Multiple Application Platform MAP-200

User Guide

22112369-050 R000
Standard
June 2016

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Chapter 1: Document History

Document Number / Revision	Date	Comment
22112369-050 R000	June 2016	Initial release with new number. Changed branding from JDSU to Viavi. Note that diagrams are not necessarily reflective of the company name change from JDSU to Viavi.
21127301-001 R004	July 2013	

Chapter 2: About this Guide

Notice

Every effort was made to ensure that the information in this manual was accurate at the time of printing. However, information is subject to change without notice, and Viavi reserves the right to provide an addendum to this manual with information not available at the time that this manual was created.

Purpose and Scope

The purpose of this guide is to help you successfully use the MAP-200 cassette. This guide includes task-based instructions that describe how to install, configure, use, and troubleshoot the MAP-200. Additionally, this guide provides a complete description of Viavi warranty, services, and repair information, including terms and conditions of the licensing agreement.

Assumptions

This guide is intended for novice and intermediate users who want to use the MAP-200 effectively and efficiently. Viavi assumes that the user is familiar with basic telecommunication concepts and terminology.

Copyright

Copyright Release

Trademarks

Document Ordering Information

This guide is a product of Viavi's Technical Information Development Department, issued as part of the MAP-200 suite of documents. The catalog number for this guide is 22112369-050 R000. It is distributed on the MAP-200 USB drive, 21127440, shipped with MAP-200 chassis and cassettes.

Terms and conditions

Specifications, terms, and conditions are subject to change without notice. The provision of hardware, services, and/or software are subject to Viavi’s standard terms and conditions, available at www.viavisolutions.com/terms.

Chapter 3: Safety and Compliance

General Safety

The MAP-200 system, including functional cassettes complies with CSA/UL/IEC 61010-1.

The following safety information must be observed whenever the unit is operated, serviced, or repaired. Failure to comply with any of these instructions or with any precaution or warning contained in this user manual is in direct violation of the standards of design, manufacture, and intended use of the unit. Viavi assumes no liability for the customer's failure to comply with any of these safety requirements.

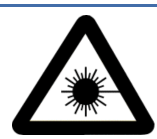
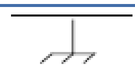
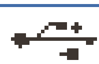
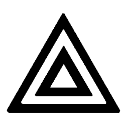
WARNING

To avoid the risk of injury or death, always observe the following precautions before initializing the unit:

- Never look into the end of an optical cable connected to an optical output device that is operating. Laser radiation is invisible, and direct exposure can severely injure the human eye.
- Use only the type of power cord supplied with the unit.
- Turning off the power to the device does not always block the externally supplied radiation to the connector at the output of the unit.
- Do not use the unit outdoors.
- To prevent potential fire or shock hazard, do not expose the unit to any source of excessive moisture.
- Do not perform any operating or maintenance procedure that is not described in this user manual. All other repairs are to be carried out only buy a qualified Viavi professional.
- Do not operate the unit when its covers or panels have been removed.

The following symbols and messages can be marked on the unit or found through out the manual (Table 1). Observe all safety instructions that are associated with a symbol.

Table 1: Safety Symbols

Symbol	Description
	**CAUTION** See the user manual for instructions on handling and operating the unit safely. The procedure can result in serious damage to or destruction of the unit if not carried out following instructions for proper use.
	Electrostatic discharge (ESD). See the user manual for instructions on handling and operating the unit safely.
	Laser Safety. See section on laser safety for full instructions on safe handling and operating of source and amplifier modules.
	Frame or chassis terminal for electrical grounding within the unit.
	USB label.
	**WARNING** **The procedure can result in serious injury or loss of life if not carried out in proper compliance with all safety instructions. Ensure that all conditions necessary for safe handling and operation are met before proceeding.**
~	AC – Alternating current
V	Volts
VA	Volt amperes

Laser Safety

Source cassettes when installed in the MAP-200 Mainframe meet the requirements of standard IEC 60825-1(2002) and comply with CFR 1040.10 except deviations per Laser Notice No. 50, July 2001 Key Feature Number 4. The following MAP-200 cassettes are optical source or amplifiers covered by the above laser safety standard.

The following safety features are incorporated in the design of the MAP-200 systems:

- Laser output ports have shutters. CAUTION: The shutters are gravity operated and not spring loaded. When the MAP-200 is used in the top facing orientation, the shutters may need to be closed manually.
- The laser(s) does not activate unless commanded by host software.
- There is a LED on each source cassette front panel indicating when the laser is on.
- The source cassette shuts down to a safety interlock line from the host. Once the safety interlock is replaced, there is a 3 second delay before the laser is re-activated.
- The MAP-200 system includes Local and Remote Safety Interlock described in detail below.

Source Cassette Laser Class

The Laser Class for each source cassette has been defined using the maximum possible wavelength range and power output of the family of lasers, as submitted to FDA. These are outlined in *Table 2: Laser Class and Parameter Limits*. For the exact specification of the lasers described in this manual, please refer to the specification section appearing later in this document for each cassette.

Table 2: Laser Class and Parameter Limits

Cassette	Marketing Number	Laser Class	Wavelength Range (nm)	Output Power (mW) Maximum
Tunable Laser Source	mTLS-A1	3B[1]	1519-1630	6
EDFA	mEDFA-A1	3B[1]	1525-1575	150
Distributed Feedback Laser	mDFB-A1	3B[1]	950-1680	< 50
Fabry-Perot Laser	mFPL-A1	3B[1]	1527-1568	62
LED	mLED-A1	3B[1]	780-1570	2.5
Broadband Source	mBBS-A1	3B[1]	1525-1575	100
Tunable Laser Grid	mTLG-A1	1M[1]	1528-1610	< 40

1. As per standard IEC 60825-1 and FDA standard 21 CFR1040.10, except deviations per Laser Notice No.50, July 2001.

⚠	**WARNING** Class 3B lasers are hazardous to eyes and skin if exposed directly. Wear the appropriate eye safety equipment.

Local Safety Interlock (MASTER ENABLE)

The safety interlock key found on the front panel of the MAP-200 must be inserted with the arrow pointed to the "ON" position for the interlock to be deactivated, and laser output to be enabled. An operator may place the key in the "OFF" position to disable all the source modules or remove the key when leaving the MAP-200 unsupervised to ensure that untrained or unprepared users do not unintentionally expose themselves to dangerous levels of optical energy.

Figure 1: Safety Interlock Key

⚠	**CAUTION** The laser cannot be activated without the key inserted in the "ON" position.

Remote Safety Interlock

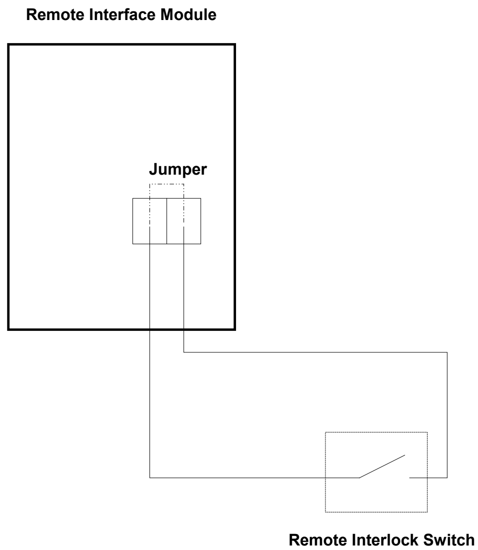
The system interlock line is a hardware safety line that controls the signal output of all laser sources within the MAP-200 system. The interlock line connects the MAP-200 chassis to each laser in the system. If the interlock circuit is broken, interlock is considered activated and all laser sources are immediately disabled removing all light at the output connectors. Upon deactivation of the interlock line, all laser sources are enabled after a three-second delay (assuming they were previously enabled). Operation and control of this line is hardware-based in order to make it fail-safe. Any failure of this interlock results in no power being supplied to the lasers.

The safety interlock connector is a 2-pin terminal block, which can be connected to a remote switch to enable an emergency shutdown. Pins 1 and 2 must be connected for laser sources in the MAP-200 chassis to be enabled.

Figure 2: Remote Interlock Terminal

A typical application would be an interruption circuit tied to a door switch that would activate the system interlock when a door is opened. Therefore, unprepared persons entering a room where a MAP-200 system is located are not exposed to hazardous levels of optical energy. The remote interlock mechanism is illustrated in Figure 3. The remote interlock switch should be closed, or a jumper inserted, to enable laser output. The MAP-200 ships with a jumper pre-installed.

Figure 3: Remote Interlock Operation



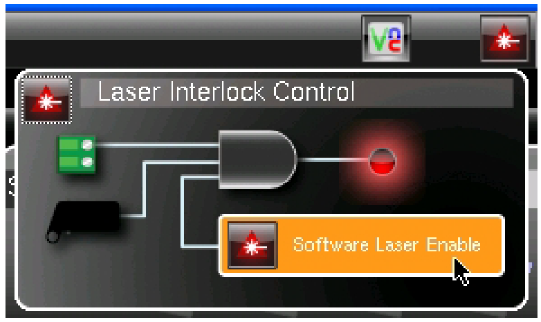
NOTE: For laser operation to be enabled, both the interlock key (Figure 1), and the remote interlock switch (Figure 3) should be configured such that laser output is enabled. A third level of protection is the Software Interlock Flag, which must be enabled from the MAP-200 GUI.

Software Interlock Flag

The software interlock flag is the third level of safety control for sources and amplifiers. This flag can be activated through automation software or through the MAP-200 GUI. Figure 4 shows the icon that brings up the safety interlock state pop-up window. This icon can be found near the top right corner of the GUI. The Software Laser Enable button must be clicked for it to be enabled, and if all other interlocks are in place, the led lights up red, as shown in figure 5, indicating that the sources can now be operated. For controlling the Software Interlock Flag state through automation software, please refer to the progamming guide section of the manual.

Figure 4: Interlock Control and Status Icon for pop-up

Figure 5: Laser Interlock Control Pop-up



The interlock line deactivates all laser sources regardless of their settings. However, other factors such as beam block and laser activation have to be considered when enabling a source output. Table 4 shows the relationship of the system interlock line, the source activation circuit, and the signal beam block.

Table 3: Laser Source Signal Output Truth Table

Laser State	*Interlock*	*Beam Block**	*Signal Out*
Inactive	X	X	No
X	Active (Interlock ON) [Master Enable Key = Off position] OR [Remote Interlock = Jumper not installed] OR [Software Interlock Flag = 0]	X	No
X	X	Active	No
Active ∼	Inactive (Interlock OFF) [Master Enable Key = On position] AND [Remote Interlock = Jumper Installed] AND [Software Interlock Flag = 1]	Inactive	Yes

X means any status (don't care).
* Beam block is an optional feature on some cards. Not all cards having a beam block utilize the interlock line.

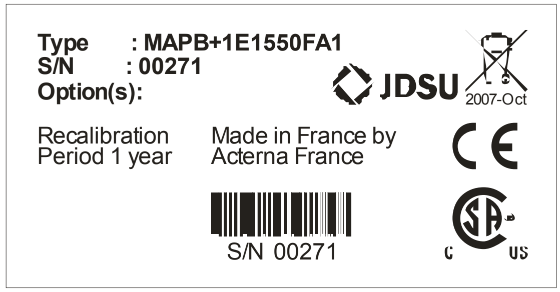
⚠	**CAUTION** Interlock does not control a remote chassis.

MAP-200 Chassis and Source Cassette Safety Labeling

Controller Label

As required by the FDA standard 21 CFR 1040.10, a label as shown in Figure 6 identifying the manufacturer, manufacturing location, marketing part number, serial number, date of manufacture, as well as CE and CSA markings (certifying testing and compliance to CE and CSA) is included on all mainframes, controllers, display and cassettes. An example is shown in Figure 9.

Figure 6: Product Identifier Label



A RoHS compliant as shown in Figure 7 (Green label for no lead) or non-compliant (Red label for lead) is included on all mainframes, controllers, display and cassettes.

Figure 7: RoHS Label

An FDA label as shown in Figure 8 is included on all chassis and source cassettes.

Figure 8: FDA label

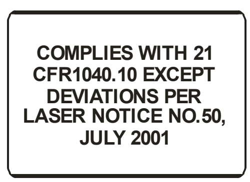
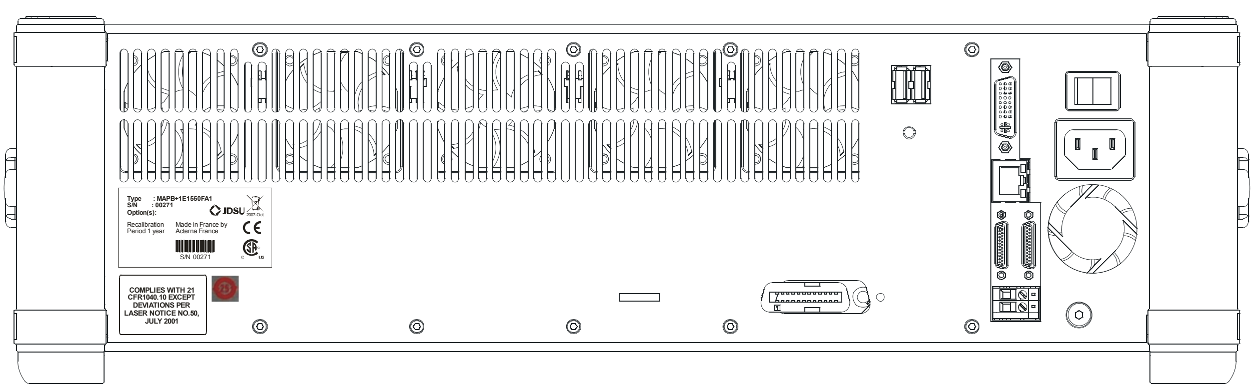


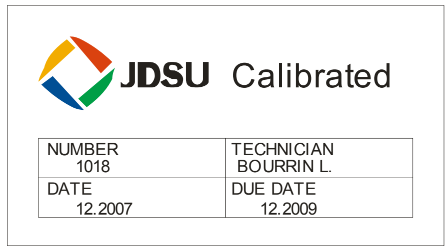
Figure 9: MAP-280 Standard configuration Chassis Labels. Left corner shows Indentifier Label, RoHS Label and FDA label in clockwise direction. The MAC address can be seen on the top right hand corner



Cassette Labels

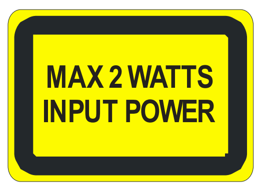
A calibration label as shown in Figure 10 is supplied to the customer as part of the Calibration Certificate and can be applied by the customer if they choose to do so. It is shown in the figures for reference only to identify the recessed area set aside for this label. See Figure 15.

Figure 10: Calibration Label



A high power label, Figure 11, is attached to the handles of all high power cassettes.

Figure 11: High power label



Optical source cassettes (cassettes that contain lasers or LED sources) require additional labels.

- All source cassettes require a Laser Classification label (Figure 12, left – for a Class 3B laser OR Figure 12, right – for a Class 1 laser) as per IEC 60825-1 and FDA depending on their wavelength and power levels. See Figures 15.

Figure 12: Laser labels

- All source cassettes require Laser Warning Labels (Figure 13 and Figure 14) to be applied to the optical connector shutters, as shown in Figure 16. If there is only one wavelength, label Figure 13 is required. If there is more than one wavelength, then label Figure 14 is required on the output shutters.

Figure 13: Single laser label

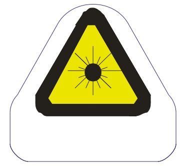


Figure 14: Dual laser label

⚠	**CAUTION** The shutters are gravity operated and not spring loaded. When the MAP-200 is used in the Top-facing configuration, the shutter may need to be closed manually.

Figure 15: MAP-200 Cassette Labels, clockwise from left: Identifier label, RoHS label, Calibration label, FDA label and laser classification label

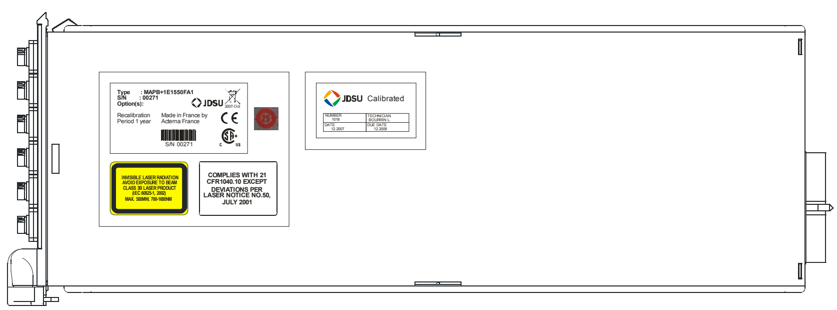
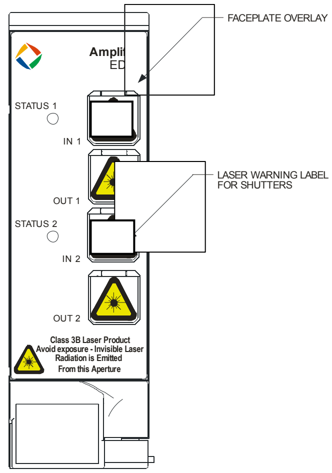


Figure 16: MAP-200 Cassette Labels: Faceplate Overlay



Safety

EMC Requirements: The MAP-200 system complies with EN61326-1, EN55022 and EN55024.

The MAP-200, including functional cassettes complies to CE requirement EN61010-1:2001, plus UL61010-1 and CAN/CSA-C22.2 No.61010-1-04 (see CE certificate of compliance).

The MAP-200 is in Installation Category (Over voltage Category) II under IEC 664. The unit is in the Pollution Degree 2 category under IEC61010-1 (Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use) and CAN/CSA-C22.2 No. 61010-1-04(Safety Requirements for Electrical Equipment for Measurement Control, and Laboratory Use, Part I: General Requirements)

The MAP-200 system has been tested and certified to an altitude of 2,000 metres.

EHSR Compliance

Noise emitted by the unit during operation does not exceed the recommended level for the health and safety (80dB) specified by the European Essential Health and Safety Requirement (EHSR) Standards, section 1.7.4 .

Caution

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.
Use of any instrument with no optical energy source in conjunction with sources must be conducted with care and recognition of the safety required according to the classification of the source.

WEEE Directive Compliance

Viavi has established processes in compliance with the Waste Electrical and Electronic Equipment (WEEE) Directive, 2002/96/EC. This product should not be disposed of as unsorted municipal waste and should be collected separately and disposed of according to your national regulations. In the European Union, all equipment purchased from Viavi after 2005-08-13 can be returned for disposal at the end of its useful life. Viavi will ensure that all waste equipment returned is reused, recycled, or disposed of in an environmentally friendly manner, and in compliance with all applicable national and international waste legislation.

It is the responsibility of the equipment owner to return the equipment to Viavi for appropriate disposal. If the equipment was imported by a reseller whose name or logo is marked on the equipment, then the owner should return the equipment directly to the reseller. Instructions for returning waste equipment to Viavi can be found in the Environmental section of Viavi's web site at http://www.viavisolutions.com/en-us/corporate/about-us/policies-and-standards .If you have questions concerning disposal of your equipment, contact Viavi's WEEE Program Management team at weee.emea@viaisolutions.com .

WARNING

The MAP-200 Controller contains a Lithium Coin Battery which contains Perchorate Material - special handling may apply

China RoHS Addendum

JDSU

21107462 Rev 000

“中国 RoHS”

《电子信息产品污染控制管理办法》（信息产业部，第 39 号）

附录 (Additional Information required for the Chinese Market only)

本附录按照“中国 RoHS”的要求说明了有关电子信息产品环保使用期限的情况，并列出了产品中含有的有毒、有害物质的种类和所在部件。本附录适用于产品主体和所有配件。

产品系列: MAP MODULAR APPLICATION PLATFORM - CHASSIS AND CASSETTES
(Product Family)

环保使用期限：

25

本标识标注于产品主体之上，表明该产品或其配件含有有毒、有害物质（详情见下表）。

其中的数字代表在正常操作条件下至少在产品生产日期之后数年内该产品或其配件内含有的有毒、有害物质不会变异或泄漏。该期限不适用于诸如电池等易耗品。

有关正常操作条件，请参见产品用户手册。

产品生产日期请参见产品的原始校准证书。

有毒、有害物质的类型和所在部件

	有毒、有害物质和元素					
元器件 (Component)	铅(Pb)	汞 (Hg)	镉(Cd)	六价铬(CR^{6+})	多溴联苯(PBB)	多溴二苯醚 (PBDE)
产品主体 MAP (Main Product)						
印刷电路板组件 (PCB Assemblies)	X	O	X	O	X	X
内部配线 (Internal wiring)	X	O	X	O	X	X
显示器 (Display)	X	X	O	O	O	O
电源 (Power Supply)	X	O	X	O	X	X
电工零件 (Electro-mechanical parts)	X	O	X	X	X	X
光模块 / 辅助模块 (Optical modules) / (Auxiliary modules)	X	O	X	X	X	X
金属外壳零件和紧扣件 (Metal case parts and fixings)	X	O	X	X	O	O
塑料外壳零件 (Plastic case parts)	O	O	O	O	X	X
配件 (Accessories)						
外接电缆和适配器 (External cables and adapters)	X	O	X	O	X	X

O：代表该部分中所有均质材料含有的该有毒、有害物质含量低于 SJ/T11363-2006 标准的限值。
X：代表该部分中所有均质材料含有的该有毒、有害物质含量高于 SJ/T11363-2006 标准的限值。

JDSU ● 3000 Merivale Road. ● Ottawa, ON, K2G 6N7, Canada
North America 800-498-JDSU (5378) ● Worldwide +800-5378-JDSU ● Website www.jdsu.com

Chapter 4: MAP-200 Introduction

General Information

The VIAVI Multiple Application Platform (MAP-200) is an optical test and measurement platform optimized for cost-effective development and manufacturing of optical transmission network elements. Today's rapidly changing optical market requires investment in productivity-enhancing technologies and tools, making the MAP-200 scalable test platform the right tool needed in even the most stringent environments. Based on the previous-generation Multiple Application Platform (MAP), the MAP-200 builds on the differentiation of offering the broadest portfolio of modules in the densest and most configurable platform. The MAP-200 is optimized for test applications in lab and manufacturing environments ranging from insertion loss testing to dispersion penalty testing (Table 4).

Table 4: List of MAP-200 applications by technology

Passives	Lasers and Amplifiers	Optical Transport
Insertion Loss	Gain Flatness	Stress Receiver Compliance
Polarization Dependent Loss	Output Power	Jitter Testing
Return Loss	Transient Response	Sensitivity
	Spectral Width	Dispersion Penalty
	Side Mode Supression Ratio	SMSR
	Wavelength	Receiver Overload
	NF and OSNR	Eye Mask / Extinction Ratio
		OSNR Sensitivity

Key Features

- Available in three mainframe configurations

- GPIB- and LXI-compliant (Ethernet)
- Optional 10.4-inch touch screen display module with integrated keypad and scroll wheel
- DVI port for external display
- USB device ports for external keyboard and mouse
- Hot-swappable cassettes (cassettes can be inserted or removed without powering down)
- Field replaceable controller/power supply module
- Compatible with current MAP modules

MAP-200 Mainframe Configurations

The MAP-200 mainframes are offered in three configurations for optimal adaptability within test sets: a three-slot configuration and a 19-inch rack, eight-slot configuration with either front- or rear-facing orientation for optimal fiber routing. All three configurations are 3U high. The MAP-200 mainframes come standard with hardware required for bench-top use including rubber-accented feet located at the corners for optimal stability and vibration isolation. Investment protection is maximized by use of a simple transition kit, which allows insertion of previously field-deployed Legacy MAP modules in the MAP-200 mainframe. Furthermore, the MAP-200 provides additional cost savings by letting users share the modules within a mainframe, through multi-user sharing features supported by LXI.

High Performance MAP-200 Cassettes

The MAP-200 portfolio of cassettes include many types of high performance cassettes including signal conditioning and switching, sources and amplification, as well as power meters.

MAP-200 Power Meters provide high absolute power measurement accuracy over a broad power and wavelength range. They support a broad combination of fiber types and connectivity options optimized for datacom and telecom applications.

MAP-200 Amplifiersare designed to meet the broadest optical signal amplification applications. They are available at various saturated output power, gain flattened or nongain flattened, C-band, L-band, and with low noise figure.

MAP-200 Attenuatorsprovide the highest performance optical power control solution. The attenuators offer the lowest insertion loss, highest input power capability, low polarization dependent loss (PDL), high dynamic range, and ultra-flat attenuation over wavelength.

MAP-200 Tunable Filters provide the lowest loss and narrowest bandwidth filter with the highest input power capability in the industry.

MAP-200 Switches are the most configurable optical signal routing solutions in their class. MAP-200 Switches are available in configurations including low channel count matrix (2x2) and single input to multiple outputs ranging from 2 to 50. In the 1x2 and 2x2 format, the modules are available with up to 8 switches per single slot module.

MAP-200 Sources are ideal sources for applications requiring a stable stimulus for parametric measurements. The sources are available at key telecom wavelengths, with broad or narrow spectral bandwidth, or with tunable spectrum.

Other functions available in the MAP-200 include a variable backreflector, polarization controller, and utility modules.

Elaborate Local Interface and Friendly Graphical User Interface

To view the graphical user interface (GUI) and for local control, the MAP-200 mainframes are compatible with standard universal serial bus (USB) keyboards, USB mice, and digital video interface (DVI) monitors. For added convenience and flexibility, VIAVI offers an optional purpose-built keypad/display module (MAP-200BKD), shown in Figure 17, that provides full local control capabilities. The MAP-200BKD features a scroll wheel, seven soft keys, five navigation buttons, plus seven pre-assigned buttons to navigate the GUI. Touch capability and user-friendly controls come standard for operation with the touch of a finger or with the supplied stylus. Located at the back of the MAP-200BKD module is an industry-standard mounting hole pattern, compatible with commercially available display mounts or the purpose-built MAP-200 Keypad Display 19-inch rack-mount kit (MAP-200B09). Alternatively, the GUI can be accessed in a PC environment via a virtual network connection (VNC) client. When in use with the MAP-230B mainframe, shown in Figure 18a, the MAP-200BKD module can also be docked directly on the top face of the unit. Pop-out feet located on the mainframe lets users position the combined unit in a front-facing manner to ensure optimal viewing and interaction with the unit.

Figure 17: Keypad/Display module and Graphical user interface

Figure 18: MAP-230B and MAP-200BKD suggested implementation

Figure a) has the MAP-200BKD mounted on the MAP-230B. This configuration is optimal for applications requiring high interactivity with the GUI. In Figure b), the MAP-200 KD is mounted on a display mount and located next to the MAP-280. This configuration is optimal for applications requiring high interactivity with the DUT and the MAP-200 modules and monitoring via the GUI

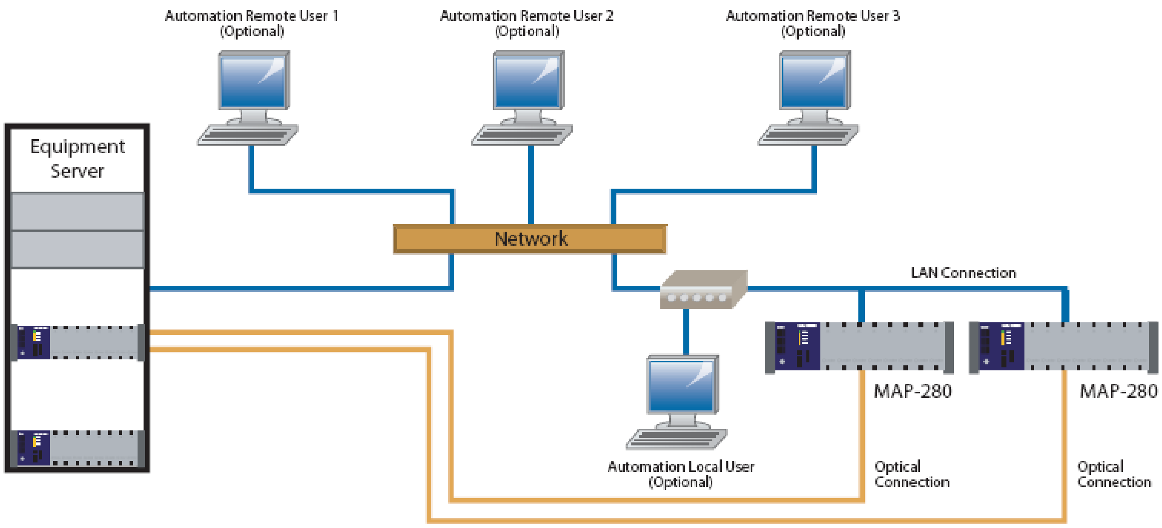
Extensive Input/Output Interfaces

The MAP-200 is a USB, General Purpose Interface Bus (GPIB), and Ethernet enabled device that supports the latest test equipment interface standard, local area network (LAN) eXtension for Instrumentation . LXI is the Ethernet-based successor to GPIB. The LXI standard defines devices using open standard for system inter-device communication.

All mainframe configurations include:

- GPIB, Ethernet, and USB device ports for remote communication
- 4 USB host ports for installing peripheral devices, including USB drives, a mouse, and a keyboard
- LXI-compliant Trigger Bus connections
- Ethernet reset button
- Laser interlock key in the front and remote interlock connector in the rear
- LXI-compliant light emitting diodes (LEDs) on the front panel
- DVI connector for external monitor

Figure 19: MAP-200 implementation within a shared resource environment



Standard Compliant Automation Drivers:

MAP-200 is supplied with Interchangeable Virtual Instrument (IVI) drivers, which are intuitive and optimized for ease of use with popular Application Development Environments such as LabVIEW, Visual C++, Visual Basic, and LabWindows™. These drivers provide full control of the modules and provide drop-in instrument programming capabilities, allowing test programmers to focus on test-level functions and sequences rather than the details required to communicate with the specific modules in the MAP-200 system. The IVI drivers come with a built-in simulator that lets Automation Developers capture system configurations so they can perform most of their development off line, freeing hardware for other purposes. These features make test automation development and debugging fast and easy.

Specifications

Table 5: General Specifications

Parameter	MAP-230	MAP-280	MAP-280R
Capacity	3 modules	8 modules	8 modules
Controller			
CPU		Power PC architecture	
Operating System		Linux	
Internal Storage		200 MB user flash storage	
Interfaces			
Remote interface		USB, GPIB, Ethernet 10/100/1000Base-T	
USB device compability		Mouse, keyboard, memory stick	
Display		External MAP-200KD (optional) or standard DVI monitor	
Ports			
USB host ports		2 rear and 2 front	
USB device ports		1 front	
LAN		1 rear	
GPIB		1 rear	
DVI video		1 rear	
LXI triggers		25-pin Micro-D connectors	
Automation			
Driver type		IVI-compliant	
Driver compatibility		LabVIEW, LabWindows, Visual C++, Visual Basic	
Accessibility		Multi-user sharing support	
Electrical and Safety			
Power[2]		100 to 125V AC/200 to 240V AC, 50/60 Hz, Auto-switching (field-replaceable as part of the power supply controller module)	
Power consumption		200 VA	
Local interlock		Key located in front	
Remote interlock		Terminals located in rear	
Mechanical and Environment[3]			
Rack-mount kit	Optional	Included	Included
Dimensions (W x H x D)[1]	29.2 x 14.9 x 42.0 cm (11.5 x 5.9 x 16.6 in)	49.6 x 14.9 x 42.0 cm (19.6 x 5.9 x 16.6 in)	49.6 x 14.9 x 42.0 cm (19.6 x 5.9 x 16.6 in)
Weight	5.9 kg (13 lb)	6.8 kg (15 lb)	6.8 kg (15 lb)
Operating temperature		0 to 50°C	
Storage temperature		–30 to 60°C	
Humidity		15–80% RH, 0 to 40°C non-condensing	

1. Dimensions include bench-top mounting hardware
2. Mains supply voltage fluctuation shall not exceed 10% of nominal supply voltage
3. The MAP-200 system has been tested and certified to an Altitude of 2,000 metres

Table 6: MAP200KD Display Specifications

Parameter	Specification
Display dimensions (H x W)	10.4-inch color screen
Resolution	800 x 600 resolution
Power	Supplied from mainframe via MAP-200A01 Keypad/Display Cable Harness Kit
Weight	1.8 kg (4 lb)

Ordering Information

Table 7: Ordering Information

Main Frames (Required)	
MAP-280	MAP-200 8-Slot Mainframe
MAP-280R	MAP-200 8-Slot Mainframe Factory Reversed Configuration
MAP-230B	MAP-200 3-Slot Mainframe
Power Cord (Required)	
CORD-US	United States Power Cord
CORD-EU	European Power Cord
CORD-UK	United Kingdom Power Cord
CORD-JP	Japan Power Cord
CORD-AU	Australian Power Cord
Accessories (Optional)	
MAP-200BKD	MAP-200 Stand-Alone Keypad/Display Module
MAP-230HC	MAP-230B Hard Case (Transit Case)
MAP-200A01	MAP-200BKD Keypad/Display Cable Harness Kit
MAP-200A013	MAP-200 Pack of 8 Adaptor Kits for MAP Single Slot Modules (Kit for 8 single width cassettes)
MAP-200A013D	MAP-200 Pack of 4 Adaptors Kits for MAP Double Slot Modules (Kit for 4 dual width cassettes)
MAP-200B09	MAP-200BKD Keypad/Display Module 19” Rack-mount Kit
MAP-200A10	MAP-200 3-Slot mainframe 19" Rack-mount Kit
Replacement/Spare Parts (Optional)	
MAP-200A03	MAP-280 8-Slot Mainframe 19" Rack-mount Kit
MAP-200A02	MAP-200 Controller for MAP-280 and MAP-230B
MAP-200A02R	MAP-200 Controller for MAP-280R
MAP-200A04	MAP-200 Safety Interlock Key
MAP-200A06	MAP-200 Blanking Plates (Kit of 3)

MAP-200A07	MAP-200 Stylus
MAP-200A08	MAP-230B 3-Slot Mainframe flip-up feet for top-facing orientation (Kit of 2)
MAP-200A11	MAP-200 Detachable Side Panels for benchtop use
MAP-200A12	MAP-200 Handles for Detachable Side Panels (only for use with MAP-230B)

Chapter 5: Getting Started

Before Initializing and Operating the Unit

- ☑ Wear an anti-static wrist strap, and work in an electrostatic discharge (ESD) controlled area.
- ☑ Inspect the unit for any signs of damage.
- ☑ If the contents are incomplete or damaged, immediately inform VIAVI and, if necessary, return the unit as outlined in the Service chapter.
- ☑ Keep the packaging.
- ☑ Read the user's manual thoroughly, and become familiar with all safety symbols and instructions to ensure that the unit is operated and maintained safely.

Initial Inspection

WARNING

To avoid electrical shock, do not initialize or operate the unit if it bears any sign of damage to any portion of its exterior surface, such as the outer cover or panels.

Check that the unit and contents are complete:

1. Inspect the shipping container for any indication of excessive shock to the contents, and inspect the contents to ensure that the shipment is complete.
2. Inspect the unit for structural damage that can have occurred during shipping.
3. Keep the packaging.

Immediately inform VIAVI and, if necessary, the carrier if the contents of the shipment are incomplete, if the unit or any of its components are damaged or defective, or if the unit does not pass the initial inspection.

What's in the box

MAP-280 and MAP-280R

The packaging for the MAP-280 & MAP-280R includes the mainframe, rack-mount ears (MAP-200A03), power cord (user specified at the time of order), Master Enable interlock key and USB drive that contains the MAP-200 reference material.

Figure 20: MAP-280 Mainframe

Figure 21: Left to Right: Rack-mount ears, Power Cords, USB Drive & Interlock Key

MAP-230B

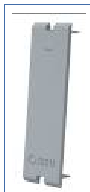
The packaging for the MAP-230B includes the mainframe, power cord (user specified at the time of order), USB drive that contain the MAP-200 reference material and Master Enable interlock key.

Figure 22: MAP-230B and default accessories

MAP-200BKD

The packaging for the MAP-200BKD includes Keypad display unit and a MAP-200A01 harnesses kit, which includes USB and DVI cables.

