

WM-1210 Wavemeter

Optical Wavelength Meter



User's Manual

 **New Focus™**
A Newport Company

EU Declaration of Conformity

Product Name: Optical Wavemeter


Model Number: WM-1210

Year  mark affixed: 2015

Type of Equipment: Electrical equipment for measurement, control and laboratory use in industrial locations.

Manufacturer: Newport Corporation

1791 Deere Avenue
Irvine, CA 92606
U.S.A.

According to ISO/IEC 17050-1 and ISO/IEC 17050-2, we declare that the accompanying product, identified with the  mark, conforms to the following European Directives:

Low Voltage Directive: 2006 / 95 / EC

EMC Directive: 2004 / 108 / EC

RoHS Directive: 2011 / 65 / EC

WEEE Directive: 2012 / 19 / EC

Supplementary Information:

Safety: EN 61010-1:2010

EMC: EN 61326-1:2013

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directives and Standards.



Mark Carroll
VP, Instruments Business
Newport Corporation
1791 Deere Ave, Irvine, CA92606 USA

Warranty

New Focus warrants that this product will be free from defects in material and workmanship and will comply with New Focus's published specifications at the time of sale for a period of one year from date of shipment. If found to be defective during the warranty period, the product will either be repaired or replaced at New Focus's option.

To exercise this warranty, write or call your local Newport office or representative, or contact Newport headquarters in Irvine, California. You will be given prompt assistance and return instructions. Send the product, freight prepaid, to the indicated service facility. Repairs will be made and the instrument returned freight prepaid. Repaired products are warranted for the remainder of the original warranty period or 90 days, whichever occurs first.

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New Focus
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Part No. 90076247 Rev A

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Service Information

This section contains information regarding factory service for the source. The user should not attempt any maintenance or service of the system or optional equipment beyond the procedures outlined in this manual. Any problem that cannot be resolved should be referred to New Focus.

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If there are any defects in material or workmanship or a failure to meet specifications, promptly notify Newport's Returns Department by calling 1-800-222-6440 or by visiting our website at www.newport.com/returns within the warranty period to obtain a **Return Material Authorization Number (RMA#)**. Return the product to Newport Corporation, freight prepaid, clearly marked with the RMA# and we will either repair or replace it at our discretion. Newport is not responsible for damage occurring in transit and is not obligated to accept products returned without an RMA#.

E-mail: rma.service@newport.com

When calling Newport Corporation, please provide the customer care representative with the following information:

- Your contact information
- Serial number or original order number
- Description of problem (i.e., hardware or software)

To help our Technical Support Representatives diagnose your problem, please note the following conditions:

- Is the system used for manufacturing or research and development?
- What was the state of the system right before the problem?
- Have you seen this problem before? If so, how often?
- Can the system continue to operate with this problem? Or is the system non-operational?
- Can you identify anything that was different before this problem occurred?

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1 Safety Precautions

1.1 Definitions and Symbols

The following terms and symbols are used in this documentation and/or appear on the WM-1210 Wavemeter where safety-related issues occur.

1.1.1 General Warning or Caution



Figure 1

General Warning or Caution symbol

The Exclamation symbol in the figure above appears on the product and in Warning and Caution tables throughout this document. This symbol designates that documentation needs to be consulted to determine the nature of a potential hazard, and any actions that have to be taken.

1.1.2 Electric Shock



Figure 2

Electrical Shock symbol

The Electrical Shock symbol in the figure above appears throughout this manual. This symbol indicates a hazard arising from dangerous voltage. Any mishandling could result in irreparable damage to the equipment, and personal injury or death.

1.1.3 European Union CE Mark



Figure 3

CE mark

The presence of the CE mark on New Focus-branded equipment means that this instrument has been designed, tested and certified compliant to all applicable European Union (CE) regulations and recommendations.

1.1.4 On



Figure 4

On symbol

The symbol in the figure above represents a power switch position on the WM-1210 Wavemeter. This symbol represents a *power on* condition.

1.1.5 Off



Figure 5

Off symbol

The symbol in the figure above represents a power switch position on the WM-1210 Wavemeter. This symbol represents a *power off* condition.

1.1.6 Waste Electrical and Electronic Equipment (WEEE)



Figure 6

WEEE Directive symbol

This symbol on the product or on its packaging indicates that this product must not be disposed of with regular waste. Instead, it is the user's responsibility to dispose of waste equipment according to local laws. The separate collection and recycling of the waste equipment at the time of disposal will help to conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. For information about where the user can drop off the waste equipment for recycling, please contact your local New Focus representative.

1.1.7 Control of Hazardous Substances



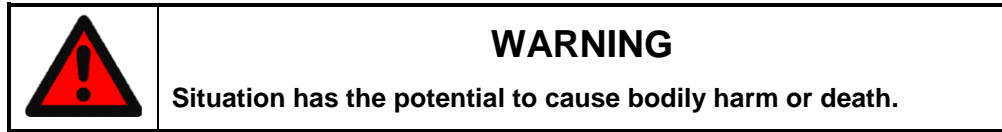
Figure 7

RoHS Compliant symbol

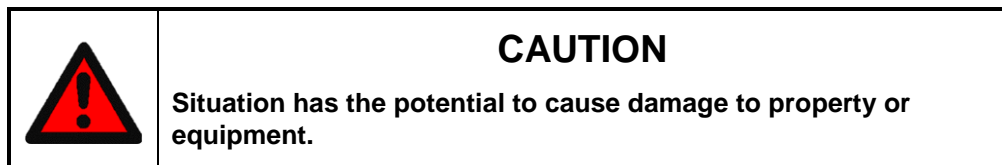
This label indicates the products comply with the EU Directive 2002/95/EC that restricts the content of six hazardous chemicals.

1.2 Warnings and Cautions

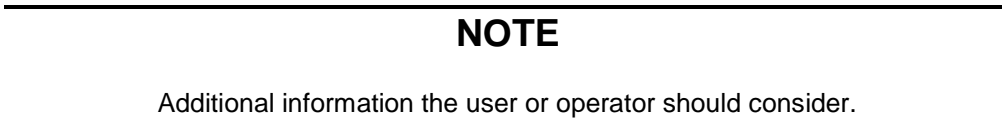
Throughout this manual, we will warn you of situations that have the potential to cause bodily harm or death by using the following Warning box:



We will warn you of situations that have the potential to cause damage to property or equipment by using the following Caution box:



Any additional information that the user or operator should consider is provided using the following Note box:



Please read and understand all Warnings, Cautions, and Notes found throughout this manual.

1.2.1 General Warnings

Observe these general warnings when operating or servicing this equipment:

- Heed all warnings on the unit and in the operating instructions.
- Do not use this equipment in or near water.
- This equipment is grounded through the grounding conductor of the power cord.
- Route power cords and other cables so that they are not likely to be damaged.
- Disconnect power before cleaning the equipment. Do not use liquid or aerosol cleaners; use only a damp lint-free cloth.
- Lockout all electrical power sources before servicing the equipment.
- To avoid explosion, do not operate this equipment in an explosive atmosphere.

- Qualified service personnel should perform safety checks after any service.
- Adhere to good laser safety practices when using this equipment.

1.2.2 General Cautions


Observe these cautions when operating this equipment:


- If this equipment is used in a manner not specified in this manual, the protection provided by this equipment may be impaired.
- Do not block ventilation openings.
- Do not position this product in such a manner that would make it difficult to disconnect the power cord.
- Position the equipment so that access to the mains disconnect On/Off switch is readily available.
- Follow precautions for static sensitive devices when handling this equipment.
- This product should only be powered as described in the manual.


There are no user-serviceable parts inside the WM-1210 Wavemeter.

1.2.3 Summary of Warnings and Cautions

The following general warning and cautions are applicable to this instrument:

	<p style="text-align: center;">WARNING</p> <p>Before operating the WM-1210 Wavemeter, please read and understand all of Section 1.</p>
---	---

	<p style="text-align: center;">WARNING</p> <p>Do not attempt to operate this equipment if there is evidence of shipping damage or you suspect the unit is damaged. Damaged equipment may present additional hazards to you. Contact New Focus technical support for advice before attempting to plug in and operate damaged equipment.</p>
---	---

	<p style="text-align: center;">WARNING</p> <p>To avoid electric shock, connect the instrument to properly earth-grounded, 3-prong receptacles only. Failure to observe this precaution can result in severe injury or death.</p>
---	---



WARNING

Before cleaning the enclosure of the WM-1210 Wavemeter, the AC power cord must be disconnected from the wall socket.



CAUTION

There are no user serviceable parts inside the WM-1210 Wavemeter. Work performed by persons not authorized by New Focus will void the warranty. For instructions on obtaining warranty repair or service, please refer to Section 7.



WARNING

If this equipment is used in a manner not specified in this manual, the protection provided by this equipment may be impaired.



WARNING

While the WM-1210 Wavemeter front panel power switch turns power OFF to the internal electronics, it should not be depended upon to fully disconnect the unit from MAINS power. Disconnect the power cord to fully isolate the WM-1210 Wavemeter from MAINS power. Do not position the WM-1210 Wavemeter so that it is difficult to disconnect the power cord.



The WM-1210 Wavemeter is intended for use in an industrial laboratory environment. Use of this product in other environments, such as residential, may result in electromagnetic compatibility difficulties due to conducted as well as radiated disturbances.



The WM-1210 Wavemeter is designed to operate in a controlled electromagnetic environment; i.e., where R.F. transmitters, such as mobile telephones, may not be used in close proximity.



WARNING

Use of controls or adjustments or performance procedures other than those specified herein may result in hazardous radiation exposure.

1.3 Location of Labels and Warnings

1.3.1 WM-1210 Wavemeter Rear Panel

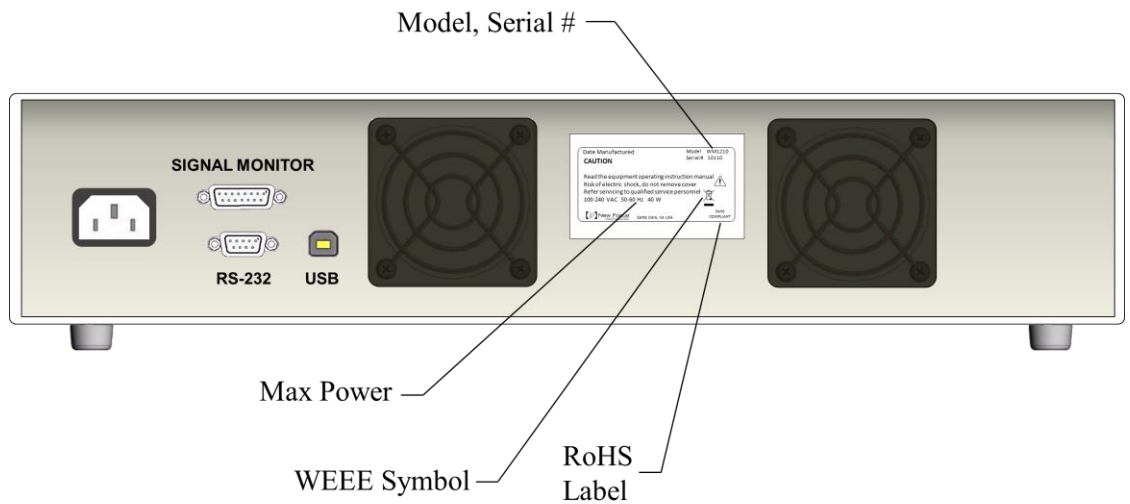


Figure 8

Location of Labels and Warnings on rear panel

2 General Information

2.1 Introduction

The New Focus WM-1210 Wavemeter enables effortless high-accuracy, high-resolution measurements of the wavelength of continuous-wave (CW) laser source in research, OEM and production applications.

