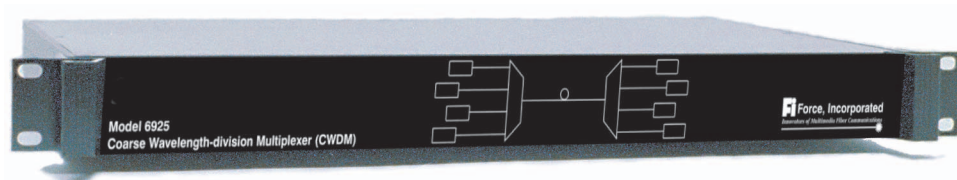


# Model 6925

1RU CWDM

IOM6925  
Revision 2.0, October 2004



**Instructions for Installation and Use**  
*Read this manual before installing or using this product.*  
*Observe all safety warnings and cautions.*

Copyright © 2004 by Force, Incorporated. All rights reserved. Force, Incorporated reserves the right to make changes to the product described in this document in the interest of document improvement.

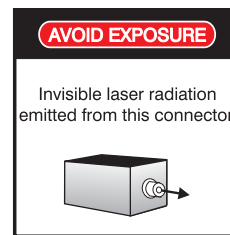




# Preface

## WARNING

**The optical emissions from the optical connectors and the optical fiber are laser-based and may present eye hazards. Follow all safety precautions.**



## About this Manual

This manual explains how to configure and install the Model 6925 1RU CWDM. It is intended for engineers and technicians who will install the units. While this guide provides basic information on how to configure and install the units, it assumes that you as the user are familiar with:

- the installation and manipulation of electronic and fiber optic transport equipment
- the installation and manipulation of coarse wavelength-division multiplexers

This manual is divided into the following sections:

- Section 1, page 1, Product Technical Bulletin: Describes the Model 6925, lists technical specifications, performance graphs, system applications, and ordering information.
- Section 2, page 5, Installation and Operation: Describes the installation and operation of the Model 6925, its connections to companion optical transport equipment, and troubleshooting.
- Section 3, page 9, Maintenance and Safety Precautions: Describes the unit maintenance of the Model 6925 as well as all relevant safety precautions.

A quick-reference index completes the user manual.



## Related Documentation

- AN136: DWDM/CWDM and ITU Channels
- AN138: Specifying Force, Inc. CWDM and DWDM Modules
- *Fiber Optic Reference Guide, 3rd Edition*. by David R. Goff (Focal Press 2002): General theory and operation of fiber optic units.
- Web Site: Our web site, <http://www.forceinc.com> may be used to download the latest versions of this manual.

## Technical Support

If you encounter any kind of problem after reading this manual, contact your local distributor or a Force, Inc. Applications Engineer. To reach technical support:

On the Web:	<a href="http://www.forceinc.com">http://www.forceinc.com</a>
By Phone (Monday through Friday 8:00 am to 5:00 pm EST):	USA (800) 732-5252 TEL (540) 382-0462
By Fax:	(540) 381-0392
By Email:	<a href="mailto:csr-sales@forceinc.com">csr-sales@forceinc.com</a>

## Warranty

Force, Incorporated standard products are warranted to be free from defects in materials and workmanship, meeting or exceeding factory specified performance standards for a period of three (3) years from date of purchase.

## Force Obligations


Force will, at its discretion and expense, repair any defect in materials or workmanship or replace the product with a new product. Force will, upon receipt of the return, evaluate the product and communicate to the customer the nature of the problem, and determine if the claim falls under warranty coverage.

If during the warranty period, Force is unable to repair the product to the original warranted state within a reasonable time, or if subcomponents of the unit have been obsoleted or discontinued, then Force has the option to provide an equivalent unit.

## Exclusions

This warranty does not extend to any product that has been damaged due to acts of God, accident, misuse, abuse, neglect, improper system design or application, improper installation, improper operation or maintenance, or connection to an improper voltage supply.

The Force warranty does not cover fuses, batteries, and lamps. Modifications or alterations of Force products (including but not limited to installation of non-Force equipment or computer programs), except as authorized by Force, will void this warranty. Removal or breaking of the seals on the product will also void the warranty. In addition, cost of repair by unauthorized persons within the warranty period of the product will not be covered by Force, Incorporated. Such repairs will void the warranty.



