HP 71450B/1B/2B Optical Spectrum Analyzers

HP Part No. 70950-90070
Edition 2
Printed in USA June 1998

1400 Fountaingrove Parkway,
Santa Rosa, CA
95403-1799, USA

Certification

Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology, to the extent allowed by the Institute's calibration facility, and to the calibration facilities of other International Standards Organization members.

Regulatory Information The specifications and characteristics chapter contains regulatory information.

Warranty

This Hewlett-Packard instrument product is warranted against defects in material and workmanship for a period of one year from date of shipment. During the warranty period, Hewlett-Packard Company will, at its option, either repair or replace products which prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by Hewlett-Packard. Buyer shall prepay shipping charges to Hewlett-Packard and Hewlett-Packard shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to Hewlett-Packard from another country.

Hewlett-Packard warrants that its software and firmware designated by Hewlett-Packard for use with an instrument will execute its programming instructions when properly installed on that instrument. Hewlett-Packard does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error-free.

Limitation of Warranty

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

NO OTHER WARRANTY IS EXPRESSED OR IMPLIED. HEWLETT-PACKARD SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Exclusive Remedies

THE REMEDIES PROVIDED HEREIN ARE BUYER'S SOLE AND EXCLUSIVE REMEDIES. HEWLETT-PACKARD SHALL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.

Assistance

Product maintenance agreements and other customer assistance agreements are available for Hewlett-Packard products.

For any assistance, contact your nearest Hewlett-Packard Sales and Service Office.

Safety Symbols

The following safety symbols are used throughout this manual. Familiarize yourself with each of the symbols and its meaning before operating this instrument.

CAUTION

The *caution* sign denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in damage to or destruction of the instrument. Do not proceed beyond a *caution* sign until the indicated conditions are fully understood and met.

WARNING

The *warning* sign denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a *warning* sign until the indicated conditions are fully understood and met.

General Safety Considerations

WARNING

Before this instrument is switched on, make sure it has been properly grounded through the protective conductor of the ac power cable to a socket outlet provided with protective earth contact.

Any interruption of the protective (grounding) conductor, inside or outside the instrument, or disconnection of the protective earth terminal can result in personal injury.

WARNING

There are many points in the instrument which can, if contacted, cause personal injury. Be extremely careful.

Any adjustments or service procedures that require operation of the instrument with protective covers removed should be performed only by trained service personnel.

CAUTION

Before this instrument is switched on, make sure its primary power circuitry has been adapted to the voltage of the ac power source.

Failure to set the ac power input to the correct voltage could cause damage to the instrument when the ac power cable is plugged in.

In This Book

This reference provides definitions for all hardkeys, softkeys, and error messages. You'll also find specifications and characteristics, menu maps, and other important information. Key definitions are organized in alphabetical order for quick access.

Chapter 1	"Specifications and Characteristics" contains HP 71450B/1B/2B specification and characteristic information.
Chapter 2	"Menu Maps" show the hierarchical structure of the various softkey menus.
Chapter 3	"Dictionary Reference" defines all hardkeys and softkeys in alphabetical order.
Chapter 4	"Error Messages" gives definitions for error codes that may be displayed on the HP 71450B/1B/2B.
Chapter 5	"Concepts" presents information for a deeper understanding of optical spectrum analysis theory and application.
Chapter 6	"Tables and Charts" supplies miscellaneous operating information that you may need.

Contents

1

Specifications and Characteristics

Specifications and Characteristics

This chapter contains specifications and characteristics for HP 71450B/1B/2B optical spectrum analyzer systems. The HP 71450B includes an HP 70950B module. The HP 71451B includes an HP 70951B module. The HP 71452B includes an HP 70952B module.

The specifications in this chapter apply to all functions autocoupled over the temperature range 0 °C to +55 °C and relative humidity < 95% (unless otherwise noted). All specifications apply after the instrument's temperature has been stabilized after 1 hour continuous operation and the auto-align routine has been run. Unless otherwise noted, specifications apply without USER CAL.

Specifications

Specifications describe warranted performance.

Characteristics

Characteristics provide useful, but nonwarranted, information about the functions and performance of the instrument. *Characteristics are printed in italics*.