A scanning Michelson interferometer is used to determine the wavelength of an fiber-coupled (FC/APC) input laser. An internal HeNe laser serves as a continuous calibration reference for each measurement, and a factory wavelength calibration is performed using measurements traceable to NIST standards. The effect of ambient air temperature, pressure and humidity on measurements are all accounted for.

The front panel display can be set to report measurements in nm, cm^{-1} or GHz, either as measured in air or vacuum. Input laser power is reported in mW or dBm. Two alternate display modes give at-a-glance indication of a measurement's deviation from an initial value and total range of variation, for power and wavelength.

Analog and digital signals from the WM-1210 Wavemeter's interferometer are made available to allow a more complete characterization of the input laser.

The WM-1210 Wavemeter reduces energy consumption and ensures enduring reliability by turning off the interferometer's drive motor when no light is detected at the input, and by turning off the internal reference HeNe after 30 minutes of inactivity.

The WM-1210 Wavemeter can be controlled remotely via an intuitive Windows application over USB or RS-232. A Windows programming library with an easy-to-use API is provided for USB and RS-232 communication. The particular SCPI command syntax used for RS-232 communication was chosen to allow for drop-in replacement of existing legacy wavemeter systems in automated production or research environments.

2.2 Specifications

2.2.1 Product Specifications

Table 1 Specifications for the WM-1210 Wavemeter

Wavelength Range	700 nm to 1650 nm
Wavelength Absolute Accuracy	± 1 PPM ¹
Wavelength Display Resolution	0.001 nm ²
Wavelength Display Units	nm, GHz, and cm ⁻¹
Wavelength Display Medium	Vacuum, standard air ³
Power Absolute Accuracy	$\pm 10\%$
Power Display Resolution	0.01 dBm
Power Display Units	dBm, mW, μ W
Sensitivity	-13 dBm ⁴
Maximum Input Power	10 dBm (10 mW)
Measurement Rate	10 Hz (10 measurements per second)
Optical Input	FC/APC connector
Instrument Interface	RS-232 and USB 2.0
Dimensions (W x D x H)	432 x 381 x 89 mm (17 x 15 x 3.5 in)
Weight	7.65 kg (17 lbs)
Power Requirements	100 to 240 VAC, 50/60 Hz

2.2.2 Environmental Requirements

Table 2 Ambient conditions required by the WM-1210 Wavemeter

Operating Temperature	15 - 30 °C
Storage Temperature	-10 - 70 °C
Pressure	500 – 900 mm Hg
Relative Humidity	< 90% RH @ 30 °C (no condensation)

¹ Calibration performed using measurements traceable to NIST standards.

² Extended (0.0001 nm) wavelength resolution available over RS-232.

³ Standard air conditions: 20 °C, 760 mmHg, 0% RH.

⁴ Minimum power required for a ± 1 PPM absolute accuracy when using a rolling average of last 32 measurements (3.2 seconds).

The WM-1210 Wavemeter is designed to operate in a controlled electromagnetic environment. While it may not be damaged by operation in an industrial electromagnetic environment, as defined in EN61316-1:2013, such operation may not yield optimal performance. For this reason, New Focus does not recommend operation of this instrument in close proximity to mobile telephones, hand-held radio transmitters, and similar devices.

3 Getting Started

3.1 Unpacking and Handling

It is recommended that the WM-1210 Wavemeter be unpacked in a lab environment or work site. Unpack the system carefully; small parts are included with the instrument. Inspect the box carefully for loose parts. You are advised to save the packaging material in case you need to ship the instrument in the future. If the original packaging material is not used to ship the WM-1210 Wavemeter, it may be damaged in transit.

3.2 Inspection for Damage

The WM-1210 Wavemeter is carefully packaged at the factory to minimize the possibility of damage during shipping. Inspect the box for external signs of damage or mishandling. Inspect the contents for damage. If there is visible damage to the instrument upon receipt, inform the shipping company and New Focus immediately. Carefully open the box and save the shipping material for later use.



WARNING

Do not attempt to operate this equipment if there is evidence of shipping damage or you suspect the unit is damaged. Damaged equipment may present additional hazards to you. Contact New Focus technical support for advice before attempting to plug in and operate damaged equipment.



CAUTION

The user is advised to save the packaging material in case the unit has to be shipped to a different location. The packaging material is specially designed to protect the unit during shipping.

3.3 Parts List

The following is a list of parts included with the WM-1210 Wavemeter:

- WM-1210 Wavemeter

- Acceptance Sheet
- North American Power Cord (10 A, 125 V, IEC 60320 C-13 connector, NEMA 5-15P plug).
- European Power Cord (10 A, 250 V, IEC 60320 C-13 connector, CEE 7/7 plug).
- USB flash drive containing the Device User's Manual, USB software drivers, software development examples, and Windows GUI application.
- Quick Start Guide


If you are missing any items or have questions about the items you have received, please contact New Focus.


3.4 Choosing and Preparing a Suitable Work Surface

The WM-1210 Wavemeter may be placed on any firm table or bench during operation. Please ensure all four feet are on the same level plane and can support the Wavemeter's weight equally. Placing equipment or heavy objects on top of the Wavemeter is not recommended, as this may potentially affect the device's measurement accuracy.

3.5 Electrical Requirements

Before attempting to power up the unit for the first time, the following precautions must be followed:

	<p style="text-align: center;">WARNING</p> <p>To avoid electric shock, connect the instrument to properly earth-grounded, 3-prong receptacles only. Failure to observe this precaution can result in severe injury and death.</p>
---	--

	<p style="text-align: center;">WARNING</p> <p>The WM-1210 Wavemeter is supplied with an appropriate detachable power cord. Do not replace this cord with an inadequately rated cord.</p>
---	---

- Have a qualified electrician verify the wall socket that will be used is properly polarized and properly grounded.
- Provide adequate distance between the WM-1210 Wavemeter and adjacent walls for ventilation purposes.
- Do not let any other equipment blow hot air towards the WM-1210 Wavemeter.

3.6 Power Supply



WARNING

To avoid electric shock, ensure that the WM-1210 Wavemeter power requirements are not exceeded by your AC MAINS line.

AC power is supplied through the rear panel power entry module connector that provides in-line transient protection and RF filtering.

3.7 Quick Start

This section outlines the basic steps needed to start using your WM-1210 Wavemeter. It assumes that earlier sections regarding safety and AC input power settings have been read. For more detailed information on how to operate the instrument, refer to Section 4.



WARNING

Before powering up or operating the WM-1210 Wavemeter, please read and understand all of Section 1.



WARNING

The safety of any system incorporating the equipment is the user's responsibility.

3.7.1 Powering the Wavemeter

The Wavemeter should only be connected to a properly-grounded, three-prong AC receptacle using the supplied AC cable.



WARNING

To avoid electric shock, connect the instrument to properly earth-grounded receptacles only. Failure to observe these precautions can result in fire, severe injury or death.

3.7.2 Quick Start for Operating the Wavemeter

1. Place the instrument on a firm, flat horizontal surface. Placing the WM-1210 Wavemeter on an uneven surface may result in reduced performance. Do not place any objects or weight on top of the instrument, as this may result in reduced performance.
2. Attach the provided AC mains cable and connect it to a properly-grounded wall outlet. The WM-1210 Wavemeter uses a universal power supply that will operate with any line voltage 100-240 VAC, 50/60 Hz.
3. Turn on the Wavemeter using the power switch located at the right side of the front panel.
4. Before connecting an FC/APC-terminated optical fiber, ensure that the fiber ferrule tip is clean and dry. Take care not to contact the fiber ferrule tip with anything as you connect the fiber to the WM-1210 Wavemeter, as this could potentially cause damage to your fiber and, in turn, damage the instrument's internal optical input fiber.
5. As soon as input laser power is detected, the interferometer mechanism will begin operating and a reading will be presented on the screen.

3.7.3 Software Installation

For instructions on how to install the software provided with the Wavemeter, please refer to the “Readme Wavemeter Application.pdf” file on the USB flash drive shipped with the device.

4 Operating the WM-1210 Wavemeter

4.1 Front Panel

The front panel of the WM-1210 Wavemeter is designed for easy operation. It is controlled via four buttons on the right of the screen, as shown in Figure 9 below.



Figure 9

Front Panel layout

4.1.1 Power Switch

Turn on the AC power using the front panel rocker switch. To turn ON the Wavemeter, flip the rocker switch to the “I” position. To turn OFF the Wavemeter, flip the front panel rocker switch to the “O” position.

4.1.2 Screen

Wavelength, power measurements and device settings are displayed on the screen. Please refer to Sections 4.2.1 and 4.2.2 for an overview of these functions.

4.1.3 Optical Input


The WM-1210 Wavemeter optical input accepts optical fibers terminated with FC/APC connectors. Before connecting an optical fiber, carefully clean the fiber end (see Section 8.2 for instructions) and optionally inspect it with a fiber scope if available. Failure to clean optical fibers before every insertion may result in a contaminated or damaged optical input.

Take care to ensure that the fiber tip does not contact the edges of the optical input receptacle as it is inserted. New Focus recommends using a new, clean

fiber patchcord with the WM-1210 Wavemeter, leaving one end connected to the instrument and using the other for connection to different laser sources.

Do not over-tighten the fiber connector by using a tool or applying excessive force.

The optical input power should be not exceed 10 dBm (10 mW) to prevent damage to sensitive components inside the device.

	<p style="text-align: center;">Caution</p> <p>Use care when handling fiber optic connectors. Always clean the fiber end before connecting the fiber to the WM-1210 Wavemeter's optical input to avoid damaging the instrument and to ensure optimum performance. For instructions on how to the clean the fiber end see Section 8.2.</p>
---	--

4.1.4 Display/Setup Button

The Display/Setup button (top button) cycles through three display screens:

Display - Main, Display - Wavelength, and Display - Power.

If the Display/Setup button is held down for 1.5 seconds, the display switches to the Configuration screen. The Display/Setup button now cycles through the Setup screens:

Setup - Configuration, Setup - Communication, and Setup - Information.

To return to the Display/Setup screens, press and hold the Display/Setup button for 1.5 seconds.

4.1.5 Select Button

Pressing the Select button highlights on-screen settings that can be modified with the Up and Down buttons. Pressing the Select button repeatedly cycles through modifiable on-screen settings. After a few seconds, the highlighted item becomes un-selected. Pressing the Select button again will highlight the last selected item.

4.1.6 Up and Down Buttons

The Up and Down buttons are used to cycle through available choices for a highlighted on-screen setting. Some selectable on-screen items do not have multiple options and instead perform actions. This is the case of the Reset item on the Display - Wavelength and Display - Power screens; Zero, Save Setup, and Recall Setup of the Setup - Configuration screen. When these items are highlighted, pressing either the Up or Down buttons performs the indicated operation.

4.2 Interface Layout

The Wavemeter's interface is composed of two groups of three screens each. The Display screens (Main, Wavelength, Power; Section 4.2.1) and the Setup screens (Configuration, Communication and Information; Section 4.2.2). Each element of the Display and Setup screens is described in Table 3 - Information contained on the Display screens. and Table 4- Information contained on the Setup screens respectively.

4.2.1 Display Screens

Main: Displays the wavelength and power of the input laser, as well as the elapsed operating time.

Errors and alerts are displayed in the bar above the selectable parameters.

Selectable items are: wavelength unit, power unit, measurement medium, averages, gain, and power offset.

