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User's Guide

WDM Channel Analysis Application

(For the Agilent 86140-Series Optical Spectrum Analyzer)



Agilent Technologies

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`Display type` for words or characters displayed on the computer's screen or instrument's display.

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Using the Application

About the Application

The WDM channel analysis application gives accurate wavelength, power and optical signal-to-noise ratio measurements. The results are displayed in an easy-to-read table. The WDM channel analysis application calculates the following statistics and display the results in the table:

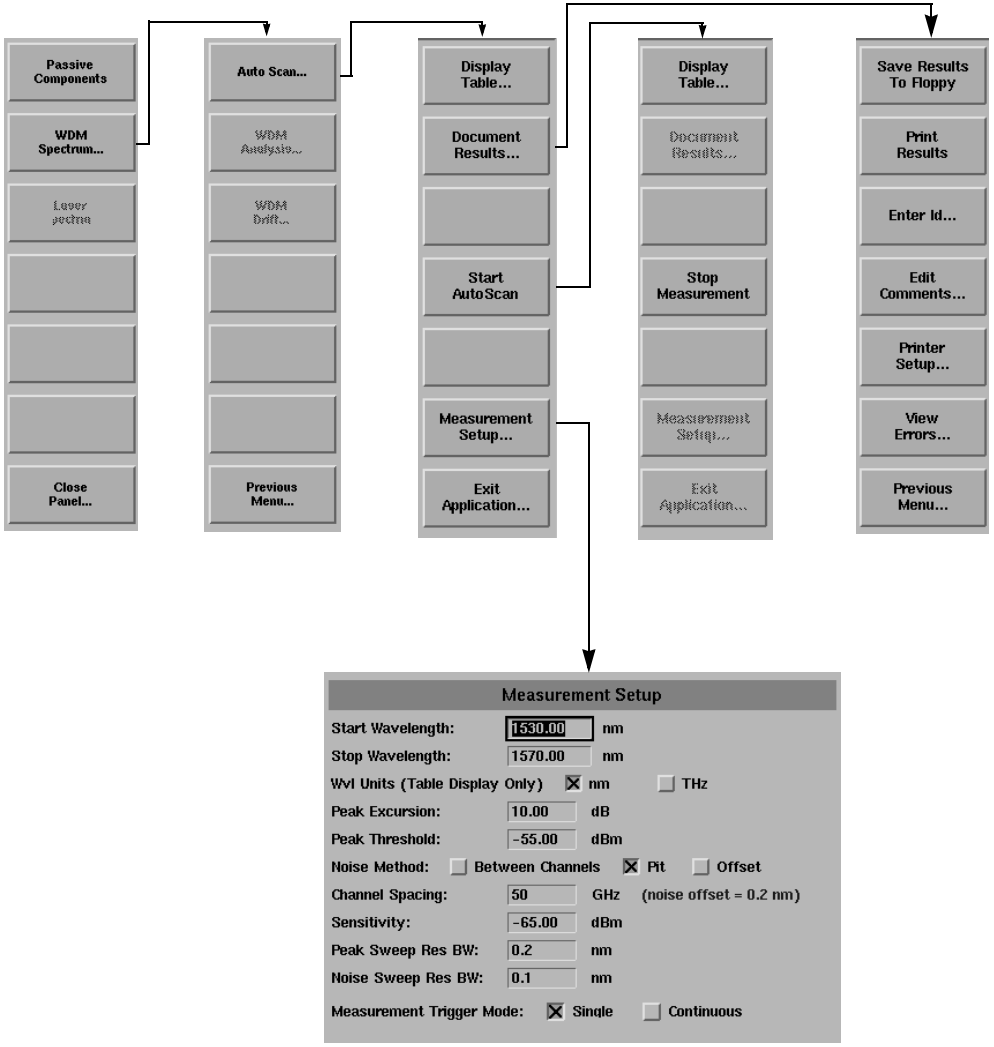
- Channel number for the channel with the maximum power
- Maximum channel power (dBm)
- Channel number for the channel with the minimum power
- Minimum channel power (dBm)
- Channel number for the channel with the maximum optical signal-to-noise ratio
- Maximum optical signal-to-noise ratio (dB)
- Channel number for the channel with the minimum optical signal-to-noise ratio
- Minimum optical signal-to-noise ratio (dB)
- Span tilt (dB/nm)
- Span tilt (dB)
- Peak-to-peak deviation, defined as:
  maximum channel power – minimum channel power

Using a noise sweep resolution bandwidth of 0.06 nm, the maximum wavelength span that can be measured is 75 nm. The maximum number of WDM channels that can be measured is 187.

The WDM channel analysis application uses a unique dual-sweep measurement technique. The first sweep uses a slightly broader filter to accurately measure signal power. The other sweep uses a very narrow band filter to measure the power density of the noise floor. The noise markers, which are corrected for filter shape, provide improved accuracy for the noise floor power density measurement which results in increased measurement accuracy of the optical signal-to-noise ratio.

This chapter provides a description of the user interface for this application. The behavior of the “Applications” menu of the OSA is also described.

The WDM Channel Analysis Application Menus



The application softkeys are accessed using the front-panel Appl's key or the Applications menu, Launch an Installed Application selection on the menu bar.

Function	See....
WDM Channel Analysis application	*"To start the WDM application" on page 1-6*
WDM Spectrum	*"To perform an autoscan" on page 1-9*
Display Table...	*"To display the results in a table" on page 1-15*
Document Results...	*"To document measurement results" on page 1-17*
Save Results to Floppy	*"To save the results to floppy" on page 1-18*
Print Results	*"To print the results" on page 1-19*
Enter ID...	*"To enter a device ID" on page 1-19*
Enter Comment...	*"To enter comments" on page 1-20*
Printer Setup	*"To set up the printer" on page 1-21*
Stop Measurement	*"To stop a measurement" on page 1-14*
Start Measurement	*"To start a measurement" on page 1-14*
Measurement Setup...	*"To set up a measurement" on page 1-10*
Exit Application	*"To exit the application" on page 1-21*

Starting the Application

This chapter explains how to start and use the WDM channel analysis application.

With the WDM channel analysis application you can test WDM sources, WDM multiplexers and other WDM components, such as filters and couplers.

