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FOM-7900B Fiber Optic System
FOS-79800E Fiber Optic Source Module
FOS-79710 1 x 4 Fiber Optic Switch Module
DPM-79810 Dual Power Meter Module

INSTRUCTION MANUAL

Manual Part No. 70032602
Printed in the U.S.A.

ILX Lightwave

FEEDBACK

To ensure that you get the most out of your ILX Lightwave product, we ask that you direct any product operation or service related questions or comments to ILX Lightwave Customer Support. You may contact us in whatever way is most convenient:

Telephone	800-459-9459
FAX	(406) 586-9405
E-mail	support@ilxlightwave.com
CS webpage	http://ilx.custhelp.com/cgi-bin/ilx.cfg/php/enduser/home.php
Mail	31950 East Frontage Road Bozeman, Montana, USA 59715

When you contact us, please have the following information:

Model Number _____

Serial Number _____

End-user name and telephone/fax: _____

Name: _____

Company: _____

Phone: _____

Fax: _____

Description or sketch of what is connected to the ILX Lightwave instrument.

Description of the problem

If ILX Lightwave determines that a return to the factory will be necessary, you will be issued a Return Authorization (RA) number. Please mark this number on the outside of the shipping box.

NOTE: The shipping box and packing material have been designed specifically for each product and should be saved for possible transportation at a later date.

WARRANTY ILX LIGHTWAVE CORPORATION warrants this instrument to be free from defects in material and workmanship for a period of one year from date of shipment. During the warranty period we will repair or replace the unit, at our option, without charge.

Limitation This warranty does not apply to shipping damage, fuses, lamps, defects caused by abuse, modifications, or to use of the product for which it was not intended.

This warranty is in lieu of all other warranties, expressed or implied, including any implied warranty of merchantability or fitness for any particular purpose. ILX Lightwave Corporation shall not be liable for any incidental, special, or consequential damages.

If a problem occurs, please notify ILX Lightwave Corporation and thoroughly describe the nature of the problem and give the serial number.

Returning an Instrument If an instrument is to be shipped to ILX Lightwave for repair or service, be sure to:

1) Obtain a Return Authorization (RA) number from the factory.
2) Attach a tag to the instrument identifying the owner and indicating the required service or repair. Include the instrument serial number (the model number followed by a sequenced four-digit number on the rear or side panel).
3) Contact ILX Lightwave for packing and shipping instructions. The original shipping container must be used.

NOTE: The shipping box and packing material have been designed specifically for each product and should be saved for possible transportation at a later date.

4) Send the instrument, transportation pre-paid to ILX Lightwave, referencing the return authorization number. We suggest that you insure the shipment.

Repairs will be made and the instrument returned transportation pre-paid. Repairs are warranted for the remainder of the original warranty or for 90 days, whichever is greater.

Claims for Shipping Damage When you receive the instrument, inspect it immediately for any damage or shortages on the packing list. If the instrument is damaged, file a claim with the carrier. ILX Lightwave can supply you with a quotation for estimated costs of repair. You must negotiate and settle with the carrier for the amount of damage.

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CALIBRATION AND REPAIR

ILX Lightwave offers complete calibration and repair service across our entire line of products. ILX Factory Authorized Service Centers are located at several locations around the globe in order to facilitate your service requirements. Quick service turn-times, an easy fixed-price repair and calibration service schedule along with knowledgeable and professional staff all combine to ease instrument maintenance and repair.

ILX Lightwave provides in-house and on-site calibration services for ILX instruments. Most ILX instruments require yearly calibration to insure performance to published specifications. ILX factory calibrations employ NIST traceable measurement instrumentation. Our Calibration Engineers and Technicians use automated test equipment to accurately and efficiently capture and record calibration data of the ILX equipment. A detailed report showing any pre-calibration, out-of-tolerance conditions are available upon request. An original certificate of calibration authenticity is provided on all instrument calibrations. On-site calibrations can be performed whenever your production schedule allows, night or day, seven days a week. Please call an ILX Customer Service or Sales Engineer at (800) 459-9459 to discuss how we can help you keep your ILX Lightwave instrumentation at peak performance.

PRODUCT SAFETY INFORMATION

Definition of symbols



Important operating and maintenance (servicing) instructions.



Risk of electrical shock.



Static-sensitive device, use proper grounding provisions.



Power ON symbol

Standby Symbol

Cautions and Warnings

CAUTION:



NO USER SERVICEABLE PARTS INSIDE, REFER SERVICING TO QUALIFIED SERVICE PERSONNEL

WARNING: The operating line voltage of the 7900B is set at the factory. The voltage setting is marked on the back panel. Changing the line voltage requires disassembly of the mainframe. In addition to voiding the warranty, removing the back panel may expose the user to the risk of electrical shock.



WARNING: Equipment may produce high leakage currents when the safety ground is faulty. Ensure that the power supply cord is connected to a properly grounded mains receptacle.



WARNING

TO PREVENT FIRE OR SHOCK HAZARD,
DO NOT EXPOSE THIS EQUIPMENT TO MOISTURE

LASER SAFETY FOR THE FOS-79800E

There are laser and electrical safety issues that must be considered during the operation of the FOS-79800E laser source modules. The FOS-79800E laser source modules must be used as intended in this manual. Any other use not specified in this manual may result in a hazard.

The high brightness, sometimes invisible light output of laser diodes and other laser sources pose a definite eye hazard. Direct viewing of the laser output can produce retinal or corneal damage. Absorption of the laser light by the eye causes localized heating and denaturing of tissue proteins. The ANSI publication Z-136.1, “The Safe Use of Lasers”, lists Maximum Permissible Exposure (MPE) levels for direct, or intrabeam viewing of laser beams. From the MPE levels, a “hazard zone” may be computed for a particular laser and exposure time. For more information concerning lasers and laser diode safety, contact the Center for Devices and Radiological Health or ILX Lightwave.

Laser Warning Label

IEC Triangle



Visible and/or invisible laser radiation. Avoid direct eye exposure to the beam.

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CHAPTER 1 INTRODUCTION

COMPANY AND TECHNOLOGY OVERVIEW

ILX Lightwave is a market and technology leader in the manufacture of photonic test and measurement instrumentation. ILX Lightwave's global customer base is comprised of leading manufacturers of fiber optic telecommunications systems and components.

ILX Lightwave serves customers from five strategically located manufacturing, sales and service centers in the United States, Canada, Japan and Europe. In keeping with its commitment to product leadership and business growth, ILX Lightwave continuously introduces new products that are designed to offer customers long-term benefits such as manufacturing yield enhancement, greater productivity or reduced cost of ownership.

PRODUCT OVERVIEW

The FOM-7900B Fiber Optic System supports up to eight modules of stabilized DFB or Fabry Perot laser sources, fiber optic switches or dual power meters. All are controlled from a single user interface.

The mainframe and modules can be controlled by a GPIB/IEEE-488.2 or RS-232 interface. Up to twenty-five FOM-7900B Systems can be linked to control up to 200 channels from one GPIB address.

AVAILABLE OPTIONS

The following options are available with the FOM-7900B Fiber Optic System.

Table 1-1 Module Options

DESCRIPTION	MODEL NUMBER
1 x 4 Fiber Optic Switch Module	FOS-79710
Precision Fiber Optic Source Module	FOS-79800E
Dual Power Meter	DPM-79810

SUMMARY OF INSTRUCTION MANUAL

Thank you for purchasing an ILX Lightwave FOM-7900B Fiber Optic System. This manual describes the maintenance and operation of the FOM-7900B Fiber Optic System and modules. We recommend that you read this manual before operating the FOM-7900B Fiber Optic System.

CHAPTER 2 System Overview

Before using the FOM-7900B Fiber Optic System the user should become familiar with the physical components of the unit. This chapter describes the exterior and interior components and provides specifications for the FOM-7900B Fiber Optic System.

CHAPTER 3 FOM-7900B Mainframe Operation

This chapter is a guide for front panel operation of the mainframe.

CHAPTER 4 FOS-79800E Module

This chapter is a guide for front panel operation of the source module.

CHAPTER 5 DPM-79810 MODULE

This chapter is a guide for front panel operation of the dual power meter module.

CHAPTER 6 FOS-79710 Module

This chapter is a guide for front panel operation of the 1 x 4 switch module.

CHAPTER 7 RS–232 Interface

This chapter is an overview of the RS–232 interface.

CHAPTER 8 GPIB Remote Operation and Common Commands

This chapter is a guide to the syntax and usage of the various IEEE/488.2 common commands. It also includes hardware diagrams and other information relating to remote operation.

CHAPTER 9 Command Reference

This chapter is a guide to the syntax and usage of the various device-dependent commands for the FOM-7900B System.

CHAPTER 10 Programming Examples

This chapter provides FOM-7900B programming examples using GPIB commands.

CHAPTER 11 Maintenance

This chapter describes how to maintain the FOM-7900B System.

CHAPTER 12 Error Messages

This chapter provides information on error messages and warnings.

CHAPTER 13 Troubleshooting

This chapter is intended to be used as a guide when the FOM-7900B mainframe or modules do not perform as expected.

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CHAPTER 2 SYSTEM OVERVIEW

FOM-7900B SYSTEM CHARACTERISTICS

Power Input[1]:	100-120VAC (50Hz/60Hz, 1.5 A) 220-240VAC (50Hz/60Hz, 0.8 A)
Rack Mounting:	19” (48.3cm)
Weight:	28lbs (12.7Kg)
Height:	7” (17.8cm)
Depth:	16” (40.6cm)
Width:	19” (48.3cm)
Maximum Relative Humidity:	<90% relative humidity, non-condensing
Operating temperature range[2]:	0°C to +40°C
Storage temperature range:	-40°C to +70°C
Maximum altitude:	3,000 meters
Chassis Ground	4mm Banana jack

Suitable for continuous operation

Ordinary Protection (Not protected against harmful ingress of moisture)
Class 1 Equipment (Grounded Type) Indoor use only

NOTE: The mains supply voltage is factory set and cannot be changed by the user. If a change is required, contact ILX Lightwave Customer Service.

1. Permitted fluctuations in rated line voltage of +6% and -10%
2. Operating temperature range may vary for individual modules

FOM-7900B SYSTEM SPECIFICATIONS

Internal Modulation

Waveform	Square Wave
Frequency	1-500 kHz
Duty Cycle	50% ± 1%
Modulation Depth	100%
Rise/Fall time	< 250 ns
Channel to Channel Synchronization[3]	<100 ns

Modulation In

Level	TTL
Frequency	1-500 kHz
Duty Cycle[1]	50% ±1%
Polarity	0 volts = Laser turned OFF +5 volts = Laser turned ON
Optical Delay[2]	<1 µs
Channel to Channel Synchronization[3]	<100 ns
Jitter[4]	<50 ns
Connector	BNC female on back panel

Modulation Out

Level	TTL
Polarity of OUT	0 volts = Laser turned OFF +5 volts = Laser turned ON
Polarity of $\overline{\text{OUT}}$	0 volts = Laser turned ON +5 volts = Laser turned OFF
Optical Delay[2]	<1 µs
Gate Delay[5]	< 60 ns/mainframe
Jitter[4]	< 50 ns

1. Input modulation duty cycles other than 50% ±1% will result in output power inaccuracies.
2. Optical Delay is defined as the time between the rising edge of the input modulation signal and the rising edge of the modulated optical output.
3. Channel to Channel Synchronization is defined as the maximum variation in optical delay between modules in the same mainframe.
4. Jitter is defined as the variation in optical delay for any given module.
5. Gate Delay is defined as the time between the input modulation signal and the output modulation signal.

Fanout	Capable of driving 3 additional FOM-7900B mainframes in parallel
Connector	BNC female on rear panel

External Trigger Input/Output

Level	TTL, Active Low
Pulse Width	100 ns minimum
Connector	BNC female on rear panel

Computer Interface

GPIB/IEEE-488.2

Hardware meets ANSI/IEEE Std. 488.2 - 1987
Software meets ANSI/IEEE Std. 488.2 - 1987
SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0, E1, E2

RS-232

Baud Rate	9600
Stop Bits	1
Parity	None
Data Bits	8
Flow Control	None
RS-232 A Connector	9 pin male “D” connector
RS-232 B Connector	9 pin female “D” connector

REAR PANEL

The following paragraphs describe the rear panel of the FOM-7900B Fiber Optic System. The FOM-7900B Mainframe Rear Panel is shown in FIGURE 2-1.



FIGURE 2-1 FOM-7900B Fiber Optic System Rear Panel

Power Entry Module and Fuse

The AC Power Entry Module and fuse are located on the right side of the FOM-7900B rear panel. The unit must be connected to a properly rated AC power source in order to operate. The AC line voltage is preset at the factory and is not adjustable in the field. Permitted fluctuations from rated line voltages are +6% and -10%.

EXAMPLE

LINE VOLTAGE	FUSE
100 – 115VAC	3A
220 – 240VAC	1.5A
3AG, 250V, SLO – BLO	

Replace fuse only with the specified type and rating as listed on the back panel of your FOM-7900B. Instructions for replacing a fuse are found in CHAPTER 11 Maintenance.

NOTE: **FOR CONTINUED PROTECTION, REPLACE FUSE ONLY WITH SPECIFIED TYPE AND RATING.**



ZUM FORTBESTEHENDEN SCHUTZ, ERSETZEN SIE DIE SICHERUNG NUR MIT DEM SPEZIFIZIERTEM TYP AND NENNWERT.

POUR ASSURER LA PROTECTION FUTURE, LE FUSIBLE DE REMPLACEMENT DOIT ETRE AUX MEMES SPECIFICATIONS.

PER UNA CORRETA PROTEZIONE, SOSTITUIRE IL FUSIBILE SOLO CON UNO DI IDENTICO TIPO E POTENZA.

GPIB Connector

The GPIB connector is located adjacent to the fan on the right hand side of the rear panel. It is compliant with ANSI/IEEE Standard 488.1-1987. Interface specifications are listed in Table 8-1. It is possible to link several FOM-7900B Mainframes together and control them all from one GPIB address.

RS-232 Connectors

The FOM-7900B can be controlled remotely through a serial link between a computer COM port and the FOM-7900B. The commands described in CHAPTER 8 GPIB Remote Operation and Common Commands and CHAPTER 9 Command Reference can be sent via GPIB or RS-232. It is possible to link several FOM-7900B Mainframes together and control them all from one RS-232 interface. Refer to CHAPTER 7 RS–232 Interface for details regarding RS-232 communications to the FOM-7900B.

Trigger Input/Output Connectors



The TRIGGER IN may be used to externally signal modules to execute a predetermined set of instructions. The input signal is active low, edge triggered, TTL, with a minimum pulse width of 100 ns. All modules will receive the trigger pulse but *not all modules support the external trigger.*



Some modules are capable of generating a trigger signal that is available at the rear panel TRIGGER OUT connector. The electrical specifications are the same at the trigger input. A trigger input signal is duplicated at the trigger output connector. Sending the *GET or TRIG GPIB commands also generates a signal at the TRIGGER OUT connector.

Modulation Input Connector (External Modulation)

It is possible to modulate the sources within the FOM-7900B using an external signal. This signal must be in the form of a TTL signal between 1 kHz and 500 kHz applied to the MODULATION IN connector on the rear panel. When the TTL signal is high (+5 volts), the source(s) will be turned on. When the TTL signal is low (0 volts), the source(s) will be turned off. The input signal is also available at the MODULATION OUT connectors on the rear panel.

To use this feature the FOM-7900B must be configured for external modulation by choosing EXTERNAL from the Mod Source menu. Refer to CHAPTER 3 FOM-7900B Mainframe Operation, for explanation of mainframe menu selections.

Modulation Output Connectors

The signal used to modulate the sources (internal or external) is available as differential outputs from the rear panel of the instrument. The non-inverted signal is high (+5 volts) when the sources are turned on and low (0 volts) when the sources are turned off. The inverted signal has the opposite polarity.

The Modulation Out signal can be used as an external signal to synchronously modulate other FOM-7900B mainframes or to trigger peripheral test equipment.

MODULE INSTALLATION

Use the following instructions when installing modules into the FOM-7900B Mainframe.



1. Make sure the power to the FOM-7900B Mainframe is turned off.

CAUTION: Do not insert or remove any module while the FOM-7900B is powered up. This could damage the module and/or mainframe. Be sure the module is properly installed before applying power to the FOM-7900B.

CAUTION: The Fiber Optic Source Module and the Dual Power Meter are static sensitive devices. Installing or removing any module from the FOM-7900B System should take place at an ESD protected workbench. The operator should be properly earth grounded.

2. Select any available mainframe channel and, if necessary, remove the blank plate that covers that channel. The plate is removed by loosening the screw at the bottom left corner.

NOTE: The DPM-79810 occupies two channels.

3. Position the module upright and guide it into the bay using the mounting rails on the top and bottom of the mainframe bay.

4. Press the module firmly into the bay. The module should “snap” securely into place.

5. Secure the module using the screw at the bottom left corner of the front panel.

POWER-UP

Connect the FOM-7900B mainframe to an AC power source. Press the POWER switch to supply power to the device and start the six-second startup sequence.

WARNING: To avoid electrical shock hazard, connect the FOM-7900B System to a properly earth grounded, three prong receptacle only. Failure to observe this precaution can result in severe injury or death.



Warm-up and Environmental Considerations

To achieve rated stability, the mainframe, with modules installed, must warm up for a minimum of one hour with the power on. Some modules may require a longer warm-up time. The operating conditions are determined by the type of module installed, but must not exceed 0-40°C and < 90%, non condensing relative humidity.

CAUTION: **DANGER: VISIBLE AND/OR INVISIBLE LASER RADIATION.**
AVOID DIRECT EXPOSURE TO THE BEAM.



GEFAR: SEHBAR UND/ODER UNSICHTBAR LASER STRAHLUNG.
MEIDE RICHTE AUFDECKUNG ANS STRAHL.



DANGER: VISIBLE ET/OU INVISIBLE LASER RADIATION.
EVITENT DIRECT EXPOSURE AU POUTRE.

PERICOLO: VISIBLE E/O INVISIBLE LASER RADIAZIONE.
EVITANO DIRETTA EXPOSURE AGLT TRAVE.

The high brightness, sometimes invisible light output of laser diodes and other laser sources poses a definite eye hazard. Direct viewing of the laser output can produce retinal or corneal damage. The ANSI publication Z-136.1, “The Safe Use of Lasers”, lists Maximum Permissible Exposure (MPE) levels for direct, or intrabeam viewing of laser beams. From the MPE levels, a “hazard zone” may be computed for a particular laser and exposure time. For more information concerning lasers and laser diode safety, contact the Center for Devices and Radiological Health or ILX Lightwave.

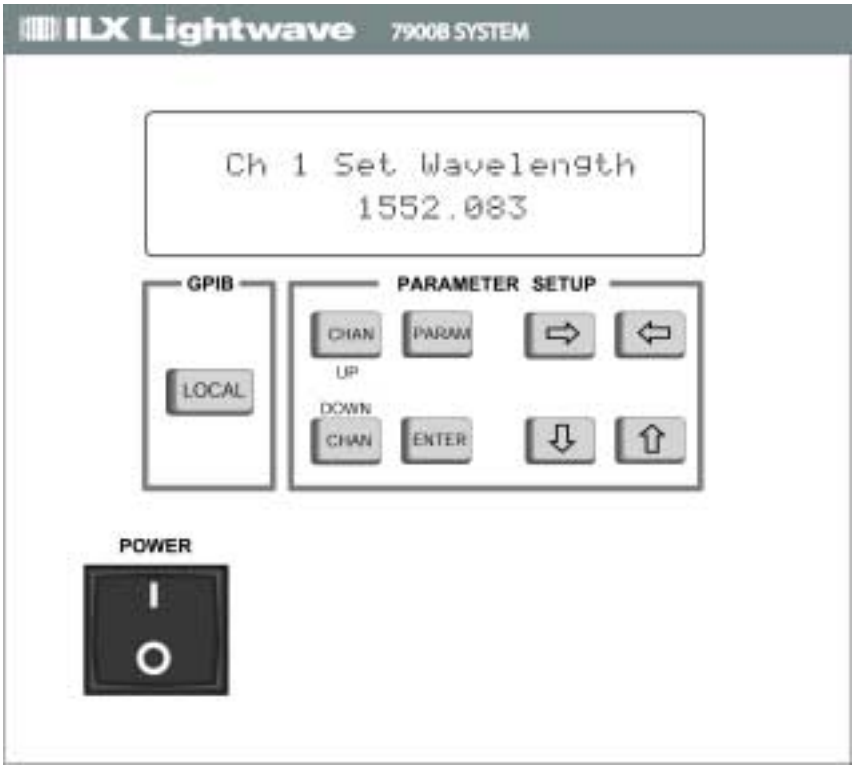
(page left blank intentionally)

CHAPTER 3 FOM-7900B MAINFRAME OPERATION

FRONT PANEL CONTROLS

Three modules are available for use in the FOM-7900B mainframe: the FOS-79800E Fiber Optic Source module, the FOS-79710 Fiber Optic Switch and the DPM-79810 Dual Power Meter. All are controlled using the mainframe keypad.

Details unique to individual modules are described in the corresponding module chapter.



Display

The selected module channel number is always shown in the upper left corner of the display. A description of the selected parameter is provided in the upper right corner of the display.

Local/Remote Control



When the FOM-7900B is addressed remotely by a host computer the display reads >>REMOTE<< and the front panel is disabled. Press the LOCAL key to return to local, front panel, control.

When the instrument is in local mode, pressing the LOCAL key causes the GPIB address to be displayed. The GPIB address can then be changed by pressing the UP and DOWN arrow keys to select the desired address. The new address is implemented when the ENTER key is pressed.

Channel Selection



Use the CHAN UP or CHAN DOWN keys to select one of the eight modules in the FOM-7900B Mainframe. When a module is selected, parameters for that module are displayed on the FOM-7900B front panel.

Parameter Selection



Repeatedly press the PARAM key to view the adjustable parameters for the selected module.

Parameter Adjustment





The LEFT and RIGHT arrow keys are used to place the cursor at a specific position in the adjustable parameter.





The UP and DOWN arrow keys are used to increase (decrease) the value of the displayed parameter highlighted by the cursor. Changes made to the parameter are not implemented until the ENTER key is pressed.

Parameter Entry



The ENTER key must be pressed after editing to apply changes to the displayed parameter. Editing sessions are automatically cancelled if the ENTER key is not pressed within 3 seconds of changing the parameter.

Sweeping Parameter Values

It is possible to rapidly adjust and implement changes to a parameter value by pressing either the UP or DOWN arrow key and the ENTER key simultaneously. This provides the capability to sweep over a range of parameter values.

MAINFRAME PARAMETER MENU

The FOM-7900B Fiber Optic System Mainframe menu is shown in Table 3-1. (Pressing the CHAN UP or CHAN DOWN key until “Ch All” is shown in the upper left corner of the display accesses the mainframe parameter menu.) A selection is made by repeatedly pressing the PARAM key until the desired parameter is displayed.

Table 3-1 Mainframe Parameter Menu

Mod Setup[1]
Mod Freq
Mod Source
User Mode[2]
Modulation
Coherence Ctl
Source Output
Setup Mode[1]
GPIB Address
Bank Address
User Mode[2]
ERROR[3]

1. Pressing ENTER at this parameter passes control to the secondary menu.
2. Pressing ENTER at this parameter passes control back to the main menu.
3. Error messages are displayed only when an error condition exists within the mainframe.

Modulation Setup

CH ALL MOD SETUP
(PRESS ENTER)

Press the ENTER key to proceed to the secondary menu structure specific to the setup of the internal/external modulation.

Modulation Frequency

CH ALL	MOD FREQ
100.00 KHZ	

Use this parameter to set the internal modulation frequency in kHz. The value on the bottom line indicates the present modulation frequency. Use the LEFT and RIGHT arrow keys to move the cursor and the UP and DOWN arrow keys to adjust the frequency. Then press the ENTER key to implement the change.

Modulation Source

CH ALL	MOD SOURCE
INTERNAL	

Use this parameter to set the modulation source as INTERNAL or EXTERNAL. The value on the bottom line indicates the present source of the modulation signal. Use the UP and DOWN arrow keys to select the source of the modulation signal. Then press the ENTER key to implement the change.

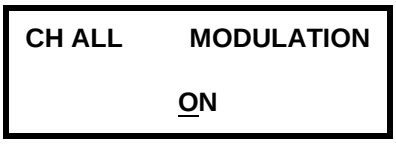
When the modulation source is **INTERNAL**, the signal generated by an internal function generator is sent down the FOM-7900B backplane and to the MODULATION OUT connectors on the rear panel. When the modulation source is **EXTERNAL**, the modulation signal provided at the MODULATION IN connector on the FOM-7900B rear panel is sent down the backplane and to the MODULATION OUT connectors. The modulation is then enabled and disabled in the modules using the **Modulation** command.

Return to Main Menu

CH ALL	USER MODE
(PRESS ENTER)	

Press the ENTER key at this display to return to the main menu structure.

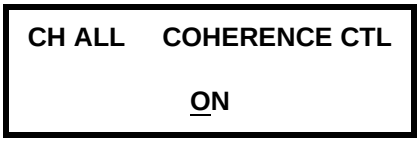
Modulation ON/OFF



Use this parameter to enable or disable the modulation in the modules. Use the UP or DOWN arrow keys to select **ON** or **OFF**. Then press the ENTER key to implement the change.

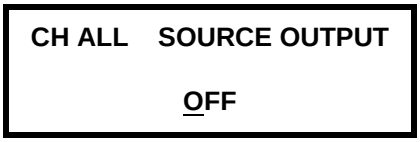
Coherence Control ON/OFF

In single mode fiber applications, light from narrow linewidth sources will remain coherent even after traveling long distances. This coherence can cause interference between reflective surfaces such as FC/PC interfaces downstream from the optical source. This interference is most noticeably seen as power instability. Enabling coherence control broadens the linewidth of the laser, thus decreasing the source's coherence length and minimizing the associated interference effects. The coherence control feature also minimizes the nonlinear effects seen in fiber optic systems due to Brillouin scattering.



Use this parameter to enable or disable coherence control in all source modules. Use the UP or DOWN arrow keys to select **ON** or **OFF**. Then press the ENTER key to implement the change.

Sources ON/OFF



Use this parameter to turn all source module outputs on or off. Use the UP or DOWN arrow keys to select **ON** or **OFF**. Then press the ENTER key to implement the change. The green LEDs on the front of all source modules indicate the state of the sources. There is a three second safety startup when the outputs are turned on. During the startup period the front panel ON LEDs blink rapidly.

Setup Mode

CH ALL SETUP MODE
(PRESS ENTER)

Press the ENTER key to proceed to GPIB remote setup.

Set GPIB Address

CH ALL GPIB ADDRESS
-01-

Use this parameter to adjust the GPIB Talk/Listen address. Use the LEFT and RIGHT arrow keys to move the cursor and the UP and DOWN arrow keys to adjust the GPIB address to a value from 1 through 31. Then press the ENTER key to implement the change.

Set Bank Address

CH ALL BANK ADDRESS
2

It is possible to link several FOM-7900B Systems together to control up to 200 channels from one GPIB Address. Each FOM-7900B in the linked system must have a unique Bank Address.

Use this parameter to adjust the Bank Address. Use the LEFT and RIGHT arrow keys to move the cursor and the UP and DOWN arrow keys to adjust the Bank Address to a value from 0 through 24. Then press the ENTER key to implement the change.

Return to Main Menu

CH ALL USER MODE
(PRESS ENTER)

Press the ENTER key at this display to return to the main menu structure.

Error Display



This parameter is displayed only when an error condition has been detected within the mainframe. The parameter cannot be modified and the arrow keys and the ENTER key are disabled. Error messages are defined in CHAPTER 12 Error Messages.

CHAPTER 4 FOS-79800E MODULE

Refer to CHAPTER 2 System Overview for installation instructions.

CAUTION: Do not insert or remove any module while the FOM-7900B is powered up. This could damage the module and/or mainframe. Be sure the module is properly installed before applying power to the FOM-7900B.



CAUTION: The Fiber Optic Source Module is a static sensitive device. Installing or removing any module from the FOM-7900B System should take place at an ESD protected workbench. The operator should be properly earth grounded.



The 79800E Source Modules with version 6.1 or higher firmware should be used in the FOM-7900B Mainframes running version 3.4 or higher firmware. Each module provides a stable laser source at a user specified maximum power and center wavelength.

Annual factory calibration is recommended for best performance of the FOS-79800E Source Modules.

FOS-79800E SPECIFICATIONS

A list of wavelength and power levels for source modules is shown in Table 4-1. Performance specifications for the series of FOS-79800E Precision Fiber Optic Source Modules are shown in Table 4-2. In keeping with our commitment to continuing improvement, ILX Lightwave Corporation reserves the right to change specifications without notice or liability for such changes.

Table 4-1 DFB Source Modules

MODULE	CENTER WAVELENGTH	MAXIMUM POWER LEVEL	STABILITY
FOS-79800E/315C1	1527.98–1564.26nm (C-band)	9–10mW	note[1]
FOS-79800E/315L1	1564.27–1610nm (L-band)	9–10mW	note[1]
FOS-79800E/315C2	1527.98–1564.26nm (C-band)	>10 up to 20mW	note[1]
FOS-79800E/315L2	1564.27–1610nm (L-band)	>10 up to 20mW	note[1]
FOS-79800E/315S	1475–1527.97nm (S-band)	9–20mW	note[1]
FOS-79800E/315EL	1610.01–1625nm (Extended L-band)	9–20mW	note[1]
FOS-79800E/SERV	1310, 1480, 1510, 1625 ±5nm (Service Channels)	9–20mW	note[2]
FOS-79800E/CUST	Customer supplied lasers, non-standard product		
FOS-79800E/000	Special product for non-standard wavelength		

1. After 1-hour warm-up (typical). Some modules may require longer warm-up time.
   For short-term stability, assume ambient temperature constant within ±0.1°C.
   For long-term stability, assume ambient temperature constant within ±1°C.
2. After warm-up of up to 6 hours. For short-term stability, assume ambient temperature constant within ±0.1°C.
   For long-term stability, assume ambient temperature constant within ±1°C.

Table 4-2 79800E Performance Specifications

OUTPUT POWER	SPECIFICATION
Level at full power[1]	Refer to Table 4-1
Stability[2]	
15 minutes (spec)	<0.005dB rms
(typical)	<0.002dB rms
24 hours	±0.03dB
Attenuation	
Calibrated range	10dB
Full range (typical)	15dB
Accuracy[3]	±0.1dB
Wavelength	**SPECIFICATION**
Available center λ	Refer to Table 4-1
Resolution	1pm
Accuracy	±50 pm
Stability	
15 minutes	±3pm
24 hours	±5pm
Tuning range	±0.85nm
Spectral width	
Coherence control OFF	<30MHz
Coherence control ON	1GHz (typical)[4]
General	**SPECIFICATION**
Side mode suppression[5]	>40dB (>45dB typical)
Signal to background[6]	>30dB
Optical isolation	>30dB
RIN[7]	-145dB/Hz
Modulation frequency[8]	1–500 kHz
Optical connector[9]	FC/APC
Operating temperature	15°C–35°C
SSE50 Option	**SPECIFICATION**
Signal/Spontaneous Emission (within ±100nm of center wavelength)	>50dB

1. User specified maximum power level.
2. After 1-hour warm-up (typical). Some modules may require longer warm-up time.
   For short-term stability, assume ambient temperature constant within ±0.1°C.
   For long-term stability, assume ambient temperature constant within ±1°C.

3. Defined as: ΔP_{meas} - ΔP_{set} from maximum power to 5dB down.
4. Other linewidths available.
5. Measured at output connector, set to maximum power.
6. ±100nm about center wavelength.
7. Measured at output connector. Use angled connector patchcords to minimize noise.
8. Modulation depth 100%, duty cycle 50%, rear panel TTL level input. Some rising edge ring above 100kHz. See FOM-7900B System Mainframe specifications for more information.
9. Other connector types available. Some specifications may be degraded. Also available: PANDA PM fiber aligned to slow axis.

Table 4-3 Module General Specifications

GENERAL SPECIFICATION	
Operating Temperature	+15°C to +35°C
Storage Temperature	-40°C to +70°C
Humidity	< 90% RH
Module Dimensions (H, W, D)	12.8 x 3.5 x 29.0cm (5 x 1.4 x 11.4in)
Weight	0.5kg (1.1lb)

SS-810 SOURCE SHUTTER OPTION

The SS-810 source shutter is a thermally stabilized optical 1x1 switch which is used to block the light from the laser in the FOS-79800E Source Module. When the shutter is shut, light is blocked but the laser remains on. The shutter can be controlled through both the front panel and the GPIB interface.

Table 4-4 SS-810 Source Shutter Specifications

SS-810 SOURCE SHUTTER SPECIFICATIONS	
Power Stability 24 hr. 25±1°C	<±0.07dB
Power stability 15 min 25±1°C	< 0.005 (rms)
Wavelength stability 24 hr @ 34±1°C	<±0.005nm
Minimum switch cycle speed	>4sec
Shutter ON/OFF power repeatability	± 0.05dB

FOS-79800E SOURCE MODULE PARAMETER MENU

For FOM-7900B system commands refer to Mainframe Parameter Menu, on page 3-4.

The FOS-79800E Precision Fiber Optic Source Module menu is shown in Table 4-5. A selection is made by repeatedly pressing the PARAM key until the desired parameter is displayed.

Table 4-5 FOS-79800E Parameter Menu

79800E Ver 6.1
Output
Source Shutter (OPEN/SHUT)
Set Level (dBm)
Set Wavelength (nm)
Cal Mode[1]
Cal Level
Cal Wavelength
Default Cal
User Mode[2]
ERROR[3]

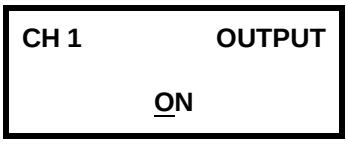
1. Pressing ENTER at this parameter passes control to the secondary menu.
2. Pressing ENTER at this parameter passes control back to the main menu.
3. Error messages are displayed only when an error condition exists in the module.

Module Identification

CH3 79800E SN XXXX
FiberOptic Src 6.1

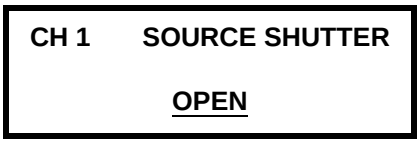
This parameter displays the model number, module serial number and the firmware version. The parameter is not adjustable. The arrow keys and ENTER are disabled.

