



OPTICAL BROADCAST SYSTEMS

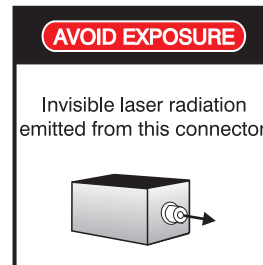
Model 3005PRO Medium Range 75 Ohm Fiber Optic L-Band Link

Installation Guide and User Manual

IOM3005PRO
Revision 1.0, October 2005

Laser Safety Warning

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



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:	http://www.forceinc.com
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:	csr-sales@forceinc.com

Contents

Shipping and Handling Precautions 14

Storing the Unit 14

Laser Safety Warning 1

Technical Support 1

Product Specifications 3

Optical and RF Characteristics 3

Electrical Characteristics 3

Physical Characteristics 3

Environmental Characteristics 4

Specification Notes 4

 System Gain vs. Optical Loss 4

 Noise Figure vs Optical Loss 5

Installation and Operation 6

General Installation Instructions 6

Transmitter Description 6

 Model 3005Pro Transmitter 6

Receiver Description 7

 Model 3005PRO Receiver 7

3RU Chassis Description 7

3RU Power Supply Description 7

Items Provided 7

Items Required 8

Inspection 8

Equipment Rack Configuration 8

Module Installation 8

LED Functions 8

Connections 9

Safety Precautions 9

Operating Instructions 9

RF Status Voltages 9

Troubleshooting 11

 Problems and Comments 11

Cleaning 11

Warranty and Return Policy 12

Warranty 12

 Force Obligations 12

 Exclusions 12

Product Return Policy 13

 Products Returned for Credit - Non Distributor 13

Products Returned for Repair or Replacement 13

 Active Product Under Warranty 13

 Obsolete Product Under Warranty 13

 Active Out of Warranty 13

 Obsolete Product Out of Warranty 14

Receiving an RMA for Returns 14

Product Specifications

Optical and RF Characteristics

	Min.	Typ.	Max.	Units	Notes
Laser Wavelength		1310		nm	
Laser Output Power	+2	+3	+4	dBm	1
Rx Optical Input Power	-20		+4	dBm	1,2
Tx Input RF Return Loss		13	10	dB	
Rx RF Output Return Loss		20	15	dB	
System Gain (0 dB Opt. Loss)	18	20	22	dB	
System Gain Variation Over Temp.	-2		2	dB	
Amp. Flatness (950 - 2150 MHz)		+/-1	+/-1.5	dB	
Group Delay (950 - 2150 MHz)		0.5	1	ns	
Noise Figure (0 dB opt. loss)		22	24	dB	
Noise Figure (9 dB opt. loss)		31	35	dB	
Tx RF Input Range	-60		-15	dBm	3
Input RF Compression Point		-8		dBm	
Output RF Compression Point		+11		dBm	
Intermodulation Distortion		-50	-40	dBc	

Two -25 dBm tones @ 1000,1001 MHz

Electrical Characteristics

	Min.	Typ.	Max.	Units	Notes
Supply Voltage		+20		VDC	
Supply Current (Tx, No LNB)		50		mA	
Supply Current (Rx)		55		mA	
Max LNB Current Draw			300	mA	4
LNB Voltage Horizontal	+16	+17	+18	Volts	
LNB Voltage Vertical	+12	+13	+14	Volts	

Physical Characteristics

	Min.	Typ.	Max.	Units	Notes
Weight		12.8		oz.	
		363		g	
Dimensions	5.25 x 2.56 x 1.25			in.	
	133 x 65 x 32			mm	

Environmental Characteristics

	Min.	Typ.	Max.	Units	Notes
Operating Temperature Range	-40		+60	°C	
Storage Temperature Range	-40		+60	°C	
Humidity (RH non-condensing)	5		95	%	

Specification Notes

- 1) All optical power levels are average values.
- 2) The receiver contains a tri-colored optical input level LED indicator. The LED will be green when the proper optical input level is being received. When the optical input falls below -20 dB, the LED will turn orange, and when the optical input exceeds +3 dBm, the LED will turn red.
- 3) The transmitter contains a tri-colored RF input level LED indicator. The LED will be green when the proper RF level is being input to the transmitter. When the RF level falls below optimum, the LED will change to orange. When the RF level rises above optimum, the LED will change to red. NOTE: An orange LED indication does not mean the transmitter is no longer functioning, it is not an error condition.
- 4) The maximum current draw specification is based on the transmitter providing LNB power.

