RF Optics, Incorporated

FOS 1000A

Fiber Optics
Test Receiver System

User's Manual

Please Check the Addendum for CHANGE INFORMATION

First Printing November 1996

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Operators Safety Summary

The general safety information in this part of the manual is for operating personnel. Specific warnings and cautions may also be found in other areas of this manual where they apply.

Terms used in This Manual

CAUTION statements identify conditions or practices that could result in damage to the equipment or other property.

WARNING statements identify conditions or practices that could result in personal injury or loss of life.

DANGER indicates a personal injury hazard immediately accessible through improper use of the equipment.

The AC Power Source

The internal power supplies used in this product have been designed for failure free operation over the life of the equipment. Failure to properly connect this equipment to AC mains can cause damage to the equipment and present conditions which may place hazardous voltages on the metal chassis.

Should it ever become necessary to replace the rear panel fuse, make sure that the equipment has been disconnected from AC mains power, and observe the fuse specifications located on the back panel.

CAUTION

To prevent damage to the equipment, use only the factory-supplied AC power cord, and operate only from connections to the appropriate AC mains power sources.

WARNING

To prevent potentially hazardous voltages from existing on the exposed metal chassis of the equipment, do not use on ungrounded electrical systems.

General Precautions

WARNING

This equipment is intended for indoor use only. Use in wet/damp conditions may result in electric shock.

The FOS 1000A product is NOT intended for use in wet weather outdoors. It is intended for operation in a horizontal position, in the ambient temperature of a typical "air conditioned" communications equipment building. Operating this equipment under other conditions may result in malfunctions or damage to the equipment. Do not use in very high temperatures, immerse in liquids, or subject to other physical abuse. Do not operate in an explosive environment.

To avoid personal injury, do not remove covers or protective panels, or operate the product without covers and protective panels installed. Refer internal service and adjustment of this product to qualified factory personnel.

Detailed System Specifications

Model FOS 1000A Test Receiver System

The following technical specifications apply to a properly operating FOS 1000A Test Receiver System Product after a 15 minute warm-up period used with either 1310 nm or 1550 nm optical sources.

Front Panel Controls and Indicators

Status/Control Display	(2) Line, 48 character, LCD with LED back light
Display/Status Mode Selection	
mW/dbM	Front Panel SPST Push-button Switch
Wavelength	Front Panel SPST Push-button Switch
Relative/Absolute	Front Panel SPST Push-button Switch
Number of Channels	Three section BCD Push-button Switch
Display/Status Modes	
Wavelength	1310 nm, 1550 nm +/- 20 nm
Mode	Absolute, Relative
Optical Power	mW, dBmW
RF Power	Estimated Carrier Power in dBmV; +/- 2 dB
OMI per Channel	Measured in percent
OMI Total	Measured in per cent
Internal Optical Input	FC/APC, accessible through the front panel
Front Panel Optical Input Adapter	SC/APC Standard, (Specify at time of Order)
Optical Input Threshold, Typical	-2 dBmW Optical, 85 Channels, 1 % OMI
Measurement Threshold Standard	-3 dBmW Optical, 79 Channels, 3.50 %
with OPT 1	-8 dBmW Optical, 79 Channels, 3.50 %
Optical Input Nominal	0 dBmW
Optical Input Maximum	+3 dBmW Optical
OMI Reading Accuracy	+/- 10 % of the OMI Reading, +/- 0.2 %
RF Output Connector	75 Ohm BNC
RF Output Return Loss	> 15 dB; 15 MHz to 860 MHz > 12 dB; 860 to 1000 MHz
RF Output Level, above Threshold	-2 dBmW Total RF Power; No Attenuation
RF Output Correlated Noise	< -95 dBmW; at RF Output
Output RF Frequency Range	20 MHz to 1000 MHz
Output RF Flatness, Typical	+/- 0.75 dB; from 20 MHz to 1000 MHz
Internal Attenuator Range	0 to 44 dB in 2 dB steps
Internal Attenuator Accuracy	+/- 0.25 dB, from 20 MHz to 1000 MHz
Internal Attenuator Flatness	+/- 0.25 dB, from 20 MHz to 1000 MHz
RF Output Distortion Performance, CSO, CTB	better than -70 dBc
Optical Receiver Equivalent Noise Input	< 8 pA per root Hz; 15 MHz to 1000 MHz

Note! Optical Input Threshold is the point at which output level control occurs with 1 % OMI, based on 85 Channel loading. Below this point, all internal attenuation is minimum and total output power specified will not be achieved.

Specifications (cont.)

Rear Panel Controls/Indicators

AC Power Input and Fuse	110/220 Volts AC (IEC Connector)
Power ON/OFF	SPST Toggle Switch

Electrical Specifications

AC Power Requirements	110V/220V, 50/60 Hz, < 25 Watts Total (85 to 250 Volts)
Rear Panel Fuse	1.0 A, 250V, slo-blo

DC Volts Required

+5 Volts	< 500 mAmps
+15 Volts	< 400 mAmps
+24 Volts	< 550 mAmps

Mechanical/Environmental Specifications

Overall Dimensions	10" D x 8" W x 4.75" H excluding handle
Temperature Range (no damage)	-20 to +60 degrees C
Operating Temperature Range	0 to +50 degrees C

Options and Accessories

Optical Input Adapters	All Standard Types Supported
Accessory Adapter Kit	
Remote Interface	Must Specify at Time of Order
Baud Rates, and port controls	8 bits (programmed internally)
Serial Port (1)	RS232 or RS485 DB-9 Male
Serial Port (2)	RS485 DB-9 Female

In the interest of continued product improvement, these specifications are subject to change without notice.

Receiving and Unpacking

These products are carefully packaged at the factory, using specially designed shipping containers to prevent damage during shipment.

Once you receive your new FOS 1000A product, be sure to inspect the shipping containers for damage prior to accepting delivery. Containers that show signs of damage may contain equipment that has been damaged by the shipping company. Should such damage be evident, notify the shipping company immediately. R. F. Optics, Inc. is not responsible for damage caused during shipment.

Carefully open the shipping containers and do not destroy them. Remove the equipment and inspect it for damage. Using the procedure outlined in the **Initial System Checkout Section** below, test the system for proper initial operation. If damage or defects are discovered, notify your sales representative immediately. You will be instructed on how to proceed. Should the equipment need to be returned, carefully repackage the equipment in the original shipping containers and return to R. F. Optics, Inc. along with the return authorization number provided to you.

Once unpacked, check the contents to make sure that you have received the following items:

- **FOS 1000A Test Receiver Product**
- **Accessory Adapter Kit (if ordered)**
- **FOS 1000A User's Manual**
- **AC Mains Line Cord**
- **FOS 1000A Test Record Summary and Serial Number**

If any of these items are missing, or you believe the FOS 1000A Product Options you received are not correct, contact your Sales Representative immediately.

Initial System Checkout

The FOS 1000A Test Receiver product can be powered and tested without actually making physical connections to a fiber network. These checks should be made at the time your FOS 1000A Test Receiver Product is received from the shipper.

DANGER

Although the FOS 1000A Test Receiver product does not emit harmful laser light on its own, the normal connections to this device can have invisible laser radiation at optical powers and wavelengths of high enough level to cause permanent damage to the eye. Do not at any time look into the exposed ends of fiber connectors, bulkhead adapters, or any fiber component carrying optical laser signals. For the initial tests below, the FOS 1000A Test Receiver does not need to be connected to the network.

WARNING

To prevent potentially hazardous voltages from existing on the exposed metal parts of the equipment, verify that the AC Mains Electrical system is properly grounded. Use only the AC Power cord supplied by the factory when making connections between the AC Mains and the equipment.

CAUTION

To prevent damage to the FOS 1000A Test Receiver's optical input, always make sure that the optical connector used matches the type on the units front panel, is not scratched, and has been properly cleaned before using. Always make sure that the Total Optical Power of the network point being measured does not exceed the maximum optical power specified at the FOS 1000A input. ***Refer to the section "Cleaning the Internal Optical Connector"*** *for instructions on how to properly access and clean the units internal optical connector.*

FOS 1000A Initial Turn-on procedure

Follow these simple steps to ensure that your FOS 1000A Test Receiver Product is functioning properly. Refer to the figures that follow when instructed to verify that the units display is correct.

Step 1. Place the FOS 1000A Test Receiver product on a suitable surface for examination of all front panel controls and indicators.

Step 2. Verify that the Rear Panel Power ON/OFF switch is set to the 0 position, OFF.

Step 3. Using the AC power cord supplied, connect it first to the unit, then to the proper AC Mains receptacle.

Step 4. Verify that the RED Front Panel Standby "Power Switch" is set to OFF.