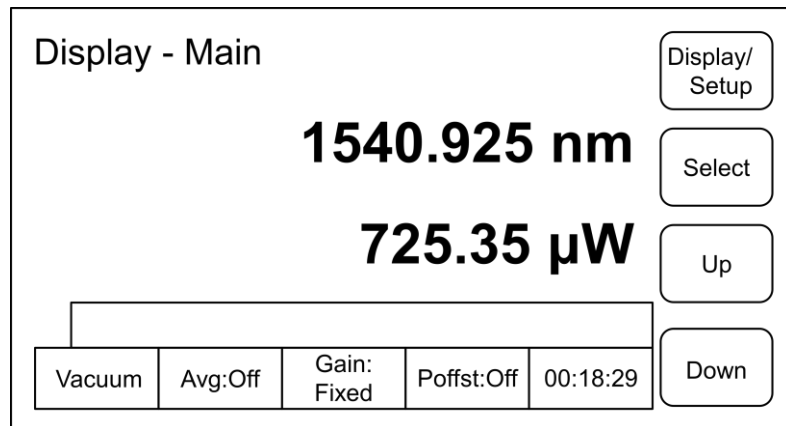


Figure 10

Display - Main screen

Wavelength: Displays the wavelength of the input laser. An initial wavelength (Start) is recorded when the WM-1210 Wavemeter first detects input light and makes a measurement or the Reset command is issued. The difference in wavelength between the current measurement and the Start measurement is displayed beside the top Δ symbol (top Δ = Current – Start). The difference between the maximum and minimum wavelength observed since Reset or initial measurement is displayed beside the bottom Δ symbol (bottom Δ = Max – Min).

Errors and alerts are displayed in the bar above the selectable parameters.

Selectable items are: wavelength unit, measurement medium, averages, gain, and Reset.

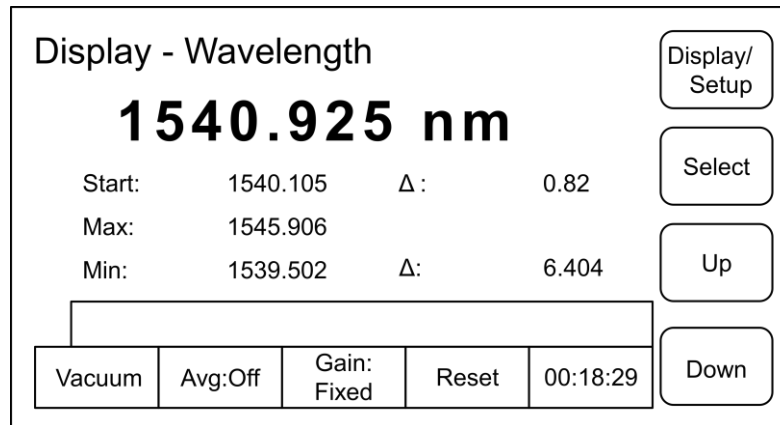


Figure 11

Display - Wavelength screen

Power: Displays the power of the input laser. An initial power (Start) is recorded when the instrument first detects input light and makes a measurement or the Reset command is issued. The difference in power between the current measurement and the Start measurement is displayed beside the top Δ symbol (top Δ = Current – Start). The difference between the maximum and minimum power observed since Reset or initial measurement is displayed beside the bottom Δ symbol (bottom Δ = Max – Min).

Errors and alerts are displayed in the bar above the selectable parameters.

Selectable items are: power offset, measurement medium, averages, gain, and Reset.

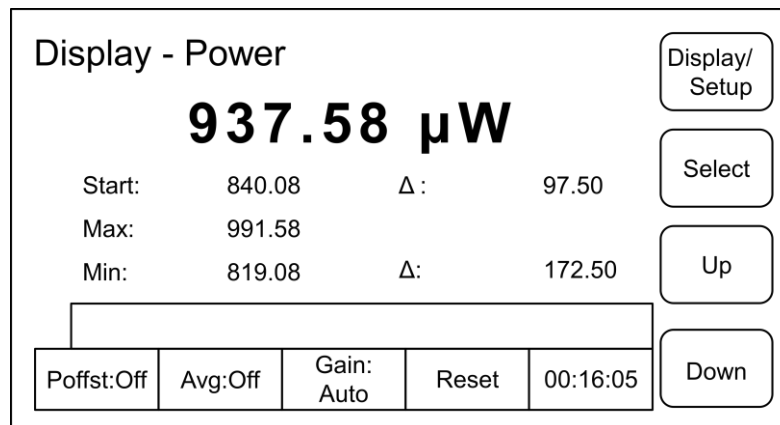


Figure 12

Display - Power screen

Table 3 - Information contained on the Display screens.

Parameter	Description
Units for Power/Wavelength	<p>Wavelength units can be changed on the Display - Main and Display - Wavelength screens.</p> <p>Options are: nm, GHz, cm^{-1}.</p> <p>Power units can be changed on the Display - Main and Display - Power screens.</p> <p>Options are: dBm and mW (or μW when input power is below 1 mW).</p>
Error Message	Errors and alerts are displayed in the red bar above the selectable parameters.
Medium	<p>Measurement medium: Wavelength values can be reported as they would be measured in standard air (20 °C, 760 mmHg, 0% relative humidity) or in vacuum.</p> <p>Options are: Std. Air and Vacuum.</p>
Avg	<p>Average: Defines the number of previous measurements used to calculate the running average. This setting does not affect measurement values queried over computer interface.</p> <p>Options are: Off; 2, 4, 8, 16, 32, 64, 128 averages.</p>

Gain	<p>Enables or disables the Autogain function, which automatically varies the sensitivity of the instrument to compensate for varying input laser power.</p> <p>Most users will want to keep Autogain enabled, but there are certain cases when it may be disabled, such as an input laser with fast and significant power changes. Though for most applications automatic gain transitions are transparent to the user, it is possible that some fast input laser power fluctuations will briefly affect the wavelength measurement. If input laser power fluctuations are affecting the instrument's wavelength measurements, the following procedure may be followed. First input a constant and midrange laser power with Autogain turned on, allow a few seconds for the instrument to adjust the gain automatically, and then turn Autogain off. This will ensure the fixed gain setting is appropriate for the input power being used.</p> <p>Note that if Autogain is disabled and the input laser power changes significantly, the WM-1210 Wavemeter may not be able to make an accurate wavelength measurement.</p> <p>Options are: Auto - system automatically adjusts the gain; fixed - system uses a fixed value.</p>
Poffst	<p>Power Offset: A constant value in dBm can be added to all displayed power values. This feature is useful if the input laser is used with an external attenuator of known value in dB. If this value is used as the Power Offset setting, the power displayed corresponds to the upstream power, before the attenuator. This feature is useful if the source laser produces more than 10 mW out of fiber, since in this case an attenuator should be used. Please note that the Power Offset will be applied even if the power units are set to mW.</p> <p>Options are: Off - no power offset applied; numeric values - 1, 2, ..., 20 dB</p>
Reset	<p>Selecting Reset sets the Elapsed Time clock to zero, and sets the present measurement of power and wavelength to the Start value on the Display - Power and Display - Wavelength screens respectively.</p>
Elapsed Time	<p>Displays the elapsed time since the instrument was turned on or Reset was selected.</p>

4.2.2 Setup Screens

Configuration: Displays several of the measurement settings available on the Display - Main, Display - Wavelength and Display - Power screens, as well as the display screen brightness setting. Please note that if settings are not saved to memory with Save Setup, they will reset to their default values after a power cycle.

Setup - Configuration			Display/ Setup
Resolution:	Auto	Zero	Select
Average:	Off	Brightness: 6	Up
Power Offset:	Off	Save Setup	Down
Gain:	Auto	Recall Setup	

Figure 13

Setup - Configuration screen

Communication: Displays communication parameters.

Setup - Communication			Display/ Setup
USB:	On		Select
RS-232:	On		Up
Baud:	19200		Down
Handshaking:	None		

Figure 14

Setup - Communication screen

Information: Displays information such as the instrument's serial number and software version. The instrument's temperature, pressure, and humidity are also displayed.

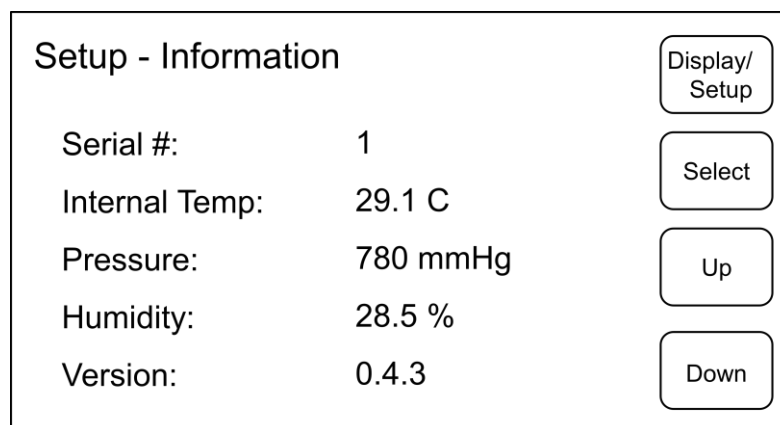


Figure 15

Setup - Information screen

Table 4- Information contained on the Setup screens

Parameter	Description
Resolution	<p>Sets the resolution with which wavelength is displayed on the screen. It is possible to set the displayed measurement resolution below the instrument's maximum resolution.</p> <p>When set to Auto, the WM-1210 Wavemeter will use the highest resolution possible given the spectral characteristics and coherence length of the input laser. Measurements of laser sources with a short coherence length or wide bandwidth may be displayed at a lower resolution. See Section 6.2 for an explanation of how the coherence length of the input laser relates to the resolution of wavelength measurements. The Auto setting is recommended for general instrument operation.</p> <p>Options are : Auto - system sets the resolution based on the coherence length of the laser; numeric values - 0.001, .01, 0.1, 1.0, 10.0.</p>
Average	<p>Average: Defines the number of previous measurements used to calculate the running average.</p> <p>This setting does not affect the values sent over the computer interface.</p> <p>Options are: Off; 2, 4, 8, 16, 32, 64, 128 averages.</p>
Power Offset	<p>See the entry for "Poffst" in Table 3 - Information contained on the Display screens.</p>
Gain	<p>See the entry for "Gain" in Table 3 - Information contained on the Display screens..</p>
Zero	<p>If the instrument reports a non-zero power measurement with no input light, select this command to re-zero the power measurement.</p>
Brightness	<p>Changes the display brightness.</p> <p>Options are: 1, 2, ..., 10 (brightest)</p>
Save Setup	<p>Saves current parameter values that will be preserved after a power cycle. When the instrument is turned on, the last saved parameters are used for configuration.</p>

Recall Setup	Recalls saved parameter values.
USB	This enables and disables communication via the USB port. Options are: on, off
RS-232	This enables and disables communication via the RS-232 port. Options are: on, off
Baud	Reports the baud rate for the RS-232 communications. Typical settings are 9600 or 19200 baud and should match the communication settings used on the host computer. The default setting is 19200 baud. Options are: 1200, 2400, 4800, 9600, and 19200.
Handshaking	Reports the type of handshaking used for the RS-232 communications. A typical setting is None and should match the communication settings used on the host computer. Options are: Hardware, Xon/Xoff (software) or None.
Serial #	Identifies the system's serial number, which is also found on the label on the rear panel. The serial number on the rear panel label may be preceded by 1 or 10, which is omitted in the display, e.g. label serial number 10220 is reported as 220 on the display.
Internal Temp	Internal instrument air temperature.
Pressure	Atmospheric pressure measured by the instrument.
Humidity	Humidity measured by the instrument.
Version	Identifies the system firmware version.

4.3 Rear Panel

The rear panel of the WM-1210 Wavemeter has various dedicated input and output connectors, as well as important labeling.