Calibration cycle

HP warrants instrument specifications over the recommended calibration interval. To maintain specifications, periodic recalibrations are necessary. We recommend that the HP 71450B/1B/2B optical spectrum analyzer be calibrated at an HP service facility every 24 months.

Contents

Definitions of Terms

Wavelength

- *Absolute Accuracy (after user cal)* refers to the wavelength accuracy after the user has performed the internal wavelength calibration using a source of known wavelength.
- *Multimode Fiber Coupling Uncertainty* refers to additional wavelength error which can occur from the loss of control of the image size and angle that the light is launched into the OSA. Multiple angles are a result of the multimoding in the larger fiber.
- *Span Linearity* is a measure of the deviation from a linear sweep.
- *Reproducibility* refers to the amount of wavelength drift which can occur over the specified time while the OSA is tuned to a specific wavelength.
- *Tuning Repeatability* refers to the wavelength accuracy of returning to a wavelength after having tuned to a different wavelength.

Resolution

- *FWHM* refers to the Full-Width-Half-Maximum resolutions that are available. This indicates the width at half power level of the signal after passing through the resolution slits.

Amplitude

- *Scale Fidelity* refers to the potential errors in amplitude readout at amplitudes other than at the calibration point. This specification is sometimes called linearity.
- *Flatness* defines a floating band which describes the error in signal amplitude over the indicated wavelength range. (This error may be removed at a given wavelength by performing the user amplitude calibration.)
- *Polarization Dependence* refers to the amplitude change that can be seen by varying the polarization of the light entering the OSA. This is not to be confused with amplitude variations caused by the varying distribution of energy between the different modes in fiber that is multimode at the wavelength of interest.

Sensitivity

- *Sensitivity* is defined as the signal level that is equal to six times the RMS value of the noise. Displayed sensitivity values are nominal. Slightly lower values may have to be entered to achieve specified sensitivity.

Dynamic Range

- *Dynamic Range* is a measure of the ability to see low-level signals that are located very close (in wavelength) to a stronger signal. In electrical spectrum analyzers, this characteristic is generally called shape factor.

Sweep Time

- *Maximum Sweep Rate* refers to the maximum rate that the instrument is able to acquire data and display it. This rate may be limited by multiple internal processes.
- *Sweep Cycle Time* refers to the time required to make a complete sweep and prepare for the next sweep. It can be measured as the time from the start of one sweep to the start of the next sweep.

Photodetector Input

- *Scale Fidelity: For any measurement with Fixed Reference Level* refers to the maximum error in a single power measurement. It also refers to the maximum error in the difference between two power measurements where the reference level was not changed between the measurements.
- *Scale Fidelity: For Multiple Measurements with Different Reference Levels* refers to the maximum error between two measurements when the reference level must be changed between the measurements.

Specifications: HP 71450B/1B/2B (HP 70950B/1B/2B)

Wavelength	
Range	600 nm—1700 nm
Span Range (continuously variable)	0.2 nm—full range and zero span
Absolute Accuracy*	±1 nm
HP 71450B/1B* (after user calibration)	±0.3 nm
HP 71452B* (after user calibration)	±0.2 nm
HP 71452B (after user calibration, within 40 nm of cal signal) (Characteristic)*	*±0.05 nm*
Span Linearity for spans ≤ 40 nm (Characteristic)*	*±0.05 nm*
Span Linearity HP 71452B (1530 nm — 1570 nm) (Characteristic)*	*±0.02 nm*
Reproducibility (1 minute)	±0.005 nm
Reproducibility (1 minute), HP 71452B (Characteristic)*	*±0.001 nm*
Tuning Repeatability	±0.005 nm
Tuning Repeatability HP 71452B (Characteristic)*	*±0.001 nm*
Settability	0.005 nm
Readout Resolution (Characteristic)	*Span / Trace Length*

Resolution Bandwidth*	
FWHM	< 0.08 and 0.1 nm—10 nm in a 1,2,5 sequence.†
FWHM of < 0.08 nm setting, HP 71452B (1530 nm — 1570 nm) (Characteristic)	*0.065 nm ±15%*
Resolution Accuracy: ≥0.5 nm, 1250 nm—1600 nm	±20%
0.1 nm—10 nm, 600 nm—1700 nm (Characteristic)	*±30%‡*
Corrected bandwidth accuracy for noise markers (1250 nm — 1600 nm):	
≥0.5 nm	±3%
0.2 nm, HP 71452B (Characteristic)	*±5%*
0.2 nm, HP 71452B Option 122	±5%

* With applied input fiber 9/125 μm.
† Resolution of 10 nm is available in first order only.
‡ The 2.0 nm resolution is nominally 2.5 nm in second order.