Output ON/OFF



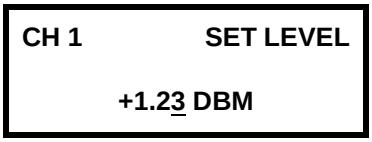
Use this parameter to turn the laser output on or off. Use the UP or DOWN arrow keys to select ON or OFF. Then press the ENTER key to implement the change. The green LED on the front of the module indicates the presence of light. The green LED will only illuminate if the Output is ON and the Shutter is OPEN.

Source Shutter OPEN/SHUT



Use this parameter to open or shut the Source Shutter. Use the UP or DOWN arrow keys to select OPEN or SHUT. Then press the ENTER key to implement the change. The green LED on the front of the module indicates the presence of light. The green LED will only illuminate if the Output is ON and the Shutter is OPEN. This parameter is displayed only when the shutter option has been detected in the module.

Set Power Level



Use this parameter to set the output power in dBm. The number displayed on the bottom line indicates the present power level. Use the LEFT and RIGHT arrow keys to move the cursor and the UP and DOWN arrow keys to adjust the level. Then press the ENTER key to implement the change.

Set Wavelength

CH 1 SET WAVELENGTH
1552.456 NM

Use this parameter to set the wavelength in nanometers. The number displayed on the bottom line indicates the present wavelength setting. Use the LEFT and RIGHT arrow keys to move the cursor and the UP and DOWN arrow keys to adjust the wavelength. Allow time for wavelength to stabilize after resetting.

User Calibration

CH 1 CAL MODE
(PRESS ENTER)

Press the ENTER key to proceed to the secondary menu structure specific to the field calibration of the FOS-79800E Fiber Optic Source Module.

Calibrate Power Level

CH 1 CAL LEVEL
+1.55 DBM

The Cal Level feature can be used when the measured output power does not match the front panel setting or to compensate for losses induced by patch cords. Use the steps below to enter a Power User Calibration. This calibration generates a single point offset that is applied to all future power levels.

1. Connect an optical power meter to the end of a fiber optic patch cord. Program the power meter to the wavelength of the FOS-79800E Precision Fiber Optic Source. Zero the power meter.

2. Set the FOS-79800E Precision Fiber Optic Source Module to a level near that of the test application. Turn the source on.

3. Proceed to the Cal Level display.

4. Give the system one hour to warm up and stabilize. Measure the output power with the power meter. Then use the LEFT and RIGHT arrow keys to move the cursor and the UP and DOWN arrow keys to enter the measured power from the power meter. Then press the ENTER key.

Calibrate Wavelength

CH 1 CAL WAVELENGTH
1554.001 NM

The Cal Wavelength feature can be used when the measured wavelength does not match the front panel setting. Use the steps below to enter a Wavelength User Calibration. The cal generates a single point offset that is applied to all future wavelength settings.

1. Connect a wavelength meter to the end of a fiber optic patch cord.

2. Set the FOS-79800E Fiber Optic Source Module to a wavelength near that of the test application. Turn the source on.

3. Proceed to the Cal Wavelength display.

4. Give the “system” 1 hour to warm up and stabilize. Measure the wavelength with the wavelength meter. Then use the LEFT and RIGHT arrow keys to move the cursor and the UP and DOWN arrow keys to enter the measured wavelength from the meter. Then press the ENTER key.

Reset User Calibration

CH 1 DEFAULT CAL
(PRESS ENTER)

Press ENTER at this display to remove the effects of the User Calibration(s). The User Calibration is an offset that is applied to all power and wavelength settings. Resetting the calibration returns these offsets to 0.00dB and 0.000nm.

Return to Main Menu

CH 1 USER MODE
(PRESS ENTER)

Press the ENTER key to return to the main menu structure.

Error Display



This parameter is displayed only when an error condition has been detected within the module. The parameter cannot be modified and the arrow keys and the ENTER key are disabled. Error messages are defined in CHAPTER 12 of this manual.

EXTERNAL TRIGGER

The FOS-79800E Fiber Optic Source Module does not support external triggering.

ERROR INDICATOR

When an error is detected within the FOS-79800E Module the red LED on the front of the module blinks. To view a description of the error press the PARAM key repeatedly until the ****ERROR**** screen is displayed. Error messages are displayed until the error causing condition is remedied. Error messages are also described in CHAPTER 12 Error Messages.

ON INDICATOR

When light is present at the output connector the green LED is on. This indicates that both the Laser is energized and the Source Shutter option is open. The default condition for the modules is laser not energized and shutter open. This configuration has been adopted to maintain consistency between modules with and without the source shutter option.

MODULATION

It is possible to modulate the laser output of the FOS-79800E. Control of the modulation is provided in the **Ch All** menu structure. Refer to CHAPTER 3 FOM-7900B Mainframe Operation for more detail. Modulation applies to all source modules simultaneously.

COHERENCE CONTROL

In single mode fiber applications, light from narrow linewidth sources will remain coherent even after travelling long distances. This coherence can cause interference between reflective surfaces such as FC/PC interfaces downstream from the optical source. This interference is most noticeably seen as power instability. The coherence control feature of the FOS-79800E broadens the linewidth of the laser, thus decreasing the coherence length and minimizing the associated interference effects. The coherence control feature also minimizes the nonlinear effects seen in fiber optic systems due to Brillouin scattering.

The Coherence Control is turned **ON** or **OFF** within the **Ch All** menu structure.

Table 4-6 FOS-79800E Module Commands

COMMAND NAME	# PARAMETERS EXPECTED	DESCRIPTION
CAL:LEVEL	##.##	Sets the Power User Calibration.
CAL:RESET	##.##	Resets the User Calibration.
CAL:WAVE	####.###	Sets the Wavelength User Calibration.
ERRor?	NONE	Returns an error code. (See CHAPTER 12)
IDN?	NONE	Returns a string that identifies the module.
LEVEL	±##.##	Sets the output power level.
LEVEL?	NONE	Returns the output power level.
OUT	#	Turns the output on and off.
OUT?	NONE	Returns the ON/OFF status of the laser.
SHUTPRES?	NONE	Returns the presence of the shutter option
SHUTTER	ON/OFF or 1/0	Opens (ON) and closes (OFF) the shutter
SHUTTER?	NONE	Returns the state of the shutter
WAVE	####.###	Sets the wavelength.
WAVE?	NONE	Returns the wavelength setting.
WAVEMAX?	NONE	Returns the maximum wavelength setting.
WAVEMIN?	NONE	Returns the minimum wavelength setting.

CHAPTER 5 DPM-79810 MODULE

The DPM-79810 Dual Power Meter Module is intended for use with the FOM-7900B Fiber Optic Mainframe running firmware Version 3.42 or higher.

Refer to CHAPTER 2 System Overview for installation instructions. The DPM-79810 Dual Power Meter Module occupies two bays.

CAUTION: Do not insert or remove any module while the FOM-7900B is powered up. This could damage the module and/or mainframe. Be sure the module is properly installed before applying power to the FOM-7900B.



CAUTION: The Fiber Optic Source Module is a static sensitive device. Installing or removing any module from the FOM-7900B System should take place at an ESD protected workbench. The operator should be properly earth grounded.



The DPM-79810 Dual Power Meter Module contains two individual optical power meters. Each power meter can be operated independently or the meters can be set to operate in a relative mode providing the difference in optical power between the two. Each individual meter is capable of measuring a maximum of 1 Watt of optical power.

Annual factory calibration is recommended for best performance of the DPM-79810 Dual Power Meter Module.

Warm-up and Environmental Considerations

To achieve rated accuracy, let the DPM-79810 warm up for at least five minutes before use. Operate the meter within the environmental limits specified in Table 5-1.

Measuring Higher Power

The DPM-79810 will accurately measure input power up to 1W. The best way to measure higher power is to use a calibrated attenuator. To set a compensating factor into the DPM-79810 so it displays the correct power of the source use USER CALIBRATION.

Understanding the Calibration Certificate

The DPM-79810 is supplied with a certificate for calibration from ILX Lightwave's laboratory. The following discussion explains the meaning of the information on your calibration certificate.

Photodetector Responsivity

The DPM-79810 Dual Power Meter module is a stable low noise current meter with a photodetector inside a special optical cavity. The cavity randomizes light input, so changes in input polarization and pattern orientation have little net effect on the detector. Factory calibration is a process of recording detector current while varying wavelength and holding light power constant. The result is a table of detector responses every 10 nanometers, in mA per mW. When you connect input light, the DPM-79810 measures detector current, then uses your wavelength setting to look up the conversion factor on the calibration table. Interpolation algorithms are used for wavelengths between these calibration points. A sample of detector response plotted as a function of wavelength, based on data from DPM-79810 meter calibrations performed at ILX Lightwave is shown in FIGURE 5-1.

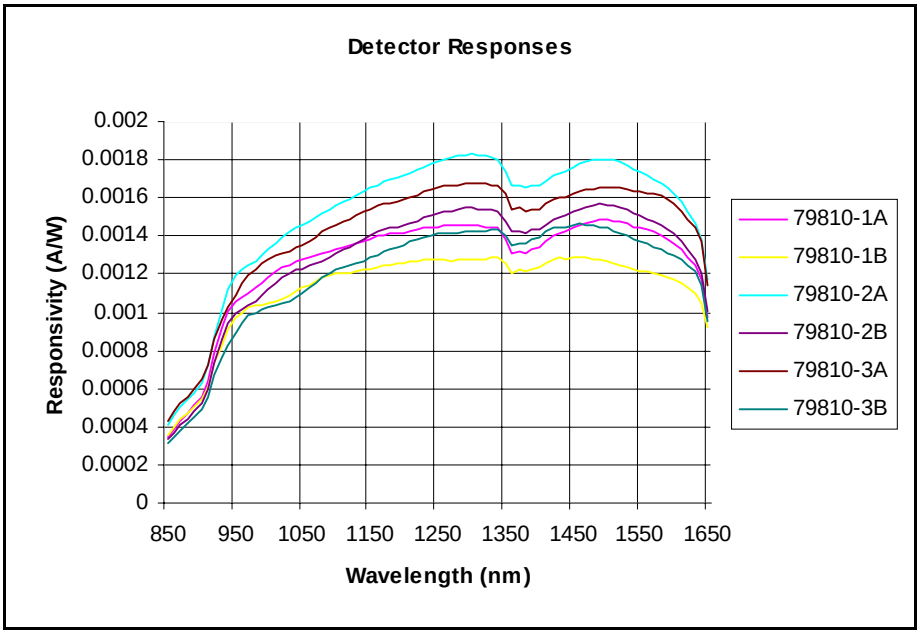


FIGURE 5-1 Sample Detector Response

The detector response is shown as photodetector current (amperes) per unit of optical power (watts). If you are familiar with normal InGaAs detector responsivity values, you may also note that these values are reduced by the loss in the DPM-79810 integrating cavity.

Note also:

- The highest detector current (greatest sensitivity) is at the longer wavelengths normally used for telecom work.
- Changes in detector response are significant enough that the meter must use the wavelength in order to display calibrated optical power.
- The flatness (or steepness) of the curve at any point is a measure of how much effect an error in wavelength input will have on the measurement result.
- Detector response is less at shorter wavelengths.

DPM-79810 SPECIFICATIONS

Performance specifications for the DPM-79810 Dual Power Meter Module are shown Table 5-1. In keeping with our commitment to continuing improvement, ILX Lightwave Corporation reserves the right to change specifications without notice or liability for such changes.

Table 5-1 DPM-79810 MODULE SPECIFICATIONS

SPECIFICATIONS - DPM-79810 DUAL POWER METER MODULE	
Wavelength range	850 to 1650nm
Power range Measurement Damage Threshold	 +30 to -40dBm >+40dBm
Accuracy Reference conditions[1] Operating conditions[2]	(NIST traceable calibration) ±2.5% ±5.0%
Polarization dependent response	±0.002dB
Measurement repeatability[3]	±0.003dB
Compatible connector types	FC, SC
Sensor type	Temperature controlled InGaAs
Noise	<150pW p-p, no filtering
Sample rate	150msec
Linearity	±0.08dB
Environment Operating temperature Storage temperature Humidity	 +10°C to +40°C -40°C to +70°C <85% RH, non-condensing

1. Temperature 23°C ±2°C, λ 1000 - 1600nm, spot diameter 1.1mm, power 100µW.
2. Within operating power and temperature ranges specified above. Add 1% for NA >0.2. Maximum NA ≤ 0.30
3. Variation in response from removing and replacing the fiber or connector into the adapter. Includes effects of variation in fiber orientation. Add ±0.003dB for NA > 0.20

DPM-79810 DUAL POWER METER MODULE

The DPM-79810 module contains two optical power meters. The top connector on the front of the module is for the first optical power meter called OPM1 and the bottom connector is for the second optical power meter called OPM2.

Initial factory settings are shown in Table 5-2. It is recommended that these initial settings are saved in the setup menu.

Table 5-2 DPM-79810 Module Initial Factory Settings

DUAL POWER METER
FILTERING = 1 (No averaging, 150msec sampling)
MODE = 1 (Absolute, meters operating independently)
REFERENCE = 0 (No reference reading stored)
UNIT = Watts
WAVELENGTH = 1550.000nm
RANGE = AUTO
USER CALIBRATION = 1.000

CONNECTING TO THE POWER METER INPUT PORT

Measurements Using a Connector

With adapters available from ILX Lightwave, the DPM-79810 can make measurements through most common fiber optic connectors.

To install an adapter, screw it onto the front panel detector mount. Take care not to contaminate the internal cavity. To remove an adapter, unscrew the four fasteners.

Once the adapter is in place, you can connect patchcords repeatedly to the meter. There is no need to remove the adapter unless you need to use a different connector type.

NOTE: Always clean the tip of the connector ferrule before a measurement, using proper tools and good technique. The core of a single-mode telecom-grade fiber is only about 9µm in diameter, so even the smallest contaminant can cause large errors if it happens to be over the fiber core.

Protecting the Cavity

The detector cavity entrance is small (~2.5 mm) so it will not tend to pick up debris. However over time dust and pollution in normal air can degrade measurement accuracy. After using the detector, protect the detector cavity by covering the entrance with the plastic shipping protector over the connector or leave the connection in place.

Cavity contamination can also happen if you are doing environmental testing where humidity causes condensation. If you suspect the cavity has been contaminated, contact ILX Lightwave Customer Service. In most cases we will be able to clean it and recalibrate it for you.

DPM-79810 DUAL POWER METER MODULE PARAMETER MENU

Both optical power meters (OPM1 and OPM2) in the module should be programmed before operation. The various measurement parameters can be set the same for both OPM1 and/or OPM2 via the SETUP BOTH menu which is accessed through the first level menus when the PARAM key is pressed with the power meter channel selected. Alternatively, the control parameters for each individual optical power meter can be set independently with the SETUP OPM1 and SETUP OPM2 channel setup menus, which are accessed with the PARAM key when the power meter channel has been previously selected.

You can move between the multiple parameter options of any setup menu by first selecting the desired optical power meter SETUP, then pushing the PARAM key to cycle through each of the individual options. The selected parameter value can be adjusted using the UP or DOWN arrow keys. The ENTER key must be pressed after entering a new value or the value will revert to the previous value. To step back up into the SETUP level menus, cycle through the parameter menus to the END SETUP and press the ENTER key.

The DPM-79810 Dual Power Meter Module menu is shown in Table 5-3. A selection is made by repeatedly pressing the PARAM key until the desired parameter is displayed.

Table 5-3 DPM-79810 Parameter Menu

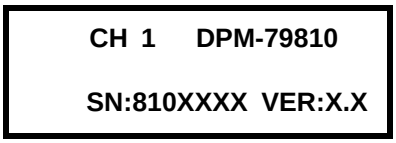
Zero Meter
OPM1
OPM2
BOTH
MODE
Absolute
Relative (1-2)
Relative (2-1)
Power1 Power2 or Relative (1-2) or Relative (2-1)
SETUP

Table 5-3 DPM-79810 Parameter Menu

- OPM1 (OPM2 or BOTH)
  - OPM1:Recall
    - 1-10
  - OPM1:Wavlngth
  - OPM1:Filtering
    - 1-50 (default = 1)
  - OPM1:Units
    - mW
    - dBm
  - OPM1:Range
    - RANGE:AUTO
      - 1Watt
      - 100mW
      - 10mW
      - 1mW
      - 100µW
      - 10µW
      - 1µW
      - 100nW
  - OPM1:User Cal
    - 0.5-2.500
  - OPM1:Reference
    - ON/OFF
  - OPM1:SaveSetup
    - 1-10
    - OPM1:End Setup
      - (PRESS ENTER)

WARNINGS

Module Identification



The first menu contains the module type, module serial number and firmware version. The parameter is not adjustable. The arrow keys and ENTER are disabled.

Request Zero Operation



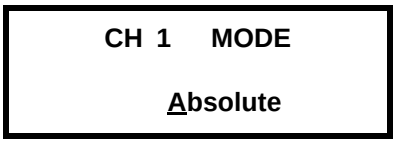
This feature applies an offset correction factor to the internal amplifiers that eliminates detectable fixed errors. These errors can be from internal effects such as detector dark current, as well as from external effects such as ambient light. The concept is similar to shorting the lead of a voltmeter and making sure the meter reads zero. To zero the DPM-79810 Select ZERO METER using the PARAM key from the SETUP menu. Make sure your fiber or connector is in place at the detector input, then press the ENTER key to zero the optical power meter.

Monitor the Zero Operation by displaying Power1 or Power2. The display will read ….+8.888Watts, +7.777Watts, +6.666Watts, etc, down to +0.000Watts, at which time the updated power measurement will be displayed. The procedure takes approximately 10 seconds.

Best results are obtained by minimizing external influences, because they are rarely stable. For this reason, the DPM-79810 limits the amount of acceptable zero offset. Error display “ZERO ERROR” in the WARNINGS display, indicates there is too much ambient light for a reliable zero.

NOTE: A “ZERO ERROR” will be displayed when the zero operation is attempted when there is too much ambient light for a reliable zero.

Mode of Operation



The mode of operation determines how the power is displayed. Select MODE using the PARAM key. Use the UP or DOWN arrow key to select an absolute or differential measurement. The available selections are ABSOLUTE, RELATIVE: 1 - 2 and RELATIVE: 2 - 1. Press the ENTER key to accept the selection.

ABSOLUTE
each power meter operates independently displaying their respective power measurement

RELATIVE: 1 - 2
the two power meters operate together displaying the difference in power OPM1 - OPM2

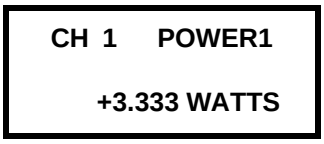
RELATIVE: 2 - 1
the two power meters operate together displaying the difference in power OPM2 - OPM1

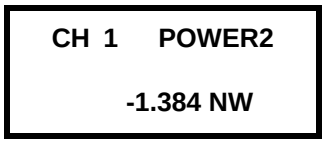
Display Power

Press the PARAM key from the MAIN level menu to display power readings. Press the ENTER key to toggle between Power1 and Power2 displays.

This display is dependent on the current mode of operation. When the mode of operation is ABSOLUTE two displays will be available, one displaying the absolute power reading from the first optical power meter and the second displaying the absolute power reading from the second optical power meter.

This menu is intended for informational purposes and contains no changeable fields.

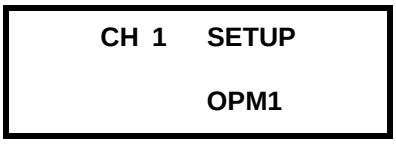








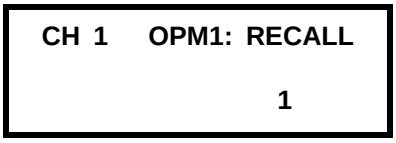
OPERATING PARAMETERS SETUP



Use this menu to modify operating parameters for the optical power meters individually or simultaneously. Select SETUP using the PARAM key from the MAIN level menu structure. Press the ENTER key to modify the displayed optical power meter's setup parameters.

NOTE: Both the first optical power meter (OPM1) and the second optical power meter(OPM2) will be set to the same operating parameters when using the SETUP BOTH menu.

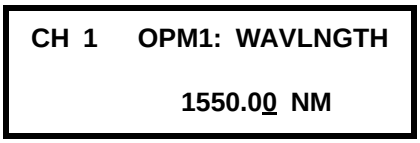
Recall Stored Setup Parameters



Use this parameter to recall previously configured setup parameters from a bin location. Select Recall using the PARAM key from the SETUP menu. Use the UP or DOWN arrow key or the numeric keypad to enter the recall bin number. Press the ENTER key to recall the stored settings.

NOTE: “EMPTY BIN” will be displayed if the user attempts to recall a bin number that does not contain previously stored setup parameters.

Source Wavelength



NOTE: Source wavelength must be entered in order for the DPM-79810 to display the correct optical power.

Select Wavlngth using the PARAM key from the SETUP menu. Use the UP or DOWN arrow key or the numeric keypad to enter the source wavelength. Press the ENTER key. The range of available wavelength settings is 850nm to 1650nm, with a default value of 1550.00nm. If the source wavelength is out of range the power reading will not be accurate.

Filtering Value (Averaging Rate)



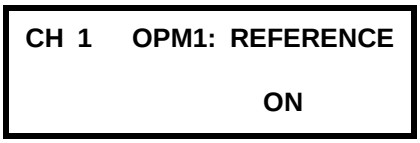
The filter setting refers to the number of digital samples that are averaged before a measurement is reported. This has the advantage of integrating out the affects of noisy signals. Select Filtering using the PARAM key from the SETUP menu. Use the UP or DOWN arrow key to enter the filtering value. Press the ENTER key. The range of available filter settings is 1 to 50 samples (with 1 offering a measurement every 150msec and 50 offering a measurement every 7.5 seconds).

Measurement Units



The optical power meter can display the measurements in either a linear scale (Watts) or a Logarithmic scale (dBm). When viewing relative measurements, either OPM1-OPM2 or OPM2-OPM1, the setting for OPM1 will establish the units displayed. Select Units using the PARAM key from the SETUP menu. Use the UP or DOWN arrow key to cycle between the two available choices. Press the ENTER key. The available selection for measurement units is either Linear (Watts) or Logarithmic (dBm).

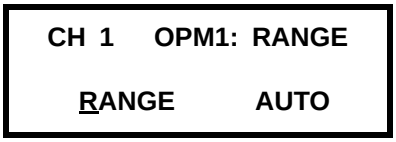
Reference Power Reading



An additional feature of this module is the ability to store a reference power measurement for each of the two individual optical power meters. When a reference reading is stored the displayed power value will be the difference between the reference power reading and the current power reading. When displaying the power reading the reference power will be contained in parenthesis. The lack of a displayed reference reading indicates the measurement is in absolute non-referenced mode.

Select Reference using the PARAM key from the SETUP menu. Use the UP or DOWN arrow key to cycle between ON and OFF. When ON is selected the power reading when the ENTER key is pressed becomes the new reference power. To disable the reference power select OFF and press the ENTER key. Reference value is stored when power is turned off.

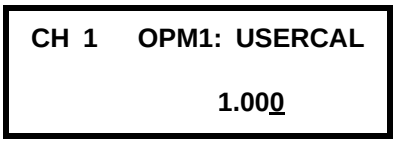
Range Setting



The optical power meter provides eight individual settings to cover the full optical power measurement range. Select Range using the PARAM key from the SETUP menu. Use the UP or DOWN arrow key to select the range setting. Press the ENTER key. The available range settings are AUTO, 1W, 100mW, 10mW, 1mW, 100mW, 10mW, 1mW and 100nW. When AUTO is selected the optical power meter automatically changes to the appropriate range setting based on the measured power. The user can force the meter to a fixed range maximum range by entering one of the eight available power ranges.

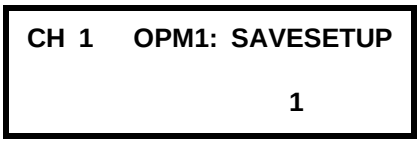
Within each range, accuracy is ± 5.0%.

User Calibration



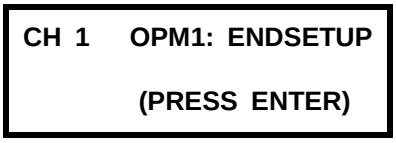
The user calibration sets a multiplication factor that is applied to the measurements. Select UserCal using the PARAM key from the SETUP menu. Use the UP or DOWN arrow key to select the user calibration factor. Press the ENTER key. The available range for the user calibration is 0.500 to 2.500. The most common application of user calibration is to calibrate the optical power meter to read correctly with an external attenuator. For example, if you attach a calibrated 3dB attenuator, only 50% of the input signal gets to the meter. In this situation, set the user calibration factor to 2.000 and the meter will then display correctly. Remember to consider the accuracy of the attenuator as well as the meter in attenuated measurements.

Save Setup Parameters



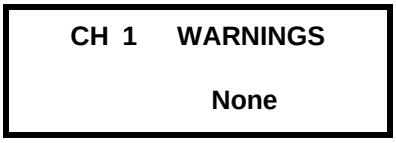
This feature allows the user to save the current setup parameters in a specified bin location. Select SaveSetup using the PARAM key from the SETUP menu. Use the UP or DOWN arrow key or the numeric keypad to enter the bin number in which the current parameters are to be stored. Press the ENTER key.

Request End Setup



This returns the user to main level menu structure for the optical power meter. Select EndSetup using the PARAM key from the SETUP menu. Then press the ENTER key to return to the main level menu structure.

WARNINGS



Displays warning messages.

OPERATING IN REMOTE CONTROL

Everything you can do from the front panel can also be done remotely. The following sections show you the fundamentals of operating your DPM-79810 Dual Power Meter module remotely through the GPIB or RS-232 interfaces.

Remote Configuration

Refer to CHAPTER 7 RS–232 Interface and CHAPTER 8 GPIB Remote Operation and Common Commands for information concerning setup of RS-232 or GPIB remote communications.

Terminology

Terminology required to successfully communicate with the DPM-79810 using GPIB is described in CHAPTER 8 GPIB Remote Operation and Common Commands. The terms frequently used in this chapter are repeated below.

<white space> refers to ASCII characters (such as Space Bar) which are used as separators in the command syntax.

<nrf value> refers to the IEEE-488.2 standard for numeric format notation. It is a generic label that means either integer, floating point or scientific notation number representation.

COMMAND REFERENCE

Table 5-4 lists the commands for the DPM-79810 module. It uses the nomenclature “OPMn” in places to indicate that a command can be sent either to the OPM1 optical power meter or to the OPM2 optical power meter. To send a command to the first optical power meter, replace “OPMn” with “OPM1”; “OPM2” will cause a command to go to the second optical power meter. Refer to CHAPTER 9 Command Reference for details on the use of the commands.

Table 5-4 DPM-79810 Module Commands

NAME	PARAMETERS	FUNCTION
MODE	1	Sets the display mode to 1 = absolute, 2 = relative OPM1 - OPM2, 3 = relative OPM2 - OPM1.
MODE?	NONE	Returns the current mode of operation; 1 = absolute, 2 = relative OPM1 - OPM2, 3 = relative OPM2 - OPM2.
OPMn:CALibration BOTH:CALibration	1	Sets the user calibration constant; valid values are 0.500 to 2.000.
OPMn:CALibration? BOTH:CALibration?	NONE	Returns the user calibration constant, 1.000 is the default.
OPMn:FILTer BOTH:FILTer	1	Sets the number of samples that are averaged to generate a measurement; valid range is 1 to 50.
OPMn:FILTer? BOTH:FILTer?	NONE	Returns the current number of samples that are being averaged to generate a measurement; 1 is the default.
OPMn:POWer?	NONE	Returns the current power measurement for optical power meter.

Table 5-4 DPM-79810 Module Commands

NAME	PARAMETERS	FUNCTION
OPMn:RANGE BOTH:RANGE	1	Sets the range value for the optical power measurement; valid range is 0 - 8. Where 0=Auto Range, 1=1W, 2=100mW, 3= 10mW, 4=1mW, 5=100µW, 6=10 µW, 7=1µW, 8=100nW
OPMn:RANGE? BOTH:RANGE?	NONE	Returns the current setting for the range value; 0 is the default.
OPMn:REFerence BOTH:REFerence	1	Sets the current power measurement as a reference value. The remaining measurements when a reference is recorded become the difference in power. The valid parameter for this command is ON or OFF.
OPMn:REFerence? BOTH:REFerence?	NONE	Returns the reference power measurement; 0.0 is the default value and indicates no stored reference is being used.
OPMn:RELative?	NONE	Returns the relative power difference between OPMn and the other optical power meter.
OPMn:UNITS:DBM BOTH:UNITS:DBM	1	Sets the optical power meter to display and respond in dBm units or Watts.
OPMn:UNITS:DBM? BOTH:UNITS:DBM?	NONE	Returns the current unit setting for the optical power meter.
OPMn:WAVElength BOTH:WAVElength	1	Sets the input wavelength that the optical power meter is reading.

Table 5-4 DPM-79810 Module Commands

NAME	PARAMETERS	FUNCTION
OPMn:WAVElength? BOTH:WAVElength?	NONE	Returns the current wavelength setting for the optical power meter.
OPMn:ZERO BOTH:ZERO	NONE	Zeros the optical detector and electronics for the optical power meter.
OPMn:ZERO? BOTH:ZERO?	NONE	Returns the status of the zeroing operation on the optical power meter.
OPMn:SAVE	1	Saves the current meter settings for both OPM1 and OPM2 to a storage bin indicated by the parameter. The valid parameter range for this command is 1 - 10.
OPMn:RECALL	1	Restores the saved bin contents from the storage bin indicated by the parameter. The valid parameter range for this command is 1 - 10.

CHAPTER 6 FOS-79710 MODULE

Refer to CHAPTER 2 System Overview for installation instructions.

CAUTION: Do not insert or remove any module while the FOM-7900B is powered up. This could damage the module and/or mainframe. Be sure the module is properly installed before applying power to the FOM-7900B.



CAUTION: The Fiber Optic Source Module is a static sensitive device. Installing or removing any module from the FOM-7900B System should take place at an ESD protected workbench. The operator should be properly earth grounded.



The FOS-79710 Fiber Optic Switch Module must be used with the FOM-7900B Mainframe. It is designed to connect a single fiber optic signal to one of four possible channels. The modules are optically transparent to signal formats and bandwidths as well as being bi-directional in operation. Random, sequential or triggered switching modes enhance switch module functionality.

The optical and mechanical performance specifications for the FOS-79710 Fiber Optic Switch Module are shown in Table 6-1.

Table 6-1 FOS-79710 Performance Specification

PARAMETER	SPECIFICATION
Fiber Type	9/125 SMF 28
Wavelength Range	1280 - 1650 nm
Connector Type	FC/APC
Insertion Loss[1]	1.2 dB typical, 1.7 dB maximum[2]
Crosstalk	< -80 dB
Polarization Dependent Loss[3]	< 0.05 dB
Repeatability[4]	< + 0.03 dB
Switching Time[5]	16 ms/channel + 300 ms (maximum)
Maximum CW Input Power	+24 dBm
Return Loss	> 55 dB
Switch Life	10 million cycles minimum
Operating Temperature	+15 °C to +35 °C
Operating Humidity	< 85% relative
Storage Temperature	-20 °C to +70 °C
Dimensions (H, W, D)	12.8 x 3.5 x 29.0 cm (5 x 1.4 x 11.4 in)
Module Weight	0.8 kg (1.8 lb)

1. Measured at 23°C ± 5°C.
2. Maximum insertion loss, any module output port.
3. Measured at 1550 nm.
4. Sequential switching, 100 cycles measured at constant temperature after module warm-up.
5. Excluding GPIB and mainframe processor latency.

When enabled, the FOS-79710 Fiber Optic Switch Module responds to an external trigger signal on the rear panel of the FOM-7900B Mainframe.

FOS-79710 PARAMETERS

For FOM-7900B system commands refer to Mainframe Parameter Menu, on page 3-4.

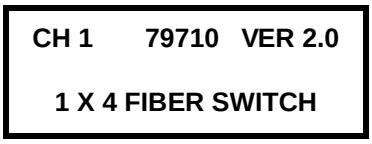
The FOS-79710 1 x 4 Fiber Optic Switch Module menu is shown in Table 6-2. A selection is made by repeatedly pressing the PARAM key until the desired parameter is displayed.

Table 6-2 FOS-79710 1 x 4 Switch Parameter Menu

79710 Ver 2.0
Output Port
Triggered Mode[1]
Trigger Enable
Sequence 1 → 4
Step #1 Port
Step #2 Port
Step #3 Port
Step #4 Port
User Mode[2]
Timed Mode[1]
Timer Enable
Time Interval
Sequence 1 → 4
Step #1 Port
Step #2 Port
Step #3 Port
Step #4 Port
User Mode[2]
ERROR[3]

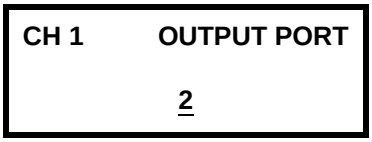
1. Pressing ENTER at this parameter passes control to the secondary menu.
2. Pressing ENTER at this parameter passes control back to the primary menu.
3. Error messages are displayed only when an error condition exists in the module.

Module Identification



This parameter displays the model number, firmware version number and a description of the module. The parameter is not adjustable. The arrow keys and ENTER key are disabled.

Select Switch Port



This menu is used to determine which port (1-4 or None) is switched to the common port (top connector). The number displayed on the bottom line indicates the current port. Use the UP and DOWN arrow keys to select a new port, then press the ENTER key to activate the change. Selecting “None” places the switch into the optically off (blocked) position. For laser safety reasons, the FOS-79710 Switch Module always powers up in the “None” position.

In Trigger or Timer modes, the port number shown reflects the last manually selected port. This menu can be used to override the current output port in these modes. However, this action may have unintended consequences for your particular application and we suggest you avoid overriding the Trigger or Timer modes.

Select External Trigger



Press the ENTER key to proceed to the secondary menu structure specific to the control of the external triggering features of the Switch Module.

Enable External Trigger

CH 1 TRIGGER ENABLE
ENABLE

Use this parameter to enable or disable the effects of the external trigger signal from the FOM-7900B rear panel. Use the UP or DOWN arrow keys to ENABLE or DISABLE the external trigger, then press ENTER to activate the change. For laser safety reasons, the FOS-79710 Switch Module always powers up with Trigger mode disabled.

When the external trigger is enabled, the module will automatically move the switch position to the next port in the sequence whenever a trigger signal is received at the FOM-7900B rear panel (or when the TRIG command is sent through GPIB). The Trigger and Timer Modes are mutually exclusive; if the Trigger Mode is ENABLEd, the Timer Mode will be DISABLEd.