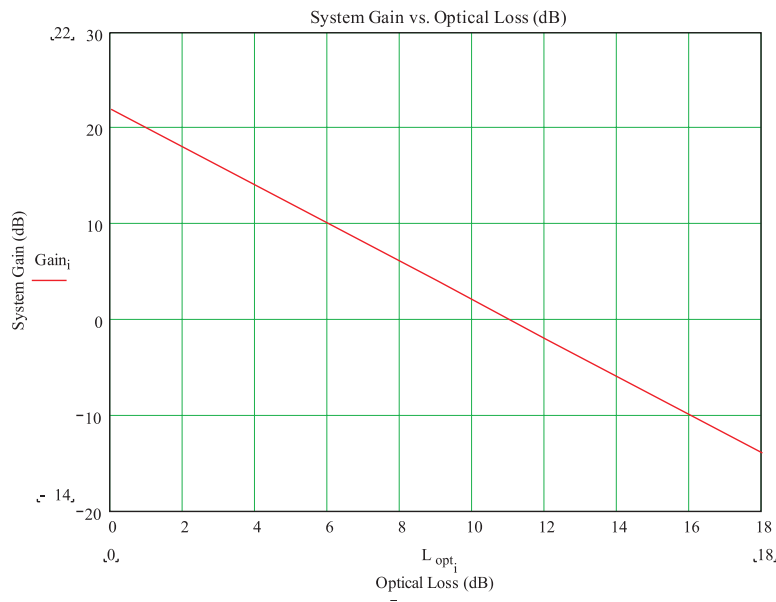


Figure 1 System Gain vs. Optical Loss

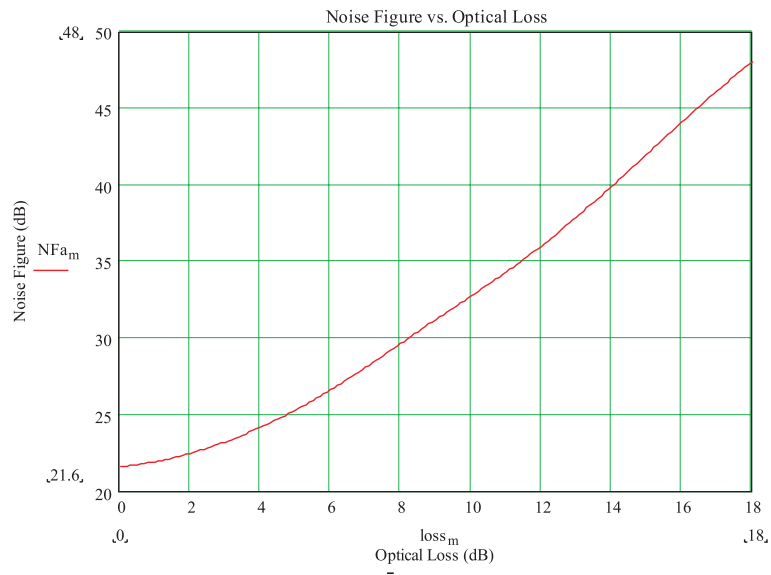


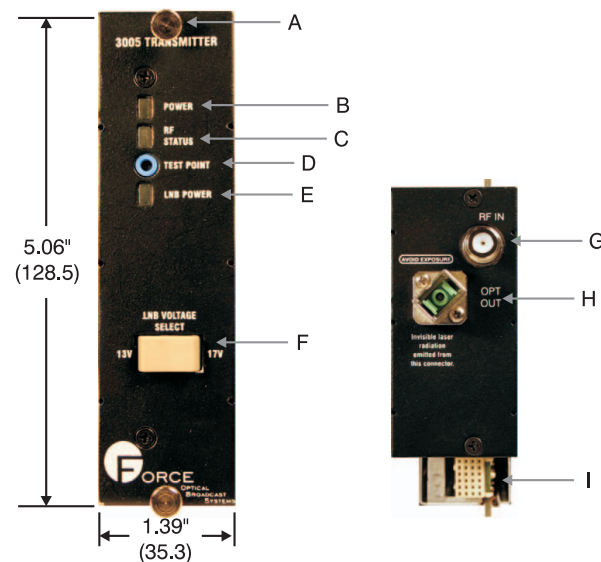
Figure 2 Noise Figure vs Optical Loss

Installation and Operation

General Installation Instructions

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

Transmitter Description



- A. Thumbscrews (2 places): Used to secure the module top and bottom to the 3RU chassis.
- B. Power (Green LED): When lit, indicates that the module is receiving AC power.
- C. RF Status (Tri-colored LED): Indicates the RF level input to the transmitter. The LED will be amber when the RF level is below normal operating levels, green when in the normal operating range, and red when the RF level is above normal.
- D. Test Point: Allows the user to monitor the RF status voltages. See RF Status Voltages on page 9 for more information.
- E. LNB Power (Green LED): When lit, indicates that the LNB power is enabled.
- F. LNB Voltage Select (Two Position Switch): Toggles between 13V and 17V.

- G. RF In (75 Ohm F Connector): RF Input to the transmitter.
- H. Optical Output (FC/APC or SC/APC connector): Optical output from the transmitter.

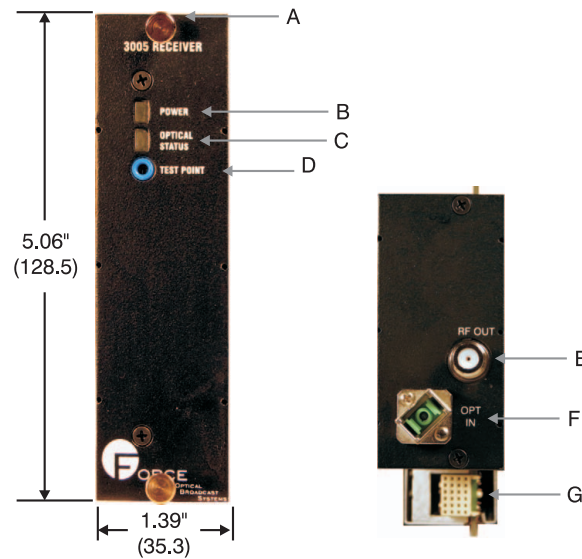
WARNING

Invisible laser radiation is emitted from the optical connector. Avoid direct eye contact with the beam.

- I. Backplane Connection: Inserts into the backplane of the rack chassis, allowing the chassis to provide power to the module.

Figure 3 Model 3005Pro Transmitter
Dimensions in parentheses are in millimeters

Receiver Description