Specifications:
HP 71450B/1B/2B (HP 70950B/1B/2B)

Amplitude‡‡				
Calibration Accuracy*,† at −30 dBm, 1300 nm		±0.5 dB		
Scale Fidelity‡		**HP 71450B/1B**	**HP 71452B**	
	Autorange Off	±0.1 dB	±0.05 dB**	
	Autorange On	±0.2 dB	±0.07 dB**	
Step Response Accuracy		**HP 71450B/1B**	**HP 71452B**	
2 μs after rising edge		*±0.2 dB (Char.)*	*±0.2 dB (Char.)*	
10 μs after falling edge***		*±0.2 dB (Char.)*	±0.2 dB	
Signal-to-Noise Measurement Accuracy†††		**HP 71450B/1B**	**HP 71452B**	
	CW	±0.63 dB	±0.18 dB	
	Pulse mode	±0.68 dB	±0.29 dB	
Display Resolution	Log	0.01 dB		
	Linear	0.23% of measurement + 0.01% of reference level		
Display Scale		0.01 −20 dB log in 0.01 dB steps, and linear		
Flatness§§		**HP 71450B/1B**	**HP 71452B**	
	1290 nm—1330 nm*	±0.25 dB	±0.25 dB	
	1530 nm—1570 nm*	±0.25 dB	±0.2 dB	
	1250 nm—1600 nm*	±1 dB	±1 dB	
	750 nm—1600 nm§	*±1.5 dB (Char.)*	*±1.5 dB (Char.)*	
	600 nm—1700 nm§	*±2 dB (Char.)*	*±2 dB (Char.)*	
Polarization Dependence HP 71450B/1B/2B†		**1250 nm—1600 nm***	**750 nm—1600 nm**§	**600 nm—1700 nm**§
		±0.5 dB**	*±1.5 dB (Char.)*	*±2.5 dB (Char.)*
Polarization Dependence HP 71452B†, *, **		**1542 nm—1562 nm**	**1300 nm—1320 nm**	
		±0.05 dB	±0.125 dB	

* With applied input fiber 9/125 μm.

† For resolutions ≥0.2 nm.

‡ With sample detector. Within 20 dB of the sensitivity noise limit, noise effects dominate and may be reduced with video averaging. Scale fidelity is applied only once for marker delta measurements.

§ With applied input fiber that is standard single mode at wavelength of interest.

** Temperature range 20 °C to 30 °C.

‡‡ With physical contact connectors. Connector variations can affect amplitude accuracy which varies with such factors as connector type and quality, connector cleanliness, temperature, damage, and wear.

§§ Between 1350 nm and 1420 nm absorption of light by atmospheric moisture affects flatness. At room temperature, total humidity effects should be < 1 dB.

*** With ≤27 dB extinction ratio.

††† 1.15 x RSS of polarization sensitivity, scale fidelity, and resolution bandwidth accuracy (and step response accuracy in pulse mode).

Sensitivity*	
600 nm—750 nm (second order only)	−60 dBm
750 nm—900 nm (second order)	−75 dBm
750 nm—900 nm (first order)	−65 dBm
900 nm—1200 nm	−75 dBm
1200 nm—1600 nm	−90 dBm
1600 nm—1700 nm†	−80 dBm

* Sensitivity is defined as signal value $\geq 6 \times$ the RMS noise value.
† Temperature range 20 °C to 30 °C.

Dynamic Range† (in 0.1 nm resolution)	**1250 nm—1600 nm**	**600 nm—1700 nm**
Excluding Multiple Order Grating Responses	−55 dB at ±0.5 nm	−50 dB at ±1 nm
	−60 dB at ±1 nm	
Chop Mode On (Characteristic)	*−70 dB at ±0.5 nm, ±1 nm, ±5 nm*	
Dynamic Range, HP 71452B Option 122†		
Excluding Multiple Order Grating Responses	**1250 nm—1600 nm**	
In 0.2 nm resolution	−58 dB at ±0.5 nm	
In 0.2 nm resolution	−65 dB at ±1 nm	
In 0.1 nm resolution (Characteristic)	*−60 dB at ±0.4 nm*	
In 0.1 nm resolution (Characteristic)	*−65 dB at ±0.8 nm*	

† With applied input fiber 9/125 μm.