Figure 23: MAP-200 Key-pad/Display and accessories

	Blanking Plates The MAP-200 will be shipped with blanking plates to cover the cassette slots. The cassette slots should, at all times during MAP-200 operation, be covered with either a blanking plate or be filled with a cassette. See the Optical Cassettes section for more details.

Cleaning Instructions

⚠	Never clean the unit when the power is turned on.

Cleaning the Equipment

1. Unplug the equipment from the line power.
2. Clean the enclosure with a water-dampened cloth.
3. DO NOT plug the unit to the line power until it is completely dry.

Cleaning Optical Connectors

- Be sure the unit's UCA and internal optical connectors are clean and undamaged. Connecting an optical connector to the unit when contaminated/dirty can cause significant damage to the unit's optics.
- Never clean the connectors when the unit is turned on.

The following items are required for cleaning:

- Filtered compressed air or dusting gas
- Lint-free pipe cleaners or lint-free swab
- Lint-free towels
- Optical grade isopropyl alcohol or optical grade 200° ethanol (do not use rubbing alcohol, which contains 30% water)

1. Remove the two adapter mounting screws with the No. 0 Phillips screwdriver. Removing the adapter will expose the internal optical connector that is fastened to the base plate. The internal connector and base plate are mounted at the factory and should not have to be adjusted under normal operating conditions.

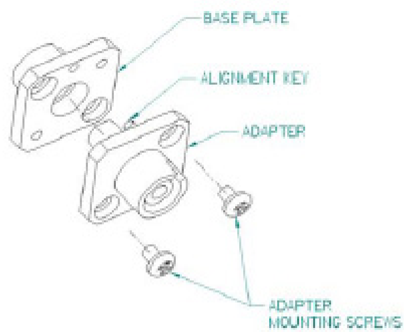


Figure 24: Front Panel Optical Adapter

2. Clean the internal cavity with a pipe cleaner and alcohol (a rotating motion will yield the best results). The adapter is a critical component that can provide highly reliable mating of optical connector, if properly maintained.

3. Gently wipe the back surface of the adapter to ensure a clear mating surface to the base plate.

4. Using the dusting gas or compressed air, blow the base plate and ferrule.

5. Apply optical grade isopropyl alcohol or optical grade ethanol to a lint-free towel/tissue. Clean the unit's optical connector by gently rubbing the ferrule. Do not apply excessive pressure while rubbing to avoid scratching and pitting.

6. Wipe the ferrule with a dry lint-free towel/tissue.

7. Using the dusting gas or compressed air, blow the end of the ferrule and base plate.

8. To insert the adapter sleeve into the base plate, align the center axis of the two parts and make sure the alignment key mates with the alignment hole on the flat surface of the base plate. Once in position, fasten the two adapter mounting screws to secure the parts together.

9. All optical jumper connectors used to mate other equipment with the MAP-200 should be cleaned thoroughly. See the Cleaning Jumper Connectors section for further details.

Cleaning Jumper Connectors

CAUTION

- Connecting damaged or dirty connectors to the unit can damage the connectors on the unit.
- Never force an optical connector. Some connectors have a ceramic ferrule that can easily be broken.
- Never clean the connectors when the unit is turned on.

Optical connectors need to be cleaned before use with the unit.

The following items are required for cleaning:

- Filtered compressed air or dusting gas
- Lint-free pipe cleaners or lint-free swab
- Lint-free towels
- Optical grade isopropyl alcohol or optical grade 200° ethanol (do not use rubbing alcohol, which contains 30% water)

To clean the connectors:

1. Ensure that the unit is shut down (See source shut down).

2. Blow the sleeve with filtered compressed air.

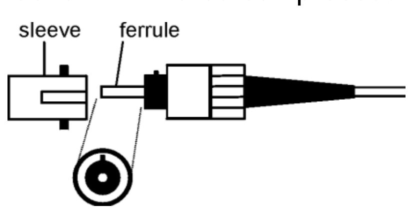


Figure 25: Connector cleaning (connector type can vary)

3. Apply optical grade isopropyl alcohol or optical grade ethanol (do not use rubbing alcohol) to a small area of a lint-free towel and rub the end of the ferrule over the wet area.

4. Wipe the ferrule on a dry area of the lint-free towel.
5. Using the dusting gas or compressed air, blow the end of the ferrule.
6. Apply the alcohol or ethanol to a lint-free pipe cleaner or swab and wipe off the remaining parts of the connector.
7. With the other end of the pipe cleaner or swab, dry the areas cleaned.
8. Using the dusting gas or compressed air, blow the areas cleaned.

MAP-200 8-Slot Chassis Details

The MAP-280 chassis is a 3U high and 19.6 inch-wide benchtop unit that houses a maximum of 8 modules. It consists of the physical enclosure, backplane and controller module. The chassis has 8 vacant slots for modules. The 8 slot chassis is also available in a reversible configuration, MAP-280R, with the same dimension as that of a MAP-280.

MAP-280

Figure 26: MAP-280 Front View

Figure 27: MAP-280 Rear View

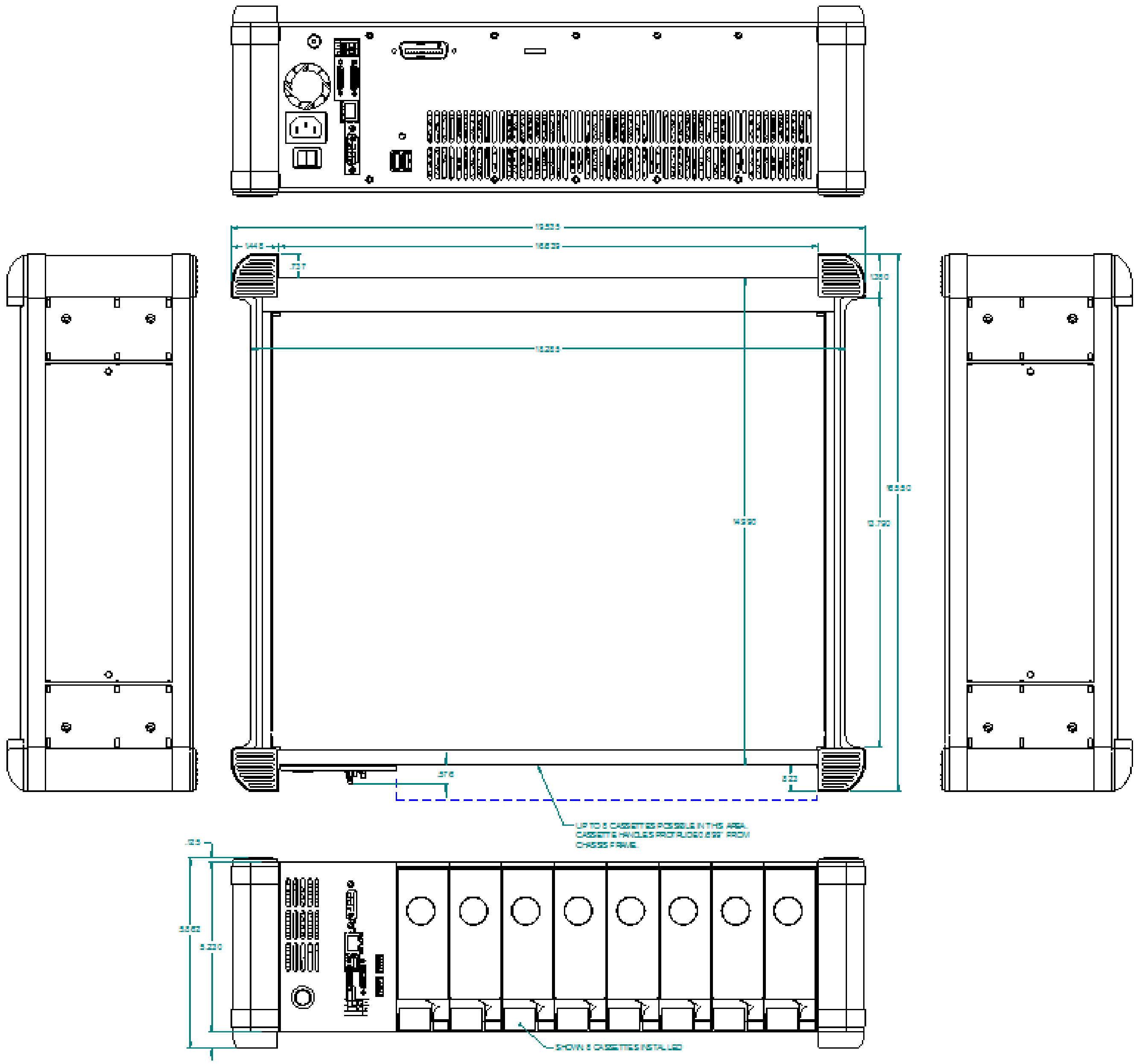
MAP-280R

Figure 28: MAP-280R Front View

Figure 29: MAP-280R Rear View

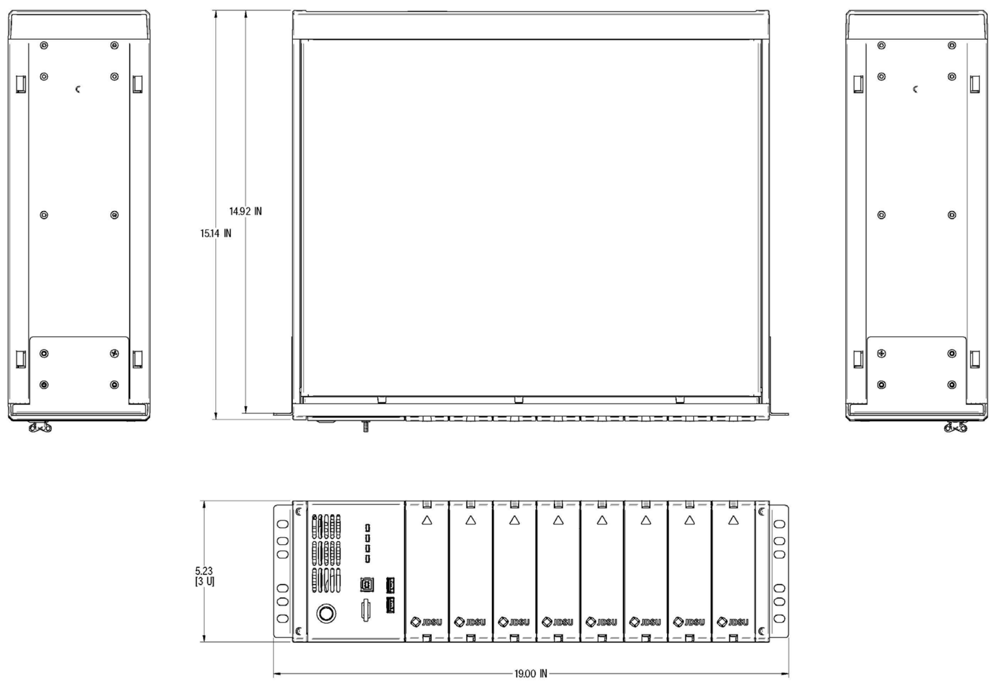
MAP-280 and MAP280R Dimensionsin Benchtop Configuration

Figure 30: MAP-280 Chassis Dimensions



MAP-280 and MAP280R Dimensions in Rack-mount Configuration

Figure 31: MAP-280 Dimensions in rack-mount configuration



MAP-200 3-Slot Chassis Details

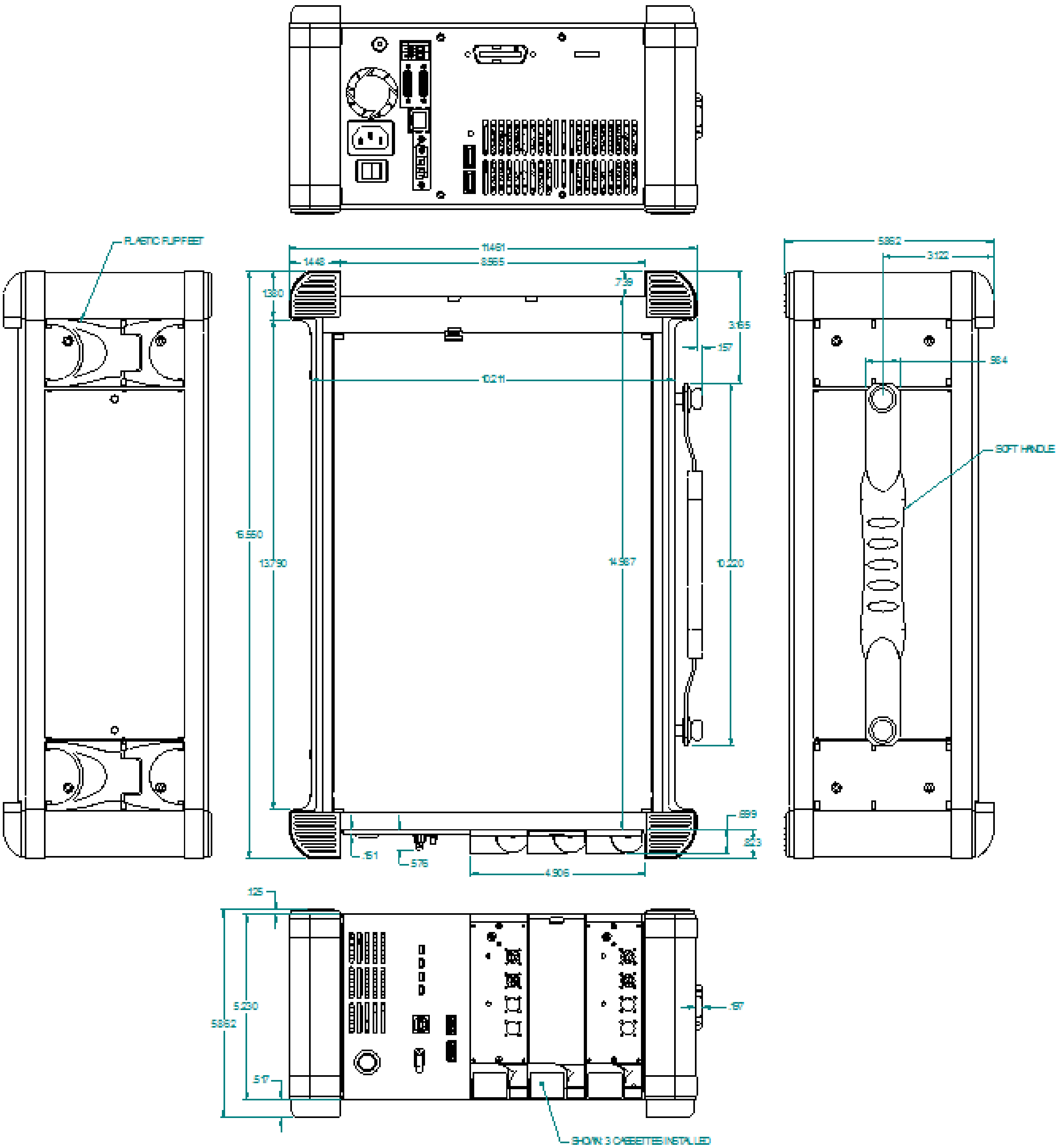
The MAP-230B chassis is a 3U high and 11.5 inch-wide benchtop unit that houses a maximum of 3 modules. It consists of the physical enclosure, backplane and controller module. The chassis has 3 vacant slots for modules.

Figure 32: Front View of MAP-230B Benchtop

Figure 33: Rear View of MAP-230B

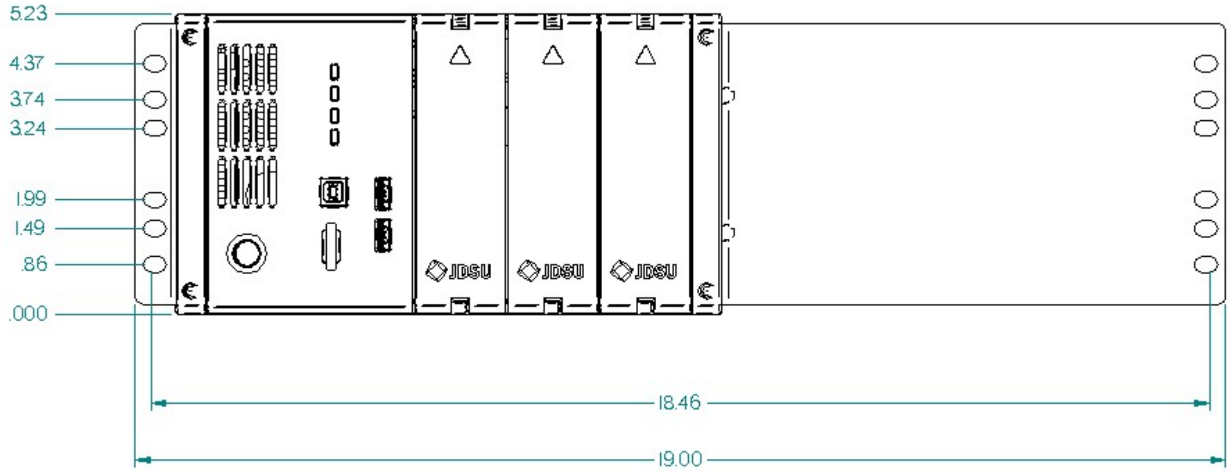
MAP-230B DimensionsBenchtop Configuration

Figure 34: MAP-230B Dimensions in Benchtop configuration



MAP-230B Dimensions Rack-mount Configuration

Figure 35: MAP-230B Dimensions in rack-mount configuration



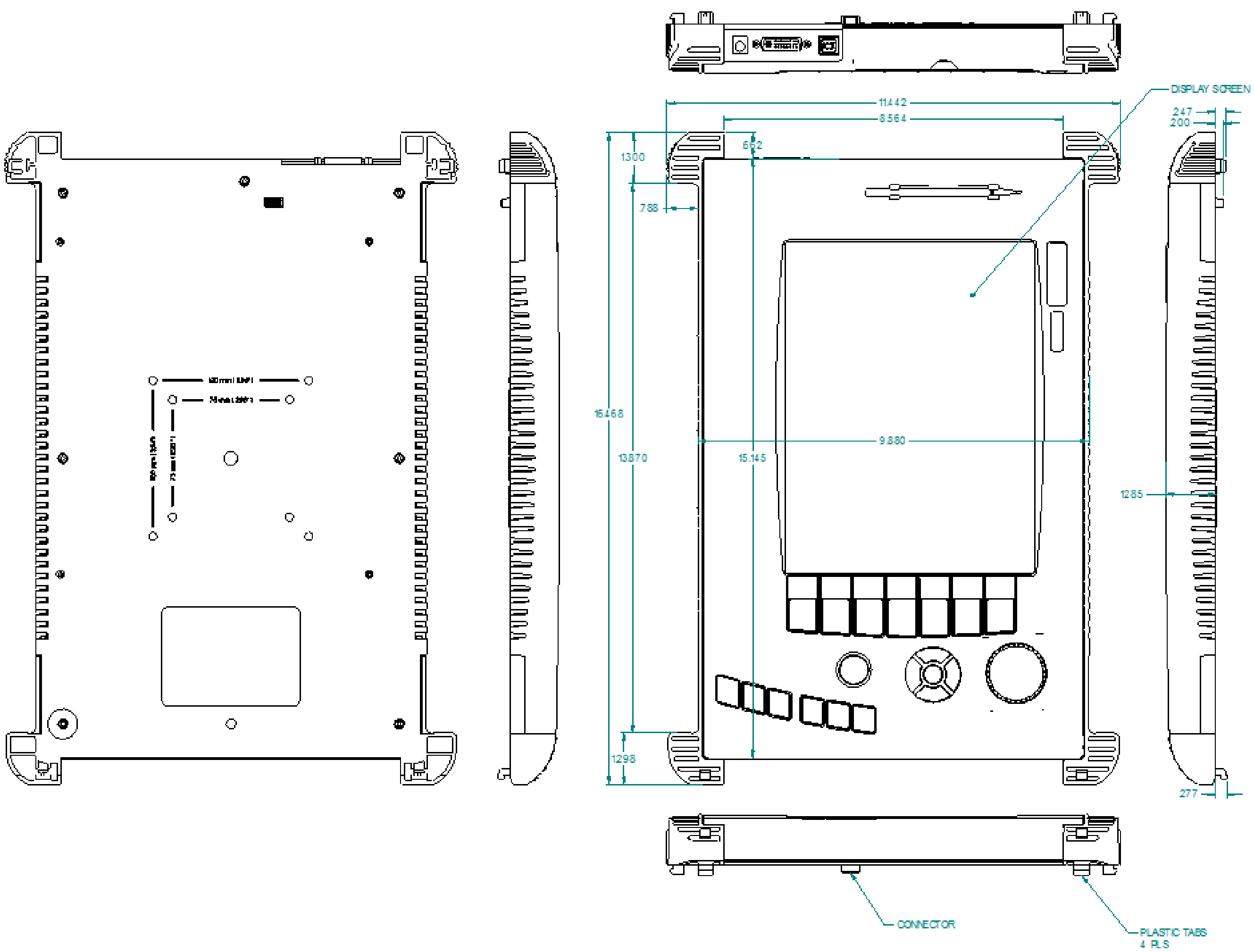
MAP-200 Display: Overview of Assembly

Figure 36: Display Unit Front Panel

This section illustrates the main components of the MAP-200 display. The display unit (see Figure 36) is an element that can be connected to the DVI connector of the MAP-200 chassis. It consists of a keypad and a touch screen which allows for local MAP-200 control.

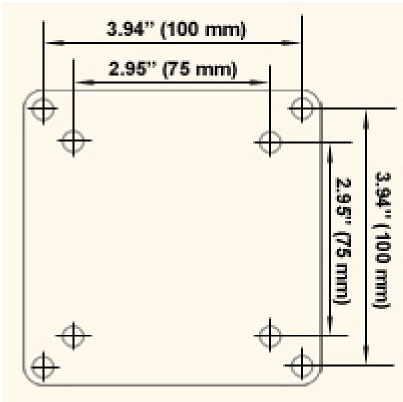
	CAUTION The display is NOT hot-swappable. The MAP-200 must be powered off prior to connecting the display. The display can be connected to the chassis either by docking OR harnesses, not both.

Figure 37: MAP200KD Dimensions



The display unit will be shipped attached to the benchtop unit. It can be removed and mounted to a VESA mounting device. The standard VESA mounting holes pattern is illustrated in Figure 38.

Figure 38: Display Unit VESA mounting holes pattern



Installation

Power Consumption

The maximum power consumption is 200 VA.

Instrument Cooling

Clear distance should be approximately 1" at the front and the back. The MAP-200 is cooled with forced airflow from the front of the cassette and through the backplane fans.   Forced airflow is provided by 5 fans in the MAP-280 and 2 fans in the MAP-230B (max. flow with no restriction: 10 cm each) installed on the rear of the controller. Average air velocity through the modules (cassettes) is 2-4 m/s.

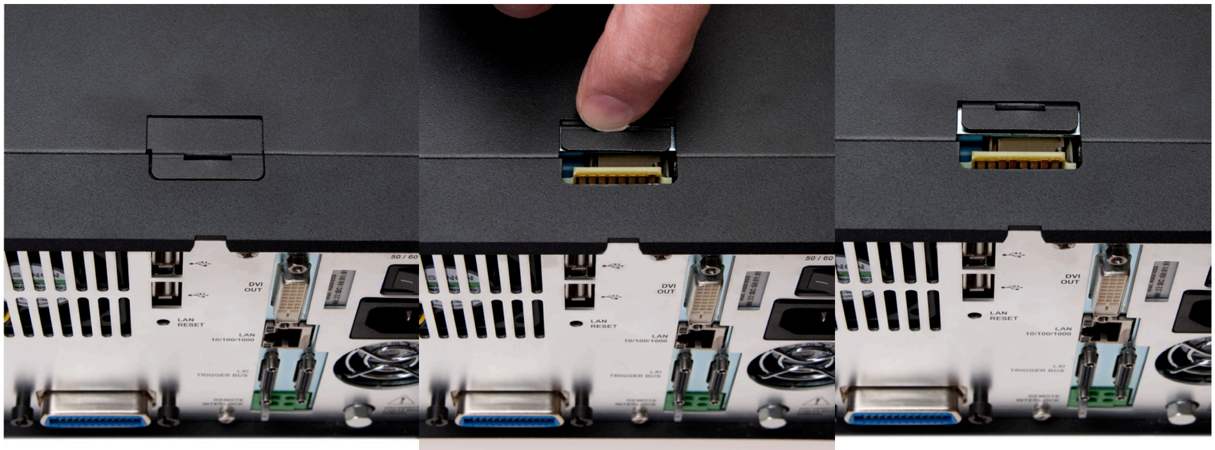
Docking MAP-200 Touch-screen Display on MAP-230B 3 Slot Chassis

The MAP-200BKD touch screen display can be docked on the MAP-230B 3 slot chassis, using docking connectors. The MAP-230B has a sliding door that can be pushed back to expose the male end docking connector.

There is a notch in the sliding door to facilitate pushing back with a finger nail or a flat screwdriver head. It is important to carefully push the sliding door to prevent damaging the male end docking connector.

	CAUTION The MAP-230B Docking connector should only be exposed if docking a MAP-200BKD display. Otherwise the connector should be covered by keeping the sliding door closed.

Figure 39: MAP-230B 3 slot chassis male end docking connector



The MAP-200BKD female end docking connector can be seen in the figure below.

Figure 40: MAP-200BKD touch screen/ display female end docking connector

To mount the display to the chassis:

1. Push sliding door on chassis back to expose male end docking connector
2. Ensure that rubber feet are removed from the 3 slot chassis
3. Position the display such that the docking connectors align
4. Secure two corners of the display, furthest from the docking connector, onto the chassis as shown in the figure below
5. Slowly dock the touch screen display such that the connectors mate and the other two corners slide and lock into place
6. Figure 41: Docking MAP-200BKD touch screen/display on MAP-230B

Rack Mounting the MAP-280 and MAP-280R

In the case of a MAP-280 or MAP-280R configuration, it may be necessary to rack-mount the chassis. This is done by placing the MAP-200 chassis on a shelf or tray in the rack and securing the chassis using the rack-mount ears MAP-200A03. It is recommended to rack-mount the unit prior to installation of optical cassettes and utilizing the bottom support brackets appropriate to your rack system.

Perform the following steps to install the chassis in a 19 inch (48.26 cm) rack:

1. Remove the 6 screws from each side of the Panel Assemblies.
2. Pry both Side Panel Assemblies from front and rear Bezel.
3. Attach the rack-mount brackets (using 8 flat-head screws) to either the front for MAP-280, or back for MAP-280R, of the chassis.
4. Sit the chassis on a tray or shelf in the rack.
5. Secure the chassis in place by securing the rack-mount ears to the rack.

Figure 42: Side Panel and Rack-mount kit installation

Rack Mounting (MAP-230B 3-slot)

In the case of a MAP-230B configuration, it may be necessary to rack-mount the chassis. This is done by placing the MAP-200 chassis on a shelf or tray in the rack and securing the chassis using the rack-mount ears MAP-200A10. It is recommended to rack-mount the unit prior to installation of optical cassettes and utilizing the bottom support brackets appropriate to your rack system.

Perform the following steps to install the chassis in a 19 inch (48.26 cm) rack:

1. Remove the 6 screws from both side Panel Assemblies.
2. Pry both Side Panel Assemblies from front and rear Bezel.
3. Attach the rack-mount brackets (using 8 flat-head screws) to either the front, or back of the chassis.
4. Sit the chassis on a tray or shelf in the rack.
5. Secure the chassis in place by securing the rack-mount ears to the rack.

Figure 43: Side Panel and Rack-mount kit installation

Installing MAP-200 Modules into a MAP-200 Chassis

Modules can be installed either before or after power-up. MAP-200 allows for hot-swapping, so the controller detects the presence and determines the type of cassette that is being added or removed without affecting the communication with other cassettes. Each modules has a unique ID, serial number, hardware version, and firmware version.

The modules are an element of MAP. Modules implement a specific functionality, which is directly applicable to optical instrumentation, testing, or measurement. Different types of instrumentation modules can reside in a single chassis and modules can be added in a plug and play manner.

Up to eight single-slot modules can be populated in each MAP-280 chassis. Modules can occupy more than a single slot, however, the total module space available is equal to eight single slots per chassis.

Perform the following steps to install a module:

1. Remove a blanking plate with a flat-head screwdriver by appling downward pressure to the tab at the top of the blanking plate. Store the faceplates for future use.

Figure 44: Removing a Faceplate

2. Slide the module into the chassis.

3. Position latch to 45° and when the cassette cannot be pushed in further, push the latch shut to make the final contact or until the cassette face plate is flush with the controller.

Figure 45: Inserting an Optical Module

MAP-200 allows for hot swapping of optical cassettes. The controller detects the presence and determines the type of module being added or removed without affecting communication with other modules.

- Use minimal force when sliding in the cassette during installation. Pushing the module in too fast could damage the connector on the back plane.
- An optical module or blanking plate MUST be present on each slot to ensure proper airflow within the unit.

Installing MAP Legacy Cassettes into a MAP-200 Chassis

The following sections explain how to convert legacy cassettes to fit into a MAP-200 chassis. Special attention is required for double width cassettes.

Converting Single Slot Cassettes

Perform the following steps to install a module:

1. Remove a blanking plate with a flat-head screwdriver by appling downward pressure to the tab at the top of the blanking plate. Store the faceplates for future use.

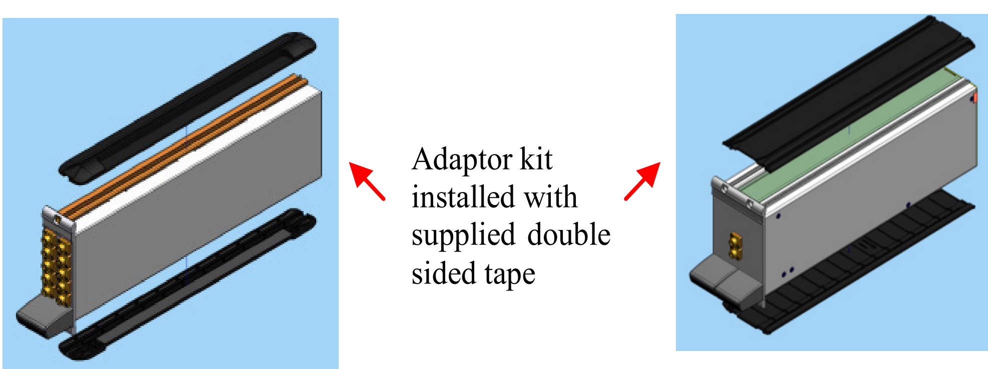
Figure 46: Removing a Faceplate

2. Remove the captive screws at the top and bottom of the MAP Legacy cassette faceplate.

3. To install the adaptor kit to the top and bottom of the module, clean cassette cover with alcohol and allow to dry.

4. Peel off the paper from the double sided tape on the guide and then attach guide to the cassette cover as shown.

Figure 47: Installing a Conversion Kit



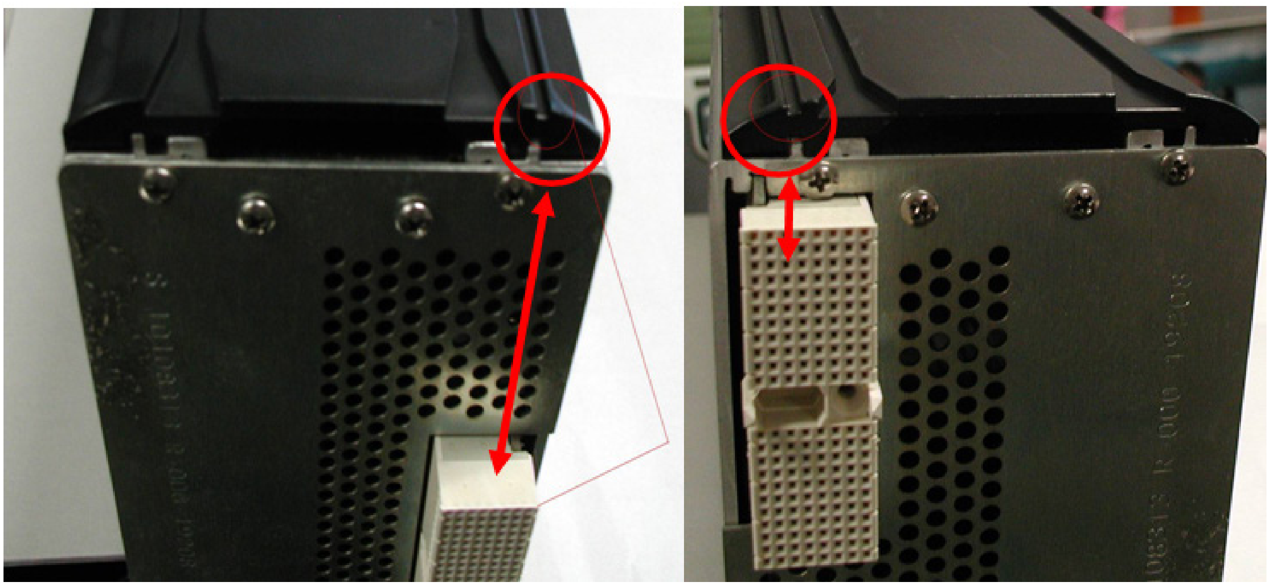
5. Insert the module in the desired slot.

Converting Double Slot Cassettes

For converting double slot cassettes, follow instruction 1-3 from previous section: **Converting Single Slot Cassettes**. IMPORTANT: If the guides are not positioned properly, the cassette will not fit properly into the chassis.

1. Determine orientation by ensuring that the smaller groove in the adaptor plate is aligned with the backplane connector as shown.
2. Peel off the paper from the double sided tape on the guide and then attach guide to the cassette cover.

Figure 48: Double slot cassette with groove aligned with backplane connector



	• Use minimal force when sliding in the cassette during installation. Pushing the cassette in too fast could damage the connector on the back plane. • An optical cassette or blanking plate MUST be present on each slot to ensure proper airflow within the unit.

Chapter 6: Maintenance

Maintenance

Upgrading the firmware

1. The latest firmware is available on the MAP-200 resource page at www.VIAVI.com .
2. Insert a formatted USB memory stick into your PC. It is recommended to have the memory stick formatted with FAT format.
3. Copy the .zip file that you downloaded from the web and save it into your PC.
4. Once the transfer is completed extract the content of the .zip file to the root directory of your USB memory stick.
5. Remove the USB memory stick using the appropriate procedure for your PC.
6. Plug your USB memory stick into your MAP-200 platform.
7. Navigate to the settings screen.
8. In the setting screen select the upgrade tab.
9. Press the upgrade button.
10. The upgrade will then take place (approximately 5 minutes). When completed you will be notified of the successful completion of the upgrade.
11. The MAP-200 will prompt your to reboot the chassis.
12. To verify that the unit has been effectively updated, after power-up you can verify the firmware version on the system screen.

NOTE: Do not simply copy contents of firmware package onto the USB drive. The controller expects the folder MAP-200 to be on the root drive.

Maintenance

Changing the Controller/Power Module

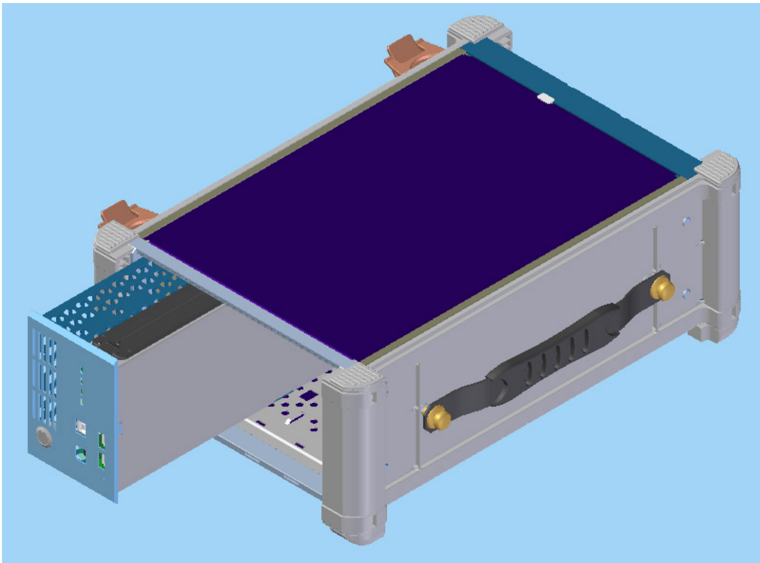
If the controller and power supply module assembly is believed to be defective, it will be replaced as one assembly.

