power: -2 to +5dBm (+3dB)				TX Power: -7 to +2dBm RX Power: -22 to -1 dB (± 3dB)
Maximum Distance with SFP-13103G-M1DRX-K SFP-13103G-M1DRX SFP-13103G-M2DRX @ 2.97 Gb/s	10 km	50 km				30 km
Maximum Distance with SFP-13103G-M1DRX-K SFP-13103G-M1DRX SFP-13103G-M2DRX @ 2.97 Gb/s	20 km	60 km				20 km
Minimum Distance with SFP-13103G-M1DRX-K SFP-13103G-M1DRX SFP-13103G-M2DRX @ 2.97 Gb/s	0 km (See Note ¹)	0 km (see Note ²)				0 km (See Note ¹)
Minimum Distance with SFP-13103G-M1DRX-K SFP-13103G-M1DRX SFP-13103G-M2DRX @ 2.97 Gb/s	N/A	50 km (see Note ³)				N/A
Optical Input Wavelength	N/A					

¹ The 1310nm Dual Transmitter (SFP-13103G-M1DTX) and Transceiver (SFP-13103G-M1TRX, SFP-13103G-M2TRX) require no attenuation between fiber transmitter and receiver connections at any cable lengths.

² All CWDM devices used in point-to-point configuration with a cable run from 0-20 km, must be attenuated by 6 dB between the fiber transmitter and receiver connections.

³ CWDM devices used with 8939FCA or 8939FCA/8939FCB modules for a mux/demux configuration with a cable run from 0-12 km (7.5 miles), must be attenuated by 4 dB between 8939FCA or the 8939FCA/8939FCB COM ports.

Table 3. Optional SFP Receiver/Transceiver Fiber Optic SFP Device Specifications

Model Numbers	SFP-13103G-M1DRX-K SFP-13103G-M1DRX, SFP-13103G-M2DRX	SFP-13103G-M1TRX-K SFP-13103G-M1TRX SFP-13103G-M2TRX
Low wavelength	1270nm	1270nm
High wavelength	1610nm	1610nm
Receiver channels	2	1
Connector type	LC	
Fiber support	Single-mode	
Data rate	143 Mb/s to 2.97 Gb/s	
Maximum Receive Signal Levels @ 2.97 Gb/s, 360 Mb/s, and 270 Mb/s	-3 dBm (0.501 mW)	
Minimum Receive Signal Levels @ 2.97 Gb/s, 360 Mb/s, and 270 Mb/s	-23 dBm (0.500794 mW)	

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