To use the WDM channel analysis application you must:

1. Start the application, see “To start the WDM application” on page 1-6.
2. Set up the measurement, see “To set up a measurement” on page 1-10.
3. Measure the device under test.

You can then:

- View the results in a table, see “To display the results in a table” on page 1-15.
- Save the results, see “To save the results to floppy” on page 1-18.
- Print the results, see “To print the results” on page 1-19.

To start the WDM application

1. Press the front-panel Appl's key or on the Applications menu select Launch an Installed Application.
2. The following screen is displayed.

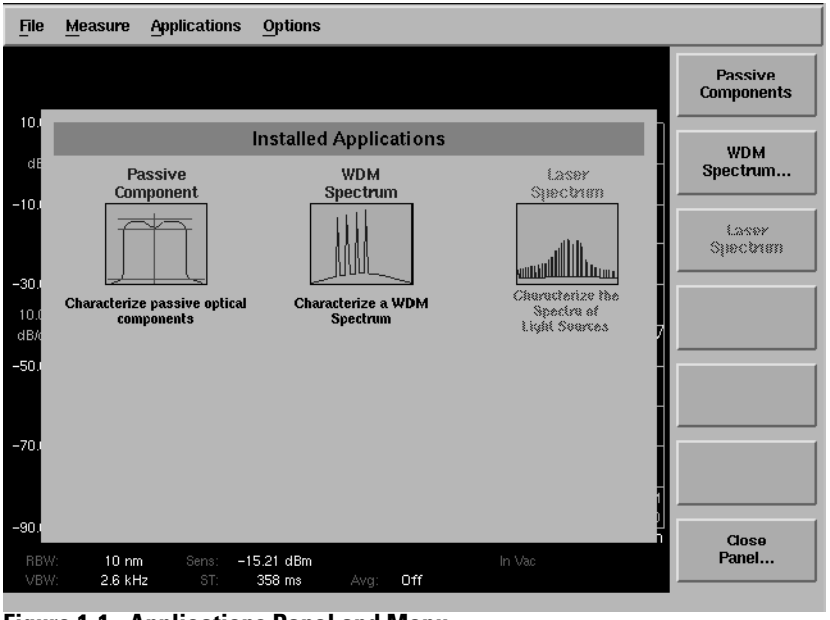
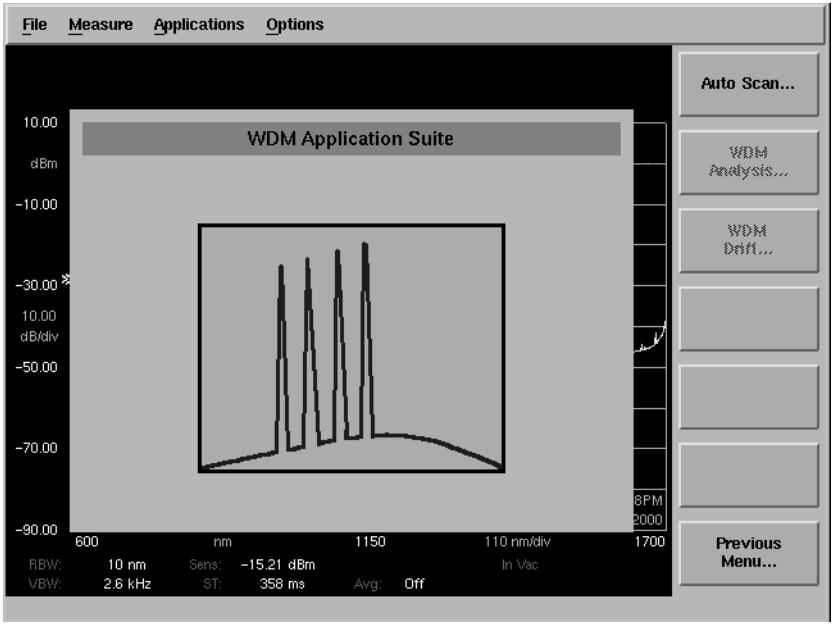


Figure 1-1. Applications Panel and Menu

The panel and the menu change whenever an application is installed or uninstalled. Each installed application has an icon on the panel and a corresponding softkey.

3. Press the *WDM Spectrum* softkey. This opens the WDM Application Suite window.



4 Press the *Auto Scan....* softkey to launch the WDM channel analysis application. The application is now ready for use.

Performing Measurements

This section provides procedures for performing the following functions:

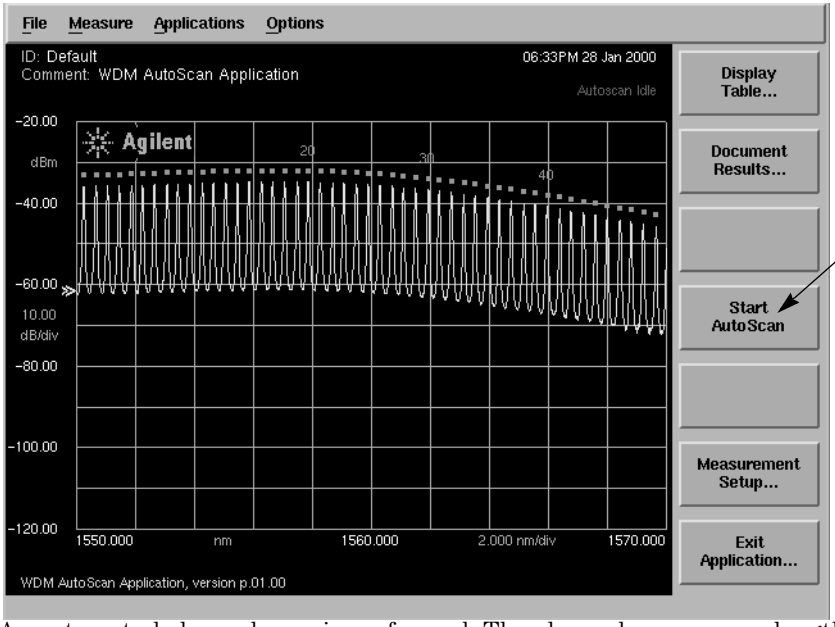
To start the WDM application 1-6
To perform an autoscan 1-9
To set up a measurement 1-10
To start a measurement 1-14
To stop a measurement 1-14
To display the results in a table 1-15
To change the wavelength units in the table 1-16
To document measurement results 1-17
To save the results to floppy 1-18
To print the results 1-19
To enter a device ID 1-19
To enter comments 1-20
To set up the printer 1-21
To exit the application 1-21

Note

The following functions assume the WDM application is loaded.