- A. Thumbscrews (2 places): Used to secure the module top and bottom to the 3RU chassis.
- B. Power (Green LED): When lit, indicates that the module is receiving AC power.
- C. Optical Status (Tri-colored LED): Indicates the optical signal into the receiver. The LED will be amber when optical signal is low, green when receiving normal optical power, and red when the input is high.
- D. Test Point: Allows the user to monitor the optical status voltages. See optical Status Voltages on page 9 for more information.
- E. RF Out (F Connector): RF output from the receiver.
- F. Optical In (FC/APC or SC/APC Connector): Optical input to the receiver.
- G. Backplane Connection: Inserts into the backplane of the rack chassis, allowing the chassis to provide power to the module.

Figure 4 Model 3005PRO Receiver
 Dimensions in parentheses are in millimeters

3RU Chassis Description

The Model 3005PRO fits in the Model 3000CB-NN 3RU rack chassis. The 3RU rack chassis can house one or two power supplies and up to eight hot-swappable transmitter or receiver modules. See IOM 3000C for complete details on the chassis.

3RU Power Supply Description

The Model 3000UC-NN power supply provides universal AC power to the rack chassis and the units installed in the chassis. Model 3000UE-NN provides -48 Volts DC power. One or two power supplies may be accommodated. The power supply features a green “Power On” LED that indicates when the chassis is receiving AC power. A ground point on the front panel provides a common ground for all modules installed in the chassis. The power supply meets all UL requirements. See IOM3000C for specifications and details.