⚠	Disconnect electrical power to the chassis at least 30 seconds prior to removing the power supply. Failure to do so may result in electrical shock.

Perform the following steps to remove/install a controller module:

1. Turn the power to the unit to the 'OFF' (0) position.
2. Disconnect all cables.
3. Use a screw driver to unscrew the jack screw at the rear of the unit that holds the controller in place. Unscrewing this screw will eject the controller/power module.
4. Remove the controller module, as shown in Figure 49.
5. Insert the replacement controller module. Re-tighten jack screw.
6. Turn the power to the 'ON' (I) position.

Figure 49: Changing the Main Controller Module



Accessories and Replacement Parts

Table 8: MAP-200 Accessories and replacement parts

MAP-200BKD MAP-200 Stand-Alone Keypad/Display Module (includes MAP-200A01)	
MAP-230HC MAP-230 Hard Case (transit case)	
MAP-200A01 MAP-200BKD Keypad/Display Cable Harness Kit	
MAP-200A13 MAP-200 Adaptor kit for MAP Cassettes 8 pairs (requires one kit per slot)	
MAP-200A13D MAP-200 Adaptor kit for MAP Double Width Cassettes 4 pairs	
MAP-200B09 MAP-200BKD Keypad/Display Module rack-mount kit	
MAP-200A10 MAP-200 3-Slot mainframe 19" rack-mount kit	
MAP-200A03 MAP-280 8-Slot Mainframe 19" Rack-mount Kit	
MAP-200A02 MAP-200 Controller for MAP-280 and MAP-230B	
MAP-200A02R MAP-200 Controller for MAP-280R	
MAP-200A04 MAP-200 Safety Interlock Key	
MAP-200A06 MAP-200 Blanking Plates (Kit of 3)	
MAP-200A07 MAP-200 Stylus	

MAP-200A08 MAP-230B 3-Slot Mainframe flip-up feet for top-facing orientation (Kit of 2)	
MAP-200A11 MAP-200 Detachable Side Panels for benchtop use	
MAP-200A12 MAP-200 Handles for Detachable Side Panels	

Chapter 7: Backwards Compatibility

Hardware

Mainframes

The MAP Legacy product line included an 8-slot Master, 3-slot Benchtop and an 8-slotSlave chassis. The Master chassis and Benchtop were standalone systems, where the slave required a Master or a Benchtop for operation. The three variants of a MAP system are shown below.

Figure 50: Legacy MAP chassis portfolio

	
A: MAP Master Front View	B: MAP Master Rear View
	
C: MAP Slave Front View	D: MAP Slave Rear View

	
E: MAP Benchtop Front View	F: MAP Benchtop Rear View

Master / Slave

The Master/ Slave relation as it currently exists will not be carried forward on the MAP-200 product - there will not be a purpose built slave unit. Previous MAP systems sales which used Slave chassis will be replaced with multiple Masters. In these cases customers will be required to revise their automation programs to port to a similar functioning MAP-200 system. The MAP-200will support browse and control of other chassis from the local user interface. Due to the discontinuation of the Master/ Slave structure, the hard MAP I/F bus connection requirement is removed.

Benchtop

Please note the 3-slot MAP-230B chassis is slightly wider than the product it replaces MAP+2B00. Because of the extra width, the MAP-230B exceeds the half-rack dimension which means it can not be mounted next to another half-rack device.

Cassettes

Optical cassettes that mount into the existing MAP product will be able to be integrated into the new MAP-200 chassis. One of the two conversion kits needs to be purchased and installed onto the modules. For single width modules, the MAP-200A013 Adaptor kit is required and for double witdh modules, the MAP-200A013D is required. These adaptors are supplied with pre-attached adhesive tape. To install to the module, refer to sections: **Converting Single Slot Modules** and **Converting Double Slot Modules**.

Optical Modules

The currently supported modules are shown in Table 10.

Table 9: Legacy MAP modules supported in MAP-200

Module	Supported in MAP-200	MAP-200 Abbreviations	Legacy Abbreviations
MAP Broadband Source	YES	mBBS	BBS
MAP Precision Attenuator	YES	mVOA	IA3, IA3-1, VEDFA, IA4

Module	Supported in MAP-200	MAP-200 Abbreviations	Legacy Abbreviations
– without power tracking			
MAP Precision Attenuator – with power tracking	YES	mVOA	IA3, IA3-2, VEDFA, IA4
MAP EDFA	YES	mEDFA	OA, EDFA
MAP Distributed Feedback Laser	YES	mDFB	DFB
MAP Fabry-Perot Laser	YES	mFPL	FPL
MAP Light Emitting Diode Source	YES	mLED	LED
MAP Optical Power Meter	YES	mOPM	OPM
MAP Small Channel Count Switch	YES	mSCS	SW
MAP Large Channel Count Switch	YES	mLCS	SKB
MAP RF Switch	YES	mRFS	RF
MAP Tunable Grating Filter	YES	mTBF	TB3, TBF
MAP Tunable Laser Source	YES	mTLS	TLS
MAP Utility	YES	mUTL	UTL
MAP Polarization Controller	YES	mPCS	PCS
MAP Clock and Data Recovery	NO		C10
MAP 10G Receiver	NO		R10
MAP 10G Transmitter	NO		T10
MAP Variable Backreflector	YES	mVBR	VBR

Control

MAP-200 will continue to support GPIB but the RS232 interface is not supported. The intent is to replace most of the functionality with the USB B interface. USB B software implementation will be available in October 2009.

Safety Interlock

The Interlock/Remote Interlock features are not the same on both platforms. The MAP-200 has the additional software interlock flag, which must be set from the GUI or automation software. Some automation script modification may be required if there are internal procedures written to address usage.

Keypad/Display

The keypad\display strategy for the MAP-200 has migrated from the existing product as follows:

- All MAP-200 configurations shall support an external keypad or mouse.
- The local keypad will be located on a separate unit known as the keypad\display

MAP Console

The MAP Console version 5.4.0 supports the MAP-200, but only with limited functionality. This release is available to help users transition from Legacy MAP to MAP-200. There will be no further development or support for Legacy MAP related software.

ActiveX Drivers

The existing MAP product uses a Console and related ActiveX drivers to manage the modules. These drivers are not supplied on the MAP-200. Instead, IVI Drivers as per LXI will be supplied.

Remote Commands

Some of the GPIB commands used on the MAP-200 have changed slightly. Please refer to Section "Programming Guide" for a complete list.

Programming and Remote Commands

Different Command Response Format

The commands below have different response format than legacy MAP products.

Table 10: Different Command Response Format

Command	mAP-200 RESPONSE FORMAT	LEGACY MAP RESPONSE FORMAT

*IDN?	`Manufacturer,Model,ID,FW`
	`e.g.,`
	VIAVI,MAP-200,123456789,1.00
		`Manufacturer,ID,Model,FW`
		`e.g.,`
		JDS Uniphase,MAP,123456789,1.00

SYST:ERR?	Error code, "Text message" e.g., -100,"Command error"	**Error code TEXT MESSAGE** **e.g.,** **-100 COMMAND ERROR**
SYST:LAY?	IA4 card name is SMA	**IA4 card name is IA3**

SCPI String response	With quotes: “xxx”	Without quotes: xxx

To establish the communication to the MAP-200, command *REM should be issued before any other commands. This is not currently required.

Legacy MAP mode

Legacy MAP mode is the format of SCPI commands for the old MAP. There is <C> parameter for all the commands except the commands start with “*”; there is a <S> parameter for all the card level commands. To provide consistency for the old MAP, this mode can be activated/deactivated through SCPI commands :SYSTem:LEGAcy:MODE. There is read-only Legacy Mode status in the local interface to indicate current legacy mode state. Once this mode is enabled all the commands sent to CMR (from either GPIB or TCP/IP socket) need to have <C>, which is set to 1, except the commands start with “*”. If this mode is deactivated, all the commands format shall follow MAP-200 format.

The port number for socket access to CMR in the legacy mode is the Router port which can be found by command :SYSTem:LAYout:PORT?.

MAP-200 New Commands

Below are commands that are newly added to MAP-200. They are NOT available for legacy MAP products.

Table 11: New SCPI Commands

Command	Parameters For The MAP-200 Non-legacy Mode	Parameters For MAP-200 Legacy Mode
*SAV	<number>	N/A
*RCL	<number>	N/A
*SDS	<number>	N/A
*WAI		N/A
:SYSTem		
:DATe?		
:TIMe?		
:LOCK:RELEase	<S>	<C>,<S>
:LEGAcy:MODE	<STATE>	<C>,<STATE>
:LEGAcy:MODE?		
:LAYout:PORT?		
:IP:LIST?		

Chapter 8: Interfaces

Convention

This guide uses naming conventions and symbols, as described in the following Table 13 and Table 14.

Table 12: Typographical conventions

Description	Example
User interface actions appear in this **typeface**.	On the Status bar, click **Start**.
Buttons or switches that you press on a unit appear in this **TYPEFACE**.	Press the **ON** switch.
Code and output messages appear in this *typeface*.	*All results okay*
Text you must type exactly as shown appears in this typeface.	Type: a:\set.exe in the dialog box
Variables appear in this typeface.	Type the new ***hostname***.
Book references appear in this typeface.	Refer to ***Newton's Telecom Dictionary***
A vertical bar | means "or": only one option can appear in a single command.	platform [a|b|e]
Square brackets [ ] indicate an optional argument.	login [platform name]
Slanted brackets <> group required arguments.	<password>

Table 13: Keyboard and menu conventions

Description	Example
A plus sign + indicates simultaneous keystrokes.	Press Ctrl+s
A comma indicates consecutive key strokes.	Press Alt+f,s
A slanted bracket indicates choosing a sub menu.	On the menu bar, click Start>Program Files.

Interfaces

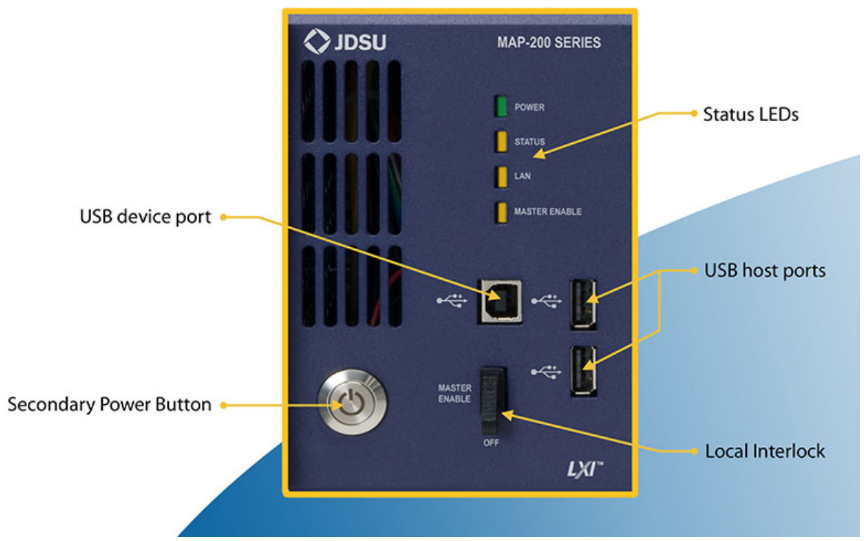
Interfaces

Front panel (left-hand side)

The front panel (left-hand side) contains, the following elements (see example below):

- 4 LED's (Power, LAN Status, System Status & Interlock)
- 1 USB-B
- 2 USB-A
- Interlock key
- Power Switch (secondary)

Figure 51: MAP-280 Front View



Interfaces

LEDs

Four LEDs on the left of the chassis are used to indicate various conditions of the MAP.

Table 14: MAP-200 Chassis LED Indicator Description

LXI Mandatory LEDs		
LED	**Color**	**Function**
Power (POWER)	Red/Amber/Green (tri-state)	OFF No Power ON (Red) when short on rail. Reseat modules[1] ON (Blinking Red) Overvoltage condition. Power cycle[1] ON (Green) when power supply is operating normally ON (Amber) when standby power is present
System Status (STATUS)	Amber/Green bi-state	ON (Amber) temporarily while chassis is initializing. ON (Red) when chassis fails (fans, onboard diagnostics etc) ON (Green) when successful boot of the processor
LAN Status (LAN)	Red/Amber/Green (tri-state)	OFF LAN Fault or no connection ON (Green) indicates LAN Normal Operation ON (Amber) Link active but no IP address ON (Flashing Green) indicates “Device Identify” ON (Red) indicates a LAN Fault or no connection
Interlock (Master Enable)	Green	ON (Green)Laser Enabled (button and software) ON (Amber) Software Laser Interlock is OFF, laser disabled OFF Laser Disabled

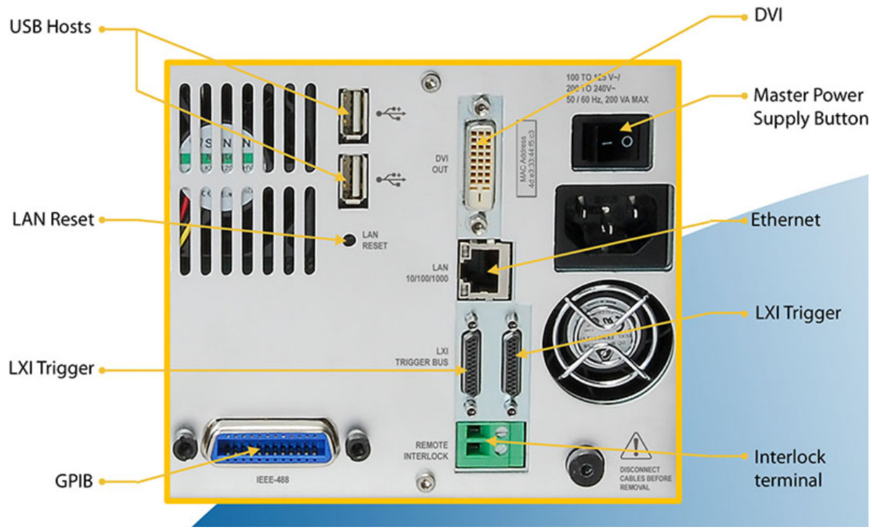
[1] If problem persists after removing and reseating all the modules, then it indicates a chassis failure. Please contact support if you encounter this problem.

Rear panel

The rear panel contains, the following elements (see example below):

- 1 Power supply entry
- 1 DVI connector for the display
- 1 RJ 45 (LAN) connector for the Ethernet interface
- 2 LXI connectors
- 2 USB-A
- 1 GPIB connector
- Ethernet Reset
- Master Power Supply Button

Figure 52: MAP-280 Rear View



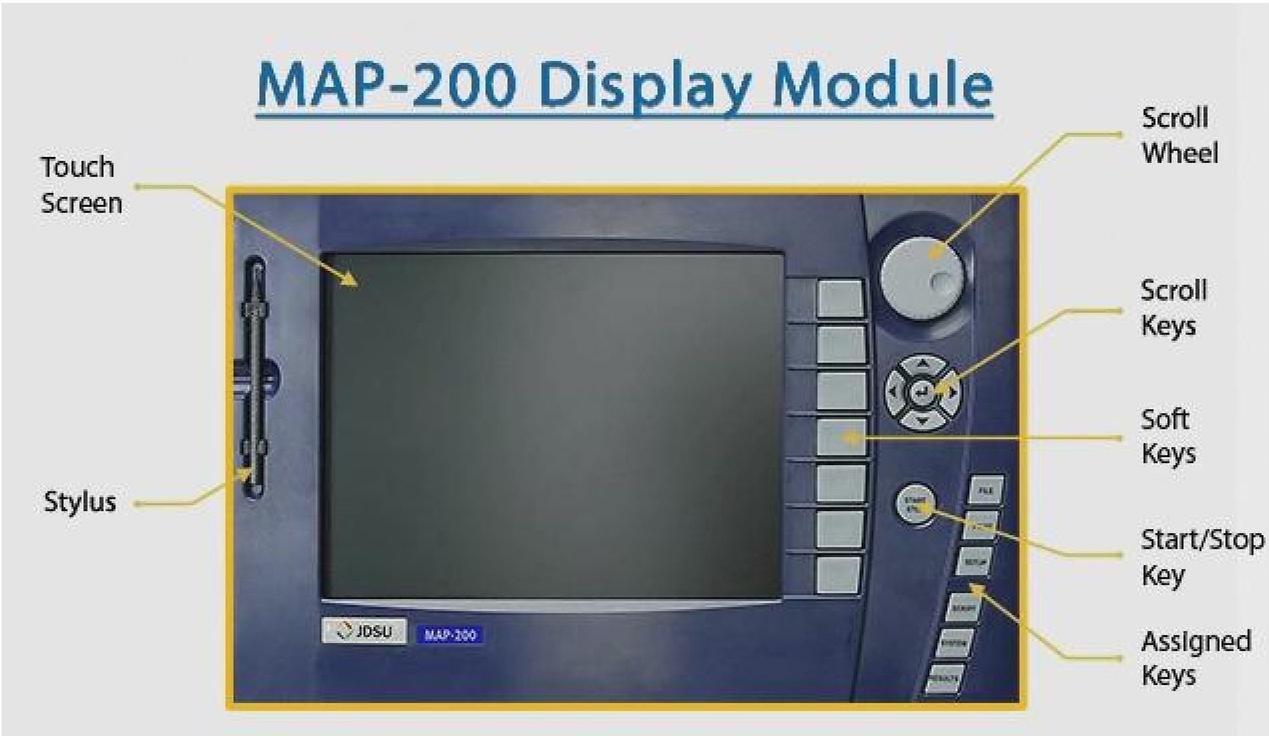
Local Control

Keypad/Display Module (MAP-200BKD)

The Keypad/Display module of the MAP-200 embodies the controls and display needed for measurement analysis.

- A large 10.4 inch TFT color screen, SVGA definition (800 x 600 pixels), back-lit with touchsreen.
- The general control buttons: SYSTEM/ SETUP/ PRINT / FILE / RESULTS
- The measurement control keys: START/STOP & SCRIPT
- Scroll keys and Direction keys for scrolling through the menus and the central button for confirmation.

Figure 53: Controls of the Interface module



Direction Keys: The direction keys have two principal functions:

- on the Results page, they are used to move the cursors or modify the zoom factor
- on the set-up pages, they are used to scroll through the menus, the central button serving to select or confirm the parameter chosen

Scroll Wheel: The wheel is used to scroll through the display screen – similar to the scroll wheel on a mouse.

PRINT: This button allows the user to print a screenshot and/or measurement results on the configured printer.

SYSTEM: This button gives access to selection of the different measurement or base functions

SETUP: This button calls up the measurement configuration menu which depends on the function in use.

RESULTS: This button calls up the results page and is used to analyze results.

FILE: This button calls up the file and directory management menu. It allows to:

- to choose the storage medium: internal memory, hard disk, floppy disk or CD-ROM, USB memory key, Flash compact memory card; file name and format; information relating to the data stored in the file

- to store files or retrieve them for selection, copying or deletion; with facilities for classifying them in directories and sub-directories

START/STOP: This button starts and stops the measurement.

SCRIPT: This button is used to enter a sequence of commands and execute it.

Note: All these functions, except PRINT and SYSTEM, depend on the modules used and the measurements made: refer to the module section of the modules for details.

External Keyboard, Mouse and Display

Note: The MAP-200 Display cannot be docked while another display DVI monitor is being used.

Interaction with the MAP-200 GUI can be done with an external keyboard and mouse. The external keyboard facilitates input of the alphanumerical configuration parameters. The external keyboard can replace all the buttons and keys of the MAP-200 except the ON/OFF button:

- The menu keys to the right of the screen are replaced by the function keys F1 to F7.
- The buttons below the screen are equivalent to Ctrl + a letter (see Table 15 below).
- The direction keys have the same function on the external keyboard and on the local interface.

Table 15: Equivalence of Function on the display unit and External keyboard

Function on the Display Unit	External keyboard
SYSTEM	CTRL + Y
SET-UP	CTRL + U
PRINT	CTRL + P
FILE	CTRL + F
RESULTS	CTRL + R
START/STOP	CTRL + S
SCRIPT (Macro)	CTRL + M
◀ ▲ ▶ ▼	← ↑ → ↓
Menu keys 1 to 7 (from top to bottom)	F1 --> F7
SAVE AND QUIT (Exit)	Enter
QUIT WITHOUT SAVING (ABORT)	Escape

Editing text using the external keyboard

In the set-up menus, it is sometimes necessary to enter alphanumerical information for names of files or results or for comments. To call up the Edit menu, select the name to be modified, then press the key. The Edit menu will appear.

- press Enter to go into the Edit menu keyboard – type the text
- press Enter to leave the Edit menu

Pressing the Esc key will close the Edit menu without saving the text.

DVI Connector

The **Digital Visual Interface** (**DVI**) is a video interface standard designed to maximize the visual quality of the digital display device. The DVI-D single and dual links are supported. There is no support for DVI-I type monitors or a VGA-DVI converter as they are analog devices.

Remote Control

The MAP-200 Unit can be connected to a PC in order to:

- remote control the unit.
- offset the screen of the MAP-200 Unit on to the PC and issue commands from the keyboard of the PC
- access the internal memory (or hard disk) of the controller from the PC and transfer files from the controller to the PC and vice versa

Four remote user interfaces are available for MAP-200:

- TCP/IP (LXI)
- GPIB (IEEE 488.1 / 488.2) – MAP legacy interface
- USB (detailed definitions are not available yet)

The MAP-200 Chassis can be controlled and programmed remotely through any available remote interfaces listed above, however only one remote interface shall be utilized at a time. Multiple remote interfaces used at the same time may cause system interaction problems. Depending on the locking status, the problems could be:

1. if the application is not locked then other connection to the application can be made and possibly cause the interaction problems
2. if the application is locked then transactions (both read and write) by other connections will be blocked
3. the local interface is read-only when an application is locked

The most straightforward, though not necessarily the best, method to program MAP-200 is to use the SCPI logical interface designed for MAP-200. This comprises a set of SCPI commands for the chassis, and a set for each of the modules available for MAP-200.

Dynamic Port Assignment using SYST:LAY:PORT? Command

Port numbers do not necessarily correspond to slot numbers and cassette port numbers can change based on hot-swapping actions from boot up to boot up. Given the dynamic association of port numbers to installed modules, it is recommended that :SYST:LAY:PORT? be called during *Initialization* routines of automation test scripts, allowing for run-time port associations, resulting in valid handles corresponding to active devices.

Such an implementation results in a more robust test software implementation, capable of handling changes to the MAP-200 cassette layout. It is also an effective tool to manage multi-user scenarios.

Dynamic Slot Assignment using SYST:LAY? Command

Slot numbers for installed modules do not change based on boot up states. However, in multi-user scenarios, it is possible for different users to set up modules configurations differently, or to use different modules in a given chassis. Hotswapping a cassette can also generate different responses to the SYST:LAY? Command depending on the state at the time of the query. Given this, it is recommended that :SYST:LAY? Be called during *Initialization* routine of automation test scripts, allowing for run-time slot associations, resulting in valid handles corresponding to active devices.

Such an implementation results in a more robust test software implementation, capable of handling changes to the MAP-200 cassette layout. It is also an effective tool to manage multi-user scenarios.

GPIB

The GPIB interface of the MAP-200 conforms to the IEEE standards 488.1-1987 and 488.2-1987. A detailed description of the GPIB interface is contained in *IEEE Std. 488.1-1987 IEEE Standard Digital Interface for Programmable Instrumentation* published by the Institute of Electrical and Electronics Engineers.

The MAP-200 chassis default settings are with Legacy Mode enabled and with GPIB address 13.

The GPIB interface requires a GPIB controller on the computer, and associated driver software. As explained earlier, there exists a set of SCPI commands for the chassis, and a set for each of the modules. Since only a single GPIB address is used for the chassis and the modules, there is a unique addressing scheme for each device in the system. The parameter list includes the address of each device, which is made up of three identifiers. The first is the chassis number (Legacy mode only). This varied from 1 through 8 for Legacy MAP, but since the Master-Slave configuration no longer exists for the MAP-200 platform, the chassis parameter is simply ignored in legacy mode. The second is the slot, which also goes from 1 through 8. The third is the device number. This is used to identify the device in a multi-device module, such as a dual OPM. In a single device unit, it must be 1.

IEEE Compliance

IEEE 488.2 Common Commands

All common commands defined in IEEE 488.2 are implemented.

IEEE 488.2 Common Registers

All status registers defined in IEEE 488.2 are fully implemented on the MAP-200 (see section 7.4).

IEEE 488.2 SCPI Commands

All MAP-200 commands generally conform to the Standard Commands for Programmable Instruments (SCPI) command language syntax, version 1999.0. SCPI is used as a baseline for MAP-200 command syntax, and where possible, SCPI-defined commands are used to implement MAP-200 functionality.

IEEE 488.1

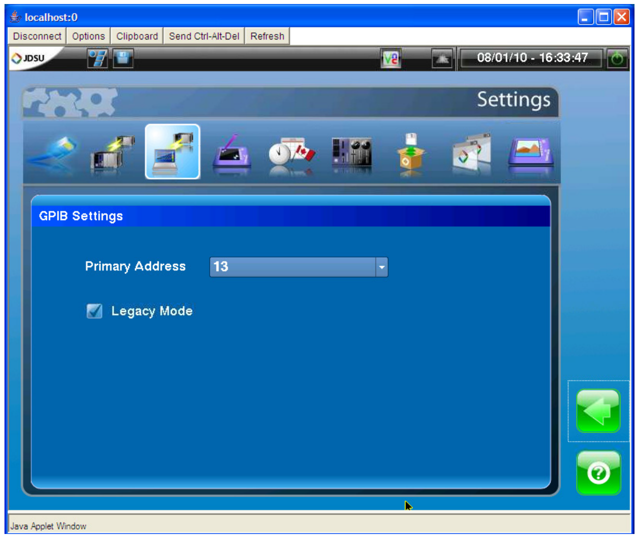
GPIB physical and electrical layer, including signaling protocol, is compliant with IEEE 488.1 specification (see section 7.1.3).

Note: SCPI compliance is neither implied nor guaranteed, and many elements of SCPI are not implemented on the MAP-200.

Default GPIB Settings

The default GPIB address for the MAP-200 chassis is 13. By default the Legacy Mode is enabled on the MAP-200 chassis. These settings can be viewed under the settings page of the MAP-200 GUI as shown in figure below

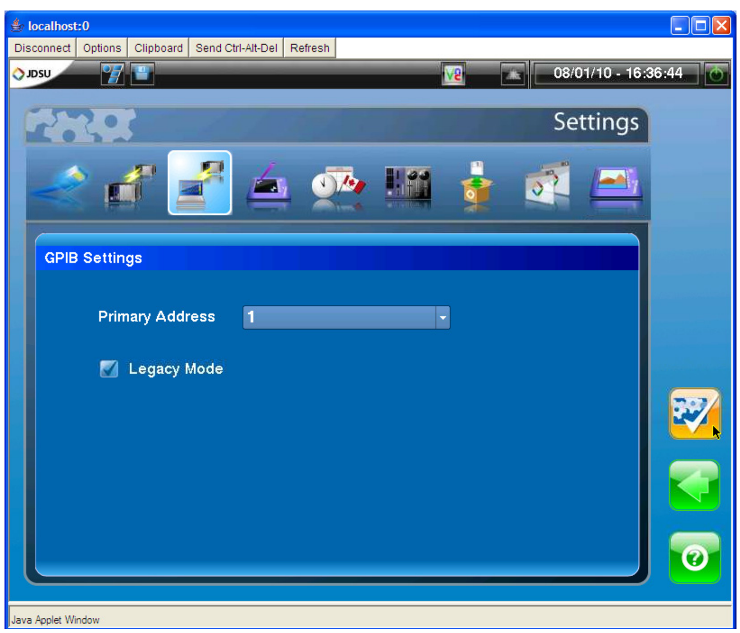
Figure 54: GPIB Settings Page



Changing GPIB Address

To change the GPIB address of the MAP-200 chassis from default address 13 to another value, navigate to the GPIB settings page as shown in Figure 55. From the drop down box labeled **Primary Address**, select the desired address. Then select the yellow check mark icon on the right hand side to apply new settings. This can be seen in the figure below

Figure 55: Changing Default GPIB Address



Ethernet

TCP/IP and LXI-11 protocols are used for the SCPI commands via Ethernet connection. The CMR (controller) is the default system access point for MAP-200 chassis. The port number is fixed, however it can change at every power cycle. From this access point, users can retrieve the system layout information (via SCPI commands SYST:LAY? and SYST:LAY:PORT?).

TCP/IP

The MAP-200 Chassis socket communication can be linked directly to a PC, or via a network. Futher applications like the tool-box and super application, will have a unique port number to communicate with. For TCP/IP access, the CMR is the interface to utilize initially, in order to access all the system commands, system layout information, and the system port information for all the cards.

Hyper Terminal with TCP/IP selection and correct port number can be used as this type of interface.

The default physical remote user interface is Ethernet.

National Instruments Measurement & Automation Explorer can be used to find the MAP-200 IP address such as the example below. Alternatively, the VIAVI LXI Instrument Discovery Browser, included on the USB Drive shipped with the MAP-200 chassis can also be used to discover the instrument IP address.

Figure 56: NI MAX for instrument IP discovery

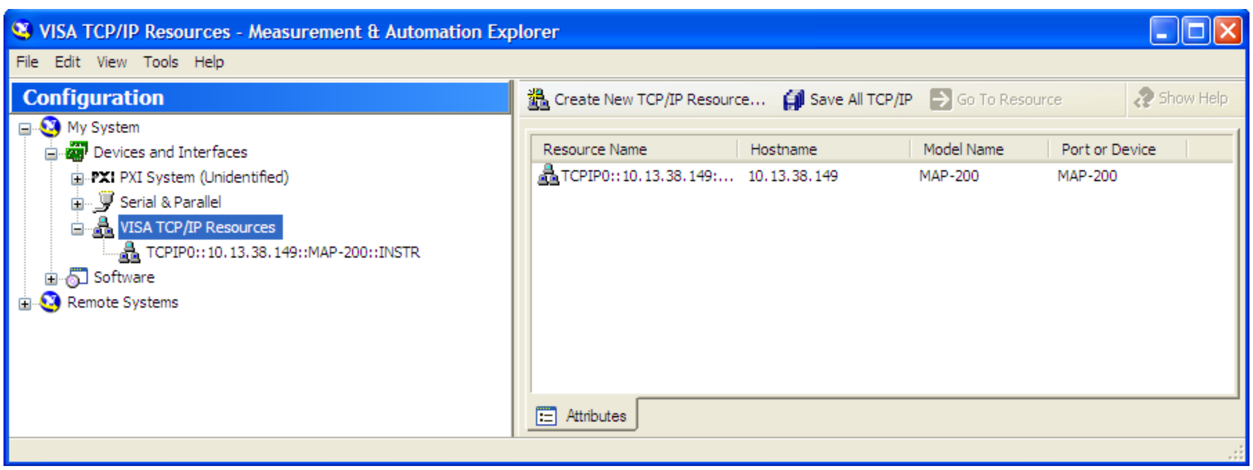
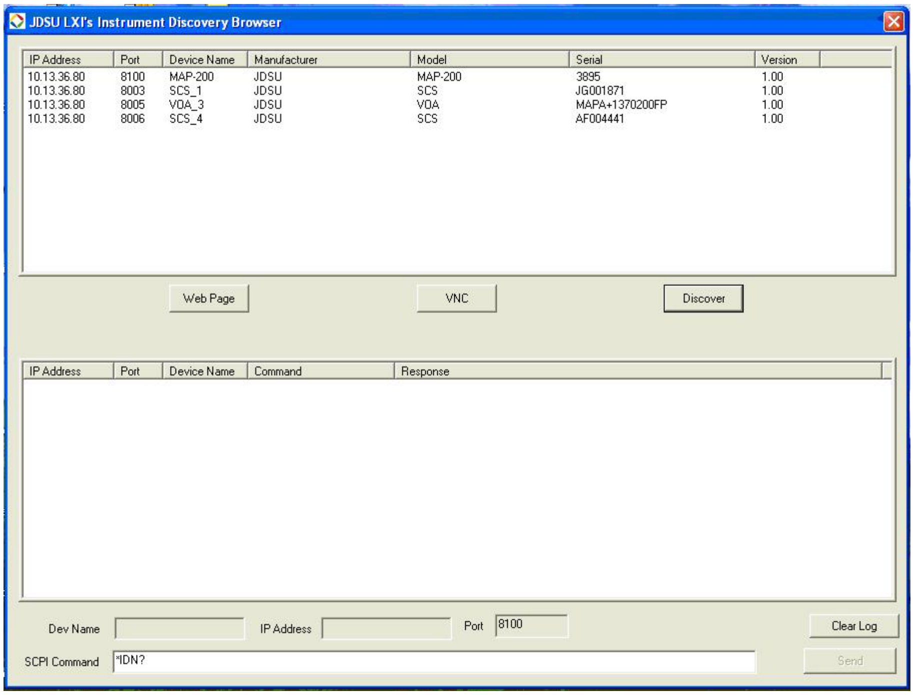


Figure 57: VIAVI LXI Instrument Discovery Browser for instrument IP discovery



Note: The Ethernet card of the equipment connected to the MAP-200 must be configured to the Auto-detect mode (Auto negotiation).

If TCP/IP (LXI) socket connection is used, only one instance should be activated at a time. Multiple connections or mixed LXI and socket to an application or to both CMR and application may cause application malfunction.

How to Discover Instrument IP Address

The instructions below are a guideline to help determine the device IP address. If after following the instructions below, communication can still not be established then it is advised that a dialogue be initiated with the support group. The contact information is available in the Technical Assistance section of the manual. Once the device IP address is known, the GUI can be accessed throug VNC or an internet browser application, like Firefox Mozilla or Internet Explorer.

DHCP

The factory default TCP/IP configuration is DHCP (Dynamic Host Control Protocol), which allows the instrument to be automatically be assigned an ip address. Instrument IP discovery tools require that the instrument be connected on the same subnet as the PC running the application.

For example:

Instrument IP: 10.13.38.101

Network Netmask: 255.255.255.0

PC1 IP: 10.13.36.100

PC2 IP: 10.13.38.20

In such a chase, PC1 will not be able to detect the instrument IP while PC2 will be able to discover it. This is because of the discrepancy between the subnets 38 and 36. In such a scenario, contact your IT department for help with subnet information.

Perform the following steps to reset to DHCP.

1. Connect the MAP-200 chassis to the network by connecting a RJ-45 cable on the ethernet port of the controller.
2. If the MAP-200 is powered on, press the LAN Reset button at the back of the controller until it is amber.
3. Wait until the LAN status LED on the front of the controller is green.

Discovering MAP-200 IP Address

1. Run the LXI discovery application and select **Discover**.
2. Instrument IP address, and populated cassette information should appear.

If the above instruction do not lead to the discovery of instrument IP and a broadcast timeout error is generated, likely the issue is that the PC and the instrument are on different subnets. In such a case, it is better to set a static IP. This behaviour typically exists for large corporations with numerous subnets.

Auto-IP

This mode can be used as an initial step when setting static IP for a chassis or to establish communication solely between a PC and an instrument.

1. Connect the MAP-200 chassis to the PC by connecting a RJ-45 cable on the ethernet port of the controller to the LAN port of the PC.
2. If the MAP-200 is already powered on, press the LAN Reset button at the back of the controller.
3. Ensure that the wireless ethernet port on PC is disabled.
4. Remove any static IP settings under network settings. This can be done by going to **Control Panel, Network Connections**. Right-click Local Area Connection and select **Properties**. Scroll down to select **Internet Protocol (TCP/IP)** as shown in Figure 58.
5. Once **Internet Protocol** is highlighted, click **Properties** button to bring up associated properties’ settings pop-up as shown in Figure 58.
6. Before changing settings, please ensure that all current settings are recorded so they can be re-enabled later.