To perform an autoscan

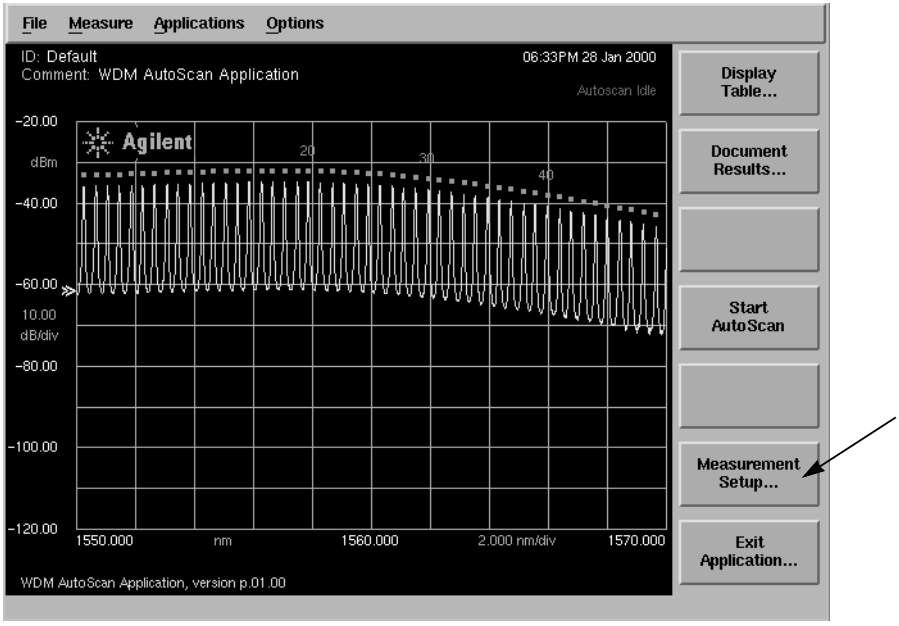
Press the *Start AutoScan....* softkey.



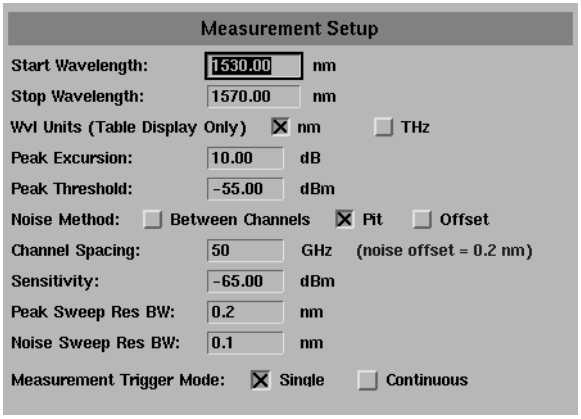
An automated channel scan is performed. The channel power, wavelength, optical signal-to-noise ratio, spectral gain tilt, and other statistics can be displayed either graphically or in a tabular format.

To set up a measurement

Press the *Measurement Setup...* softkey to open the Measurement setup menu and panel. This softkey is enabled whenever the system is not actively measuring.



The Measurement Setup panel opens.



WDM Measurement Setup panel

Setup panel selections

Start Wavelength

Set the start wavelength for the Auto Scan function.

Stop Wavelength

Set the stop wavelength for the Auto Scan function.

Wvl Units

Select the wavelength units, either nm or THz, used in the tabular display.

Peak Excursion

Set the peak excursion value in dB.

Peak Threshold

Set the peak threshold value in dBm.

Noise Method

Select the noise method used. You can choose *Between Channels*, *Pit*, or *Offset*.

Channel Spacing

Set the channel spacing value in GHz.

Sensitivity

Set the sensitivity value in dBm.

Note

Increasing sensitivity results in a more precise scan but increases the scan time.

Peak Sweep Res BW

Set the resolution bandwidth value to be used during peak sweep.

Noise Sweep Res BW

Set the resolution bandwidth value to use during noise sweep.

> **Note**
>
> Decreasing the resolution bandwidth provides a more accurate sweep but increases the scan time.

Measurement Trigger Mode

Select either single or continuous trigger mode. The default is single trigger mode.

The navigation key operation is explained in "To fill in a setup panel" on page 1-22.

Default Measurement Settings

Default Measurement Settings

Start Wavelength	Default: 1530 nm Reset by pressing the *Defaults* softkey, otherwise retains the previous setting from the last time the application was started. Value is entered from the keypad or incremented using the RPG. Units are fixed in nm.
Stop Wavelength	Default: 1570 nm Reset by pressing the *Defaults* softkey, otherwise retains the previous setting from the last time the application was started. Value is entered from the keypad or incremented using the RPG. Units are fixed in nm.
Wavelength Units	Reset by pressing the *Defaults* softkey, otherwise retains the previous setting from the last time the application was started. Units can be selected to be displayed (in tabular display mode only) in nm or in THz. If THz units are selected, the channel numbers stay the same, for example, the left-most peak on the graphical display will still be labeled #1. The actual wavelength values in the tabular display will change to reflect the THz equivalent.
Channel Spacing	Default: 50 GHz Reset by pressing the *Defaults* softkey, otherwise retains the previous setting from the last time the application was started. Value is entered from the keypad or incremented using the RPG. This value is the spacing between adjacent channels on the input signal. This value is used to calculate the noise offset value to use (noise offset = 1/2 channel spacing). The calculated noise offset value is displayed to the right of the channel spacing.