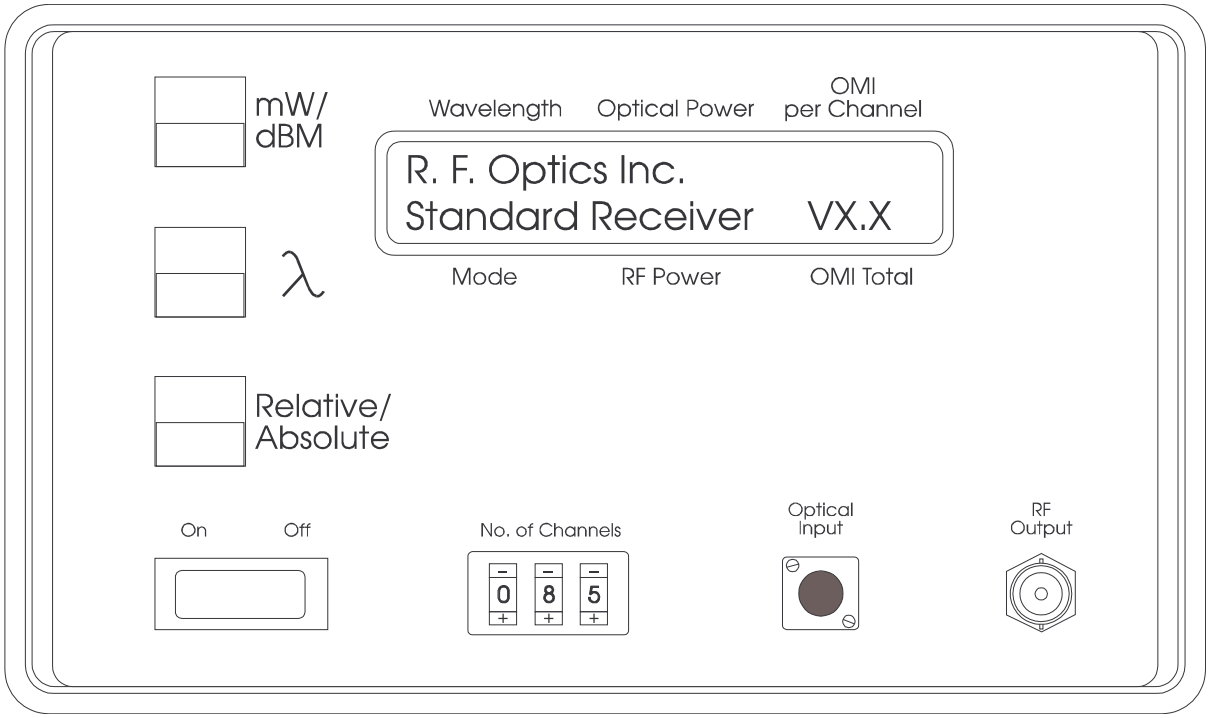

Figure 1 The FOS 1000A at Power-Up

Initial System Checkout (cont.)

Step 5. Turn the unit on. Set the Rear Panel Power ON/OFF switch to the 1 position, ON. Set the RED Front Panel Standby "Power Switch" to ON. The LCD display should be lit, and the sign-on message shown in the figure will display for a moment. The current software version is displayed in the lower right corner. You will hear the internal attenuator adjusting for minimum attenuation, since no modulated optical signal is connected to the unit.

CAUTION

To prevent damage to the FOS 1000A Test Receiver's optical input and to ensure it remains free of dirt and dust, do not remove the protective cover at this time. Always make sure that the optical connector cover is in place when the unit is not being used.

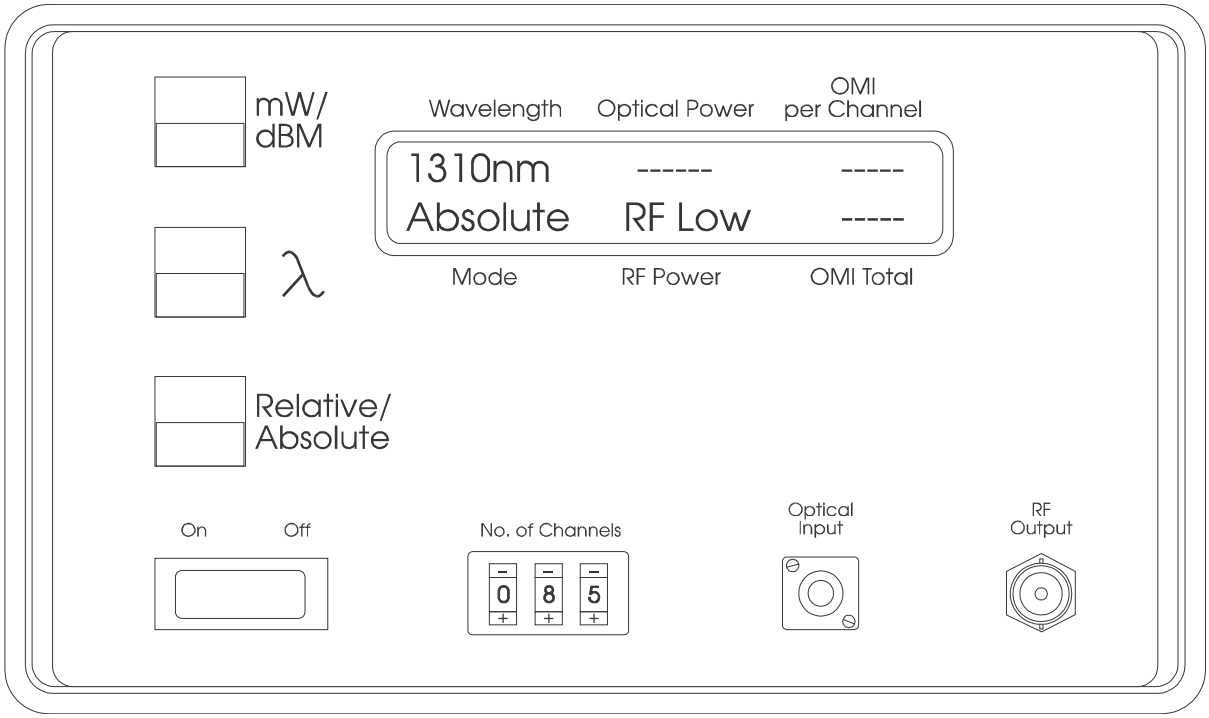

Figure 2 The FOS 1000A after Initial Power-Up

Initial System Checkout (cont.)

Step 6. After the initial sign on message is displayed, the normal power-up mode displays will be as shown. Press the Front Panel mW/dBM push-button once and notice that the LCD display changes accordingly. Press the Front Panel Wavelength push-button once and notice that the LCD display changes the wavelength displayed. Press the Relative/Absolute push-button and notice that the displayed values change accordingly. If these initial checks give the indicated results proceed to step 7 below. Otherwise contact your Sales representative for instructions.

Step 7. Set the Front Panel Standby "Power Switch" to OFF. Set the rear-panel power switch to OFF. Disconnect the unit from the AC MAINS. You may now proceed to the section "**Using your FOS 1000A Test Receiver"** or continue on through the functional descriptions in the remainder of the introduction.

CAUTION

To prevent damage to the FOS 1000A Test Receiver's optical input and to ensure it remains free of dirt and dust, always make sure that the optical connector cover is replaced when the unit is not being used.

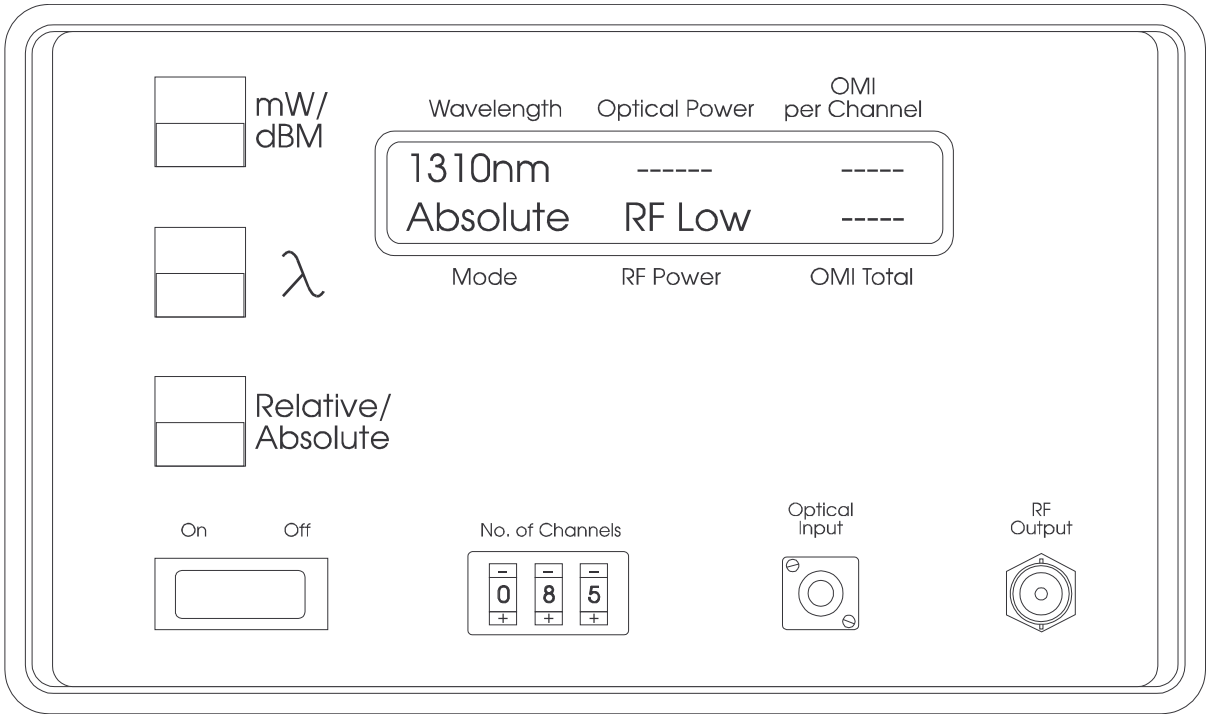

Figure 3 The FOS 1000A Front Panel at Power-up without an Optical Input

FOS 1000A Test Receiver Operations Guide

FOS 1000A Introduction

The FOS 1000A is a high quality, microprocessor controlled, optical test receiver. It was specifically designed to "look" like the typical wide-band optical to electrical converter typical of those used in today's CATV, CCTV, Multi-Channel or other high quality optical telecommunications networks. As such, the FOS 1000A can be used to simulate the optical receiver characteristics of an optical node, greatly simplifying transmitter performance measurements and allowing for such measurement at the transmit site before any time consuming field checks are made.