Initialize Trigger Switch Sequence

CH 1 SEQUENCE 1 → 4
(PRESS ENTER)

Press the ENTER key to initialize the four-element trigger switch sequence to the following default sequence:

1 → 2 → 3 → 4 ↵

Customize Trigger Switch Sequence

CH 1 STEP #1 PORT
4

Use this and the next three menu items to customize the switch sequence for the external trigger mode. Use the UP or DOWN arrow keys to select the next port in the sequence and press ENTER to activate the change. Pressing ENTER does not change the current switch position but merely places the new port position into the chosen element of the sequence array. It is possible to select “None” to skip a switch position, or to shorten the executed sequence by repeating a port position.
For instance, to switch repeatedly between ports 1 and 3, choose the sequence **1 → 3 → 1 → 3 ↵**.

Return to Main Menu

CH 1	USER MODE
(PRESS ENTER)	

Press the ENTER key to return to the main menu structure.

Select Timed Mode

CH 1	TIMED MODE
(PRESS ENTER)	

Press the ENTER key to proceed to the menu for controlling the Timed Mode interval switching feature.

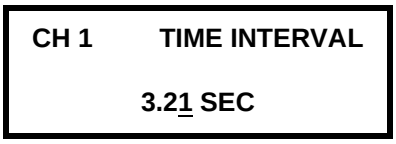
Enable Interval Timer

CH 1	TIMER ENABLE
ENABLE	

Use this parameter to enable or disable the automatic switching of the built-in timer. Use the UP or DOWN arrow keys to ENABLE or DISABLE the timer, then press ENTER to activate the change. For laser safety reasons, the FOS-79710 Switch Module always powers up with Timer mode disabled.

When the timer is enabled, the module will automatically move the switch position to the next port in the sequence at the rate determined by the timer interval. The Timer mode is convenient for conducting long-term tests in situations where remote control of the switch by a host computer is not possible. Note that the Timer and Trigger modes are mutually exclusive; if the Timer mode is ENABLEd, the Trigger mode will be DISABLEd.

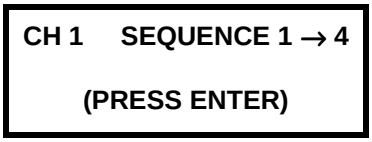
Set Interval Time



This parameter sets the internal timer interval in seconds. Use the LEFT and RIGHT arrow keys to move the cursor and the UP and DOWN arrow keys to adjust the interval time. Then press the ENTER key to activate the change.

The timer interval is can be set from 1.00 to 60.00 seconds. The resolution of the internal timer itself is 10 ms; however it should be kept in mind that the absolute resolution of the switch is 16 ms.

Initialize Timer Switch Sequence



Press the ENTER key to initialize the four-element timer switch sequence default: **1 → 2 → 3 → 4 ↵**

Customize Timer Switch Sequence



Use this and the next three menu items to customize the switch sequence for the Timer mode. Use the UP or DOWN arrow keys to select the next port in the sequence and press ENTER to activate the change. Pressing ENTER here does not change the actual switch position but merely places the new port position into the chosen element of the sequence array. It is possible to select “None” to skip a switch position, or to shorten the executed sequence by repeating a port position.
For instance, to switch repeatedly between ports 2 and 4, choose the sequence **2 → 4 → 2 → 4 ↵**.

Return to Main Menu

CH 1	USER MODE
(PRESS ENTER)	

Press the ENTER key to return to the main menu structure.

Error Display

CH 1	**ERROR**
504	INVALID SWITCH

This parameter is displayed only when an error condition has been detected within the module. The parameter cannot be modified and the arrow keys and ENTER key are disabled. Error messages are defined in CHAPTER 12.

EXTERNAL TRIGGER SPECIFICATIONS

When Trigger mode is enabled, the FOS-79710 Fiber Optic Switch Module responds to an external trigger signal on the rear panel of the FOM-7900B Mainframe. The same effect may be accomplished by sending the TRIG command using GPIB or RS-232 communication protocol. The TRIG command is particularly useful for switching several FOS-79710's simultaneously. The electrical specifications of the external trigger interface are shown in Table 6-3.

Table 6-3 External Trigger Specifications

External Trigger Parameter	Specification
Level	TTL, Normally high (+5 volts)
Edge	Active Low (triggers on high to low transition)
Pulse Width	100 ns minimum
Latency	500 ms absolute maximum (time between trigger edge & complete stability of optical signal)
Switching Frequency	2.0 Hz maximum (triggers above this rate will produce maximum switching frequency).

For every trigger pulse or TRIG command sent to the FOM-7900B, the switch will move to the next port in the switch sequence array. Trigger pulses occurring at a frequency higher than the maximum will produce the maximum switch rate.

Table 6-4 FOS-79710 1 x 4 Switch Module Commands

NAME	PARAMETER	DESCRIPTION
ERR?	NONE	Returns an error code (See CHAPTER 12).
IDN?	NONE	Returns a string that identifies the module.
INTERVAL	##.##	Sets the timer interval in seconds.
INTERVAL?	NONE	Returns the timer interval, in seconds.
PORT	#	Sets the port that is switched to the common port.
PORT?	NONE	Returns the currently-selected switch port.
SEQ:DEFAULT	NONE	Initializes the Trigger/Timer switch sequence.
SEQ:SWn	#	Sets the nth position in the switch sequence array.
SEQ:SWn?	NONE	Returns the nth position from the sequence array.
SEQ:TMR	ON/OFF	Enables or Disables the Interval Timer (1 or 0).
SEQ:TMR?	NONE	Returns the state of the Timer Mode (1 or 0).
SEQ:TRG	ON/OFF	Enables or Disables the External Trigger (1 or 0).
SEQ:TRG?	NONE	Returns the state of the Trigger Mode (1 or 0).

CHAPTER 7 RS–232 INTERFACE

RS-232 COMMUNICATIONS PROTOCOL

To establish serial communications between a computer serial port and the FOM-7900B System, a serial cable is connected between an available COM port on the host computer and the RS-232 connector on the rear panel of the FOM-7900B. This cable must be wired *straight through* and have a male connector on the FOM-7900B side. The serial port on the computer is initialized to the parameters described in Table 7-1.

Table 7-1 RS–232 Parameter Values

PARAMETER	VALUE
Baud Rate	9600
Stop Bits	1
Parity	None
Data Bits	8
Flow Control	None

LINKING MULTIPLE FOM-7900B SYSTEMS

It is possible to link up to twenty-five FOM-7900B Systems to control up to 200 channels from one GPIB address or one RS-232 connection to a host computer.

If several FOM-7900B mainframes are being controlled from one GPIB address, a GPIB cable is connected to the first FOM-7900B and the GPIB address is set for that unit. Serial cables are used between subsequent FOM-7900B mainframes. The cable between the first and second mainframes must have male connectors (pins) on both ends and must have one twist between pins 2 and 3. Refer to Table 7-2. This cable is connected between the RS-232 A connectors on both units.

Additional FOM-7900B mainframes are linked using a cable that has a female connector on one end and a male connector on the other end. This cable should have ***no*** twists between pins 2 and 3 (in other words, it must be wired *straight through*). The female end of this cable is inserted into the RS-232 B connector of the upstream FOM-7900B and the male end into the RS-232 A connector of the downstream FOM-7900B. Refer to Table 7-2 for more details.

Table 7-2 RS–232 Connector wiring between the first two mainframes in a series

WIRING DIAGRAM	
Connector 1	Connector 2
1	1
2	***3***
3	***2***
4	4
5	5
6	6
7	7
8	8
9	9

NOTE: A unique Bank Address must be assigned to each FOM-7900B in the chain. ***The unit connected to the GPIB interface must be assigned a bank address of 0.***

FIGURE 7-1 shows the addressing scheme for all FOM-7900B modules.

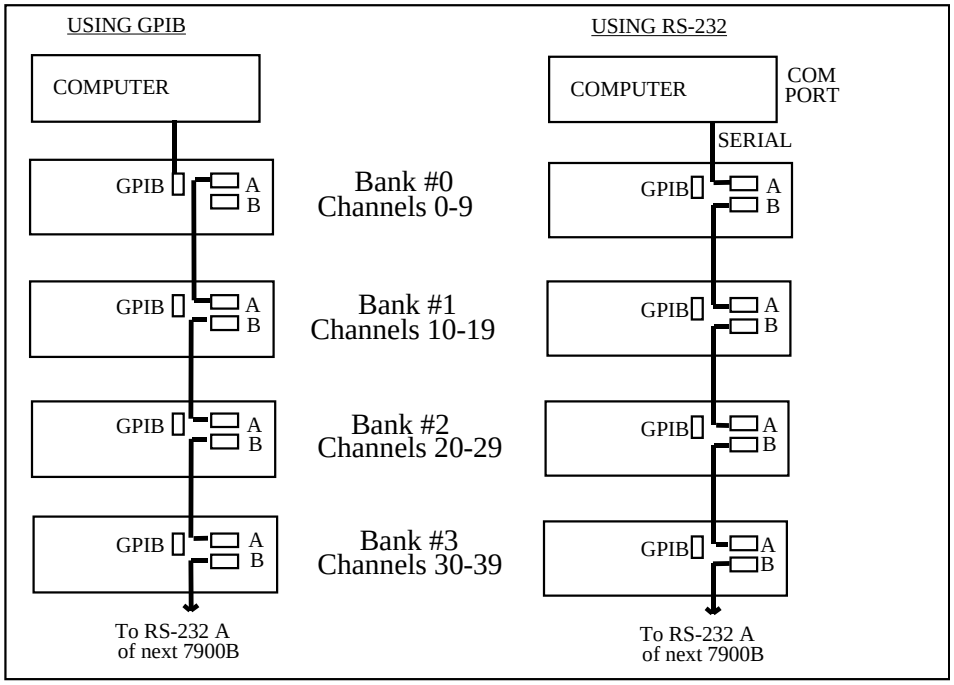


FIGURE 7-1 FOM-7900B Stacked System

COMMUNICATION WITH MULTIPLE FOM-7900B SYSTEMS

The following issues are important when communicating with a stacked FOM-7900B System.

All of the GPIB common commands listed in CHAPTER 8 and device specific commands listed in CHAPTER 9 respond normally with multiple FOM-7900B systems.

All GPIB commands and queries, including 488.2 common commands and queries, are sent to the FOM-7900B mainframe (or module) selected by the CHAN command. This includes the reset command *RST. Use the following formula to determine the channel number of a module in a multiple FOM-7900B system.

CHAN # = (Bank Address x 10) + Slot number

NOTE: A unique Bank Address must be assigned to each FOM-7900B in the chain. ***The unit connected to the GPIB interface must be assigned a bank address of 0.***

FIGURE 7-1 shows the addressing scheme for all FOM-7900B modules.

EXAMPLE: The fourth channel in the second mainframe would be CHAN 14.

The sixth channel in the eleventh mainframe would be CHAN 106.

All CHAN x0 commands (e.g. CHAN 0, 10, 20, ... 240) are directed to the appropriate mainframe. This is important for commands such as MOD ON/OFF, and FREQ.

CHAN x9 commands (e.g. CHAN 9, 19, 29, ... 249) are module specific and will apply to all modules in the mainframe. If CHAN x9 is selected then subsequent commands are forwarded to all the modules in the selected mainframe. The command sequence CHAN 49; LEVEL -3.00 is useful to set the power level for all eight sources in the fifth mainframe to -3.00 dBm

The following rules must be followed when sending commands and queries to a “stacked” FOM-7900B System (these rules apply to a system connected to the host computer with either a GPIB cable or an RS232 cable).

The CHANNEL command should always be sent as the only command on the command line, and it must be followed by an *OPC? (operation complete) query. No other command or query should appear on the command line.

EXAMPLE: Incorrect command line:

CHANNEL 25 ; LEVEL 5.0 ; WAVE 1550.0 ;*OPC?

Correct command lines:

CHANNEL 25 ; *OPC?

LEVEL 5.0; WAVE 1550.0;*OPC?

Any command line sent should be terminated by an *OPC? query if it does not already contain a query.

EXAMPLE: Incorrect command lines:

MOD ON

LEVEL 5.00

Correct command lines:

MOD ON; *OPC?

LEVEL 5.00; *OPC?

LEVEL 5.00; LEVEL ?

Commands and/or queries to different banks must not be mixed on the same command line.

EXAMPLE: Incorrect command lines:

CHAN 12; LEVEL 5; CHAN 13; LEVEL 5;WAVE 1550.0

CHAN 22; LEVEL?;WAVE ?; CHAN 23; LEVEL?;WAVE?

There are three errors above:

1. Mixing commands to multiple channels on the same command line
2. Sending a message that does not contain a query (the first line)
3. Not using the correct method of selecting a channel

Correct command lines:

CHAN 12; OPC ?

LEVEL 5;OPC?

CHAN 13;*OPC?

LEVEL 5;WAVE 1550.0;*OPC?

CHAN 22;*OPC?

LEVEL?;WAVE?

CHAN 23;*OPC?

LEVEL?;WAVE?

If a non-existent bank is addressed and sent a query, the response “Bank not found: n” will be returned in approximately 10 seconds, where n is the bank number (channel number divided by 10). This time-out period can be changed with the TIMEOUT command described in CHAPTER 9.

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CHAPTER 8 GPIB REMOTE OPERATION AND COMMON COMMANDS

A GPIB/IEEE-488.2 interface is installed in the FOM-7900B System to allow fast and efficient remote operation. This interface complies with the IEEE-488.2/1987 standard to the extent shown below.

Table 8-1 GPIB Capability

IEEE-488 INTERFACE SPECIFICATIONS	
SH1	Source Handshake - complete compatibility
AH1	Acceptor Handshake - complete capability
T6	Talker Functions
L4	Listener Functions
SR1	Service Request - complete capability
RL1	Remote Local Function - complete capability
PP0	Remote Configuration Parallel Poll - no capability
DC0	Device Clear - no capability
DT1	Device Trigger - complete capability
C0	Controller Function - no capability
E1, E2	Three-state bus drivers with automatic switch to open collector during Parallel Poll

Other GPIB features include:

- A concise and straightforward command set
- Full serial poll capability, with SRQ
- Full local/remote capability including LOCAL LOCKOUT

This chapter is divided into three parts. The first part contains information for getting started using GPIB. It also contains the syntax for each 488.2 common command which is supported by the FOM-7900B. The second part contains information on status reporting. The third part contains information on remote interface messages which are generally transparent to the user.

7900 AND GPIB CONTROLLER SYNCHRONIZATION

To ensure that the 7900 instrument is synchronized with the computer while under GPIB control, follow each command with a query. It is imperative that the response to the query is read by the computer. This effectively forces the computer to wait for the response to the query before transmitting the next command. Since every 7900 command is sequential, the instrument will not return a query response until the preceding command has been completed.

PREPARATION FOR GPIB CONTROL

To use the FOM-7900B remotely, an IEEE-488 interface adapter is required in the host computer. These adapters and support software are available from several manufacturers and can be installed in most computers.

LOCAL Control

When the instrument is in REMOTE all front panel controls are disabled except the LOCAL key and the display indicates >>REMOTE<<. Press the LOCAL key to return the device to LOCAL control, re-enabling the front panel.

When the unit is in LOCAL mode, pressing the LOCAL key causes the GPIB address to be shown on the display for three seconds, e.g. -01-.

REMOTE Control

Whenever the instrument is addressed by a system controller the display indicates >>REMOTE<< and the front panel is disabled from manual control. Press the LOCAL key to return to manual control.

GPIB Address

The talk and listen addresses on the FOM-7900B are identical. When the unit is in LOCAL mode, pressing the LOCAL key causes the GPIB address to be displayed. Extended GPIB addressing is not implemented in the FOM-7900B. Use the following procedure to change the GPIB address.

1. Press the CHAN UP or CHAN DOWN key until **Ch All** is displayed.

2. Press PARAM repeatedly until **Setup Mode** is displayed. Press the ENTER key.

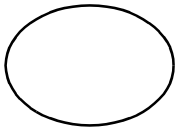
3. Press PARAM repeatedly until **GPIB Address** is displayed. Use the UP and DOWN arrow keys to select the desired GPIB address then press the ENTER key. The allowable range is 1 through 31.

ANSI/IEEE-488.2 DEFINITIONS

The following sections contain the relevant definitions for syntax diagrams and syntax elements for the GPIB commands, as defined by the IEEE-488.2 standard.

Syntax Diagrams

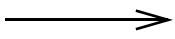
Syntax diagrams indicate the most complete form of GPIB command construction. The terminology shown here and in subsequent sections is used throughout this manual to define the command syntax. These syntax diagrams conform to the ANSI/IEEE-488.2-1987 standard and the terminology presented here reflects that standard.



The oval (or round) shape contains a terminal syntactic element. These represent a basic function such as a single ASCII character, which cannot be divided.



Rectangles contain non-terminal syntactic elements. These represent elements which are expandable to a diagram of terminal syntactic elements. However, they are presented as a unit for clarity or emphasis.



Lines and arrows indicate correct paths through the syntax diagram. A reverse line around an element indicates that the element may be repeated indefinitely. A forward arrow around an element indicates that the element is optional.

<white space>

White space is defined by the syntactic diagram shown in FIGURE 8-1, where <white space character> is defined as a single ASCII-encoded byte in the range 00-09, 0B-20 (0-9, 11-32 decimal). This range includes the ASCII control characters, carriage return, and the space, but excludes the new line character.

In most practical programming situations, the space character (space bar) would be used as white space. White space is generally used to separate syntactic elements and is processed without interpretation.

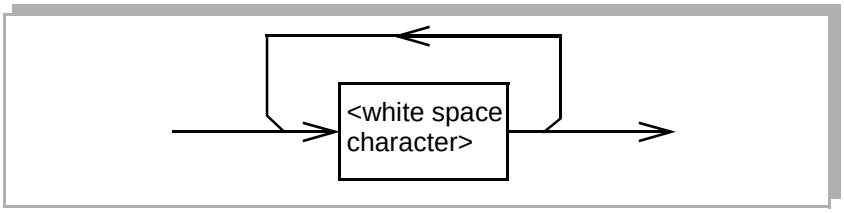


FIGURE 8-1 White Space Syntactic Diagram

<nrf value>

The symbol, <nrf value>, refers to the flexible numeric representation, as defined by the IEEE-488.2 standard. This means that numbers may be represented in one of three forms, integer, floating point, or engineering/ scientific notation. All of the following are equal nrf values:

20, +20, 20.0, +20.0, 2.0E+1, +2.0E+1, 2.0e+1, +2.0e+1

<suffix unit>

The symbol, <suffix unit>, refers to the suffix program data that may follow an <nrf value>. If the suffix is not used, a default suffix is assumed. The device interprets any alpha characters following decimal data as a suffix without regard to upper/lower case. Suffixes are not utilized in the FOM-7900B System.

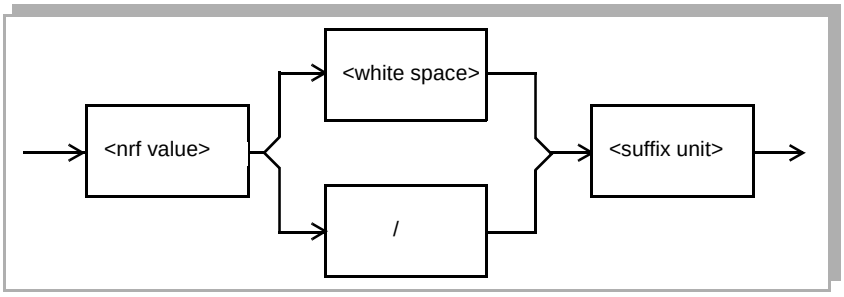


FIGURE 8-2 Suffix Syntactic Diagram

<PROGRAM MESSAGE TERMINATOR>

When a command is sent using the standard format, the host computer (or GPIB driver) usually puts a <NL><^END> (line feed-EOI) on the data bus following the command string. The IEEE-488.2 standard requires <NL><^END>, however, many GPIB drivers utilize <CR><NL><^END> or <NL>. The FOM-7900B accepts <LF><^END>, <CR><NL><^END>, <NL> or <^END> as an acceptable <PROGRAM MESSAGE TERMINATOR. The FOM-7900B always terminates its query responses with <CR><NL><^END> unless changed by the **TERM** command.

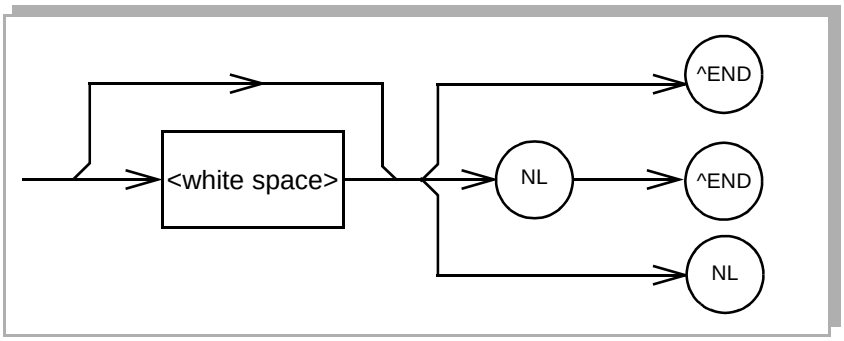


FIGURE 8-3 <PROGRAM MESSAGE TERMINATOR>

<PROGRAM MESSAGE UNIT SEPARATOR>

A <PROGRAM MESSAGE UNIT SEPARATOR> is used to separate sequential <PROGRAM MESSAGE UNIT> elements (commands) from one another within a <PROGRAM MESSAGE>. The syntax for a <PROGRAM MESSAGE UNIT SEPARATOR> is shown in FIGURE 8-4.

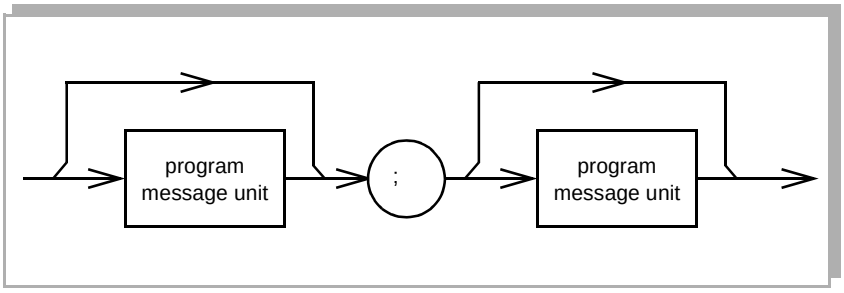


FIGURE 8-4 <PROGRAM MESSAGE UNIT SEPARATOR>

<PROGRAM HEADER SEPARATOR>

The <PROGRAM HEADER SEPARATOR> separates the <COMMAND PROGRAM HEADER> (GPIB command) from the <PROGRAM DATA> (first parameter after the command). A single white space must be used to separate the command from the first parameter.

<compound command program header>

Some of the FOM-7900B remote commands require a compound structure. This is done to distinguish between different commands of the same type. The compound command structure is similar to a directory path structure, as found in DOS. For example, commands which deal with FOM-7900B calibration have the path **CAL:**, as in the command to calibrate the display to a known output power:

CAL:LEVEL 0.5

A <compound command program header> is a compound command heading which may be followed by <program data> (parameters). A compound command or <compound command program header> is similar to a path for a file that starts with the root directory and lists the intermediate subdirectories. The syntax for a <compound command program header> is shown in FIGURE 8-5. The syntax diagram for a <compound query program header> is shown in FIGURE 8-6.

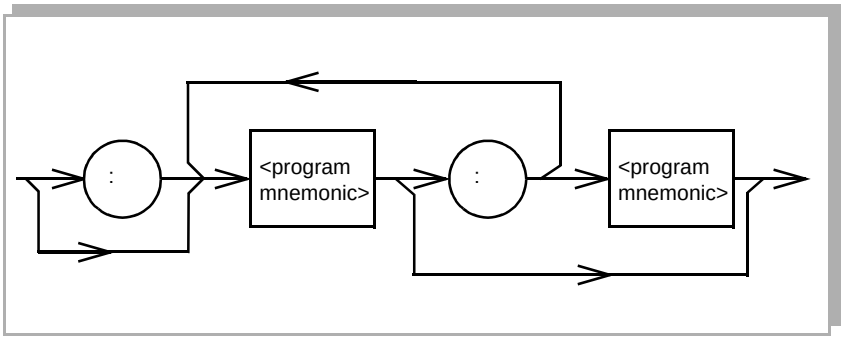


FIGURE 8-5 <compound command program header>

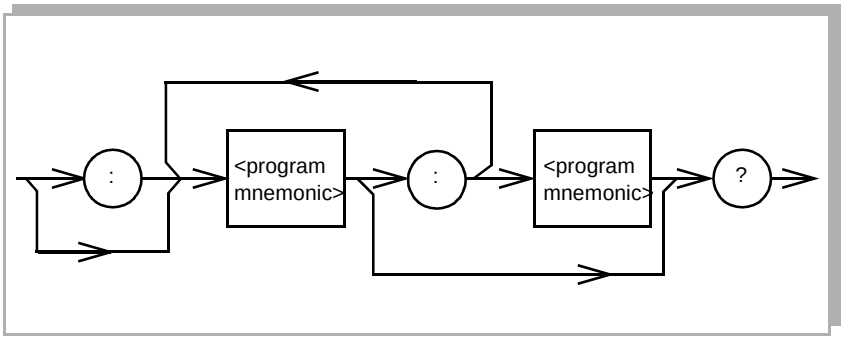


FIGURE 8-6 <compound query program header>

A <program mnemonic> is a command or command path identifier. For example, the <PROGRAM MESSAGE> “ENABLE:COND 256" consists of the command “COND” and the path identifier “ENABLE:.” All of the legal <compound command program headers> may be traced by starting from the root node of the command structure and moving down by levels to paths, and finally to the command.

A <PROGRAM MESSAGE TERMINATOR> causes the next command search to begin at the root node. A leading colon (:) on a <PROGRAM MESSAGE UNIT> causes the instrument to begin searching for the command at the root node. Otherwise (after a semicolon), the instrument first searches the most recently used node for the command. It continues to search the command tree until it finds a legal command path, by searching each previously used node up to the root. If no legal path is found, the instrument generates an error message.

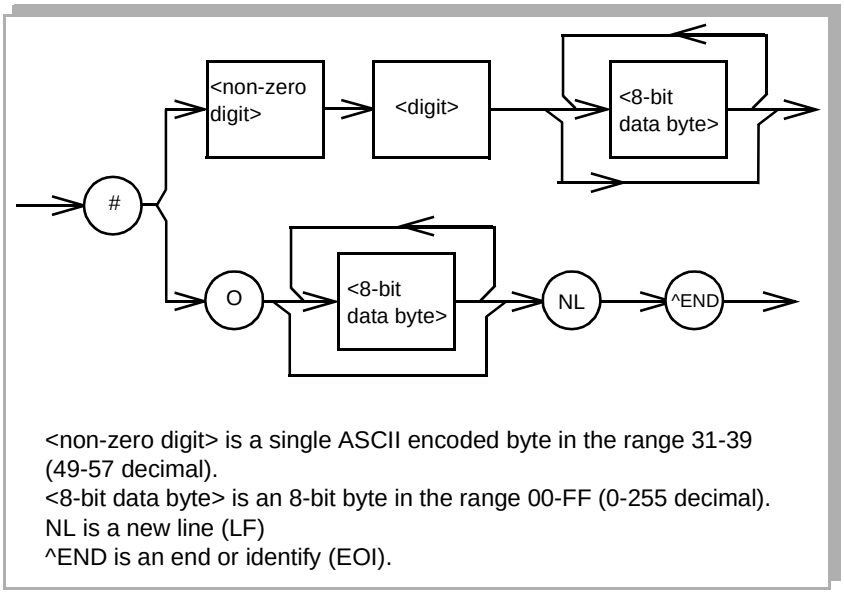
<PROGRAM DATA> (Parameters)

<PROGRAM DATA> (parameters) may be entered after a command in a <PROGRAM MESSAGE UNIT>. The <COMMAND PROGRAM HEADER> (command) and first <PROGRAM DATA UNIT> (parameter) must be separated by a <PROGRAM HEADER SEPARATOR> (white space).

<ARBITRARY BLOCK PROGRAM DATA>

This element allows any 8-bit bytes (including extended ASCII) to be transmitted in a message. The syntax for an <ARBITRARY BLOCK PROGRAM DATA> element is shown in FIGURE 8-7.

The only FOM-7900B command that requires arbitrary block program data is the *PUD command.



<non-zero digit> is a single ASCII encoded byte in the range 31-39 (49-57 decimal).
<8-bit data byte> is an 8-bit byte in the range 00-FF (0-255 decimal).
NL is a new line (LF)
^END is an end or identify (EOI).

FIGURE 8-7 <ARBITRARY BLOCK PROGRAM DATA>

<PROGRAM DATA SEPARATORS>

When there is a list of <PROGRAM DATA UNITS> (parameters) following a <PROGRAM HEADER SEPARATOR> (white space), the <PROGRAM DATA UNITS> must be separated with a <PROGRAM UNIT SEPARATOR>. FIGURE 8-8 shows a syntax diagram for a <PROGRAM UNIT SEPARATOR>.

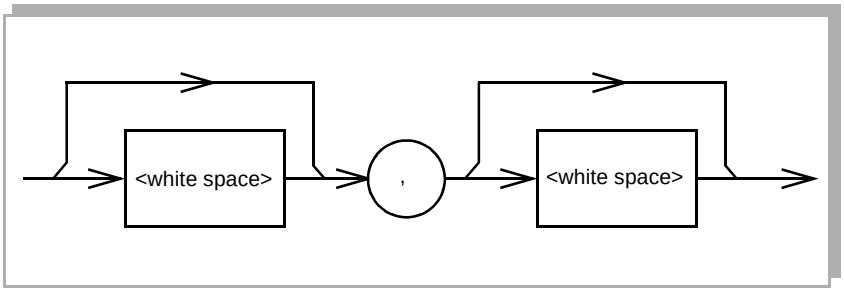


FIGURE 8-8 <PROGRAM DATA SEPARATOR>

Power-on Conditions

At power-on, the FOM-7900B complies with the ANSI/IEEE Std. 488.2-1987 requirements. It initializes the device parameters to be the same as when the power was last shut down. However, **the source outputs are always disabled at power-up**. The default conditions may be recalled by using the *RST command. Default conditions are shown below.

Default Parameters

There are no default values for omitted parameters. If a command is expecting a parameter and none is entered, an error is generated. If a reset is performed with the *RST command, the instrument is configured as shown in Table 8-2.

Table 8-2 FOM-7900B Default Settings

FOM-7900B DEFAULT CONFIGURATION	
GPIB	LOCAL indicator is off (unless *RST is sent through GPIB)
Channel	
Modulation	Ch 1
OFF	
Modulation Frequency	1 kHz
Source Output	OFF
Coherence Control	OFF

GETTING STARTED WITH GPIB

This section is intended as a quick guide to the GPIB syntax and commands used by the FOM-7900B. The FOM-7900B module (device-dependent) commands are described in CHAPTER 9 Command Reference.

Overview of the FOM-7900B Syntax

Generally, a command or query is entered as shown in Table 8-1. The command/query must contain all of the letters which are shown in upper case in FIGURE 8-2 and Table 8-1. However, the command parser is not case sensitive so either upper or lower case may be used in any combination. The lower case letters shown with the commands are optional and may be used for software clarity. The commands **FREQ?** and **FREQuency?** are equal.

The syntax of the FOM-7900B commands follow the rules laid out in the IEEE-488.2 standard. Colons (:) indicate the start of a new command path. Semicolons (;) indicate a separation of commands within a string. A leading semicolon may be used to return the FOM-7900B command parser to the command path root.

Spaces may be placed anywhere in a command string (after the command header or query question mark), and must be used to separate the command (header) from the first parameter (or program data). For more information, refer to the IEEE-488.2 standard definition <white space>, on page 8-4. Examples of valid syntax for commands with the FOM-7900B are shown in Table 8-3.

Table 8-3 Valid Syntax for Commands

:ENAB:COND 256
:enable:event 256
***IDN?**

Examples of invalid syntax for commands are shown in Table 8-4. These command strings would produce an error.

Table 8-4 Invalid Syntax for Commands

INVALID SYNTAX	ERROR	VALID SYNTAX
ENAB COND 13	Missing colon between program headers.	**ENAB:COND 13**
CHAN 2 LEVEL?	Missing semicolon between commands.	**CHAN 2;LEVEL?**
ERR ?	Space not allowed before question mark.	**ERR?**
LVL?	Letters must be in the correct order.	**LEVEL?**

Using Commands with Parameters

Some commands expect a parameter. For example, to adjust the internal modulation frequency to 100 kHz the command would be “FREQ 100.00". If a single parameter is expected, it should follow the command with one space between the command and the parameter.

Substitute Parameter Names

For clarity in programming, the (Boolean) values of one and zero may also be represented by the appropriate substitute parameter names, as shown in Table 8-5.

The ON parameter name could be used in place of the 1. The commands **OUT 1**, **OUT ON** and **OUT TRUE** are equal.

Table 8-5 Substitute Parameter Names

SUBSTITUTE NAME	VALUE
ON	1
OFF	0
TRUE	1
FALSE	0

Queries

A query has no space between the mnemonic and the question mark, as in:

OUT?

Terminators

The FOM-7900B uses a terminator of <NL><^END> (new line, EOI). In almost all cases, these terminators are automatically inserted by the system controller or GPIB driver. For more information, refer to the IEEE-488.2 standard definition <PROGRAM MESSAGE TERMINATOR>.

COMMON COMMANDS AND QUERIES

This section contains a list of the common commands and queries which are supported by the FOM-7900B. These commands are distinguished by the * (asterisk) which begin each mnemonic. The common commands and queries are listed in alphabetical order, and a brief description of their functions and syntax is given below. For more information on these commands, refer to the ANSI/IEEE 488.2-1987 standards reference.