Input Power	
0.05 dB Compression Level, Within Selected Resolution (Characteristic)	*≥10 dBm*
Maximum Displayed Level (Characteristic)	*≥15 dBm*
Maximum Safe Input Level	+20 dBm per 5 nm, +30 dBm total

Specifications:
HP 71450B/1B/2B (HP 70950B/1B/2B)

Input Return Loss with physical contact connectors		
Fiber input size:	9 μm	>35 dB total (connector limited)
		>50 dB internal reflections (Characteristic)
	50 μm	*>28 dB (Characteristic)*
	62.5 μm	*>26 dB (Characteristic)*

Sweep Time *(Characteristic)*		
Maximum Sweep Rate		*40 nm / 50 ms*
Maximum Sweep Rate in Zero Span		*50 μs / trace point*
Sweep Cycle Time†	*50 nm span, auto zero off*	*<180 ms*
	50 nm span, auto zero on	*<340 ms*
	500 nm span, auto zero on	*<650 ms*
	Full span, auto zero on	*<1s*
	−80 dBm sensitivity, 30 nm span, auto zero on	*< 2s*
	−90 dBm sensitivity, 30 nm span, auto zero on	*< 35s*

† Sweep cycle time includes forward sweep time plus overhead between sweeps.

ADC Trigger Accuracy *(Characteristic)*	
Jitter	*±0.5 μs*
Trigger Delay Range	*2 μs–6.5 ms*

Additional Specifications: HP 71451B (HP 70951B)

Monochromator Insertion Loss (into 62.5 μm fiber)	
(See characteristic plot)*	
850 nm	<19 dB
1300 nm	<7 dB
1550 nm	<10 dB
Maximum Input Power	+20 dBm per 5 nm; +30 dBm total

Characteristic Monochromator Loss

* Second order is selected when the stop wavelength is at or below 900 nm and resolution is < 10 nm.

Additional Specifications:
HP 71451B (HP 70951B)

WARNING The light emitted from this connector is the filtered and slightly attenuated light input to the front-panel MONOCHROMATOR INPUT connector. In the following instrument modes: preselector, stimulus response, and photodetector test, light energy can radiate from the front-panel MONOCHROMATOR OUTPUT connector.

Monochromator Output (into 62.5 μm fiber)		
Polarization Dependence*, for Resolutions $\geq$ 0.2 nm		
1250 nm—1600 nm		$\pm$0.5 dB†
700 nm—1600 nm (Characteristic)		*$\pm$1.5 dB*
600 nm—1700 nm (Characteristic)		*$\pm$2.5 dB*
Resolution Selections (FWHM)		0.08 nm and 0.1 nm—10 nm in a 1,2,5 sequence.
Resolution accuracy for	$\geq$ 0.5 nm, 1250 nm—1600 nm	$\pm$20%
	0.1 nm—10nm, 600 nm—1700 nm	*$\pm$30%*‡

* With applied input fiber that is standard single mode at wavelength of interest.
† Temperature range 20 °C to 30 °C.
‡ The 2.0 nm resolution is nominally 2.5 nm in second order.

Photodetector Input (in power meter mode)		
Accuracy at −30 dBm* (ref to 1300 nm)		
20 °C to 30 °C	±0.35 dB	
0 °C to 55 °C	±0.5 dB	
Maximum Safe Power Level	+20 dBm	
1 dB Compression Level	≥+7 dBm	
Scale Fidelity (for ≤ +2 dBm inputs)†		
For any Measurement with Fixed Reference Level	±0.1 dB	
For Multiple Measurements with Different Reference Levels	±0.2 dB	
Display Resolution		
Log	0.01 dB	
Linear	0.23% of measurement + 0.01% of reference level	
	1250 nm–1600 nm	**600 nm–1700 nm**
Power Range (up to 50 dB in any reference level setting)		
Maximum Displayed Level (Characteristic)	*10 dBm*	*10 dBm*
Sensitivity§	−95 dBm	−85 dBm
Flatness (for ≤2 dBm input)*	±0.4 dB	±2 dB‡