7. Ensure that **Obtain an IP address automatically** option is selected.

8. It is advised to renew the IP address, after connecting to the MAP-200. This can be done through the command prompt.

   a. In command prompt, type: ipconfig/release

   b. In command prompt, type: ipconfig/renew

   c. In auto-IP mode, the command prompt should return an IP address starting with169

Figure 58: PC TCP/IP Settings Page

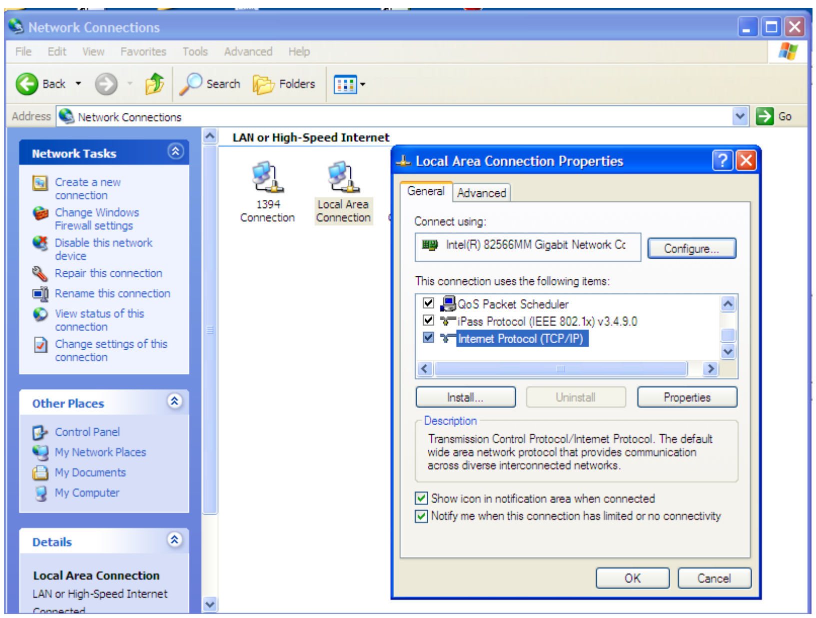
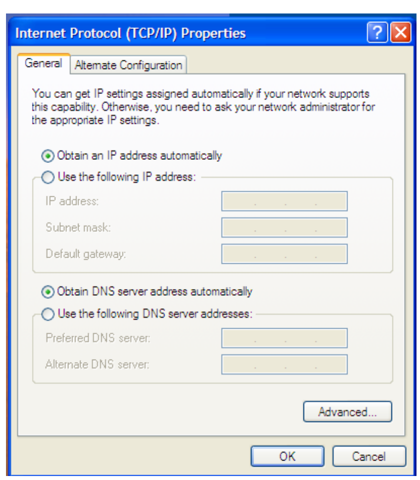


Figure 59: Internet Protocol (TCP/IP) Properties pop-up



9. Ensure the LAN status LED on the front of the controller is green.

10. Run the LXI discovery application and select **Discover**.

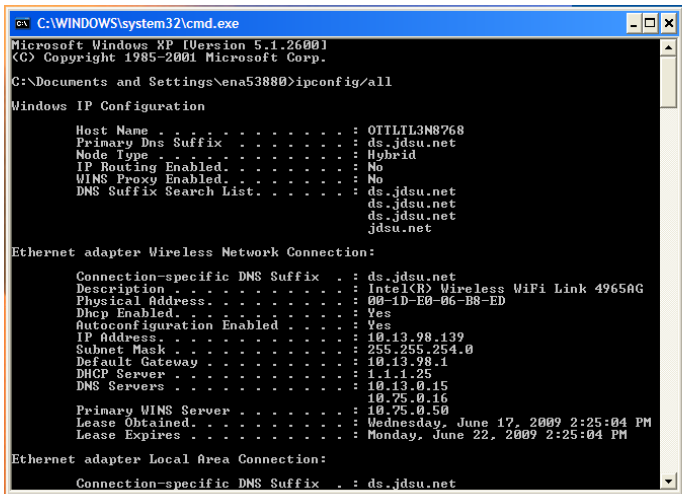
Instrument IP address, and populated cassette information should appear.

Static IP

A static IP address persists on a PC or LXI instrument, regardless of router or instrument shutdown. Typically an IT division assigns or alots Static IP addresses. It is advisable to get IT to provide an available IP address before assigning it to the MAP-200.

Setting a static IP also requires some other parameters to be known, such as the gateway, DNS server among others. If this information is not provided by the IT deparment, it can typically be found through the command prompt by typing the command: **ipconfig/all**. The information returned should be recorded. An example of this is shown below.

Figure 60: Acquiring TCP/IP parameters



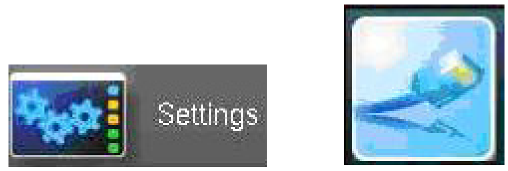
1. Follow instructions in Auto-IP section until the instrument IP address is discovered.

2. Follow instruction in Connecting through Internet Browser section below, until the instrument GUI appears.

3. From the home page, select **Settings**, Figure 61a, to access the settings page.

4. Under settings, select the RJ-45 connector icon, Figure 61, to access the TCP/IP page.

Figure 61: GUI Settings and TCP/IP icons



5. Enter the necessary parameters for static IP settings in the page, as shown in Figure 62. Mulitple static IP addresses can be stored under different profiles.

6. Select the yellow check mark icon to apply settings.

7. Follow instruction in section Connection through Internet Browser with the newly set static IP address. Once the settings are applied, connectivity to the GUI will be lost. The connection can be re-established by using the newly set static IP address.

Figure 62: TCP/IP settings page and yellow Save icon with checkmark

Connecting through Internet Browser

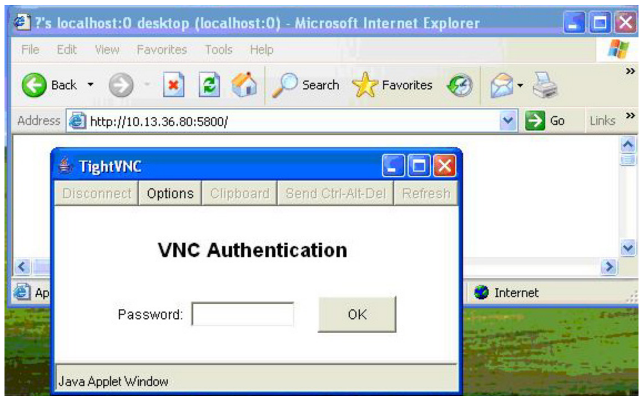
A connection through an Internet Browser application, like Internet Explorer or Mozilla Firefox, can be used to access the MAP-200 GUI. This brings up the Java Applet, which connects to the VNC server on the MAP-200 chassis. To be able to run this, the device IP address must be known.

1. Enter the IP address of the MAP-200 chassis and append it with ":5800", in the format: http://xxx.xxx.xxx.xxx:5800

2. A VNC authentication pop-up window should appear, as in Figure 63 requiring a password. Enter ***map200*** as this is the default password. The :5800 is default port address for the VNC session.

3. The web interface GUI should appear

Figure 63: VNC authentication pop-up through Internet Browser



Direct connection or VNC

The MAP-200 includes an imbedded java VNC server but a third party VNC clients such asTight VNC (V1.2.9) and Real VNC (V 4.1.1). To access the VNC server you must identify the MAP-200 IP address. If you have a Keypad/Display module or external monitor connected to the DVI port, you can find the IP address in the system screens.

1. Connect the RJ 45 connector of the controller to that of the PC with a straight-thru or crossover Ethernet cable.

2. Wait for approximately ten seconds while the connection is established.

3. Use the LXI discovery tool (or equivalent software) provided by the LXI consortium.

4. The discovery tool will display the MAP-200 IP address.

5. On the PC, go into Internet Explorer and type the address displayed by the discovery tool followed by :5800 (example http://.XXX.XXX.XXX:5800).

6. A VNC window will open demanding a password. The password is " map200".

The screen of your MAP-200 Unit will then appear offset on to your PC. You can use the keyboard and mouse of the PC to control the MAP-200 Unit.

USB-B

The USB-B connection is not currently supported in firmware. However, in the future, a USB-B interface will be available, which will allow programmatic control of the MAP-200.

LXI Wire Trigger BUS (WTB)

The LXI wire trigger signals are multiplexed inside FPGA to allow software to configure which LXI trigger line is sent to the modules. The 4 trigger lines that run from the FPGA to the modules can be configured as inputs or outputs depending on the application that is running at the module level.

The LXI external hardware triggers are not currently implemented. However, future applications will support external hardware triggering through the WTB. This will also elevate the LXI status of the MAP-200, comparable to a class A or B LXI instrument

.

Chapter 9: Graphical User Interface

GUI Introduction

Html help files have been created to help users navigate the MAP-200 GUI. These are accessible via the MAP-200 GUI. An example is included below:

Figure 64: Key GUI Help Sections

①**System Symmary:** Display a general summary of the system's state. The state of the interlock, faults, CPU usage and User Flash Memory usage is displayed.

②**System Information:** General system indentification is displayed including the device's ethernet and MAC addresses. The installed Software Versions is also displayed.

③**Main System Views:** These buttons allow access to the main system screens. The Instrument Summary provides a view into the state of all cassettes through the Summary Widgets. The Settings screen allows configuration of the chassis. The Filemanager provides management of files stored on the User Flash partition and also the transfer of files to and from USB memory sticks.

④**Super Applications:** Super Applications extend the base capability of the MAP-200 platform by provided intergrated application solutions. Any installed Super Applications are displayed and accessible in this panel.

⑤**Support Applications:** Additional software packages are accessible in this panel. Remote access to other MAP-200 chassis is possbile thought the VNC application. Internet access is possible using the built-in Web Browser.

Accessing GUI Help Files

The GUI help files can be found on the USB drive shipped with the MAP-200 chassis. The help files are HTML based and have links to the various sections of the GUI, which can all be accessed through the main page. To launch the main page:

- Unzip the contents into the root folder
- Navigate to the root folder
- Click on **MAP-200_GUI_HELP** to launch the help files main page
- Alternatively, navigate to folder **MAP200Help** and double click the file **index.html** to launch the help files main page

User Profiles

Users have the capability of storing device settings, such as wavelength, power level, switch positions and other such parameters as a profile. This new feature is especially benficial in the following cases:

- Shared usage: If a system is used by more than one user, each can set up a profile to quickly recall the desired starting state without having to manuall enter parameters every time
- Multiple applications: Some applications may require different settings than others. States can be saved to match various applications
- Response time: In time critical applications, it may be necessary to change device states quicker than remote interface commands allow. In such cases it is easier to use one command to change a profile to change the state of the chassis and devices, rather than to issue multiple commands to change device states sequentially.
- Safe state: If the user application is critical to maintaining a particular state, even in power recovery situations, it may be desirable to boot up the chassis in a known state. Hence a profile can be set up and the chassis can be configured to boot up in the specified state

Profiles can be recalled in run-time and will take effect immediately. Another option is to configure the chassis to boot up in a particular profile.

Available Profiles

There are 5 user profiles available, labeled 1-5 on the GUI (and 2-6 respectively, if using a remote interface). There are two other profiles that are read only. These are the factory default state and last shut down state. A user can change profiles 1-5 and can use the other two reserved states to recall either a factory default state or the last shut down state.

Figure 65: Accessing State Management

This can be viewed by clicking on the following icon, which is always visible on the GUI:

Figure 66: Disk icon representing state management

The available profiles can be seen below:

Figure 67: State Management Dialog Box

The first icon on the left, indicates the factory default profile, followed by the last shut down state profile. Following these are user profiles, listed as 1 through 5. At the bottom are icons to save and recall profiles.

Saving a Profile

User profiles can be saved quickly through the GUI. A user has the option to save up to 5 custom profiles.

1. Enter the desired parameters and change to desired settings for the instruments. The screen shot below shows instrument settings that will be saved under *Profile 1.* The power level is set to 3dBm and wavelengths are at default for the mDFB in slot 1 and mLCS switches in slot 2 and 3 are in position 1.

Figure 68: Instrument settings to store under user Profile 1

2. Bring up the State Management Dialog Box by seleting the Disk icon. At this stage none of the available profiles are highlighted as can be seen in the figure below.

Figure 69: State Management Dialog Box from Instrument Summary Page

3. Select the desired profile number, which will highlight the profile number and also enable the save and recall icons. In this case, the user profile 1 is selected.

Figure 70: Selecting a profile to save

4. Select the *save to disk* icon on the bottom right hand corner of the State Management Dialog Box as shown below

Figure 71: Save Profile Icon

5. The dialog box disappears after a profile has been saved successfully.

To highlight the convenience of the profile feature, the section below continues to follow abovementioned instructions to save different settings under a different profile.

a. Changed settings: Power level to 5dBm and wavelenght offset by 1nm in slot 1 mDFB module and mLCS at position 8, as can be seen in the figure below:

Figure 72: Instrument Settings for user profile

b. These settings are saved under profile 5 as seen in the figure below

Figure 73: Saving instrument settings to profile 5

Recalling Profiles

User profiles can be recalled quickly through the GUI. A user has the option to recall up to 5 custom profiles and default factory and last shut down states as well.

1. Bring up the State Management dialog box by selecting the disk icon as shown below

Figure 74: State Management Dialog Box Access

2. Highlight the profile to recall. In this case Profile 1 is selected for recalling, which highlights the profile icon and also enables the Save to Disk and Recall from Disk icons. Select bottom left icon to Recall from Disk, as shown below

Figure 75: Recalling a Saved User Profile

3. This brings up the settings previously saved under profile 1, as can be seen below

Figure 76: Profile 1 state recalled

4. To bring up another profile, simply follow step 2 with the desired profile number

Powering Up in a Specific Profile State

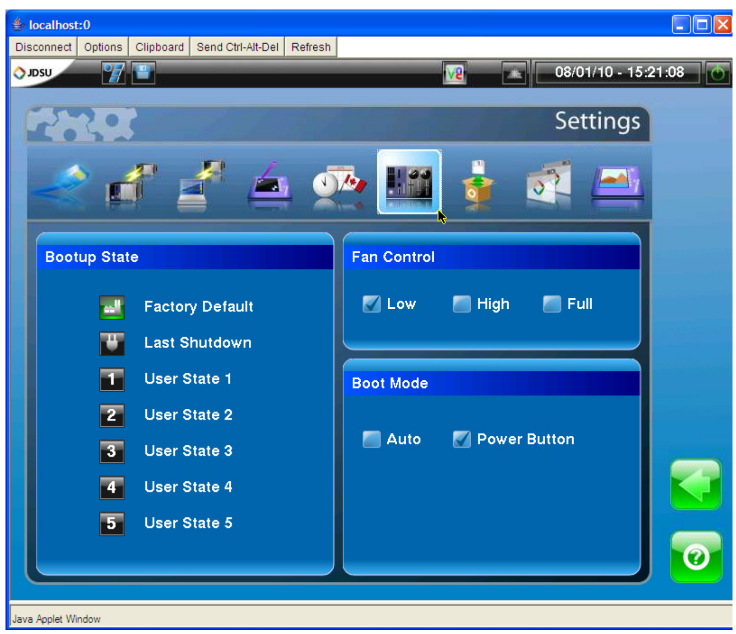
It is also possible to boot a chassis in a particular profile state. If the option to boot in a specific user profile is selected, a user should ensure that the profile exists with the settings as desired. Refer to sections Saving a Profile and Recalling Profiles to set and confirm profiles.

1. From the home page, navigate to the settings page by clicking on the settings icon, as shown in figure below

Figure 77: Accessing Settings Page

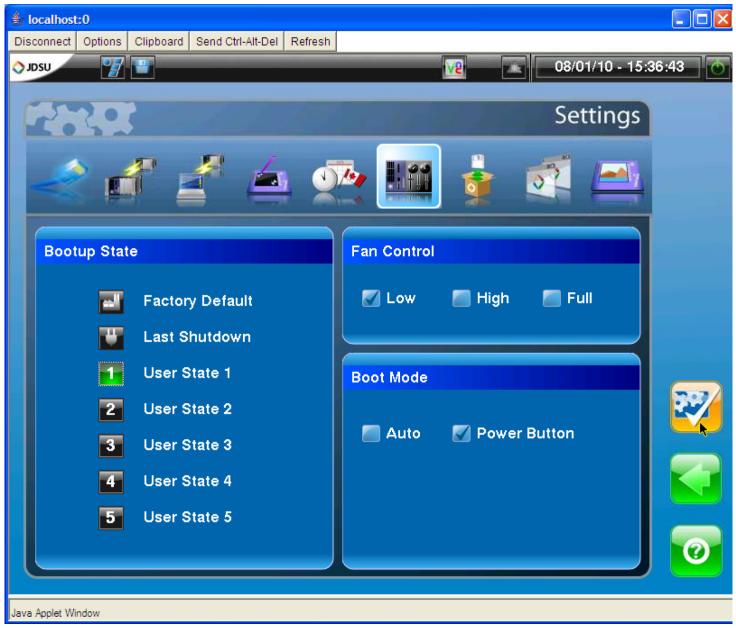
2. Navigate to Boot Up State Tab page by selecting the chassis icon

Figure 78: Boot Up State Management



3. Select desired profile to for boot up state. Note that a yellow check mark icon appears after a selection is made. Ensure that the yellow check mark icon is selected to apply new settings

Figure 79: Selecting Boot Up Profile



4. The chassis will reboot into the state indicated by the profile selected, on every start up.

Chapter 10: Signal Conditioning Module Manuals

MAP-200 EDFA

⚠	**WARNING** Class 3B lasers are hazardous to eyes and skin if exposed directly. Please refer to Laser Safety section for more information.

MAP-200 EDFA General Information

The MAP-200 Erbium-Doped Fiber Amplifier (EDFA) Modules combine the optical performance of the tradional VIAVI benchtop models with the flexibility and modularity of the MAP-200.

Many variants (pre-amplifier, booster, and high-power booster, in-line and booster-DWDM) of the MAP-200 EDFA Module are available. The EDFA features a noise figure as low as 3.5 dB, and gain up to 37 dB. Currently the high-power booster offers an output of 20 dBm.

The variants of the EDFA target diverse applications such as amplifier emulation, OSNR (optical signal-to-noise ratio) experiments, and network compliance tests.

Applications

- Pre-amp and booster amplifier emulation
- DWDM transmission – for multi-channel applications
- Sonet/SDH systems – for single-channel applications
- Optical Signal-to-Noise Ratio measurements

MAP EDFA Key Features and Benefits

- Wide choice of variants: pre-amplifier, booster and high-power booster
- High output power and gain

- Low noise figure
- Monitoring and alarms

MAP-200 EDFA Front Panel Description

Figure 80: mEDFA module front panel

MAP-200 EDFA Module LED Description

Table 16: mEDFA LED Description

LED	Description	
EDFA STATUS	Off	Laser Source is OFF
	Green	Laser Source is ON
	Red	Error or Interlock Activated

MAP EDFA Specifications

Optical and general specifications of the MAP-200 Optical Amplifier (EDFA) are shown in Table 17 below.

Table 17: mEDFA-A1 Specifications

Parameter	1550	1552	1552	1554	1558	1590	1592	1594
Amplifier type	Pre-amp	Booster	Booster high power	In-line	Booster DWDM	Pre-amp	Booster	In-line
Operating wavelength range	1528 to 1565 nm	1528 to 1565 nm	1528 to 1565 nm	1528 to 1565 nm	1528 to 1563 nm	1565 to 1610 nm	1565 to 1610 nm	1565 to 1610 nm
Input signal	Single channel	Single channel	Single channel	Single channel	Multichannel (DWDM)	Single channel	Single channel	Single channel
Saturated output power (minimum)[1]	≥14 dBm	≥17 dBm	≥20 dBm	≥17 dBm	≥21 dBm	≥15 dBm	≥15 dBm	≥20 dBm
Noise figure (maximum)[2]	≤3.5 dB	≤4.5 dB	≤5.0 dB	≤3.8 dB	≤5.5 dB	≤5.0 dB	≤5.5 dB	≤5.5 dB
Small signal gain (minimum)[3]	≥37 dB	≥30 dB	≥32 dB	≥35 dB	≥25 dB	≥24 dB	≥22 dB	≥28 dB
Input/output monitors	No	Yes	Yes	No	Yes	No	Yes	Yes
Polarization dependent loss (PDL) (maximum)	≤0.2 dB	≤0.2 dB	≤0.2 dB	≤0.2 dB	≤0.25 dB	≤0.3 dB	≤0.3 dB	≤0.3 dB
Polarization mode dispersion (PMD) (maximum)	≤0.5 ps	≤0.4 ps	≤0.4 ps	≤0.5 ps	≤0.65 ps	≤0.6 ps	≤0.6 ps	≤0.6 ps
Input/output isolation (typical)	N/A/32 dB	45/32 dB	45/32 dB	32/32 dB	32/32 dB	N/A/40 dB	40/40 dB	40/40 dB
Spectral gain flatness (maximum) (p-p)[4]	N/A	N/A	N/A	N/A	≤1.4 dB	N/A	N/A	N/A
Operating temperature	0 to 40°C							
Storage temperature	–30 to 60°C							
Humidity	Maximum 95% RH non-condensing from 0 to 45°C							
Dimensions (W x H x D)	4.06 x 13.26 x 37.03 cm (1.6 x 5.22 x 14.58 in)							
Weight	1.3 kg (2.87 lb)							

Note: All specifications guaranteed at 1550nm at 23°C.

1. Saturated Output Power measured:
   - At 1550 nm at Pin = –4 dBm
   - At 1550 nm at Pin = –4 dBm (mid-span) for models 1550, 1552, 1554, 1558
   - At 1590 nm at Pin = 0 dBm (mid-span) for models 1590, 1592, 1594
2. Noise figure measured:
   - At Pin = –30 dBm for model 1550
   - At Pin = –4 dBm for models 1552, 1558, 1592
   - At Pin = –20 dBm for models 1554, 1590, 1594
3. Small signal gain measured:
   - At Pin = –30 dBm for model 1550
   - At Pin = –20 dBm for model 1552, 1554, 1590, 1592, 1594
   - At Pin = –4 dBm for model 1558
4. Flatness optimized:
   - At Pin = –4 dBm for model 1558

MAP-200 EDFA Theory of Operation

The optics of the MAP-200 EDFA Module consists of an erbium-doped fiber amplifier (EDFA) gain stage with supporting optical components specifically designed to achieve maximum output power at the bulk-head mounted optical connector while maximumizing input/output isolation.

An optical fiber doped with the rare-earth erbium can be made to amplify light signals passing through it. The energy-levels of the erbium atom are such that they can be excited by low-wavelength (higher energy) radiation and then stimulated to emit 1310 nm or 1550 nm radiation by passing 1310 or 1550 nm signals through the fiber. This property is exploited to produce fiber amplifiers.

The amplification, or gain, is controlled by the intensity of the laser used to pump the EDFA. One important property of an EDFA is that it preserves the pulse and modulation characteristics of the input signal, thus allowing it to be used as an in-line amplifier or repeater in communications networks. EDFAs require no opto-electronic or electro-optical conversions.

EDFAs can come with one pump laser or two. They can also have a number of detectors. The first detector would normally be used to detect if there is any input signal. If there is none, the pump laser(s) are shut down. Another detector would be used as an output detector, to ensure that the pump laser is driven appropriately to get the required output. Optionally, another detector can be used to detect back reflection. Significant back reflection would indicate that the output connector is open/disconnected. It would then be safer to shut down the amplifier.

The MAP EDFA offers these options in the 1528-1563 nm, in both single and multimode versions.

MAP-200 EDFA Configuration Information

Table 18: mEDFA configuration parameters and information

Device	Integer	Device Number
Type	String	**Card Name**
BandType	String	**Working Bandwidth**
Gmin	Float	**Min Gain**
Gmax	Float	**Max Gain**
Imin	Float	**Min Laser Current**
Imax	Float	**Max Laser Current**
Pmin	Float	**Min Laser Power**
Pmax	Float	**Max Laser Power**
IPmin	Float	**Min Input Power**
IPmax	Float	**Max Input Power**
OPmin	Float	**Min Output Power**
OPmax	Float	**Max Output Power**
LOSmin	Float	**Min LOS Limit**
LOSmax	Float	**Max LOS limit**
BACREFmin	Float	**Min Back-reflection limit**
BACREFmax	Float	**Max Back-reflection limit**
BACREF Detector?	String	**Back-reflection meter present***
Input Detector?	String	**Input photo detector present**
Output Detector?	String	**Output photo detector present**

Device	Integer	Device Number
AGC Presence?	String	**Auto Gain Controller present**

*Only one back-reflection meter can be present on a card, thus multiple devices will have the same response for this field.

MAP-200 EDFA General Information

Table 19: mEDFA module general information

Serial Number	String	(8 characters)
Part Number	String	(23 characters)
Card Firmware Rev	String	(4 characters)
Firmware Rev 1	String	(4 characters)
Firmware Rev 2	String	(4 characters)
HW Rev	String	(4 characters)
Assembly Date	String	(8 characters)
Description	String	(30 characters)

MAP-200 Variable Optical Attenuator

MAP-200 Variable Optical Attenuator Parameters Safety

WARNING

When using the MAP Variable Optical Attenuator with optical powers greater than 200mW, ensure that the direction of laser travel is from the IN port to the OUT port as labelled on the mVOAx front panel. Inserting high optical power into the OUT port may result in damage to the mVOAx.

MAP-200 Variable Optical Attenuator General Information

The MAP-200 Variable Optical Attenuator is a high-resolution, wide wavelength-range attenuator ideal for use in applications such as analog systems and high bit-rate digital systems. The attenuator is built on proven industry leading technology for maximum reliability and performance.

Many configurations are available; single or dual device per single-width module, single-mode or multimode fiber, four standard connector types, and tap option or power control feature. The power control option can function as an in-line power monitor.

MAP-200 Variable Optical Attenuator Key Features

- Ultra low insertion loss (<1.0 dB) and outstandingspectral uniformity
- Fastest transition speed in its class (up to 25 dB/s)
- Configurable by user at time of order (fiber type, density,built-in options, high power option)
- Optional built-in power monitor provides comprehensiveclosed-loop power control settings
- Optional higher power capability can withstand up to 2Winput power for single-mode fiber (500 mW for MMF)

MAP-200 Variable Optical Attenuator Applications

- Transmitter dispersion testing and eye mask testing
- Receiver sensitivity testing
- EDFA noise figure and gain flatness testing
- Power meter calibration
- Loss simulation

MAP-200 Variable Optical Attenuator Specifications

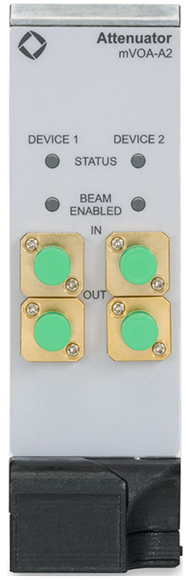
Parameter	Single-mode		Multimode[10]	
	No power control	With power control	No power control	With power control
Insertion loss at minimum attenuation[1,2,3]	≤1.0 dB[4,5]	≤1.7 dB[5]	≤1.5 dB[4]	≤2.2 dB
Maximum input power (Standard power/High power option)[13]	+23 dBm/+33 dBm		+23 dBm/+27 dBm	
Wavelength range	1260 to 1650 nm		750 to 1350 nm	
Attenuation range[1]	70 dB		65 dB	
Attenuation flatness[8,9]	±0.04 dB from 0 to 30 dB		N/A	
Attenuation slew rate (nominal)	25 dB/s typical		20 dB/s typical	
Attenuation setting resolution	0.001 dB		0.001 dB	
Attenuation accuracy[1,3,12,14]	±0.1 dB		±0.1 dB	
Attenuation repeatability, 2σ[3,11,12,14]	±0.01 dB		±0.01 dB	
Closed loop output power range (In-line power monitor option)	N/A	–49 to +11 dBm @ 1310/1550 ±15 nm	N/A	–40 to +5 dBm @ 850/1310 ±15 nm
Relative power meter uncertainty[3,5,9]	N/A	±0.03 dB	N/A	±0.03 dB
Power setting repeatability[5,9]	N/A	±0.015 dB	N/A	±0.015 dB
Power setting resolution	N/A	0.001 dBm	N/A	0.001 dBm
Polarization dependent loss (from 0 to 25 dB)[3,6]	<0.08 dB	<0.15 dB	N/A	N/A
Return loss[7]	>55/45 dB typical (PC/APC connector)		>30 dB typical (PC connector)	
Shutter isolation	100 dB typical			
Warm up time	30 minutes			
Calibration period	2 years			
Operating temperature	0 to 50°C			
Storage temperature	–30 to 60°C			
Operating humidty (relative, non-condensing)	<90% @ 23°C, <20% @ 50°C			
Dimensions (W x H x D)	4.06 x 13.26 x 37.03 cm (1.6 x 5.22 x 14.58 in)			
Weight	1.1 kg (2.43 lb) single/1.3 kg (2.87 lb) dual			

1. At 1310 ±15 nm and 1550 ±15 nm for single-mode unit and at 850 ±15 nm and 1300 ±15 nm for multimode unit
2. Including one mated pair of connectors
3. At 23 ±5°C
4. Not including tap coupler loss, if installed. Add 0.7 dB for tap coupler option
5. Value shown is for 1550 nm. For 1300/1310 nm the value is typical
6. At 1550 nm ±15 mm only
7. At 1550 nm ±15 nm for SMF, 1300 nm ±15 nm for MMF
8. From 1480 nm to 1640 nm relative to 0 dB attenuation
9. For unpolarized light
10. 10.Multimode specifications are valid for category 4 CPR
11. Constant wavelength, constant temperature, constant state of polarization
12. Measured using low coherence laser source
13. Damage at high optical power due to scratched or poorly cleaned connectors may result. For high power applications, incident light must be applied from “IN” port to “OUT” port. VIAVI assumes no responsibility for these user conditions
14. From 0 to 45 dB attenuation

MAP-200 Variable Optical Attenuator Front Panel

The front panel of the unit is shown in Figure 81:

Figure 81: Front of a Dual MAP-200 Variable Optical Attenuator with Built-in Options



MAP VOA Cassette LED Description

Table 20: mVOA Operating Controls and LEDs

LED	Color	Description
Beam Enabled	Green	Beam is enabled – normal attenuator operation
	Red	Beam is blocked – light not transmitted to output fiber
Status	Green	Power Mode: output optical power level within the last set range, attenuator not moving Attenuation Mode: attenuation level at last set point, attenuator not moving
	Red	Power Mode: Power setting unachievable or Attenuator failure Attenuation Mode: Attenuator failure
	Yellow	Power mode : Adjusting to last set output power range (attenuator moving) Attenuation mode : Adjusting to last set attenuator level (attenuator moving)

MAPVariable Optical Attenuator Configurations

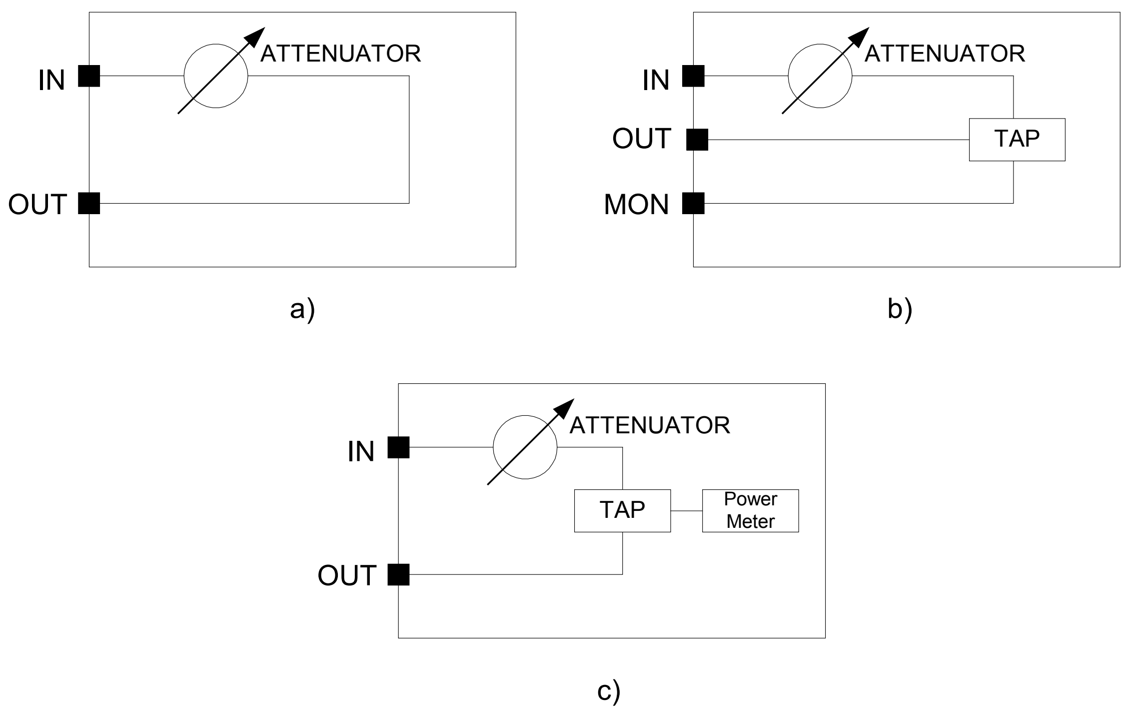
One of the primary applications of an attenuator is to allow an optical signal to be adjusted to a precise output power level. With the MAP Variable Optical Attenuator, three options are possible:

a) A standard attenuator. To control output power, measurement of the input power is required prior to testing. Output power is externally calculated based on the set attenuation. Figure 82a shows the standard attenuator.

b) A standard output tap. Calibration of the output power is achieved through use of an external power meter and calibration of the tap path loss. Adjustments for changes in input power require external adjustments of the attenuator. Figure 82b shows implementation of the standard output tap.

c) An internal in-line power monitor. Output powers can be set directly with internal calibration and monitoring compensating for input power and path losses. In addition, the unit may be set into a tracking mode where the attenuator is dynamically adjusted to compensate for input power level changes and achieve a stable output power level. Figure 82c shows the internal in-line power monitor.

Figure 82: Optical Configurations of the MAP-200 Variable Optical Attenuator Module



MAP-200 Variable Optical Attenuator Theory of Operation

The MAP-200 Variable Optical Attenuator can be operated in two modes — attenuation mode and power mode. These two modes, with and without the built-in power meter option, are described in this section.

The MAP-200 Variable Optical Attenuator is highly wavelength independent. For example, the attenuation in the whole S+C+L wavelength range varies so little that for practically all applications the user can operate at one setting – for example the default setting of 1550nm. If required, the attenuator has built-in wavelength calibration factors to compensate for the wavelength dependence. For optimal accuracy, correctly set the operating wavelength for each device to match the center wavelength of the optical source to the nearest 1 nm. The commands are still available to adjust the wavelength setting of the MAP-200 Variable Optical Attenuator automation software written for the MAPA+2xxx will be compatible with the mVOAx.

The power returned by the power monitor is the calibrated power at the output connector of the attenuator module.

Attenuation Mode

The attenuation mode allows the user to operate the MAP-200 Variable Optical Attenuator in a relative power mode. The attenuation is set according to the following equation:

$$\text{Attenuation Setting} = A_{Required} + \text{Attenuation Offset} \qquad (1)$$

Where:

1. Attenuation Setting is the value entered by the user
2. Attenuation Offset is an optional value that can be entered by the user to compensate for losses in the system. All attenuations specified are offset by this amount.
3. $A_{Required}$ is calculated using equation 1 above.

In this mode, only the attenuation offset is used. To determine what the offset should be, measure the power through the system without the MAP Variable Optical Attenuator connected, and with the MAP Variable Optical Attenuator inline but set to 0 dB attenuation. The difference between the two powers gives the additional loss from the attenuator.