Force, Incorporated makes no other representation or warranty of any other kind, express or implied, with respect to the goods, whether as to merchantability, fitness for a particular purpose, or any other matter. Force, Incorporated's liability shall not include liability for any special, indirect or consequential damages, or for any damages arising from or attributable to loss of use, loss of data, loss of goodwill, or loss of anticipated or actual revenue or profit, or failure to realize expected savings, even if Force, Incorporated has been advised of the possibility of such damages. This warranty constitutes Force, Incorporated's entire liability and the customer's sole remedy for defects in material and workmanship.

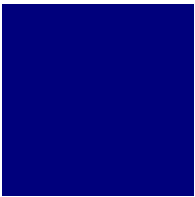
### **Warranty Activation**

Failure to activate the warranty may cause the effective warranty beginning date to revert to the date of manufacture rather than the date of purchase. To activate the three year warranty for this product, go to Force, Inc.'s web site at **<http://www.forceinc.com/warranty/>** and submit the warranty activation form, or return the warranty activation card enclosed with the product. For customer assistance, contact (800) 732-5252 or (540) 382-0462 or email Force customer support at [csr-sales@forceinc.com](mailto:csr-sales@forceinc.com).



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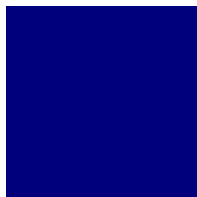
# Section 1 Product Technical Bulletin

## 1.1 Product Overview

The Model 6925 1RU CWDM is an all-fiber, bidirectional multiplexer/demultiplexer. The coarse wavelength-division multiplexer/demultiplexer allows four, six, or eight channels to be stacked in the 1550 nm region of optical fiber. The Model 6925 features low insertion loss and low polarization-dependent loss. The units operate using single-mode fiber, and may be configured for unidirectional or bidirectional four, six, or eight channel transmission. The Model 6925 implements higher channel-to-channel isolation to ensure that no interference occurs between channels in a bidirectional configuration. CWDM technology increases the capacity of the embedded fibers, allowing multiple video, audio, and data channels to be transmitted over one fiber, while maintaining system performance and enhancing transport systems. The Model 6925 is an excellent choice for addressing the increased need for efficient and capable optical transmission.

## 1.2 Optical Specifications

	Min.	Typ.	Max.	Units	Notes See Section 1.4
<b>4 Channel Models</b>					
Center Wavelengths	1511, 1531, 1551, 1571			nm	
0.5 dB Passband		15		nm	
Ripple of Passband		0.4		dB	
Insertion Loss		2.0	2.5	dB	
Channel Uniformity			1.2	dB	1
Isolation of Adjacent Channels	25			dB	
Isolation of Non-adjacent Channels	40			dB	
Directivity	55			dB	
Polarization Dependent Loss			0.1	dB	
Return Loss	45			dB	
Polarization Mode Dispersion			0.1	ps	
Thermal Stability			0.006	dB/°C	
Optical Power			250	mW	



**6 Channel Models**

	Min.	Typ.	Max.	Units	Notes
Center Wavelengths	1471, 1491, 1511, 1531, 1551, 1571			nm	See Section 1.4
0.5 dB Passband	Center Wavelength $\pm$ 7			nm	
Ripple of Passband		0.3		dB	
Insertion Loss		2.8	3.4	dB	
Channel Uniformity			1.2	dB	
Isolation of Adjacent Channels	28			dB	
Isolation of Non-adjacent Channels	40			dB	
Directivity	50			dB	
Polarization Dependent Loss			0.2	dB	
Return Loss	45			dB	
Polarization Mode Dispersion			0.1	ps	
Thermal Stability			0.006	dB/°C	
Optical Power			250	mW	

**8 Channel Models**

Center Wavelengths	1471, 1491, 1511, 1531, 1551, 1571, 1591, 1611			nm	1
0.5 dB Passband		15		dB	
Ripple of Passband		0.4		dB	
Insertion Loss		3.6	4.5	dB	
Channel Uniformity			1.5	dB	
Isolation of Adjacent Channels	28			dB	
Isolation of Non-adjacent Channels	40			dB	
Directivity	55			dB	
Polarization Dependent Loss			0.2	dB	
Return Loss	45			dB	
Polarization Mode Dispersion			0.1	ps	
Thermal Stability			0.007	dB/°C	
Optical Power			250	mW	