In addition to the instruments low distortion portable optical receiver capabilities, several additional features of the FOS 1000A simplify repetitive measurements otherwise requiring several other high cost instruments.

The FOS 1000A has the ability to measure ***Optical Power*** in mW or dBmW, within the 1310 nm or 1550 nm optical windows. Optical power is displayed on the front panel at all times in either ***absolute or relative modes.*** Toggling between wavelengths, power display, or measurement modes is accomplished simply from the front panel using the three front panel push-button switches shown in the figure above.

Unique to the FOS 1000A is it's ability to monitor and measure ***Optical Modulation Index*** of an optical carrier in percent per channel or total. Each value is conveniently displayed on the front panel while the modulation signal is within the units measurement range. In addition, system channel loading is easily programmed using the front panel BCD push buttons as shown.

See the text that follows for more detailed descriptions of the features and operations of the FOS 1000A.

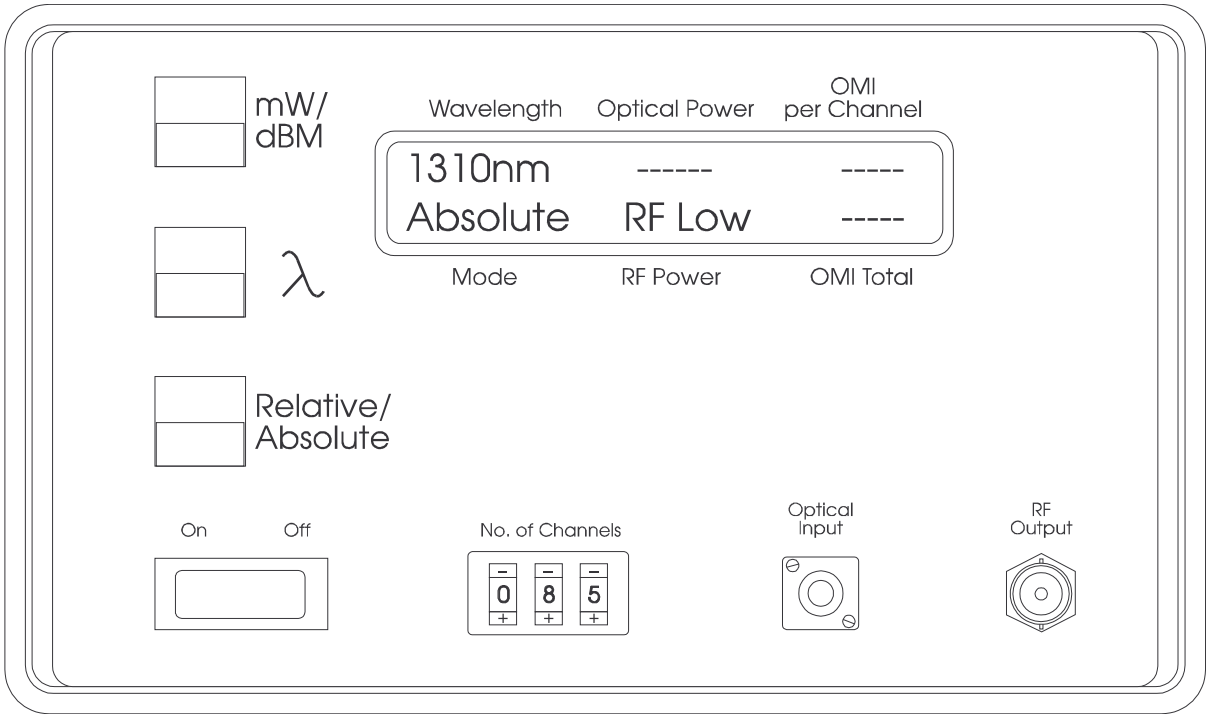

Figure 4 The FOS 1000A Front Panel Controls and Indicators

FOS 1000A Test Receiver Operations Guide (cont.)

FOS 1000A Front Panel Controls and Indicators

Control of the FOS 1000A Test Receivers' functional modes and displays is accomplished from the units front panel. The following controls and display indicators are available. Refer to the figure above while becoming familiar with the units' controls and indicators.

Front Panel Controls

mW/dBM	used to toggle the Optical Power Reading Units from mWatts to dBmWatts.
Wavelength (Lambda)	used to toggle the Indicated Wavelength from 1550 nm to 1310 nm.
Relative/Absolute	used to change the Display Modes between Absolute and Relative.
No. of Channels	used to "Program" the unit for proper Optical Modulation Measurement.

Front Panel LCD Indicators

Top Display Line	Wavelength, Optical Power, Per Channel OMI in percent
Bottom Display Line	Display Mode, RF Power, Total OMI in percent

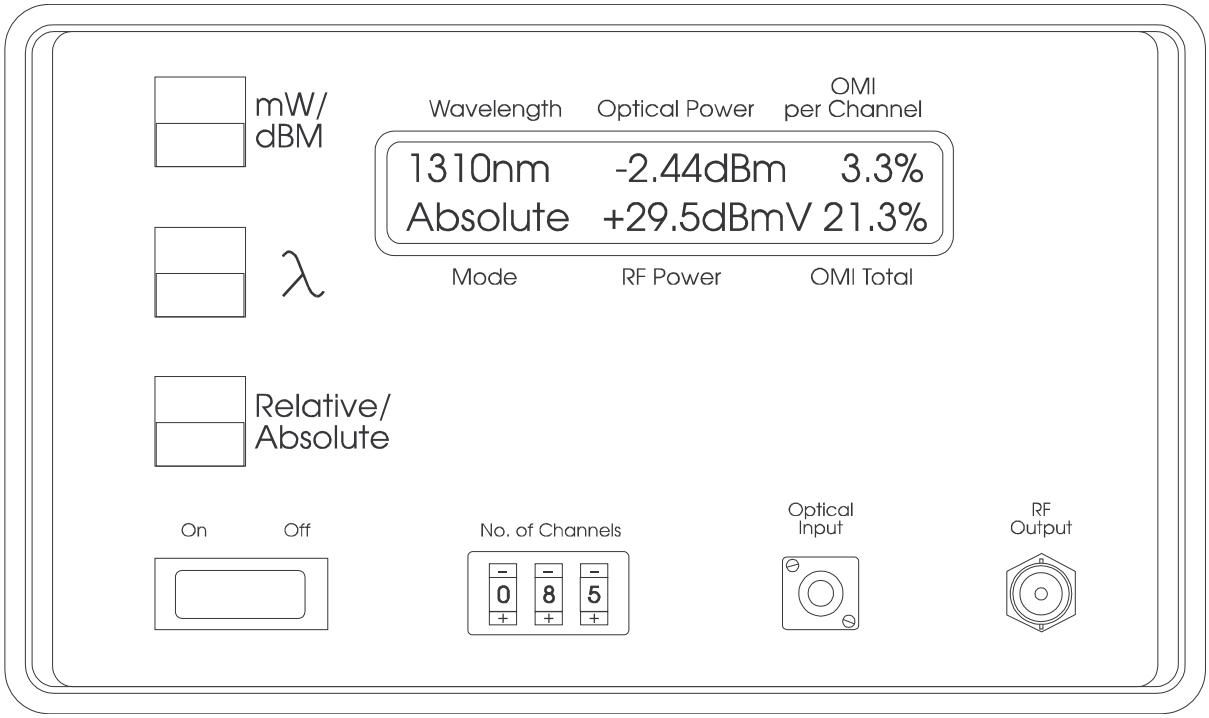

Figure 5 The FOS 1000A Default mW/dBM Selection

FOS 1000A Test Receiver Operations Guide (cont.)

FOS 1000A mW/dBM Selection

When the FOS 1000A is powered on, it comes up in the following default display modes.

Wavelength	***1310 nm***
Optical Power	***Read in mWatts***
Display Mode	***Absolute***

To change the input Optical Wavelength Selection use the ***mW/dBM*** push-button. Optical Power display mode will toggle between modes at each press of the push-button. In the figure above, the unit has been toggled from the default power on mode of mWatts to dBmW. In this mode, the Optical Power will be read out in Power relative to 1 mWatt. Below an optical power input of -20.0 dBmW, the reading will be blanked.