Transimpedance Input	
Current Range	0 to −10 mA
Maximum Current	±10 mA
Maximum Voltage	±10 V
Input Impedence *(Characteristic)*	*270*Ω

* With applied input fiber 9/125 μm.
† To within 20 dB of the sensitivity noise limit.
‡ Flatness for 1650 to 1700 nm applies for ambient temperature from 20 °C to 30 °C only.
§ Sensitivity applies within 1 minute of last zeroing.

Current Output (Option 001)	
Range	0 to $\pm$200 mA (source or sink)
Resolution (Characteristic)	*50 μA steps*
Accuracy	2% $\pm$50 μA
Clamp Voltage (nominal)	$\pm$2.7 V
Noise Density at 1 kHz (Characteristic)	$<$ *4 nA/$\sqrt{Hz}$*
Stability Within 30 Minutes (Characteristic)	$<$ *100 ppm $\pm$ 500 nA*
Temperature Drift (Characteristic)	$<$ *(100 ppm $\pm$500 nA)/ $^\circ$C*

Pulse Mode	
Pulse Range	10 μs to 6.5 ms
Pulse Resolution	100 ns
Duty Cycle Range	pulse width/1 s to 100%

Specifications: Optional Built-In White Light Source

Light Source Output (Option 002)		
Wavelength*		900 nm to 1700 nm
Minimum Output Power Spectral Density (9/125 μm fiber)		
	900 to 1600 nm	−67 dBm/nm (0.2 nW/nm)
	900 to 1600 nm (typical)	−64 dBm/nm (0.4 nW/nm)
	1600 to 1700 nm	−70 dBm/nm (0.1 nW/nm)
Minimum Output Power Spectral Density (characteristic)		
	50/125 μm fiber	−50 dBm/nm (10 nW/nm)†
	62.5/125 μm fiber	−46 dBm/nm (25 nW/nm)†
Output Stability (Characteristic)		*±0.02 dB over 10 minutes*
Lamp Lifetime, mean time between failures (MTBF) (Characteristic)		*>5000 hours*

Stimulus Response System Specifications		**1250 to 1600 nm 9/125 μm fiber**	**900 to 1700 nm 62.5/125 or 50/125 μm fiber**
Passive Optical-to-Optical Devices			
(with HP 71450B/1B/2B OSA)			
(with HP 70950B/1B/2B OSA)			
Measurement Range	10 nm RBW	0 to 33 dB	0 to 30 dB
		(36 dB typical)	0 to 40 dB (1000—1600 nm)
Dynamic Range (characteristic)	*10 nm RBW*	*36 dB*	*24 dB (900—1000 nm)*
	10 nm RBW		*36 dB (1000—1600 nm)*
	0.5 nm to 10 nm RBW		*9 dB (1600—1700 nm)*
Measurement Accuracy‡		±0.1 dB	±0.2 dB
Optical-to-Electrical Devices			
(with HP 71451A or HP 70951A OSA)			
Minimum Responsivity (characteristic)	*Rshunt > 1 MΩ*	*0.01 A/W*	*0.01 A/W*
Accuracy (characteristic)‡		*±0.9 dB*	*±0.9 dB*

* Filtered below 850 nm.
† Includes power in full numerical aperture of fiber.
‡ Does not include connector repeatability or effects of noise on measurement. Noise effects can be reduced with video filtering or video averaging. For multimode-fiber measurements assume DUT does not modify mode structure.

Specifications: Optional Swept Polarization Dependent Loss Kit

Swept PDL System Specifications (HP 71451B Option 003)	**1250 to 1600 nm**
(with HP 71451B or HP 70951B OSA containing Option 002, Built-In White Light Source)	
Accuracy*	
O/O Devices (external photodetector)	+0.1/−0.05 dB
O/O Devices (internal photodetector) (characteristic)	*+0.2/−0.1 dB*
O/E Devices (characteristic)	*+0.075/−0.025 dB*
Polarizer Extinction Ratio	
Measurement Range (characteristic)	*0 to 30 dB*

* Assumes polarization controller covers all desired states of polarization. For devices with less than 5 dB loss.