Default Measurement Settings

Peak Excursion	Default: 10 dB Same as the next peak excursion criteria in the base OSA. This is the level the trace has to go up and down for a spectral feature to be considered a peak. The default value is 10 dB. Reset by pressing the *Defaults* softkey, otherwise retains the previous setting from the last time the application was started. Value is entered from the keypad or incremented using the RPG. Units are fixed in dB.
Noise Measured at	Default: Pit Reset by pressing the *Defaults* softkey, otherwise retains the previous setting from the last time the application was started.
Between Channels check box	When selected (X), the Noise marker is placed half-way between channels when making a noise power density measurement. The Noise power density used in the OSNR calculation is linearly interpolated between the noise marker to the left and to the right of the channel.
Pit check box	Places the noise marker at the lowest point between adjacent channels. The Noise power density used in the OSNR calculation is linearly interpolated between the noise marker to the left and to the right of the channel.
Offset check box	Places the noise marker 'noise offset' to the left and to the right of the channel when making a noise power density measurement. The Noise power density used in the OSNR calculation is linearly interpolated between the noise marker to the left and to the right of the channel.
Sensitivity	Default: –65 dBm User determines sensitivity by typing value in box. Units are fixed in dBm.
Peak RBW	Default: 0.2 nm User selectable value. Units are fixed in nm. Default/recommended value is 0.2 nm.
Noise RBW	Default: 0.1 nm User selectable value. Units are fixed in nm. Default/recommended value is 0.01 nm.
Measurement Trigger Mode	Default: Single Application can either make a single measurement or be in continuous measurement mode until stopped. User selectable trigger mode.
Scale/div	10 dB/div
Noise Marker	Normalized to 0.1 nm

To start a measurement

1 Press the *Start AutoScan* softkey to start the measurement process.

A 2-sweep measurement is initiated. After the measurement is completed, the system either stops (Measurement Trigger Mode = Single), or initiates another 2-sweep measurement (Measurement Trigger Mode = Continuous).

Once the measurement is stopped, the button label changes to *Stop Measurement*.

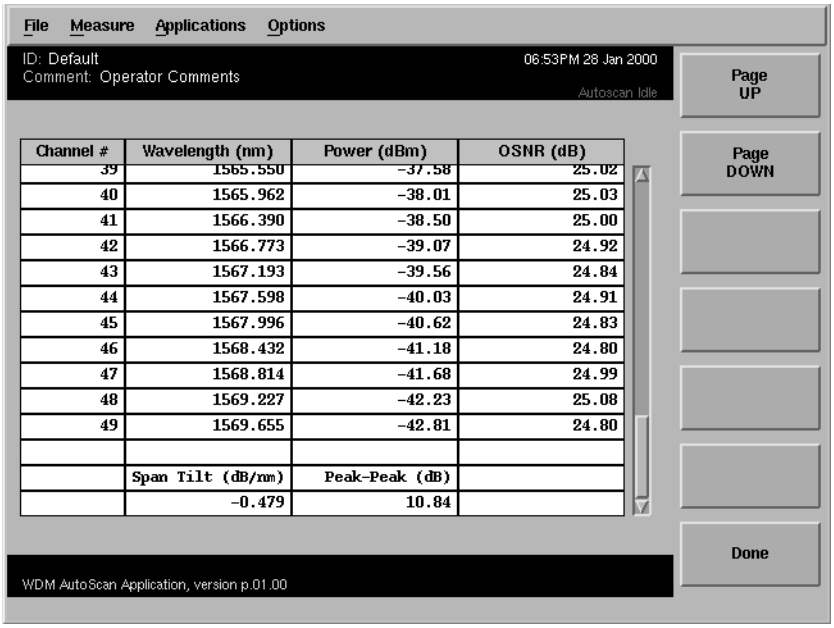
To stop a measurement

Press the *Stop Measurement* to stop a measurement in progress.

Selecting this softkey will stop the 2-sweep measurement cycle mid-sweep. Once the measurement is stopped, the button label changes to *Start AutoScan*.

To display the results in a table

Press the *Display Table....* softkey. The results are displayed in a table similar to the one shown below.



Channel #	Wavelength (nm)	Power (dBm)	OSNR (dB)
39	1565.550	-37.58	25.02
40	1565.962	-38.01	25.03
41	1566.390	-38.50	25.00
42	1566.773	-39.07	24.92
43	1567.193	-39.56	24.84
44	1567.598	-40.03	24.91
45	1567.996	-40.62	24.83
46	1568.432	-41.18	24.80
47	1568.814	-41.68	24.99
48	1569.227	-42.23	25.08
49	1569.655	-42.81	24.80
	Span Tilt (dB/nm)	Peak-Peak (dB)	
	-0.479	10.84	

Page Up	display the previous page of results, if possible.
Page Down	display the next page of results, if possible.
Done	exit the tabular display and return to the Auto Scan main menu.

The WDM channel analysis application calculates the following statistics and display the results at the bottom of the table:

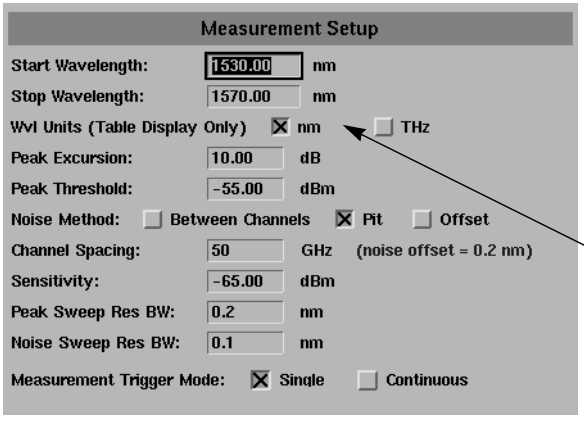
- Channel number for the channel with the maximum power
- Maximum channel power (dBm)
- Channel number for the channel with the minimum power
- Minimum channel power (dBm)
- Channel number for the channel with the maximum optical signal-to-noise ratio
- Maximum optical signal-to-noise ratio (dB)
- Channel number for the channel with the minimum optical signal-to-noise

ratio
- Minimum optical signal-to-noise ratio (dB)
- Span tilt (dB/nm)
- Span tilt (dB)
- Peak-to-peak deviation, defined as:
  maximum channel power – minimum channel power

Using a noise sweep resolution bandwidth of 0.06 nm, the maximum wavelength span that can be measured is 75 nm. The maximum number of WDM channels that can be measured is 187.