CAUTION

To prevent damage to the FOS 1000A Test Receiver's optical input receiver, ***Do Not*** *drive the optical input port with greater than + 3 dBmW (2 mWatts) of Total Optical Power. Care must be used in networks utilizing multiple wavelengths on a single Fiber Optic Cable that the Total Optical Power into the instrument does not exceed this value. Optical Attenuators are readily available and can be used for measurements of higher Optical Powers.*

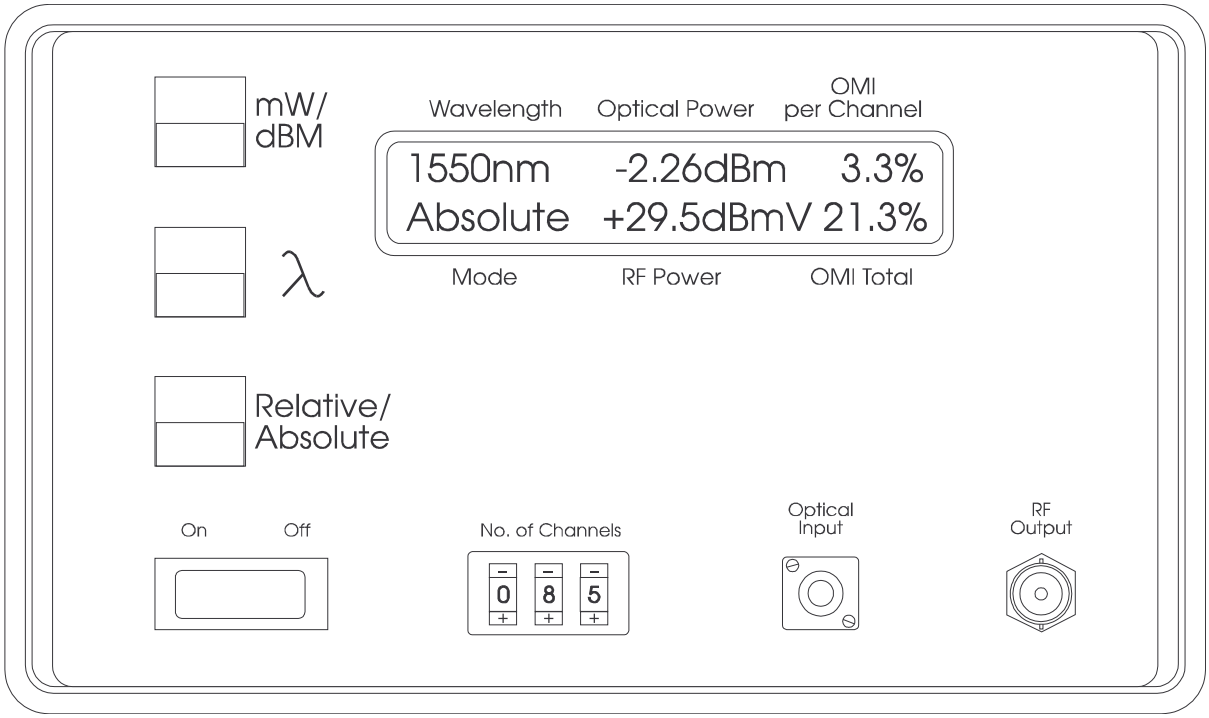

Figure 6 The FOS 1000A Wavelength Select Push-button

FOS 1000A Test Receiver Operations Guide (cont.)

FOS 1000A Wavelength Selection

When the FOS 1000A is powered on, it comes up in the following default display mode.

Wavelength	***1310 nm***
Optical Power	***Read in mWatts***
Display Mode	***Absolute***

To change the input Optical Wavelength Selection use the ***Wavelength (Lambda symbol)*** push-button. Optical Wavelength display mode will toggle between modes at each press of the push-button. In the figure above, the Optical Wavelength has been toggled from the default power on mode of 1310 nm to 1550 nm. In this mode, the internal characteristics and calibrations are set for 1550 nm.

The FOS 1000A Test Receiver's optical detection hardware will actually respond to Optical Signals in the range of 1290 nm to 1600 nm. The instruments internal calibrations are factory set for greatest accuracy in the region of 1310 nm and 1550 nm respectively.

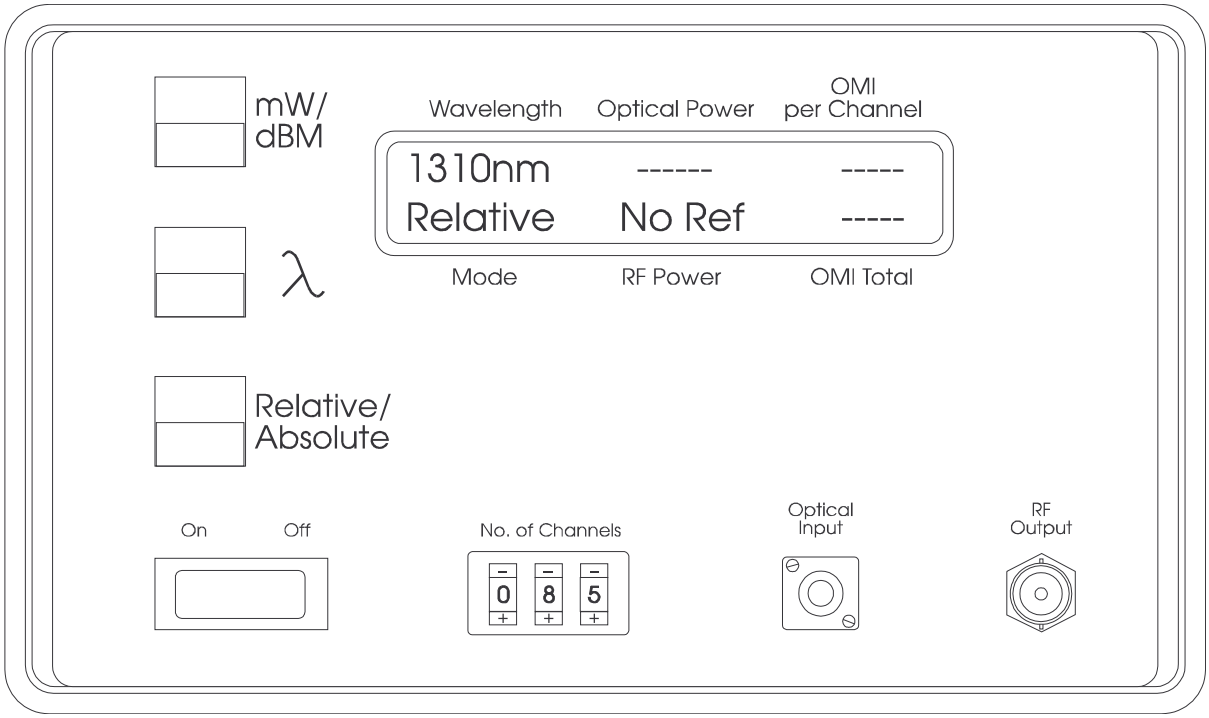

Figure 7 The FOS 1000A Relative/Absolute Mode Select Push-button

FOS 1000A Test Receiver Operations Guide (cont.)

FOS 1000A Relative/Absolute Mode Selection

When the **FOS 1000A** is powered on, it comes up in the following default display modes.

Wavelength	***1310 nm***
Optical Power	***Read in mWatts***
Display Mode	***Absolute***

To change between Absolute readings, and Relative readings, use the ***Relative/Absolute*** push-button. In the Absolute measurement mode, Optical Power and OMI are read out according to internal instrument calibrations.

When the Relative display mode is selected, subsequent readings will be based on a reference stored at the same time the display mode is toggled. This allows the user to reference to a particular point, and then make readings based on the stored reference. This reference is destroyed when the unit is powered off.

In the figure above, the instrument is in the Relative Display Mode with respect to the unconnected power-on condition which was stored when the Relative/Absolute Push-button was pressed. The ***No Ref*** annunciator is on, signaling that the RF Modulation signal was below the instruments measurement threshold when the relative mode was entered. Under this condition, the OMI readings will be blanked. ***See the section "RF Modulation Out of Range" for more information.***

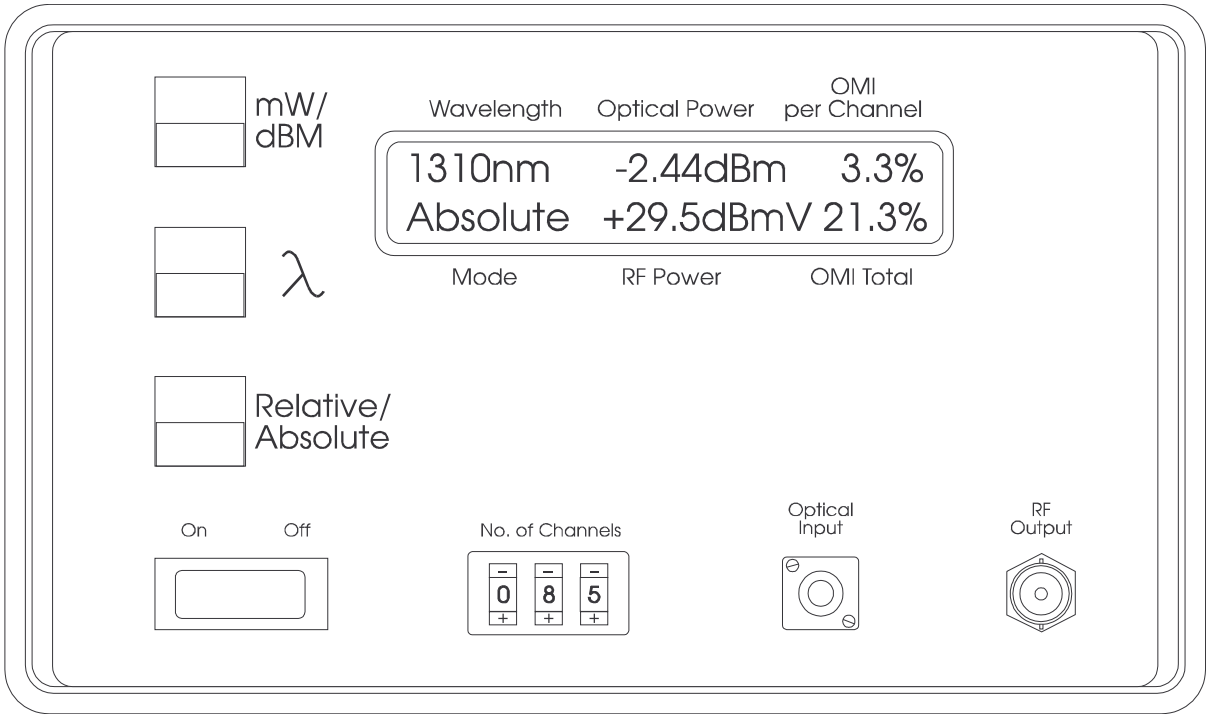

Figure 8 The FOS 1000A Normal Display Mode Absolute, 1310 nm

FOS 1000A Test Receiver Operations Guide (cont.)