**1.3 Environmental and Physical Characteristics**

	Min.	Typ.	Max.	Units	Notes
Operating Temperature Range	0		+65	°C	See Section 1.4
Storage Temperature Range	-40		+85	°C	
Humidity	5		90	%	2
Weight		5.5		lbs.	
		2.4		kg	
Physical Dimensions	19.0 x 1.75 x 11.8			in.	3
	483 x 45 x 300			mm	3

**1.4 Specification Notes**

- 1) Channel uniformity specification is given at the center wavelength.
- 2) Humidity is RH non-condensing.
- 3) Dimensions include mounting flanges.



### 1.5 Applications

Figure 1.1 illustrates the Model 6925 in a broadcast transport platform using a redundant fiber path configuration via the Model 5615 Optical A/B Switch. This application uses eight CWDM broadcast transmitters. Four transmitters connect to one Model 6925 1RU CWDM mux while the other four transmitters connect to a second Model 6925. The two outputs of each CWDM connect to the A and B inputs of the Model 5615 switch. Normally each fiber will take a different route to improve reliability. At the receive end, the Model 5615 outputs the primary fiber signal to the CWDM demux.

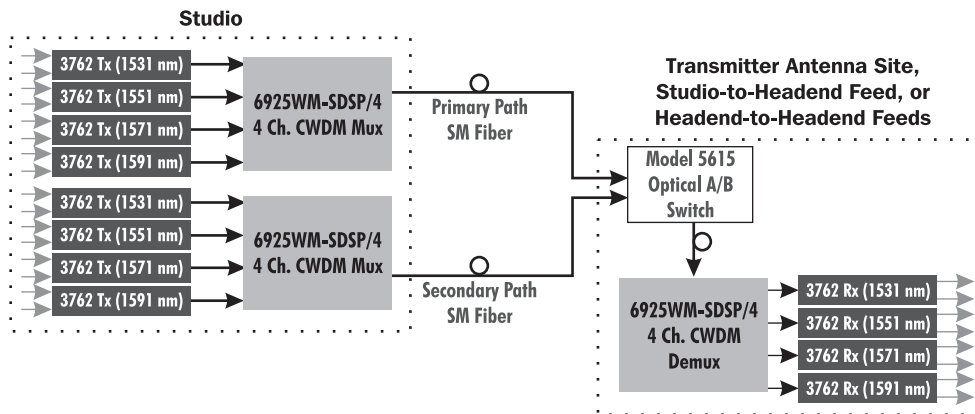


Figure 1.1 CWDM Broadcast Transport Platform in a Redundant Path Configuration

Figure 1.2 illustrates a high density Teleport application, using the Model 6925 to increase the number of channels per fiber.

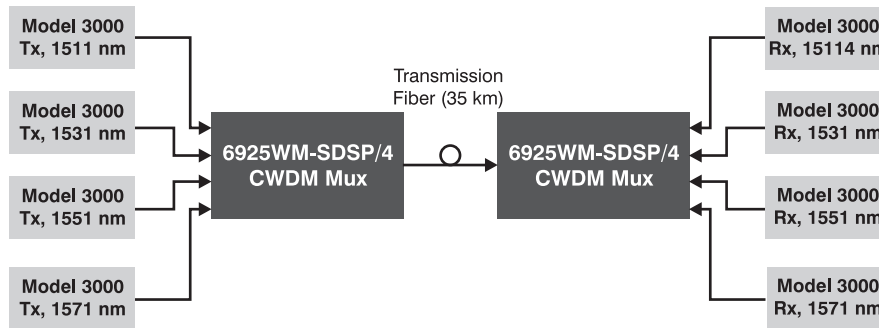


Figure 1.2 L-Band Teleport Transport using a CWDM

### 1.6 Part Numbers

CWDM Options	4-Channel	6-Channel	8-Channel
Mux, 1RU, SC/APC Connectors	6925WM-SDSP/4	6925WM-SDSP/6	6925WM-SDSP/8
Demux, 1RU, SC/APC Connectors	6925WD-SDSP/4	6925WD-SDSP/6	6925WD-SDSP/8
<b>Optical Jumper</b>	<b>1-Meter</b>	<b>3-Meters</b>	
SC/APC Connectors	8000-0241-03	8000-0241-04	