Items Provided

The following is a list of items provided with each Model 3005PRO:

Qty.	Mfr.	P/N	Description
AR	Force, Inc.	3005P-T-1310-SA	Transmitter, LNB Power, SC/APC Connectors
AR	Force, Inc.	3005P-R-SA	Receiver, SC/APC Connectors
1 per connector	Any	Any	Active Device Receptacle Caps

Items Required

Qty.	Mfr.	P/N	Description
AR	Force, Inc	3000CB-NN	3RU 19" Rack Chassis
1 or 2	Force, Inc	3000UB-NN	3RU Power Supply, Universal AC
1 or 2	Force, Inc.	3000UE-NN	3RU Power Supply, -48 Volts DC
AR	Force, Inc	3000EA-NN	Optional Blank Panel for unused module slots
AR	Force, Inc	3000EB-NN	Optional Blank Panel for unused power supply slot
1 per rack	Any	Any	Three-wire Ground IEC Power Cable (AC Versions)
AR	Any	Any	14 AWG Stranded Copper Wire (UL 1061, 300V, 80°C) (DC Versions)
AR	Any	Any	Standard EIA 19" Rack with Earth Ground
AR	Any	Any	9/125 μm Single-mode Fiber with Appropriate Optical Connectors

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 have been completed.

Equipment Rack Configuration

Carefully unpack the chassis, 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 chassis should be located in an area that provides adequate lighting and is relatively free from dust. To ensure the modules do not overheat, leave 1RU of space above and below each installed 3000 chassis. When connecting power to the 3000 chassis, take care as to not overload the branch circuit supplying power to whatever is already connected. Also, make sure there are no obstructions in the fan exhaust or inlet paths.

Module Installation

The modules come pre-installed in the 3000 chassis. Make sure that adequate space is available for cabling and safe access for inspection or troubleshooting. When replacing modules, align the top and bottom of the module with the rack guides in the 3RU rack. Push the module firmly to engage the rear power plane connector.

NOTE

When using redundant power supplies, apply power to the power supply before module installation into the rack chassis. If power is not at the power supply at installation, an alarm condition will be reported to the DB-25 connector located at the rear of the rack chassis. See IOM3000 for a list of faults that may be reported.

LED Functions

Location/Name	Color	Condition
Transmitter/Power	Green	Unit is powered.
	Off	Unit is not powered.
Transmitter/RF Alarm	Green	Composite RF power within optimal range.
	Red	Composite RF power too high.
	Orange	Composite RF power too low.
Receiver/Power	Green	Unit is powered.
	Off	Unit is not powered.
Receiver/Optical Alarm	Green	Optical power between -20 dBm and +4 dBm.
	Red	Optical power above +4 dBm.
	Orange	Optical power below -20 dBm.

NOTE: All trip levels are guaranteed within ±2 dB.

Connections

Connector Name and Location	Connector Type	Tx Connector Function	Rx Connector Function
Rear Panel	FC/APC* or SC/APC	Optical Output	Optical Input
Rear Panel	F	RF Input/LNB Power Output	RF Output/LNB Power Input

*Note: The FC/APC interface uses the "wide-key" standard and is optimized for use with FC/APC connectors that have a 2.14 wide alignment key. "Narrow-key" FC/APC connectors (2.02 mm), often referred to as JDS compatible, may be used but will produce inferior results. Standard FC/PC connectors have a 2.36 mm wide key and cannot be plugged into either unit.

Safety Precautions

The optical emission from the units are laser-based and present eye hazards if improperly used. **Never use any kind of optical instrument to view the optical output of the unit.** Complete laser safety procedures may be downloaded at <http://www.forceinc.com/techbull/laser-safety-procedures.pdf>. As always, be careful when working with optical fibers. Fibers can cause painful injury if they penetrate the skin.

Operating Instructions

- 1) Install the links as described on page 6.
- 2) Clean the optical connectors. Download <http://www.forceinc.com/techbull/optical-connector-cleaning.pdf> for complete cleaning instructions.
- 3) Connect the optical fiber to the transmitter and the receiver. Be sure that the fiber has continuity and less than the maximum allowable optical loss. Also be certain that the fiber is the proper size. Force, Inc. recommends that this product only be used with single-mode fiber.
- 4) Connect the satellite LNB output to the RF input of the transmitter.
- 5) Connect the RF output on the receiver to the appropriate broadband receiver (e.g., broadband distribution amplifier or TV set top receiver.)
- 7) Apply power to the chassis. Move the LNB switch to the desired LNB voltage. The units are now fully operational. No user adjustment or attention required.