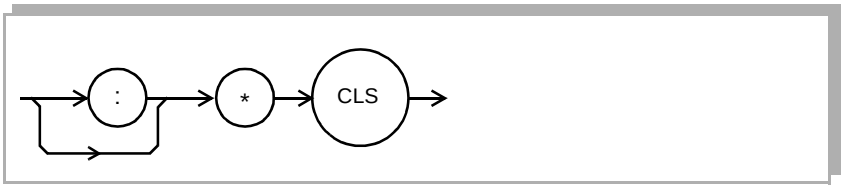
Table 8-6 GPIB Common Commands

COMMAND	DESCRIPTION
***CLS**	Clears existing errors
***ESE**	Sets Event Status Enable register
***ESE?**	Queries Event Status Enable register
***ESR?**	Queries Event Status Register
***IDN?**	Identification Query
***OPC**	Sets Operation Complete bit
***OPC?**	Queries Operation Complete
***PSC**	Clears registers at power-up
***PSC?**	Queries Power-on-Status-Clear flag
***PUD**	Protected User Data
***PUD?**	Retrieves Protected User Data
***RST**	Resets the instrument
***SRE**	Sets Service Request Enable register
***SRE?**	Queries the Service Request Enable register
***STB?**	Queries Status Byte
***TRG**	Trigger all modules
***WAI**	Wait for No-Operation-Pending Flag

*CLS

Sending the **CLEAR STATUS** command resets the Standard Event Register (*ESR?), Status Byte (*STB?) and Error Queue (ERR?) to zero. This command may be used to clear the status registers before enabling SRQ generation from instrument events.

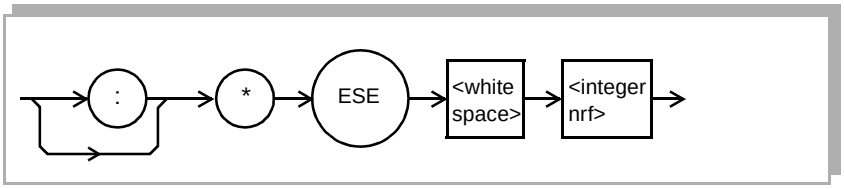
SYNTAX



*ESE

The **STANDARD EVENT STATUS ENABLE** command is used to load the Standard Event Status Enable Register. The Standard Event Status Enable Register is logically ANDed to the Standard Event Register, refer to FIGURE 8-9. If the result is non-zero then the Event Summary Bit (bit #5) in the Status Byte is set to one. The *ESE command is useful for assigning which events are capable of generating an SRQ.

SYNTAX

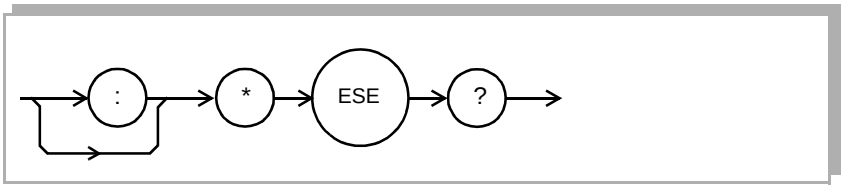


where, the <integer nrf> is the binary integer sum of the enabled bits in FIGURE 8-9. The value must be between 0 and 255.

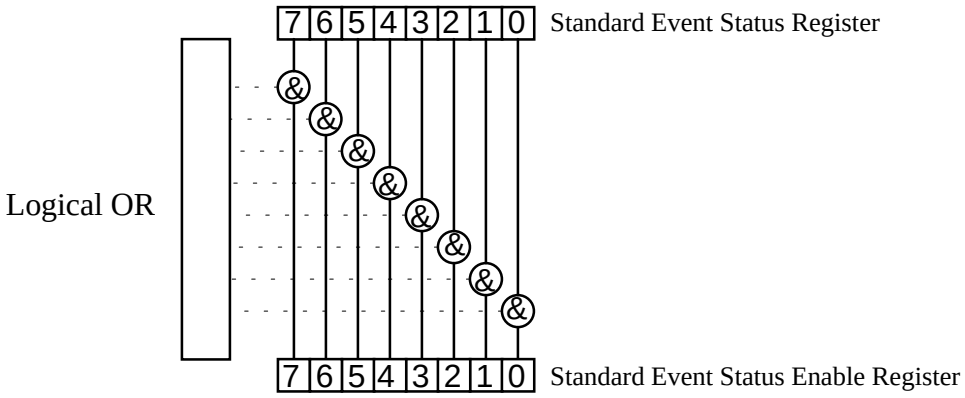
*ESE?

The **STANDARD EVENT ENABLE REGISTER QUERY** allows the user to determine which status bits can set the summary bit (bit 5) in the Status Byte. The response is the sum of the enabled bits presented in FIGURE 8-9.

SYNTAX



RESPONSE Binary Integer Sum of enabled bits in FIGURE 8-9. The value must be between 0 and 255.



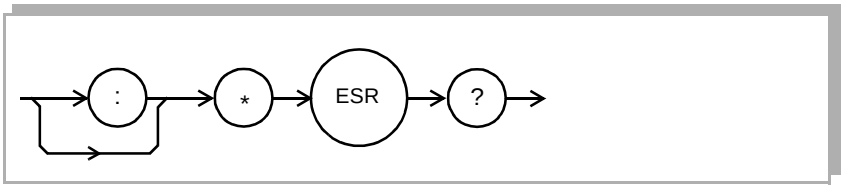
Bit Reference	
0- Operation Complete	4- Execution Error
1- N/A	5- Command Error
2- Query Error	6- N/A
3- Device Dependent Error	7- Power On

FIGURE 8-9 Standard Event Status Register/Standard Event Status Enable Register

***ESR?**

This query causes the device to return the value of the **STANDARD EVENT REGISTER**. The value of the response is the binary integer sum of the bits presented in FIGURE 8-9.

SYNTAX

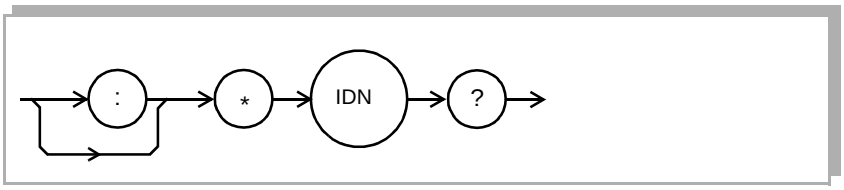


RESPONSE Binary Integer Sum between 0 and 255. FIGURE 8-9.

***IDN?**

This query causes the FOM-7900B to return the **MAINFRAME IDENTIFICATION** string. The string is 39 bytes long.

SYNTAX

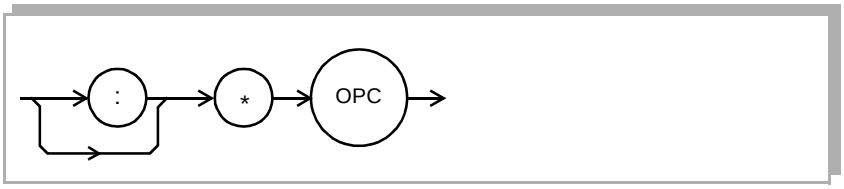


RESPONSE ILX Lightwave,7900 System 7900xxxx,3.40

***OPC**

The ***OPC** command causes the device to generate the **OPERATION COMPLETE** message in the Standard Event Status Register when all pending commands have been completed. Refer to FIGURE 8-9.

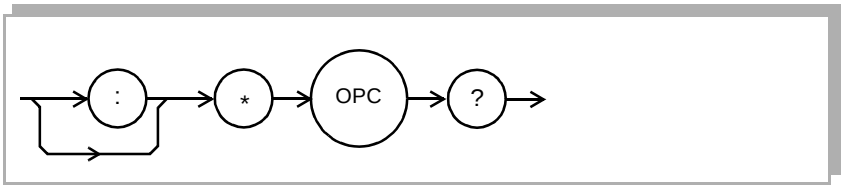
SYNTAX



*OPC?

The **OPERATION COMPLETE QUERY** places an ASCII character 1 into the FOM-7900B's Output Queue when all pending operations have been finished.

SYNTAX

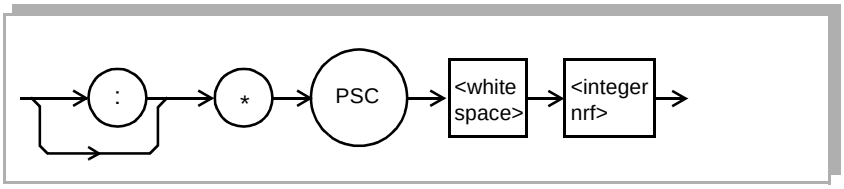


RESPONSE 1 - when all overlapped commands are complete.

*PSC

The **POWER-ON STATUS CLEAR** command controls the automatic power-on clearing of the Service Request Enable Register (*SRE), Standard Event Status Enable Register (*ESE), Event Status Enable Register (:ENAB:EVE), Condition Status Enable Register (:ENAB:COND), (:ENAB:EVE), (ENAB:COND). This may be used to avoid undesirable service requests when the device is powered up.

SYNTAX



where, the <integer nrf> is a boolean value:

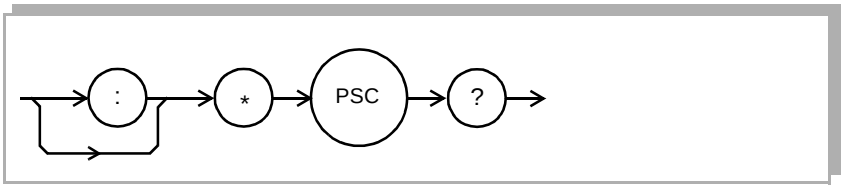
0 - Power-on-status-clear flag is set false, therefore allowing SRQ interrupts after power-on.

1 - Power-on-status-clear flag is set true, therefore clearing all enable registers and disallowing SRQ interrupts to be asserted after power-on.

*PSC?

The **POWER-ON STATUS CLEAR QUERY** allows the programmer to query the FOM-7900B's power-on-status-clear flag.

SYNTAX



RESPONSE

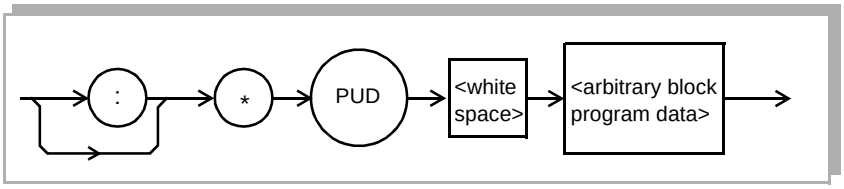
0 - The Standard Event Status Register (*ESE), Service Request Enable Register (*SRE), Event Status Enable Register (ENAB:EVE), Condition Status Enable Register (ENAB:COND), Power Event Status Enable Register (ENAB:EVE), Power Condition Status Enable Register retain their values when power is cycled to the FOM-7900B.

1 - The registers listed above are cleared (set to zero) when the FOM-7900B power is cycled.

*PUD

The **PROTECTED USER DATA** command stores data unique to the FOM-7900B, such as calibration date and serial number. The PUD data is entered by the factory and protected from change by the “SECURE” command. The arbitrary block program data is 25 bytes long.

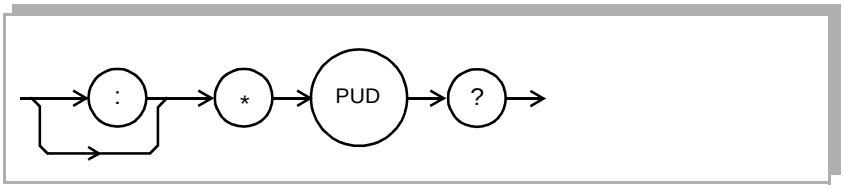
SYNTAX



*PUD?

The **PROTECTED USER DATA QUERY** allows the user to retrieve the contents of the *PUD storage area. The response is the contents of the unique data which was last entered.

SYNTAX



RESPONSE The factory set response to the *PUD? is: #221nnnnnnnnvvgrMMDDYYABC

where, n - Unit Serial number

v - Firmware Revision number

gr - GPIB enabled/RS232 enabled

MMDDYY - Date of factory calibration

ABC - Initials of calibrating technician

*RST

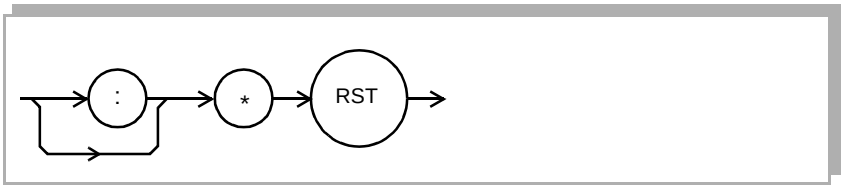
The **RESET** command performs a device reset.

The Operation Complete Command Idle State (OCIS) is the state which the FOM-7900B is in when it is no longer waiting for any operation to complete, after an *OPC command has been executed.

The Operation Complete Query Idle State (OQIS) is the state which the FOM-7900B is in when it is no longer waiting for any operation to complete, after an *OPC? query has been executed.

These idle states allow the FOM-7900B to complete it's reset process before continuing with any other commands after the *RST is executed. Table 8-2 describes the state of the FOM-7900B following the *RST command.

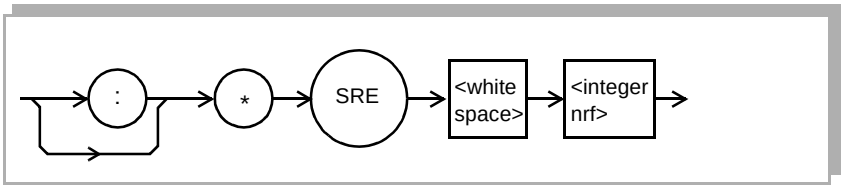
SYNTAX



***SRE**

The **SERVICE REQUEST ENABLE** command sets the Service Request Enable Register bits to allow the FOM-7900B to generate the user-selectable service requests (SRQ). The Service Request Enable Register is logically ANDed to the Status Byte. If the result is non-zero then bit #6 of the Status Byte is set to 1 and an SRQ interrupt is initiated.

SYNTAX

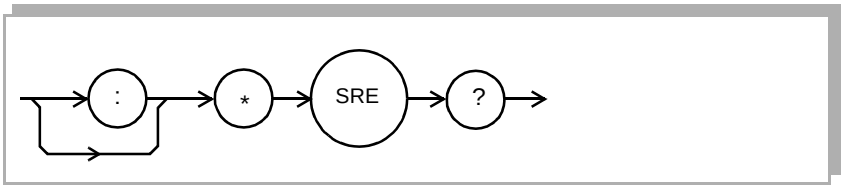


where, the <integer nrf> is the binary integer sum of the enabled bits in FIGURE 8-10.

***SRE?**

The **SERVICE REQUEST ENABLE QUERY** allows the user to determine the contents of the Service Request Enable Register.

SYNTAX



RESPONSE Binary Integer Sum of enabled bits in FIGURE 8-10. The value must be between 0 and 255.

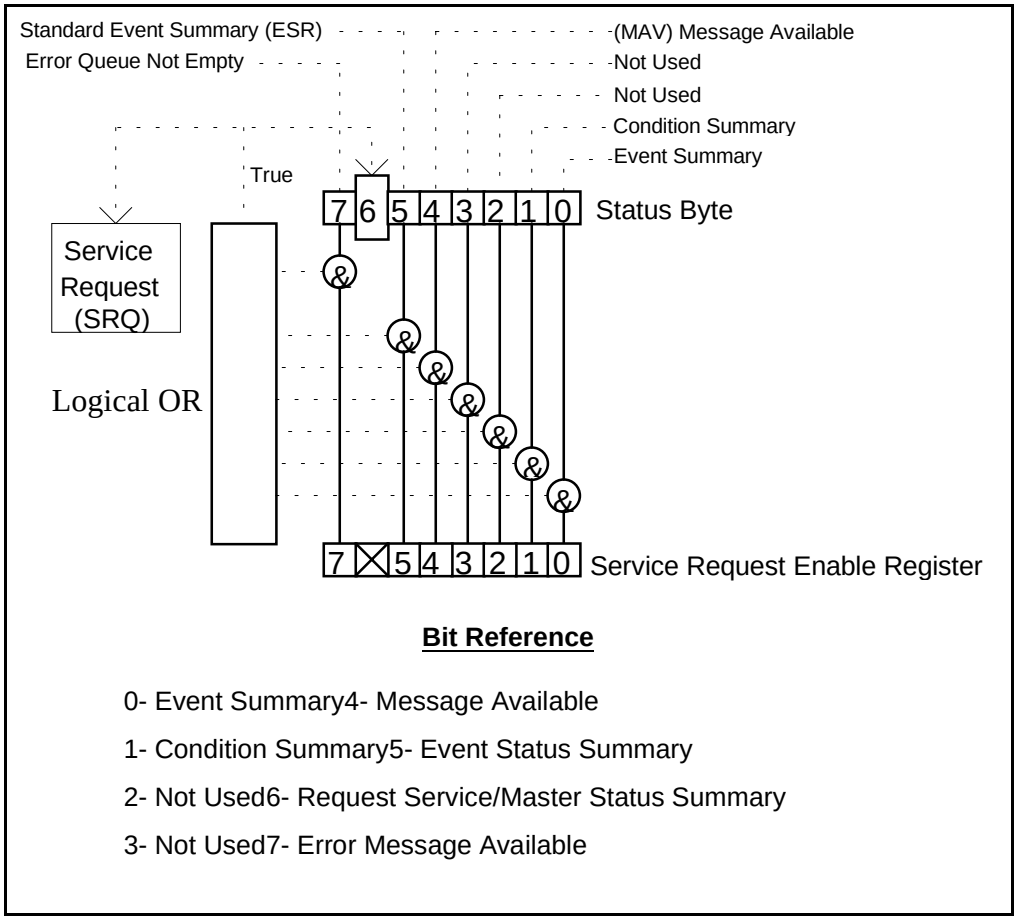
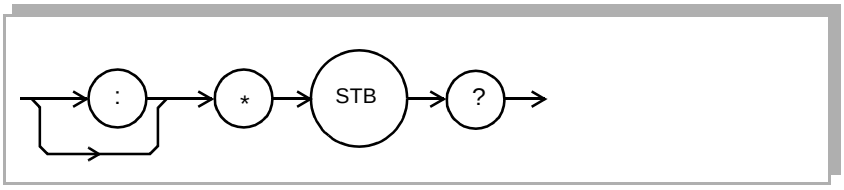


FIGURE 8-10 Service Request Enable Register

*STB?

The **STATUS BYTE QUERY** allows the programmer to read the Status Byte described in FIGURE 8-10.

SYNTAX

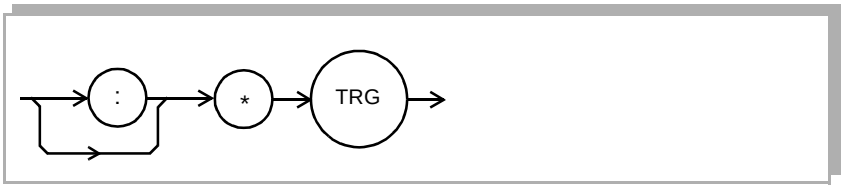


RESPONSE Binary Integer Sum between 0 and 255. Refer to FIGURE 8-11.

*TRG

The **TRIGGER** command is equivalent to the Group Execute Trigger which sends a trigger signal to all modules in the FOM-7900B Mainframe.

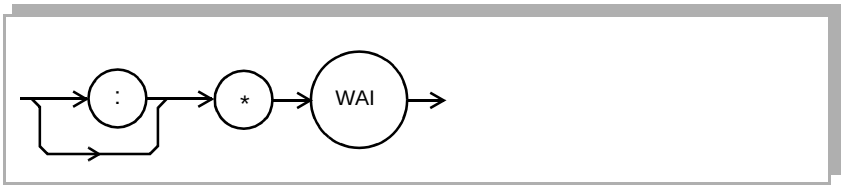
SYNTAX



*WAI

The **WAIT-TO-CONTINUE** command prevents the instrument from executing any further commands until the No-Operation-Pending flag is true. This allows the programmer to make the FOM-7900B wait for the completion of an operation before continuing.

SYNTAX



ERROR MESSAGES

Error messages may appear on the display. These errors are also held for retrieval through GPIB. The error queue can be read by issuing the "**ERR?**" command. This command returns a string containing up to ten error messages from the error message queue.

If "**ERR?**" is sent when the error queue is empty an ASCII zero (0) is returned. If the error queue is active bit #7 in the Status Byte is also set to one (1). Each installed module has its own error queue.

CHAPTER 12 contains an explanation of the error messages which may be reported remotely by the FOM-7900B.

STATUS REPORTING

FIGURE 8-11 shows the status reporting scheme for the FOM-7900B Fiber Optic System. Each of the internal status reporting registers which may be accessed by a command or query have the appropriate GPIB command or query written above or below the register definition. For example, the Condition Register may be queried with the "COND?" query, as shown by its register heading in FIGURE 8-11.

The condition or event registers are logically ANDed with their respective enable registers (e.g. ENAB:COND). These bits are then logically ORed to form a summary message in the status byte for that particular type of register. For example, suppose the internal modulation on condition is enabled, and that condition occurs, then bit #1 of the Status Byte Register would be set.

Device Dependent Event and Condition Registers

The Event Registers are used to report events which occur during the operation of the instrument. Events differ from conditions in that events signal an occurrence once, and are not reset until the Event Register is queried or the FOM-7900B is powered off. Conditions reflect the current state of the device, and therefore may change many times during operation. Querying a Condition Register does not change its contents.

Operation Complete Definition

Note that bit #0 of the Standard Event Status Register contains the Operation Complete flag (see *OPC, on page 8-17). This bit may be used to signal an SRQ to the controlling software for more efficient, interrupt driven software. Enable the SRQ by setting bit #0 in the Standard Event Status Enable Register (*ESE) and bit #5 in the Service Request Enable Register (*SRE). This may be used to initiate service request routines which depend on the completion of all previous commands.

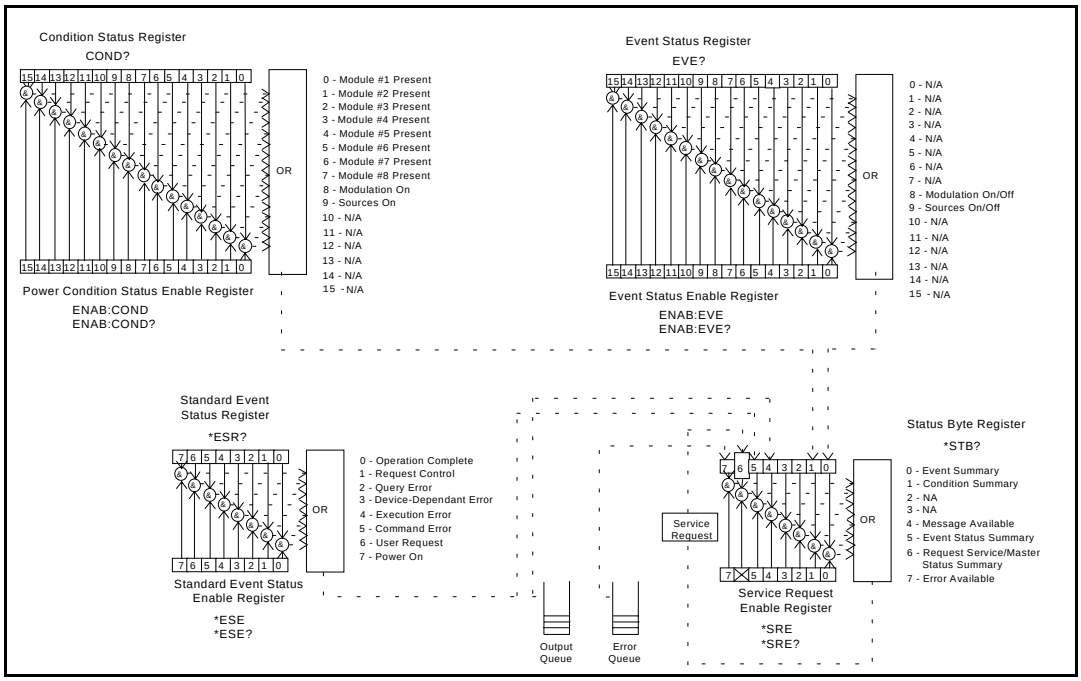


FIGURE 8-11 FOM-7900B Status Reporting Schematic Diagram

Command Timing and Completion

This section describes, for each device-dependent command, whether that command is performed in an overlapped or sequential manner. In other words, it states whether the next command may begin while the present command is being executed, or if the next command must wait until the present command is completed before its execution begins.

All FOM-7900B device-dependent commands are executed in an overlapped manner, using the operation complete flag.

The *WAI (common command) is an example of a sequential command which forces the next command to wait until the no-operation-pending flag is true. This is essentially the same as waiting for the OPC flag to become true, because the no-operations-pending flag is used to set the OPC flag (bit 0 of the Standard Event Status Register).

In normal operation, the overlapped commands execute faster than would appear by querying the OPC flag. This is due to the nature of the non-volatile memory storage process. This is done to ensure that the OPC flag is never set prematurely. However, in most cases, the individual operation will be completed immediately.

Whenever there is response data in the Output Queue, bit 4 is set in the Status Byte Register. Whenever there is any error message in the Error Queue, bit 7 is set in the Status Byte Register.

INPUT BUFFER AND OUTPUT DATA

The input buffer is 256 bytes long and the <PROGRAM MESSAGE> must not exceed this length. The output buffer is also 256 bytes long. The user may enter as many queries as is desired in a single input message, and the FOM-7900B responds to all of them in the same output message, if possible.

All query responses are evaluated at the time the query is parsed, and not at the time the response message is sent. In most cases this does not create a problem since the time between parsing a query and sending its response is small, unless the GPIB controller takes a long time to request the response.

REMOTE INTERFACE MESSAGES

The following sections are intended as a reference for using the FOM-7900B with the GPIB option when an understanding of the lower level interface messages is required. These sections deal with the remote interface messages which are available with the instrument, and they contain a list of the Interface Function subsets. This information is generally not required by the user unless there is a question of compatibility of the instrument with a specific controller. A list of interface messages which are not supported by the FOM-7900B is shown in Table 8-8. These messages will be ignored by the FOM-7900B.

The interface messages listed in this chapter are handled by the National Instruments TNT4882 GPIB interface IC and the AMD186EM microcontroller in the FOM-7900B, and are transparent to the higher level commands. However, they may be explicitly used in some GPIB programs. A list of the FOM-7900B's allowable interface messages is shown in Table 8-7.

Interface Function Subsets

Table 8-1 contains the remote Interface Function Subsets which are supported by the FOM-7900B. For more information, see the ANSI/ IEEE-488.1-1987 standard.

Remote Messages

The following list contains GPIB remote messages which are compatible with the FOM-7900B GPIB driver.

Table 8-7 FOM-7900B Allowed GPIB Interface Messages

FOM-7900B ALLOWED GPIB INTERFACE MESSAGES				
ACG	GET	MTA	SCG	UCG
ATN	GTL	OTA	SPD	UNL
DAB	IFC	PCG	SPE	UNT
DAC	LAG	REN	SRQ	
DAV	LLO	RFD	STB	
END	MLA	RQS	TAG	

Remote Interface Messages Not Supported by FOM-7900B

Table 8-8 contains GPIB interface messages which are known to be incompatible with the FOM-7900B. Other interface messages which are not listed may also be incompatible with the FOM-7900B.

Table 8-8 GPIB Interface Messages Not Supported by the FOM-7900B

GPIB INTERFACE MESSAGES NOT SUPPORTED BY FOM-7900B				
DCL	NUL	PPE	PPR4	PPR8
EOS	OSA	PPR1	PPR5	PPU
IDY	PPC	PPR2	PPR6	SDC
MSA	PPD	PPR3	PPR7	TCT

(page left blank intentionally)

CHAPTER 9 COMMAND REFERENCE

This chapter is a guide to the syntax and usage of the various device-dependent commands for the FOM-7900B System. It contains a reference for all of the FOM-7900B mainframe and module commands in alphabetical order.

The device-dependent commands are denoted by the √ next to the device label in the command description.

The commands which emulate local (front panel) operation are denoted by the √ next to the Front Panel label in the upper left corner of the command description.

The DPM-79810 module is a dual power meter. Commands to control a parameter in one of the power meters are the same as commands for the other power meter; they are differentiated by the use of the OPM1 or OPM2 header. OPMn will sometimes be used to mean OPM1 or OPM2. Also included is the BOTH header, this allows the user to set a parameter in both optical power meters to the same value with a single command.

FIGURE 9-1 shows the format for the command descriptions in this chapter. The error messages which may be displayed on the FOM-7900B front panel are listed in CHAPTER 13.

TERMINOLOGY

Terminology required to successfully communicate with the FOM-7900B Mainframe using GPIB is described in CHAPTER 8 GPIB Remote Operation and Common Commands. The terms frequently used in this chapter are repeated below.

<white space> refers to ASCII characters (such as Space Bar) which are used as separators in the command syntax.

<nrf value> refers to the IEEE-488.2 standard for numeric format notation. It is a generic label which means either integer, floating point or scientific notation number representation.

<suffix> refers to the IEEE-488.2 standard for suffixes. Suffixes are not used.

COMMANDS AND QUERIES

There are two types of device communication: commands, which tell the device to do something and do not return anything, and queries, which return a stored value or instrument state but do not change the device state. Queries must be terminated with a question mark (?), while commands may require one or more parameters.

COMMAND **FREQ 100.00**
Internal Modulation Frequency is set to 100.000 kHz

QUERY **FREQ?**
Returns the Internal Modulation Frequency

Substitute Parameter Names

For clarity in programming, the Boolean values of one and zero may be represented by the appropriate substitute parameter names (Refer to Table 8-5). The commands **MODULATION 1**, **MODULATION ON** and **MODULATION TRUE** are identical.

Compound Command Structure

Some FOM-7900B GPIB commands require a compound structure. This is done to distinguish between different commands of the same type.

The compound command structure is similar to a directory path structure, as found in DOS. For example, commands which deal with FOS-79800E calibration have the path **CAL:**, as in the command **CAL:LEVEL 2.50** to calibrate the displayed output power for a FOS-79800E Precision Source Module to 2.50 dBm.

Table 9-1 lists all FOM-7900B device-dependent commands, with the full path shown for each command and a brief description. Detailed syntax diagrams and descriptions start on page 9-10.

Common Commands

The GPIB Common Commands which are defined by the ANSI/ IEEE-488.2-1987 standard are described in CHAPTER 8. These commands do not necessarily reflect front panel operations but are useful for generic device control. Some of the common commands are useful for advanced programming techniques, such as generating service requests (SRQ).

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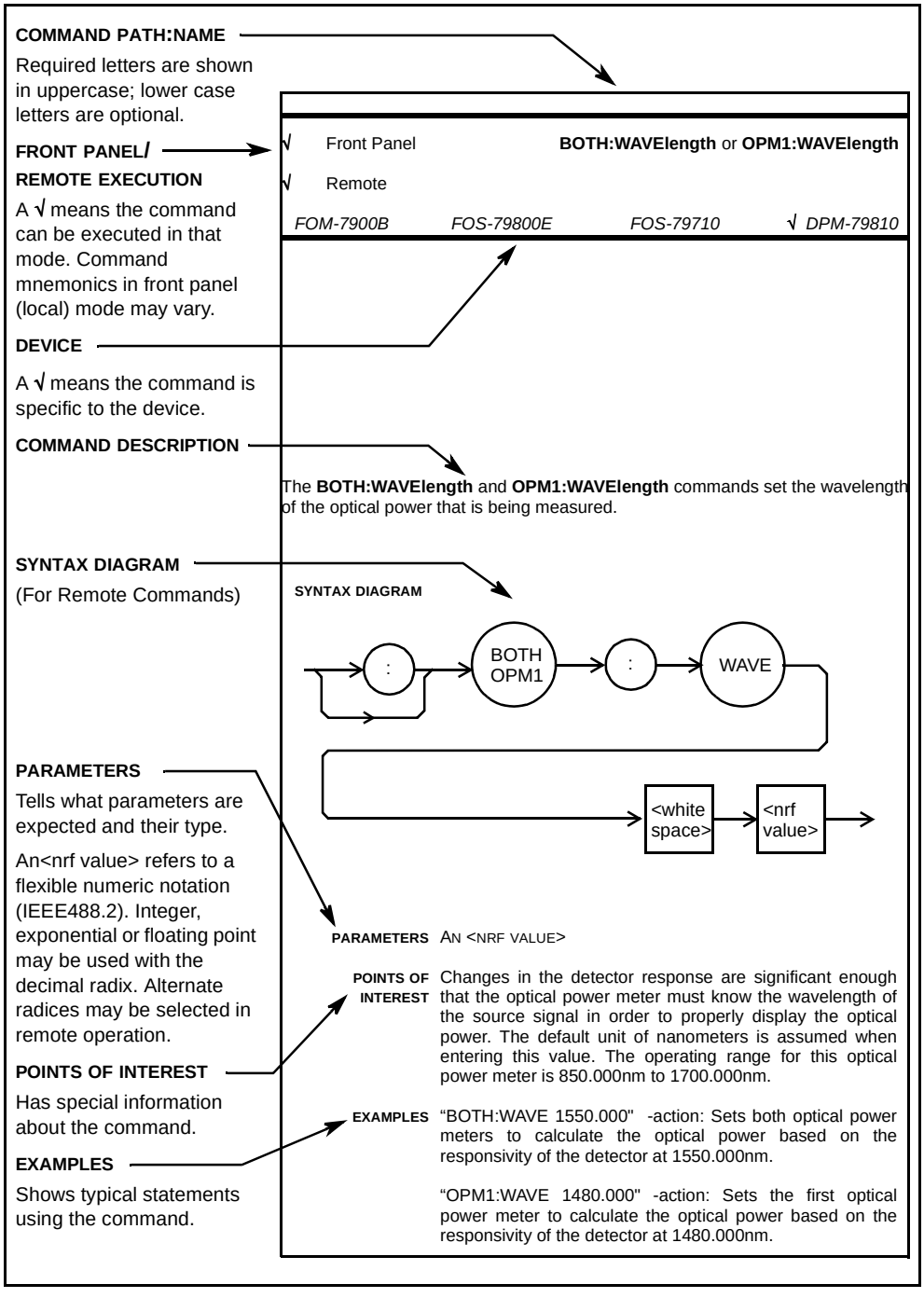


FIGURE 9-1 Command Format

Table 9-1 FOM-7900B Mainframe Specific Commands

COMMAND	PARAMETER	DESCRIPTION
CHannel	1	Selects the channel (module).
CHannel?	NONE	Returns the current channel, e.g. 8, or 9 (Channel all).
COHerence	ON/OFF	Enables/Disables the Coherence Control in all modules.
COHerence?	NONE	Returns the status of the Coherence Control.
CONDition?	NONE	Returns the Condition Status Register.
ENAB:COND	1	Sets the enable register for Conditions.
ENAB:COND?	NONE	Returns the Condition Enable Register.
ENAB:EVENT	1	Sets the enable register for Events.
ENAB:EVENT?	NONE	Returns the Event Enable Register.
ERRors?	NONE	Returns errors generated since last error query.
EVEnt?	NONE	Returns the Event Status Register.
FREQuency	1	Internal modulation setpoint in kHz.
FREQuency?	NONE	Returns the internal modulation frequency in kHz.
MESsage	1	Used to enter a string message of up to 16 characters.
MESsage?	NONE	Returns a previously stored ASCII message.
MODulation	ON/OFF	Turns internal modulation on or off.
MODulation?	NONE	Returns status of internal modulation.
OUTput	ON/OFF	Turns all channel outputs on or off.
OUTput?	NONE	Returns status channel output.
RADix	1	Used to set the radix type for numerical data.
RADix?	NONE	Used to return the radix type for numerical data.
SECURE	1	Used by service personnel to access PUD.
SOURCE	1	Used to set the source of the modulation signal.
SOURCE?	NONE	Returns the source of the modulation signal.
TERM	TRUE/FALSE	Used to add a <CR> to GPIB terminations.
TIME?	NONE	Returns elapsed time since power-up.
TIMEOUT	1	Sets the response time-out for banked remote systems.
TIMEOUT?	NONE	Returns the response time-out for banked remote sys-
TIMER?	NONE	Returns elapsed time since last TIMER?
TRIGger	NONE	Used to trigger compatible modules.