**Notes:**



# Section 2 Installation and Operation

## 2.1 General Installation Requirements

The installation of these units is very simple. There are no special unpacking instructions, except that care should be taken to handle units gently. The unit requires no assembly and only threshold adjustments are needed. Follow the instructions below to properly install the units.

## 2.2 Items Provided

The following is a list of items provided with each Model 6925 1RU CWDM:

Qty.	Mfr.	P/N	Description
AR	Force, Inc.	6925WM-SDSP/X	CWDM Mux, 1RU, SC/APC Connector, 4, 6, or 8 channels (X specifies the channel count.)
AR	Force, Inc.	6925WD-SDSP/X	CWDM Demux, 1RU, SC/APC Connector, 4, 6 or 8 channels (X specifies the channel count.)
1 per connector	AR	Any	Active Device Receptacle Caps
AR	Force, Inc.	8000-0241-XX	Optical Jumpers. See Section 1.6, page 3 for part numbers

## 2.3 Items Required

Qty.	Mfr.	P/N	Description
AR	Any	Any	Standard IEC 19" Wide Relay Rack
4 sets per unit	Any	Any	Bolts, Washers, and Nuts Required to Install Unit in the Relay Rack
AR	Any	Any	Optical Transmission Terminals
AR	Any	Any	9/125 μm Single-mode Fiber

## 2.4 Inspection

Remove the unit from its shipping container. Any in-shipment damage that may have occurred should be visually apparent. Look for bent or damaged connectors or mounting brackets. Claims for damage incurred in shipment should be made directly to the transportation company in accordance with their instructions. Save the shipping cartons until installation and performance verification are completed.

## 2.5 Equipment Rack Configuration

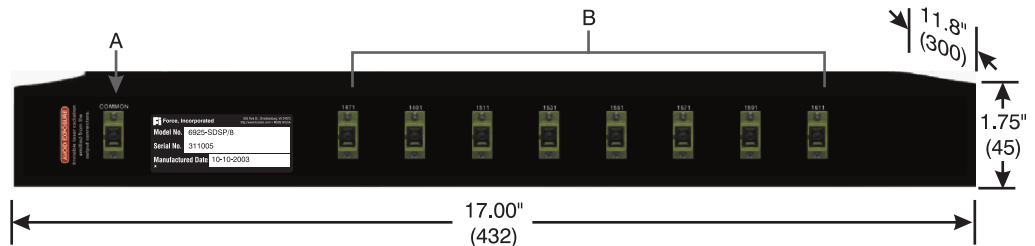
Carefully unpack the unit, and install it in your earth grounded equipment rack. Make sure to load the heaviest equipment near the bottom of the rack and the lightest equipment at the top of the rack. The surface of the equipment rack that mates to the chassis mounting ears should be conductive. The unit should be located in an area that provides adequate lighting and is relatively free from dust. The units are each housed in a single 19" EIA standard 1RU (1.75 inch) rack-mount chassis.

## 2.6 Connections

Connector Name	Connector Type	Mux Connector Function	Demux Connector Function
Common	SC/APC (1)	Transmission Fiber Optical Output	Transmission Fiber Optical Input
1471, 1491, 1511, 1531, 1551, 1571, 1591, 1611 (2)	SC/APC (1)	CWDM Optical Inputs	CWDM Optical Outputs

- (1) Only APC type optical connectors should be connected to the optical ports. Never connect a PC or UPC type connector to these units. Permanent damage to the optical ports can result.
- (2) The unit ships with the required optical jumpers. Replacement jumpers may also be ordered separately. See Section 1.6, page 3 for part numbers.