Power Mode

The power mode allows the user to set the output power of the MAP-200 Variable Optical Attenuator in absolute power. The power mode has a power offset that is used to match the output power reading of the MAP-200 Variable Optical Attenuator to the measured power on an optical power meter. It also has a wavelength power offset that can be used to compensate for wavelength dependence in the system.

Power Mode without Built-in Power Monitor

Without the built-in power monitor, the output power target is set according to the following equation:

$$A_{Required} = P_{Offset} + P_{WavelengthOffset} - P_{Target} \qquad (2)$$

where:

P_{Target} is the user-specified output power target

P_{Offset} is a value that must be entered by the user to compensate for losses in the system, and to account for the input power (otherwise assumed to be 0 dBm), in order to make the power at the output of the attenuator equal to the desired value. For example, if the input power is actually 2 dBm and the loss in the attenuator is 1.5 dB, the output power is 0.5 dB higher than expected. Thus, the user should set the P_{Offset} to 0.5 dB.

$P_{WavelengthOffset}$ is an optional value that can be entered by the user to compensate for wavelength specific losses in the system.

$A_{Required}$ is the calculated value of the required attenuation.

The attenuator calculates the $A_{Required}$ using equation 2, and moves to that attenuation value.

Power offset when there is no power monitor

When there is no power monitor, the MAP-200 Variable Optical Attenuator does not have a measure of the output power. It assumes that the input power is 0 dBm. The user can set the power offset to include both the actual input power and the losses in the rest of the system.

To determine what the power offset should be, measure the power, using a power meter, at the output when the MAP-200 Variable Optical Attenuator is set to 0 dB attenuation. Get the output power from the attenuator, using through a remote connection. The power meter reading minus that from the attenuator gives the correct power offset.

Power Mode with a Built-in Power Monitor

With the built-in power monitor, the attenuation is set according to the following equation:

$$A_{Required} = P_{Current} + P_{Offset} + P_{WavelengthOffset} - P_{Target} - A_{Current} \qquad (3)$$

where:

1. P_{Target} is the power target entered by the user
2. $P_{Current}$ is the current power measured by the internal power monitor. The simplest way to determine the power offset is to measure the power coming out of the attenuator and subtracting from this the power read by the power monitor.
3. P_{Offset} is a value entered by the user to compensate for losses in the system
4. $P_{WavelengthOffset}$ is an optional value that can be entered by the user to compensate for wavelength specific losses in the system
5. $A_{Current}$ is the current attenuator setting
6. $A_{Required}$ is the calculated attenuation required to reach the output power target.

Notes:

1. If the beam block is activated this command returns the last output power measured before the beam block was enabled.

2. The power returned by the power monitor is the calibrated power at the output connector of the attenuator module.

3. When the built-in beam block is enabled, the attenuation goes to infinite attenuation. Power tracking is not possible until the beam block is disabled.

Because of possible fluctuations of the input power, the output power can change over time. If the attenuator has the optional built-inpower monitor, the last measured output power (updated synchronously to the sampling frequency defined by the ATIME) is returned when queried for the output power. If the attenuator has no built-in power monitor, the last output power target set by the user is returned.

Parameters Used in Power Tracking

Seek accuracy: This parameter is entered as a positive value, but it defines a value that is both added to and subtracted from the target power to define a “power accuracy window”. It determines how accurately the MAP Variable Optical Attenuatorachieves the output power. When seeking, it continues adjusting the attenuation until the output power is within the seek accuracy.

Hold threshold (Optional): This parameter is an incremental value which is added to and subtracted from the seek accuracy to define a power level which, if exceeded, triggers the attenuator to move to a power level within the “power accuracy window”. The attenuator sets the hold threshold to zero if the user enters no value. This triggers the attenuator to move as soon as it exceeds the power accuracy window.

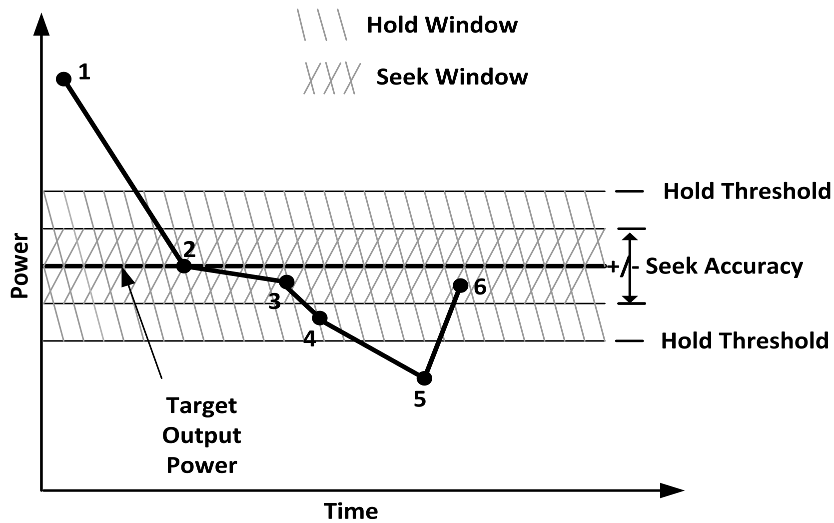
The hold accuracy determines when a new seek operation is triggered. The hold threshold is added to the seek threshold and by default is 0 dB. This can be set to any positive value, thus defining a new hold threshold. If it is set to a small positive value, it can help guard against unnecessary seeks due to power drifts in the source. If it is set too large, the output power can drift significantly without triggering a new seek.

ATIME: This parameter defines the time over which the measured power values are averaged. In the MAP Variable Optical Attenuator, the power is measured every 1 ms. Thus, if the ATIME is 100 ms, 100 samples are averaged to determine the power. The longer the ATIME, the smoother are the power readings. Conversely, the shorter ATIME is made, the noisier the output power appears to be. This makes tracking more difficult. In addition, the power tracking algorithm is triggered once every ATIME. Hence, in order to keep tracking smooth it is recommended that ATIME be made sufficiently large, of the order of 100 s of ms.

Attenuator Response in Power Tracking Mode

The scenario described below follows a possible power tracking sequence. It explains how the attenuator behaves as a function of the currently read power, the power target, the seek accuracy and the hold threshold. The output power as a function of time is shown in Parameters Used in Power Tracking. Power tracking is enabled either from the Local Interface Module or remotely, as explained in later sections. The attenuator fetches the power once every sampling period, defined by the averaging time (ATIME) set by the user. Depending on the value of the output power and the power target, the attenuator decides what needs to be done. The scenario shown in *Figure 83: mVOA Power Tracking Parameters* below explains how power tracking is implemented in the MAP Variable Optical Attenuator.

Figure 83: mVOA Power Tracking Parameters



Point 1: The attenuator is at a random power level and the user enters a new power target. The attenuation value required to achieve this power is calculated using equation 3, and the attenuator moves to that attenuation. The attenuation is adjusted to ensure that the output power is the target power ± the seek accuracy.

Point 2: The attenuator verifies that the current position is within the seek accuracy. It verifies that the Output Power Target is within the limits defined by the seek accuracy, shown by the crosshatched area in Figure 64.

Point 3: At the end of the next averaging period, the output power is again checked. If the power fluctuates but remains within the seek accuracy, the attenuator does not move.

Point 4: If the power fluctuates but remains within the hold accuracy, the attenuator does not move.

Point 5: If the power fluctuates beyond the hold threshold, the attenuator re-calculates a new position to achieve a power within the seek accuracy.

Point 6: The output power is fetched once every averaging period. If the power is outside the hold threshold, as in point 5, attenuator movement is triggered. Otherwise, the attenuator is dormant.

If power tracking is enabled (see the Power Tracking device property or the equivalent SCPI OUTPut:POWer:CONTrol command), activating the beam block disables power tracking. Power tracking is restored to its original state when the beam is unblocked.

Power offset with a power monitor

The power meter used in the power monitor is calibrated so that the output read is the power at the output connector. This is close to, but not quite, the same as the power measured by a power meter at the end a patch cord connected to the attenuator. Moreover, any other devices connected to the attenuator will contribute their own insertion losses. Such losses are accounted for through the power offset.

A simple way to measure this is to compare the power measured at the end of the chain using a power meter against that given by the output power monitor of the attenuator.

Wavelength power offset

In addition to the power offsets mentioned above, another correction users may want to apply is that due to the wavelength dependence of components in the optical path. In order for this to be meaningful, the user must provide the proper operating wavelength.

The MAP-200 Variable Optical Attenuator is calibrated for wavelength dependence every 1 nm over its whole wavelength range. Hence, it is not necessary for the user to correct for the wavelength dependence of power caused by the attenuator. However, other components used could cause wavelength dependence. To provide the user with some way to correct for this, we have provided the wavelength power offset array. The array is a list of power offsets used to correct power measurements at different wavelengths. The user can enter offsets at as many wavelengths as desired. The MAP Variable Optical Attenuator interpolates the offset for the current operating wavelength, and adds this to all power values reported.

To determine the offset at different wavelengths, use a tune-able source. Set the wavelength of the source to a specific value. With all components connected, and the attenuator set to 0 dB attenuation, measure the power with a power meter set to operate at the tuned wavelength. Read the power from the power monitor of the MAP Variable Optical Attenuator. This power minus the power offset obtained earlier is the wavelength power offset at the given wavelength. Repeat for as many wavelengths as desired.

Once the table has been built up, it can be entered into the MAP-200 Variable Optical Attenuatorusing SCPI commands or the IVI drivers.

MAP-200 Variable Attenuator Parameters Configuration Information

Table 21: mVOA configuration information

Device	Integer	Device Number
Type	String	Card Name
CalWavelength1	Float	
CalWavelength2*	Float	
MaxAtt	Float	
Bblock Mechanism?	String	

*if 0 then, only one wavelength calibrated.

Items below are available if the attenuator is an SMA model

Power Monitor?**	String	
Fiber Type	String	
Wmin	Float	Min Wavelength
Wmax	Float	Max Wavelength
Pmin	Float	Min Detector Power
Pmax	Float	Max Detector Power
OFFSmin	Float	Min Offset
OFFSmax	Float	Max Offset

Typical values for each item is in brackets ( ).
** If the card is an IA3 model the output photo detector parameter and all subsequent parameters in the configuration string are not present.

MAP-200 Variable Optical Attenuator Parameters Information

Table 22: mVOA parameter information

Serial Number	String	(8 characters)
Part Number	String	(23 characters)
Card Firmware Rev	String	(4 characters)
Firmware Rev 1	String	(4 characters)
Firmware Rev 2	String	(4 characters)
HW Rev	String	(4 characters)
Assembly Date	String	(8 characters)

Description	String	(30 characters)

MAP-200 Variable Optical Attenuator Parameters Registers

The MAP-200 supports the VOA class of attenuators. For the benefit of legacy users, information on legacy modules is also provided. The table below can help identify and relate the mVOA part number to the legacy part number.

IA3: This was the first generation of MAP attenuators without power monitoring

SMA: This was the second generation of MAP attenuators with improved mechanics over IA3 and also had power monitoring options

IA4: This is the current generation of MAP attenuators with state of the art optics and mechanics.

Table 23: mVOA nomenclature relationship

MAP Attenuator Part Number	VOA Class Part Number	Applicable Commands Identifier
MVOA-A2	IA4	MVOA
MVOA-A1	IA4	
MAPA+23	SMA	MAPA+23
MAPA+13	IA3	MAPA+13. Note, not all MVOA commands are applicable. See details on Card Applicable field of command details to identify

MAP-200 Polarization Controller

MAP-200 Polarization Controller General Information

The MAP-200 Polarization Controller Module provides an efficient and precise way of creating any state of polarization. It can also be used as part of a polarization state analyzer.

The single width MAP-200 Polarization Controller Module is comprised of three rotating elements, a high extinction ratio polarizer, a quarter-wave plate, and a half-wave plate. The controller configuration is offered with a single-mode or a polarization maintaining fiber input.

The polarization controllers can be combined with other instruments to complete measurement test systems such as erbium-doped fiber amplifier or passive component test sets.

Optical Features

The optical features are:

- Three independently controllable optical elements to achieve any desired polarization state
- Each element can be scanned at its own set rate to achieve a periodic change in the state of polarization

Key Features & Benefits

The key features and benefits are:

- Complete polarization control
- Designed to meet 802.3ae 10 GbE testing requirements
- Designed to perform fast PDL measurements (4-state Mueller method)
- Compact single width module
- Very high angular accuracy and absolute fast axis alignment accuracy

Applications

The applications include:

- Passive component PDL and PMD measurements
- EDFA noise and PDG measurements
- 10GbE transceiver worst-case relative intensity noise and dispersion penalty measurements
- Optical Signal to Noise and Extinction Ratio measurements

MAP-200 Polarization Controller Front Panel Description

Figure 84 shows the front panel of the MAP-200 Polarization Controller Subsystem (PCS).

Figure 84: Front Panel of the MAP-200 Polarization Controller

The MAP-200 PCS can be ordered with an SMF input or a polarization maintaining fiber (PMF) input. You can choose the connector type to suit your application.

MAP-200 Polarization Controller LED Description

Each colour on the LED represents a different meaning. Table 24 lists each LED with corresponding colour and meaning.

Table 24: mPCS LED and Description

LED	Colour	Description
STATUS	GREEN	Card is OK
	AMBER	One or more elements are rotating

MAP-200 Polarization Controller Specifications

Below are the optical and general specifications of the MAP-200 Polarization Controller.

Parameter	1310 nm	1550 nm
Wavelength range	1260 to 1360 nm	1420 to 1630 nm
Insertion loss (IL)[1,3]	<1.5 dB	<1.5 dB
IL variation with wavelength[1,3]	±0.1 dB	±0.1 dB
IL variation with rotation[1,3,4]	±0.05 dB	±0.05 dB
Return loss (RL)	>45 dB	>45 dB
Extinction ratio[2]	>40 dB	
Fast axis alignment accuracy	<± 0.5°	
Angular accuracy	±0.1°	
Rotational resolution	0.075°	
Maximum rotational speed per element	900°/s	
Maximum optical input power	100 mW	
Calibration	2 years	
Operating temperature	10 to 40°C	
Storage temperature	–30 to 60°C	
Humidity	Maximum 95% RH from 10 to 40°C non-condensing	
Dimensions (W x H x D)	4.06 x 13.26 x 37.03 cm (1.6 x 5.22 x 14.58 in)	
Weight	1.6 kg (3.5 lb)	

1. From 1520 to 1630 nm for the 1550 nm version
2. Measured with a >45 dB polarized narrow spectral line source
3. At 23°C 5°C
4. IL variation using an incoherent (broadband) source with both waveplates rotating at differing rates

MAP-200 Polarization Controller Theory of Operation

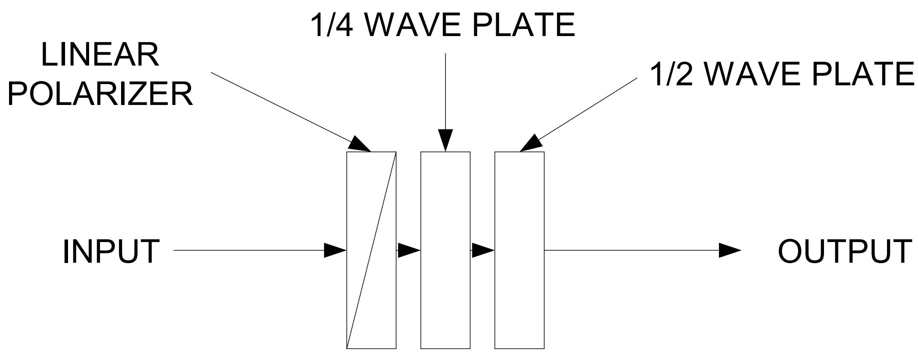
The MAP-200 Polarization Controller Subsystem (PCS) is a precision, automated polarization controller that is capable of rotating input light through all points on a Poincaré sphere. High rotational resolution and speed are obtained using micro-stepped motors and advanced driving circuitry.

The MAP-200 PCS provides an efficient method to change the polarization state of the input light, from single-mode fiber (SMF) or a polarization-maintaining fiber (PMF). The controller can be combined with other instruments, such as erbium-doped fiber amplifier (EDFA) and MAP filters and attenuators to complete a measurement test system. It can also be used for single-mode component testing for polarization sensitivity, or as part of a polarization state analyzer, used to calculate Stokes vectors for input polarization states.

The MAP-200 PCS provides a higher extinction ratio and more accurate polarization control than simple Lefevre coils. Changes to the state of polarization (SOP) are achieved using three rotating optical element — a high extinction ratio linear polarizer, a quarter-wave retardation plate, and a half-wave retardation plate.

Figure 85 shows the in-line arrangement of the optical components in the PCS. Light from the single-mode fiber, at the input, passes through the linear polarizer, the 1/4 wave retarder plate, and the 1/2 wave retarder plate. The polarizer linearly polarizes the light to a high extinction ratio, the quarter-wave plate converts the SOP from linear to elliptical or circular, and the half-wave plate rotates the polarization of the light. With this combination of elements, any possible SOP can be produced.

Figure 85: Optical Component Layout in the MAP PCS

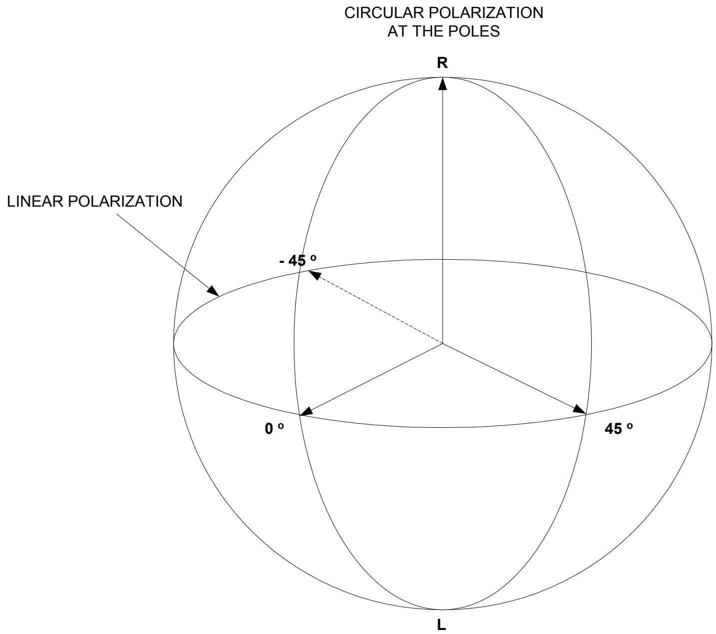


The polarizer, the 1/4 wave retarder, and the 1/2 wave retarder are mounted in a rotary stage that is controlled by a micro-stepped stepper motor. The rotation resolution is 0.075° and the maximum rotation speed is 900° per second. When all the optical elements are at home position, the fast axes of the 1/4 wave retarder and the 1/2 wave retarder are aligned with the fast axis of the polarizer. All three elements can be rotated independently to prespecified absolute or positions relative to their current positions. Each element can also be set to scan at a specified rate, independent of the others. Thus, you can set the PCS up to produce a continuously varying set of polarization states.

The Poincaré Sphere

A convenient way of representing, and understanding, the polarization states of light is to use the Poincaré Sphere. Here, every point on the sphere is a possible state of polarization. Light can be analyzed by treating it as two components, polarized in two orthogonal planes perpendicular to the direction of the light propagation, or the Poynting vector. These two components have a phase difference between them. Unpolarized light is one in which the phase different between the components varies randomly. The effect is that the resultant polarization of the light changes randomly as the light propagates. Only the plane of polarization changes, not the intensity of the light. On the Poincaré Sphere, unpolarized light is a point that moves randomly on the sphere. Figure 86 shows the Poincaré Sphere.

Figure 86: Poincaré Sphere



Linearly-polarized light is represented by a point on circle intersecting the sphere with the horizontal plane that divides the sphere in half. Such light is obtained by passing unpolarized light through the linear polarizer (element 1 in the PCS).

Circular polarization is obtained when the relative phase difference between the two components is a constant quarter wavelength. If that is the case, the resultant light appears to have a plane of polarization that rotates at a constant rate. If it rotates in a clock-wise direction when viewed in the direction of propagation, it is said to be right-circularly polarized, and is left-circularly polarized if it rotates in the opposite direction. A quarter wavelength phase difference is achieved by using a birefringent material, in which the index of refraction is different in two orthogonal axes. Light polarized along one axis (the fast axis) travels faster than light polarized along the orthogonal axis (the slow axis). The thickness of the quarter-wave plate is such that, at one particular wavelength, the relative phase difference is exactly a quarter wavelength. Element2 in the PCS is a quarter-wave plate.

If the relative phase difference between the two components is half a wavelength, linearly-polarized light passing through it experiences a change in polarization represented by a reflection about the centre of the Poincaré sphere. Thus, light polarized at 45 comes out polarized at -45°. Left-circularly polarized light going through a half-wave plate becomes right-circularly polarized. Element3 in the PCS is a half-wave plate.

The three optical elements can be positioned to produce any desired output polarization state from any known input polarization state.

Varying Polarization States

The MAP PCS provides independent control of all three optical elements to suit any application. Each element can be positioned by specifying either an absolute or a relative position. Elements can be positioned with a resolution of 0.075°. There are 4800 motor steps in a full 360° rotation.

Sixteen set points are provided for each device to enable you to get favourite polarization states easily. Each set point consists of the positions of the three elements.

In order to get output at any polarization state, first determine where to set the first element to get linearly polarized light with as little loss as possible, which depends on the SOP of the input. Then, set the quarter-wave and half-wave plates to get the desired SOP.

When looking from the polarizer input towards the optical components, the plates appear to rotate in a clockwise direction when scanning up in degrees and in a counterclockwise direction when scanning down in degrees.

Scan Rates

Scan rates are available to all three elements in the device. Not all rates are available. If you specify a scan rate that is not available, the controller chooses the scan rate nearest to the one you specified.

The ability to choose the scan rate is most useful when one or more elements are put into continuous scan mode. The scan rates can be chosen independently for each of the scanning elements to suit your application. If the polarization states change too fast for your application, you can reduce the rate for all them, keeping the ratios the same, thus getting the same SOP sequence at a slower rate.

MAP-200 Polarization Controller Configuration Information

Table 25: mPCS configuration information

Device	Integer	Device Number
Type	String	Card Name
Model	Char	PCS Model
Element1	String	Element Name
Element2	String	Element Name
Element3	String	Element Name
Rmin	Float	Min Rate
Rmax	Float	Max Rate
Wcentre1	Float	Centre Wavelength
Wcentre2	Float	Centre Wavelength
Wcentre3	Float	Centre Wavelength

*Rmin/Rmax values are dependant on gear ratio for the particular model.

MAP-200 Polarization Controller Parameter Information

Table 26: mPCS parameter information

Serial Number	String	(8 characters)
Part Number	String	(23 characters)
Card Firmware Rev	String	(4 characters)
Firmware Rev 1	String	(4 characters)
Firmware Rev 2	String	(4 characters)
HW Rev	String	(4 characters)
Assembly Date	String	(8 characters)
Description	String	(30 characters)

MAP-200 Variable Backreflector

MAP-200 Variable Backreflector General Information

The MAP-200 Variable Backreflector provides precise levels of return loss to transmitters, enabling measurement of system sensitivity and system degradation as a function of back reflection.

When used with a transmitter/receiver pair and characterization equipment, the back reflector can be used to establish the magnitude of reflections that significantly degrade transmission system performance, and to characterize the problems they cause.

The reflector uses VIAVI variable optical attenuator and high-reflectivity mirror to precisely control the level of return loss. The module is available in single-mode or multimode and with an optional coupler for monitoring.

Key Features and Benefits

- 0.002 dB resolution
- Operation at 850/1310 or 1310/1550 nm
- Optional port for power monitoring
- Single-mode or multimode fiber
- Complies to CE requirements plus UL3101-1 and CAN/CSA-C22.2 No. 1010.1

Applications

- Transmitter/receiver development and testing
- Reflection test for connectors

- Quality assurance acceptance testing
- Laser development and production

MAP-200 Variable Backreflector Front Panel Description

Figure 87 shows the front panel of the MAP-200 Variable Backreflector Module. The port labelled “IN” is the input port. It is also the port through which the backreflected signal is output. The second port shown is the output (“OUT”) port through which the transmitted portion of the input light is emitted. It is possible to have a single or dual mVBRx module, with each having the monitor option, or not. Figure 90 and Figure 91 show two variants — single backreflector without a coupler, and a single backreflector with a coupler.

Figure 87: MAP-200 Variable Backreflector front panel

MAP-200 Variable Backreflector LED Description

Table 27: mVBR LED Description

LED	COLOUR	MEANING
STATUS	Off	Module not selected
	Green	Module is selected by local interface
BEAM ENABLED	Red	Beam is blocked
	Green	Beam is enabled

MAP-200 Variable Backreflector Specifications

Parameter	Single-mode fiber (SMF) without Coupler	Single-mode fiber (SMF) with 50/50 Coupler	Multimode fiber (MMF) without Coupler	Multimode fiber (MMF) with 50/50 Coupler
Wavelength range	1260 to 1650 nm	1260 to 1650 nm	750 to 1350 nm	750 to 1350 nm
Maximum backreflection level	≥5.0 dB	≥9.5 dB	≥5.0 dB	≥9.5 dB
Minimum backreflection level (APC/PC)	≤60/≤45 dB	≤60/≤45 dB	–30/≤30 dB	–30/≤30 dB
Insertion loss (IL)(IN to OUT) [1,2,3]	N/A	<5.0 dB	N/A	<6.0 dB
Relative backreflection setting accuracy [1,3,4]	±0.2	±0.2	±0.4	±0.4
Backreflection setting resolution	0.01	0.01	0.01	0.01
Fiber type	9/125 µm	9/125 µm	50/125 or 62.5/125 µm	50/125 or 62.5/125 µm
Polarization dependent loss (PDL)[1]	<1.0 dB	<1.0 dB	N/A	N/A
Maximum optical input power	200 mW			
Calibration period	2 years			
Warm-up time	30 minutes			
Operating temperature	0 to 50°C			
Storage temperature	–30 to 60°C			
Humidity	<90% at 23°C, <20% at 50°C (relative non-condensing)			
Dimensions (W x H x D)	4.06 x 13.26 x 37.03 cm (1.6 x 5.22 x 14.58 in)			
Weight	1.1 kg (2.43 lb) single backreflector/1.3 kg (2.87 lb) dual backreflector			

1. At 1310 ±15 and 1550 ±15 nm for SM units and at 850 ±15 nm and 1310 ±15 nm for MM units
2. Including one mated pair of connectors
3. At 23 ±5°C
4. From maximum backreflection to –40 dB for SM units and from maximum backreflection to –25 dB for MM units

MAP-200 Variable Backreflector Internal Operation

The MAP-200 Variable Backreflector is available in two configurations — without a power monitor, and with power monitor. The configuration without the power monitor option has one input and one output port. The configuration with a power monitor has an additional output for the monitor signal, to which a power meter can be attached. Shown below is the backreflector without the monitor option in Figure 88. Figure 89 shows the variable reflector with a tap and a monitor output.

Figure 88: MAP-200 Variable Backreflector Module without Coupler

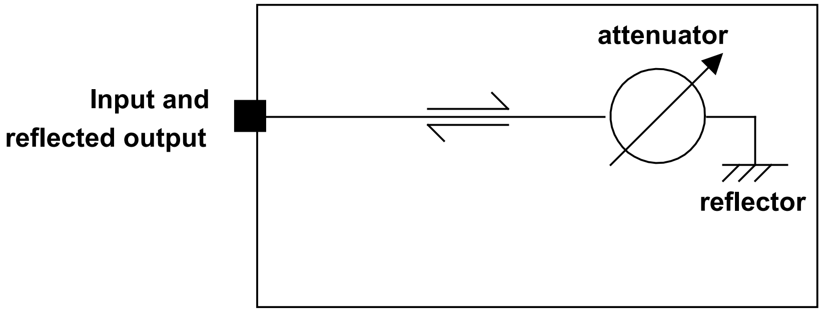
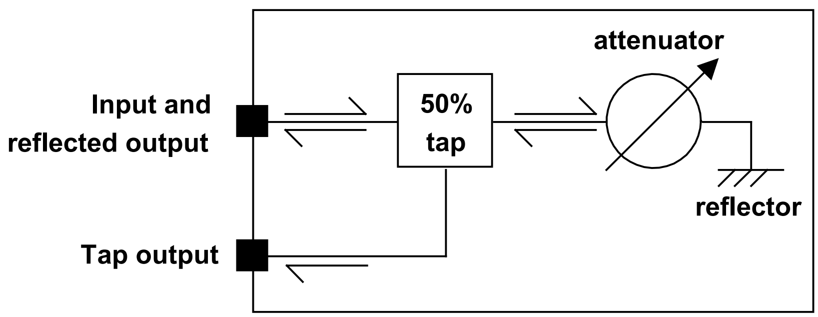


Figure 89: MAP-200 Variable Backreflector with Power Monitor Option



Reflections in optical systems can come from a number of sources. Primary sources include the fiber (Rayleigh backscatter) and Fresnel reflections that occur at the planar junction of two materials having different refractive indices, for example, connector and fiber endfaces, splices, bulk optic interfaces, and detector surfaces.

A typical example of Fresnel reflection would be at the polished end of an open connector. The backreflection from a FC/PC connector that is exposed to air is –14.7 dB. If you have open connectors, and need to reduce the backreflection, you should use FC/APC connectors, the backreflection from which would be –50 dB or lower.

Typically only Fresnel reflections are significant because transmitters are relatively insensitive to distributed reflections such as Rayleigh backscatter. Return Loss caused by Rayleigh backscatter varies with the length and type of fiber. Rayleigh backscatter can be a large contributor to return loss in installed systems or when using long fiber.

When highly coherent sources such as distributed feedback (DFB) or tunable lasers are used, light can reflect back and forth between interfaces (such as connectors) and interfere with the primary signal. This effect typically shows up as noise and drift in absolute power.

In transmission systems, power fluctuations due to backreflections distort the signal and translate to an increased bit error rate, which can be measured as a function of the backreflection. Hence, there is a need to measure the backreflection *in situ*, and to characterize the performance of a system in the presence of varied levels of backreflection.

Using the MAP-200 Variable Backreflector

Using a mVBR without a Coupler

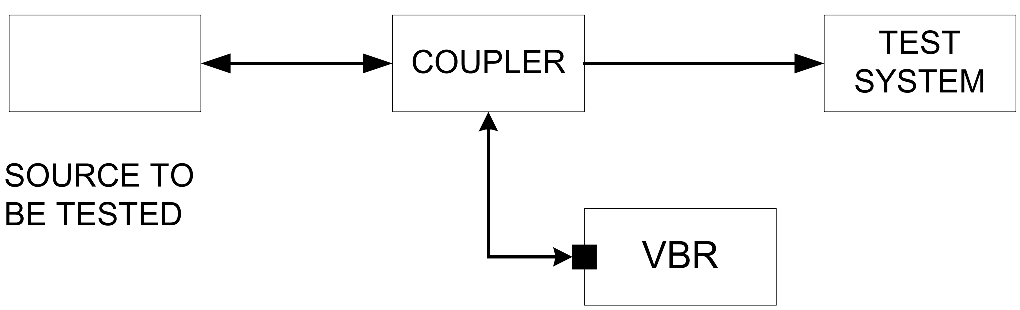
The Variable Backreflector has one port labelled “IN”. Light entering the backreflector at the IN fiber goes directly to the mirror through the attenuator. The reflected light passes back through the attenuator to the input fiber. The attenuator is adjusted to block some of the light so that the light reflected back provides the desired back reflection.

Due to losses in going through connectors both ways, and through any additional components between the source and the mVBRx, the backreflection is actually less than desired. The offset can be set to compensate for this. An easy way to determine what the offset should be is to use a back reflection meter, to measure the actual backreflection when the device is set to a particular value with an offset of 0 dB.

The major use of the backreflector is to study the effects of a backreflected signal on transmitter or laser performance. To inject a backreflected signal for this purpose, you need an external coupler to split the light from the source, sending a portion of it to the backreflector and the rest to a measurement setup.

When using the backreflector, connect the transmitter/laser to be tested as shown in Figure 90.

Figure 90: Using a MAP-200 Variable Backreflector without a Coupler

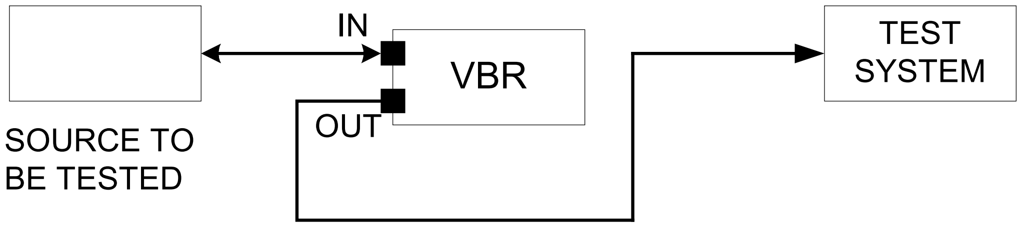


If the offset is correctly set, the back reflector can be set up to provide a known back reflection to the source. The effect of back reflection can then be studied. The setup shown in Figure 89 can also be use to study the effects of back reflection on a transmission system, where the source can be a data stream and the test system can be an error detector.

Using a mVBR with a Built-in Coupler

A similar arrangement can be used with an mVBRx with a built-in coupler, as shown in Figure 91.

Figure 91: Testing a Source with an mVBRx with Built-in Coupler



The variable backreflector is calibrated at the factory to produce the required backreflection at the output port. All the user needs to do is account for losses in the backreflection path from other connectors and devices by measuring and setting the offset correctly. The user can set the desired level of backreflection from either the local interface or remote interface.

The final backreflection including the offset is the displayed. The backreflection set by the unit is the desired backreflection plus the backreflection offset.

$B_{Final} = B_{set} + B_{offset}$

The user can thus request the total backreflection he actually desires. The backreflector adjusts its setting using the offset previously set by the user to account for all other losses, so that the final backreflection is what the user desired.

MAP-200 Variable Backreflector Configuration Information

Table 28: mVBR configuration information

Device	Integer	Device number
Type	String	Card type: BR Controller
Model	String	Card model designation
BRmin	Float	Min back-reflection*
BRmax	Float	Max back-reflection**
Wmin	Float	Min Wavelength
Wmax	Float	Max Wavelength
CalWavelength1	Integer	Calibration Wavelength1
CalWavelength2	Integer	Calibration Wavelength1
Beam Block	String	Beam Block Mechanism?

* User should use an external power meter to measure the inherent back-reflection of the card.

MAP-200 Variable Backreflector Parameter Information

Table 29: mVBR parameter information

Serial Number	String	(8 characters)
Part Number	String	(23 characters)
Card Firmware Rev	String	(4 characters)
Firmware Rev 1	String	(4 characters)
Firmware Rev 2	String	(4 characters)
HW Rev	String	(4 characters)
Assembly Date	String	(8 characters)
Description	String	(30 characters)

MAP-200 Tunable Grating Filter

MAP-200 Tunable Filter General Information

The MAP-200 Tunable Grating Filter Module (TB3) is a tunable bandpass filter that offers continuous wavelength tuning from 1420 to 1630 nm. It is ideal for applications requiring low insertion loss, high rejection, narrow bandwidth, and wavelength tuning resolution of 0.005 nm. The standard model has a maximum input power of 300 mW and the high power option provides a maximum input power of 1000 mW.

Three options are available:

- The peak search option, used to find the absolute maximum transmission power within the filter's wavelength tuning range or a local maximum
- 10% tap option for power monitoring

MAP-200 Tunable Grating Filter Module is ideal for applications where the user needs to suppress amplified spontaneous emissions (ASE) or needs to isolate specific wavelengths. These applications include amplifier characterization, bit error rate (BER) testing and optical signal to noise ratio (OSNR) measurement.

The TB3 is divided into three basic models based on the bandwidth of the filter. These are labeled C, G and K. Another option is standard (300 mW) or high power (1W). This option is available only for the C and G models. In addition to this, the user can select a TB3 with or without the peak search option. If the TB3 does not have the peak search option, the user can select a 10%, 50% or no tap. As with all MAP modules, the user can specify the bulkhead connectors, selecting from six types.