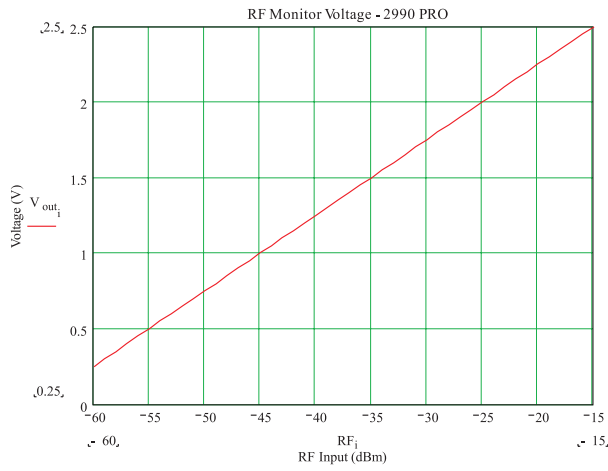
RF Status Voltages

The Force Model 3005PRO transmitter is equipped with a frequency-insensitive, true-rms responding RF power meter to aid in installation. Any signals in the 950-2150 MHz range applied to the RF input will generate a "linear in dB" voltage proportional to the applied power. This voltage can be monitored at pin 1 of the power connector (pin 1 has an identifying mark on the connector). The power can be computed from the voltage as follows:

$$P \text{ input} = 20 * (V_{\text{pin 1}} - 3.25) \quad \text{where: } P \text{ input is in dBm (re 75 Ohms)}$$

$V_{\text{pin 1}}$ is in Volts

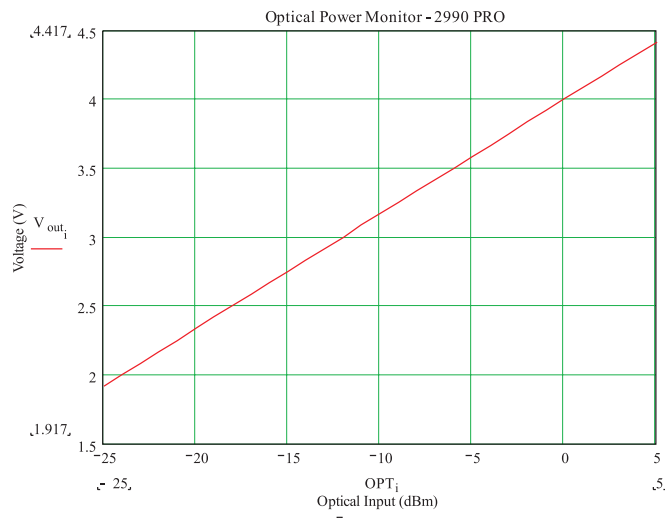
The following graph can be used in lieu of the formula above:



The Force Model 3005PRO receiver is equipped with an optical power monitor to simplify installation. When optical power is applied to the unit, a “linear in dB” voltage corresponding to the power magnitude is present on pin 1 of the power connector (pin 1 has an identifying mark). The optical power can be computed from this voltage as follows:

$$\text{Optical Input Power (dBm)} = 12 * (V_{\text{pin1}} - 4) \quad \text{where: } V_{\text{pin1}} \text{ is in Volts}$$

The following graph can be used to determine input level in lieu of the above formula:



Troubleshooting

Common problems include using a transmitter as a receiver and vice versa, lack of continuity in the optical fiber, lack of power (or reversed power), or improper input levels. Note that the transmitters and receivers are designed to work with a 75 Ohm system.

Problems and Comments

Problem	Check	Comments
No optical power out of Tx.	Check Tx power connection.	Verify that the power connection is firmly made to the chassis, and verify the integrity of the power cord. Be sure that that the primary power source has not been inadvertently turned off and that no fuses have blown in the unit or at the power source.
No optical power at the Rx.	Check power at the Tx.	If there is power at the Tx, verify proper fiber is connected to the Rx. If the proper fiber is connected, ensure the integrity of the fiber.
Signal out of Rx is noisy.	Check optical power at the Rx.	The input level to the receiver must be between -20 dBm and +4 dBm for the unit to operate properly.
No signal out of Rx.	Verify the input signal at the Rx.	The input level to the receiver must be between -20 dBm and +4 dBm for the unit to operate properly.
	Check the Rx power connection.	Verify that the power connection is firmly made to the chassis, and verify the integrity of the power cord. Be sure that that the primary power source has not been inadvertently turned off and that no fuses have blown in the unit or at the power source.
Signal amplitude out of Rx too large or distorted.	Verify that the Rx output is terminated into 75 Ohms.	Add a 75 Ohm terminating resistor.
Signal out of Rx is distorted.	Verify input signal at Rx.	The input level to the receiver must be between -20 dBm and +4 dBm for the unit to operate properly.
	Verify fiber size.	Single-mode fiber must be used with this product.