To change the wavelength units in the table

1 Press the *Measurement Setup....* softkey. The following window opens.



Measurement Setup panel

2 Select the desired units for the table. You can select either nanometers or terahertz.

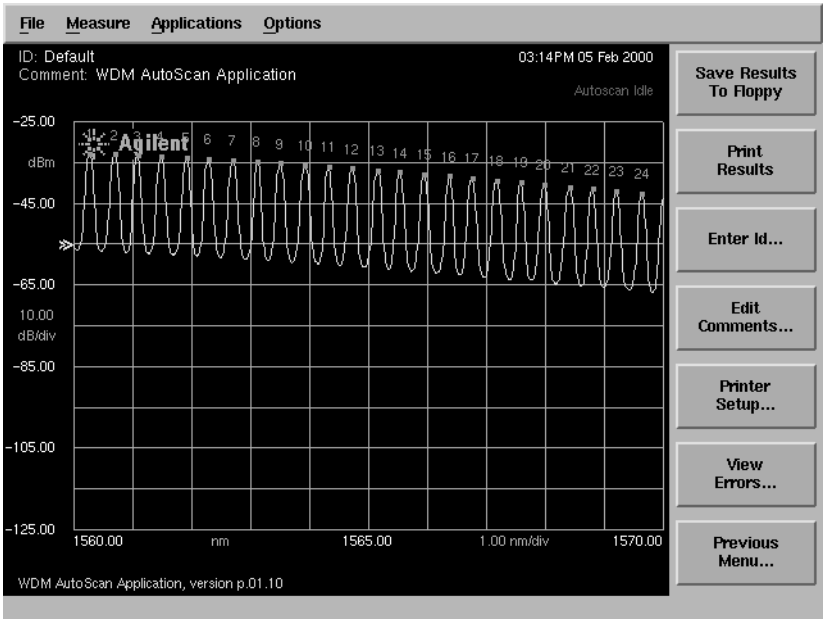
3 Press the *Close Panel....* softkey when you are finished making your selections.

To document measurement results

There are two ways to document results in the WDM Application. You can either print them to a printer (specified under printer setup) or you can save them to a floppy disk.

When the instrument is not sweeping, the *Document Results...* key of the WDM Application Main Menu is enabled.

1 Press the *Document Results...* softkey. The following window opens.

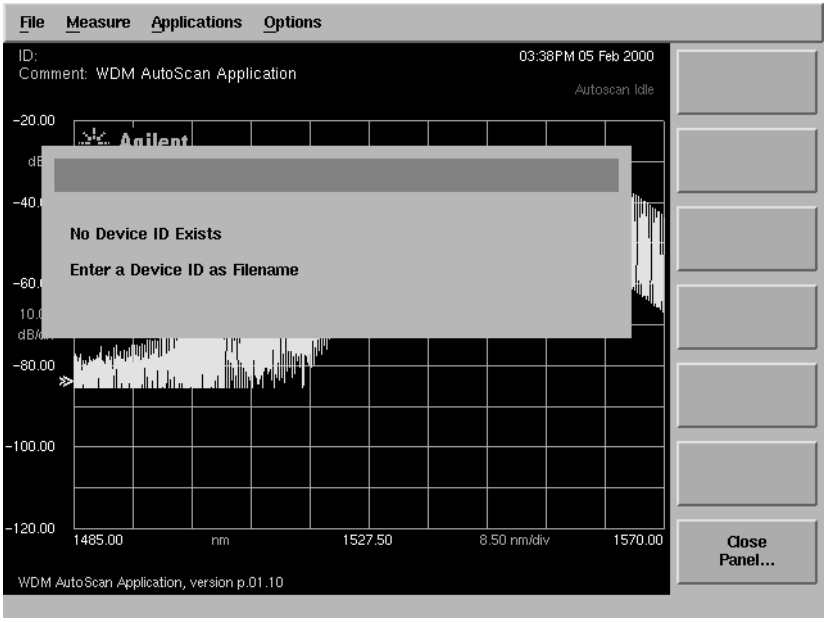


Document Results Menu

To save the results to floppy

Press the *Save Results to Floppy* softkey to save the current results to a file on the floppy drive.

The name of the file is defined as the last 8 characters of the ID. If no ID exists, a message prompts the user to `"Enter a Device ID as file-name"`. See "To enter a device ID" on page 1-19 for additional information.



Save Dialog Panel and Menu

If the ID already exists, the warning "`Overwrite File?`" is displayed.

The current file is saved in *.csv* spreadsheet format.

To print the results

1. Press the *Print Results* softkey to print the results to the target printer.

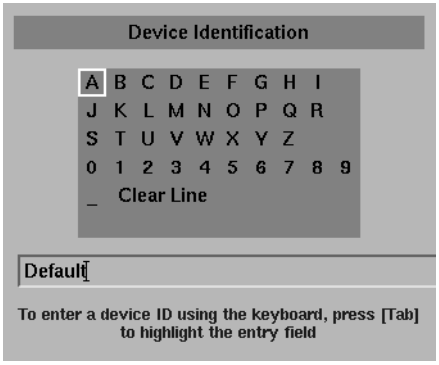
   The target printer is as set by factory default, otherwise it retains the previous setting from the last time the application was started.

2. To change the target printer, press the *Printer Setup* softkey.

3. The print operation is confirmed by a progress message displayed in the standard progress panel used in the base instrument.

To enter a device ID

1. Press the *Enter ID...* softkey to access the Device Identification panel

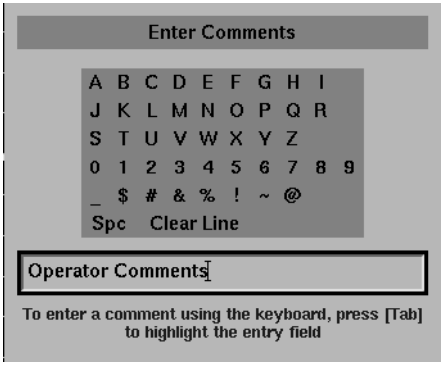


Device Identification panel

Entering characters and navigating this panel is explained in "To use the alphanumeric panel softkeys" on page 1-24.

To enter comments

1 Press the *Enter Comments...* softkey to access the Enter Comments panel.



Enter Comments panel

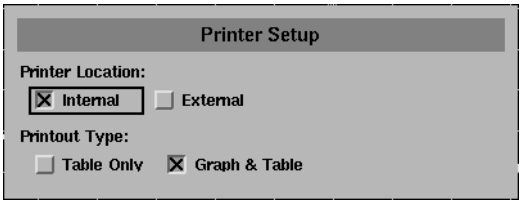
Entering characters and navigating this panel is explained in "To use the alphanumeric panel softkeys" on page 1-24.