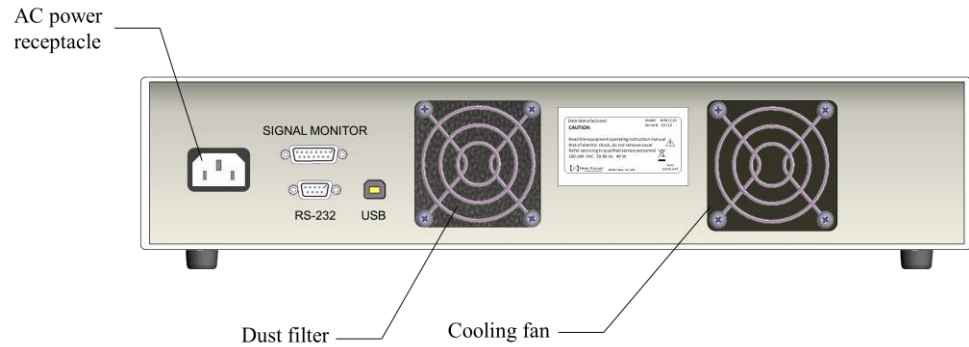


Figure 16

Rear Panel of Wavemeter

4.3.1 USB Interface

The WM-1210 Wavemeter is designed to communicate with standard USB Host interfaces. The connector on the rear panel is a standard USB-B type. Please note that Wavemeter software (driver and libraries) must be installed on the host computer to establish USB communication. Please see the PDF file "**Readme Wavemeter Application.pdf**" included on the USB flash drive for software installation instructions.

4.3.2 RS-232 Serial Interface

The WM-1210 Wavemeter is designed to communicate over a standard RS-232 serial interface. The connector on the rear panel is a standard female 9-pin D-sub type.

To connect the WM-1210 Wavemeter to a PC built-in serial port, use a straight-through cable. A straight-through cable is used to connect a DTE device (PC) to a DCE device (WM-1210 Wavemeter). The TXD-RXD and RTS-CTS pins are not cross-connected in this case, hence the term straight through cable.

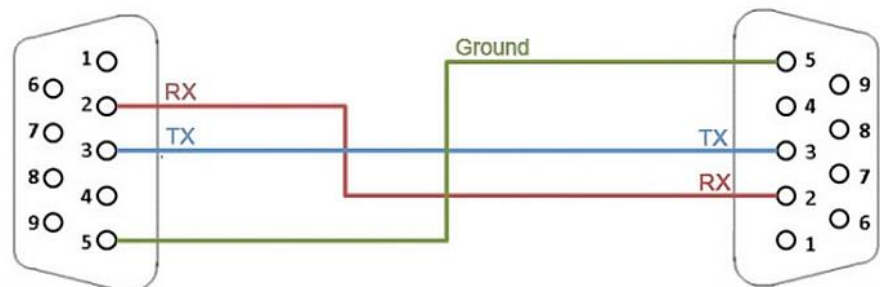


Figure 17

Simple straight through cable

Alternatively, inexpensive USB-to-RS-232 converter cables are widely available and work well to establish a serial link between the WM-1210 Wavemeter and a PC, especially if the PC does not have a built-in serial port.

4.3.3 AC Power Cord

The WM-1210 Wavemeter can be operated at 50 or 60 Hz mains frequency. The instrument can be operated at AC line voltages ranging from 100 to 240 VAC.

The power cord supplied with each unit should be plugged only into a properly grounded outlet to prevent electrical shock in the event of an internal short circuit to the metal cabinet. The detachable power cord should be connected to the IEC320 connector on the power entry module.

4.3.4 Signal Monitor

The Signal Monitor is a female DA-15 type connector that provides access to analog and digital (CMOS level-) signals relevant to the WM-1210 Wavemeter's operation and can be useful for characterizing an unknown laser source or troubleshooting unexpected instrument operation. Note that the Signal Monitor connector is oriented horizontally on the WM-1210 Wavemeter. Each pin's function is described in Table 5.

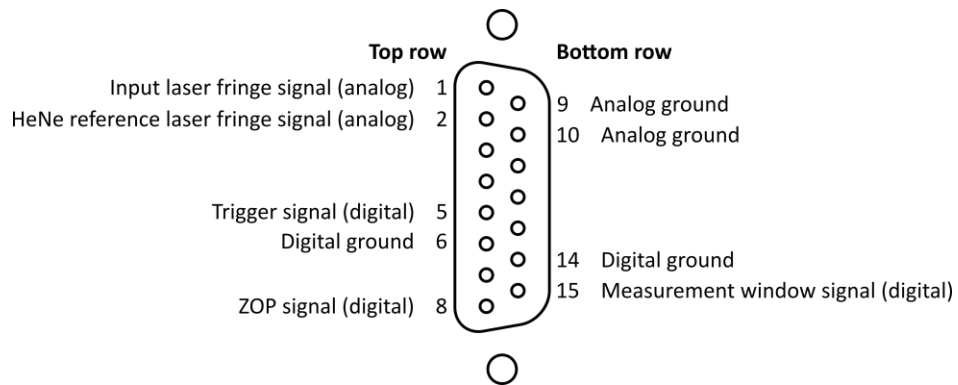


Figure 18

Signal monitor female DA-15 connector pinout.

Table 5 - Signal Monitor pinout.

DA-15 Pin #	Signal Name	Description
1	Input laser fringe signal	Analog fringe signal from the input laser.
2	HeNe reference laser fringe signal	Analog signal from the HeNe reference laser.
5	Trigger signal	This digital signal is high during the maximum possible interferometer measurement interval. It serves as a reference against which to compare the Measurement Window signal, which may be as long as—or shorter than—the Trigger signal.
6, 14	Digital ground	Ground for digital signals.
8	ZOP signal	Zero Optical Path signal. This digital signal goes high at the location of the scan where both interferometer arms are of equal length.
9, 10	Analog ground	Ground for Analog signals.
15	Measurement Window signal	This signal is high over the portion of the scan where the input fringe signal amplitude is large enough to make a good measurement. For narrow-linewidth, single-mode input lasers the Measurement Window signal will generally be as long as the Trigger signal, since the input laser fringe signal will be of good amplitude over the entire scan range. Wide-linewidth or non-single-mode laser sources may exhibit Measurement Window signals that are shorter than the Trigger signal, and the Measurement Window signal may go high multiple times during a single scan. If this is the case, only the Measurement Window that contains the ZOP low-to-high transition will be used for wavelength measurement.
3, 4, 7	Reserved	

11, 12, 13	NC	No connection.
---------------	----	----------------

Table 6 below summarizes the electrical characteristics of the Signal Monitor outputs. Typically these signals would be monitored on an oscilloscope with inputs set to the high impedance setting.

Table 6 - Signal Monitor Electrical Characteristics.

Characteristic	Digital Outputs (CMOS-level)	Analog Outputs
Output Voltage	$V_{OL\ max} = 0.4\ V$ $V_{OH\ min} = 2.9\ V$	$\pm 5.5\ V\ max$ (open circuit)
Output Current	$I_{OL} = 12\ mA\ typical$	70 mA max
Output Impedance	33 Ohm	50 Ohm

5 Computer Interfacing

5.1 Overview

The WM-1210 Wavemeter is equipped with USB and RS-232 interfaces to receive commands from, and send responses to, a host PC. USB communication requires the installation of drivers on a Windows PC, and RS-232 communication can be established with any computer or device.

The commands supported by the WM-1210 Wavemeter can be divided into the following two categories: commands that cause it to return a stored or measured value (query commands), and commands that cause it to take a desired action (set commands).

Query commands must end with a question mark (?). It is recommended that when a query command is sent, the response to that command from the instrument be read before issuing any other command.

Set commands, on the other hand, are used to configure/set up the instrument for a desired mode of operation. No acknowledgement response is sent from the WM-1210 Wavemeter to the host PC after issuing a set command.

5.1.1 Command Termination

There are two special ASCII characters used when communicating with the WM-1210 Wavemeter.

- Carriage Return: ASCII character with value 13 in decimal and 0xD in hexadecimal. Represented in this manual as <CR>.
- Line Feed: ASCII character with value 10 in decimal and 0xA in hexadecimal. Represented in this manual as <LF>.

All commands or queries sent to the WM-1210 Wavemeter must be terminated by a <LF> character, though the instrument will accept <CR>, <LF>, <CR><LF> or <LF><CR>.

All responses to queries sent by the instrument to the host PC are terminated by a <LF> character. Note that set commands sent from the host PC do not elicit a response from the instrument.

In general the leading colon (:) may be omitted from commands and queries sent to the instrument.

5.1.2 USB Communication

The WM-1210 Wavemeter is designed to communicate with a host PC via a standard USB interface. Before connecting the instrument to the USB interface the application included on the USB flash drive that accompanies the WM-1210 Wavemeter must be installed. The application automatically installs the right USB drivers. Communication can be done through this interface by using the application or by developing software in a programming language. The software CD contains communication drivers and example programs in the following programming languages: LabVIEW and C#.NET. Please see the PDF file "**Readme Wavemeter Application.pdf**" included on the USB flash drive for software installation instructions.

5.1.3 RS-232 Serial Communication

The instrument is designed to communicate with a host computer or device via its RS-232 communication interface. The pinout of the 9-pin D-sub connector located on the rear panel of the instrument is designed to interface directly with a PC RS-232 serial port using a straight-through cable (described in Section 4.3.2). A USB-to-RS232 converter cable can be used if the host PC does not have a serial port.

To communicate with the instrument, the host PC's RS-232 settings must be configured as follows: 8 data bits, no parity checking, 1 stop bit, no handshaking. Handshaking is set to None by default on the WM-1210 Wavemeter, though other supported options are Hardware and Xon/Xoff. The instrument supports the following baud rates: 1200, 2400, 4800, 9600, 19200. These settings can be changed in the Setup - Communication screen (see Section 4.2.2).

On startup the WM-1210 Wavemeter will send a single NULL (0x0) character over the RS-232 interface.

5.2 Commands and Queries

As mentioned above, there are two types of device commands: set commands that change an instrument setting or cause the instrument to take a desired action, and queries that return a stored value or state of the instrument. Queries must end with a question mark (?), while set commands may require parameter(s) to follow. This is an example query command:

```
:SENSe:MEDEium?<LF>
```

This manual follows the convention that upper-case letters must always be included in the command, but lower-case letters may be omitted. The actual

characters sent to the instrument may be upper-case, lower-case, or any combination thereof—commands are not case-sensitive when communicating with the instrument. Note that all lower-case letters in a given word must be omitted; e.g. :SENS:MED?, :SENSe:MED?, and :SENS:MEDium? are all valid abbreviated commands, but :SENSe:MEDi? and :SENS:MEDIu? are not.

The reply from the instrument to any valid form of the above command is:

```
AIR<LF>
```

This is an example set command:

```
:SENSe:MEDium AIR<LF>
```

Since this is a set command, the instrument will not send a reply back.

For query commands, when communicating over RS-232 it may be useful to configure your program's communication settings to terminate the serial read on the <LF> character, since this will always be the last character sent as a reply to a query. For set commands, on the other hand, the read operation should be skipped entirely, since no data is returned.

Some instrument status queries return an integer (e.g. *STB?, :STATus:QUESTionable:CONDition?, :STATus:QUESTionable:HARDware:CONDition?). Certain bits of the binary representation of this integer are used to provide information about the instrument's state. For example, if an *STB? query returns the integer value 40, then the binary representation 101000_2 of this integer indicates that bits 3 and 5 are set (bits are enumerated starting from 0 at the least-significant on the right to most-significant bit on the left). The instrument therefore has errors in the error queue and a bit is set in the Questionable Condition Register.