FOS 1000A Normal Display Mode

CAUTION

To prevent damage to the FOS 1000A Test Receiver's optical input, always make sure that the optical connector used matches the type on the units front panel, is not scratched, and has been properly cleaned before using. Always make sure that the Total Optical Power of the network point being measured does not exceed the maximum optical power specified at the FOS 1000A input.

The figure above shows the front panel display for an *FOS 1000A* Test Receiver connected to an optical network. Note in the figure that the wavelength selected is 1310 nm, and the display mode is Absolute. The instruments internal calibration will be set to 1310 nm.

For this network, the instrument is indicating that the Optical Power is -2.44 dBmW, and is modulated with RF Signals which are within the measurement range. The user has selected the proper number of channels as 85 on the 3 digit push-button switch. Under this condition, the RF Power reading is approximately 29.5 dBmV.

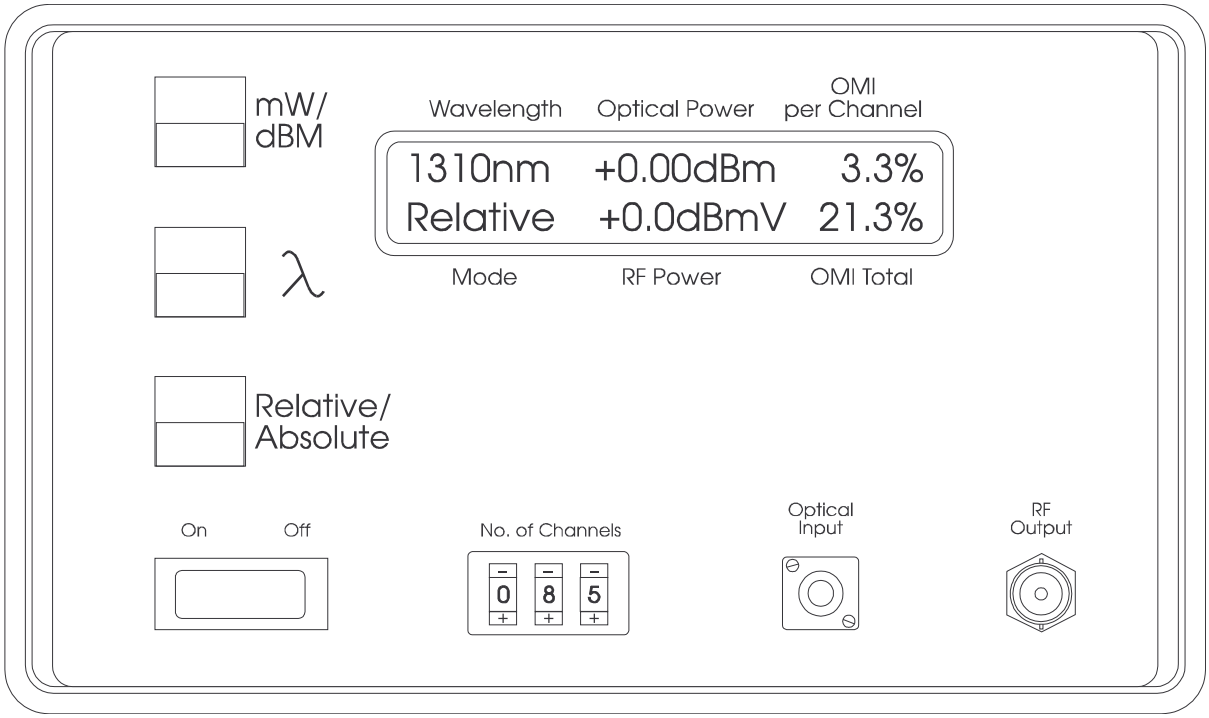

Figure 9 The FOS 1000A Relative Display Mode

FOS 1000A Test Receiver Operations Guide (cont.)

FOS 1000A Relative Display Mode

The user wishes to monitor the optical network for changes from this "reference" condition. This is easily accomplished by pressing the ***Relative/Absolute*** push-button once. The front panel LCD now changes to indicate that the data currently displayed in "Relative" to some other input condition, i.e. the condition that was stored when the Relative/Absolute push-button was pressed.

Since the measurements are now relative to the same stored values, the Optical Power, RF Power readouts will be zero. Note that the OMI readings did not change. The user can now monitor the network for "changes" in optical power or RF Power over time. Further, since the OMI is a function of the Optical Transmitter only, changes in Optical Power level will not change the OMI. Changes in OMI however, will also show a relative change in the RF Power level.

Hence, the **FOS 1000A** can be used as a troubleshooting tool to help isolate technical problems in the telecommunications network, between those related to the optical signal, and those related to RF Modulation on the Optical Signal. ***See the next section "Relative Display Mode with RF Modulation Change".***

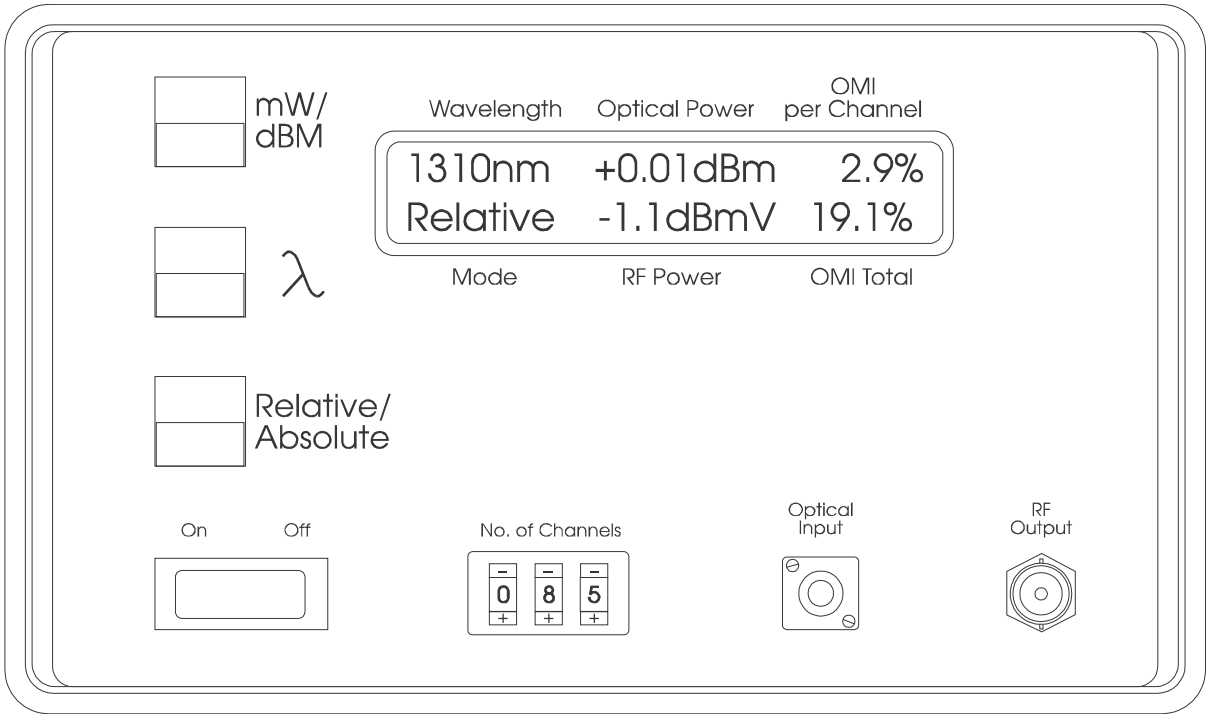

Figure 10 The FOS 1000A Relative Display Mode, with RF Modulation Change

FOS 1000A Test Receiver Operations Guide (cont.)

FOS 1000A Relative Display Mode, with RF Modulation Change

As an example, a reference condition was stored in the FOS 1000A by a technician in the morning and the instrument was left on as a monitor for changes which may occur later on. The technician then left for several hours.

When the technician returned, the displayed data was as shown above. The figure now represents the displayed data for the optical network after a change had occurred.

The following observation was made. The optical power was changed only slightly since the reference was stored. This would indicate that the equipment generating the optical carrier was probably OK. The Optical Modulation, however, had dropped by almost half a percent per channel in this 85 channel system. This condition indicated a problem in the RF network feeding the optical transmitter itself, and the technician started making inquiries as to possible changes made by other technical staff. Later it was found that RF levels had been changed as part of a routine maintenance program without altering drive levels to the optical equipment at the site.