General Specifications

Inputs Outputs	
Optical Output (HP 71451B or HP 70951B)	62.5 μm fiber
Optical Input (HP 70950B/1B)	Multimode fiber, standard
Optical Input (HP 70952B)	9 μm fiber
Optical Connectors	FC/PC standard; other interface adapters available
Rear-Panel Connectors	SMB (electrical)

Dimensions	
HP 71450B/1B/2B	222 mm high $\times$ 425.4 mm wide $\times$ 526 mm long (8.75 in $\times$ 16.75 in $\times$ 20.7 in)
HP 70950B/1B/2B	Standard 4/8-width module

Weight	
HP 71450B/1B/2B	28 kg (61.6 lb)
HP 70950B/1B/2B	8 kg (17.6 lb)

Environmental	**Operational**	**Storage**
Temperature	0 °C to +55 °C	−40 °C to +71 °C
Humidity	<95% R.H.	Noncondensing
Shock and Vibration	Tested to MIL-T-28800D class 5 par. 3.7.4, 3.7.5.2 and 3.	
EMI	Conducted and radiated interference is in compliance with CISPR Pub 11 and MIL-STD 461C part 7 CE03 (AF) and RE02.	

Power Requirements	
HP 71450B/1B/2B	
Voltage and Frequency	87—132 VAC, 47 Hz—66 Hz and 356 Hz—444 Hz 174—264 VAC, 47 Hz—66 Hz
Maximum Power	260 W maximum (350 VA maximum)

Regulatory Information

The information on the following page applies to the HP 70950B/1B/2B optical spectrum analyzer product.

DECLARATION OF CONFORMITY
according to ISO/IEC Guide 22 and EN 45014

Manufacturer's Name:	Hewlett-Packard Co.
Manufacturer's Address:	1400 Fountaingrove Parkway Santa Rosa, California 95403 U.S.A.

Declares that the product:

Product Name:	Optical Spectrum Analyzer
Model Numbers:	HP 71450B/1B/2B HP 70950B/1B/2B
Product Options:	This declaration covers all options of the above products.

Conforms to the following product specifications:

Safety:	IEC 348:1978/HD 401:1980
EMC:	CISPR 11:1990 /EN 55011:1991, Group 1 Class A IEC 801-2:1991 /EN 50082-1:1992, 4 kV CD, 8 kV AD IEC 801-3:1984 /EN 50082-1:1992, 3V/m, 27-500 MHz IEC 801-4:1988 /EN 50082-1:1992, 500 V signal, 1000 V AC

Supplementary Information:

The products herewith comply with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC.

Santa Rosa, California	3/20/95	Dixon Browder
Location	**Date**	**Dixon Browder / Quality Manager**

European Contact:
Your local Hewlett-Packard Sales and Service Office or Hewlett-Packard GmbH, Department ZQ/Standards Europe, Herrenberger Straße 130, D-71034 Boeblingen (FAX: +49-7031-14-3143)