To set up the printer

1 Press the *Printer Setup* softkey to access the Printer Setup panel.

The default setting is the internal printer and the default printout type is table only.

2 Use the check boxes to select the target printer, either external or internal, and the printout type. This setting is reset by when the front-panel Preset key is pressed, otherwise the previous setting from the last time the application was started is retained.



Printer Setup panel

Navigating and filling in the setup panel is explained in "To fill in a setup panel" on page 1-22.

Previous Menu... Returns to the Auto Scan Menu.

To exit the application

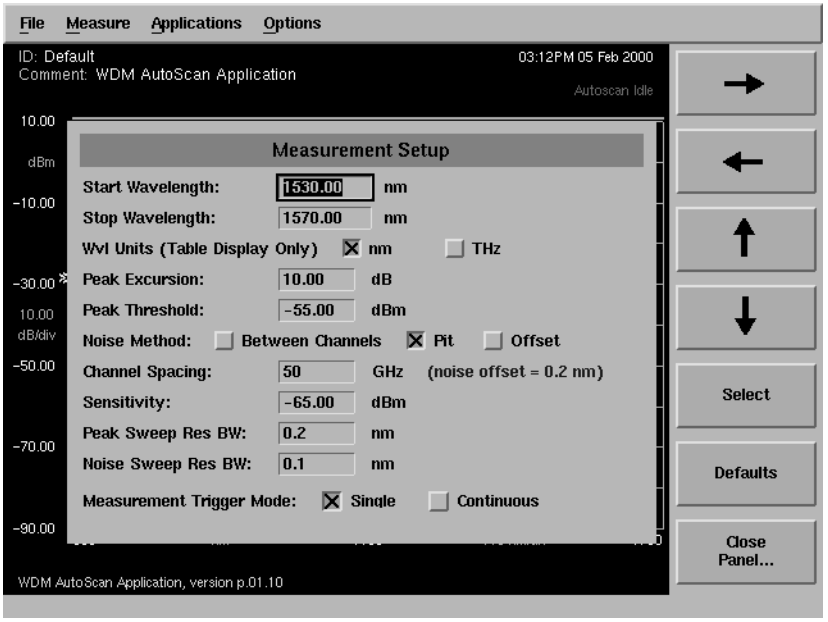
1 Press the *Exit Application* softkey to exit the Autoscan application.

Using the Setup Panels

Any of the instrument settings can be changed by using either the front-panel keys or the menu bar selections. Many of the menu selections and front-panel keys display a softkey panel. Settings in softkey panels are changed using the softkeys, data-entry keys, mouse, and trackball.

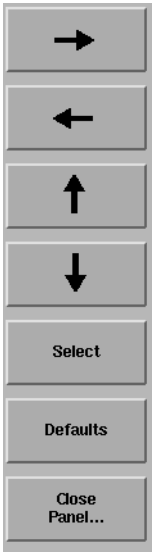
To fill in a setup panel

Setup panels, such as the Measurement Setup panel, allow you to adjust setup conditions which are not frequently changed.



An example of a setup panel

Using the softkeys



The arrow softkeys

Allow you to navigate from field to field in the dialog box. The highlighted parameter can be changed.

The Select softkey

Selects or deselects the highlighted parameter.

The Defaults softkey

Resets the parameters to their default condition.

Close Panel.... softkey

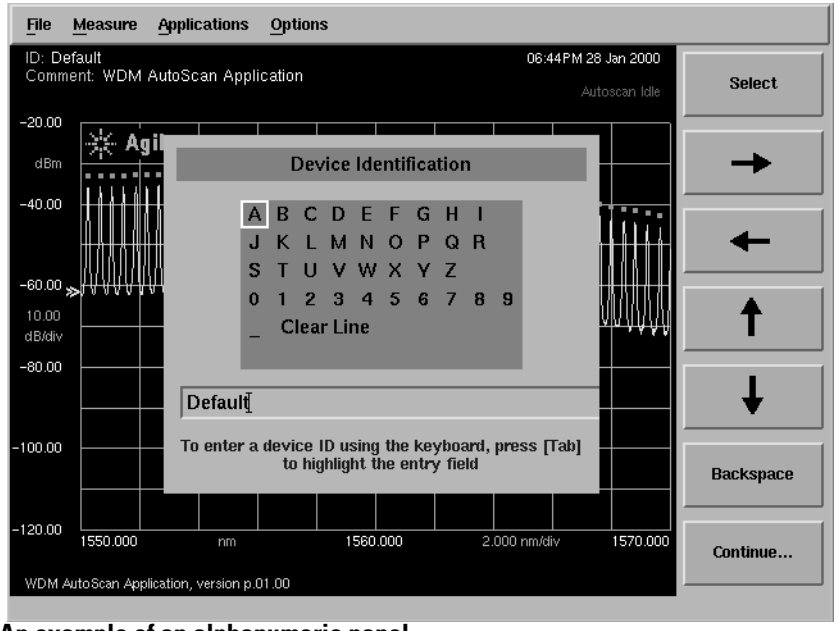
Saves the current setup and returns you to the previous menu.

The front-panel number keys, step keys, and knob

Allow you to enter a numeric value in the highlighted field.

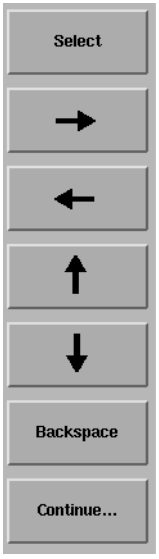
To use the alphanumeric panel softkeys

Alphanumeric panels, such as the Device ID panel, allow you to enter identification and comment labels for the devices you test.



An example of an alphanumeric panel

Using the softkeys



The arrow softkeys

Allow you to navigate from character to character in the dialog box.

The Select softkey

Selects the highlighted character.

The Backspace softkey

Removes a previously selected character.

Continue.... softkey

Saves the current entry and returns you to the previous menu.