DEVICE SPECIFIC COMMANDS

The CHAN command must be sent before a device specific command (shown in Table 9-2 and Table 9-3) so that the proper module will be addressed. An example of the use of the CHAN command is shown below.

CHAN 3

Future commands (except common commands) are directed to the module in channel 3.

CHAN?

Returns the active channel number.

CHANNEL 6

Future commands are directed to channel 6.

Table 9-2 FOS-79800E Module Commands

COMMAND	PARAMETERS	DESCRIPTION
CAL:LEVEL	##.##	Sets the Power User Calibration.
CAL:RESET	##.##	Resets the User Calibration.
CAL:WAVE	####.###	Sets the Wavelength User Calibration.
ERRor?	NONE	Returns an error code. (See CHAPTER 12)
IDN?	NONE	Returns a string that identifies the module.
LEVEL	±##.##	Sets the output power level.
LEVEL?	NONE	Returns the output power level.
OUT	#	Turns the output on and off.
OUT?	NONE	Returns the ON/OFF status of the laser.
SHUTPRES?	NONE	Returns the presence of the shutter option
SHUTTER	ON/OFF or 1/0	Opens (ON) and closes (OFF) the shutter
SHUTTER?	NONE	Returns the state of the shutter
WAVE	####.###	Sets the wavelength.
WAVE?	NONE	Returns the wavelength setting.
WAVEMAX?	NONE	Returns the maximum wavelength setting.
WAVEMIN?	NONE	Returns the minimum wavelength setting.

Table 9-3 FOS-79710 1 x 4 Switch Module Commands

COMMAND	PARAMETERS	DESCRIPTION
ERR?	NONE	Returns an error code (See CHAPTER 12).
IDN?	NONE	Returns a string that identifies the module.
INTERVAL	##.##	Sets the timer interval in seconds.
INTERVAL?	NONE	Returns the timer interval, in seconds.
PORT	#	Sets the port that is switched to the common port.
PORT?	NONE	Returns the currently-selected switch port.
SEQ:DEFAULT	NONE	Initializes the Trigger/Timer switch sequence.
SEQ:SWn	#	Sets the nth position in the switch sequence array.
SEQ:SWn?	NONE	Returns the nth position from the sequence array.
SEQ:TMR	ON/OFF	Enables or Disables the Interval Timer (1 or 0).
SEQ:TMR?	NONE	Returns the state of the Timer Mode (1 or 0).
SEQ:TRG	ON/OFF	Enables or Disables the External Trigger (1 or 0).
SEQ:TRG?	NONE	Returns the state of the Trigger Mode (1 or 0).

Table 9-4 DPM-79810 Module Commands

NAME	PARAMETERS	FUNCTION
MODE	1	Sets the display mode to 1 = absolute, 2 = relative OPM1 - OPM2, 3 = relative OPM2 - OPM1.
MODE?	NONE	Returns the current mode of operation; 1 = absolute, 2 = relative OPM1 - OPM2, 3 = relative OPM2 - OPM2.
OPMn:CALibration BOTH:CALibration	1	Sets the user calibration constant; valid values are 0.500 to 2.000.
OPMn:CALibration? BOTH:CALibration?	NONE	Returns the user calibration constant, 1.000 is the default.
OPMn:FILTer BOTH:FILTer	1	Sets the number of samples that are averaged to generate a measurement; valid range is 1 to 50.
OPMn:FILTer? BOTH:FILTer?	NONE	Returns the current number of samples that are being averaged to generate a measurement; 1 is the default.
OPMn:POWer?	NONE	Returns the current power measurement for optical power meter.
OPMn:RANGE BOTH:RANGE	1	Sets the range value for the optical power measurement; valid range is 0 - 8. Where 0=Auto Range, 1=1W, 2=100mW, 3= 10mW, 4=1mW, 5=100µW, 6=10 µW, 7=1µW, 8=100nW
OPMn:RANGE? BOTH:RANGE?	NONE	Returns the current setting for the range value; 0 is the default.
OPMn:REFerence BOTH:REFerence	1	Sets the current power measurement as a reference value. The remaining measurements when a reference is recorded become the difference in power. The valid parameter for this command is ON or OFF.

Table 9-4 DPM-79810 Module Commands

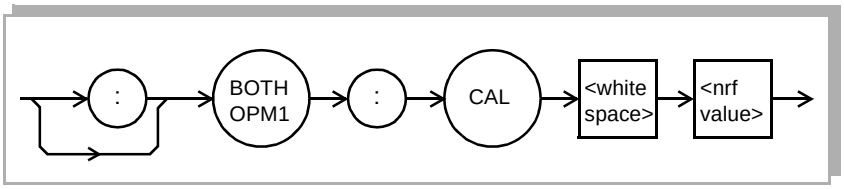
NAME	PARAMETERS	FUNCTION
OPMn:REFerence? BOTH:REFerence?	NONE	Returns the reference power measurement; 0.0 is the default value and indicates no stored reference is being used.
OPMn:RELative?	NONE	Returns the relative power difference between OPMn and the other optical power meter.
OPMn:UNITS:DBM BOTH:UNITS:DBM	1	Sets the optical power meter to display and respond in dBm units or Watts.
OPMn:UNITS:DBM? BOTH:UNITS:DBM?	NONE	Returns the current unit setting for the optical power meter.
OPMn:WAVElength BOTH:WAVElength	1	Sets the input wavelength that the optical power meter is reading.
OPMn:WAVElength? BOTH:WAVElength?	NONE	Returns the current wavelength setting for the optical power meter.
OPMn:ZERO BOTH:ZERO	NONE	Zeros the optical detector and electronics for the optical power meter.
OPMn:ZERO? BOTH:ZERO?	NONE	Returns the status of the zeroing operation on the optical power meter.
OPMn:SAVE	1	Saves the current meter settings for both OPM1 and OPM2 to a storage bin indicated by the parameter. The valid parameter range for this command is 1 - 10.
OPMn:RECALL	1	Restores the saved bin contents from the storage bin indicated by the parameter. The valid parameter range for this command is 1 - 10.

FOM-7900B MAINFRAME AND MODULE COMMAND REFERENCE

√ Front Panel		**_____:CALibration**
√ Remote		
FOM-7900B	*FOS-79800E*	*FOS-79710*	*√ DPM-79810*

The **BOTH:CALibration** and **OPM1:CALibration** commands set the user calibration constant.

SYNTAX DIAGRAM



PARAMETERS An <nrf value>; 0.500 to 2.000.

POINTS OF INTEREST The most common application of user calibration is to calibrate the optical power meter to read correctly with an external attenuator. For example, if you attach a calibrated 3dB attenuator, only 50% of the input signal gets to the meter. In this situation, set the user calibration factor to 2.000 and the meter will then display correctly. Remember to consider the accuracy of the attenuator as well as the meter in attenuated measurements.

EXAMPLES

BOTH:CAL 2.0

Sets both optical power meters user calibration constant to 2.

OPM1:CAL 0.5

Sets the first optical power meter user calibration constant to 0.5.

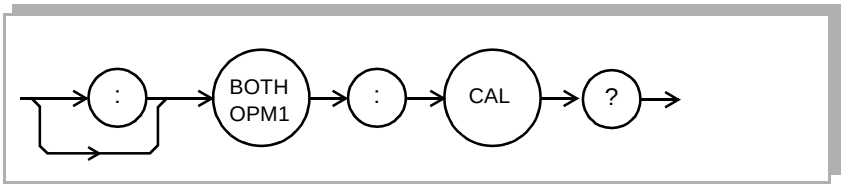
√ Front Panel **_____:CALibration?**

√ Remote

FOM-7900B *FOS-79800E* *FOS-79710* *√ DPM-79810*

The **BOTH:CALibration?** and **OPM1:CALibration?** queries return the current user calibration constant.

SYNTAX DIAGRAM



PARAMETERS None. The response is an <nrf value>.

POINTS OF INTEREST A setting of 1.000 disables the affects of a user calibration constant.

EXAMPLES **BOTH:CAL? 1.0,1.0**
Means that a user calibration is not active.

OPM1:CAL? 2.0
The user needs the actual measurement value doubled.

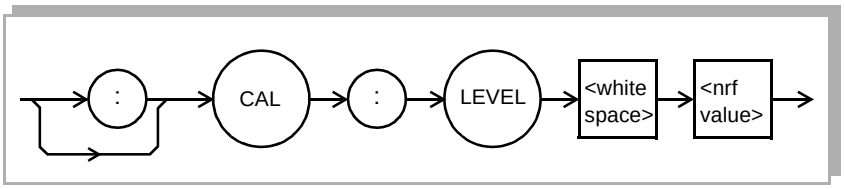
√ Front Panel **CAL:LEVEL**

√ Remote

FOM-7900B *√ FOS-79800E* *FOS-79710* *DPM-79810*

The **CAL:LEVEL** command is used to field calibrate the output power.

SYNTAX DIAGRAM



PARAMETERS The <nrf value> is the actual, measured output power from the module.

POINTS OF INTEREST The User Calibration can be used when the measured output power does not match the front panel setting or to compensate for losses induced by patch cords. Use the **CAL:LEVEL** command to enter the measured power in dBm for a particular channel. The effects of the User Calibration are removed with the **CAL:RESET** command.

EXAMPLES **CAL:LEVEL +1.12**
Resets the measurement to 1.12 dBm.

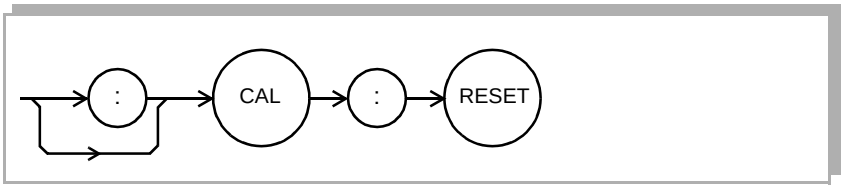
√ Front Panel **CAL:RESET**

√ Remote

FOM-7900B √ *FOS-79800E* *FOS-79710* *DPM-79810*

The **CAL:RESET** command removes the effects of the Power and Wavelength User Calibrations.

SYNTAX DIAGRAM



PARAMETERS None.

POINTS OF INTEREST The User Calibration is an offset that is applied to all future power levels and wavelength settings. Resetting the User Calibration returns these offsets to 0.00 dB and 0.000 nm.

EXAMPLES **CAL:RESET**
Removes the effects of the User Calibrations.

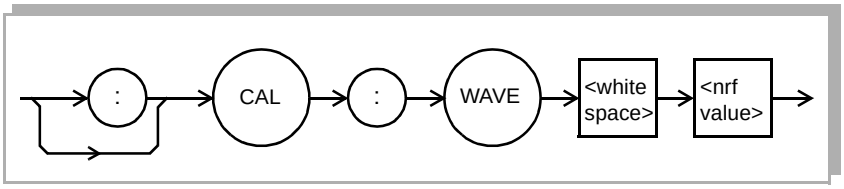
√ Front Panel **CAL:WAVE**

√ Remote

FOM-7900B *√ FOS-79800E* *FOS-79710* *DPM-79810*

The **CAL:WAVE** command is used to field calibrate the wavelength setting.

SYNTAX DIAGRAM



PARAMETERS The <nrf value> is the actual, measured wavelength from the module.

POINTS OF INTEREST The User Calibration can be used when the measured wavelength does not match the front panel setting. Use the **CAL:WAVE** command to enter the measured wavelength in nanometers. The effects of the User Calibration are removed with the **CAL:RESET** command.

EXAMPLES **CAL:WAVE 1555.230**
The measured wavelength is 1555.230 nm.

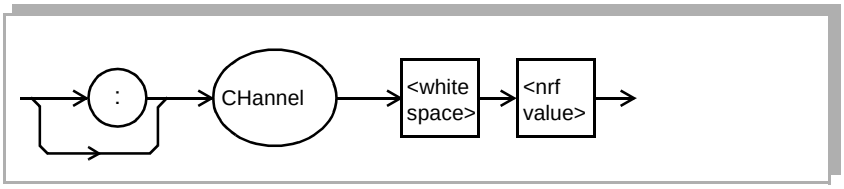
√ Front Panel **CHannel**

√ Remote

√ FOM-7900B *FOS-79800E* *FOS-79710* *DPM-79810*

The **CHannel** command is used to select a module channel number for future commands/queries.

SYNTAX DIAGRAM



PARAMETERS The <nrf value> is an integer between 0 and 249.

POINTS OF INTEREST Zero is the channel selection for mainframe-specific commands to bank address zero. Select channel 0 to set parameters specifically to the mainframe. The channel numbers for the FOM-7900B System are determined as shown in Table 9-5.

Table 9-5 FOM-7900B Channel Numbers

BANK	CHANNEL	NOTES
0	0	Bank 0 mainframe only commands
0	1-8	Specific modules in bank 0
0	9	All channels in bank 0
1	10	Bank 1 mainframe only commands
1	11-18	Specific modules in bank 1
1	19	All channels in bank 1
2	20	Bank 2 mainframe only commands

The scheme above is valid up through Bank 24, Channel 249.

EXAMPLES **CH 0**

selects channel 0 of bank 0 (mainframe only commands).

CHANNEL 22

selects channel 22 (module #2 in bank #2).

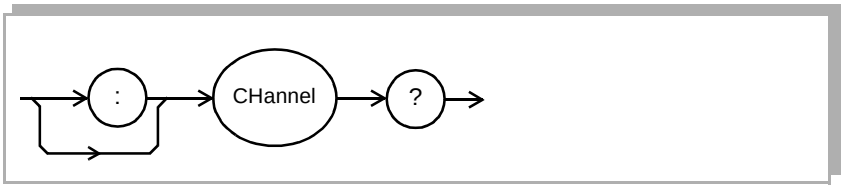
CHAN 79

selects channel 79 (all modules in bank #7).

√	Front Panel	**CHannel?**
√	Remote	
√ *FOM-7900B*	*FOS-79800E* *FOS-79710* *DPM-79810*	

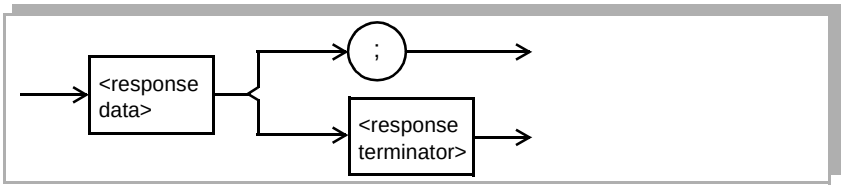
The **CHannel?** query is used to determine which channel has been selected.

SYNTAX DIAGRAM



PARAMETERS None

RESPONSE



where the response data is an integer between 0 and 249 representing the channel number.

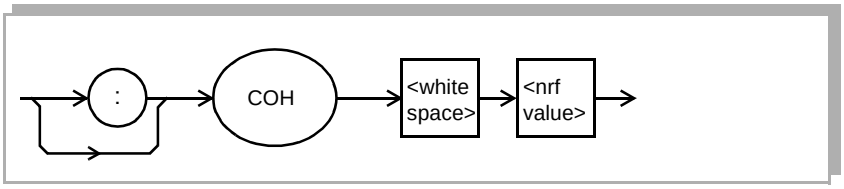
EXAMPLES **CHannel?**

4 the module in channel four is selected.

√	Front Panel	**COHerence**
√	Remote	
√ *FOM-7900B*	*FOS-79800E* *FOS-79710* *DPM-79810*	

The **COHerence** command is used to turn on or off the coherence control feature in compatible modules.

SYNTAX DIAGRAM



PARAMETERS The <nrf> is a 1—ON or 0—OFF.

POINTS OF INTEREST This command will turn the coherence control feature on or off. Some modules may not have this feature and will not be affected.

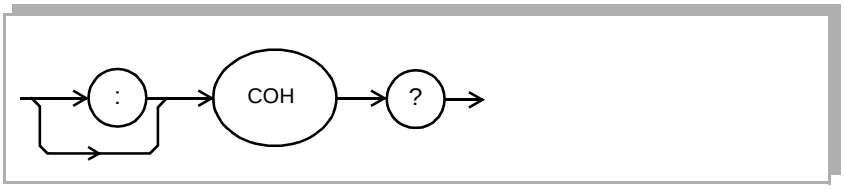
EXAMPLES **COH 1**
turns the coherence control feature on.

COHERENCE OFF
turns the coherence control feature off.

	Front Panel	**COHerence?**
√	Remote	
√ *FOM-7900B*	*FOS-79800E* *FOS-79710* *DPM-79810*	

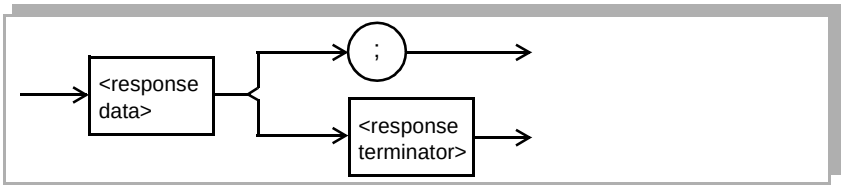
The **COHerence?** query returns the ON/OFF status of the coherence control feature.

SYNTAX DIAGRAM



PARAMETERS None.

RESPONSE



where the response data is a 1—ON or 0—OFF

POINTS OF INTEREST Use **COHerence?** to verify the state of the coherence control feature.

EXAMPLES **COH?**

0 coherence control is turned off.

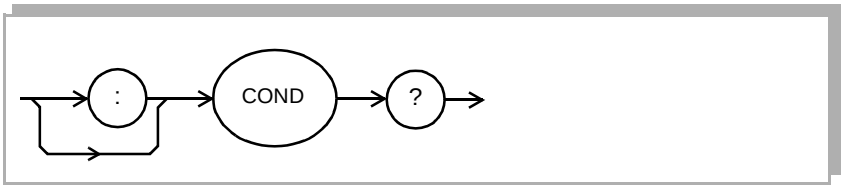
Front Panel **CONDition?**

√ Remote

√ *FOM-7900B* *FOS-79800E* *FOS-79710* *DPM-79810*

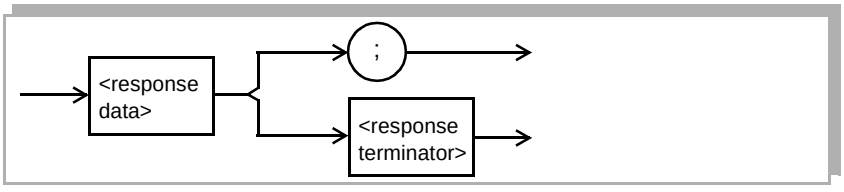
The **COND?** query returns the value of the FOM-7900B condition status register.

SYNTAX DIAGRAM



PARAMETERS None.

RESPONSE



where the response data is the binary sum of the following:

1	Module #1 Present	256	Modulation On
2	Module #2 Present	512	Sources On
4	Module #3 Present	1024	Not Used
8	Module #4 Present	2048	Not Used
16	Module #5 Present	4096	Not Used
32	Module #6 Present	8192	Not Used
64	Module #7 Present	16384	Not Used
128	Module #8 Present	32768	Not Used

POINTS OF INTEREST The condition status may be constantly changing. This register is ***not*** cleared (set to zero) when queried or when the ***CLS** command is sent. In other words, this register always reflects the real time condition of the instrument.

The conditions above are filtered by the condition enable register (See **ENABle:COND**) before being summarized in the status byte. Refer to the status reporting diagram in FIGURE 8-11.

EXAMPLES **COND?**

97 Modules 1, 6 and 7 are present.

Front Panel **ENABle:**

√ Remote

FOM-7900B *FOS-79800E* *FOS-79710* *DPM-79810*

The **ENABle:** command path is used to access the FOM-7900B status enable commands.

The following commands can be reached by first specifying the **ENABle:** command path.

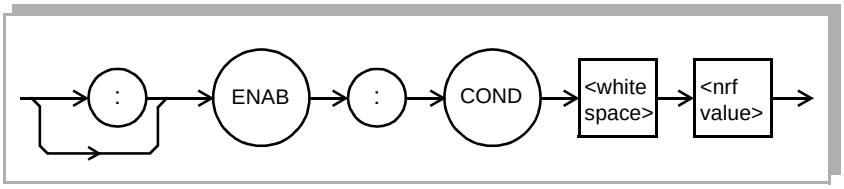
ENABle:CONDENABle:EVEnt

ENABle:COND?ENABle:EVEnt?

	Front Panel	**ENABle:COND**
√	Remote	
√ *FOM-7900B*	*FOS-79800E* *FOS-79710* *DPM-79810*	

The **ENABle:COND** command sets the condition status enable register. This register is a filter which is logically ANDed to the condition register. If the result is non-zero, bit #1 in the Status Byte is set.

SYNTAX DIAGRAM



PARAMETERS The <nrf value> whose sum represents the enabled bits below:

1	Module #1 Present	256	Modulation On
2	Module #2 Present	512	Sources On
4	Module #3 Present	1024	Not Used
8	Module #4 Present	2048	Not Used
16	Module #5 Present	4096	Not Used
32	Module #6 Present	8192	Not Used
64	Module #7 Present	16384	Not Used
128	Module #8 Present	32768	Not Used

POINTS OF INTEREST The condition enable register can be read using the **ENABle:COND?** query. The condition status register can be monitored using the **COND?** query. If any of the enabled bits in the Condition Register are true, bit #1 of the Status Byte is set. Refer to the Status reporting diagram in FIGURE 8-11.

The enable registers retain their values at power-up unless the power-on status clear flag is set true see ***PSC** in CHAPTER 8.

EXAMPLES **ENAB:COND 513**

Allows an SRQ interrupt to be sent to the computer when any sources are turned on or if Module #1 is present.

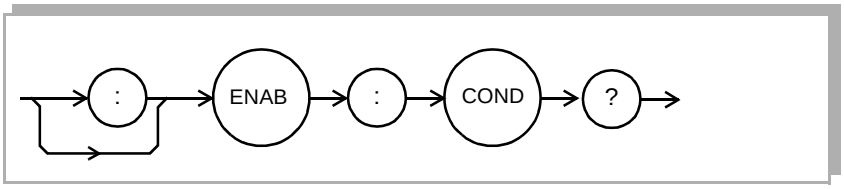
Front Panel **ENABle:COND?**

√ Remote

√ *FOM-7900B* *FOS-79800E* *FOS-79710* *DPM-79810*

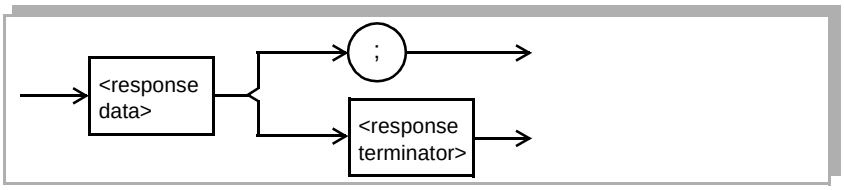
The **ENABle:COND?** query returns the value of the FOM-7900B status condition enable register.

SYNTAX DIAGRAM



PARAMETERS None.

RESPONSE



where the response data is the binary sum of the following:

1	Module #1 Present	256	Modulation On
2	Module #2 Present	512	Sources On
4	Module #3 Present	1024	Not Used
8	Module #4 Present	2048	Not Used
16	Module #5 Present	4096	Not Used
32	Module #6 Present	8192	Not Used
64	Module #7 Present	16384	Not Used
128	Module #8 Present	32768	Not Used

POINTS OF INTEREST The condition enable register can be set by using the **ENABle:COND** command. The condition status can be monitored by the **COND?** command. Refer to the Status reporting diagram in FIGURE 8-11.

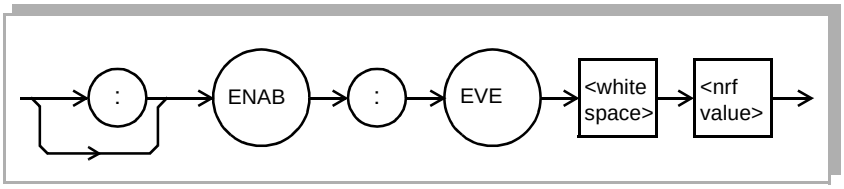
EXAMPLES **ENAB:COND?**

144 the presence of module 5 and 8 are allowed to be summarized in the Status Byte.

	Front Panel	**ENABle:EVEnt**
√	Remote	
√ *FOM-7900B*	*FOS-79800E* *FOS-79710* *DPM-79810*	

The **ENABle:EVEnt** command sets the event status enable register. This register is a filter which is logically ANDed to the event register. If the result is non-zero, bit #0 in the Status Byte is set to one.

SYNTAX DIAGRAM



PARAMETERS The <nrf value> whose sum represents the enabled bits below:

1	Not Used	256	Modulation ON/OFF
2	Not Used	512	Sources ON/OFF
4	Not Used	1024	Not Used
8	Not Used	2048	Not Used
16	Not Used	4096	Not Used
32	Not Used	8192	Not Used
64	Not Used	16384	Not Used
128	Not Used	32768	Not Used

POINTS OF INTEREST The event enable register can be read using the **ENABle:EVEnt?** query. The event status register can be monitored using the **EVEnt?** query. If any of the enabled bits in the Event Register are true, bit #0 of the status register is set. Refer to the status reporting diagram in FIGURE 8-11.

The enable registers retain their values at power-up unless the power-on status clear flag is set true see ***PSC** in CHAPTER 8.

EXAMPLES **ENAB:EVE 256**

Modulation ON or OFF updates bit #0 of the Status Byte.

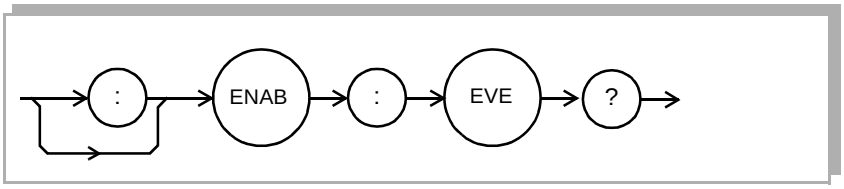
Front Panel **ENABle:EVEnt?**

√ Remote

√ *FOM-7900B* *FOS-79800E* *FOS-79710* *DPM-79810*

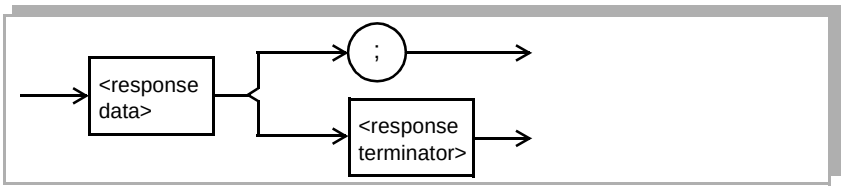
The **ENABle:EVEnt?** query returns the value of the FOM-7900B status event enable register.

SYNTAX DIAGRAM



PARAMETERS None.

RESPONSE



where the response data is the binary sum of the following:

1	Not Used	256	Modulation ON/OFF
2	Not Used	512	Sources ON/OFF
4	Not Used	1024	Not Used
8	Not Used	2048	Not Used
16	Not Used	4096	Not Used
32	Not Used	8192	Not Used
64	Not Used	16384	Not Used
128	Not Used	32768	Not Used

POINTS OF INTEREST The event enable register can be set by using the **ENABle:EVEnt** command. The condition status can be monitored by the **EVEnt?** command. Refer to the Status reporting diagram in FIGURE 8-11.

EXAMPLES **ENAB:EVE?**

512 the Sources ON or OFF events are allowed to be summarized in the Status Byte.

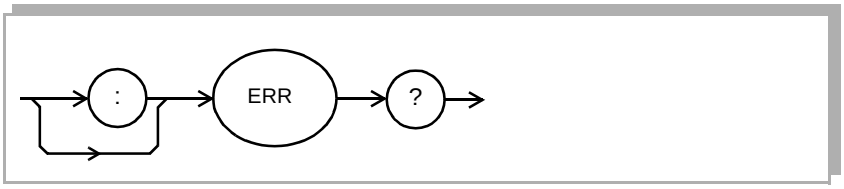
√ Front Panel **ERRor?**

√ Remote

√ *FOM-7900B* √ *FOS-79800E* √ *FOS-79710* *DPM-79810*

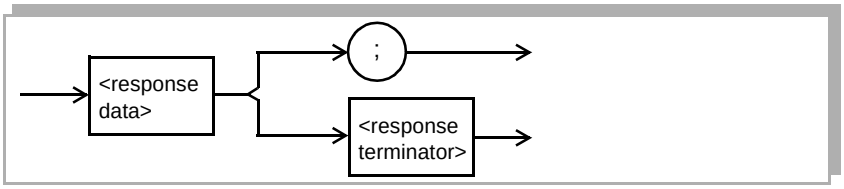
The **ERRor?** query returns a list of command, execution and device errors which have occurred since the last **ERRor?** query or ***CLS** command. The error codes are listed in Table 9-6, Table 9-7 and Table 9-8. Each module has its own separate error queue.

SYNTAX DIAGRAM



PARAMETERS None.

RESPONSE



where each <response data> consists of an error code value.

Table 9-6 Error Codes for the FOS-79710 1 X 4 Switch Module

ERROR CODE	DESCRIPTION
123	Command Syntax Error
201	Value Out of Range Error
220	Parameter Missing Error
504	Switch Mechanism has failed

Table 9-7 Error Codes for the FOS-79800E Source Module

ERROR CODE	DESCRIPTION
123	Command Syntax Error
501	Laser Diode Case Temperature Control Error
502	Laser Diode Internal Temperature Control Error
503	Laser Diode Current Limit Error
508	Calibration Data Error
509	Set-point Data Error

Table 9-8 Mainframe Specific Errors

ERROR CODE	EXPLANATION
401	Channel number out of range (0 to 9 legal).
402	Bank address number out of range (0 to 24 legal).
403	Internal modulation frequency out of range (1 to 500 kHz legal).
404	Command or query sent to empty channel (no module installed in channel).

POINTS OF INTEREST

The response data is a list of the current error codes represented by numbers and separated by commas. A response of zero indicates that there are no errors to report. The response is sent as character data. The error query should be directed to the mainframe or specific module by issuing the **CHan** command first.

When the error queue is active (errors exist), bit #7 in the Status Byte is set to one.

EXAMPLES

ERR?

0 there are no errors to report.

ERRORS?

403 the internal modulation frequency is out of range.

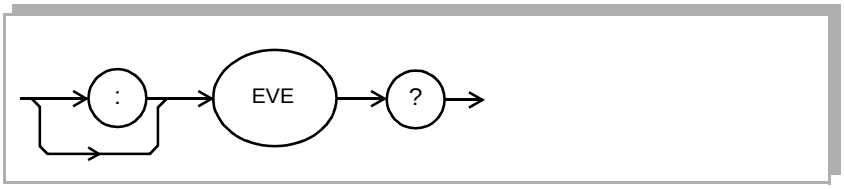
Front Panel **EVEnt?**

√ Remote

√ *FOM-7900B* *FOS-79800E* *FOS-79710* *DPM-79810*

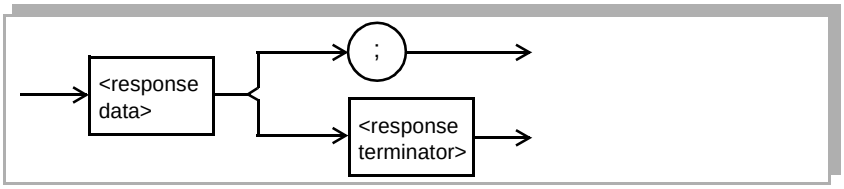
The **EVEnt?** query returns the value of the FOM-7900B status event register.

SYNTAX DIAGRAM



PARAMETERS None.

RESPONSE



where the response data is the binary sum of the following:

VALUE	RESPONSE	VALUE	RESPONSE
1	Not Used	256	Modulation ON/OFF
2	Not Used	512	Sources ON/OFF
4	Not Used	1024	Not Used
8	Not Used	2048	Not Used
16	Not Used	4096	Not Used
32	Not Used	8192	Not Used
64	Not Used	16384	Not Used
128	Not Used	32768	Not Used

POINTS OF INTEREST The events which are summarized in bit #0 of the Status Byte can be set by using the **ENABle:EVEnt** command. The event status register is cleared when this query is sent or when the ***CLS** command is issued. Refer to the Status reporting diagram in FIGURE 8-11.

EXAMPLES **EVE?**

256 internal modulation has been turned ON/OFF.

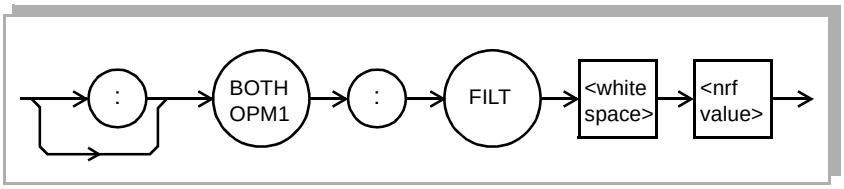
√ Front Panel _____**FILTer**

√ Remote

FOM-7900B *FOS-79800E* *FOS-79710* √ *DPM-79810*

The **BOTH:FILTer** and **OPM1:FILTer** commands set the number of samples to average a measurement over.

SYNTAX DIAGRAM



PARAMETERS An <nrf value>; 1 to 50.