5.2.1 Index of Commands

The main command and query groups are:

Basic Commands	Sense
Measure	Status
Calculate	System
Display	Unit

These are described briefly in Table 7 - Index of all computer communication commands, organized by group and in detail in the following subsections.

Multiple arguments or responses are represented with curly braces { ... | ... | ... } and optional arguments by square brackets [...].

Table 7 - Index of all computer communication commands, organized by group.

Syntax	Description
Basic Commands	
*CLS	Clears the error queue.
*IDN?	Identification string query.
*RCL	Recall saved instrument settings.
*RST	Reset all settings to default.
*SAV	Save instrument settings.
*STB?	Queries the Status Byte.
Measure	
:FETCh{:POWer :ENVironment :FREQuency :WAVelength :WNUMber}?	Queries the last successfully measured value for power, air pressure/temperature, frequency, wavelength or wavenumber.
:MEASure{:POWer :ENVironment :FREQuency :WAVelength :WNUMber}?	Queries the next successfully measured value for power, air pressure/temperature, frequency, wavelength or wavenumber.
Calculate	
:CALCulate:DATA? {POWer FREQuency WAVelength WNUMber}	Queries a power, frequency, wavelength or wavenumber value from the CALCulate system.
:CALCulate:DELTA[:STATe]?	Queries if the DELTA response to a :CALCulate:DATA? query is activated.
:CALCulate:DELTA[:STATe] {ON OFF }	Activates the DELTA type of response for a :CALCulate:DATA? query.
:CALCulate:DELTA:METHod?	Queries what type of DELTA query is set.

:CALCulate:DELTA:METHOD {START MAXMin}	Sets the type of DELTA query to perform. (START— the difference between current and START values, or MAXMin— the difference between MAXimum and MINimum values).
:CALCulate:MAXimum[:STATE]?	Queries if the MAXimum response to a :CALCulate:DATA? query is activated.
:CALCulate:MAXimum[:STATE] {ON OFF}	Activates the MAXimum type of response for a :CALCulate:DATA? query.
:CALCulate:MINimum[:STATE]?	Queries if the MINimum response to a :CALCulate:DATA? query is activated.
:CALCulate:MINimum[:STATE] {ON OFF}	Activates the MINimum type of response for a :CALCulate:DATA? query.
:CALCulate:RESet	The Elapsed Time counter is reset; MINimum, MAXimum and START quantities are set to the current values of wavelength, wavenumber, frequency, power and air pressure/temperature.
:CALCulate:START[:STATE]?	Queries if the START response to a :CALCulate:DATA? query is activated.
:CALCulate:START[:STATE] {ON OFF}	Activates the START type of response for a :CALCulate:DATA? query.
:CALCulate:TIME[:ELAPsed]?	Queries the time elapsed since :CALCulate:RESet or power on.
Display	
:DISPlay:DIALog?	Queries the name of the display active on the screen.
:DISPlay:DIALog {MAIN WAVelength POWER}	Sets which display is active on the screen.

:DISPlay:RESolution?	Queries the resolution used on the display and for wavelength/wavenumber/frequency queries.
:DISPlay:RESolution {AUTO 0.001 0.01 0.1 1 10 100}	Sets the resolution used on the display and for wavelength/wavenumber/frequency queries.
:DISPlay:UNITs:POWer?	Queries the units of power used on the display.
:DISPlay:UNITs:POWer {DBM MICRowatts MILLiwatts}	Selects the units of power used on the display.
:DISPlay:UNITs:WAVelength?	Queries the units of wavelength used on the display.
:DISPlay:UNITs:WAVelength {NM GHZ WNUMber}	Selects the units of wavelength used on the display.
Sense	
:SENSe:AVERage?	Returns the number of measurements averaged when displaying values on the front panel screen.
:SENSe:AVERage {OFF 2 4 8 ... 128}	Sets the number of measurements averaged when displaying values on the front panel screen.
:SENSe:MEDIum?	Queries the medium used to calculate display wavelength, wavenumber and frequency values.
:SENSe:MEDIum {AIR VACuum}	Sets the medium used to calculate display wavelength, wavenumber and frequency values.
:SENSe:POWeroffset?	Queries the value (in dBm) added to the power measurements displayed on the screen.
:SENSe:POWeroffset {OFF 1 ... 20}	Sets the value (in dBm) added to the power measurements displayed on the screen.
:SENSe:GAIN?	Queries the gain setting used for input laser measurements.

:SENSe:GAIN {AUTO FIXed}	Sets the gain setting used for input laser measurements.
:SENSe:RESolution?	Queries the resolution setting used over RS-232. EXTended resolution reports wavelength (only) values to 0.0001 pm
:SENSe:RESolution {STANdard EXTended}	Sets the resolution setting used over RS-232. EXTended resolution reports wavelength (only) values to 0.0001 pm.
Status	
:STATus:QUEStionable:CONDition?	Queries the Questionable Condition Register. Each bit of the integer that is returned provides information about the reliability of each type of measurement the instrument performs.
:STATus:QUEStionable:ENABle?	Queries the Questionable Enable Register. Each bit of the integer that is returned indicates an enabled or disabled bit in the Questionable Condition Register.
:STATus:QUEStionable:ENABle <integer>	Sets the Questionable Enable Register. Each bit of the integer that is sent enables or disables a bit in the Questionable Condition Register.
:STATus:QUEStionable:HARDware:CONDition?	Queries the Questionable Hardware Register. Each bit of the integer that is returned provides information about hardware status.
System	
:SYSTem:ERRor?	Returns errors from the error queue until it is empty.
Unit	
:UNIT:POWer?	Queries the power units used for power queries.

:UNIT:POWer {DBM W}	Sets the power units used for power queries.
-----------------------	--

5.2.2 Basic Commands

The following commands are used for general instrument operation.

*CLS	
Description	Clears the error queue.

*IDN?	
Description	<p>Identification string query. Returns manufacturer, model number, firmware version, firmware date and serial number as: New_Focus WM-1210 vX.Y.Z MM/DD/YY SN####</p> <p>The *IDN? query is useful when identifying one of multiple instruments connected to the host PC.</p>

*RCL	
Description	<p>Recall instrument settings. Equivalent to using the Recall Setup command on the Setup - Configuration screen, this restores the settings that were last saved to memory using Save Setup or *SAV. The Gain setting is not changed. Unlike other set commands, *RCL responds with a single 0xFF character over RS-232.</p>

*RST																															
Description	Reset all settings to default. After issuing *RST, the following settings will be changed.																														
	<table border="1"> <thead> <tr> <th>Command</th> <th>Default Setting/Response</th> </tr> </thead> <tbody> <tr> <td>:CALCulate:DELTA[:STATE]?</td> <td>0 (off)</td> </tr> <tr> <td>:CALCulate:DELTA:METHOD?</td> <td>START</td> </tr> <tr> <td>:CALCulate:MAXimum[:STATE]?</td> <td>0 (off)</td> </tr> <tr> <td>:CALCulate:MINimum[:STATE]?</td> <td>0 (off)</td> </tr> <tr> <td>:CALCulate:START[:STATE]?</td> <td>0 (off)</td> </tr> <tr> <td>:DISPlay:DIALog?</td> <td>MAIN (the display will return to Display - Main even if it was on one of the Settings screens).</td> </tr> <tr> <td>:DISPlay:RESolution?</td> <td>AUTO</td> </tr> <tr> <td>:DISPlay:UNITs:POWER?</td> <td>DBM</td> </tr> <tr> <td>:DISPlay:UNITs:WAVElength?</td> <td>NM</td> </tr> <tr> <td>:SENSe:AVERage?</td> <td>OFF</td> </tr> <tr> <td>:SENSe:MEDIum?</td> <td>VACUUM</td> </tr> <tr> <td>:SENSe:POWERoffset?</td> <td>OFF</td> </tr> <tr> <td>:SENSe:GAIN?</td> <td>AUTO</td> </tr> <tr> <td>:UNIT:POWER?</td> <td>DBM</td> </tr> </tbody> </table>	Command	Default Setting/Response	:CALCulate:DELTA[:STATE]?	0 (off)	:CALCulate:DELTA:METHOD?	START	:CALCulate:MAXimum[:STATE]?	0 (off)	:CALCulate:MINimum[:STATE]?	0 (off)	:CALCulate:START[:STATE]?	0 (off)	:DISPlay:DIALog?	MAIN (the display will return to Display - Main even if it was on one of the Settings screens).	:DISPlay:RESolution?	AUTO	:DISPlay:UNITs:POWER?	DBM	:DISPlay:UNITs:WAVElength?	NM	:SENSe:AVERage?	OFF	:SENSe:MEDIum?	VACUUM	:SENSe:POWERoffset?	OFF	:SENSe:GAIN?	AUTO	:UNIT:POWER?	DBM
	Command	Default Setting/Response																													
	:CALCulate:DELTA[:STATE]?	0 (off)																													
	:CALCulate:DELTA:METHOD?	START																													
	:CALCulate:MAXimum[:STATE]?	0 (off)																													
	:CALCulate:MINimum[:STATE]?	0 (off)																													
	:CALCulate:START[:STATE]?	0 (off)																													
	:DISPlay:DIALog?	MAIN (the display will return to Display - Main even if it was on one of the Settings screens).																													
	:DISPlay:RESolution?	AUTO																													
	:DISPlay:UNITs:POWER?	DBM																													
	:DISPlay:UNITs:WAVElength?	NM																													
	:SENSe:AVERage?	OFF																													
	:SENSe:MEDIum?	VACUUM																													
:SENSe:POWERoffset?	OFF																														
:SENSe:GAIN?	AUTO																														
:UNIT:POWER?	DBM																														

*SAV	
Description	Save instrument settings. When the instrument powers up (or *RCL is issued) it will use the settings stored in memory the last time *SAV (or Save Settings) were used.

*STB?			
Description	Queries the Status Byte. The Status Byte contains information about the status of the instrument.		
	Bit	Bit Value	Default Setting/Response
	5	32	At least one bit is set in the Questionable Condition Register.
	3	8	At least one error in the error queue.
	2	4	Reserved.
Query Response	Returns a non-negative integer.		
Example	Query:	*stb?	
	Response:	8	
	The binary representation of 8 is 101000b, indicating that bits 3 and 5 are set.		

5.2.3 Measurement Commands

The WM-1210 Wavemeter completes ten measurements per second, or one measurement every 100 ms, approximately. When a wavelength, wavenumber, or frequency measurement is completed, input laser power, internal temperature and atmospheric pressure are all measured. These values remain available until the next successful measurement, when they are replaced by new values.

There are two ways of requesting a measured value from the WM-1210 Wavemeter. :FETCh:*? queries the last successfully measured value. If the query is sent again before another scan is completed, the same value will be returned. On the other hand, :MEASure:*? will return the *next* successfully-completed measurement as soon as it is available (at some point within the next 0 to 100 ms). If the query is sent again before another scan is completed, the response will be delayed until the next measurement is available.

A typical use of :FETCh:*? and :MEASure:*? is as follows. The following three queries are sent in a loop for continuous measurement of wavelength, power, and environmental conditions.

```
:MEASure:WAVelength?
```

```
:FETCh:POWer?
```

```
:FETCh:ENVironment?
```

As long as the two :FETCh:*? queries are sent before a new scan has been completed (i.e. well within 100 ms of receiving the response from the :MEASure:WAVelength? query), the values they return will correspond to those taken during the measurement reported by :MEASure:WAVelength?, and these measurements of wavelength, power, temperature and atmospheric pressure can be considered simultaneous.