## 2.7 Rear Panel Description



- A. Common (SC/APC Connector): On the multiplexer unit, this connector provides the transmission fiber optical output. On the demultiplexer unit, this connector provides the transmission fiber optical input.
- B. 1471 through 1611 (SC/APC Connector): On the multiplexer unit, these connectors provide the CWDM optical inputs. On the demultiplexer unit, these connectors provide the CWDM optical outputs.

### WARNING

OPTICAL LASER RADIATION IS PRESENT AT THE OPTICAL OUTPUT CONNECTORS. AVOID DIRECT EYE EXPOSURE TO THE INVISIBLE BEAM.

**Figure 2.1 Model 6925 1RU CWDM Rear Panel**  
(Dimensions in parentheses are in millimeters.)

## 2.8 Connections and Power-up

- 1) Install the Model 6925 as described in Section 2, page 5 of this document.
- 2) Clean the optical connectors. See Section 3.2.1, page 9 for cleaning instructions.
- 3) Connect the companion optical CWDM transmitter outputs to optical inputs 1471-1611 on the multiplexer using the optical jumpers provided.
- 4) Connect the "Common" optical port to the transmission fiber. Be sure that the fiber has continuity and less than the maximum allowable optical loss required by the transmitter.
- 5) At the receive end, connect the transmission fiber to the "Common" optical port on the demultiplexer.

- 6) Connect optical outputs 1471-1611 to the optical CWDM receiver inputs using the optical jumpers provided.
- 7) Apply power to the optical transmitters and receivers as detailed in the user manuals for the companion equipment. Assuming that the transmitters and receivers are operating properly, the units are now fully operational. No additional user adjustment or attention is required. See Section 3.1, page 9 for instructions on maintaining and cleaning the link.

## 2.9 Troubleshooting

The Model 6925 1RU CWDM is a passive device and rarely represents a point of failure for a CWDM system. Be sure to maintain clean optical connections at all times. More common problems involve the optical transport terminals, including using an optical transmitter as a receiver and vice versa, lack of continuity in the optical fiber, lack of power (or reversed power) at the transmitter or receiver ends, or improper transmitter or receiver input levels. If problems persist contact the factory.



**Notes:**



## Section 3 Maintenance and Safety Precautions

### 3.1 Unit Maintenance

No user maintenance is required. The Model 6925 contains no user serviceable parts and requires no routine service. Contact the factory if the unit requires warranty repair work.

### 3.2 Cleaning

If the units need to be cleaned, avoid the use of all solvents and use low-pressure clean air to remove loose dirt. Use low-pressure clean air to clear the connectors of any debris. Dirty or scratched connector end faces will greatly reduce the unit's performance. Foam-tipped swabs such as the 2.5mm Mini Foam Swab offered by Fiber Instrument Sales (P/N F1-0005) may be saturated with denatured alcohol\* and inserted into the optical port for cleaning. **DO NOT INSERT A DRY SWAB INTO THE OPTICAL PORT AS THIS MAY DAMAGE THE FIBER END FACE.** Many fiber optic installations experience degraded performance due to dirty optical connector end faces. The following procedure should be used to properly clean the optical connector end faces.

#### 3.2.1 Optical Connector Cleaning Equipment

- Kimwipes® or any lens-grade, lint-free tissue. The type sold for eyeglasses work quite well.
- Denatured Alcohol.

#### NOTE

Use only industrial grade 99% pure isopropyl alcohol. Commercially available isopropyl alcohol is for medicinal use and is diluted with water and a light mineral oil. Industrial grade isopropyl alcohol should be used exclusively.

- 30X Microscope.
- Canned Dry Air.

#### 3.2.2 Directions for Optical Connector Cleaning

- 1) Fold the tissue twice so it is four layers thick.
- 2) Saturate the tissue with alcohol.
- 3) First clean the sides of the connector ferrule. Place the connector ferrule in the tissue, and apply pressure to the sides of the ferrule. Rotate the ferrule several times to remove all contamination from the ferrule sides.
- 4) Now move to a clean part of the tissue. Be sure it is still saturated with alcohol, and it is still four layers thick. Put the tissue against the end of the connector

ferrule. Put your fingernail against the tissue so that it is directly over the ferrule. Now scrape the end of the connector until it squeaks. It will sound like a crystal glass that has been rubbed when it is wet.