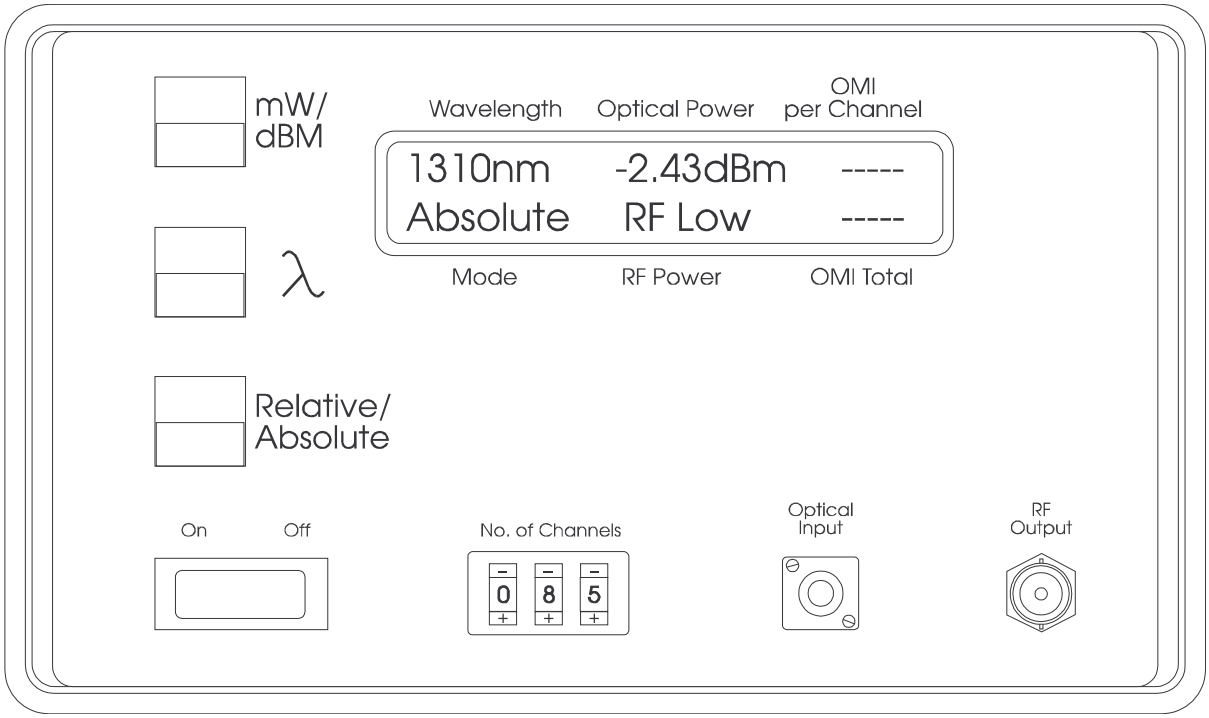

Figure 11 The FOS 1000A with RF Modulation Out of Range

FOS 1000A Test Receiver Operations Guide (cont.)

FOS 1000A with RF Modulation Out of Range

The figure above shows the **FOS 1000A** connected to an optical network with near nominal optical input signal at 1310 nm. The measurement mode is Absolute. Note however that the RF Low annunciator has come on indicating that the RF Modulation signal is below the instruments measurement range.

Under these conditions the OMI readings will be "blanked" since a valid measurement cannot be made. The point at which this occurs is referred to as the ***Optical Input Threshold***, and is defined as follows:

> ***Optical Input Threshold is the point at which output level control occurs with 1 % OMI, based on 85 Channel loading. Below this point, all internal attenuation is minimum and total RF output power specified will not be achieved. With 1 % per channel OMI, 85 Analog Channel loading, this point is typically -2.0 dBmW.***

Optical Input Threshold is a function of OMI and, as a result, will occur at different optical input powers. OMI readings will not be valid at a point where the detected RF Level falls approximately 6 dB below the Optical Input Threshold, and the OMI readouts will be blanked.

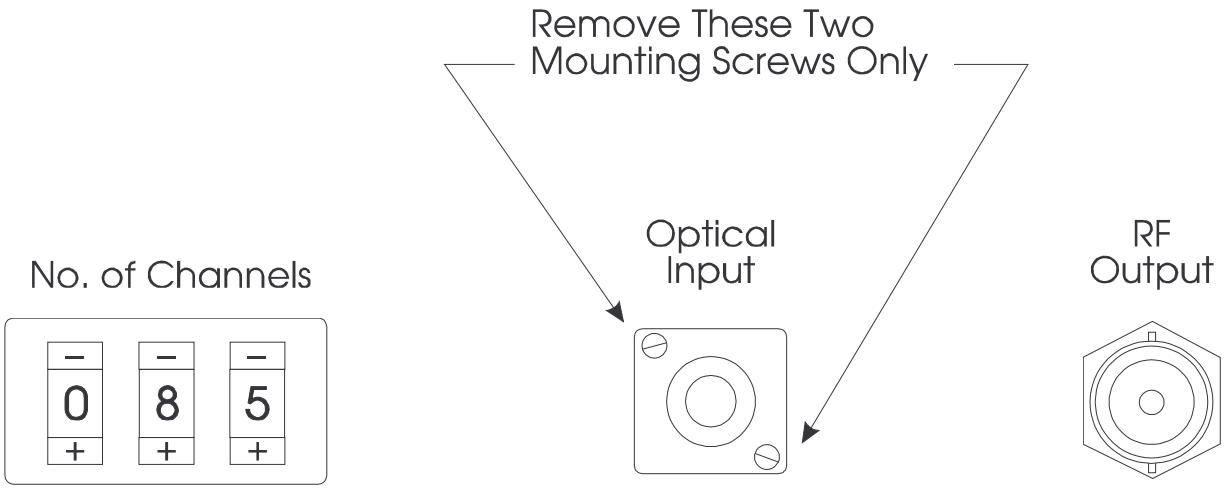

Figure 12 Optical Interface Mounting Screws for Cleaning

FOS 1000A Test Receiver Operations Guide (cont.)

Cleaning the Optical Interface of the FOS 1000A

The Optical Input connector on the FOS 1000A was designed for simple removal to allow changing connector types or to clean the optical component inside the unit. To remove the optical input assembly do the following:

Remove the two 2-56 Stainless Steel Machine Screws as shown in the figure.

Gently pull the assembly off of the front panel of the FOS 1000A, revealing the internal optical connection and fiber.

Carefully remove the optical connector from the assembly, and use appropriate care in cleaning.

Replace the optical connector on the assembly.

Gently place the assembly back into contact with the front panel and secure with the two machine screws.

CAUTION

To prevent damage to the FOS 1000A Test Receiver's Front Panel Hardware, use only the Machine Screws provided for this purpose. Should you accidentally lose one of the mounting screws, contact the factory for a proper replacement. To prevent damage to the optical input components, always make sure that the optical connector used matches the type on the units front panel, is not scratched, and has been properly cleaned before using. Always remember to replace the optical input cover when the unit is not in use.

Understanding the Communications Protocol For Optional Serial Interface Equipment

The *FOS 1000A* Test Receiver is available with serial interfaces as an option. This allows for connection of the *FOS 1000A* Test Receiver to computer equipments having this type of interface. For example, an IBM PC or equivalent could be located within the same building as the *FOS 1000A*, or used as part of an overall computer controlled test environment. Both RS232 and RS485 Hardware protocols are supported.

The descriptions that follow are intended to provide the information necessary to allow programmers to develop device drivers which would allow communication with the *FOS 1000A* instrument and other computer software.

Tables 1 through 19 illustrate the communications protocol which must be followed in order to communicate with the *FOS 1000A* Test Receiver.

Table 1 FOS 1000A General Command/Response String Format

BYTE(S)	**0**	**1, 2**	**3, 4**	**5**	**6..N**	**N+1..N+4**	**N+5**
CHARACTER	^B	NA	DA	CMD	DF	CS	CR
DESCRIPTION	START	NODE	DEVICE	COMMAND	DATA	CHECKSUM	RETURN
COUNT	1	2	2	1	0..20	4	1
	BYTE	BYTES	BYTES	BYTE	BYTES	BYTES	BYTE

Start Character ***CNTRL B*** ***Single Byte Field*** indicating the start of transaction.

Node Address ***Two byte Hex-ASCII*** representation of the ***Node Address*** in the range 0 to 127.

Device Address ***Two byte Hex-ASCII*** representation of the ***Device Address*** in the range 0 to 127. By definition ***Device 0 is the Node itself.***

Command Character ***Single Byte Character*** in the range of ***20 Hex to 7F Hex***. ***20 Hex*** is reserved for the Command Response Field from the ***Device or Node.***

Data Field ***A Variable length Data Field*** up to 20 Bytes in Length depending on the Command.

Checksum ***Four Byte Hex-ASCII*** representation of the 16 bit binary word generated by adding all bytes of the Command String from the Start Byte through the end of the Data Field.

End Character ***ASCII CR*** ***Single Byte ASCII Carriage Return Character*** representing the end of the Command String.

Note! The maximum length of the Command or Response String is 32 ASCII Characters.

FOS 1000A Communications Protocol (cont.)

GETSTATUS ***Get Instrument Status***

Table 2 FOS 1000A Get Instrument Status Command String

0	1, 2	3, 4	5	6..9	10
^B	NA	DA	S	CS	CR
START	NODE	DEVICE	COMMAND	CHECKSUM	RETURN
1	2	2	1	4	1
BYTE	BYTES	BYTES	BYTE	BYTES	BYTE

Table 3 FOS 1000A Get Instrument Status Response String

0	1, 2	3, 4	5	6	7.9	10..13	14
^B	NA	DA	20 Hex	f	n	CS	CR
START	NODE	DEVICE	RESPONSE	MODE	STATUS	CHECKSUM	RETURN
1	2	2	1	1	3	4	1
BYTE	BYTES	BYTES	BYTE	BYTE	BYTE3	BYTES	BYTE

Start Character ***CNTRL B*** ***Single Byte Field*** indicating the start of transaction.

Node Address ***Two byte Hex-ASCII*** representation of the ***Node Address*** in the range 0 to 127.