This measurement loop approach works well if other measurements with other instruments need to be synchronized to the primary wavelength measurement rate of the wavemeter.

Alternatively, if it is not possible to wait for the wavemeter to return a reply to the :MEASure:WAVelength? command, the measurement loop may be changed to

```
:FETCh:WAVelength?
```

```
:STATus:QUEStionable:CONDition?
```

```
:FETCh:POWer?
```

```
:FETCh:ENVironment?
```

Bit 0 of the integer returned by :STATus:QUEStionable:CONDition? will be set if the wavelength that was just queried by :FETCh:WAVelength? has already been read by a previous query. This way it is possible to sort new wavelength measurements from old (already received) wavelength measurements, even if the numerical value of the wavelength measurement has not changed.

:FETCh{:POWER :ENVironment :FREQuency :WAVelength :WNUMber}?	
Description	Queries the last successfully measured value for power, air pressure/temperature, frequency, wavelength or wavenumber.
Query Response	Floating-point value in scientific notation.
Example	Query: :fetc:wav? Response: 7.802440E+02

:MEASure{POWER :ENVironment :FREQuency :WAVelength :WNUMber }?	
Description	Queries the next successfully measured value for power, air pressure/temperature, frequency, wavelength or wavenumber.
Query Response	Floating-point value in scientific notation.
Example	Query: :meas:wav? Response: 7.802440E+02

5.2.4 Calculate Commands

The CALCulate group of commands are used to query the measurements that are displayed on the Display - Power and Display - Wavelength screens. Generally more than one command is used to perform a query: the numerical value returned by :CALCulate:DATA? depends on which :CALCulate:* setting is turned on. The flowchart below summarizes typical use of the :CALCulate:* system. Each path through the flowchart results in the retrieval of a different type of measurement by :CALCulate:DATA?. Initially, the :CALCulate:RESet command can be sent to initialize all deltas, extrema, and starting value. Next the quantity of interest is selected (maximum value, minimum value, start value or delta). If a delta value is selected, the type of delta must be specified next (start - current value, or maximum - minimum value). Finally, the value itself is queried with :CALCulate:DATA?.

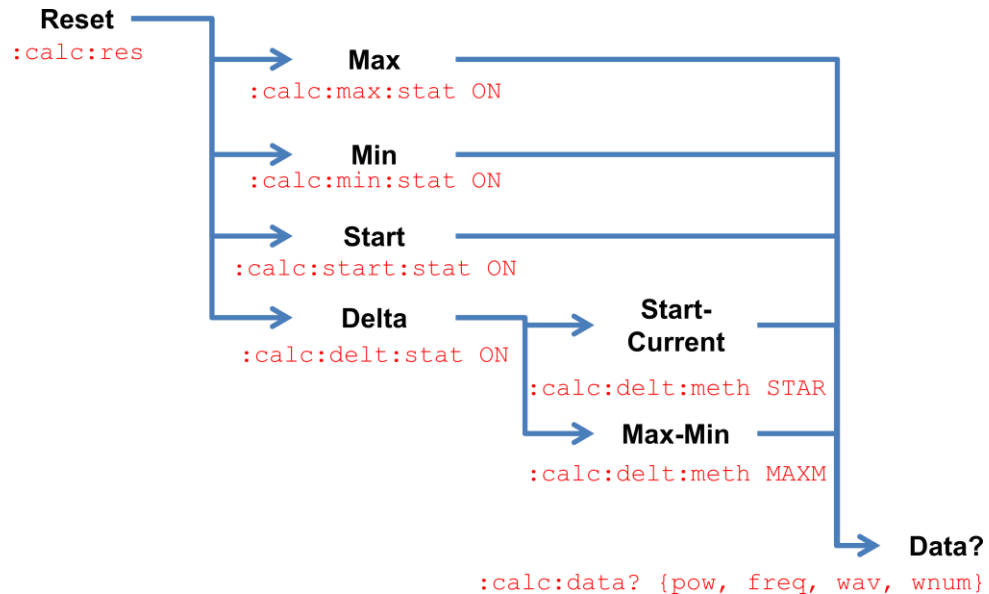


Figure 19

:CALCulate:* system.

Note that turning one of the settings ON will turn the others OFF. If they are all OFF (e.g. after issuing *RST), a :CALCulate:DATA? query will not return a response.

:CALCulate:DATA? {POWER FREQUENCY WAVELENGTH WNUMBER}	
Description	Queries a power, frequency, wavelength or wavenumber value from the CALCulate system.
Query Response	Floating-point value in scientific notation.
Example	<p>The following query sequence queries the total range of wavelength variation seen since reset.</p> <p>Command: :calc:delt:stat on</p> <p>Command: :calc:delt:meth maxm</p> <p>Query: :calc:data? wav</p> <p>Response: 4.000000E-03</p> <p>This indicates that the input laser's wavelength has changed over a range of 3 pm since reset.</p>

:CALCulate:DELTA[:STATE]?	
Description	Queries if the DELTA response to a :CALCulate:DATA? query is activated.
Query Response	0 for OFF, 1 for ON.
Example	<p>Command: :calc:delt:stat on</p> <p>Query: :calc:delt:stat?</p> <p>Response: 1</p>

:CALCulate:DELTA[:STATE] {ON OFF}	
Description	Activates the DELTA type of response for a :CALCulate:DATA? query.
Example	Command: :calc:delt:stat on

:CALCulate:DELTA:METHod?	
Description	Queries what type of DELTA query is set.
Query Response	{MAXMIN, START}
Example	Command: :calc:delt:meth maxm Query: :calc:delt:meth? Response: MAXMIN

:CALCulate:DELTA:METHod {START MAXMin}	
Description	Sets the type of DELTA query to perform. (START— the difference between current and START values, or MAXMin— the difference between MAXimum and MINimum values).
Example	Command: :calc:delt:meth star

:CALCulate:MAXimum[:STATe]?	
Description	Queries if the MAXimum response to a :CALCulate:DATA? query is activated.
Query Response	0 for OFF, 1 for ON.
Example	Command: :calc:max on Query: :calc:max? Response: 1

:CALCulate:MAXimum[:STATe] {ON OFF}	
Description	Activates the MAXimum type of response for a :CALCulate:DATA? query.
Example	Command: :calc:max on

:CALCulate:MINimum[:STATE]?	
Description	Queries if the MIN response to a :CALC:DATA? query is activated.
Query Response	0 for OFF, 1 for ON.
Example	Command: :calc:min on Query: :calc:min? Response: 1

:CALCulate:MINimum[:STATE] {ON OFF}	
Description	Activates the MINimum type of response for a :CALCulate:DATA? query.
Example	Command: :calc:min on

:CALCulate:RESet	
Description	The Elapsed Time counter is reset; MINimum, MAXimum and START quantities are set to the current values of wavelength, wavenumber, frequency, power and air pressure/temperature, and both DELTA values (START and MAXMin) are reset to zero for these quantities.
Example	Command: :calc:res Query: :calc:tim? Response: 0.000000E+00 (assuming less than one second elapsed between issuing the :CALC:RES command and querying :CALC:TIM?).

:CALCulate:STARt[:STATE]?	
Description	Queries if the STAR response to a :CALC:DATA? query is activated.
Query Response	0 for OFF, 1 for ON.
Example	Command: :calc:star on Query: :calc:star? Response: 1

:CALCulate:START[:STATe] {ON OFF}	
Description	Activates the START type of response for a :CALCulate:DATA? query.
Example	Command: :calc:star on

:CALCulate:TIME[:ELAPsed]?	
Description	Queries the time elapsed since :CALCulate:RESet or power on.
Query Response	The number of whole seconds elapsed since instrument power-on or reset as a floating-point value in scientific notation.
Example	Query: :calc:tim? Response: 2.580000E+02 258 seconds (4 minutes and 18 seconds) have elapsed since power-on or reset.

5.2.5 Display Commands

This group of commands controls the information displayed on the screen.

:DISPlay:DIALog?									
Description	<p>Reports which display is active on the screen.</p> <p>When one of the Settings displays is active, the query response is also one of {MAIN WAVELENGTH POWER}, as follows:</p> <table border="1"> <thead> <tr> <th>Active Display</th> <th>Query Response</th> </tr> </thead> <tbody> <tr> <td>Setup - Configuration</td> <td>MAIN</td> </tr> <tr> <td>Setup - Communication</td> <td>WAVELENGTH</td> </tr> <tr> <td>Setup - Information</td> <td>POWER</td> </tr> </tbody> </table>	Active Display	Query Response	Setup - Configuration	MAIN	Setup - Communication	WAVELENGTH	Setup - Information	POWER
Active Display	Query Response								
Setup - Configuration	MAIN								
Setup - Communication	WAVELENGTH								
Setup - Information	POWER								
Query Response	{MAIN WAVELENGTH POWER}								
Example	Query: :disp:dial? Response: MAIN								

:DISPlay:DIALog {MAIN WAVelength POWer}	
Description	Sets which display is active on the screen. Only the Main, Wavelength and Power displays can be set on the screen with this command.
Example	Command: :disp:dial main

:DISPlay:RESolution?	
Description	Queries the resolution used on the display and for wavelength/wavenumber/frequency queries.
Query Response	{AUTO 0.001 0.01 0.1 1.0 10.0 100.0}
Example	Query: :disp:res? Response: AUTO

:DISPlay:RESolution {AUTO 0.001 0.01 0.1 1 10 100}				
Description	<p>Sets the resolution used on the display and for wavelength, wavenumber, and frequency queries.</p> <p>See Sections 4.2.1 and 6.2 for descriptions of the AUTO setting.</p> <p>When the resolution is set to 10 or 100, only frequency and wavenumber measurements are affected. Wavelength resolution is never displayed/reported below 1 nm.</p> <p>When :SENSe:RESolution is set to EXTended, extended resolution will only be applied to wavelength values reported over RS-232 if :DISPlay:RESolution is set to AUTO or 0.001. Lower-resolution settings will override the :SENSe:RESolution EXTended setting.</p>			
Examples	Query/ Command	Display/ Response	Query/ Command	Display/ Response
	:disp:res auto		:disp:res 1	
	:meas:wav?	952.724	:meas:wav?	953
	:fetc:freq?	314668.6	:fetc:freq?	314669
	:fetc:wnum?	10496.22	:fetc:wnum?	10496
	:disp:res 0.001		:disp:res 10	
	:meas:wav?	952.724	:meas:wav?	953
	:fetc:freq?	314668.6	:fetc:freq?	314670
	:fetc:wnum?	10496.22	:fetc:wnum?	10500
	:disp:res 0.01		:disp:res 100	
	:meas:wav?	952.72	:meas:wav?	953
	:fetc:freq?	314668.6	:fetc:freq?	314700
	:fetc:wnum?	10496.22	:fetc:wnum?	10500
	:disp:res 0.1			
	:meas:wav?	952.7		
	:fetc:freq?	314668.6		
	:fetc:wnum?	10496.2		

:DISPlay:UNITs:POWer?	
Description	<p>Queries the units of power used on the display.</p> <p>If the input laser power is below 1 mW and the :DISPlay:UNITs:POWer setting is either MICRowatts or MILLiwatts, the query will return MICROWATTS and the display will report the power in microwatts.</p> <p>If the input laser power is over 1 mW and the :DISPlay:UNITs:POWer setting is either MICRowatts or MILLiwatts, the query will return MILLIWATTS and the display will report the power in mW.</p>
Query Response	{DBM MICROWATTS MILLIWATTS}
Example	<p>Query: :disp:unit:pow?</p> <p>Response: DBM</p>

:DISPlay:UNITs:POWer {DBM MICRowatts MILLiwatts}	
Description	<p>Selects the units of power used on the display.</p> <p>If the :DISPlay:UNITs:POWer setting is either MICRowatts or MILLiwatts, the display will display input laser power in mW if input laser power is over 1 mW, and in microwatts if input laser power is below 1 mW. In other words, selecting MICRowatts or MILLiwatts has effectively the same outcome for the power units used on the display.</p>
Example	<p>Command: :disp:unit:pow dbm</p>

:DISPlay:UNITs:WAVelength?	
Description	Queries the units of wavelength used on the display.
Query Response	{NM GHZ WNUMBER}
Example	<p>Query: :disp:unit:wav?</p> <p>Response: NM</p>

:DISPlay:UNITs:WAVelength {NM GHZ WNUMBER}	
Description	Selects the units of wavelength used on the display.
Example	Command: :disp:unit:wav nm

5.2.6 Sense Commands

The :SENSe:* commands affect how measurements are performed.