POINTS OF INTEREST Increasing the filtering allows the module to average numerous samples before providing a measurement. This has the advantage of integrating out the affects of noisy signals. A value of 1 will provide a measurement every 150msec each increase in filter count will add an additional 150msec. Therefore when the filter setting is 50 it will take 7.5 seconds before a new reading is available.

EXAMPLES **BOTH:FILT 50**

Sets both optical power meters to average a reading over 50 individual measurement samples.

OPM1:FILT 1

Sets the first optical power meter to report each individual measurement sample without averaging.

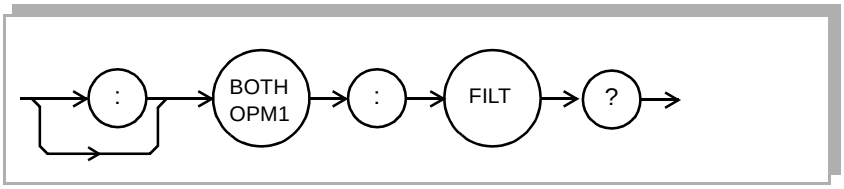
√ Front Panel _____**FILTer?**

√ Remote

FOM-7900B *FOS-79800E* *FOS-79710* √ *DPM-79810*

The **BOTH:FILTer?** and **OPM1:FILTer?** queries return the current filter settings.

SYNTAX DIAGRAM



PARAMETERS None. The response is an <nrf value>.

POINTS OF INTEREST A setting of 1 disables all filtering.

EXAMPLES **BOTH:FILT?**

1.0,1.0 Indicates both optical power meters have no filtering.

OPM1:FILT?

2 The user has requested to average a reading over 2 measurement samples.

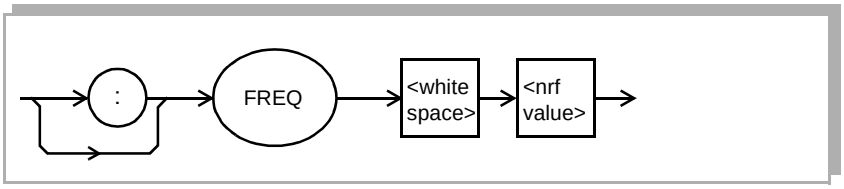
√ Front Panel **FREQuency**

√ Remote

√ *FOM-7900B* *FOS-79800E* *FOS-79710* *DPM-79810*

The **FREQuency** command is used to set the internal modulation frequency.

SYNTAX DIAGRAM



PARAMETERS The <nrf value> is a floating point value representing the internal modulation frequency in kHz.

POINTS OF INTEREST The internal modulation signal is common to all modules. This signal can be set between 1 kHz and 500 kHz.

EXAMPLES **FREQ 100.00**
sets the internal modulation frequency to 100.00 kHz.

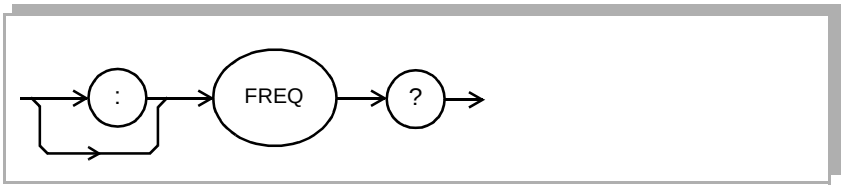
√ Front Panel **FREQuency?**

√ Remote

√ *FOM-7900B* *FOS-79800E* *FOS-79710* *DPM-79810*

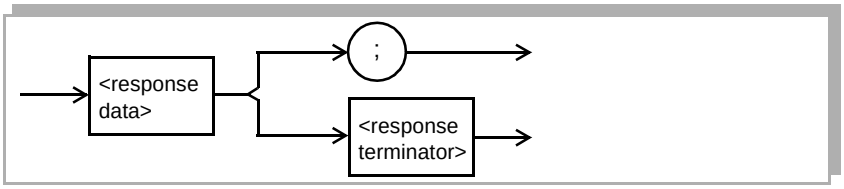
The **FREQuency?** query returns the modulation frequency in kHz.

SYNTAX DIAGRAM



PARAMETERS None.

RESPONSE



where the response data is a floating point value equal to the internal modulation frequency setpoint in kHz.

POINTS OF INTEREST The internal modulation signal is common to all modules. This signal can be set between 1 kHz and 500 kHz.

EXAMPLES **FREQ?**

3.50 means the modulation frequency is 3.50 kHz.

FREQUENCY?

100.00 means the modulation frequency is 100 kHz.

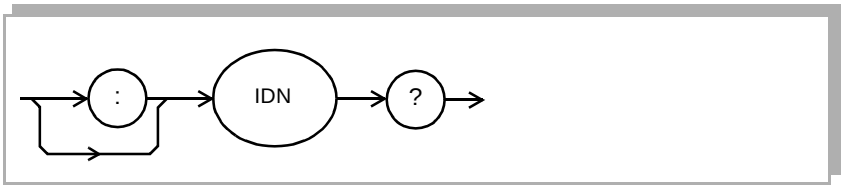
√ Front Panel **IDN?**

√ Remote

FOM-7900B √ *FOS-79800E* √ *FOS-79710* √ *DPM-79810*

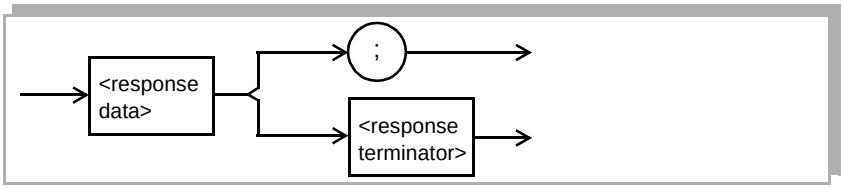
The IDN? query returns a string identifying the module, i.e. 79800E. With the DPM-79810 Dual Power Meter Module, the module serial number is also returned. For example the string 79810PP04 identifies the DPM-79810 Dual Power Meter Module with the module serial number PP04.

SYNTAX DIAGRAM



PARAMETERS None.

RESPONSE



POINTS OF INTEREST Use this command to verify the identification and location of each module.

This command has the same effect as repeatedly pressing the **PARAM** key until the module title parameter is displayed.

EXAMPLES **IDN?**

79800E means the module at the channel defined by the CHAN command is a 79800E Precision Fiber Optic Source Module.

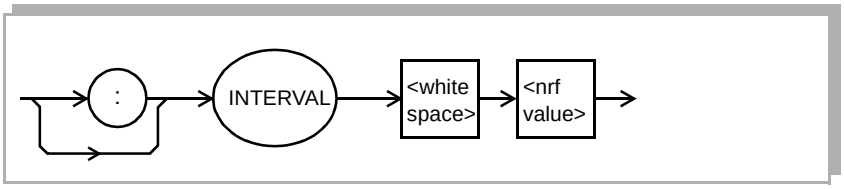
√ Front Panel **INTERVAL**

√ Remote

FOM-7900B *FOS-79800E* *√ FOS-79710* *DPM-79810*

The **INTERVAL** command sets the time interval used in the timer mode. When the time interval has elapsed, the module automatically moves the switch to the next port in the sequence array.

SYNTAX DIAGRAM



PARAMETERS The <nrf value> is the interval time value, in seconds.

POINTS OF INTEREST When the timer is enabled, the module will automatically move the switch position to the next port in the sequence at the rate determined by the timer interval. The switch sequence is described by the **SEQ:SWn** commands.

The time interval range is 1.00 to 60.00 seconds. The resolution of the timer itself is 10 ms, however, the absolute resolution of the switch is 16 ms.

EXAMPLES **INTERVAL 10.50**

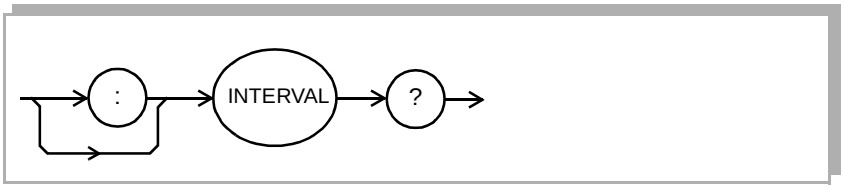
The interval timer is set to 10.50 seconds.

√	Front Panel	**INTERVAL?**
√	Remote	

FOM-7900B *FOS-79800E* √ *FOS-79710* *DPM-79810*

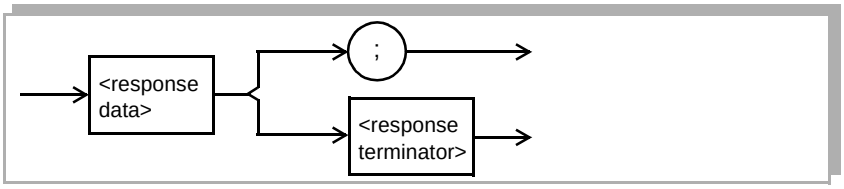
The **INTERVAL?** query returns the value of the internal timer, in seconds.

SYNTAX DIAGRAM



PARAMETERS None.

RESPONSE



where the <response data> represents the interval time value, in seconds.

POINTS OF INTEREST When the timer is enabled, the module will automatically move the switch position to the next switch in the sequence at the rate determined by the timer interval. The switch sequence is described in by the **SEQ:SWn** commands.

The time interval range is 1.00 to 60.00 seconds. The resolution of the timer is 10 ms, however, the absolute resolution is 16 ms.

EXAMPLES **INTERVAL?**

5.55 means the interval timer is set to 5.55 seconds.

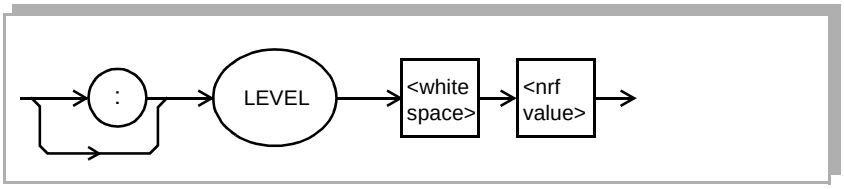
√ Front Panel **LEVEL**

√ Remote

FOM-7900B *√ FOS-79800E* *FOS-79710* *DPM-79810*

The **LEVEL** command sets the output power level from the fiber optic source.

SYNTAX DIAGRAM



PARAMETERS The <nrf value> is the power level in dBm.

POINTS OF INTEREST Use this command to set the output power in dBm. The source is enabled and disabled using the **OUT** command.

EXAMPLES **LEVEL -3.00**
The output power level is set to -3.00 dBm

LEVEL 1.50
The output power level is set to +1.50 dBm.

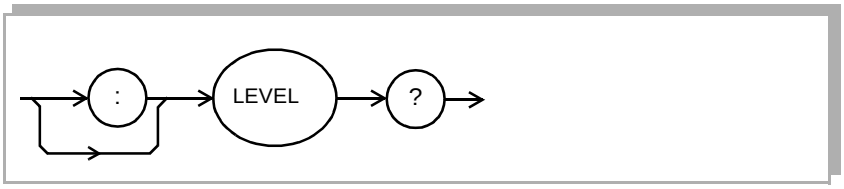
√ Front Panel **LEVEL?**

√ Remote

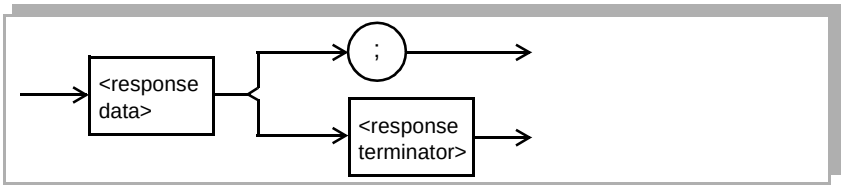
FOM-7900B *√ FOS-79800E* *FOS-79710* *DPM-79810*

The **LEVEL?** query returns the output power level setting.

SYNTAX DIAGRAM



RESPONSE



where the <response data> represents the set power level in dBm.

POINTS OF INTEREST This command returns the present output power level in dBm. The level is set with the **LEVEL** command.

EXAMPLES **LEVEL?**

-0.50 means the power level is -0.50 dBm.

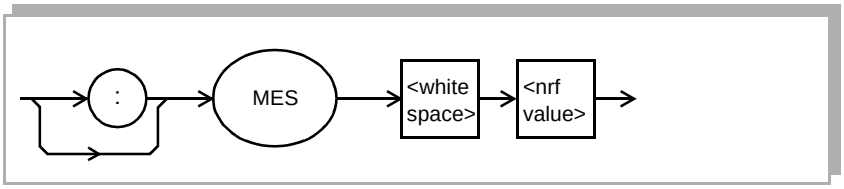
Front Panel **MESsage**

√ Remote

√ *FOM-7900B* *FOS-79800E* *FOS-79710* *DPM-79810*

The **MESsage** command allows the user to enter an ASCII string of up to 16 non-zero characters plus enclosing quotes. This command may be useful for storing messages which relate to a test or configuration.

SYNTAX DIAGRAM



PARAMETERS An ASCII string which is 1 to 16 bytes in length.

POINTS OF INTEREST The message may contain any ASCII character, but will be terminated when a NULL terminator character is received. If the message has less than 16 bytes, the FOM-7900B will fill the remaining message space with the space character. After 16 bytes have been entered, the FOM-7900B will null-terminate the string.

EXAMPLES **“MESSAGE “This is a test””**

The string, “This is a test” will be stored in non-volatile memory.

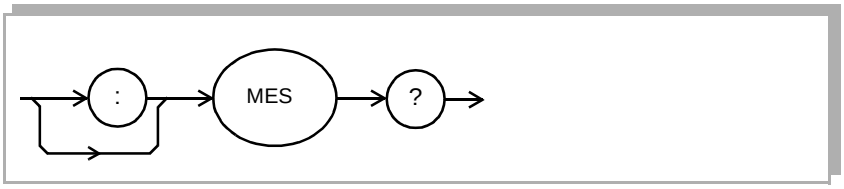
“MES “Test3””

The string, “Test3 “ will be stored in non-volatile memory.

	Front Panel			**MESsage?**
√	Remote			
√	*FOM-7900B*	*FOS-79800E*	*FOS-79710*	*DPM-79810*

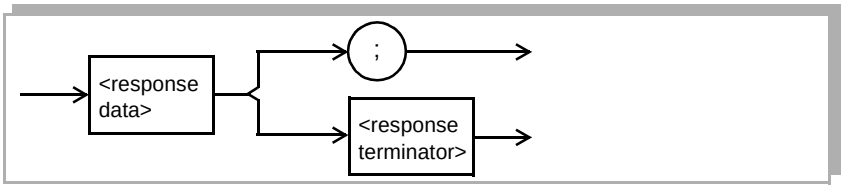
The **MESsage?** query returns the previously stored message. This message will always be 16 bytes long and enclosed in quotes. Do not include quotes when counting the characters.

SYNTAX DIAGRAM



PARAMETERS None.

RESPONSE



where the response data is an ASCII string, 16 bytes long.

POINTS OF INTEREST The response data will be a 16 byte long string. If there is no previously stored message, the response will be all spaces. The message is entered using the MESsage command.

EXAMPLES **“MES? ”**

“Test3 ” the previously stored message was “Test3”.

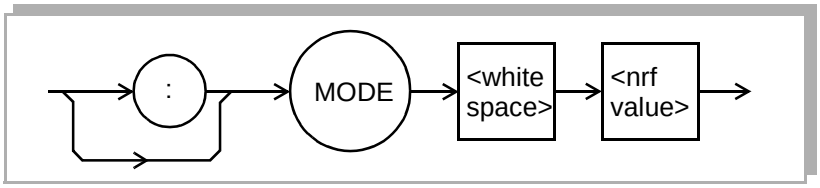
√ Front Panel **MODE**

√ Remote

FOM-7900B *FOS-79800E* *FOS-79710* *√ DPM-79810*

The **MODE** sets the optical power meters to operate in absolute or relative mode.

SYNTAX DIAGRAM



PARAMETERS An <nrf value>; 1 = Absolute, 2 = Relative (OPM1-OPM2), 3 = Relative (OPM2-OPM1).

POINTS OF INTEREST This feature only modifies how the front panel will display the measured power. All three measurements are available through GPIB regardless of the mode setting.

EXAMPLES **MODE 2**

Sets the front panel to display the difference in optical power between the first optical power meter and the second optical power meter.

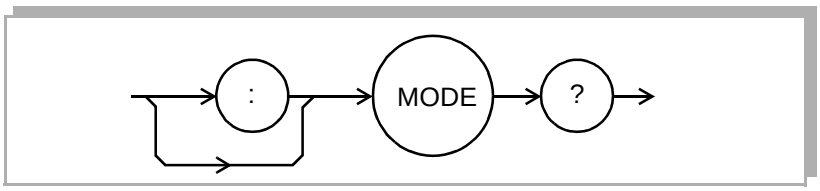
√ Front Panel **MODE?**

√ Remote

FOM-7900B *FOS-79800E* *FOS-79710* *√ DPM-79810*

The **MODE?** query returns the current mode of operation for the front panel displayed power.

SYNTAX DIAGRAM



PARAMETERS None. The response is an <nrf value>;

1 = Absolute
2 = Relative (OPM1-OPM2)
3 = Relative (OPM2-OPM1)

POINTS OF INTEREST This is a convenient method to verify that the mode has changed after issuing the mode command.

EXAMPLES **MODE?**
2 Indicates that module is displaying the difference in measured optical power of the first meter and the second meter (OPM1 - OPM2).

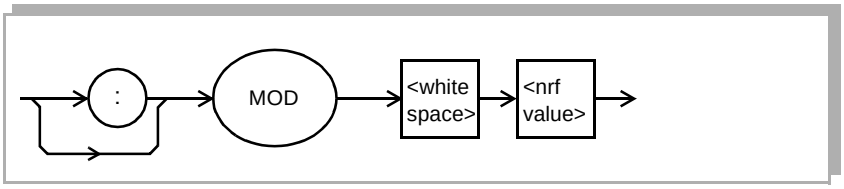
√ Front Panel **MODulation**

√ Remote

√ *FOM-7900B* *FOS-79800E* *FOS-79710* *DPM-79810*

The **MODulation** command is used to turn the internal modulation on or off.

SYNTAX DIAGRAM



PARAMETERS The <nrf> is a 1—ON or 0—OFF.

POINTS OF INTEREST This command is used to enable or disable the internal modulation in the selected mainframe.

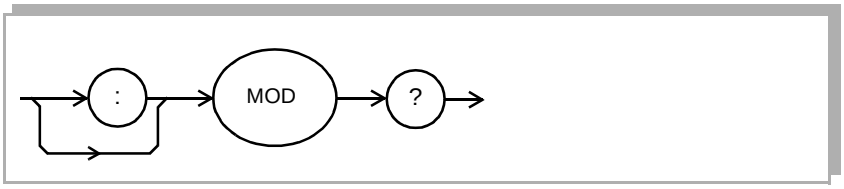
EXAMPLES **MOD 1**
turns the internal modulation on.

MODULATION ON
turns the internal modulation on.

√	Front Pane l	**MODulation?**
√	Remote	
√	*FOM-7900B* *FOS-79800E* *FOS-79710* *DPM-79810*	

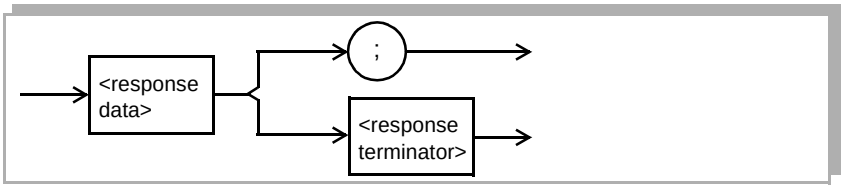
The **MODulation?** query returns the ON/OFF status of the internal modulation.

SYNTAX DIAGRAM



PARAMETERS None.

RESPONSE



where the response data is a 1—ON or 0—OFF

POINTS OF INTEREST Use **MODulation?** to verify the ON/OFF status of the internal modulation.

EXAMPLES **MOD?**

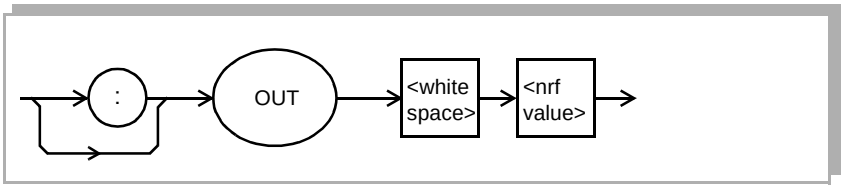
0 the FOM-7900B internal modulation is turned off.

√	Front Panel	**OUT**
√	Remote	

FOM-7900B √ *FOS-79800E* *FOS-79710* *DPM-79810*

The **OUT** command is used to turn the source on or off.

SYNTAX DIAGRAM



PARAMETERS The <nrf value> of **ON** or **1** to turn the laser on, **OFF** or **0** to turn the source off.

POINTS OF INTEREST If this command is sent to channel 0 or 9 then all sources within the mainframe are turned ON/OFF.

If sent to a specific module (1-8) in the mainframe, then only that channel is turned ON/OFF.

The green LED on the front of the module indicates the state of the source. When the output is turned on there is a three second safety startup. During the startup period the front panel ON LED blinks rapidly.

EXAMPLES **OUT 0**

Turns the laser source off.

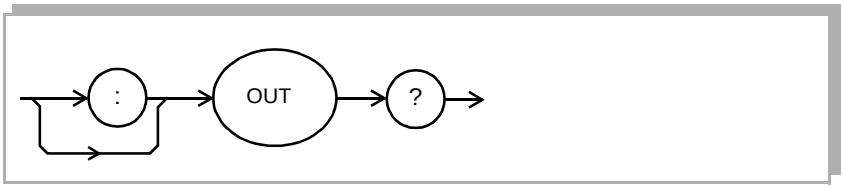
OUT ON

Turns the laser source on.

√	Front Panel	**OUTput?**
√	Remote	
√ *FOM-7900B*	√ *FOS-79800E* *FOS-79710*	*DPM-79810*

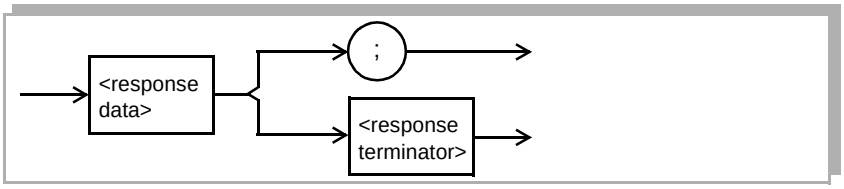
The OUTput? query returns the ON/OFF status of the sources.

SYNTAX DIAGRAM



PARAMETERS None.

RESPONSE



where the response data is a 1—ON or 0—OFF

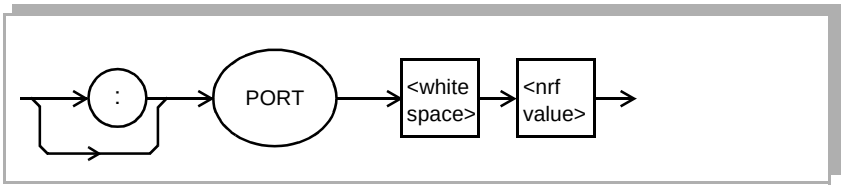
EXAMPLES **OUT?**

0 The selected channel is turned off.

√	Front Panel	**PORT**
√	Remote	
FOM-7900B	*FOS-79800E* √ *FOS-79710*	*DPM-79810*

The **PORT** command is used to switch any port to the common port.

SYNTAX DIAGRAM



PARAMETERS The <nrf value> is the port number to be switched to the common port.

POINTS OF INTEREST The <nrf value> can range from 0 to 4. Zero is the optically off position.

EXAMPLES **PORT 3**
Port #3 is switched to the common port.

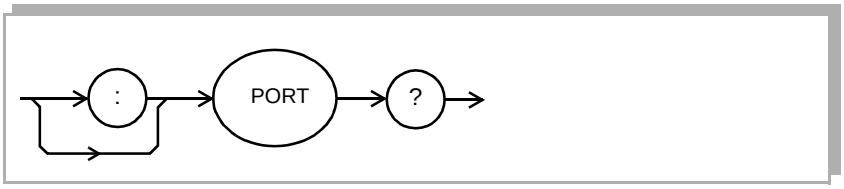
√ Front Panel **PORT?**

√ Remote

FOM-7900B *FOS-79800E* √ *FOS-79710* *DPM-79810*

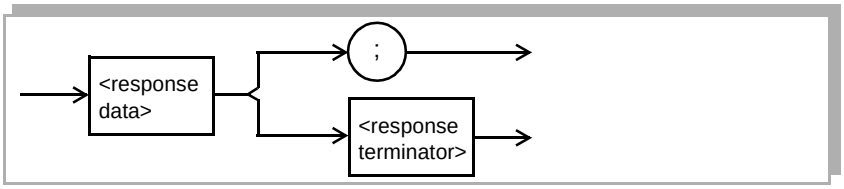
The **PORT** query returns the current port number that is switched to the common port.

SYNTAX DIAGRAM



PARAMETERS None.

RESPONSE



where the <response data> represents the port number.

POINTS OF INTEREST The response is the port number that is switched to the common port. Port zero is the optically off position.

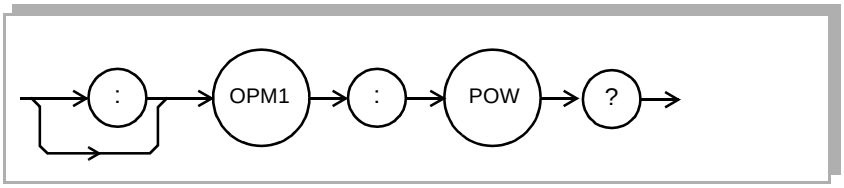
EXAMPLES **PORT**
0 The common port is switched to the optically terminated position.

√	Front Panel	_____**POWer?**
√	Remote	

FOM-7900B *FOS-79800E* *FOS-79710* √ *DPM-79810*

The **OPM1:POWer?** query returns the current optical power measurement reading.

SYNTAX DIAGRAM



PARAMETERS None. The response is an <nrf value>.

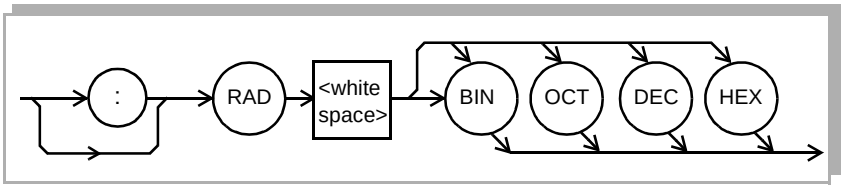
POINTS OF INTEREST In dBm mode, the response will be indicated with a suffix of DBM. The response time for new readings is dependant on the filter setting.

EXAMPLES **OPM1:POW? 2.79565E-006**
The mode for the first optical power meter is set to WATTS and the measured optical power is 2.79565µW.

	Front Panel			**RADix**
√	Remote			
√	*FOM-7900B*	*FOS-79800E*	*FOS-79710*	*DPM-79810*

The **RADix** command allows the programmer to select the radix type for status, condition, and event query response data. Decimal, binary, hexadecimal, and octal are allowed.

SYNTAX DIAGRAM



PARAMETERS Character program data is expected, as shown above.

POINTS OF INTEREST **DECimal** is the default type. Only the first three letters of the words decimal, hexadecimal, binary, or octal are required.

When the **RADIX** is selected, all status, condition, and event queries will return values in the new radix. In the cases where the radix is not **DECimal**, the flexible numeric type <nrf value> (as shown in the Command Reference diagrams) will be replaced by **HEX**, **BIN**, or **OCT** representation.

All of the above radixes may be used to enter program data at any time, without the need for issuing the **RADix** command. The proper prefix must also be used with Hex (#H), binary (#B), or octal (#O).

This command may be useful for setting up status reporting blocks. The bit-wise status representation may be more easily read in BIN, HEX, or OCT.

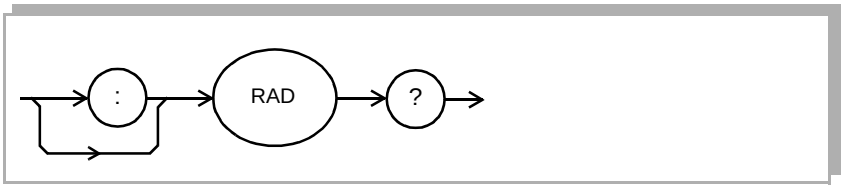
EXAMPLES **RAD DEC**
the decimal radix is selected.

rad hex; *ESR
#H80 hexadecimal radix is selected and power on was detected.

	Front Panel			**RADix?**
√	Remote			
√	*FOM-7900B*	*FOS-79800E*	*FOS-79710*	*DPM-79810*

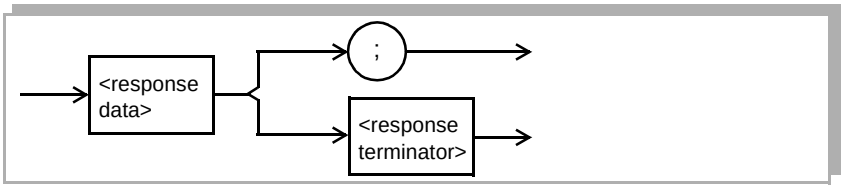
The **RADix?** query allows the programmer to determine which radix type for status, condition, and event query response data is currently selected. Decimal, binary, octal, and hexadecimal are allowed.

SYNTAX DIAGRAM



PARAMETERS None.

RESPONSE



where the character response data of **DEC** means decimal, **BIN** means binary, **HEX** means hexadecimal, and **OCT** means octal.

POINTS OF INTEREST **DEC** is the default type. The **RADix** command is used to select the form which GPIB status registers are returned (Binary, Octal, Decimal or Hexadecimal). Once changed, the new radix will remain in effect until the power is shut off or a new **RADix** command is issued.

EXAMPLES

RAD?
Dec The selected radix is decimal.

RADIX?
Hex The selected radix is hexadecimal.

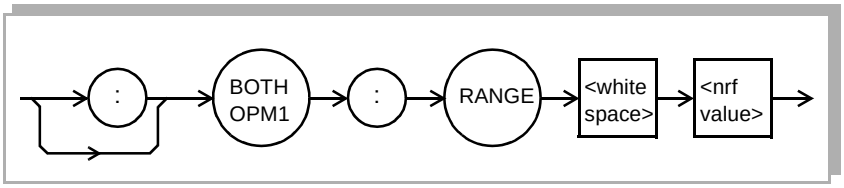
√ Front Panel _____**RANGE**

√ Remote

FOM-7900B *FOS-79800E* *FOS-79710* *√ DPM-79810*

The **BOTH:RANGE** and **OPM1:RANGE** commands set the optical power meter to a given measurement range or set the optical power meter to autorange.

SYNTAX DIAGRAM



PARAMETERS An <nrf value>; 0 to 8.

POINTS OF INTEREST The available range settings are AUTO, 1W, 100mW, 10mW, 1mW, 100µW, 10µW, 1µW and 100nW mapped respectively to the values 0 to 8. When AUTO is selected the optical power meter automatically changes to the appropriate range setting based on the measured power. The user can force the meter to a fixed maximum range by entering one of the eight available power ranges.

EXAMPLES **BOTH:RANGE 0**

Sets both optical power meters to automatically set their range based on the measured optical input power.

OPM1:RANGE 1

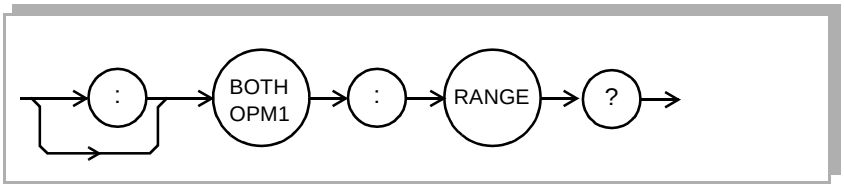
Sets the first optical power meter to the 1 Watt range for measuring optical power in the range of 1Watt to 100milliwatts.

√	Front Panel	_____**RANGE?**
√	Remote	

FOM-7900B *FOS-79800E* *FOS-79710* √ *DPM-79810*

The **BOTH:RANGE?** and **OPM1:RANGE?** queries return the current optical power measurement range setting.

SYNTAX DIAGRAM



PARAMETERS None. The response is an <nrf value> 0 to 8.

POINTS OF INTEREST The available range settings are AUTO, 1W, 100mW, 10mW, 1mW, 100µW, 10µW, 1µW and 100nW mapped respectively to the values 0 to 8. When AUTO is selected the optical power meter automatically changes to the appropriate range setting based on the measured power. The user can force the meter to a fixed range maximum range by entering one of the eight available power ranges.

EXAMPLES

BOTH:RANGE? 0,0

Indicates that both optical power meters are set to automatically range based on their measured optical input power.

OPM1:RANGE? 1

The range for the first optical power meter is fixed to measure optical powers in the range from 1Watt to 100milliwatts.

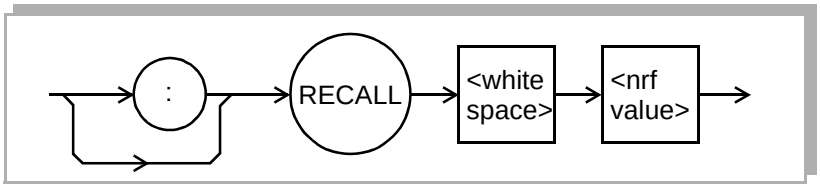
√ Front Panel _____**:RECALL**

√ Remote

FOM-7900B *FOS-79800E* *FOS-79710* √ *DPM-79810*

The **OPM1:RECALL** command restores the user settings for the selected optical power meter stored at the indicated bin location.

SYNTAX DIAGRAM



PARAMETERS An <nrf value>; values 1 - 10 indicating the storage bin.

POINTS OF INTEREST The user can restore stored settings that have been previously been saved to a storage bin. It will be necessary for the user to remember where each of the desired settings have been previously saved.

EXAMPLES **OPM1:RECALL 1**

Restores the user settings for the first optical power meter previously stored in bin number 1.

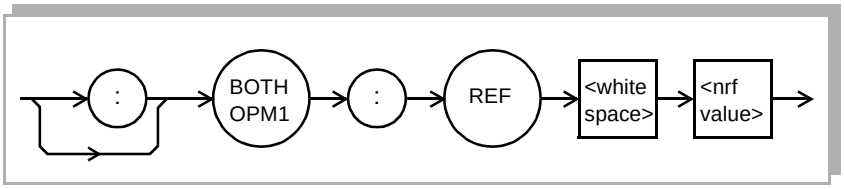
√ Front Panel _____**:REFerence**

√ Remote

FOM-7900B *FOS-79800E* *FOS-79710* √ *DPM-79810*

The **BOTH:REFerence** and **OPM1:REFerence** commands enable or disable a reference measurement in which the optical power meters measures a delta in optical power. The established reference power will be measured and stored when the reference command “ON” is received and the remaining measurements will be reported as the delta in the current optical power and stored reference optical power.