Key Features and Benefits

- Narrow bandwidth
- Low PDL (< 0.3 dB)
- Wide wavelength range (1420 to 1630 nm)
- High power input (1 W)

MAP-200 Tunable Filter Front Panel

Figure 92: mTBF front panel

MAP-200 Tunable Filter Specifications

Optical and general specifications of the MAP-200 Tunable Grating Filter are shown below.

Parameter	Model C	Model G	Model K
Wavelength range	1420 to 1630 nm	1420 to 1630 nm	1420 to 1630 nm
Optical shape	Gaussian	Gaussian	Gaussian
–3 dB bandwidth[1]	0.11 nm ±15%	0.25 nm ±15%	0.55 nm ±15%
3/20 dB ratio[1]	0.40 ±0.05	0.31 ±0.05	0.31 ±0.05
Insertion loss (IL)[2]			
1520 to 1610 nm	<6.0 dB	<5.8 dB	<5.8 dB
1480 to 1630 nm	<8.0 dB	<8.0 dB	<8.0 dB
Input power[3]	300 mW or 1 W	300 mW or 1 W	300 mW
Return loss (RL)[4]	>45 dB		
Wavelength resolution	0.005 nm		
Polarization dependent loss (PDL)[5], 1480 to 1630 nm	<0.3 dB		
Tuning speed	>5 nm/s		
Peak to average background noise	>45 dB		
Accuracy	±0.2 nm		
Peak search accuracy	<0.2 dB from output peak power		
Polarization mode dispersion (PMD)	<0.3 ps		
Group delay variation within a –3 dB bandwidth	<5 ps		
Recommended calibration period	1 year		
Operating temperature	10 to –40°C		
Storage temperature	–10 to 60°C		
Dimensions (W x H x D)	8.1 x 13.26 x 37.03 cm (3.19 x 5.22 x 14.58 in)		
Weight	2.3 kg (5.07 lb)		

1. Measured at 1550 nm
2. Add 1.2 dB for tap or peak search option

3. At 23°C ±5°C
4. At selected wavelength
5. Input power is within the range of –20 dBm to +20 dBm. Excludes PDL effect

MAP-200 Tunable Filter Theory of Operation

The filter makes use of proven diffraction grating technology and reliable stepper motor performance to provide smooth tuning. Light wavelengths are separated along several discrete paths with the use of the grating filter. VIAVI's proven stepper motor apparatus is used to precisely adjust the angle of the grating to isolate a specified wavelength.

Figure 93: mTBF functional diagram

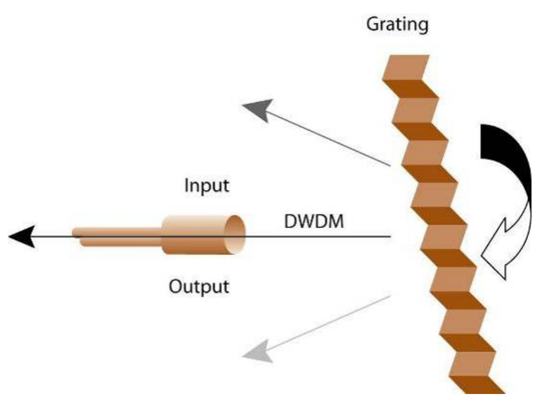
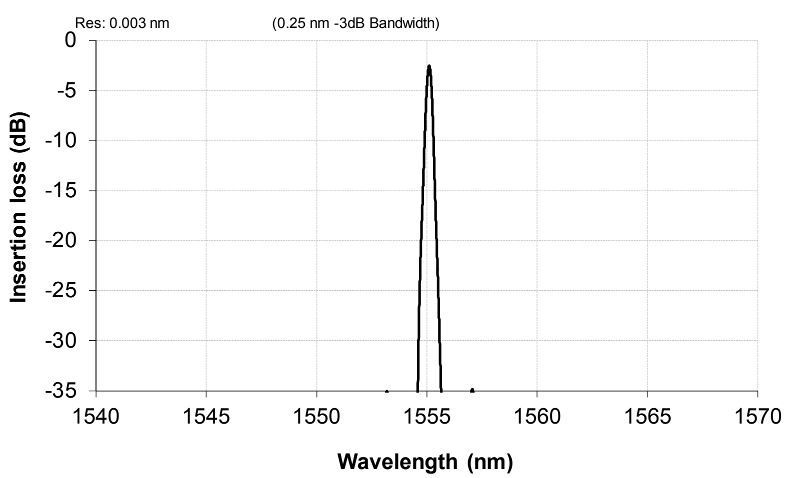


Figure 94 shows the low insertion loss and sharpness of the TB3 Series Tunable Grating Filter

Figure 94: mTBF G model filter shape



Tunable Grating Filter Applications

The TB3 Series Tunable Grating Filter can be used as a building block for many applications. The modular format facilitates filtering applications with other VIAVI MAP modules and/or bench top instruments in many different test set-ups. Typically, a filter is used to drop one channel from a WDM system where the dropped channel is tested for performance such as BER. It is also used to suppress ASE noise from different laser sources.

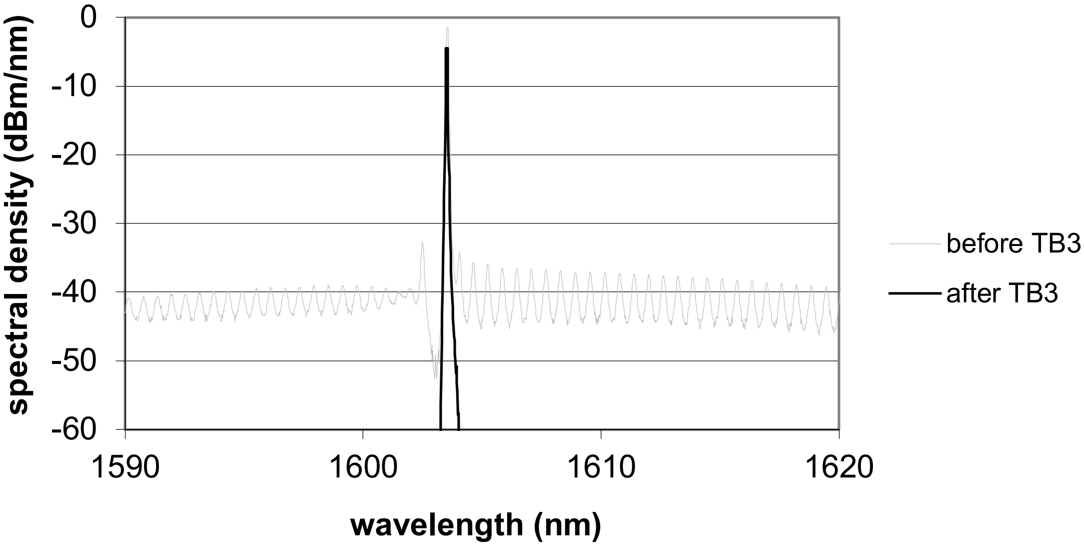
Tunable Grating Filter in Channel Drop Application

The center wavelength of the TB3 Series Tunable Grating Filter can be tuned to any WDM channel. If the channel spacing is greater than the filter bandwidth the channel selected will be transmitted while all others are blocked within the filter module. To select a channel from a narrow spacing WDM system, a narrow bandwidth filter must be used. Alternatively, the IL of a narrower band filter is more sensitive to source or filter wavelength drift. Therefore, the selection of the filter is important. The TB3 filter offers four different bandwidths for selection. The filer is designed to have a best overall performance and to introduce minimal artifacts such as IL, PDL, PMD and chromatic dispersion.

Tunable Grating Filter in Laser Spontaneous Emission Suppression

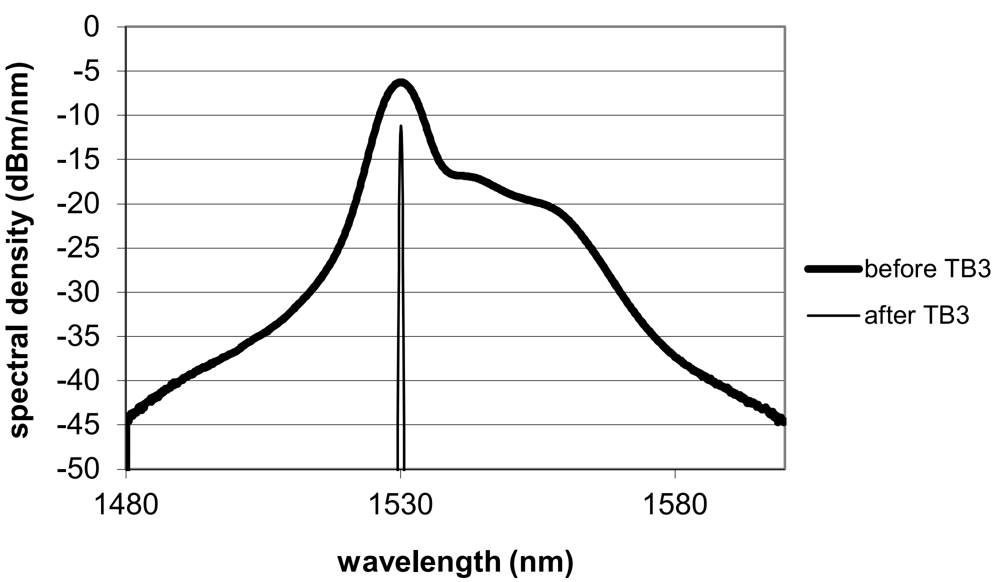
Light sources from semiconductor lasers (Distributed Feedback Laser, Fabry-Perot laser, Tunable laser) intrinsically contain ASE noise in addition to the main lasing light if no additional filtering is implemented. ASE noise presents a problem for many high dynamic range and high wavelength resolution measurements, e.g. fiber Bragg grating measurement and WDM filters with sharp wavelength edges. The TB3 filter is a capable building block to filter ASE noise in these applications with its wide wavelength tuning range and very stable filter wavelength. Figure 95 shows the spectra of a DFB laser before and after ASE noise reduction by a TB3 filter with 0.2nm bandwidth, both spectra are measured by an OSA with 0.1nm bandwidth.

Figure 95: Spontaneous emission filtering of a DFB laser source



In some applications, a single wavelength light with low coherence other than a laser light is desired. TB3 filter can be used with a broadband source to provide a tunable low coherence source. Figure 96 shows a EDFA broadband source filtered by a TB3.

Figure 96: Filtering of a EDFA broadband source



MAP-200 Tunable Filter Configuration Information

Table 30: mTBF configuration information

Parameter	Type
Device	Integer
Type	String
Model*	Character
Wmin	Integer
Wmax	Integer
-3dB bandwidth	String
PM status	String
Coupler ratio	String

* Some models may not be available until next release

MAP-200 Tunable Filter Parameter Information

Table 31: mTBF parameter information

Parameter	Type	Characters
Serial Number	String	(8 characters)
Part Number	String	(23 characters)
Card Firmware Rev	String	(4 characters)
Firmware Rev 1	String	(4 characters)
Firmware Rev 2	String	(4 characters)
HW Rev	String	(4 characters)
Assembly Date	String	(8 characters)
Description	String	(30 characters)

Chapter 11: Measurement Module Manuals

MAP-200 Optical Power Meter: mOPM-B1

MAP Optical Power Meter General Information

VIAVI offers it's latest design of Optical Power Meter for use with the MAP-200 Platform, with many new configurations. For insertion and removal of the cassette please refer to the Chapter 5: Getting Started section of the MAP-200 Manual.

- Three different detector types covering high power, standard and premium performance
- Choice of 1, 2 or 4 detectors per cassette
- Detectors available as integrated into the cassette, or as remote heads.
- Ability to mix detectors in a cassette (Remote head option only not panel mount)
- Compact remote head compared to competition
- Industry leading linearity
- Low relative uncertainty

Choice of Detector Types

3mm InGaAs Premium Performance MAP Power Meter

The Premium Performance detector is optimized for applications using single-mode (SM) or multimode (MM) fiber and will measure power levels from -80 to 11 dBm over the wavelength range of 750 to 1700 nm. It features high accuracy, very linear behaviour and extremely low relative uncertainty due to polarization. It can be recognized by it's larger diameter and 3mm detector chip when the connector adapter is removed.

Figure 97: 3mm InGaAs Premium Performance MAP Power Meter

2mm InGaAs General Purpose MAP Power Meter

The General Purpose detector is optimized for applications using single-mode (SM) or multimode (MM) fiber (62.5 micron or less) and will measure power levels from -70 to 11 dBm over the wavelength range of 800 to 1650 nm. It features high accuracy, very linear behaviour and low relative uncertainty due to polarization. It can be recognized by its smaller diameter, and 2mm detector chip when the connector adapter is removed.

Figure 98: 2mm InGaAs General Purpose MAP Power Meter

Filtered 2mm InGaAs High Power MAP Power Meter

The High Power detector is optimized for applications using single-mode (SM) or multimode (MM) fiber (62.5 micron or less) and will measure power levels from -45 to 27 dBm over the wavelength range of 800 to 1650 nm. It features high accuracy as well as very linear behaviour. It can be recognized by its smaller diameter and dark reflective surface.

NOTE THAT USE OF THIS DETECTOR FOR HIGH POWER MEASUREMENTS REQUIRES THAT CONNECTOR ADAPTERS BE USED THAT ARE DESIGNED TO HANDLE HIGH POWER.

Initially the special adapter shown in Figure 100 will be supplied as an interim solution until the AC9xx series of adapters are available. AC118 is the only currently available adapter compatible with the High Power OPM.

Figure 99: 2mm InGaAs High Power MAP Power Meter

Figure 100: High Power OPM Detector Adapter (Interim)

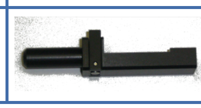
Adaptable to Many Fiber Connector Types

All General Purpose and Premium Performance MOPM are supplied with one AC100 and one AC101 per detector. All High Power MOPM are supplied with one AC100 and one high power FC adapter per connector. As an option for remote head users, a 6 foot (1.8m) extension cable is available.

The detector heads are designed to be used with those existing VIAVI AC1xx series of interchangeable detector adapters defined in the **Optional Accessories** table. These are available for most connector types as well as a fiber holder that permits bare fiber measurements. For connector adapters not shown, please contact VIAVI. Note that a new AC9xx series of connector adapters will feature high power compatibility and repeatable return loss.

Optional Accessories

Table 32: mOPM-B1 Power Meter Accessories

Description*	Existing Part Number*	AC1xx Image
Detector cap	AC100	
*FC adapter	*AC101	
*ST adapter	*AC102	
*SC adapter	*AC103	
LC	AC118	
Bare Fiber adapter	AC121	

*Not for use with high power option MPMHP or MOPM-B1RHHP

Flexible Configuration with High Density of Detectors: Cassette-mounted or Remote Detectors

The user has the option of specifying a cassette with detectors mounted directly on the cassette faceplate, or with electrical connectors to which remote detector heads can be attached. In either configuration, the density available is 1, 2 or 4 detectors per single width cassette. While cassette mounted detectors must be configured with identical detector types, the user has the flexibility with remote heads, to mix detector types.

MAP mOPM-B1 Front Panel Description

The front panel of the mOPM-B1 cassette will have 1, 2 or 4 detectors of the same type mounted directly to the cassette, or it will have 1, 2 or 4 quick disconnect electrical connectors for the attachment of remote heads. (Remote head detector types can be mixed). The configuration with panel mounted detectors will also indicate, by means of a warning label, on the bottom plastic latch, the maximum optical input power that should be used to avoid damage to the detector. In the case of the remote head cassette, this label is missing because it is determined by the remote head detector itself. Refer to Figure 101 below.

Figure 101: mOPM-B1PMH Panel Mount configuration with FC connector adapters.

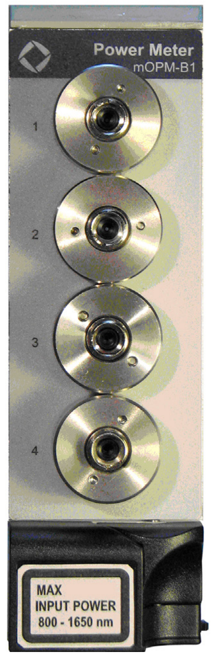
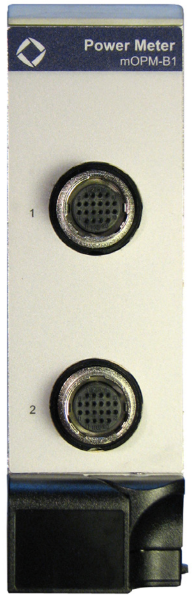


Figure 102: mOPM-B1RH2 Remote Head configuration available with up to 4 connectors



MAP mOPM-B1RH Remote Head Description

The MAP-200 OPM Remote Head enables measurement of optical power at a distance from the cassette itself, for those cases where this is more convenient on the workbench or from a rack mounted situation. The standard cable length supplied is 5 feet(1.5 metres) with an optional 6 foot(1.8 metres) extension cable. A warning on the front face of the head indicates the maximum input optical power allowed in order to not damage the specific detector type. Refer to Figure 102 below.

Figure 103: Single Detector Remote Head with FC connector adapter

MAP-200 OPM Model Identification

The following information is printed on the manufacturing label. This label can be found on the side panel of the power meter cassette, or on the bottom of a remote head, or via software.

<u>Type</u>: Marketing Model Number

mOPM-Bnxxx, where n is the major marketing release number starting at 1

xxx is either PMH for a cassette with panel mounted heads, RHy for remote head cassette,with y=number of connectors 1,2 or 4, or RHzP for remote head, with z=detector type;

G=General Purpose 2mm InGaAs

H=High Power 2mm InGaAs with filter

P=Premium Performance 3mm InGaAs

<u>Option</u>: For Panel Mount Detectors,: MPMzP where z is defined above

<u>SN</u>: Serial Number

MAP-200 OPM Calibration Information

A calibration certificate and label is included with the cassette. The label is supplied separate from the cassette in case the user prefers this to reside in their quality records separate from the cassette itself.

MAP Optical Power Meter Specifications: mOPM-B1

Table 33: mOPM-B Power Meter Specifications

Parameter	General Purpose	Premium Performance	High Power
Detector Type	InGaAs	TEC InGaAs	Filtered InGaAs
Detector Size	2mm	3mm	2mm
Wavelength Range	800-1650nm	750-1700nm	800-1650nm
Operating Temperature	10 to 40°C	15 to 40°C	10 to 40°C
Fiber Type[1]	Core Size 62.5 µm N.A. ≤ 0.27	Core size 62.5 µm N.A. ≤ 0.27	Core Size 62.5 µm N.A. ≤ 0.27
Dynamic Range (@1550nm)	+11 dBm to -70dBm	+11 dBm to -80dBm	+27dBm to -45dBm
Uncertainty at Reference Conditions[2]	± 2.5 % (800-1510nm) ± 2.4 % (1510-1600nm) ± 2.7 % (1600-1635nm)	± 2.2 % (800-1510nm) ± 2.3 % (1510-1600nm) ± 2.5 % (1600-1635nm)	± 3.9 % (800-960nm) ± 3.6 % (960-1300nm) ± 3.7 % (1300-1510nm) ± 3.8 % (1510-1600nm) ± 4.0% (1600-1635nm)
Total Uncertainty[3]	± 3.2 % ±5pW (800-900nm) ± 5.2 % ±5pW (900-960nm) ± 3.1 % ±5pW (960-1510nm) ± 3.1 % ±5pW (1510-1600nm) ± 3.8 % ±5pW (1600-1635nm)	± 3.0 % ±1pW (800-1510nm) ± 3.1 % ±1pW (1510-1600nm) ± 3.4 % ±1pW (1600-1635nm	± 4.6 % ±100pW (800-900nm) ± 7.9 % ±100pW[6] (900-960nm) ± 3.9 % ±100pW (960-1300nm) ± 4.4 % ±100pW (1300-1510nm) ± 4.5 % ±100pW (1510-1600nm) ± 5.2 % ±100pW (1600-1635nm)
Linearity (at 23±5°C)	±0.010 dB ± 5pW	±0.010 dB ± 1pW	±0.010 dB ± 100pW *for -45dBm to +10dBm.* ±0.03 dB *for +10 to +27dBm*
Noise(peak to peak)[4]	2 pW	1 pW	50 pW
Return Loss	>55dB typ	>55dB typ	>55dB typ
Relative Uncertainty due to Polarization[5]	<±0.015 dB	<±0.01 dB	<±0.07 dB
Max Channels per Cassette	1,2 or 4		
Sampling Time	4 µs (250kHz)		
Averaging Time	20 µs to 5s		
Buffer Size	100000 points		
Supported Connectors[7]	FC,ST,SC,LC,MU,MT-RJ,Bare Fiber, MT[7]		
Recalibration Period	1 year		
Warm-up Time	30 minutes		
Humidity	15-80% RH, non condensing		
Dimension	4.06x13.26x37.03cm (1.6 x5.22x14.58in)		
Weight	1.2 kg(2.65 lb)		

Notes:
1.For 62.5 µm core fiber, additional uncertainty of 1%(PC) or 2%(APC) must be added due to overfill of 2mm detector
2.Fiber SMF-28, T=23±5°C, Spectral width of source< 6 nm, Optical Power on detector= -20 dBm, 500ms averaging time.
3. SMF 28, N.A. of fiber ≤ 0.27, Temperature, humidity and power range per Table
4.1 second averaging time, 300 second observation time, T=23±5°C

5. All states of polarization, constant power, straight connector, T=23±5°C. MPMGP and MPMPP at constant WL=1550nm±30nm, MPMHP at WL=1310nm.
6.For 900 – 960nm only, uncertainty indicated is for 15-35 °C
7.Note that MT Connector size prevents the use of adjacent channels. Therefore a 4 channel cassette only allows 2 MT input at a time.

mOPM Theory of Operation

Detector Uncertainty due to Polarization

The mOPM-B1 family of MAP Power Meters (OPM) use detectors with intrinsically low uncertainty due to polarization: ±< 0.01 dB for the Premium Performance and <± 0.015 dB for the General Purpose detector options. This helps maintain high repeatability in power measurements, virtually independent of the launch polarization of the light entering the detector. In general uncertainty due to polarization is less a concern for high power measurement applications. Due to the filter element employed for the High Power detector option, this value is <± 0.07 dB.

Input Optical Source

The MAP-200 OPM will measure power accurately from a wide variety of source types including those with modulated signals.

Dark Current

All photodetectors produce some response even when no light falls on them. This is known as dark current, dark voltage or dark power. The dark power is greater for larger area detectors. It will also depend on the type of detector and the environment. The dark power defines the absolute minimum power that the meter can measure. The value of dark power is measured at the factory, and used to compute power. The dark power value has a greater influence on the accuracy of power measurements at low power levels. For accurate low power measurements, dark power should be measured under the same conditions as the planned measurement. A user should do a dark measurement when the equipment is first installed, and whenever there is a significant change in the measurement environment, especially in the electrical circuits to which the equipment is attached.

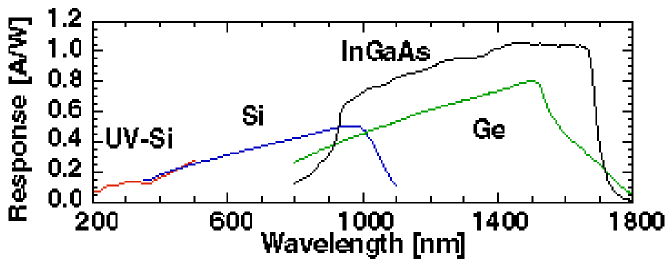
Performing a Dark Measurement

Ensure that the power sensing mode is set to Auto. Cap the detector using the provided cap, AC100, to ensure that no light enters the detector. Press the “Execute User Power Dark Measurement” button in the detailed OPM-B view on the GUI. The present setting should change to “User Cal.”.

Responsivity of the Detector vs. Wavelength

The response of the detector varies with the wavelength of the incident light. The magnitude of this dependence varies with the material used in the photodetector. All 3 detector types offered on the mOPM-B1 are based on InGaAs.

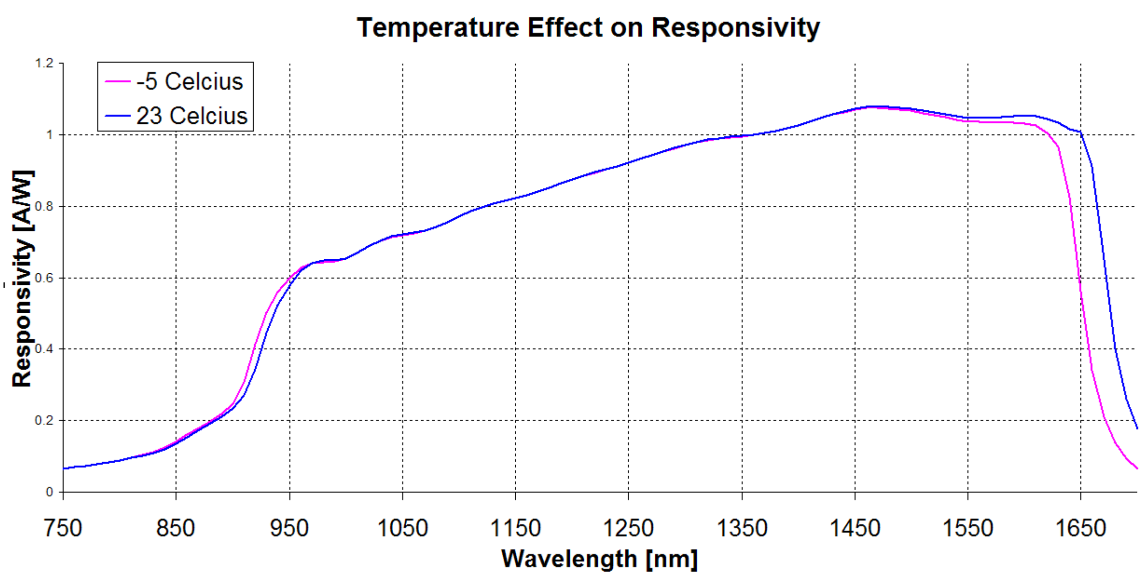
Figure 104: Detector material responsivity to wavelength



Responsivity of the Detector vs. Temperature

The **MPMPP** (Premium Performance) detector option uses a TEC cooler to provide controlled conditions and therefore less uncertainty at lower (750 – 1000nm) and higher(1550 - 1700nm) wavelengths. This is illustrated in Figure 104 below, showing responsivity of a detector operating at 23°C. The “-5 Celcius” is with the TEC cooler on. Without the TEC cooler, the responsivity shifts as shown by the “23 Celcius” curve.

Figure 105: Temperature Effects on InGaAs detector



Dependence on Wavelength

As shown in Figure 104, there is a significant variation in a detector material sensitivity to wavelength. To account for this variation, MAP power meters are calibrated at a number of wavelengths. These calibration curves are stored in the power meter. When power is measured, the value is corrected to match the wavelength. It is therefore essential that the user specify the wavelength at which the power should be determined to an accuracy of 1 nm.

Cleanliness

It is important to be sure that connectors, at the time of inserion into the connector adapter of the power meter are properly cleaned. Refer to the MAP-200 manual “Getting Started” section for recommended cleaning procedure. Occasionally it is worth checking the surface of the detector is clean. This can be done by unscrewing the ACxxx stainless adapter covering the detector. If required, due to dust, the detector surface can be cleaned using the same process as the connector.

Calibration of the Power Meter

The power meter is calibrated at the factory to NIST traceable standards. Essentially, several calibration steps are required to calibrate for power at all levels and wavelengths of interest. Factory calibration is recommended annually.

The process of power meter calibration is as follows:

1. **Dark correction:** the ADC count is measured without light incident at each gain stage. For each measurement, the head subtracts off the dark level (n_D) after reading the ADC for the current gain stage. Users have the ability to take their own Dark Current measurements and also the option to restore to factory default Dark Current measurement values.

2. **Linearity calibration:** input light is measured at different power levels to calculate the correction factors for each gain stage. This calibration can be performed only at the factory. It is recommended that power meters be returned to the factory for calibration at least once every 12 months.

3. **Responsivity calibration:** a lookup table describing the spectral responsivity of each photodiode is built up from measurements at wavelengths 1 nm apart for the wavelength range of interest. This calibration can be performed only at the factory. It is recommended that power meters be returned to the factory for calibration at least once every 12 months.

4. **Absolute power calibration:** the power-offset coefficient is obtained by calibrating the meter to the working standard -- one that is traceable to NIST standards. The procedure used for calibration meets the requirements of IEC standard 61315. This calibration can be performed only at the factory. It is recommended that power meters be returned to the factory for calibration every 12 months.

Dynamic Range

The power meter uses variable gains at different power levels to achieve a large dynamic range. The power meter is calibrated independently with all possible gain settings.

Setting Power Ranges

To achieve the dynamic range specified for it, the power meter uses different gains in selected power ranges. The power meter uses five such gain ranges. These are shown in Table 34 and Table 35 below.

Table 34: mOPM-B1 power range for General Purpose and Premium Performance Detectors

Range Setting	Power Threshold	
	Lower Limit (dBm)	Upper Limit (dBm)
1	-8	11
2	-26	-6
3	-42	-24
4	-59	-40
5	-80	-57

Table 35: mOPM-B1 power range for High Power Detector

Range Setting	**Power Threshold**	
	Lower Limit (dBm)	**Upper Limit (dBm)**
1	9	27
2	-9	11
3	-26	-7
4	-42	-24
5	-60	-40

Power ranges can be used in one of two modes: *auto* and *manual*. If the range selection is set to auto, the power meter selects the gain range to use based on the power as measured in the current setting. If the power falls below a certain threshold, and the lowest gain range has been reached, low input power is signaled. If the power exceeds a preset threshold at highest power range, high input power is signaled.

In the manual setting, the user decides which gain range the power meter uses. The meter does not adjust gain range based on the input power. This has the effect of lowering the dynamic range. On the positive side, power measurements are faster because the meter does not check and adjust the gain range. A user should select the highest gain range that includes all power levels the user is interested in measuring. The dynamic range of power measurements is limited to the range selected by the user. In manual mode, all power measurements are made using the same gain.

Power Measurement Modes

The power meter internally samples the power every 4μs. The actual measured power is obtained over the ATIME, or averaging time, period. The 4μs samples are averaged over this ATIME period to provide a single measured power value. For example, by setting ATIME to 5ms, and with the fixed internal sampling period of 4μs, the measured power will be obtained by averaging 1250 samples. The default ATIME period is 100ms and can range from as low as 20μs to as high as 5s.

The power meter can be operated in two modes: *Single-Shot Mode* or *Continuous Mode*. In Single-Shot mode, only a single measured power is obtained as queried by the user. A FETCH command in this case will always return the same (previously acquired) power. In Continuous Mode, the power meter will continuously acquire new measured power values as each ATIME period expires. A FETCH command here will return the most recently acquired measured power. In both modes, a READ command will initiate a new ATIME measurement period and will return the resulting measured power.

More on FETCH

If the power meter is in continuous mode, the value returned is that averaged over the last complete ATIME period. If the power meter is in single-shot mode, the power returned is whatever was last acquired. The time and the number of samples averaged are unknown. It is recommended that the FETCH command be used only after the power meter has been put into continuous sampling mode. When a FETCH is done, the result is returned immediately.

READ Command

The second way to get the power is to issue a READ command. If the power meter is in single-shot mode, it initiates a new power measurement. After ATIME has expired, the power meter returns the averaged power value. Thus, in singleshot mode, the time to get the power is at least ATIME. If the power meter is in continuous sampling mode, the READ command does not initiate a new read, but simply waits for the current ATIME period to expire, at the end of which it returns the current measured power value. Thus, the time to READ the power, when the power meter is in continuous sampling mode, is less than ATIME (not including other overhead).

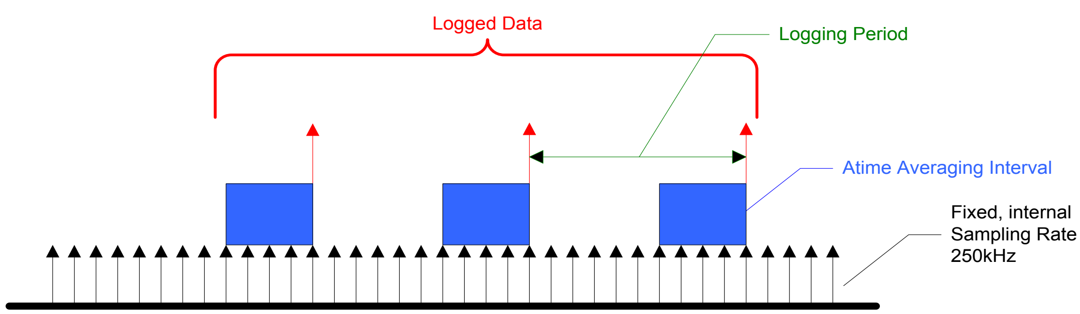
Choice of ATIME

ATIME is the time over which data for a single power measurement is acquired and averaged. The choice of ATIME depends on the variability of the power as a function of time. This depends on the stability of the source and the noise inherent in the system. To reduce noise, you need to make ATIME as long as possible. This increases the time required to acquire a new measurement. To get an accurate power measurement, the power should not drift significantly during the time it is being averaged. Hence, you should make ATIME small enough to ensure that power is stable during the ATIME. The more unstable the source, the shorter ATIME may have to be. For more stable sources, you can make ATIME large, thus reducing noise and increasing the accuracy and resolution of the measurement.

Data Logging

Data logging is a new feature of the MOPM-B1 power meter. The logging frequency can be defined in terms of Atime periods, and the number of samples to log up to a maximum of 100,000. Triggering can be defined for each detector channel, as well as trigger delay time, threshold level and rising or falling edge. Pictorially this is represented in Figure 105 below.

Figure 106: Representation of Atime and Data Logging function



Data Logging Commands

For Data Logging Acquisition Control (cassette level, no device parameter)

:SENSe:LOGging:PERiod[?]

Specifies the logging frequency (in ms)

:SENSe:LOGging:ENAble[?] (1,2,3,4)

Select devices to Log

:SENSe:LOGging:SAMPles[?]

Specifies the number of samples to log (max 100000)

:SENSe:LOGging:PREtrigger[?]

Sets number of pretrigger points. (0 to disable pretrigger). Pretrigger enables data logging for X ms (user defined timeframe in ms) before the trigger event occurs

:SENSe:LOGging:STATe[?] [STARt|STOP|TRIG]

- Starts or Stops logging action
- TRIG specifies using Triggering

For Trigger Support (cassette level, no device parameter)

:TRIGger

:STATe[?] [STOP, ARM, FORce]

- Trigger? States [Stopped, Armed, Delay, Triggered]
- Tigger action will not occur unless state has been set to ARM
- FORce will immediately force a trigger event

:SOURce[?] [device]

Select the device (head) to be used as the trigger source

:EDGE

:LEVel[?]

Trigger threshold level in dBm

:SLOPe[?] [RISE,FALL]

Rising/falling edge selection. Only one trigger type can be specified

:DELay[?]

Trigger Delay time (in ms); 0 for no delay. A trigger delay will start storing data X ms (user defined timeframe in ms) from the trigger event

For Data Retrieval (per device)

:SENSe:LOGging:DATA? <start><len>

- Use SCPI Binary Block Protocol
- Returns array of IEEE floats with powers in dBm. This requires a user to capture the binary data and post-process to convert it to numeric value
- Data in buffer exists until a new logging cycle is started, at which point the previous device data is erased

:SENSe:LOGging:POINts?

Number of data points available

For Logging Operations

- Immediate Logging

1. Set Acquisition Parameters

Atime

2. Set Logging Parameters

:LOG:ENAble (select devices to log)

:LOG:PERiod

:LOG:SAMPles

3. Start Logging

:LOG:STATe START

- Triggered Logging

1. Set Acquisition Parameters

Atime

2. Set Logging Parameters

:LOG:ENAble (select devices to log)

:LOG:PERiod

:LOG:SAMPles

:LOG:PREtrigger

3. Set Trigger Parameters

:TRIG:EDGE:LEVel

:TRIG:EDGE:SLOPe

:TRIG:EDGE:DELay

4. Set Logging Trigger

:LOG:STATe TRIG

5. Arm Trigger

:LOG:TRIG:ARM

- Logging Status
- Has Logging been triggered?