:SENSe:AVERage?	
Description	Returns the number of measurements averaged when displaying values on the front panel screen. This setting does not affect the values returned over computer interface.
Query Response	{OFF 2 4 8 ... 128}
Example	Query: :sens:aver? Response: OFF

:SENSe:AVERage {OFF 2 4 8 ... 128}	
Description	Sets the number of measurements averaged when displaying values on the front panel screen. This setting does not affect the values returned over computer interface. Unsupported numerical arguments are ignored without generating a syntax error.
Example	Command: :sens:aver 32

:SENSe:MEDium?	
Description	Queries the medium used to calculate onscreen wavelength, wavenumber and frequency values.
Query Response	{AIR VACUUM}
Example	Query: :sens:med? Response: VACUUM

:SENSe:MEDium {AIR VACuum}	
Description	Sets the medium used to calculate onscreen wavelength, wavenumber and frequency values.
Example	Command: :sens:med air

:SENSe:POWeroffset?	
Description	Queries the value (in dBm) added to the power measurements displayed on the screen.
Query Response	{OFF 1 ... 20}
Example	Query: :sens:pow? Response: OFF

:SENSe:POWeroffset {OFF 1 ... 20}	
Description	Sets the value (in dBm) added to the power measurements displayed on the screen.
Example	Command: :sens:pow off

:SENSe:GAIN?	
Description	Queries the gain setting used for input laser measurements.
Query Response	{AUTO FIXED}
Example	Query: :sens:gain? Response: AUTO

SENSe:GAIN {AUTO FIXEd}	
Description	Sets the gain setting used for input laser measurements.
Example	Command: :sens:gain auto

:SENSe:RESolution?	
Description	Queries the resolution setting used over RS-232.
Query Response	{STANDARD EXTENDED}
Example	Query: :sens:res? Response: EXTENDED

:SENSe:RESolution {STANdard EXTended}	
Description	<p>Sets the resolution setting used over RS-232. EXTENDED resolution reports wavelength (only) values to 0.0001 pm.</p> <p>When :SENSe:RESolution is set to EXTENDED, extended resolution will only be applied to wavelength values reported over RS-232 if :DISPlay:RESolution is set to AUTO or 0.001. Lower-resolution settings will override the :SENSe:RESolution EXTENDED setting.</p> <p>This setting is not preserved after power cycling the instrument, and is not saved by *SAV.</p>
Example	Command: :sens:res extended

5.2.7 Status Commands

The :STATus:* group of commands and queries provide information on the operational status of the WM-1210 Wavemeter. There are three main registers used with the :STATus:* group of commands:

Questionable Condition Register

Questionable Enable Register

Questionable Hardware Condition Register.

The Questionable Condition Register is composed of a collection of bits that provide information about the reliability of each type of measurement the instrument performs.

The Questionable Enable Register is composed of a collection of bits that enable or disable reporting of conditions by the Questionable Condition Register. If a bit is set in the Questionable Enable Register, its corresponding bit is never set in the Questionable Condition Register, even if the condition for that bit is true.

Like the Questionable Condition Register, the Questionable Hardware Condition Register is composed of a collection of bits that provide information about the operation of the instrument's hardware.

These registers are set or queried via commands that accept or return non-negative integers. The registers' bits correspond to each bit in the binary representation of these integers.

:STATus:QUEStionable:CONDition?																																					
Description	<p>Queries the Questionable Condition Register. Each bit of the integer that is returned provides information about the reliability of each type of measurement the instrument performs.</p> <p>Note that each of these bits may be disabled by the Questionable Enable Register using :STATus:QUEStionable:ENABle.</p> <table border="1"> <thead> <tr> <th>Bit</th> <th>Bit Value</th> <th>Default Setting/Response</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>1</td> <td>The wavelength value from the present scan has already been queried (e.g. a result of querying :FETC:wav? twice within one scan, or querying :MEAS:wav? followed by :FETC:wav? within one scan).</td> </tr> <tr> <td>1</td> <td>2</td> <td>Reserved.</td> </tr> <tr> <td>2</td> <td>4</td> <td>Reserved.</td> </tr> <tr> <td>3</td> <td>8</td> <td>The input laser power is outside the instrument's operating range.</td> </tr> <tr> <td>4</td> <td>16</td> <td>The instrument's internal temperature is outside the instrument's operating range.</td> </tr> <tr> <td>5</td> <td>32</td> <td>The wavelength value measured is outside the instrument's operating range.</td> </tr> <tr> <td>6</td> <td>64</td> <td>Reserved.</td> </tr> <tr> <td>7</td> <td>128</td> <td>Reserved.</td> </tr> <tr> <td>8</td> <td>256</td> <td>Reserved.</td> </tr> <tr> <td>9</td> <td>512</td> <td>The atmospheric pressure value measured is outside the instrument's operating range.</td> </tr> <tr> <td>10</td> <td>1024</td> <td>At least one of the ten other bits in this Questionable Condition Register is set.</td> </tr> </tbody> </table>	Bit	Bit Value	Default Setting/Response	0	1	The wavelength value from the present scan has already been queried (e.g. a result of querying :FETC:wav? twice within one scan, or querying :MEAS:wav? followed by :FETC:wav? within one scan).	1	2	Reserved.	2	4	Reserved.	3	8	The input laser power is outside the instrument's operating range.	4	16	The instrument's internal temperature is outside the instrument's operating range.	5	32	The wavelength value measured is outside the instrument's operating range.	6	64	Reserved.	7	128	Reserved.	8	256	Reserved.	9	512	The atmospheric pressure value measured is outside the instrument's operating range.	10	1024	At least one of the ten other bits in this Questionable Condition Register is set.
	Bit	Bit Value	Default Setting/Response																																		
	0	1	The wavelength value from the present scan has already been queried (e.g. a result of querying :FETC:wav? twice within one scan, or querying :MEAS:wav? followed by :FETC:wav? within one scan).																																		
	1	2	Reserved.																																		
	2	4	Reserved.																																		
	3	8	The input laser power is outside the instrument's operating range.																																		
	4	16	The instrument's internal temperature is outside the instrument's operating range.																																		
	5	32	The wavelength value measured is outside the instrument's operating range.																																		
	6	64	Reserved.																																		
	7	128	Reserved.																																		
	8	256	Reserved.																																		
9	512	The atmospheric pressure value measured is outside the instrument's operating range.																																			
10	1024	At least one of the ten other bits in this Questionable Condition Register is set.																																			
Query Response	Returns a non-negative integer.																																				
Example	<p>Query: :stat:ques:cond?</p> <p>Response: 1048</p> <p>The binary representation of 1048 is 10000011000_b, indicating that bits 3, 4 and 10 are set.</p>																																				

:STATus:QUEStionable:ENABle?	
Description	<p>Queries the Questionable Enable Register. Each bit of the integer that is returned indicates an enabled or disabled bit in the Questionable Condition Register.</p> <p>If a bit is set in the Questionable Enable Register, the same bit will never be set in the Questionable Condition Register, even if the condition for that bit is true.</p>
Query Response	Returns a non-negative integer.
Example	<p>Query: :stat:ques:enab?</p> <p>Response: 2047</p> <p>The binary representation of 2047 is 11111111111_b, indicating that all eleven bits of the Questionable Enable Register are set. As a result, no bits in the Questionable Condition Register will be set, even if their condition is true.</p> <p>Query: :stat:ques:enab?</p> <p>Response: 0</p> <p>The binary representation of 0 is 00000000000_b, indicating that all eleven bits of the Questionable Enable Register are not set. As a result each bit of the Questionable Condition Register will be set (or not) depending on whether their condition is true (or not).</p>

:STATus:QUEStionable:ENABle <integer>	
Description	<p>Sets the Questionable Enable Register. Each bit of the integer that is sent enables or disables a bit in the Questionable Condition Register.</p> <p>If a bit is set in the Questionable Enable Register, the same bit will never be set in the Questionable Condition Register, even if the condition for that bit is true.</p>
Example	<p>Command: :stat:ques:enab 0</p> <p>The binary representation of 0 is 00000000000_b, indicating that all eleven bits of the Questionable Enable Register are not set. This allows all conditions in the Questionable Condition Register to be reported by their respective bits.</p>

:STATus:QUEStionable:HARDware:CONDition?			
Description	Queries the Questionable Hardware Register. Each bit of the integer that is returned provides information about hardware status.		
	Bit	Bit Value	Default Setting/Response
	0	1	Reserved.
	1	2	HeNe reference laser not ready.
	2	4	Reserved.
	3	8	Reserved.
	4	16	Reserved.
	5	32	Flash memory reading failure.
	6	64	Reserved.
	7	128	No scan trigger. The interferometer's scan assembly is not moving.
	8	256	Input signal too low. There is not enough input laser power to make a measurement.
	9	512	Reserved.
	10	1024	Reserved.
	11	2048	Reserved.
12	4096	Input laser power out of range.	
13	8192	Reserved.	
Example	Query:	:stat:ques:hard:cond?	
	Response:	256	
	The binary representation of 256 is 00000100000000 _b , indicating that bit 8 is set. There is not enough input laser power to make a measurement.		

5.2.8 System Commands

The :SYSTem:ERRor? query returns information about errors in the error queue.

:SYSTem:ERRor?															
	Returns errors from the error queue until it is empty.														
Description	<table border="1"> <thead> <tr> <th>Error Number</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>No error.</td> </tr> <tr> <td>102</td> <td>Syntax error.</td> </tr> <tr> <td>104</td> <td>Data type error.</td> </tr> <tr> <td>108</td> <td>Parameter not allowed.</td> </tr> <tr> <td>-109</td> <td>Missing parameter.</td> </tr> <tr> <td>-200</td> <td>Execution error.</td> </tr> </tbody> </table>	Error Number	Description	0	No error.	102	Syntax error.	104	Data type error.	108	Parameter not allowed.	-109	Missing parameter.	-200	Execution error.
	Error Number	Description													
	0	No error.													
	102	Syntax error.													
	104	Data type error.													
	108	Parameter not allowed.													
-109	Missing parameter.														
-200	Execution error.														
Query Response	<integer>, "<string>"														
Example	Query: :syst:err? Response: -102, "Syntax error"														

5.2.9 Unit Commands

The :UNIT:POWER command and query control the units of the power measurements returned by :FETCH:POWER? and :MEASURE:POWER?. Note that the arguments used for the :UNIT:POWER commands are different from the arguments used for the :DISPLAY:UNITS:POWER.

:UNIT:POWER?	
Description	Queries the power units used for remote power queries.
Query Response	{DBM W}
Example	Query: :unit:pow? Response: W

:UNIT:POWER {DBM W}	
Description	Sets the power units used for remote power queries.
Example	Response: :unit:pow?