2

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Remote Commands

WDM Channel Analysis Application Remote Commands

The user's guide for the mainframe provides detailed information on remote programming of the instrument. Only commands unique to the WDM application are included in this chapter.

The WDM channel analysis application application remote command set is comprised of two types of commands:

General Application support commands

These are part of the base firmware and support applications in general. These commands allow the user to get a list of installed applications, load/unload an application, etc.

WDM channel analysis application specific commands

These remote commands are specific to the WDM channel analysis application and allow the user to control the WDM channel analysis application remotely.

Command Conventions

Convention	Description
< >	Angle brackets indicate text strings entered by the developer.
[ ]	Square brackets indicate that the keyword DEFAULT can be used instead of a value or a variable for that parameter. Refer to the actual command description for the behavior when the DEFAULT keyword is used for a parameter.
|	Indicates a choice of one element from a list.
{ }	Braces indicate a group of constants to select from. Each constant is separated by the | character.
name	Indicates the variable for which you provide a descriptive name. Any letter (Aa-Zz) followed by letters, digits (0-9) and underscore (_). Only the first 32 characters are significant.
spec_min	–infinity. The parameter *spec_min* cannot be a variable, only a constant or DEFAULT.
spec_max	+infinity. The parameter *spec_max* cannot be a variable, only a constant or DEFAULT.
from	Start wavelength or frequency of trace in nm (default) or THz.
to	Stop wavelength or frequency of trace in nm (default) or THz.
excursion	+excursion: means excursion dBs up (for example, from a pit). -excursion: means excursion dBs down (for example, from a peak).
ref_pt	The reference point to be used for a measurement keyword.

CALCulate Subsystem Commands

The CALCulate subsystem performs post-acquisition data processing. The CALCulate subsystem operates on data acquired by a SENSe function. For more information, refer to page 4-1 of the *1997 SCPI Command Reference*.

`CALCulate:DATA:CPOWers?`

This command allows the user to download the array of channel powers measured. The data is returned in either an ASCII or binary form as determined by the FORMat:DATA command. The number of data points in this array is determined by the CALCulate:DATA:NCHannels? query.

`CALCulate:DATA:CSNR?`

This command allows the user to download the array of channel OSNR values measured. The data is returned in either an ASCII or binary form as determined by the FORMat:DATA command. The number of data points in this array is determined by the CALCulate:DATA:NCHannels? query.

`CALCulate:DATA:CSTats?`

This command allows the user to download the following statistics using a single query:

- Channel number for the channel with the maximum power
- Maximum channel power (dBm)
- Channel number for the channel with the minimum power
- Minimum channel power (dBm)
- Channel number for the channel with the maximum optical signal-to-noise ratio
- Maximum optical signal-to-noise ratio (dB)
- Channel number for the channel with the minimum optical signal-to-noise

ratio
- Minimum optical signal-to-noise ratio (dB)
- Span tilt (dB/nm)
- Span tilt (dB)
- Peak-to-peak deviation, defined as:
  maximum channel power – minimum channel power

Using a noise sweep resolution bandwidth of 0.06 nm, the maximum wavelength span that can be measured is 75 nm. The maximum number of WDM channels that can be measured is 187.

The data is returned in either an ASCII or binary form as determined by the FORMAT:DATA command.

`CALCulate:DATA:CWAVelengths?`

This command allows the user to download the array of channel wavelengths measured. The data is returned in either an ASCII or binary form as determined by the FORMat:DATA command. The number of data points in this array is determined by the CALCulate:DATA:NCHannels? query. The units are either nanometers or terahertz and can be changed using the CALCulate:DATA:TABLe:WAVe command.

`CALCulate:DATA:NCHannels?`

This command allows the user to query the number of channels detected in the last measurement. The data is returned as an ASCII integer.

`CALCulate:DATA:TABLe:WAVe NM|THZ`

`CALCulate:DATA:TABLe:WAVe?`

Sets the wavelength units used for the tabular display and for the CALCulate:DATA:CWAVelengths remote query. The instrument x-axis display always displays wavelength in nanometers and is not affected by this command.

`CALCulate:PEXcursion[:PEAK] <numeric_value>`

`CALCulate:PEXcursion[:PEAK]?`

Sets the peak excursion value for the marker search routines. The peak excursion value is used to determine whether or not a local maximum in the trace is to be considered a peak. To qualify as a peak, both sides of the local maximum must fall by at least the peak excursion value.

```
CALCulate:THReshold <numeric_value> [W|MW|UW|DBM]
CALCulate:THReshold?
```

Specifies the value for the peak search threshold. Peaks with amplitudes below this value will not be included in the channel count.

Default units are DBM.

DISPlay Subsystem Commands

```
DISPlay[:WINDow[1]]:TRACe:Y[:SCALe]:RLEVel <numeric_value>[W|MW|UW|DBM]
DISPlay[:WINDow[1]]:TRACe:Y[:SCALe]:RLEVel?
```

Specifies the value of the reference level. Default units are DBM. Starting a measurement from the front panel sets the reference level automatically based on the maximum channel power. The reference level needs to be set manually when using the instrument remotely.

FORMat Subsystem Commands

```
FORMat[:DATA] REAL[32,64]|ASCII
FORMat[:DATA]?
```

Specifies the trace data format used during data transfer via HP-IB. This command affects data transfers for the CALCulate[:DATA] subsystem. The ASCII format is a comma-separated list of numbers. The REAL format is a definite-length block of 64-bit floating-point binary numbers. The definite-length block is defined by IEEE 488.2: a "#" character, followed by one digit (in ASCII) specifying the number of length bytes to follow, followed by the length (in ASCII), followed by length bytes of binary data. The binary data is a sequence of 8-byte (64-bit) floating point numbers.

INITiate Subsystem Commands

`INITiate:IMMediate`

Initiates a new 2-sweep WDM measurement.

INSTrument Subsystem Commands

```
INSTrument:CATalog?
{OSA,PassiveComponent,WDM_AutoScan<null>}
```

Comma-separated list of strings representing the Modes and Applications supported in the instrument.

```
INSTrument:CATalog:FULL?
{OSA,0PassiveComponent,1,WDM_AutoScan,2}
```

Comma-separated list of string-numeric pairs representing

The Modes and Applications supported in the instrument.

```
INSTrument:SELect <identifier>          identifier - string
INSTrument:NSELect <numeric_value>
INSTrument:NSELect?
```

Loads the application or instrument mode specified.