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. For complete connector cleaning instructions, download <http://www.forceinc.com/techbull/optical-connector-cleaning.pdf> from Force's web site.

Warranty and Return Policy

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.

Product Return Policy

Customers will be permitted to return products for credit, repair, or replacement only after receiving authorization from the Customer Service Manager (CSM) and only with a valid Return Material Authorization (RMA) number. The criteria determining whether a product is covered under this policy are described below and RMA numbers will be issued only under these guidelines. For Return Requests that do not comply with the following criteria, the CSM must have approval from the VP Operations, or designee prior to issuing an RMA number.

Products Returned for Credit - Non Distributor

Customers will be allowed to return product for credit only under the following conditions:

- Products are current standard Force products as per the price list.
- Products are in new, unused, and undamaged condition and are in the original packaging.
- Products were originally shipped to the customer requesting Return Authorization.
- Request for return is for a valid reason as determined by Force, Inc.
- Products were shipped to the customer less than 3 months prior to return request.
- Customer receives proper Return Material Authorization prior to returning the product.
- Customer pays return freight and insurance if requested by Force, Inc.

Customers will be issued a credit for the original selling price of the product less a 20% restocking charge after verification that the product meets the criteria as stated above. Payment to customers with no outstanding balance will be made 30 days after requested by customer.

Products Returned for Repair or Replacement

Force's response to a customer product return request will be based upon whether or not the product is still part of Force's standard product offering and whether or not the product is still under warranty. A product will be considered active if it is currently part of Force's standard product offering. Active products are denoted in Force's current price list. Obsolete products are not considered active. A product is considered under warranty in accordance with "Force, Inc. Product Warranty"

Prior to receiving an RMA number, the customer will be asked to discuss the reason for the return with Technical Support to try to resolve the problem. This discussion will be documented to aid with troubleshooting and repair of the product. Any detail the customer can provide will expedite the process once the product is received.

The criteria denoted above will cause any incoming returns to fall into one of the following categories:

- A. The product is currently active and is under warranty.
- B. The product is currently obsolete, but is still under warranty.
- C. The product is active, but out of warranty.
- D. The product is obsolete and out of warranty.

Active Product Under Warranty

Force will honor the warranty for these products. As a result, product(s) should be accepted upon return for rework or repair in accordance with Force's warranty policy.

Obsolete Product Under Warranty

Force will honor the warranty for these products. As a result, product(s) should be accepted upon return for rework or repair in accordance with Force's warranty policy.

Active Out of Warranty

Force will accept return of product under this category as long as the sale of the product occurred less than five (5) years prior to the return request. The product serial number should aid in determining the age in cases where information is not in the data base. Rework or repair will be in accordance with Force's warranty policy and will include an evaluation charge, which will be quoted to the customer prior to the return of the product. The evaluation charge is 20% of the current list price of the product or a minimum of \$250 whichever is

greater. The customer will either need to provide a purchase order number (with approved credit) or a credit card number before receiving an RMA number. Force cannot guarantee its ability to repair or rework the product. If costs to repair the product exceed the evaluation charge, the customer will be notified of such charges and instruction to proceed with repairs will be indicated either by a P.O. number or credit card authorization.

Obsolete Product Out of Warranty

Force is not obligated to accept requests for product under this category. The CSM, with prior approval from Operations will be responsible for approving return requests for products falling under this category.

Receiving an RMA for Returns

Customers requesting RMA numbers for any reason will be instructed as to how and where to ship the products being returned, and will be directed to show the RMA number on all external packaging and documentation. The CSM is responsible for providing any necessary instructions to the customer to ensure proper handling of the returned material. Upon receipt of the product, all Force personnel are to process the return as per SP002, "Handling of Customer Returns". Contact the factory at USA (800) 732-5252 or TEL (540) 382-0462 to request an RMA.

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. **SEVERE SHOCK HAZARD!**

Storing the Unit

If a unit is to be out of service 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°C to +60°C.
- 2) A low humidity environment is preferable for long term storage.
- 3) All connectors should be covered with active device receptacle caps.