- 5) Use the microscope to verify the quality of the cleaning. If it isn't completely clean repeat the steps with a clean tissue.
- 6) Mate the connector immediately! Don't let the connector lie around and collect dust before mating.
- 7) Air can be used to remove lint or loose dust from the port of a transmitter or receiver to be mated with the connector. Never insert any liquid into the ports.

### 3.2.3 Connector Handling

- 1) **NEVER TOUCH THE FIBER END FACE OF THE CONNECTOR.**
- 2) Connectors not in use should be covered over the ferrule by a plastic dust cap. It is important to note that inside of the ferrule dust caps contains a sticky gelatinous residue that is the by-product of the making of the dust cap. This residue will remain on the ferrule end after the cap is removed. Therefore it is critical that the ferrule end be cleaned thoroughly **BEFORE** it is mated to the intended unit.

## 3.3 Safety Precautions

The optical emission from the units are laser-based Class IIIb, and may present eye hazards if improperly used. **NEVER USE ANY KIND OF OPTICAL INSTRUMENT TO VIEW THE OPTICAL OUTPUT OF THE UNIT.** As always, be careful when working with optical fibers. Fibers can cause painful injury if they penetrate the skin.

### 3.3.1 Laser Safety Procedures

- 1) **ALWAYS** read the product data sheet and the laser safety label before powering the product. Note the operating wavelength, optical output power, and safety classification.
- 2) If safety goggles or other eye protection are used, be certain that the protection is effective at the wavelength(s) emitted by the device under test **BEFORE** applying power.
- 3) **ALWAYS** connect a fiber to the output of the device **BEFORE** power is applied. Power should never be applied without an attached fiber output. If the device has a connector output, a connector should be attached that is connected to a fiber. This ensures that all light is confined within the fiber waveguide, virtually eliminating all potential hazard.
- 4) **NEVER** look in the end of a fiber to see if light is coming out. **NEVER!** Most fiber optic laser wavelengths (1310 nm and 1550 nm) are totally invisible to the unaided eye and will cause permanent damage. Shorter wavelength lasers (e.g. 780 nm) are visible and are very damaging. Always use instruments, such as an optical power meter, to verify light output.
- 5) **NEVER NEVER NEVER** look into the end of a fiber on a powered device with **ANY** sort of magnifying device. This includes microscopes, eye loupes, and magnifying glasses. This **WILL** cause a permanent, irreversible burn on your retina. Always double check that power is disconnected before using such devices. If possible, completely disconnect the unit from any power source.
- 6) If you have questions about laser safety procedures, please call Force, Incorporated for assistance before powering your product. A Sales Engineer or Applications Engineer may be reached at (540) 382-0462.



7) Laser safety classes for the Model 6925 are as follows:

Class	Wavelength Range	Optical Power Accession Limits
IIIb	180 nm to 400 nm	Varies with $\lambda$ and exposure time. 0.5 Watt
	400 nm to $10^6$ nm	

### 3.4 Shipping and Handling Precautions

The units are, in general, very rugged and can withstand the stresses of most shipping and handling circumstances. However, the following precautions should be taken:

- 1) When the units are shipped they should be wrapped in a protective material, such as bubble wrap, to protect against excessive jarring and to prevent damage to the external finish of the units. Always use packing material to separate multiple units that are packaged together.
- 2) Care should be taken not to drop or strike the units in any way, especially around the optical connectors.
- 3) The units should never be submersed in any liquid.

### 3.5 Storing the Unit

If a unit is to be out of use for an extended period of time, the following steps should be taken to ensure the preservation of the unit:

- 1) The storage temperature range is  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ .
- 2) A low humidity environment is preferable for long term storage.
- 3) All connectors should be covered with active device receptacle caps.

### 3.6 Repair Service

For equipment repair or technical assistance, contact Customer Service (800) 732-5252 (USA) or (540) 382-0462. A Returned Material Authorization (RMA) number must be issued by Customer Service before the return of a failed unit. Units should be returned in their original shipping carton, if available. Always include a complete description of the failure or observed anomalies, and include the unit's model number and serial number, which are located on the rear panel product label.



**Notes:**



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