SYNTAX DIAGRAM



PARAMETERS An <nrf value>; 1 = on (enabled), 0 = off (disabled).

POINTS OF INTEREST The reference value is stored when power is turned off. Please note when operating in this mode the reported measurement will be a difference in power, if this mode is being used and the user is not aware of the fact the readings will appear to be erroneous.

EXAMPLES **BOTH:REF 1**

Sets both optical power meters to report the subsequent measurements as a difference in optical power from the current optical power.

OPM1:REF 0

Disables the first optical power meter from measuring the optical power as a difference from the reference optical power.

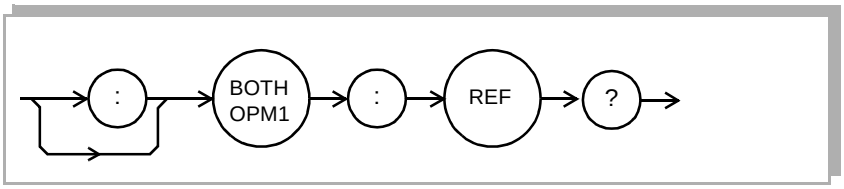
√ Front Panel **_____:REFerence?**

√ Remote

FOM-7900B *FOS-79800E* *FOS-79710* √ *DPM-79810*

The **BOTH:REFerence?** and **OPM1:REFerence?** queries return the current state of the optical reference.

SYNTAX DIAGRAM



PARAMETERS None. The response is an <nrf value>; 1 = on (enabled), 0 = off (disabled).

POINTS OF INTEREST Care must exercised in knowing when the reference command is enabled. Making measurements in reference mode and not expecting referenced results will lead to erroneous measurements.

EXAMPLES **BOTH:REF? 0,0**

Indicates that both optical power meters are not operating in reference mode.

OPM1:REF? 1

The first optical power meter is operating in reference mode.

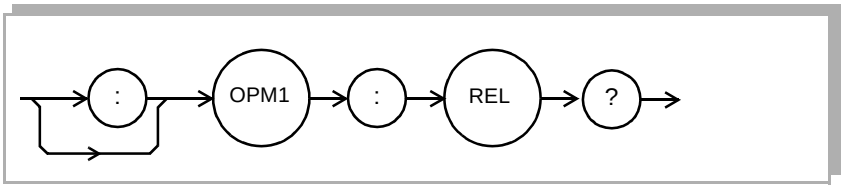
√ Front Panel **_____:RELative?**

√ Remote

FOM-7900B *FOS-79800E* *FOS-79710* √ *DPM-79810*

The **OPM1:RELative?** query returns the current optical power difference between the first optical power meter and the second optical power meter.

SYNTAX DIAGRAM



PARAMETERS None. The response is an <nrf value>.

POINTS OF INTEREST When using OPM2 with this command, the optical power will be reported as the difference between the second optical power meter and the first optical power meter. In dBm mode, the response will be indicated with a suffix of DB.

EXAMPLES **OPM1:REL? -13.584DB**

Indicates that the mode for first optical power meter is set to DBM and the measured optical power between OPM1 and OPM2 is -13584dB.

OPM1:REL? 2.79565E-006

The mode for the first optical power meter is set to WATTS and the measured optical power between OPM1 and OPM2 is 2.79565mW.

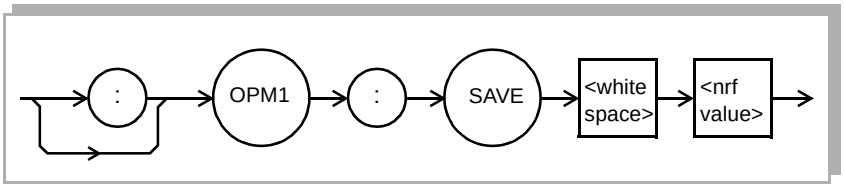
√ Front Panel **_____:SAVE**

√ Remote

FOM-7900B *FOS-79800E* *FOS-79710* *√ DPM-79810*

The **OPM1:SAVE** command stores the user settings for the selected optical power meter to a storage bin for recall and use latter.

SYNTAX DIAGRAM



PARAMETERS An <nrf value>; values 1 - 10 indicating the storage bin.

POINTS OF INTEREST This feature allows users to save their specific settings to be recalled and used at a latter time. The user must remember which of the ten bins in which the settings have been saved.

EXAMPLES **OPM1:SAVE 1**

Saves the current user settings for the first optical power meter to storage bin number 1.

Front Panel **SECURE**

√ Remote

√ FOM-7900B *FOS-79800E* *FOS-79710* *DPM-79810*

The **SECURE** command allows the service technician access to the protected user data command, *PUD. This data is normally changed at the factory so the **SECURE** command is not needed by the user.

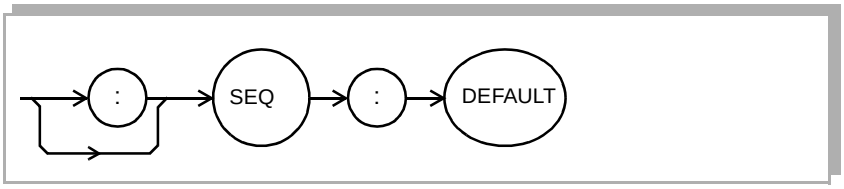
√ Front Panel **SEQ:DEFAULT**

√ Remote

FOM-7900B *FOS-79800E* *√ FOS-79710* *DPM-79810*

The **SEQ:DEFAULT** command initializes the switch sequence array to its default sequence.

SYNTAX DIAGRAM



PARAMETERS None.

POINTS OF INTEREST This command initializes the trigger/timer switch sequence array to the following default sequence:

$1 \rightarrow 2 \rightarrow 3 \rightarrow 4$

EXAMPLES **SEQ:DEFAULT**
Initializes the trigger/timer switch sequence.

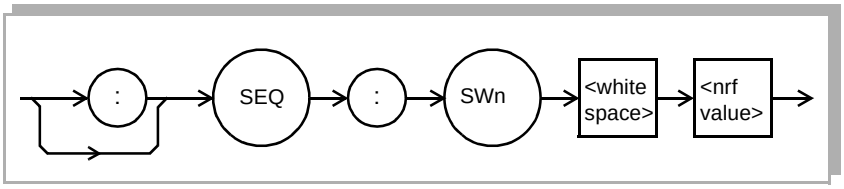
√ Front Panel **SEQ:SWn**

√ Remote

FOM-7900B *FOS-79800E* *√ FOS-79710* *DPM-79810*

The **SEQ:SWn** command is used to set the nth switch position in the trigger/timer sequence array, where the array index n is between 1 and 4.

SYNTAX DIAGRAM



PARAMETERS n is the array index value, between 1 and 4. The <nrf value> is the port value, between 0 and 4, where zero denotes the optically off position.

POINTS OF INTEREST Use this command to customize the switch sequence for the external trigger or internal timer modes. This command places the port number into the nth position in the switch sequence array. Entering a value here does not change the current switch position but merely places the new switch into the sequence array.

EXAMPLES **SEQ:SW1 3**

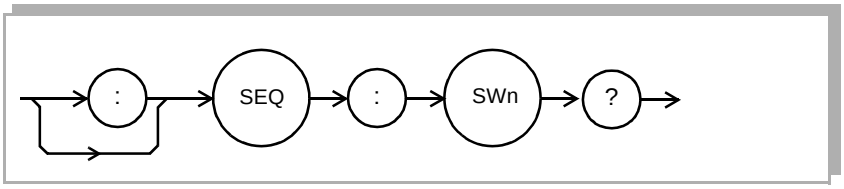
Places port 3 into the first position in the sequence array.

√	Front Panel	**SEQ:SWn?**
√	Remote	

FOM-7900B *FOS-79800E* √ *FOS-79710* *DPM-79810*

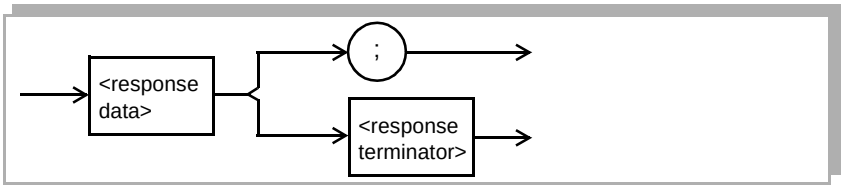
The **SEQ:SWn?** query returns the port number that is in the nth position in the switch sequence array.

SYNTAX DIAGRAM



PARAMETERS None. The value n is the switch sequence array index, between 1 and 4.

RESPONSE



where the <response data> represents the port number in the nth position of the switch sequence array.

POINTS OF INTEREST Use this command to query the port number in the nth position of the trigger/timer switch sequence array.

EXAMPLES **SEQ:SW3?**

2 Port 2 is in the third position of the switch sequence array.

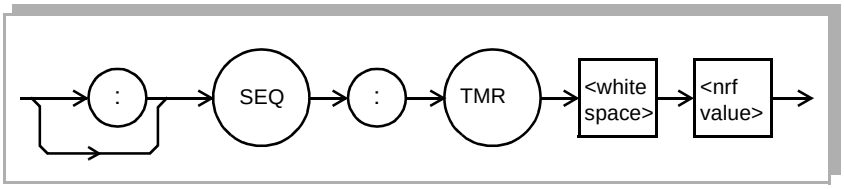
√ Front Panel **SEQ:TMR**

√ Remote

FOM-7900B *FOS-79800E* *√ FOS-79710* *DPM-79810*

The **SEQ:TMR** command is used to enable or disable the interval timer mode

SYNTAX DIAGRAM



PARAMETERS The <nrf value> is a 1 or a 0 to enable or disable the interval timer.

POINTS OF INTEREST Use this command to enable or disable the automatic switching of the built-in timer. When the timer is enabled the module will automatically move the switch position to the next port in the trigger/timer sequence at the rate determined by the timer interval set by the **INTERVAL** command.

EXAMPLES **SEQ:TMR 0**
Timer mode is disabled.

SEQ:TMR ON
Timer mode is enabled.

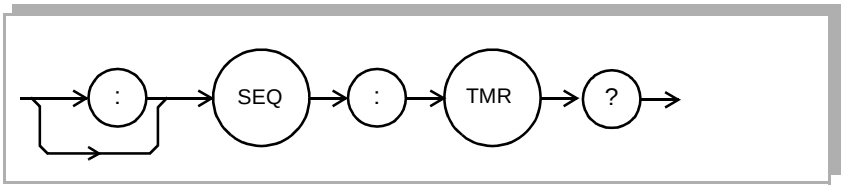
√ Front Panel **SEQ:TMR?**

√ Remote

FOM-7900B *FOS-79800E* *√ FOS-79710* *DPM-79810*

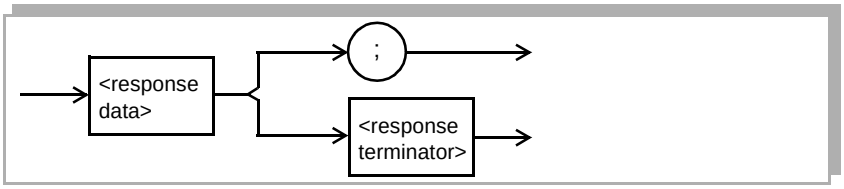
The **SEQ:TMR?** query returns the state of the timer mode (enabled or disabled).

SYNTAX DIAGRAM



PARAMETERS None.

RESPONSE



where the <response data> is a 0 or 1 if the timer mode is disabled or enabled.

POINTS OF INTEREST Use this command to query the status of the timer mode. When the timer is enabled the module will automatically move to the next port in the sequence at the rate determined by the **INTERVAL** command.

EXAMPLES **SEQ:TMR?**
0 Timer mode is disabled.

SEQ:TMR?
1 Timer mode is enabled.

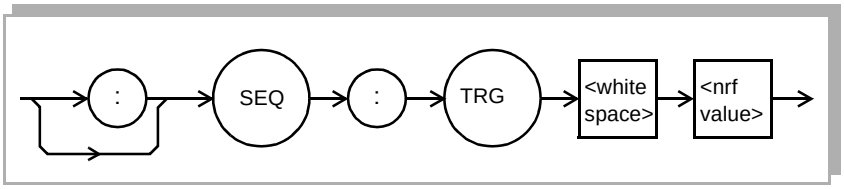
√ Front Panel **SEQ:TRG**

√ Remote

FOM-7900B *FOS-79800E* √ *FOS-79710* *DPM-79810*

The **SEQ:TRG** command is used to enable or disable the external trigger mode

SYNTAX DIAGRAM



PARAMETERS The <nrf value> is a 1 or a 0 to enable or disable the external trigger.

POINTS OF INTEREST Use this command to enable or disable the effects of the external trigger signal. When the external trigger is enabled the module will automatically move the switch position to the next switch in the sequence whenever a trigger signal is received at the FOM-7900B rear panel or when the **TRIG** command is sent through GPIB.

EXAMPLES **SEQ:TRG 0**
The external trigger is disabled.

SEQ:TRG ON
The external trigger is enabled.

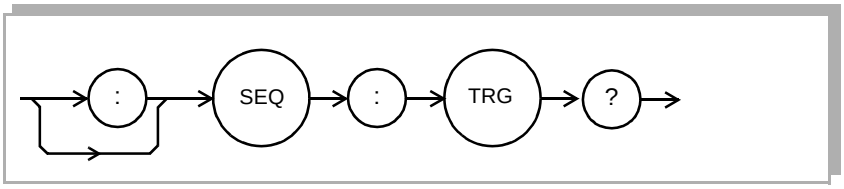
√ Front Panel **SEQ:TRG?**

√ Remote

FOM-7900B *FOS-79800E* √ *FOS-79710* *DPM-79810*

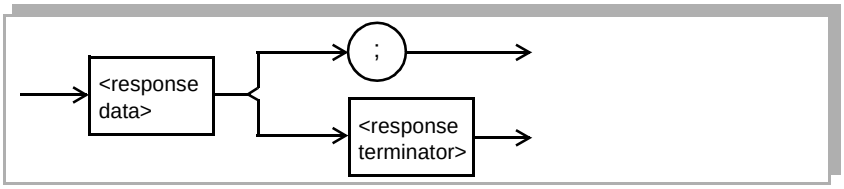
The **SEQ:TRG** query returns the state of the external trigger mode (enabled or disabled).

SYNTAX DIAGRAM



PARAMETERS None.

RESPONSE



where the <response data> is a 0 or 1 if the external trigger is disabled or enabled.

POINTS OF INTEREST Use this command to query the status of the external trigger. When the trigger is enabled the module will automatically move to the next switch in the sequence whenever a trigger signal is received at the FOM-7900B rear panel or whenever the TRIG command is sent through GPIB.

EXAMPLES **SEQ:TRG?**
0 The external trigger mode is disabled.

SEQ:TRG?
1 The external trigger mode is enabled.

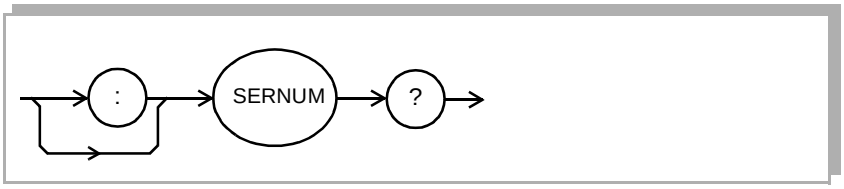
Front Panel **SERNUM?**

√ Remote

FOM-7900B *√ FOS-79800E* *FOS-79710* *DPM-79810*

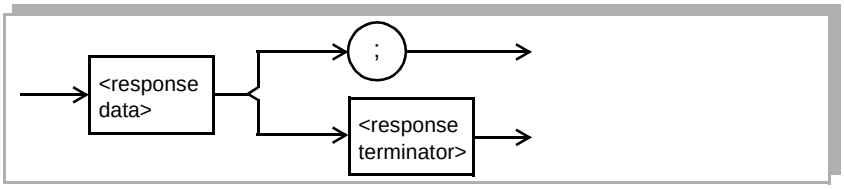
The SERNUM? query returns the serial number of the source module. To query the mainframe serial number, refer to the common command *IDN?, on page 8-16. To query the power meter serial number, refer to the device dependent command IDN? on page 9-28.

SYNTAX DIAGRAM



PARAMETERS None

RESPONSE



where the response data is the serial number of the module

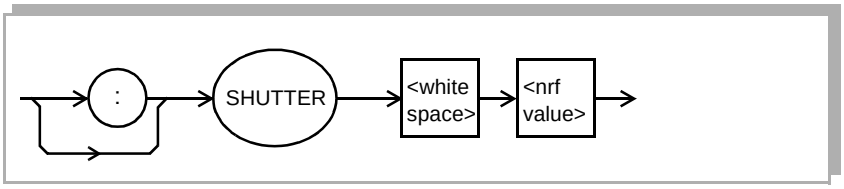
EXAMPLES **SERNUM?**
F109 The module serial number if F109

√ Front Panel **SHUTTER**

√ Remote

FOM-7900B *√ FOS-79800E* *FOS-79710* *DPM-79810*

SYNTAX DIAGRAM



PARAMETERS The <nrf value> is the desired state of the source shutter 1—ON for open and 0—OFF for shut.

POINTS OF INTEREST Use this command to set the state of the source shutter. The laser is energized by using the **OUT** command. The laser must be energized and the source shutter must be open for light to emit from the connector.

EXAMPLES **SHUTTER ON**
The source shutter is opened.

SHUTTER 1
The source shutter is opened.

SHUTTER OFF
The source shutter is shut.

SHUTTER 0
The source shutter is shut.

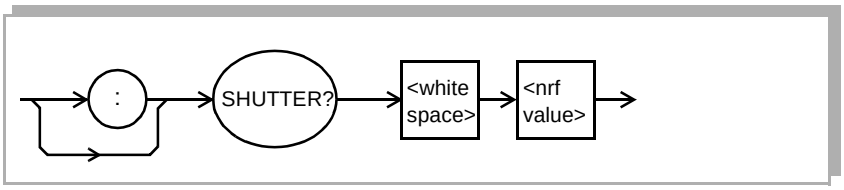
√ Front Panel **SHUTTER?**

√ Remote

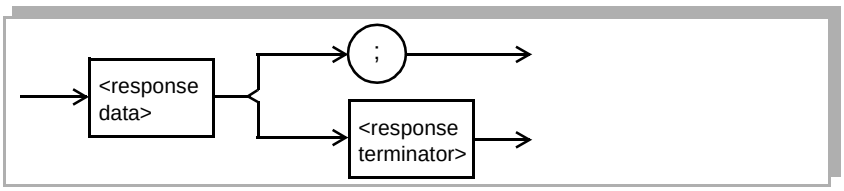
FOM-7900B *√ FOS-79800E* *FOS-79710* *DPM-79810*

The **SHUTTER?** query returns the state of the source shutter, 1 for open and 0 for shut. The **SHUTTER** command is used to open and shut the source shutter option. The normal state upon power up of the source shutter is OPEN.

SYNTAX DIAGRAM



RESPONSE



where the <response data> represents the state of the source shutter 1 for OPEN and 0 for SHUT.

POINTS OF INTEREST This command returns state of the source shutter. The state of the shutter is set with the **SHUTTER** command and the laser is energized with the **OUT** command.

EXAMPLES **SHUTTER?**
1 means the source shutter is open.

SHUTTER?
0 means the source shutter is shut.

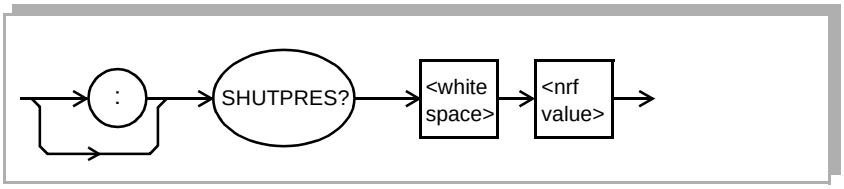
√ Front Panel **SHUTPRES?**

√ Remote

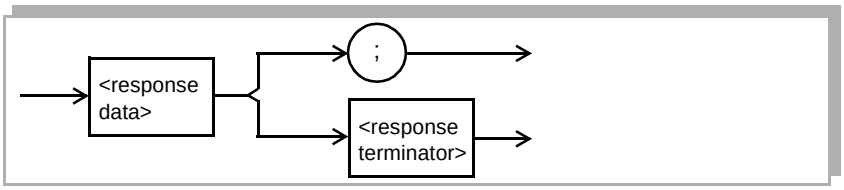
FOM-7900B *√ FOS-79800E* *FOS-79710* *DPM-79810*

The **SHUTPRES?** query is used to determine if a shutter has been installed in a module (present or not present). The **SHUTTER?** query returns the state of the source shutter (open or shut). The **SHUTTER** command is used to open and shut the source shutter option. The normal state upon power up of the source shutter is open.

SYNTAX DIAGRAM



RESPONSE



where the <response data> represents the presence of the source shutter 1 for installed and 0 for not installed.

POINTS OF INTEREST This command returns presence of the source shutter. The state of the shutter is set with the **SHUTTER** command and the laser is energized with the **OUT** command.

EXAMPLES **SHUTPRES?**
1 means the source shutter option is installed.

SHUTPRES?
0 means the source shutter option is not installed.

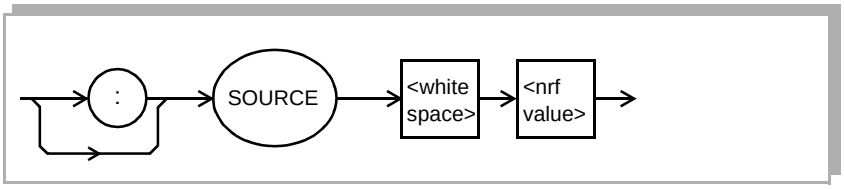
√ Front Panel **SOURCE**

√ Remote

√ *FOM-7900B* *FOS-79800E* *FOS-79710* *DPM-79810*

The **SOURCE** command is used to select the modulation source as INTERNAL or EXTERNAL.

SYNTAX DIAGRAM



PARAMETERS The <nrf> is a 0 for internally generated modulation or a 1 for external modulation.

POINTS OF INTEREST This command is used to select the source of the modulation signal that goes to each module. INTERNAL modulation is generated within the FOM-7900B Mainframe. EXTERNAL modulation is provided to the mainframe through a rear panel BNC connector.

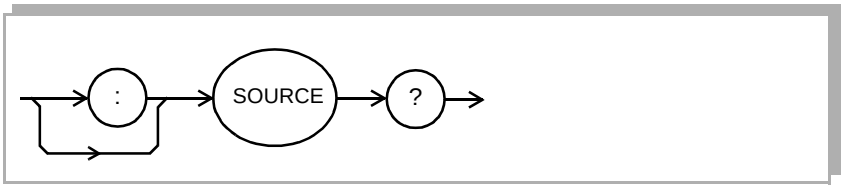
EXAMPLES **SOURCE 0**
The modulation source is internal.

SOURCE 1
The modulation source is external.

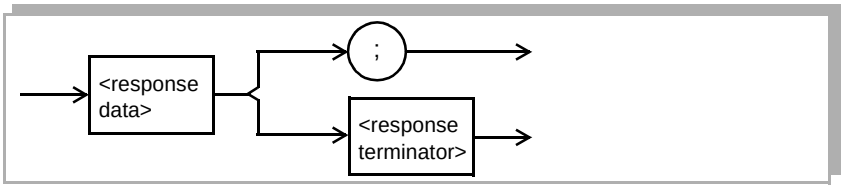
√	Front Panel	**SOURCE?**
√	Remote	
√ *FOM-7900B*	*FOS-79800E* *FOS-79710* *DPM-79810*	

The **SOURCE?** query returns the source of the modulation signal as either internal or external.

SYNTAX DIAGRAM



RESPONSE



where the response data is a 0 for internal and a 1 for external modulation source.

POINTS OF INTEREST Use **SOURCE?** to verify the source of the modulation signal as internal or external.

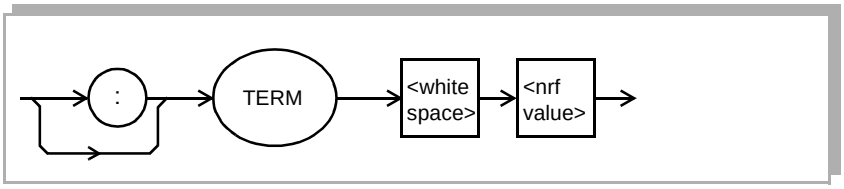
EXAMPLES **SOURCE?**

0 The source of the modulation signal is internal.

	Front Panel			**TERM**
√	Remote			
√ *FOM-7900B*	*FOS-79800E*	*FOS-79710*	*DPM-79810*	

The **TERM** command is used to add a carriage return to GPIB response termination from the FOM-7900B.

SYNTAX DIAGRAM



PARAMETERS The <nrf> is a 1 (true) or 0 (false).

POINTS OF INTEREST The IEEE-488.2 standard for GPIB requires all commands and responses to be terminated with [LF][EOI]. The FOM-7900B is IEEE-488.2 compliant, however, some older GPIB control cards still expect the termination sequence to be [CR][LF][EOI]. Sending the TERM TRUE command will add a carriage return to the termination sequence. TERM FALSE will remove the carriage return from the termination.

EXAMPLES

TERM TRUE

The GPIB termination sequence is [CR][LF][EOI].

TERM FALSE

The GPIB termination sequence is [LF][EOI].

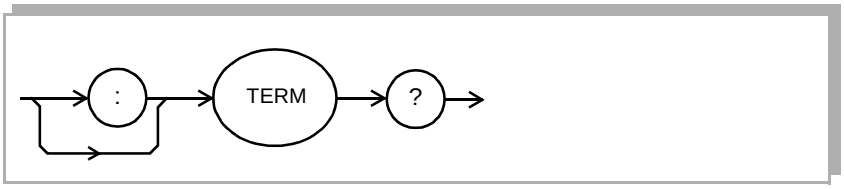
Front Panel **TERM?**

√ Remote

FOM-7900B *FOS-79800E* *FOS-79710* *DPM-79810*

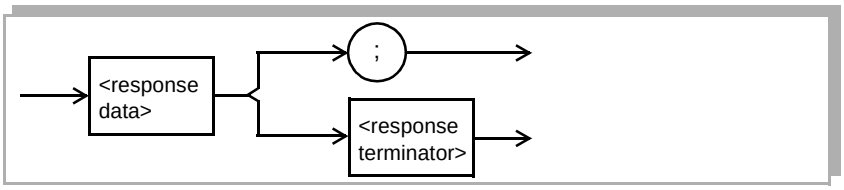
The **TERM?** query returns a 1 if the GPIB response terminator is [CR][LF][EOI] and returns a 0 if the response terminator is [LF][EOI].

SYNTAX DIAGRAM



PARAMETERS None.

RESPONSE



where the response data is a 1—ON or 0—OFF.

POINTS OF INTEREST Use **TERM?** to verify the state of the GPIB termination characters.

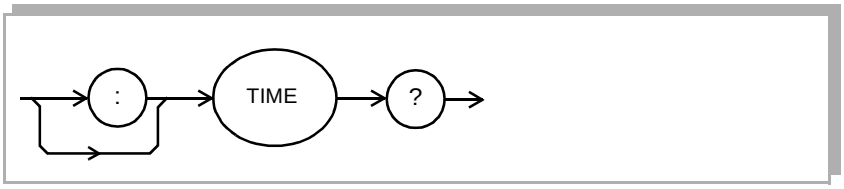
EXAMPLES **TERM?**

0 GPIB response terminator is [LF][EOI] which is the IEEE-488.2 standard.

	Front Panel	**TIME?**
√	Remote	
√	*FOM-7900B* *FOS-79800E* *FOS-79710* *DPM-79810*	

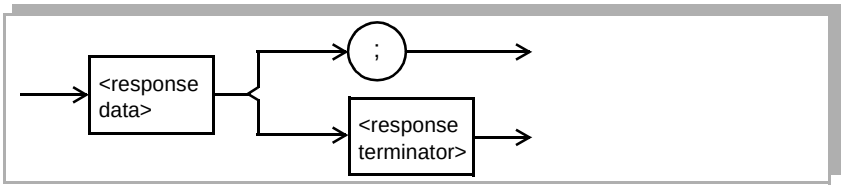
The **TIME?** query allows the programmer to determine how much time has passed since the FOM-7900B System was last powered up.

SYNTAX DIAGRAM



PARAMETERS None.

RESPONSE



where the response is character data in the form: hours:minutes:seconds.

POINTS OF INTEREST The TIME clock is independent of the TIMER clock.

The clock “turns over” after approximately 1193 hours.

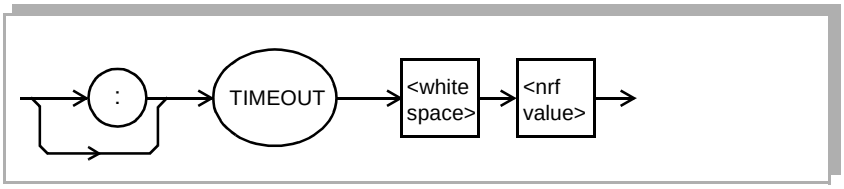
EXAMPLES **TIME?**

0:01:02.36 1 minute and 2.36 seconds have passed since the FOM-7900B was powered up.

	Front Panel			**TIMEOUT**
√	Remote			
√	*FOM-7900B*	*FOS-79800E*	*FOS-79710*	*DPM-79810*

The **TIMEOUT** command selects a time-out value (in milliseconds) to use in detecting other 7900 systems in a banked RS232 configuration. If a particular channel does not respond to a query within this time, the query response “Bank not found: <banknumber>” will be returned. The default value for the time-out is 10000 milliseconds (10 seconds).

SYNTAX DIAGRAM



PARAMETERS The <nrf value> is an integer between 0 and 2,147,483,647..

EXAMPLES

TIMEOUT 20000
remote unit response time-out is set to 20 seconds

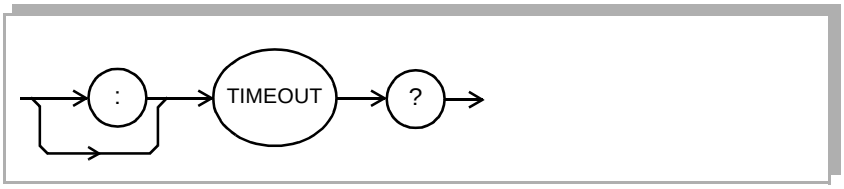
TIMEOUT 500
remote unit response time-out is set to 1/2 second

TIMEOUT 10000
remote unit response time-out is set to the default of 10 seconds

	Front Panel			**TIMEOUT?**
√	Remote			
√	*FOM-7900B*	*FOS-79800E*	*FOS-79710*	*DPM-79810*

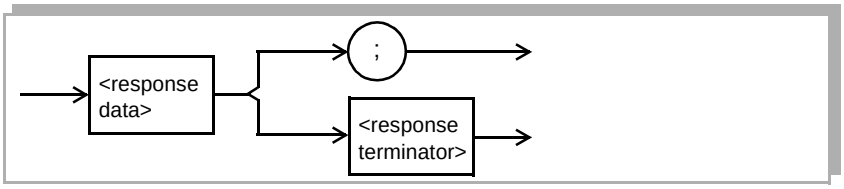
The **TIMEOUT?** query is used to determine which the query response time-out for banked remote units.

SYNTAX DIAGRAM



PARAMETERS None.

RESPONSE



where the response data is an integer between 0 and 2,147,483,647 representing the response time-out in milliseconds.

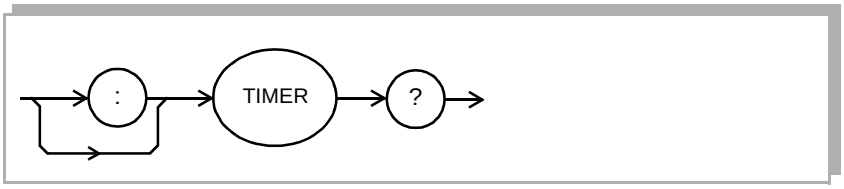
EXAMPLES **TIMEOUT**

15000 Query response time-out is 15 seconds.

	Front Panel			**TIMER?**
√	Remote			
√	*FOM-7900B*	*FOS-79800E*	*FOS-79710*	*DPM-79810*

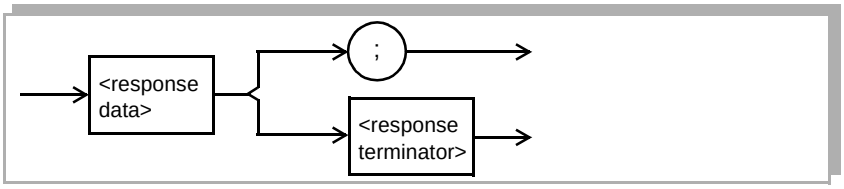
The **TIMER?** query allows the programmer to determine how much time has passed since the last **TIMER?** query was issued.

SYNTAX DIAGRAM



PARAMETERS None.

RESPONSE



where the response is character data in the form: hours:minutes:seconds.

POINTS OF INTEREST Each time the **TIMER?** query is issued, the timer is reset to 00:00:00.0 and the elapsed time since the last **TIMER?** query is returned. The timer counter is initialized at power-up. The first time the **TIMER?** query is issued its response is the same as the **TIMER?** query. The clock “turns over” after about 1193 hours.

EXAMPLES **TIMER?**

6:24:59.06 6 hours, 24 minutes, 59.06 seconds have passed since the last **TIMER?** query was issued.

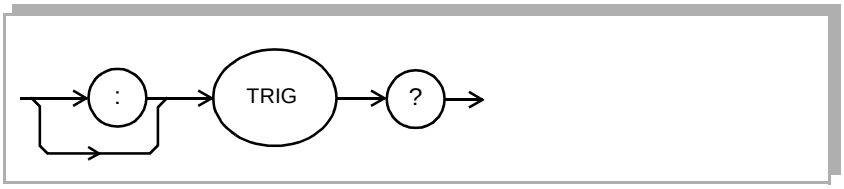
Front Panel **TRIGger**

√ Remote

√ *FOM-7900B* *FOS-79800E* *FOS-79710* *DPM-79810*

The **TRIGger** command activates the trigger signal down the backplane of the FOM-7900B mainframe and triggers all compatible modules.

SYNTAX DIAGRAM



PARAMETERS None.