1. Check Trigger:

:TRIG:STATe?

Change to TRIGGERED

2. Or Check Logging

:LOG:STATe?

Change from TRIG to START shows logging has started.

- Is Logging complete?

1. Check Log status

:LOG:STATe?

- START means logging is still running
- Change to DONE shows logging has completed

User Interface

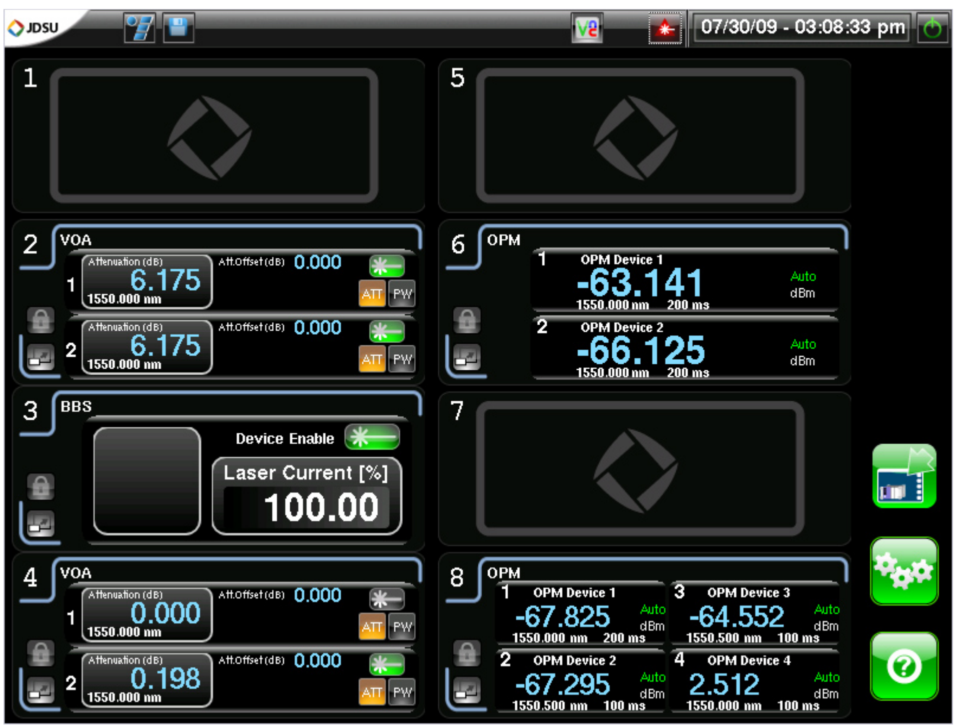
The MAP-200 optical power meter can be controlled via the local (graphical) user interface in the case where you have the optional keypad display module (MAP-200-KD), or it can be controlled remotely via command set.

MAP Optical Power Meter Graphical User Interface

Instrument Summary Panel

The MAP-200 screen shot in Figure 106 shows the MAP OPM as part of the summary panel for an 8 slot chassis. Slot 6 shows a dual legacy OPM(optical power meter mOPM-A1) and slot 8 shows a new quad OPM(mOPM-B1).

Figure 107: MAP-200 GUI Screen Shot of Instrument Summary Panel)



Device Summary Panel(mOPM-A1 and mOPM-B1)

Figure 107 and 110 show the detailed view of mOPM-A1 and mOPM-B1 respectively.

Figure 108: GUI screen shot of dual Legacy OPM(mOPM-A1) cassette

Figure 109: GUI screen shot of New Remote Cassette mOPM-B1 with 3 Remote Heads

mOPM-B1 Graphical User Interface Limitations

The mOPM-B1 series of power meters provides advanced functionality, such as the ability to log data into an internal buffer. It is important to note that currently, the advanced functionality associated with internal mOPM-B buffers, data capture and triggering is only available through a user automation environment using SCPI interface, as described in the **Data Logging** section.

The IVI drivers and LabView plug and play drivers for the mOPM-B1 will be released shortly. In the future these features will also be made available on the graphical user interface.

mOPM-B1 Optical Power Meter Configuration Information

Table 36: mOPM-B1 configuration information from Configuration Query

Device	Numeric	1 to 4
Type	String	OPM-B
Wmin	Numeric	Variable (refer to Detector Type Specification)
Wmax	Numeric	Variable (refer to Detector Type Specification)
Pmin	Numeric	Variable (refer to Detector Type Specification)
Pmax	Numeric	Variable (refer to Detector Type Specification)
Ranges	Numeric	Variable (refer to Detector Type Specification)

mOPM-B1 Optical Power Meter Parameter Information

Table 37: mOPM-B1 parameter information from System Information Query

Serial Number	(1 - 16 characters)
Part Number	(1 - 46 characters)
Module 1 Card Firmware Rev	(1 - 12 characters)
Module 2 Card Firmware Rev	(1 - 12 characters)
Module FPGA Firmware Rev	(1 - 8 characters)
Module EPLD Firmware or HW Rev	(1 - 8 characters)
Assembly Date	(1- 16 characters)
Description	(1- 60 characters)

MAP-200 Optical Power Meter: mOPM-A1

mOPM-A1 Optical Power Meter General Information

VIAVI offers two types of Multiple Application Platform (MAP) Power Meter Modules: a power meter with 3 mm InGaAs detector and a power meter with 10 mm Ge detector.

3 mm InGaAs MAP Power Meter

The Power Meter is optimized for applications using single-mode (SM) or multimode (MM) fiber to measure power levels from -80 to 10 dBm over the wavelength range of 800 to 1650 nm. It features a high accuracy, high linearity and extremely low polarization dependent loss (PDL). The MAP Power Meter Module with 3 mm InGaAs detector is available in single or dual configuration and comes with an analog electrical output for external monitoring. The averaging time can be set as low as 100 µs for high-speed applications.

For ultimate flexibility, the detector heads were designed with VIAVI AC100 interchangeable detector adaptors. Detector adaptors are available for six connector types, as well as a fiber holder that permits bare fiber measurements. The module is supplied with an FC detector adaptor as a standard accessory. An optional integrating sphere may be fastened to the front panel allowing for increased power measurement capability to 33 dBm (2W) with decreased PDL to 0.005 dB.

10 mm Ge MAP Power Meter

This versatile power meter can be used in applications using standard SM or MM fiber as well as SM or MM ribbon cable with fiber counts as high as 72. The power meter can accurately measure power levels from -50 tp 3 dBm over the wavelength range of 800 to 1650 nm. The detector heads are compatible with the VIAVI AC400 series interchangeable detector adaptors. This module is supplied with an FC detector adaptor as a standard accessory.

Key Features and Benefits

- Low PDL (< 0.01 dB)
- Wide wavelength range (850-1650 nm)
- High power input (> 1 W)
- Dual detector option
- Bare fiber measurements capability
- CE compliant (in MAP chassis)

mOPM-A1 Optical Power Meter Front Panel

Figure 110: mOPM-A1 front panel

mOPM-A1 Optical Power Meter Specifications

Parameter	3 mm InGaAs MAP Power Meter	10 mm Ge MAP Power Meter
Sensor element	3 mm InGaAs	10 mm Ge
Wavelength range	800 to 1650 nm	800 to 1650 nm
Power range	–80 to 10 dBm	–50 to 3 dBm
Fiber type	SMF and MMF with N/A ≤0.27	
Maximum core diameter for single fiber	62.5 µm (N/A ≤0.27)	
Maximum core diameter for ribbon cable[1]	N/A	62.5 µm (N/A ≤0.27)
Uncertainty at reference condition	±2.5% (1200 ≤ λ ≤1550 nm)[2] ±4.0% (800 ≤ λ<1200 nm)[2] ±3.5% (1550 ≤ λ ≤1600 nm)[2] ±4.0% (1600 ≤ λ ≤1630 nm)[2]	±4%[3] N/A N/A N/A
Total uncertainty[4,5]	±4.5% ±5 pW (800 ≤ λ ≤1630 nm)	±5.5% ±100 pW
Relative uncertainty Polarization[6] Spectral ripple[7]	 ±0.01 dB ±0.005 dB	 <0.01 dB <0.01 dB
Linearity (at T = 23 ±5 °C)	1520 ≤ λ ≤1570 nm –65 to 10 dBm <± 0.02 dB	±0.025 dB[8]
Return loss (RL)[9]	>55 dB	>50 dB
Noise[10] (peak to peak)	<5 pW	<±100 pW
Averaging time	100 µs to 5 s	100 µs to 5 s
Analog output	0 to 2 volts	N/A
Recalibration period	1 year	
Warm-up time	20 minutes	
Operating temperature	5 to 40°C	
Humidity	non-condensing	
Dimensions (W x H x D)	4.06 x 13.26 x 37.03 cm (1.6 x 5.22 x 14.58 in) 8.10 x 13.26 x 37.03 cm (3.19 x 5.22 x 14.58 in)	
Weight	1.2 kg (2.65 lb)	

1. Six rows of 12 fibers with a 0.250 mm vertical and horizontal pitch
2. Reference condition: Fiber type: SMF-28, Ambient temperature: 23 ±3°C, Spectral width of source: <1 nm, Optical power on detector: 100 µW (–10 dBm)
3. Reference condition: CW laser with P = –10 dBm;Wavelength 1550 nm; FWHM <10 nm; SM fiber with single channel FC connector adapter; Ambient temperature 25 ±3°C
4. Operating conditions: N/A of fiber ″0.27 Temperature, humidity and power ranges: as specified. For FC/APC connector N/A = 0.27 add 1%
5. For wavelengths >1600 nm and temperatures >35°C add 1.0%
6. Polarization: Polarization states at fixed wavelength (1550 ±30 nm) and constant power; Straight connector; T = 23 ±5°C
7. Ripple: 1545 ″⌊ ″1565 nm; Fixed state of polarization; Constant power; Straight connector; T = 23 ±5°C
8. For 3 dBm >P >-30 dBm
9. RL: At 1310 nm and 1550 nm; 8° angled connector; T = 23 ±5°C
10. Noise: Averaging time 1 s; Observation time 300 s;Wavelength 1550 nm; T = 23 ±5°C

mOPM-A1 Optical Power Meter Theory of Operation

The MAP-200 Power Meter Module uses a 3 mm InGaAs detector that can measure from 10 to -80 dBm. An optional 10 mm InGaAs detector head is also available. The power meter can be used over the 850 nm to 1650 nm range and is available in single or dual detector configurations.

The power meter features incomparable accuracy, high linearity and extremely low PDL. The sampling rate fixed at 100 µs. The power meter provides an analog output that allows you to monitor power with an oscilloscope or a voltmeter.

Detector PDL

The MAP-200 Optical Power Meter (OPM) uses detector with intrinsically low PDL, < 0.01 dB. This helps maintain high repeatability in power measurements, virtually independent of the launch polarization of the light entering the detector.

Dark Current

All photodetectors produce some response even when no light falls on them. This is known as dark current, or dark voltage or dark power. The dark power is larger for larger area detectors, depends on the type of detector, and is environment-dependent. The dark power defines the absolute minimum power that the meter can measure. The value of dark power is measured at the factory, and used to compute power. The dark power value affects the accuracy of power measurements more at low power levels than at high power levels. For accurate low power measurements, dark power should be measured under the same conditions as the measurement. You should do a dark measurement when the equipment is first installed, and whenever there is a significant change in the measurement environment, especially in the electrical circuits to which the equipment is attached.

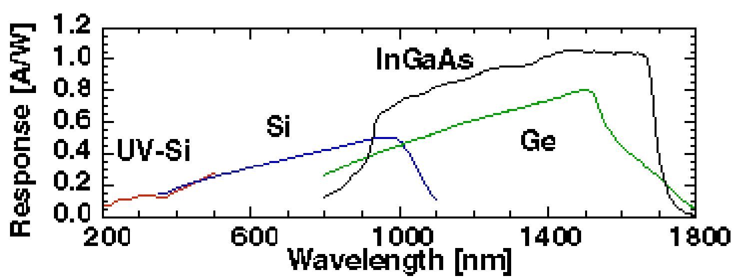
Performing a dark measurement

Ensure that the power sensing mode is set to Auto. Cap the detector using the provided cap to ensure that no light enters the detector. Press the “Execute User Power Dark Measurement” button. The present setting should change to “User Cal.”.

Responsivity of the detector

The response of the detector varies with the wavelength of the incident light. The magnitude of this dependence varies with the material used in the photodetector. The 3 mm detector uses InGaAs, while the 10 mm detector uses Ge.

Figure 111: Response of different materials to incident wavelength



Dependence on wavelength

As shown above, there is a significant variation in detector sensitivity with wavelength. To account for this variation, MAP-200 optical power meters are calibrated at a number of wavelengths. These calibration curves are stored in the power meter. When power is measured, the value is corrected to match the wavelength. Hence, it is essential that you specify the wavelength at which the power should be determined to an accuracy of 1 nm.

Calibration of the power meter

The power meter is calibrated at the factory to NIST traceable standards. Essentially, four separate calibration steps are required to calibrate for power at all levels and wavelengths of interest.

The process of power meter calibration is as follows:

1. **Dark correction:** the ADC count is measured without light incident at each gain stage. For each measurement, the head subtracts off the dark level (n_D) after reading the ADC for the current gain stage.

2. **Linearity calibration:** input light is measured at different power levels to calculate the correction factors for each gain stage.

3. **Responsivity calibration:** a lookup table describing the spectral responsivity of each photodiode is built up from measurements at wavelengths 1 nm apart for the wavelength range of interest.

4. **Absolute power calibration:** the power-offset coefficient is obtained by calibrating the meter to the working standard -- one that is traceable to NIST standards. The procedure used for calibration meets the requirements of IEC standard 61315. This calibration can be performed only at the factory. It is recommended that power meters be returned to the factory for calibration at least once every 12 months.

High power measurements

The power meter is capable of measuring power up to +10 dBm. This is made possible by using a calibrated integrating sphere AC330. Note that this option is available only for the 3 mm InGaAs detector. The integrated so that the loss is known accurately at all relevant wavelengths. This is used to offset the power meter reading to give the true input power.

The integrating sphere provides two additional advantages full collection of all the input light and complete depolarization of the input signal. All the light from the input fiber is collected through the spherical lens in the integrating sphere. Thus, bare fiber measurements are relatively easy make. Power measurements are more repeatable than without the integrating sphere. The integrating sphere also serves to reduce the sensitivity of measurements to the launch polarization. This also serves to make measurements more repeatable.

Dynamic range

The power meter uses variable gains at different power levels to achieve a large dynamic range. The power meter is calibrated independently with all possible gain settings.

Power ranges and how to set them

To achieve the dynamic range specified for it, the power meter uses different gains in selected power ranges. The power meter uses seven such gain ranges. These are shown in Table 39 below.

Table 38: mOPM-A1 power ranges

Range Setting	Power Threshold	
	Lower Limit (dBm)	Upper Limit (dBm)
1	10	-7
2	3	-14
3	-9	-26
4	-21	-38
5	-33	-50
6	-45	-62
7	-53	-70

Power ranges can be used two modes auto and manual. If the range selection is set to auto, the power meter selects the gain range to use based on the power as measured in the current setting. If the power falls below a certain threshold, and the lowest gain range has been reached, low input power is signaled. If the power exceeds a preset threshold at highest power range, high input power is signaled. In the manual setting, you decide what gain range the power meter uses. The meter does not adjust gain range based on the input power. This has the effect of lowering the dynamic range. On the positive side, power measurements are faster because the meter does not check and adjust the gain range. You should select the highest gain range that includes all power levels you are interested in measuring. The dynamic range of power measurements is limited to the range selected by you. In manual mode, all power measurements are made using the same gain.

Power Measurement Modes

The power meter can be used to measure power in two modes. The first is the usual single-shot measurement. The other is continuous mode, in which measurements are made continuously, with data update rates selected by you. The power meter samples power every 100 us, when activated. This is done whenever you enable either a single measurement, or measurement in continuous mode. You can also specify a parameter known as ATIME, which is the averaging time. This can vary from 100 us to 5 s. The power meter starts a measurement, and averages all samples digitized every 100 us until ATIME has expired. The averaged power is then placed in an output register. This new value can be read this by issuing a FETCH or

READ command. The difference between these two commands is explained later in this section.

When ATIME is specified, this fixes the number of samples that are averaged. For example, if ATIME is 5 ms, 50 samples are averaged since a new sample is acquired every 100 us. This applies to both continuous mode and single-shot measurements. There are two distinct ways to retrieve the measured values.

One is to FETCH the result. If the power meter is in continuous mode, the value returned is that averaged over the last complete ATIME period. If the power meter is in single-shot mode, the power returned is whatever was last acquired. The time and the number of samples averaged are unknown. It is recommended that the FETCH command be used only after the power meter has been put into continuous sampling mode. When a FECTH is done, the result is returned immediately.

The second way to get the power is to issue a READ command. If the power meter is in single-shot mode, it initiates a new power measurement. After ATIME has expired, the power meter returns the averaged power value. Thus, in singleshot mode, the time to get the power is at least ATIME. If the power meter is in continuous sampling mode, the READ command does not initiate a new read, but simply waits for the current ATIME period to expire, at the end of which it returns the current measured power value. Thus, the time to READ the power, when the power meter is in continuous sampling mode, is less than ATIME (not including other overhead).

Choice of *ATIME*

ATIME is the time over which data for a single power measurement is acquired and averaged. The choice of ATIME depends on the variability of the power as a function of time. This depends on the stability of the source and the noise inherent in the system. To reduce noise, you need to make ATIME as long as possible. This increases the time required to acquire a new measurement. To get an accurate power measurement, the power should not drift significantly during the time it is being averaged. Hence, you should make ATIME small enough to ensure that power is stable during the ATIME. The more unstable the source, the shorter ATIME may have to be. For more stable sources, you can make ATIME large, thus reducing noise and increasing the accuracy and resolution of the measurement.

Resolution of the measurement.Power Meter Analog Output

OPM (power meter) modules provide one analog output port per detector head on each module. Analog output port characteristics are as follows:

- Output voltage is in the range of 0 – 2 V DC.
- Output voltage varies in proportion to the input power.
- Output voltage frequency is equal to Atime.

Output voltage represents an absolute power; no offset or reference is applied.

mOPM-A1 Optical Power Meter Configuration Information

Table 39: mOPM-A1 configuration information

Device	Integer
Type	String
Wmin	Integer
Wmax	Integer
Pmin	Integer
Pmax	Integer
Ranges	Integer

mOPM-A1 Optical Power Meter Parameter Information

Table 40: mOPM-A1 parameter information

Serial Number	String	(8 characters)
Part Number	String	(23 characters)
Card Firmware Rev	String	(4 characters)
Firmware Rev 1	String	(4 characters)
Firmware Rev 2	String	(4 characters)
HW Rev	String	(4 characters)
Assembly Date	String	(8 characters)
Description	String	(30 characters)

Chapter 12: Source Module Manuals

MAP-200 TLG Laser

⚠	**WARNING** Class 1M Laser product – invisible laser radiation, do not view directly with optical instruments. Please refer to Laser Safety section for more information.

MAP-200 TLG Laser General Information

The MAP-200 TLG is a new generation tunable laser module, which is ideal for DWDM testing where the capability to change wavelength on demand over the C and L bands with 25GHz spacing is essential.

The TLG laser module advances the optical source capability by offering C or L band tunability, and dense configurations with 1, 2 or 4 sources per module.

Key Features and Benefits

- One, two or four lasers in one module
- C or L band
- 25 GHz channel spacing
- 38nm operating range
- Narrow linewidth <5MHz
- C band features:
- Output Power > 12dBm
- SMSR 40dB min

MAP-200 TLG Laser Front Panel Description

The MAP-200 TLG Laser Module faceplate has number of variations to accommodate the different configurations available to the user.

Figure 112: Front Panel of mTLG Quad Laser Module

MAP-200 TLG LED Description

Table 41: mTLG LED Description

LED	Colour	Description
STATUS LED	Off	Laser source is OFF
	Green	Laser source is ON
	Red	Error or Interlock activated

NOTE: The TLG Status LED in always found next to the main output connector of the TLG laser it is reporting.

MAP-200 TLG Laser Specifications

Parameter	C-Band	L-Band
Wavelength		
Tuning range	191.30 to 196.10 THz, 1528.77 to 1567.13 nm	186.35 to 190.95 THz,1570.01 to 1608.76 nm
Accuracy[1,2,3]	±2 GHz (± 0.016 nm)	
Stability 15 minutes[1,2,3]	±0.005 nm Typ	
Stability 24 hours[1,2,3]	±0.01nm Typ	
Channel spacing	25 GHz	
Power		
Setting range[4]	7 to 13 dBm	7 to 11 dBm
Stability 15 minutes[1,2,3]	±0.005 dB Typ	
Stability 24 hours[1,2,3]	±0.03dB Typ	
Resolution	<0.1 dB Typ	
Spectral properties		
Linewidth[5]	≤5 MHz	
SMSR	40dB min, 45 dB Typ	38 dB min, 45 dB Typ
RIN	–140 dB/Hz Typ;–135 dB/Hz Max	–138.5 dB/Hz Typ; –133.5dB/Hz Max
Other		
Fiber type	Polarization maintaining fiber; Polarization aligned to slow axis and connector	
Supported connectors	FC/APC	
Warm-up time	1 hour	
Operating temperature	10 to 40°C	
Humidity	<80% RH, 10 to 40°C non-condensing	
Dimension	4.06 x 13.26 x 37.03 cm (1.6 x 5.22 x 14.58 in)	
Weight	1.3 kg (2.95 lbs) maximum (varies with configuration)	

1. At full power.
2. After 1-hour warm up.
3. Constant temperature within 25 ±3°C.
4. Power at max setting: >12 dBm for C-band and >10 dBm for L-band.
5. Natural (instantaneous) linewidth of the laser; with self-homodyne measurements indicated linewidth is typically 50-100 MHz.

MAP-200 TLG Laser Theory of Operation

Internal Operation

The MAP-200 TLG Module is based on a Sampled Grating Distributed Bragg Reflector (SG-DBR) laser with an integral wavelength locker. Wavelength and output power settings are controlled using the MAP-200 GUI or automation interfaces. The integrated wavelocker and automatic power control loop enable very stable operation.

MAP-200 TLG Laser Configuration Information

Table 42: mTLG configuration information

Device	Integer	Device Number	1
Type	String	Card Name	TLG
Pmin	Float	Min Power	0 to +10 dBm (+7 dBm)
Pmax	Float	Max Power	0 to +15 dBm (+11 dBm)
Wmim	Float	Min Wavelength	1100-1700nm (1575nm)
Wmax	Float	Max Wavelength	1100-1700nm (1630nm)
Fmin	Float	Min Frequency	180 – 199 THz
Fmax	Float	Max Frequency	180 – 199 THz
Gridmin	Float	Min grad spacing	25 GHz

MAP-200 TLG Laser Parameter Information

Table 43: mTLG parameter information

Serial Number	String	Max 18 characters
Part Number	String	Max 24 characters
Card Firmware Rev	String	Max 4 characters
Card Firmware Rev	String	Max 4 characters
FPGA Rev	String	Max 4 characters
HW Rev	String	Max 4 characters
Assembly Date (YYYYMMDD)	String	Max 8 characters
Description	String	Max 32 characters

MAP-200 Broadband Source

> **WARNING**
> Class 3B lasers are hazardous to eyes and skin if exposed directly.
> Please refer to Laser Safety section for more information.

MAP-200 Broadband Source General Information

The MAP-200 BBS Module is a high-power, source ideal for network development, or component test and development. The optics of the MAP-200 BBS Module consist of an erbium based gain block with supporting optical components specifically designed to achieve maximum output power at the bulkhead-mounted optical connector while minimizing input/output isolation.

Key Features and Benefits

- Output power to 50 mW
- High laser stability (0.02 dB over 1 hour)
- Bulkhead optical output connectors (FC/PC, FC/APC, SC/PC, SC/APC)
- LED alarms
- Monitors

MAP-200 Broadband Source Front Panel Description

Figure 113: Front of mBBS Module

MAP-200 Broadband Source Module LED Description

Table 44: mBBS LED description

LED	Description	
BBS STATUS	Off	Indicates Laser Source is OFF
	Green	Indicates Laser Source is ON
	Red	Error or Master Enable is OFF

MAP-200 Broadband Source Specifications

Specifications

Parameter	C-Band 50 mW Output Power	C-Band 100 mW Output Power
Operating wavelength range	1527 to 1568 nm	1525 to 1568 nm
Total optical power (minimum)[1]	50 mW	100 mW
Spectral gain flatness (maximum)[2]	1.6 dB	1.6 dB
Total output power stability	0.02 dB	
Output isolation (minimum)	45 dB	
Operating temperature	0 to 50°C	
Storage temperature	–30 to 60°C	
Humidity	Maximum 95% RH non-condensing from 0 to 45°C	
Dimensions (W x H x D)	4.06 x 13.26 x 37.03 cm (1.6 x 5.22 x 14.58 in)	
Weight	2.3 kg (5.07 lb)	

[1] Measured at 1550 nm at 23°C after one hour warm up
[2] Flatness range 1529 to 1565 nm for C-Band model

MAP-200 Broadband Source Theory of Operation

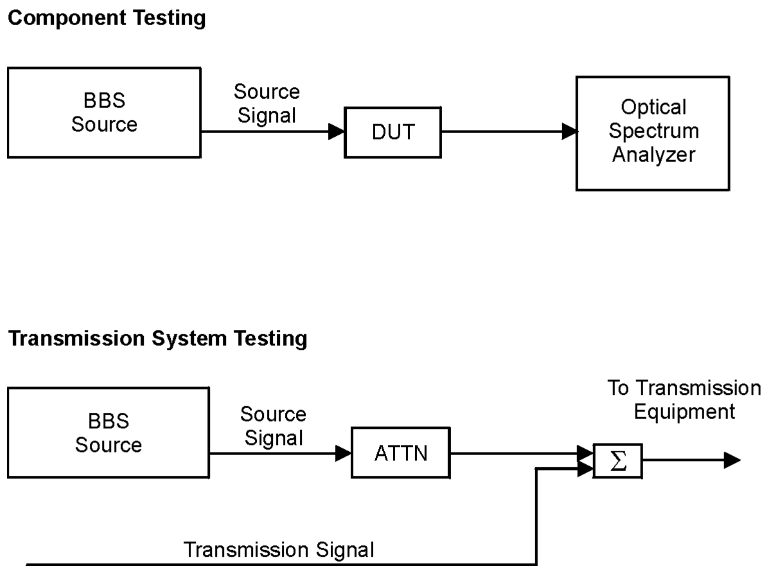
The optics of the MAP-200 BBS Module consist of an erbium based gain block with supporting optical components specifically designed to achieve maximum output power at the bulkhead-mounted optical connector while minimizing input/output isolation.

The MAP-200 BBS Module is used for optical component measurement and telecommunications transmission testing:

- Spectral measurements of couplers, WDMs, isolators, and other optical components
- Noise loading in system experiments
- Polarization mode dispersion (PMD) measurements

Figure 113 illustrates the connection of MAP-200 BBS Module for optical component and transmission system testing.

Figure 114: Component and Transmission System Testing



MAP-200 Broadband Source Configuration Information

Table 45: mBBS configuration information

Device	Integer	Device Number
Type	String	Card Name
BandType	String	Working Bandwidth
Imin	Float	Min Laser Current
Imax	Float	Max Laser Current
LPmin	Float	Min Laser Power
LPmax	Float	Max Laser Power
CurrentAdjust?	String	User-selectable laser current*

* If laser current is not user-selectable it will be set to 100% when laser is enabled.

MAP-200 Broadband Source Parameter Information

Table 46: mBBS parameter information

Serial Number	String	(8 characters)
Part Number	String	(23 characters)
Card Firmware Rev	String	(4 characters)
Firmware Rev 1	String	(4 characters)
Firmware Rev 2	String	(4 characters)

HW Rev	String	(4 characters)
Assembly Date	String	(8 characters)
Description	String	(30 characters)

MAP-200 DFB Laser

	WARNING Class 3B lasers are hazardous to eyes and skin if exposed directly. Please refer to Laser Safety section for more information.

MAP-200 DFB Laser General Information

The MAP-200 Distributed Feedback (DFB) Laser Module emits an extremely narrow spectral width making it an excellent source for DWDM system testing. The standard MAP-200 DFB laser can be selected to comply with the 100 GHz (0.8 nm) ITU grid in the C and L-band (1527-1610 nm) wavelength range. An array of DFB lasers set at different ITU channels may be used to emulate an ITU grid of transmitters in an optical network.

Key Features and Benefits

- One or two DFB lasers in one module
- Wavelength tuning range of at least 1.5 nm
- Peak power output of 10 or 20 mW
- DFB lasers can be modulated from 200 Hz to 300 kHz
- Synchronization between MAP modules can be done with either the internal or external trigger
- DFB lasers are available on the100 GHZ ITU spacing (50 GHz optional)
- Many options are available (FlexMux, power monitor and beam block)
- Single-mode or polarization maintaining fiber output.

MAP-200 DFB Laser Front Panel Description

The MAP-200 DFB Laser Module faceplate has number of variations to accommodate the different configurations available to the user.

Figure 115: Front Panel of mDFB Laser Module with Dual Laser

MAP-200 DFB LED Description

Table 47: mDFB LED Description

LED	Colour	Description
STATUS LED	Off	Laser source is OFF
	Green	Laser source is ON
	Amber	Beam block activated. Laser source is ON, but beam is blocked.
	Red	Error or Interlock is activated

NOTE: The DFB Status LED in always found next to the main output connector of the DFB laser it is reporting.

MAP-200 DFB Laser Specifications

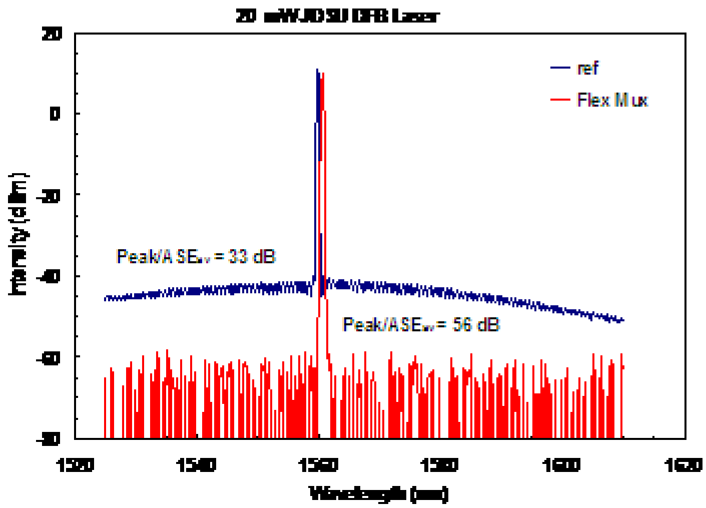
Parameter	Specification
Wavelength	
Range	ITU grid C+L-band (see Channel Code Grid)
Accuracy	±0.03 nm
Stability 15 minutes[1, 2, 3]	±0.005 nm
Stability 24 hours[1, 2, 3]	±0.01 nm
Tuning range	≥ 1.5 nm
Resolution	0.01 nm
Power	
Laser output[4]	10 or 20 mW
Laser power uncertainty[3]	±5%
Stability 15 minutes[1, 2, 3]	±0.005 dB
Stability 24 hours[1, 2, 3]	±0.03 dB
Resolution[5]	0.01 dB
Attenuation range	10 dB
Internal modulation[1]	
Range[6]	0.2 to 400 kHz
Depth	0 to 100%
Duty cycle	15 to 85%
Function	Square, Sinusoidal and Triangular
Spectral properties	
Width coherence control off	<30 MHz
Width coherence control on	≥ 500 MHz
Side mode suppression ratio (SMSR)	>40 dB
Optical signal-to-noise ratio (OSNR) (peak to maximum background)	30 dB
Optical isolation	30 dB
Relative intensity noise (RIN)	–140 dB/Hz
Recommended calibration period	1 year
Operating temperature	10 to 40°C
Storage temperature	–30 to 60°C
Dimensions (W x H x D)	4.06 x 13.26 x 37.03 cm (1.6 x 5.22.x 14.58 in)
Weight	0.5 kg (1.1 lb)

1. At full power
2. After 1 hour warm-up
3. Constant temperature within 25 ±3°C
4. Not including options
5. For maximum power to (maximum power –8 dB)
6. Nominal duty cycle is accurate from 0.2 to 100 kHz. Analog modulation bandwidth is 400 kHz

MAP-200 DFB Laser Theory of Operation

Figure 115 shows the output of the MAP-200 DFB with a single laser. The “OUT” terminal provides a calibrated laser output light that features software adjustable power level and wavelength.

Figure 116: mDFB output spectrum



MAP-200 DFB Laser Configuration Information

Table 48: mDFB configuration information

Device	Integer
Type	String
Wmin	Float
Wmax	Float
Wdef	Float
Pmim	Float
Pmax	Float
Imin	Float
Imax	Float
Fmin	Float
Fmax	Float
BeamBlock Presence? String	

MAP-200 DFB Laser Parameter Information

Table 49: mDFB parameter information

Serial Number	String	(8 characters)
Part Number	String	(23 characters)
Card Firmware Rev	String	(4 characters)

Firmware Rev 1	String	(4 characters)
Firmware Rev 2	String	(4 characters)
HW Rev	String	(4 characters)
Assembly Date	String	(8 characters)
Description	String	(30 characters)

MAP-200 Fabry-Perot Laser

WARNING

Class 3B lasers are hazardous to eyes and skin if exposed directly.
Please refer to Laser Safety section for more information.

MAP-200 Fabry-Perot General Information

The MAP-200 FP Module is a high-power source ideal for network development, or component test and development. The optics of the MAP-200 FP Module consist of a light emitting diode with supporting optical components specifically designed to achieve maximum output power at the bulkhead-mounted optical connector while minimizing input/output isolation.

Key Features and Benefits

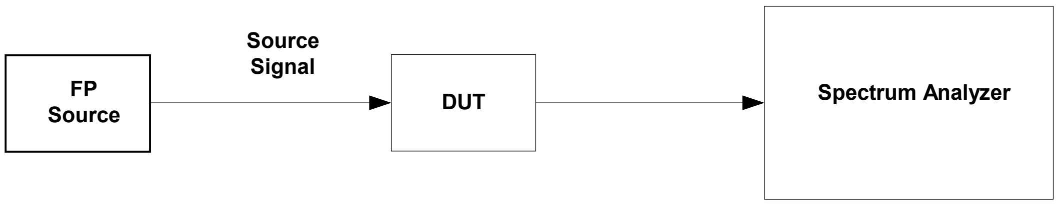
- Dual independent sources available in single module
- Control and Monitoring features
- Multimode/single mode output
- Internal/external modulation circuitry

Applications

- Optical component spectral tests
- Systems compliance tests
- Sensors and imaging

Figure 116 illustrates the connection of a FP source for optical component and transmission system testing.