Example

```
INSTrument:SELect "WDM_AutoScan"
INSTrument:NSELect 2
```

SENSe Subsystem Commands

```
SENSe:BANDwidth|BWIDth[:RESolution]:NOISe <numeric_value> [M|NM|UM|A]
SENSe:BANDwidth|BWIDth[:RESolution]:NOISe?
```

Specifies the resolution bandwidth value used for the ‘noise’ sweep in the 2-sweep measurement mode. Default units are M.

```
SENSe:BANDwidth|BWIDth[:RESolution]:PEAK <numeric_value> [M|NM|UM|A]
SENSe:BANDwidth|BWIDth[:RESolution]:PEAK?
```

Specifies the resolution bandwidth value used for the ‘peaks’ sweep in the 2-sweep measurement mode. Default units are M.

```
SENSe:CHANnel:SPACing <numeric_value> [HZ|KHZ|MHZ|GHZ]
SENSe:CHANnel:SPACing?
```

Specifies the value for channel spacing. Default units are GHZ.

```
SENSe:NOISe [PIT|FIXED|HD]
SENSe:NOISe?
```

Specifies how the noise measurement locations are determined (pit, fixed offset, or half-distance between channels).

```
SENSe:POWer[:DC]:RANGe:LOWer <numeric_value> [W|MW|UW|DBM]
SENSe:POWer[:DC]:RANGe:LOWer?
```

Specifies the sensitivity value used for the WDM channel analysis application measurements. Default units are DBM.

> The maximum value for sensitivity is +300 dBm. The minimum value is the value that causes the sweep time to become 1000 seconds, and is an attribute of each individual optical spectrum analyzer. The minimum value will always be less than the values for sensitivity shown in the Specifications section of the User's Guide.

```
SENSe:[WAVelength:]STARt <numeric_value> [M|NM|UM|A|HZ|KHZ|MHZ|GHZ]
SENSe:[WAVelength:]STARt?
```

Specifies the start wavelength for the WDM channel analysis application. Default units are M.

```
SENSe:[WAVelength:]STOP <numeric_value> [M|NM|UM|A|HZ|KHZ|MHZ|GHZ]
SENSe:[WAVelength:]STOP?
```

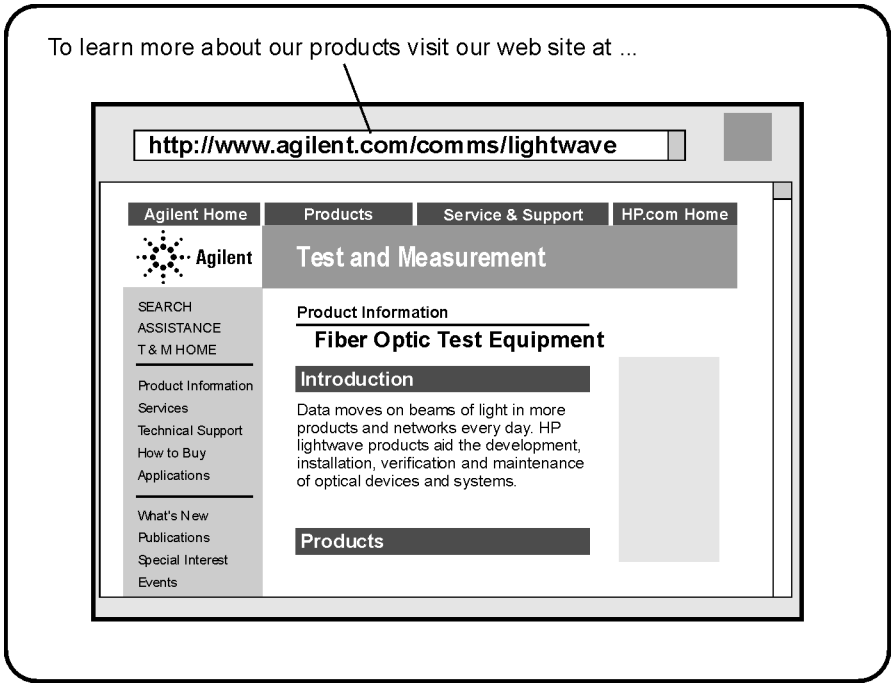
Specifies the stop wavelength for the WDM channel analysis application. Default units are M.

3

Contacting Agilent Technologies

Contacting Agilent Technologies

To learn more about your optical spectrum analyzer and other lightwave optical communication test solutions, visit our Internet web site. Before returning an instrument for service, call the Agilent Technologies Instrument Support Center at (800) 403-0801, visit the Test and Measurement Web Sites by Country page at http://www.tm.agilent.com/tmo/country/English/index.html, or call one of the numbers listed below. See “Agilent Technologies Service Offices” on page 3-4 for a list of service centers.



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To learn more about Fiber Optic Test Equipment, go to the Agilent Technologies home page listed above, and follow this path:

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3. Under Products, click Fiber Optic Test Equipment.

This path will take you to the Fiber Optic Test Equipment page. Alternately, you can enter the URL for this page directly:

http://www.tm.agilent.com/tmo/Products/English/FiberOpticTestEquipment.html

Agilent Technologies Service Offices

Before returning an instrument for service, call the Agilent Technologies Instrument Support Center at (800) 403-0801, visit the Test and Measurement Web Sites by Country page at http://www.tm.agilent.com/tmo/country/English/index.html, or call one of the numbers listed below.

Agilent Technologies Service Numbers

Austria	01/25125-7171
Belgium	32-2-778.37.71
Brazil	(11) 7297-8600
China	86 10 6261 3819
Denmark	45 99 12 88
Finland	358-10-855-2360
France	01.69.82.66.66
Germany	0180/524-6330
India	080-34 35788
Italy	+39 02 9212 2701
Ireland	01 615 8222
Japan	(81)-426-56-7832
Korea	82/2-3770-0419
Mexico	(5) 258-4826
Netherlands	020-547 6463
Norway	22 73 57 59
Russia	+7-095-797-3930
Spain	(34/91) 631 1213
Sweden	08-5064 8700
Switzerland	(01) 735 7200
United Kingdom	01 344 366666
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