POINTS OF INTEREST The trigger signal will be sent to all modules within a FOM-7900B mainframe. The signal will be present at the **TRIGGER OUT** connector on the back panel. Refer to individual chapter on modules for details regarding how the trigger affects each module.

EXAMPLES **TRIG**

Triggers all compatible modules in a FOM-7900B mainframe.

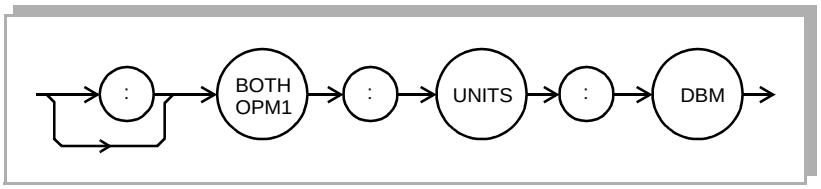
√ Front Panel **_____:UNITS:DBM**

√ Remote

FOM-7900B *FOS-79800E* *FOS-79710* √ *DPM-79810*

The **BOTH:UNITS:DBM** and **OPM1:UNITS:DBM** commands enable or disable the reporting of optical power measurements in dB or dBm.

SYNTAX DIAGRAM



PARAMETERS An <nrf value>; 1 = on (enabled), 0 = off (disabled).

POINTS OF INTEREST When the dBm units are disabled the optical measurements are reported in their default unit of Watts.

EXAMPLES **BOTH:UNITS:DBM 1**

Sets both optical power meters to report the subsequent measurements in dBm or dB units.

OPM1:UNITS:DBM 0

Disables the first optical power meter from reporting measurements in dBm units, subsequent measurements are report in Watt units.

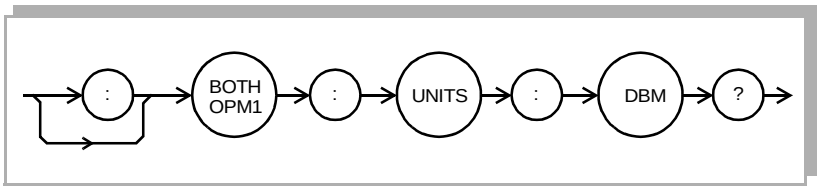
√ Front Panel **_____:UNITS:DBM?**

√ Remote

FOM-7900B *FOS-79800E* *FOS-79710* √ *DPM-79810*

The **BOTH:UNITS:DBM?** and **OPM1:UNITS:DBM?** queries return the current units used for reporting power.

SYNTAX DIAGRAM



PARAMETERS None. The response is an <nrf value>; 1 = on (enabled), 0 = off (disabled).

POINTS OF INTEREST When the dBm units are not active, the optical power measurements are reported in Watts. When dBm units is active the units are either reported in dBm for absolute measurements and dB for relative measurements.

EXAMPLES **BOTH:UNITS:DBM? 0,0**

Indicates that both optical power meters are reporting their optical power measurements in Watts.

OPM1:UNITS:DBM? 1

The measurement reporting for the first optical power meter is in either dBm or dB units.

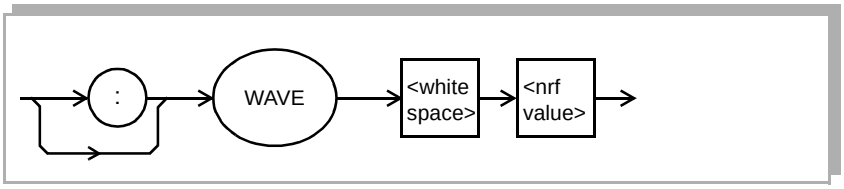
√ Front Panel **WAVE**

√ Remote

FOM-7900B *√ FOS-79800E* *FOS-79710* *DPM-79810*

The **WAVE** command sets the wavelength of the 79800E Precision Fiber Optic Source.

SYNTAX DIAGRAM



PARAMETERS The <nrf value> is the desired wavelength setting in nanometers.

POINTS OF INTEREST Use this command to set the wavelength of the source. The source is enabled and disabled using the **OUT** command.

EXAMPLES **WAVE 1553.67**
The wavelength is set to 1553.67 nm.

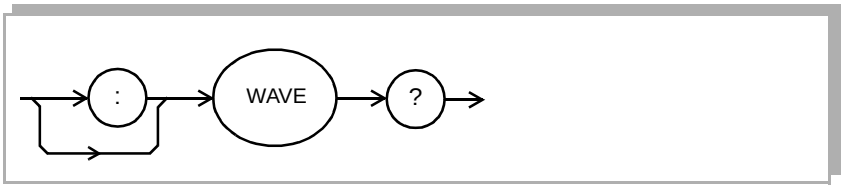
√ Front Panel **WAVE?**

√ Remote

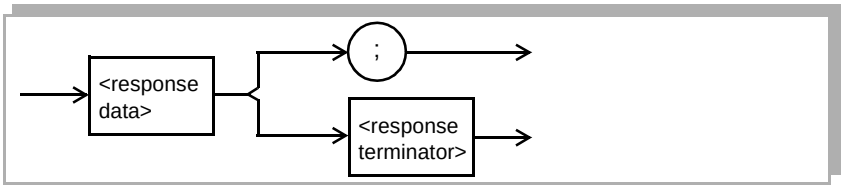
FOM-7900B *√ FOS-79800E* *FOS-79710* *DPM-79810*

The **WAVE?** query returns the source's wavelength setting in nanometers.

SYNTAX DIAGRAM



RESPONSE



where the <response data> represents the wavelength in nanometers.

POINTS OF INTEREST This command returns the present wavelength setting in nanometers. The wavelength is set with the **WAVE** command.

EXAMPLES **WAVE?**

1550.406 the wavelength is set to 1550.406 nm.

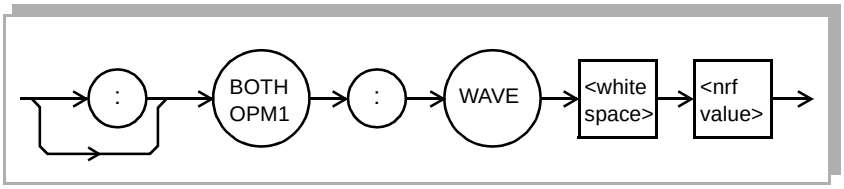
√ Front Panel **_____:WAVElength**

√ Remote

FOM-7900B *FOS-79800E* *FOS-79710* √ *DPM-79810*

The **BOTH:WAVElength** and **OPM1:WAVElength** commands set the wavelength of the optical power that is being measured.

SYNTAX DIAGRAM



PARAMETERS An <nrf value>

POINTS OF INTEREST Changes in the detector response are significant enough that the optical power meter must know the wavelength of the source signal in order to properly display the optical power. The default unit of nanometers is assumed when entering this value. The operating range for this optical power meter is 850.000nm to 1700.000nm.

EXAMPLES **BOTH:WAVE**

1550.000 Sets both optical power meters to calculate the optical power based on the responsivity of the detector at 1550.000nm.

OPM1:WAVE

1480.000 Sets the first optical power meter to calculate the optical power based on the responsivity of the detector at 1480.000nm.

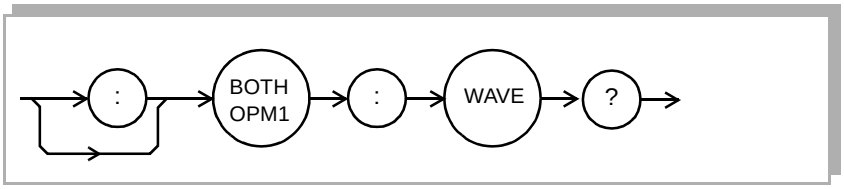
√ Front Panel **_____:WAVElength?**

√ Remote

FOM-7900B *FOS-79800E* *FOS-79710* √ *DPM-79810*

The **BOTH:WAVElength?** and **OPM1:WAVElength?** queries return the current wavelength the power meter is using to calculate the optical power measurement.

SYNTAX DIAGRAM



PARAMETERS None. The response is an <nrf value>.

POINTS OF INTEREST Changes in the detector response are significant enough that the optical power meter must know the wavelength of the source signal in order to properly display the optical power. The wavelength is always reported in nanometers.

EXAMPLES **BOTH:WAVE?**

1550.000,1560.00 Indicates that the first optical power meter is using 1550.000nm and the second optical power meter is using 1560.00nm to calculate the optical power measurement.

OPM1:WAVE?

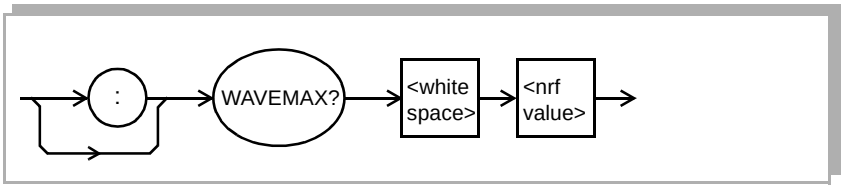
1550.000 The first optical power meter is using 1550.000 to calculate the optical power measurement.

√	Front Panel	**WAVEMAX?**
√	Remote	

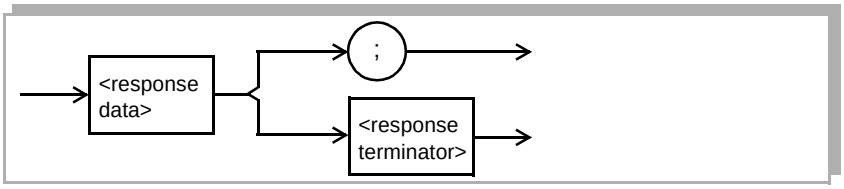
FOM-7900B *√ FOS-79800E* *FOS-79710* *DPM-79810*

The **WAVEMAX?** query returns the maximum wavelength setting in nanometers.

SYNTAX DIAGRAM



RESPONSE



where the <response data> represents the wavelength in nanometers.

POINTS OF INTEREST The wavelength is set with the **WAVE** command and cannot be greater than the WAVEMAX ? value.

EXAMPLES **WAVEMAX?**

1551.256 the maximum wavelength is set to 1551.256 nm.

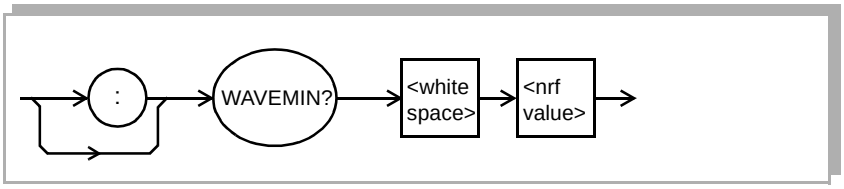
WAVEMIN?

√ Remote

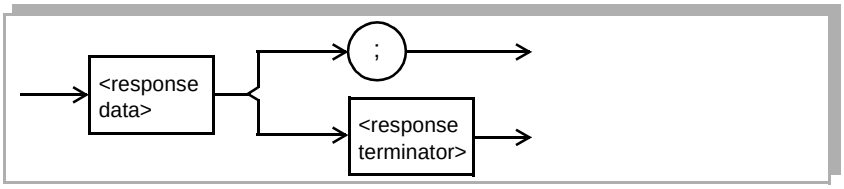
FOM-7900B *√ FOS-79800E* *FOS-79710* *DPM-79810*

The **WAVEMIN?** query returns the minimum wavelength setting in nanometers.

SYNTAX DIAGRAM



RESPONSE



where the <response data> represents the wavelength in nanometers.

POINTS OF INTEREST The wavelength is set with the **WAVE** command and cannot be less than the **WAVEMIN?** value.

EXAMPLES **WAVEMIN?**

1549.308 the minimum wavelength is set to 1549.308 nm.

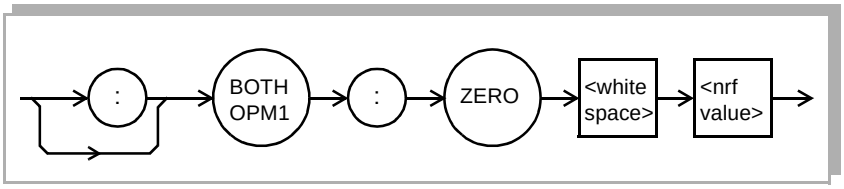
√ Front Panel **_____:ZERO**

√ Remote

FOM-7900B *FOS-79800E* *FOS-79710* √ *DPM-79810*

The **BOTH:ZERO** and **OPM1:ZERO** commands instruct the meter to perform a zeroing operation to calibrate both optical and electronic offsets.

SYNTAX DIAGRAM



PARAMETERS An <nrf value>; 1 = start zero operation, 0 = abort zero operation in process.

POINTS OF INTEREST This feature applies an offset correction factor to the internal amplifiers that eliminates detectable fixed errors. These errors can be from internal effects such as detector dark current, as well as from external effects such as ambient light. The concept is similar to shorting the lead of a voltmeter and making sure the meter reads zero. Best results will always be obtained by minimizing external influences, because they are rarely stable. For this reason, the DPM-79810 limits the amount of acceptable zero offset. Caution should be exercised when using this command, the optical input must be sealed from ambient light and no optical source signal can be present.

EXAMPLES

BOTH:ZERO 1

Instructs both optical power meters to perform the zeroing operation.

OPM1:ZERO 0

Instructs the first optical power meter to abort the zeroing operation.

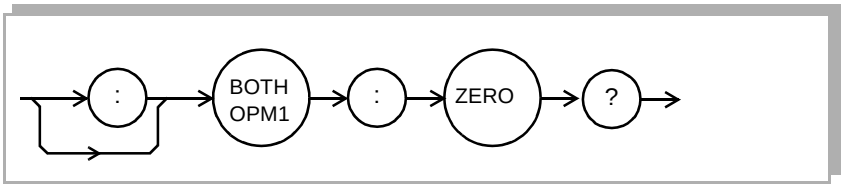
√ Front Panel **_____:ZERO?**

√ Remote

FOM-7900B *FOS-79800E* *FOS-79710* *√ DPM-79810*

The **BOTH:ZERO?** and **OPM1:ZERO?** queries return the status of the zeroing operation.

SYNTAX DIAGRAM



PARAMETERS None. The response is an <nrf value>; 1 = in process, 0 = complete.

POINTS OF INTEREST Once a zeroing operation is initiated it is necessary to ensure that it has been completed before continuing on to make measurements. The Zero Operation takes approximately 10 seconds.

EXAMPLES

BOTH:ZERO? 1,0

Indicates that the first optical power meter is in the process of the zeroing operation and the second optical power meter is not in the process of the zeroing operation.

OPM1:ZERO? 1

The first optical power meter is in the process of the zeroing operation.

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CHAPTER 10 PROGRAMMING EXAMPLES

This section provides examples of programming the FOM-7900B using GPIB. These examples are written in QuickBASIC for the National Instruments NI-488.2 GPIB card. The first is an example of a “driver” for GPIB communications with the FOM-7900B. The second is an example of an output power and wavelength display calibration. These examples are not complete, and will not execute by themselves. The initialization of some variables and files have been purposely omitted.

Table 10-1 GPIB Driver

```
10   SUB 7900dvr(Device_id,Command$,Response$,Err$)
20   'This driver provides bus time-out protection and looks for device dependent errors.
30
40   ON ERROR GOTO handler                    ' Watch for software errors
50   CALL Ibtmo(Device_id, 10)                ' Provide 300 mSec time-out on GPIB
60
70   Cmd_len% = LEN(Command$)                 ' Get length of command string
80   IF (Cmd_len% > 0) THEN
90       CALL Ibwrt(Device_id,Command$)       ' Send the command
100  END IF
110  IF (INSTR(Command$,"?") THEN             ' Is the command a query?
120      CALL Ibrd(Device_id,Response$)        ' Get the response
130  END IF
140
150  CALL Ibwrt(Device_id,"*STB?")            ' Get the Status Byte
160  CALL Ibrd(Device_id,Status_byte%)
170  Err_bit% = Status_byte% AND 128          ' Is the error queue active bit set?
180  IF (Err_bit% > 0) THEN
190      CALL Ibwrt(Device_id,"ERR?")         ' Get the Error queue
200      CALL Ibrd(Device_id,Err$)            ' Report the Errors
```

Table 10-1 GPIB Driver

210	PRINT “ERROR IN 7900B COMMUNICATIONS - DEVICE DEPENDENT ERROR”
220	PRINT “ERRORS ARE: “ Err$
230	END IF
240	IF (Ibsta AND Timo) THEN PRINT “7900B GPIB TIMEOUT “ ' Did the bus timeout?
250	EXIT SUB
260 Handler:	' Did the software bomb?
270	PRINT “MISC SOFTWARE GENERATED ERRORS IN 7900B DRIVER SUB”
280	END SUB

Table 10-2 Display Calibration

10	SUB Cal_Display(Device_id, Level, Wave)
20	' Enters the level and wavelength display cal points for a 79800E Fiber Optic Source Module
30	
40	CALL 7900dvr(Device_id,”CH 1",Response$,Err$)' Set the channel number
50	CALL 7900dvr(Device_id,”CAL:LEVEL Level”,Response$,Err$) 'Cal the output display
60	CALL 7900dvr(Device_id,”CAL:WAVE Wave”,Response$,Err$)' Cal the wavelength disp.
70	CALL 7900dvr(Device_id,”LEVEL 1.00",Response$,Err$)' Set output level to 1.00 dBm
80	CALL 7900dvr(Device_id,”LEVEL?”,Response$,Err$)' Verify level setpoint
90	Lev = VAL(Response$)
100	PRINT “The current output level setpoint is “; Lev
110	END SUB

CHAPTER 11 MAINTENANCE

This chapter describes how to maintain the FOM-7900B System. Included are sections covering fuse replacement and line voltage information.

WARNING: To avoid electrical shock hazard, connect the FOM-7900B System to a properly earth grounded, three prong receptacle only. Failure to observe this precaution can result in severe injury or death.



CAUTION: Do not insert or remove any module while the FOM-7900B is powered up. This could damage the module and/or mainframe. Be sure the module is properly installed before applying power to the FOM-7900B.





CAUTION: RISK OF ELECTRICAL SHOCK. DO NOT OPEN

VORSICHT: HOCHSPANNUNG NICHT OFFNEN.

ATTENTION: RISQUE D'ELECTROCUTION. NE PAS OUVRIR.

ATTENZIONE: RISCHIO DI SHOCK ELECTRICO. NON APRIRE.



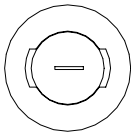
CONNECT THE INSTRUMENT TO A PROPERLY EARTH GROUNDED, THREE PRONG RECEPTACLE.

ANSHLIESS DAS INSTRUMENTIERE BIS EIN ANGEBRACHT ERDE GROUNDED, DREIPRONG RECEPTACLE.

ABOUCHENT LA INSTRUMENT POUR CONVENABLE EARTH GROUNDED, TROIS PRONG RECEPTACLE.

CONNECT GLI STRUMENTANO A UN PROPER TERRA GROUNDED, TRE PRONG RICETTACOLO.

FUSE REPLACEMENT



Fuses are accessed from the rear panel of the FOM-7900B. Before replacing the fuses, turn the power off and disconnect the power cord. Then remove the fuse holder with a regular screwdriver.

LINE VOLTAGE	FUSE
100–115VAC	3A
220–240VAC	1.5A
3AG, 250V, SLO–BLO	

Only use fuses rated for the power line voltage in your area as indicated on the rear panel.

NOTE:



FOR CONTINUED PROTECTION, REPLACE FUSE ONLY WITH SPECIFIED TYPE AND RATING.

ZUM FORTBESTEHENDEN SCHUTZ, ERSETZEN SIE DIE SICHERUNG NUR MIT DEM SPEZIFIZIERTEM TYP AND NENNWERT.

POUR ASSURER LA PROTECTION FUTURE, LE FUSIBLE DE REMPLACEMENT DOIT ETRE AUX MEMES SPECIFICATIONS.

PER UNA CORRETA PROTEZIONE, SOSTITUIRE IL FUSIBILE SOLO CON UNO DI IDENTICO TIPO E POTENZA.

LINE VOLTAGE SELECTION

The AC line voltage is preset at the factory and cannot be changed in the field. Permitted fluctuations from rated line voltages are +6% and -10%. Contact ILX Lightwave should it be necessary to change the AC line voltage.

MODULE REPLACEMENT

Use the following instructions when replacing modules into the FOM-7900B Mainframe.



1. Make sure the power to the FOM-7900B Mainframe is turned off.

CAUTION: Do not insert or remove any module while the FOM-7900B is powered up. This could damage the module and/or mainframe. Be sure the module is properly installed before applying power to the FOM-7900B.

CAUTION: The Fiber Optic Source Module is a static sensitive device. Installing or removing any module from the FOM-7900B System should take place at an ESD protected workbench. The operator should be properly earth grounded.

2. Select any available mainframe channel and, if necessary, remove the blank plate that covers that channel. The plate is removed by loosening the screw at the bottom left corner.

3. Position the module upright and guide it into the bay using the mounting rails on the top and bottom of the mainframe bay.

4. Press the module firmly into the bay. The module should “snap” securely into place.

5. Secure the module using the screw at the bottom left corner of the front panel.

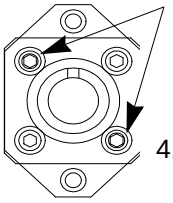
FOS-79800E AND FOS-79710 MODULE MAINTENANCE

The FOS-79800E Fiber Optic Source Module and the FOS-79710 1 x 4 Fiber Optic Switch Module should not require maintenance, however, the fiber optic connectors may become contaminated with foreign material.

Cleaning Fiber Optic Connectors

1. Turn off the power switch and unplug the main frame.

2. Loosen the module front panel screw at the bottom center of the module and grasp the module handle. Pull the module outward from the mainframe chassis.



3. Remove the two #2 sockethead cap screws that hold the fiber connector bulkhead on the front panel of the module. Remove the bulkhead and allow the internal fiber connector to protrude through the hole in the front panel where the bulkhead was located.

4. Unscrew one of the internal fiber connectors from the connector bulkhead. It is recommended that only one fiber be disconnected at a time to avoid getting the fibers in the wrong place after cleaning.

5. Clean the fiber ferrule by gently wiping the end with a soft tissue wetted with methanol, or similar fiber optic cleaning equipment. Screw the fiber ferrule to the connector bulkhead.

6. Carefully replace the bulkhead connector to the module front panel and secure it with the two #2 sockethead cap screws that were removed in step three.

7. Repeat steps three through six above for all of the fiber connectors to the module front panel.

USER CALIBRATION OF THE FOS-79800E MODULE

User Calibration(s) can be utilized when the measured output power and/or wavelength do not match front panel settings. Use the procedures below to field calibrate the power and wavelength.

Wavelength Calibration

The Wavelength User Calibration can be used when the measured wavelength does not match the front panel setting. Use the steps below to enter a Wavelength User Calibration. This calibration generates a single point offset that is applied to all future wavelength settings.

1. Connect an optical wavelength meter to the end of a fiber optic patch cord that is also connected to the 79800E Precision Fiber Optic Source. Setup the meter for a measurement in a vacuum.

2. Set the 79800E Precision Fiber Optic Source Module to a wavelength near that of the test application. Turn the source on.

3. Proceed to the Cal Wavelength display.

4. Give the system enough time to warm up and stabilize—at least one hour. Measure the wavelength with the wavemeter. Enter this measurement as the Cal Wavelength value.

Power Calibration

The Power User Calibration can be used when the measured output power does not match the front panel setting or to compensate for losses induced by patch cords. Use the steps below to enter a Power User Calibration. This calibration generates a single point offset that is applied to all future power levels.

1. Connect an optical power meter to the end of a fiber optic patch cord that is also connected to the 79800E Precision Fiber Optic Source. Program the power meter to the wavelength of the 79800E. Zero the power meter.

2. Set the 79800E Precision Fiber Optic Source Module to a level near that of the test application. Turn the source on.

3. Proceed to the Cal Level display.

4. Give the system enough time to warm up and stabilize. Measure the output power with the power meter. Enter this power measurement as the Cal Level value.

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CHAPTER 12 ERROR MESSAGES

Error messages may appear on the display when problems occur within the FOM-7900B. Error messages are shown on the front panel display. In remote operation, the current error list can be read by issuing the “ERR?” query. When this is done, a string is returned containing all of the error messages that are currently in the error message queue. The mainframe and each module contain their own error queue. Direct the ERR? query to a specific module or mainframe by issuing the CH x command first.

The error codes are numerically divided into areas of operation. Refer to Table 12-1.

Table 12-1 Error Code Classification

ERROR CODE RANGE	AREA OF OPERATION
001 to 099	Internal Program Errors
100 to 199	Parser Errors
200 to 299	Execution Control Errors
300 to 399	GPIB Errors
400 to 499	Mainframe Specific Errors
500 to 599	Module Specific Errors

Table 12-2, Table 12-3, Table 12-4, Table 12-5 and Table 12-6 contain all of the error messages that may be generated by the device. Not all of these messages may appear on the front panel display. Some refer to GPIB communication only.

FOM-7900B FIBER OPTIC SYSTEM ERRORS

Table 12-2 Parser Errors

ERROR CODE	EXPLANATION
101	<program mnemonic> is too long.
102	<PROGRAM MESSAGE UNIT> is too long.
103	<DEFINITE LENGTH ARBITRARY BLOCK PROGRAM DATA> length too long.
104	<NON-DECIMAL NUMERIC PROGRAM DATA> type not defined.
105	<DECIMAL PROGRAM DATA> exponent not valid.
106	<DECIMAL PROGRAM DATA> digit expected.
107	<DECIMAL PROGRAM DATA> digit not expected.
108	<DECIMAL PROGRAM DATA> more than one decimal point.
109	<DECIMAL PROGRAM DATA> more than one exponential indicator (E).
110	<SUFFIX PROGRAM DATA> must have digit following sign.
111	<SUFFIX PROGRAM DATA> must have alpha character following operator.
113	<ARBITRARY BLOCK PROGRAM DATA> length less than digit count.
114	<DEFINITE LENGTH BLOCK PROGRAM DATA> premature end of data.
115	<PLACEHOLDER PROGRAM DATA> identifier not valid.
116	Parser syntax error, character was not expected.
120	<program mnemonic> Lookup, word as part of a header path, has no commands.
121	<program mnemonic> Lookup, word as part of a header path, is not found.
122	<program mnemonic> Lookup, cannot find a null entry.
123	<program mnemonic> Lookup, word within context of current path, is not found.

Table 12-2 Parser Errors

ERROR CODE	EXPLANATION
124	<program mnemonic> Lookup, failed because query/command type match failed.
125	<program mnemonic> Lookup, word within context of common command path, is not found.
126	Too few or too many program data elements.

Table 12-3 Execution Control Errors

ERROR CODE	EXPLANATION
201	<PROGRAM DATA> value out of range.
202	<PROGRAM DATA> will not convert to valid type.
203	Security violation, command is not available without clearance.
204	<PROGRAM DATA> suffix type is not valid.
205	<PROGRAM DATA> is not a Boolean value or word.
206	<PROGRAM DATA> will not convert to a signed 16-bit value.
207	<PROGRAM DATA> will not convert to an unsigned 16-bit value.
208	<PROGRAM DATA> will not convert to a signed 32-bit value.
209	<PROGRAM DATA> will not convert to an unsigned 32-bit value.
210	<PROGRAM DATA> will not convert to a floating point value.
211	<PROGRAM DATA> will not convert to a character value.
212	<PROGRAM DATA> will not convert to a byte array pointer.
213	<PROGRAM DATA> is incorrect block data length.
214	<PROGRAM DATA> length exceeds maximum.
219	Present modular configuration doesn't match that of stored setting.
220	Required parameter is missing from command.

Table 12-4 GPIB Errors

ERROR CODE	EXPLANATION
301	A <RESPONSE MESSAGE> was ready, but controller failed to read it. (Query error).
302	Device was addressed to talk, but controller failed to read all of the <RESPONSE MESSAGE>. (Query error)

Table 12-5 Mainframe Specific Errors

ERROR CODE	EXPLANATION
401	Channel number out of range (0 to 9 legal).
402	Bank address number out of range (0 to 24 legal).
403	Internal modulation frequency out of range (1 to 500 kHz legal).
404	Command or query sent to empty channel (no module installed in channel).

Table 12-6 Module Specific errors

ERROR CODE	EXPLANATION
501	Case Temperature Error (79800E and 79880 modules only).
502	Temperature Control Error (79800E and 79880 modules only).
503	Current Limit Error (79800E and 79880 modules only).
504	Self Test Error (79710).
507	Single Mode Limit Error (79880 module only).
508	Calibration Data Error. Calibration data in EEPROM is invalid; module must be recalibrated (79800E and 79880 modules only). Contact ILX Lightwave Customer Service.
509	Setpoint Read Error. Invalid setpoints stored in EEPROM; set-points are reset to module defaults (79800E and 79880 modules only).

Table 12-7 FOS-79710 Switch Error Messages

ERROR CODE	DESCRIPTION
123	Command Syntax Error
201	Value Out of Range Error
220	Parameter Missing Error
504	Switch Mechanism has failed

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CHAPTER 13 TROUBLESHOOTING

This chapter is intended to be used as a guide when the FOM-7900B mainframe or modules do not perform as expected. It is not a service manual, rather a guide to alleviate basic problems which may arise during operation. Some of the common causes and corrective actions for problems are listed in this chapter. If additional symptoms persist, contact your ILX Lightwave representative.

SYSTEM TROUBLESHOOTING GUIDE

Table 13-1 System Troubleshooting

SYMPTOM	CAUSES AND CORRECTIVE ACTIONS
FOM-7900B will not power up	1) Check the power cord to make sure that it is properly connected. Check the fuse for integrity and the proper rating. 2) If the above suggestion fails, verify the line voltage selection is compatible for your area.
Channel Output will not turn on or will not stay on.	1) Check to be certain the channel output has been turned on and that the output level setpoint is correct. 2) Make sure an appropriate fiber patch cord has been correctly installed to the output connector. 3) A TEC open circuit, Current Limit or Power Limit condition could be disabling the output.

GPIB TROUBLESHOOTING GUIDE

If you have difficulty operating the FOM-7900B through GPIB, refer to the symptoms listed here.

Table 13-2 GPIB Troubleshooting

SYMPTOM	CAUSES AND CORRECTIVE ACTIONS
No response from the FOM-7900B upon a GPIB command (remote indicator does not come on).	1) Check that a GPIB (or RS232) cable is connected between the FOM-7900B and the system controller (your computer). This cable should be less than 3 meters long. 2) Check that the GPIB address is set properly and the controlling software is sending commands to the proper address. 3) Make sure no two devices have the same GPIB address. 4) Check that there are fewer than 15 devices on the bus and there is less than 20 meters of total cable. 5) Check that the GPIB controller card in the host computer is configured properly. 6) Try isolating the FOM-7900B by removing all other instruments from the bus.
Slow or unexpected response to GPIB commands.	1) Make sure no two devices have the same GPIB address. 2) Check that there are fewer than 15 devices on the bus and there is less than 20 meters of total GPIB cable. 3) Make sure the GPIB controller card in the host computer is configured properly. 4) Isolate the FOM-7900B by removing all other instruments from the bus.

Table 13-2 GPIB Troubleshooting

SYMPTOM	CAUSES AND CORRECTIVE ACTIONS
Device does not respond to command (remote indicator is on)	1) Read the error queue remotely (ERR?). The command syntax or command structure may be in error. 2) Read the status byte (*STB?) and condition register (COND?) for possible device problems. 3) Make sure the GPIB controller card in the host computer is configured properly.
Bus hangs	1) Place a software timeout around the command in question to prevent the hang. 2) Check the syntax of the command that is causing the hang; especially if the command is a query and software is waiting for a response. 3) Make sure the controlling software is not requesting information from the FOM-7900B without first sending the proper query. 4) Make sure the GPIB controller card in the host computer is configured properly. 5) Check the GPIB cables and the GPIB address.

Table 13-3 FOS-79710 Switch Module Errors

SYMPTOM	CAUSES AND CORRECTIVE ACTIONS
Persistent ERROR 504	1) Power down the FOM-7900B. Remove the Switch module and reinsert it. Ensure the module is seated well into the FOM-7900B Mainframe. Power up the FOM-7900B and recheck the switch module for ERROR 504. 2) Call ILX Lightwave customer service.
Unstable power levels or unequal power from difference ports	1) It may be necessary to clean the fiber optic bulkhead connectors on the front panel of the module. 2) Make sure the input source to the switch module is stable.

Table 13-4 FOS-79800E Source Module Errors

SYMPTOM	CAUSES AND CORRECTIVE ACTIONS
ERROR 501 when the laser is first turned on.	1) The laser is being turned on before the laser case temperature has stabilized. The error should reset when the system has warmed up adequately. The output power may not be stable during this warm-up period.
Unstable power level from the module.	1) It may be necessary to clean the fiber optic bulkhead connectors on the front panel of the module. 2) Make sure the FOM-7900B system has warmed up adequately. 3) It may be necessary to turn on the Coherence Control
ERROR 503	1) The laser source is being overdriven. Reduce the output level and try again.
ERROR 508	1) The calibration data stored in the 79800E non-volatile memory (EEPROM) has become invalid. 2) The module must be recalibrated or reprogrammed with the original calibration data.
ERROR 509	1) The values of the user-adjustable setpoints such as level and wavelength currently stored in non-volatile memory (EEPROM) have become invalid. These values will be set to the factory defaults based on the module calibration, and the error condition will be cleared. 2) If this happens frequently, the external AC power supplied to the FOM-7900B may not be within specification.

Table 13-4 FOS-79800E Source Module Errors

SYMPTOM	CAUSES AND CORRECTIVE ACTIONS
Output power is substantially different than the displayed output level.	1) Make sure the patch cord is clean, free of defects and properly connected to the 79800E. 2) The internal fiber ferrule may be contaminated. It may be necessary to clean the fiber optic bulkhead. 3) The display calibration may not be accurate. Perform a user calibration. Try resetting the User Calibration first.
Measured wavelength is substantially different than the displayed setting or the wavelength will not tune.	1) The display calibration may not be accurate. Perform a user calibration. Try resetting the User Calibration first.

Table 13-5 DPM-79810 Dual Power Meter Module Errors

"EE1 Error"	Calibration Data corrupted on OPM1
"EE2 Error"	Calibration Data corrupted on OPM2
"User Cal1 Active"	OPM1 User Cal value set to value other than 1.
"User Cal2 Active"	OPM2 User Cal value set to value other than 1.
"OPM1:ZERO Fail"	Last Zero operation since power up failed.
"OPM2:ZERO Fail"	Last Zero operation since power up failed.

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