Figure 117: FPL Laser for Component Testing



MAP-200 Fabry-Perot Front Panel

Figure 118: Front of a Dual Source mFPL Module

MAP-200 Fabry-Perot Module LED Description

Table 50: MFPL Status LEDs

LED	Description	
STATUS	Off	Indicates Laser Source is OFF
	Green	Indicates Laser Source is ON
	Red	Error or Interlock Activated

MAP-200 Fabry-Perot Specifications

Parameter	980 nm	1310 nm	1480 nm	1550 nm	1625 nm	1650 nm
Peak wavelength	980 ±20 nm	1310 ±20 nm	1480 ±20 nm	1550 ±20 nm	1625 ±20 nm	1650 ±20 nm
Spectral width (FWHM)	<5 nm	<5 nm	<5 nm	<6 nm	<7 nm	<7 nm
Total power[1, 2]	0 dBm	–3 dBm	–3 dBm	–3 dBm	–3 dBm	–3 dBm
Fiber type	Flexcor™	SMF-28	SMF-28	SMF-28	SMF-28	SMF-28
Modulation[3]	0.2 to 20 kHz					
Stability (15 minutes)[1, 2, 4]	±0.005 dB					
Connector type	FC/PC, FC/APC					
Operating temperature	10 to 40°C					
Storage temperature	–30 to 60°C					
Dimensions (W x H x D)	4.06 x 13.26 x 37.03 cm (1.6 x 5.22 x 14.58 in)					
Weight	0.5 kg (1.1 lb)					

1. After 30 minute warm-up
2. Measured at constant temperature of 23 ±5°C
3. Modulation duty cycle is adjustable from 15% to 85%.Modulation depth is fixed at 100%
4. Measured at full power

Parameter	850 nm	1310 nm	1550 nm
Peak wavelength	850 ±20 nm	1310 ±20 nm	1550 ±20 nm
Spectral width (FWHM)	<8 nm	<8 nm	<8 nm
Total power[1, 2]	–3 dBm	–6 dBm	–6 dBm
Modulation[3]	0.2 to 20 kHz		
Stability (15 minutes)[1, 2, 4]	±0.01 dB		
Connector type	FC/PC, FC/APC		
Operating temperature	10 to 40°C		
Storage temperature	–30 to 60°C		
Dimensions (W x H x D)	4.06 x 13.26 x 37.03 cm (1.6 x 5.22 x 14.58 in)		
Weight	0.5 kg (1.1 lb)		

1. After 30 minute warm-up
2. Measured at constant temperature of 23 ±5°C
3. Modulation duty cycle is adjustable from 15% to 85%.Modulation depth is fixed at 100%
4. Measured at full power

MAP-200 Fabry-Perot Configuration Information

Table 51: mFPL configuration information

Device	Integer	Device Number
Type	String	Card Name
OperatingWav	String	Operating Wavelength
Pmin	Float	Min Power
Pmax	Float	Max Power
Pdef	Float	Def Power
Fmin	Float	Min Frequency

Device	Integer	Device Number
Fmax	Float	Max Frequency
Modulation Presence	String	Modulation Hardware

MAP-200 Fabry-Perot Parameter Information

Table 52: mFPL parameter information

Serial Number	String	(8 characters)
Part Number	String	(23 characters)
Card Firmware Rev	String	(4 characters)
Firmware Rev 1	String	(4 characters)
Firmware Rev 2	String	(4 characters)
HW Rev	String	(4 characters)
Assembly Date	String	(8 characters)
Description	String	(30 characters)

MAP-200 LED Source

WARNING

Class 3B lasers are hazardous to eyes and skin if exposed directly. Please refer to Laser Safety section for more information.

MAP-200 LED General Information

The MAP-200 LED Module is a high-power source ideal for network development, or component test and development. The optics of the MAP-200 LED Module consist of a light-emitting diode with supporting optical components specifically designed to achieve maximum output power at the bulkhead-mounted optical connector while maximizing input-output isolation.

The MAP-200 LED Source is available in one configuration — with local modulation, which can be enabled/disabled as required. A number of operating wavelength options, connector types and fiber types are available, as detailed in the part numbering scheme below.

MAP-200 LED Key Features and Benefits

- Dual independent sources available in single module

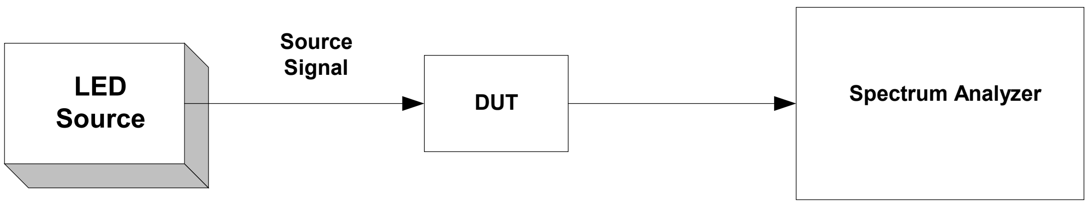
- Control and Monitoring features
- Multimode/singlemode output
- Internal modulation circuitry

Applications

- Optical component spectral tests
- Systems compliance tests
- Sensors and imaging

Figure 118 illustrates the connection of a LED source for optical component and transmission system testing.

Figure 119: LED Source for Component Testing



MAP-200 LED Front Panel Description

Figure 120: mLED Source Front Panel

MAP-200 LED Module LED Description

Table 53: mLED front panel LED description

LED	Description	
STATUS	Off	Indicates Laser Source is OFF
	Green	Indicates Laser Source is ON
	Red	Error or Interlock Activated

MAP-200 LED Specifications

Parameter	Single-mode (SM) 1310 nm	Single-mode (SM) 1550 nm	Multimode (MM) 850 nm	Multimode (MM) 1310 nm	Multimode (MM) 1550 nm
Peak wavelength	1310 ±20 nm	1550 ±20 nm	850 ±20 nm	1310 ±20 nm	1550 ±20 nm
3 dB width	>40 nm	>40 nm	—	—	—
Spectral ripple (RB = 0.1 nm)	0.35 dB	0.35 dB	—	—	—
Total power[1, 2]	0 dBm	0 dBm	–3 dBm	–3 dBm	–3 dBm
Modulation	0.2 to 20 kHz				
Stability (15 minutes)[1, 2, 3]	±0.01 dB				
Connector type	FC/PC, FC/APC				
Operating temperature	10 to 40°C				
Storage temperature	–30 to 60°C				
Dimensions (W x H x D)	4.06 x 13.26 x 37.03 cm (1.6 x 5.22 x 14.58 in)				
Weight	0.5 kg (1.1 lb)				

1. After 30 minute warm-up
2. Measured at constant temperature of 23 ±5°C
3. Measured at full power

MAP-200 LED Internal Theory of Operation

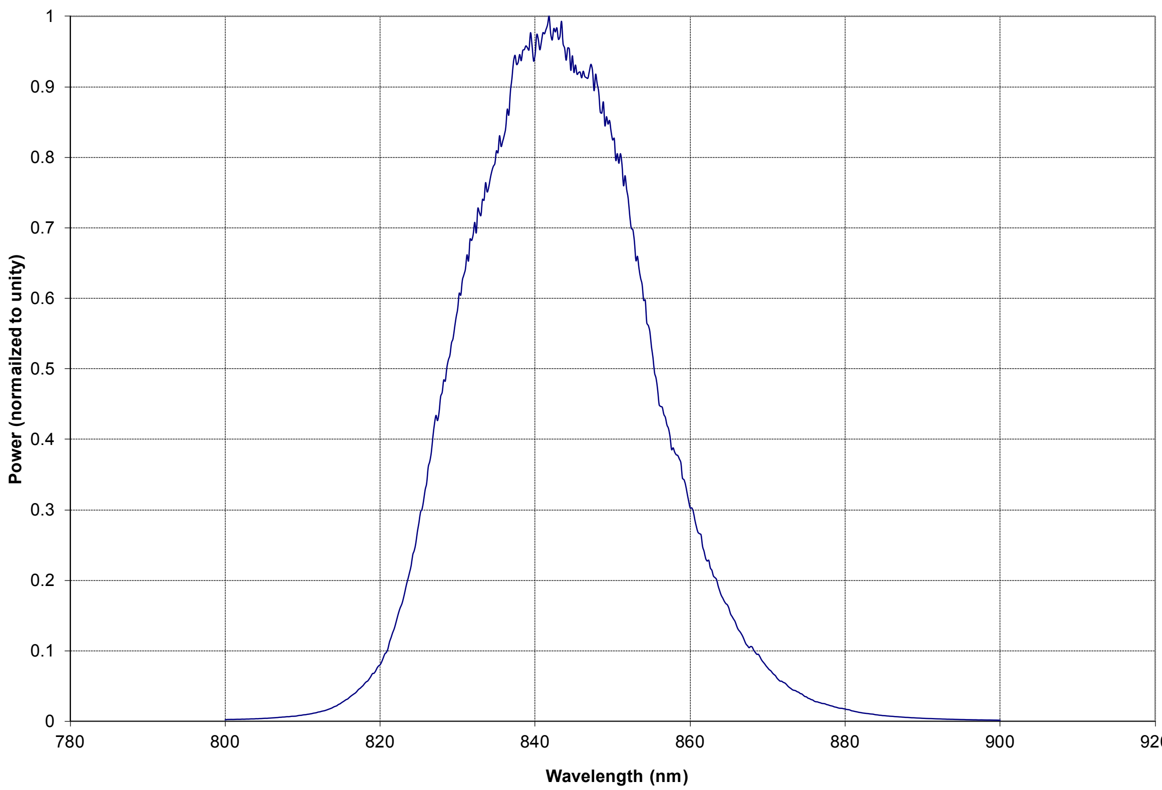
The VIAVI LED Source uses superluminiscent diodes (SLED). Superluminiscence occurs when spontaneous emissions from an Edge-emitting Light Emitting Diode (ELED) experience gain due to higher injected currents and reflections from facets. Superluminescent diodes (SLDs) are differentiated from both conventional LEDs and Laser Diodes (LDs). Although the output is not fully coherent, SLEDs emit light consisting of amplified spontaneous emissions. The spectral characteristics of light from SLDs are intermediate between those of conventional LEDs and Laser Diodes. The spectral width is narrower than that of conventional LEDs, but larger than that of laser diodes.

SLEDs have a much shorter coherence length than lasers. Thus, they can be used to produce speckle-free light beams required in many imaging applications.

MAP-200 LED sources are equipped with internal square-wave modulation, which can be enabled or disabled as desired. The modulation duty cycle can be varied when modulation is enabled.

Shown in Figure 120 is the power density spectrum of a typical LED Source as measured with an OSA set at 0.2 nm resolution. The source was driven by 100 mA forward current. The 3 dB bandwidth is approximately 27 nm.

Figure 121: Power Density Spectrum of a typical LED Source



MAP-200 LED Configuration Information

Table 54: mLED configuration information

Device	Integer	Device Number
Type	String	Card Name
OperatingWav	String	Operating Wavelength
Pmin	Float	Min Power
Pmax	Float	Max Power
Pdef	Float	Def Power
Fmin	Float	Min Frequency
Fmax	Float	Max Frequency

Modulation Presence	String	Modulation Hardware

MAP-200 LED Parameter Information

Table 55: mLED parameter information

Serial Number	String	(8 characters)
Part Number	String	(23 characters)
Card Firmware Rev	String	(4 characters)
Firmware Rev 1	String	(4 characters)
Firmware Rev 2	String	(4 characters)
HW Rev	String	(4 characters)
Assembly Date	String	(8 characters)
Description	String	(30 characters)

MAP-200 Tunable Laser

WARNING

Class 3B lasers are hazardous to eyes and skin if exposed directly. Please refer to Laser Safety section for more information.

General Information

The Multiple Application Platform (MAP-200) Tunable Laser Module is an external cavity tunable diode laser that offers exceptional speed, accuracy and flexibility at a competitive price, making it the ideal source for advanced fiberoptic systems and component testing.

The wide wavelength range enables testing over the entire C+L-band range with a single source, while its high speed, mode-hop-free sweeping not only reduces testing time, but permits process testing and alignment of components during manufacturing.

As with all MAP-200 modules, it may be seamlessly integrated with the extensive family of MAP-200 modules, which enables complete custom solutions to be rapidly assembled and expanded as needed.

Key Features and Benefits

- Peak power output of up to + 8dBm.
- High absolute accuracy means no need for frequent calibrations.

- Good repeatability results in consistent measurements.
- Truly continuous, smooth tuning, *i.e.* small tuning speed variations, no backward movements or mode hops, are important for many applications such as interferometry and fiber sensing.
- Narrow Linewidth is prerequisite for high-resolution interferometric, heterodyne and spectroscopic measurements.
- Wide tuning range, covering one or two bands, eliminates the need for multiple sources and offers flexible use.
- High tuning speed results in fast measurements, saves time and cost.
- Flexible start and stop wavelength settings in sweeping mode.
- Synchronization between MAP modules can be done with either the internal or external trigger.
- Polarization maintaining fiber output.

MAP-200 TLS Front Panel

Figure 122: Front Panel of MAP-200 TLS Module

MAP-200 TLS Module LED Description

Table 56: mTLS LED Description

LED	COLOUR	DESCRIPTION
STATUS	Off	Laser source is OFF
	Green	Laser source is ON
	Red	Error or Interlock is activated
	Amber	Laser source is BUSY

mTLS Specifications

Parameter	Specification
Wavelength	
Range	1519 to 1630 nm, C+L-band
Accuracy[1,2,3]	±15 pm enhanced accuracy mode[4], ±60 pm regular mode
Stability[1,2]	±3 pm (typical) (1 hr), ±10 pm (24 hrs)
Repeatability[1,2]	±3 pm (typical) enhanced accuracy mode[4]
Resolution[1,2]	1 pm
Tuning speed	1 to 100 nm/s
Power	
Maximum power	
Over wavelength range	+5.0 dBm (>6.0 dBm typical)
Peak	+8.0 dBm
Stability[1,2]	0.01 dB (1 hr)
Resolution	0.001 dB
Flatness while scanning[4]	0.6 dB over wavelength range
Flatness while stepping	±0.05 dB
Spectral properties	
Line width, coherence control off	<150 kHz
Side mode suppression ratio (SMSR)	45 dB
Signal-to-ASE ratio	See spectral plot (Figure 1)
Relative intensity noise (RIN)	–140 dB/Hz
Fiber/connector type	PMF/APC connector
Fiber extinction ratio	>20 dB
Recommended calibration period	1 yr
Operating temperature	15 to 35°C
Storage temperature	–20 to 50°C
Dimensions (W x H x D)	8.1 x 13.26 x 37.03 cm (3.19 x 5.22 x 14.58 in)
Weight	3.8 kg (8.38 lb)

1. Measured at 25°C ±1°C
2. After 1 hour warm-up
3. Valid for one month after calibration or user wavelength offset setting within ±4°C
4. Fixed power of 3 dBm

Theory of Operation

Internal Operation

The MAP-200 TLS Module is based on external cavity laser capable of highly linear mode-hop free performance over 110 nm sweeping range. The laser is connected through the Main Control CCA the MAP backplane that provides access to the laser either from a common MAP console or from an external computer.

Enhanced Accuracy Mode (EAM)

This mode enables high (± 15 pm) wavelength accuracy. Although this mode restricts the output power of the laser to 3 dBm, all other functionality of the module is preserved allowing both stepping and linear sweeping modes.

To enable the mode, select the Enhanced Accuracy check box. It takes only 15 seconds to fully enable the mode. During this time the TLS will hold BUSY status.

The EAM is required to be enabled separately and cannot be a part of the initialization procedure. Disabling and re-enabling the TLS will disable the Enhanced Accuracy mode.

To disable EAM, simply remove the check mark from the Enhanced accuracy check box. The optical power and wavelength of the output signal will remain unchanged.

MAP-200 TLS Configuration Information

Table 57: mTLS configuration information

Device	Integer	Device Number
Type	String	Card Name
Wmin	Float	Min Wavelength
Wmax	Float	Max Wavelength
Wdef	Float	Def Wavelength
Pmin	Float	Min Power
Pmax	Float	Max Power
Pdef	Float	Def Power
Imin	Float	Min Current
Imax	Float	Max Current
Fmin (Not Enabled)	Float	Min Frequency
Fmax (Not Enabled)	Float	Max Frequency
EAMPmin	Float	MinPower in EAM Mode
EAMPmax	Float	MaxTemp in EAM Mode
C. C. (Not Enabled)	String	Coherence Control ?

MAP-200 TLS Parameter Information

Table 58: mTLS parameter information

Serial Number	String	(8 characters)
Part Number	String	(23 characters)
Card Firmware Rev	String	(4 characters)
Firmware Rev 1	String	(4 characters)
Firmware Rev 2	String	(4 characters)
HW Rev	String	(4 characters)
Assembly Date	String	(8 characters)
Description	String	(30 characters)

mTLS Configuration Parameters' Ranges

Table 59: mTLS configuration parameters' ranges

Parameter	Description	Minimum	Maximum	Step	Comments
Laser State	Turn Laser On/Off	N/A	N/A	N/A	Enabled – Turn Laser ON Disabled – Turn Laser OFF
Power	Set Laser Power	-3 dBm	10 dBm	0.001 dBm	Limited by the Power Limit
Power Offset	Adjust the Power	-1 dB	1 dB	0.001 dB	
Mode	Set Laser to Normal Mode or Enhanced Accuracy Mode	N/A	N/A	N/A	Normal – Normal Mode EAM – Mode Hop Free with constant power
Wavelength	Set Laser WL	1517.500 nm	1635.000 nm	0.001 nm	
Wave Offset	Adjust the WL	-1 nm	+1 nm	0.001 nm	
Wavelength 1	Defines start of the sweep range	1517.500 nm	1630.000 nm	0.001 nm	Wavelength 1 has to be smaller than Wavelength 2
Wavelength 2	Defines end of the sweep range	1520.000 nm	1635.000 nm	0.001 nm	

Parameter	Description	Minimum	Maximum	Step	Comments
Forward Sweep Type	Specifies the type of sweep from Wavelength 1 to Wavelength 2	N/A	N/A	N/A	Linear – Smooth sweep, with step size = 0 Stepped – this sweep requires step size > 0, and TimeStep
Back Sweep Type	Specifies the type of sweep for return from Wavelength 2 to Wavelength 1	N/A	N/A	N/A	Linear/Stepped – uses settings of the forward sweep (Wavelength 1 to Wavelength 2); Fallback – returns the laser to Wavelength 1 at a maximum tuning speed (100 nm/sec); Stop – the laser stop at Wavelength 2
Wave Step Size	Defines wavelength step in stepping mode.	0	117.500 nm	0.001 nm	For linear sweep wavestep = 0. For stepped sweep wavestep > 0
Forward Speed	Sets the tuning speed from Wavelength 1 to Wavelength 2	1 nm/sec	100 nm/sec	0.1 nm/sec	
Backward Speed	Sets the tuning speed from Wavelength 2 to Wavelength 1	1 nm/sec	100 nm/sec	0.1 nm/sec	
Time Step	Sets timing for the wavelength steps	1 ms	30000 ms	0.001 ms	Limited by the maximum tuning speed of the laser (100 nm/sec)
Wave1 Dwell Time	Sets dwell time for Wavelength 1	1 ms	100000000 ms	0.001 ms	
Wave2 Dwell Time	Sets dwell time for Wavelength 2	1 ms	100000000 ms	0.001 ms	
Number of Cycles	Specifies a number of tuning cycles to be performed	1 and -1 (continuous)	1000	1	-1 used for continuous sweeping

Chapter 13: Routing Module Manuals

MAP-200 Large Channel Count Switch

MAP-200 Large Channel Count Switch General Information

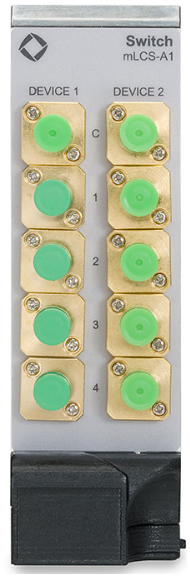
The MAP-200 Large Channel Count Switch is based on VIAVI expanded beam anc alignment technologies and exhibits low insertion loss (IL) and high return loss (RL It is available in single-switch configurations from 1x4 up to 1x50 and dual independent switch configurations from 1x4 up to 1x25. An important element of an optical test bed, optical switches increase throughput by enabling time-saving automation, reduce uncertainty from repeated connector mating, and maximize expensive testers.

MAP-200 Large Channel Count Switch Key Features and Benefits

- Low insertion loss <0.7 dB
- Low polarization dependent loss < 0.04 dB
- Wide wavelength range
- High return loss > 57 dB

MAP-200 Large Channel Count Switch Front Panel Description

Figure 123: Front Panel of the large channel count switch



MAP-200 Large Channel Count Switch Specifications

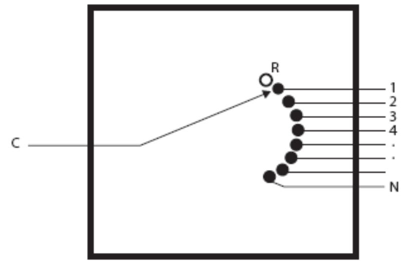
Parameter	Single-mode Fiber (SMF) 9/125 Typical/Maximum	Multimode Fiber (MMF) 50/125 and 62.5/125 Typical/Maximum
Wavelength range	1270 to 1670 nm	850 to 1350 nm, 750 to 940 nm
Insertion loss (IL)[1]		
(N = number of output channels)		
N ≤25	0.5 dB/0.7 dB	0.4 dB/0.6 dB
N >25	0.8 dB/1.2 dB	0.7 dB/1.0 dB
Polarization dependent loss (PDL)[1]		
N ≤25	0.02 dB/0.04 dB	N/A
N >25	0.04 dB/0.08 dB	N/A
Return loss (RL)[1, 2]		
N ≤25	62 dB/57 dB	25 dB/20 dB
N >25	55 dB/45 dB	20 dB/20 dB
IL Stability		
N ≤25	±0.02 dB/±0.025 dB	
N >25	±0.03 dB/±0.04 dB	
Repeatability sequential switching		
N ≤25	±0.005 dB/±0.01 dB	
N >25	±0.01 dB/±0.03 dB	
Repeatability random switching		
N ≤25	±0.01 dB/±0.05 dB	
N >25	±0.03 dB/±0.08 dB	
Crosstalk		
N ≤25	–80 dB/N/A	
N >25	–80 dB/N/A	
Switching time (first channel / each additional channel)	25 ms/15 ms	
Maximum input power (optical)	300 mW	
Lifetime	>100 million cycles	
Operating temperature	–5 to 55°C	
Storage temperature	–30 to 60°C	
Dimensions (W x H x D)	4.06 x 13.26 x 37.03 cm (1.6 x 5.22 x 14.58 in)	
Weight	1.3 kg (2.87 lb) maximum (varies with configuration)	

1. Excluding connectors. All optical measurements taken after temperature has been stabilized for one hour
2. RL is based on 1 m pigtail (equivalent to bulkhead version)

MAP-200 Large Channel Count Switch Theory of Operation

Large channel count switches use precision motors to position input and/or output channels for selection. They have one or two input channels, and multiple output channels. The switch is bidirectional and so inputs and outputs are interchangeable.

Figure 124: A 1XN switch where C is common for input signal



MAP-200 Large Channel Count Switch Configuration Information

Table 60: mLCS configuration information

Device	Numeric
Type	String
MaxIn	Numeric
MaxOut	Numeric
Latching?	String

MAP-200 Large Channel Count Switch Parameter Information

Table 61: mLCS switch parameter information

Serial Number	String	(8 characters)
Part Number	String	(23 characters)
Card Firmware Rev	String	(4 characters)
Firmware Rev 1	String	(4 characters)
Firmware Rev 2	String	(4 characters)
HW Rev	String	(4 characters)
Assembly Date	String	(8 characters)
Description	String	(30 characters)

MAP-200 Small Channel Count Switch

MAP-200 Small Channel Count Switch General Information

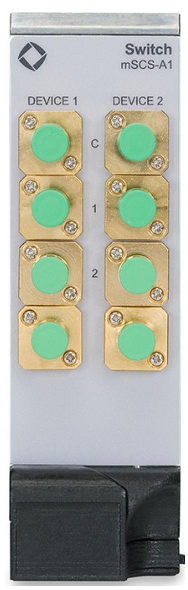
The mSCS-A1 is based on optical prism and mirror technology that directs incident light into selected output channels. It is available in 1x2 and 2x2 configurations and supports multiple devices per MAP module, single-mode or multimode fiber, and four connector types. An important element of an optical test bed, optical switches increase throughput by enabling time-saving automation, reducing uncertainty from repeated connector mating, and maximizing expensive testers.

MAP-200 Small Channel Count Switch Key Features and Benefits

1. Insertion loss (IL) <0.8 dB and return loss (RL) >55 dB
2. Low polarization dependent loss (PDL) 0.08 dB
3. Up to 8 switches per module

MAP-200 Small Channel Count Switch Front Panel

Figure 125: Front Panel of the MAP-200 small channel count switch



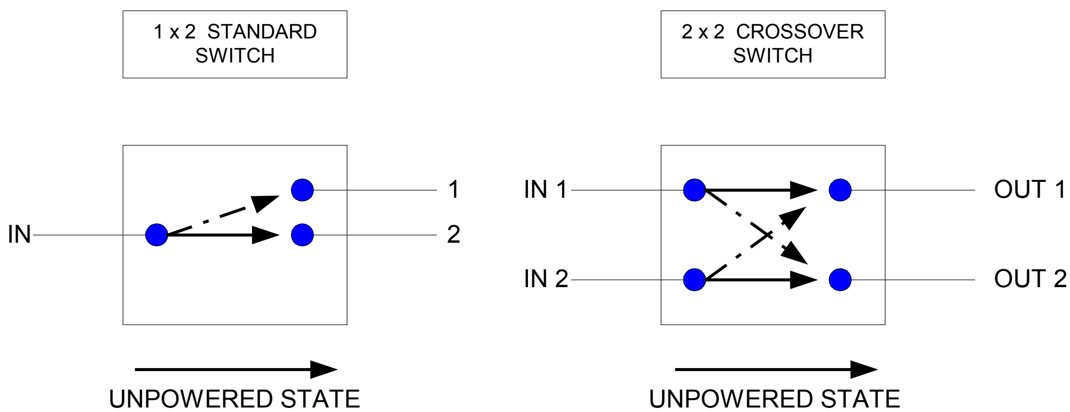
MAP-200 Small Channel Count Switch Specifications

Parameter	Specifications	
	Single-Mode (SM)	Multimode (MM)
Wavelength	1310 and 1550 nm	850 and 1310 nm
Insertion loss (IL)[1]		
1 x 2	≤0.8 dB	≤0.8 dB
2 x 2	≤1.0 dB	≤1.1 dB
Return loss (RL)[1]	>55 dB	>20 dB
Polarization dependent loss (PDL)[1]	≤0.1 dB	N/A
Repeatability	±0.05 dB	±0.02 dB
Crosstalk	<–60 dB	<–35 dB
Optical input power	300 mW	300 mW
Switching speed	10 ms	
Latching	Yes	No
Lifetime	>10 million cycles	
Operating temperature	0 to 50°C	
Storage temperature	–30 to 60°C	
Humidity	90% relative, non-condensing	
Dimensions (W x H x D)	4.06 x 13.26 x 37.03 cm (1.6 x 5.22 x 14.58 in)	
Weight	1.1 kg (2.43 lb) maximum (varies with configuration)	

1. Unless otherwise specified, all specifications at start of life at 23°C ±3°C, 45% RH ±5% and optical input power of –25 to 0 dBm, excluding connectors

MAP-200 Small Channel Count Switch Theory of Operation

Figure 126: Small channel count switch configurations



MAP-200 Small Channel Count Switch Configuration Information

Table 62: mSCS configuration information

Device	Numeric
Type	String
MaxIn	Numeric
MaxOut	Numeric

Latching?	String

MAP-200 Small Channel Count Switch Parameter Information

Table 63: mSCS parameter information

Serial Number	String	(8 characters)
Part Number	String	(23 characters)
Card Firmware Rev	String	(4 characters)
Firmware Rev 1	String	(4 characters)
Firmware Rev 2	String	(4 characters)
HW Rev	String	(4 characters)
Assembly Date	String	(8 characters)
Description	String	(30 characters)

MAP-200 Utility

MAP-200 Utility General Information

The MAP-200 Utility Module is designed to simplify the mechanical integration of passive optical components for test sets. The Utility Module is a highly configurable module that contains passive optical devices such as 1x4 splitters, 1x8 splitters and taps. It supports angle or flat polish connectors as well as single-mode and multimode fibers.

A blank module is available for mechanical mounting of components such as isolators, circulators or fixed attenuators. The modules are supplied with mounting hardware and up to ten bulkhead adapters for ease of integration.

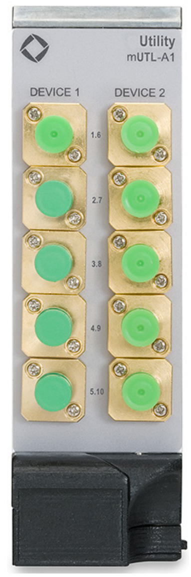
Key Features and Benefits

- NEW: WDM Modules for MUX/DEMUX capability
- Ideal for individual lane testing on WDM signals for 100GE and 40GE applications
- Many tap ratios available
- Up to 3 couplers per module
- Single-mode and multimode
- CE compliant (in MAP-200 chassis)

MAP-200 Utility Front Panel Description

An example of the MAP-200 Utility Module front panel configurations is shown in Figure 126. A standard Utility Module has 10 bulkhead adapter mounting holes on the front panel. If the configuration selected requires fewer than ten bulkhead adapters, the mounting holes are sealed with black covers. A label describing the internal connections is attached to the side panel of the module. This label includes the device port description cross-referenced to the port number on the Utility Module silkscreen.

Figure 127: MAP-200 Utility Module Front Panel



	CAUTION The bulkhead adapter covers must not be removed to ensure proper airflow within the MAP system

MAP-200 Utility Specifications

Singlemode

Parameter	SM 1x2, 1/99 Coupler (Fused)	SM 1x2, 10/90 Coupler (Fused)	SM 1x2, 30/70 Coupler (Fused)	SM 1x2, 50/50 Coupler (Fused)
Fiber type	9/125 µm			
Wavelength	1310/1550 nm			
Insertion loss (IL)	<24.0/1.2 dB	<11.8/<1.2 dB	<6.5/<2.4 dB	<4.1 dB
Optical power handling	300 mW			
Number of slots	1			
Dimensions (W x H x D)	4.06 x 13.26 x 37.03 cm (1.6 x 5.22 x 14.58 in)			
Weight	1.0 kg (2.2 lb)			

Multimode

Parameter	MM 10/90 Coupler (Micro-optic)	MM 50/50 Coupler (Micro-optic)
Fiber type	50/125 µm or 62.5/125 µm	
Wavelength	850/1310 nm	
IL	<11.8/<1.2 dB	<4.1 dB
Optical power handling	300 mW	
Number of slots	1	
Dimensions (W x H x D)	4.06 x 13.26 x 37.03 cm (1.6 x 5.22 x 14.58 in)	
Weight	<1.0 kg (2.2 lb)	

mWDM-A100GE

Parameter	
Fiber type	9/125 µm
Wavelength	1295.6 nm, 1300.1 nm, 1304.6 nm, 1309.1 nm
IL	<2.0 dB
Pass bandwidth	+/- 1.50 nm
Ripple in passband	<0.5 dB
Return loss	>45 dB
Isolation adjacent channel	>15 dB
Isolation non-adjacent channel	>15 dB
Internal fiber length	1+/-0.1 m
Number of slots	1
Dimensions (W x H x D)	4.06 x 13.26 x 37.03 cm (1.6 x 5.22 x 14.58 in)
Weight	<1.0 kg (2.2 lb)

mWDM-A1040GE

Parameter	
Fiber type	9/125 µm
Wavelength	1271 nm, 1291 nm, 1311 nm, 1333 nm
IL	<1.7 dB
Pass bandwidth	+/- 6.50 nm
Ripple in passband	<0.5 dB
Return loss	>45 dB
Isolation adjacent channel	>30 dB
Isolation non-adjacent channel	>50 dB
Internal fiber length	1+/-0.1 m
Number of slots	1
Dimensions (W x H x D)	4.06 x 13.26 x 37.03 cm (1.6 x 5.22 x 14.58 in)
Weight	<1.0 kg (2.2 lb)

MAP-200 Utility Configuration Information

Table 64: mUTL configuration information

NumDevices	Integer	Number of connector ports
Type	String	Card type: Passive Utility
Model	String	Card model designation

MAP-200 Utility Parameter Information

Table 65: mUTL parameter information

Serial Number	String	(8 characters)
Part Number	String	(23 characters)
Card Firmware Rev	String	(4 characters)
Firmware Rev 1	String	(4 characters)
Firmware Rev 2	String	(4 characters)
HW Rev	String	(4 characters)
Assembly Date	String	(8 characters)
Description	String	(30 characters)

Chapter 14: Technical Support

Visit this site on the web, http://www.viavisolutions.com/en/services-and-support/support/technical-assistance, select your country and then select “FOPLT” or “MAP-200” to find the MAP-200 technical assistance phone number for your region.

Chapter 15: Service

Storing and Shipping

To maintain optimum operating reliability, do not store the unit in locations where the temperature falls below -30 °C or rises above 60 °C. Avoid any environmental condition that can result in internal condensation. Ensure that these temperature and humidity requirements can also be met whenever the unit is shipped.

Claims and Repackaging

Immediately inform Viavi and, if necessary, the carrier, if

- The contents of the shipment are incomplete
- The unit or any of its components are damaged or defective
- The unit does not pass the initial inspection

In the event of carrier responsibility, Viavi will allow for the repair or replacement of the unit while a claim against the carrier is being processed.

Packing Guidelines With Original Packaging

- Ensure foam is properly placed
- Use the L-Shaped cardboard piece to hold controller in place
- Do not ship with the display mounted on the chassis, ensure it is packaged separately
- Do not ship with MTLS and MTBF populated in the chassis

Packing Guidelines Without Original Packaging

- Do not ship with any modules populated in the chassis
- Do not ship with the display mounted on the chassis, ensure it is packaged separately

- Ensure the bottom of the chassis is supported
- Ensure sufficient cushioning is provided for all modules, chassis and display being shipped

Returning Shipments to Viavi

Viavi only accepts returns for which an approved Return Material Authorization (RMA) has been issued by Viavi. This number must be obtained prior to shipping any material to Viavi. The owner's name and address, the model number and full serial number of the unit, the RMA number, and an itemized statement of claimed defects must be included with the return material.

Return shipments to Viavi in the original shipping container and packing material. If these are not available, packaging guidelines are as follows:

1. Cover the front panel with a strip of foam.
2. Wrap the unit in anti-static packaging.
3. Pack the unit in a reliable shipping container.
4. Use enough shock-absorbing material (10 to 15 cm or 4 to 6 in on all sides) to cushion the unit and prevent it from moving inside the container. Pink poly anti-static foam is the recommended material.
5. Seal the shipping container securely.
6. Clearly mark FRAGILE on its surface.
7. Always provide the model and serial number of the unit and the RMA number on any accompanying documentation.

Please contact the RMA department, using the contact information under Technical Support on page 199 to provide an RMA number and a shipping address.

Chapter 16: Glossary

Term	Definition
CE	European Community
Chassis	Refers to the mechanical MAP enclosure that houses cassettes and cards.
CI Card	Cassette Interface PCB. This is a common component of all MAP cassettes.
Controller	MAP controller card
CSA	Canadian Standards Association
Device	The part of a card that is individually addressed and controlled to perform a particular action based on card type. For example, a switch card contains switch devices that can be controlled to connect specific input channels to specific output channels.
DWDM	Dense Wavelength Division Multiplexer
ESD	Electrostatic Discharge
FC	Fiber Coupler
FC/APC	Ferrule Connector/Angled Polished Connector
FC/PC	Ferrule Connector/Polished Connector
FP laser	Fabry–Pérot laser
GPIB	General Purpose Interface Bus
IEC	International Electrotechnical Commission
IEEE	Institute of Electronic and Electrical Engineers
IL	Insertion Loss
ISO	International Standards Organization
VIAVI	JDS Uniphase Corporation
LXI	LAN-based eXtensions for Instrumentation
MAP	Multiple Application Platform. Refers to one or more shelves that house and control modular cards to form a system.
MM	Multi Mode
Module	Refers to a functional element on a MAP cassette.
OPM	Optical Power Meter. A card containing one or more optical power detectors. Detectors may be internally integrated within the card or consist of a detector 'head' connected via cable to the card.

PCB	Printed Circuit Board
PDL	Polarization Dependent Loss
RMA	Return Material Authorization
SCPI	Standard Commands for Programmable Instruments.
SLED or SLD	Superluminescent Light Emitting Diode.
Slot	One of eight physical areas where a card may be inserted within a MAP chassis. Mechanical guides specify where cards may be inserted.
SM	Single Mode
SMF	Single Mode Fiber
TEC	ThermoElectrically Cooled
UCA	Universal Connector Adapter
UL	Underwriters Laboratory
USB	Universal System Bus
WDM	Wavelength Division Multiplexer

Multiple Application Platform MAP-200 User Manual

User Guide

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English

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