Device Address ***Two byte Hex-ASCII*** representation of the ***Device Address*** in the range 0 to 127. By definition ***Device 0 is the Node itself.***

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End Character ***ASCII CR*** ***Single Byte ASCII Carriage Return Character*** representing the end of the Command String.

f ***The Current User Front Panel Selections***

Bit 0	***Optical Power Mode***	***0***	***mW***	***1***	***dBmW***
Bit 1	***Display Mode***	***0***	***Absolute***	***1***	***Relative***
Bit 2	***Wavelength***	***0***	***1310 nm***	***1***	***1550 nm***
Bits 3-7	***Reserved***				

n ***Current Number of Channels Setting***

Byte 1 ***ASCII Hex Character 0-9 for the Hundreds digit***
Byte 2 ***ASCII Hex Character 0-9 for the Tens digit***
Byte 3 ***ASCII Hex Character 0-9 for the Ones digit***

FOS 1000A Communications Protocol (cont.)

GETOP ***Get Optical Power***

Table 4 FOS 1000A Get Optical Power Command String

0	1, 2	3, 4	5	6..9	10
^B	NA	DA	A	CS	CR
START	NODE	DEVICE	COMMAND	CHECKSUM	RETURN
1	2	2	1	4	1
BYTE	BYTES	BYTES	BYTE	BYTES	BYTE

Table 5 FOS 1000A Get Optical Power Response String

0	1, 2	3, 4	5	6..9	10..13	14
^B	NA	DA	20 Hex	OPTICAL		CR
START	NODE	DEVICE	RESPONSE	POWER	CHECKSUM	RETURN
1	2	2	1	4		1
BYTE	BYTES	BYTES	BYTE	BYTES		BYTE

Start Character ***CNTRL B*** ***Single Byte Field*** indicating the start of transaction.

Node Address ***Two byte Hex-ASCII*** representation of the ***Node Address*** in the range 0 to 127.

Device Address ***Two byte Hex-ASCII*** representation of the ***Device Address*** in the range 0 to 127. By definition ***Device 0 is the Node itself.***

Command Character ***Single Byte Character*** in the range of ***20 Hex to 7F Hex***. ***20 Hex*** is reserved for the Command Response Field from the ***Device or Node.***

Data Field ***A Variable length Data Field*** up to 20 Bytes in Length depending on the Command.

Checksum ***Four Byte Hex-ASCII*** representation of the 16 bit binary word generated by adding all bytes of the Command String from the Start Byte through the end of the Data Field.

End Character ***ASCII CR*** ***Single Byte ASCII Carriage Return Character*** representing the end of the Command String.

FOS 1000A Communications Protocol (cont.)

GETOMI ***Get OMI***

Table 6 FOS 1000A Get OMI Command String

0	1, 2	3, 4	5	6..9	10
^B	NA	DA	B	CS	CR
START	NODE	DEVICE	COMMAND	CHECKSUM	RETURN
1	2	2	1	4	1
BYTE	BYTES	BYTES	BYTE	BYTES	BYTE

Table 7 FOS 1000A Get OMI Response String

0	1, 2	3, 4	5	6..9	10..13	14..17	18
^B	NA	DA	20 Hex	TOTAL	/CHAN		CR
START	NODE	DEVICE	RESPONSE	OMI (RMS)	OMI (PK)	CHECKSUM	RETURN
1	2	2	1	4	4	4	1
BYTE	BYTES	BYTES	BYTE	BYTES	BYTES	BYTES	BYTE

Start Character ***CNTRL B*** ***Single Byte Field*** indicating the start of transaction.

Node Address ***Two byte Hex-ASCII*** representation of the ***Node Address*** in the range 0 to 127.

Device Address ***Two byte Hex-ASCII*** representation of the ***Device Address*** in the range 0 to 127. By definition ***Device 0 is the Node itself.***

Command Character ***Single Byte Character*** in the range of ***20 Hex to 7F Hex***. ***20 Hex*** is reserved for the Command Response Field from the ***Device or Node.***

Data Field ***A Variable length Data Field*** up to 20 Bytes in Length depending on the Command.

Checksum ***Four Byte Hex-ASCII*** representation of the 16 bit binary word generated by adding all bytes of the Command String from the Start Byte through the end of the Data Field.

End Character ***ASCII CR*** ***Single Byte ASCII Carriage Return Character*** representing the end of the Command String.

FOS 1000A Communications Protocol (cont.)

GETRF ***Get RF Power***

Table 8 FOS 1000A Get RF Power Command String

0	1, 2	3, 4	5	6..9	10
^B	NA	DA	P	CS	CR
START	NODE	DEVICE	COMMAND	CHECKSUM	RETURN
1	2	2	1	4	1
BYTE	BYTES	BYTES	BYTE	BYTES	BYTE

Table 9 FOS 1000A Get RF Power Response String

0	1, 2	3, 4	5	6..9	10..13	14
^B	NA	DA	20 Hex	/CHAN		CR
START	NODE	DEVICE	RESPONSE	RF	CHECKSUM	RETURN
1	2	2	1	4	4	1
BYTE	BYTES	BYTES	BYTE	BYTES	BYTES	BYTE

Start Character ***CNTRL B*** ***Single Byte Field*** indicating the start of transaction.

Node Address ***Two byte Hex-ASCII*** representation of the ***Node Address*** in the range 0 to 127.

Device Address ***Two byte Hex-ASCII*** representation of the ***Device Address*** in the range 0 to 127. By definition ***Device 0 is the Node itself.***

Command Character ***Single Byte Character*** in the range of ***20 Hex to 7F Hex***. ***20 Hex*** is reserved for the Command Response Field from the ***Device or Node.***

Data Field ***A Variable length Data Field*** up to 20 Bytes in Length depending on the Command.

Checksum ***Four Byte Hex-ASCII*** representation of the 16 bit binary word generated by adding all bytes of the Command String from the Start Byte through the end of the Data Field.

End Character ***ASCII CR*** ***Single Byte ASCII Carriage Return Character*** representing the end of the Command String.

FOS 1000A Communications Protocol (cont.)

GETCALVARS ***Get Calibration Variables***

Table 10 FOS 1000A Get Calibration Variables Command String

0	1, 2	3, 4	5	6..9	10
^B	NA	DA	C	CS	CR
START	NODE	DEVICE	COMMAND	CHECKSUM	RETURN
1	2	2	1	4	1
BYTE	BYTES	BYTES	BYTE	BYTES	BYTE

Table 11 FOS 1000A Get Calibration Variables Response String

0	1, 2	3, 4	5	6..9	10..13	14..17	18
^B	NA	DA	20 Hex	PRF	V		CR
START	NODE	DEVICE	RESPONSE	PRIME	MONITOR	CHECKSUM	RETURN
1	2	2	1	4	4	4	1
BYTE	BYTES	BYTES	BYTE	BYTES	BYTES	BYTES	BYTE

Start Character ***CNTRL B*** ***Single Byte Field*** indicating the start of transaction.

Node Address ***Two byte Hex-ASCII*** representation of the ***Node Address*** in the range 0 to 127.

Device Address ***Two byte Hex-ASCII*** representation of the ***Device Address*** in the range 0 to 127. By definition ***Device 0 is the Node itself.***

Command Character ***Single Byte Character*** in the range of ***20 Hex to 7F Hex***. ***20 Hex*** is reserved for the Command Response Field from the ***Device or Node.***

Data Field ***A Variable length Data Field*** up to 20 Bytes in Length depending on the Command.

Checksum ***Four Byte Hex-ASCII*** representation of the 16 bit binary word generated by adding all bytes of the Command String from the Start Byte through the end of the Data Field.

End Character ***ASCII CR*** ***Single Byte ASCII Carriage Return Character*** representing the end of the Command String.

FOS 1000A Communications Protocol (cont.)

SETMODE ***Set New Instrument Mode Value***

Table 12 FOS 1000A Set New Mode Value Command String

0	1, 2	3, 4	5	6	7..10	11
^B	NA	DA	F	m	CS	CR
START	NODE	DEVICE	COMMAND	MODE	CHECKSUM	RETURN
1	2	2	1	1	4	1
BYTE	BYTES	BYTES	BYTE	BYTE	BYTES	BYTE

Table 13 FOS 1000A Set New Mode Value Response String

0	1, 2	3, 4	5	6	7	8..11	12
^B	NA	DA	20 Hex	m	s		CR
START	NODE	DEVICE	RESPONSE	MODE	STATUS	CHECKSUM	RETURN
1	2	2	1	1	1	4	1
BYTE	BYTES	BYTES	BYTE	BYTE	BYTE	BYTES	BYTE

Start Character ***CNTRL B*** ***Single Byte Field*** indicating the start of transaction.

Node Address ***Two byte Hex-ASCII*** representation of the ***Node Address*** in the range 0 to 127.

Device Address ***Two byte Hex-ASCII*** representation of the ***Device Address*** in the range 0 to 127. By definition ***Device 0 is the Node itself.***

Command Character ***Single Byte Character*** in the range of ***20 Hex to 7F Hex***. ***20 Hex*** is reserved for the Command Response Field from the ***Device or Node.***

Data Field ***A Variable length Data Field*** up to 20 Bytes in Length depending on the Command.

Checksum ***Four Byte Hex-ASCII*** representation of the 16 bit binary word generated by adding all bytes of the Command String from the Start Byte through the end of the Data Field.

End Character ***ASCII CR*** ***Single Byte ASCII Carriage Return Character*** representing the end of the Command String.

m ***The NEW Mode Value Sent/Received***

ASCII 0 ***Absolute Readings***
ASCII 1 ***Relative Readings***

s ***Mode Status***

ASCII 0 ***Mode Was Invalid***
ASCII 1 ***Mode Was Received and Updated***

FOS 1000A Communications Protocol (cont.)