6 Getting the most out of the WM-1210 Wavemeter

6.1 Principles of Operation

The WM-1210 Wavemeter can be used with little knowledge of its internal function or operating principles, performing automatic measurements of an input laser's wavelength. However, it is recommended that the user become familiar with some basic aspects of its design, especially when making measurements of a laser source of unknown or potentially unexpected characteristics. Some of these characteristics may affect the WM-1210 Wavemeter's measurement accuracy and these are covered in Section 6.2 below.

6.1.1 Interferometer Design

The wavelength of the input laser is determined by comparing it to the wavelength of an internal HeNe laser reference. Light from both lasers is sent into a scanning Michelson interferometer where the length of one of the interferometer's arms is changed periodically. This produces a time-varying sinusoidal signal (referred to as interference fringes) at each laser's photodetector. These interference fringes are counted for both lasers during a given measurement window, generating a *fringe count*.

Since the interferometer's path-length change is the same for both lasers, the input laser fringe count is related to the HeNe fringe count by the ratio of their wavelengths. The wavelength of the HeNe reference is known, so the input laser's wavelength can be accurately derived.

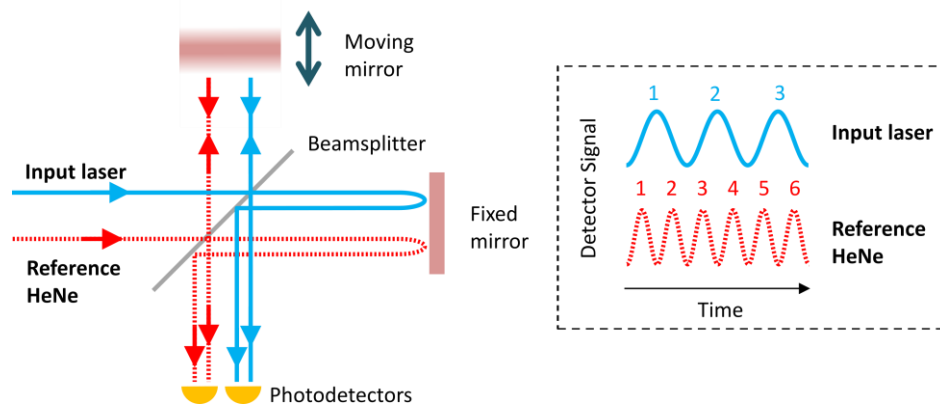


Figure 20 Overview of the WM-1210's principles of operation.

This wavelength measurement is performed in ambient air, which can vary in temperature, pressure, and humidity. To compensate for the very slight relative differences in refractive index experienced by the input laser and the HeNe reference as these conditions change, the instrument continuously measures these air conditions and applies the corresponding correction to the reported wavelength.

6.1.2 Wavelength Calibration

Each WM-1210 Wavemeter is factory-calibrated at two wavelengths near either end of the specified operating wavelength range. A measurement at 1527 nm using an NIST Standard Reference Material SRM-2517a acetylene absorption reference guarantees that these calibration measurements are both accurate and traceable to current NIST wavelength standards.⁵

6.1.3 HeNe Reference Laser

The WM-1210 Wavemeter uses a multi-mode HeNe laser as its reference. Since this is a multi-mode laser, at any given time two to three adjacent HeNe cavity modes will be lasing simultaneously. The exact wavelength of these lasing modes changes slightly over time as the HeNe laser cavity undergoes small temperature variations (a phenomenon common to all multi-mode non-stabilized HeNe lasers called *mode sweeping*). As a result, the effective HeNe wavelength as measured by the WM-1210 Wavemeter sweeps up and down very slightly around the HeNe center wavelength (632.9914 nm⁶), in turn affecting the internally-measured wavelength of the input laser. These variations are small (sub-pm), and are accounted for in the wavelength

⁵ Specifically, NIST Special Publication 260-133 (2001) on NIST SRM 2517a "High Resolution Wavelength Calibration Reference for 1510 to 1540 nm Acetylene $^{12}\text{C}_2\text{H}_2$ ".

⁶ See "K. D. Mielenz, K. F. Nefflen, W. R. C. Rowley, D. C. Wilson, and E. Engelhard, *Appl. Opt.* 7, 289-293 (1968)", and "GR Hanes, KM Baird, J Deremigis, *Appl Opt.* 1973 Jul 1;12(7):1600-5. doi: 10.1364/AO.12.001600".

absolute accuracy specification. However, when wavelength measurements are queried over RS-232 serial link and the Extended Resolution setting is turned on (see Section 5.2.6), these small variations are apparent for very stable and narrow-linewidth input laser sources, and do not indicate malfunction of the WM-1210 Wavemeter.

6.2 Measurement Accuracy

The WM-1210 Wavemeter will perform accurate and automatic measurements of an input laser. Some input laser sources, however, may cause readings that do not display the full resolution or cause otherwise unexpected behavior. Usually this is a consequence of the input laser's spectral characteristics or low input laser power. If the input laser's characteristics are not known, the Signal Monitor port can be used to obtain more information about the input laser.

6.2.1 Input Laser Spectral Characteristics

Wavelength measurements are dependent upon the generation of good interference fringes within the WM-1210 Wavemeter's Michelson interferometer. In general, fringes will be generated around the location where the two optical path lengths of the interferometer arms are equal (the *Zero Optical Path* point). The distance over which these fringes are generated as one interferometer arm is made longer or shorter than the other is the *coherence length* of the laser, and is defined as $L_{\text{coh}} \approx c/(\pi\Delta\nu)$ (where c is the speed of light and $\Delta\nu$ is the laser's spectral bandwidth). The WM-1210's full measurement accuracy will only be achieved if the input laser has a coherence length greater than the stroke length of the internal Michelson interferometer's variable-length arm, i.e. several cm, as this will allow the maximum number of fringes to be counted for both the input laser and the HeNe reference laser.

If the input laser's coherence length is shorter than the interferometer's stroke length, there will be fewer input laser and HeNe fringes available to calculate the ratio of fringe counts, affecting the resulting wavelength measurement's accuracy. If the WM-1210 Wavemeter's Resolution setting (see Section 4.2.2, Table 4- Information contained on the Setup screens and Section 5.2.5) is set to AUTO, the instrument will respond to this reduced measurement resolution by reducing the amount of digits displayed on the front panel or reported via computer query.

If the input laser is not single-mode, beating between input laser modes will, in general, decrease fringe contrast and reduce the number of fringes available for measurement. It may not be possible to perform an accurate measurement of a multimode laser, such as a self-lasing Fabry-Perot laser diode.


6.2.2 Input Laser Power


If there is not enough power available to the WM-1210 Wavemeter for a fully-accurate measurement, successive readings may show increased spread, both in Standard Resolution and Extended Resolution modes. If this is the case, turn on averaging or increase the power available at the optical input.

The photodiodes used for fringe counting are wavelength-dependent and at shorter wavelengths will require more minimum input power than at longer wavelengths.

7 Maintenance and Service

7.1 Enclosure Cleaning

	<p style="text-align: center;">WARNING</p> <p>Work performed by persons not authorized by New Focus will void the warranty.</p>
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	<p style="text-align: center;">WARNING</p> <p>Before cleaning the enclosure of the WM-1210 Wavemeter, the AC power cord must be disconnected from the wall socket.</p>
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The WM-1210 Wavemeter enclosure should only be cleaned with a damp lint-free cloth wetted with a mild soapy water solution. Do not use an acetone, alcohol, or any other solvents as this may damage the finish on the enclosure.

7.2 Fan Filter Cleaning

The fan on the rear panel of the WM-1210 Wavemeter provides ventilation to the internal components. A filter is used to on the fan intake and exhaust ports. Over time they will collect dust, and therefore should be cleaned periodically.

To clean the filter:

1. Remove the plastic grill covering the filter using a 2 mm hex driver.
2. Remove the filter from the grill.
3. Use a mild solution of soap and a soft brush to clean the filter.
4. Rinse and allow the filter to completely dry.
5. Position filter on rear panel and reattach the plastic grill cover over it.

7.3 Technical Support

Information and advice about the operation of any New Focus product is available from our technical support engineers. For quickest response, ask for New Focus Technical Support and know the model and serial number for your product.

Hours: 8:00–5:00 PST, Monday through Friday (excluding holidays).

Phone: +1 (408) 980-5903

Email: techsupport@newfocus.com

We typically respond to faxes and email within one business day.

7.4 Obtaining Service

The WM-1210 Wavemeter has been designed to provide years of trouble-free operation with virtually no maintenance except for ensuring that the unit is not damaged, contaminated, or used in an unsafe manner. The WM-1210 Wavemeter contains no user serviceable parts; therefore any service to the unit should be performed by a qualified New Focus engineer. To obtain information regarding service, contact New Focus or your New Focus representative. Please have the following information available:

1. Instrument model number (on the front panel or panel label).
2. Instrument serial number (on the rear panel label).
3. Description of the problem.

If the instrument is to be returned to New Focus, you will be given a Return Material Authorization (RMA) number, which you should reference in your shipping documents.

7.5 Warranty

New Focus, a division of Newport Corporation, guarantees the WM-1210 Wavemeter to be free of defects for one year from the date of shipment. This is in lieu of all other guarantees, expressed or implied, and does not cover incidental or consequential loss. This warranty is void if the unit enclosure is opened.

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8 Appendix

8.1 Error Messages

Error messages that may be displayed on the WM-1210's screen are listed in Table 8. If more than one error condition is present, the error with the highest priority is displayed. These errors are listed in order of decreasing priority in the table below.

Table 8 - Description of WM-1210 error messages

Error String	Description
Reference Laser: No Fringes Detected	The HeNe reference laser was not detected. Contact New Focus technical support for assistance.
Temperature/Pressure: Out of Range	The air temperature or atmospheric pressure measured by the instrument is out of its acceptable range. Ensure the instrument's two ventilation ports are not blocked and that the environmental temperature is within the specified range of 15 °C - 30 °C. Contact New Focus technical support for assistance.
Input Laser: Intensity Too Low	There is insufficient input laser power to perform a measurement. Check that the input optical fiber is clean, of the FC/APC type (not FC/PC), and verify the power out of the fiber itself with an external power meter. Some power losses are to be expected when making the

	connection from the external fiber to the instrument's input connector internal fiber. Increase the amount of input laser power if possible. If the problem cannot be resolved, contact New Focus customer support for assistance.
Scan Engine: No Trigger	The interferometer's moving assembly is not moving, or there is a problem with the drive mechanism. Contact New Focus customer support for assistance.
Input Laser: Wavelength Out of Range	The input laser wavelength has been measured to be outside the instrument's operating range of 700 nm to 1650 nm. Contact New Focus customer support for assistance.
DUT Laser: Out of Range	Input laser power is too high, and it has been measured as greater than 10 mW by the instrument. Immediately lower the input laser's power. Excessive input laser power may damage the instrument.

8.2 Fiber End Cleaning

A clean fiber optic connector is critical for accurate measurements with the WM-1210 Wavemeter as well as preventing damage to the instrument's optical input. Using a dirty input laser fiber, even if the contamination is not visible to the naked eye, may damage the optical input, resulting in permanent damage and loss of instrument sensitivity.

Always ensure any optical fiber ferrule inserted into the WM-1210 Wavemeter is completely clean. New Focus suggests inspecting, cleaning, and re-inspecting a fiber's tip before inserting it into the instrument's optical connector.

1. Inspect the fiber end with a fiber microscope.
2. Gently wipe the fiber tip with a lint-free swab wetted with pure isopropyl alcohol. Do not use any hard metal or plastic objects to scrape the fiber end.

3. Inspect the fiber end again with a fiber microscope. If dirt and debris is still present, repeat the cleaning and inspection procedure until it is clean.

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