SETWAVELENGTH ***Set Wavelength to New Wavelength***

Table 14 FOS 1000A Set Wavelength Command String

0	1, 2	3, 4	5	6	7..10	11
^B	NA	DA	G	w	CS	CR
START	NODE	DEVICE	COMMAND	WLENGTH	CHECKSUM	RETURN
1	2	2	1	1	4	1
BYTE	BYTES	BYTES	BYTE	BYTE	BYTES	BYTE

Table 15 FOS 1000A Set Wavelength Response String

0	1, 2	3, 4	5	6	7	8..11	12
^B	NA	DA	20 Hex	w	s		CR
START	NODE	DEVICE	RESPONSE	WIENGTH	STATUS	CHECKSUM	RETURN
1	2	2	1	1	1	4	1
BYTE	BYTES	BYTES	BYTE	BYTE	BYTE	BYTES	BYTE

Start Character ***CNTRL B*** ***Single Byte Field*** indicating the start of transaction.

Node Address ***Two byte Hex-ASCII*** representation of the ***Node Address*** in the range 0 to 127.

Device Address ***Two byte Hex-ASCII*** representation of the ***Device Address*** in the range 0 to 127. By definition ***Device 0 is the Node itself.***

Command Character ***Single Byte Character*** in the range of ***20 Hex to 7F Hex***. ***20 Hex*** is reserved for the Command Response Field from the ***Device or Node.***

Data Field ***A Variable length Data Field*** up to 20 Bytes in Length depending on the Command.

Checksum ***Four Byte Hex-ASCII*** representation of the 16 bit binary word generated by adding all bytes of the Command String from the Start Byte through the end of the Data Field.

End Character ***ASCII CR*** ***Single Byte ASCII Carriage Return Character*** representing the end of the Command String.

w ***The NEW Wavelength Value Sent/Received***

ASCII 0 ***1310 nm***
ASCII 1 ***1550 nm***

s ***Wavelength Status***

ASCII 0 ***Wavelength Was Invalid***
ASCII 1 ***Wavelength Was Received and Updated***

FOS 1000A Communications Protocol (cont.)

SETPWRMODE ***Set to New Optical Power Display Mode***

Table 16 FOS 1000A Set to New Optical Power Display Mode Command String

0	1, 2	3, 4	5	6	7..10	11
^B	NA	DA	H	p	CS	CR
START	NODE	DEVICE	COMMAND	P MODE	CHECKSUM	RETURN
1	2	2	1	1	4	1
BYTE	BYTES	BYTES	BYTE	BYTE	BYTES	BYTE

Table 17 FOS 1000A Set to New Optical Power Display Mode Response String

0	1, 2	3, 4	5	6	7	8..11	12
^B	NA	DA	20 Hex	p	s		CR
START	NODE	DEVICE	RESPONSE	MODE	STATUS	CHECKSUM	RETURN
1	2	2	1	1	1	4	1
BYTE	BYTES	BYTES	BYTE	BYTE	BYTE	BYTES	BYTE

Start Character ***CNTRL B*** ***Single Byte Field*** indicating the start of transaction.

Node Address ***Two byte Hex-ASCII*** representation of the ***Node Address*** in the range 0 to 127.

Device Address ***Two byte Hex-ASCII*** representation of the ***Device Address*** in the range 0 to 127. By definition ***Device 0 is the Node itself.***

Command Character ***Single Byte Character*** in the range of ***20 Hex to 7F Hex***. ***20 Hex*** is reserved for the Command Response Field from the ***Device or Node.***

Data Field ***A Variable length Data Field*** up to 20 Bytes in Length depending on the Command.

Checksum ***Four Byte Hex-ASCII*** representation of the 16 bit binary word generated by adding all bytes of the Command String from the Start Byte through the end of the Data Field.

End Character ***ASCII CR*** ***Single Byte ASCII Carriage Return Character*** representing the end of the Command String.

p ***The NEW Optical Power Mode Sent/Received***

ASCII 0 ***set units to mWatts***
ASCII 1 ***set units to dBmWatts***

s ***Optical Power Mode Status***

ASCII 0 ***Optical Power Mode Was Invalid***
ASCII 1 ***Optical Power Mode Was Received and Updated***

FOS 1000A Communications Protocol (cont.)

SETCHANCOUNT ***Set to New Channel Count***

Table 18 FOS 1000A Set to New Channel Count Command String

0	1, 2	3, 4	5	6..9	10..13	14
^B	NA	DA	I	n	CS	CR
START	NODE	DEVICE	COMMAND	COUNT	CHECKSUM	RETURN
1	2	2	1	4	4	1
BYTE	BYTES	BYTES	BYTE	BYTES	BYTES	BYTE

Table 19 FOS 1000A Set to New Channel Count Response String

0	1, 2	3, 4	5	6..9	10	11..14	15
^B	NA	DA	20 Hex	CHANNEL	s		CR
START	NODE	DEVICE	RESPONSE	COUNT	STATUS	CHECKSUM	RETURN
1	2	2	1	4	1	4	1
BYTE	BYTES	BYTES	BYTE	BYTES	BYTE	BYTES	BYTE

Start Character ***CNTRL B*** ***Single Byte Field*** indicating the start of transaction.

Node Address ***Two byte Hex-ASCII*** representation of the ***Node Address*** in the range 0 to 127.

Device Address ***Two byte Hex-ASCII*** representation of the ***Device Address*** in the range 0 to 127. By definition ***Device 0 is the Node itself.***

Command Character ***Single Byte Character*** in the range of ***20 Hex to 7F Hex***. ***20 Hex*** is reserved for the Command Response Field from the ***Device or Node.***

Data Field ***A Variable length Data Field*** up to 20 Bytes in Length depending on the Command.

Checksum ***Four Byte Hex-ASCII*** representation of the 16 bit binary word generated by adding all bytes of the Command String from the Start Byte through the end of the Data Field.

End Character ***ASCII CR*** ***Single Byte ASCII Carriage Return Character*** representing the end of the Command String.

n ***The NEW Channel Count Sent/Received***
Valid Count Range from 1 to 200

s ***Channel Count Mode Status***

ASCII 0 ***Channel Count Was Invalid***
ASCII 1 ***Channel Count Was Received and Updated***

The FOS 1000A Optical Input Attenuator Option

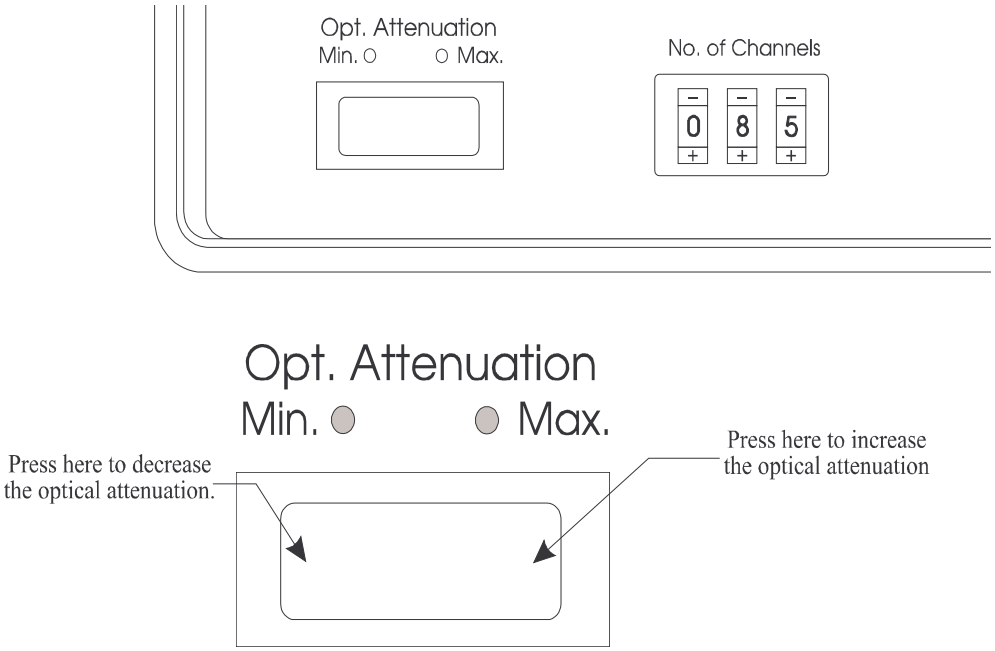

Figure 13 The FOS 1000A Front Panel with optional Optical Attenuator

The FOS 1000A Internal Optical Attenuator Operation

The figure above shows the FOS 1000A Front Panel with the Internal Optical Attenuator Installed. Powering the FOS 1000A On/Off is controlled by the rear panel AC Mains switch.

The Optical Attenuator is used to protect the optical detector from input overload when connecting to high power devices. Increasing or decreasing Optical Loss into the unit is controlled via the Front Panel Toggle Switch as shown. Pressing the "Right-Half" of the switch will increase attenuation (see figure). Continuously pressing the "Right-Half" of the switch will increase attenuation until the maximum is reached. Once the maximum attenuation is reached (> 35 dB), the Max. LED annunciator will light.

Pressing the "Left-Half" of the switch will decrease attenuation. Continuously pressing the "Left-Half" of the switch will decrease attenuation until the minimum is reached. Once the minimum attenuation is reached, the Min. LED annunciator will light. The optical input reading is calibrated to take into account the small amount of optical loss in the attenuator at its' minimum setting. This allows the FOS 1000A to be used in conjuction with external "Lab Quality" attenuators when *True Optical Power* must be known. ***When set to minimum internal attenuation, the true optical power level is:***

True Optical Power = (External Attenuator Setting) + (Optical Power Reading on LCD)

Addendum Information

First Printing July 11, 2008

Part Number RFO 017-00005 Revision 00

Changes Made

August 2008 Removed Reference to FOS860A Updates

Reason for Change

Added revisions and corrections to headers only