Notice for Germany: Noise Declaration

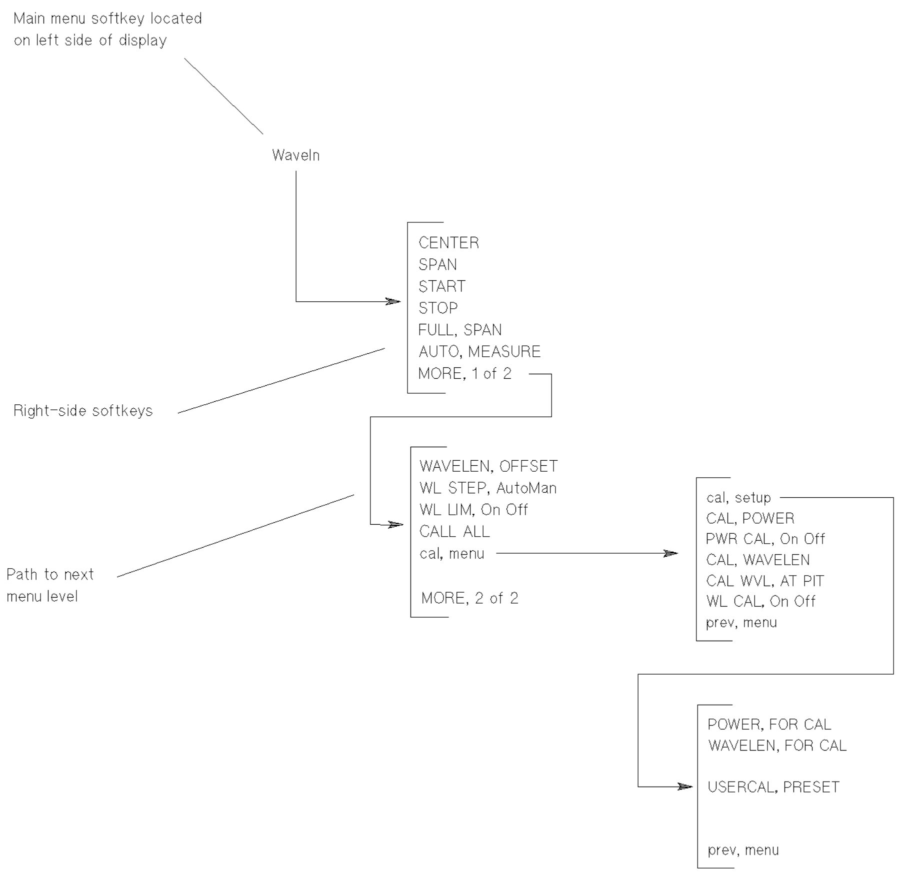
LpA < 70 dB
am Arbeitsplatz (operator position)
normaler Betrieb (normal operation)
nach DIN 45635 T. 19 (per ISO 7779)

2

Menu Maps

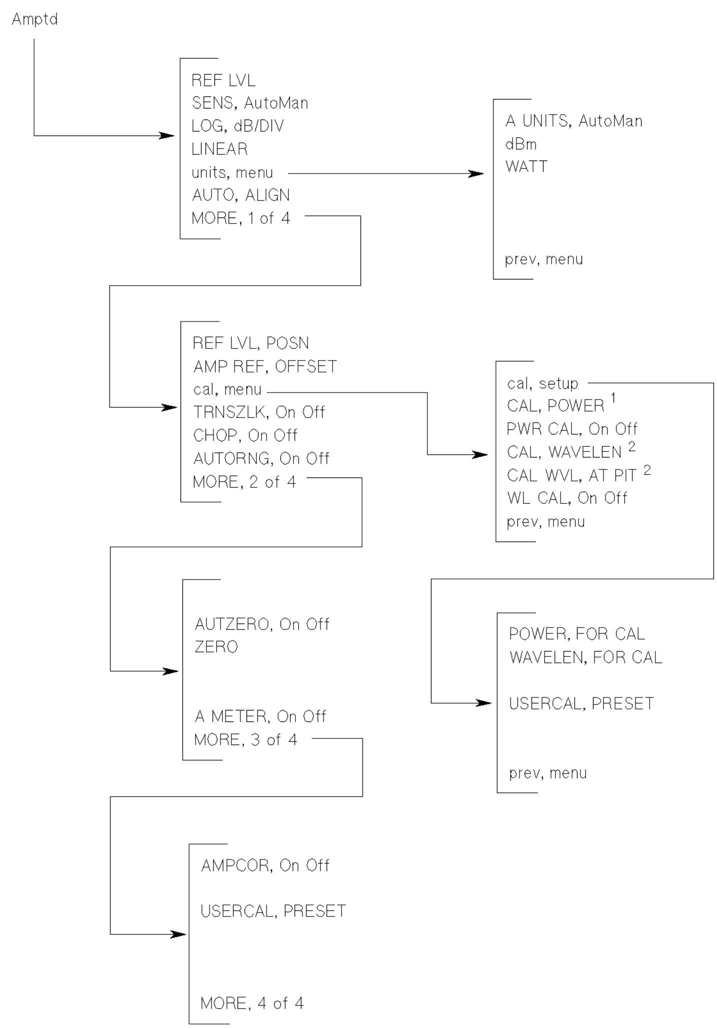
Menu Maps

The menu maps that are in this chapter graphically represent the softkey menus that are located under the (MENU) key. Maps for each left-side softkey are shown in alphabetical order. Menu maps contain the following features:



Contents

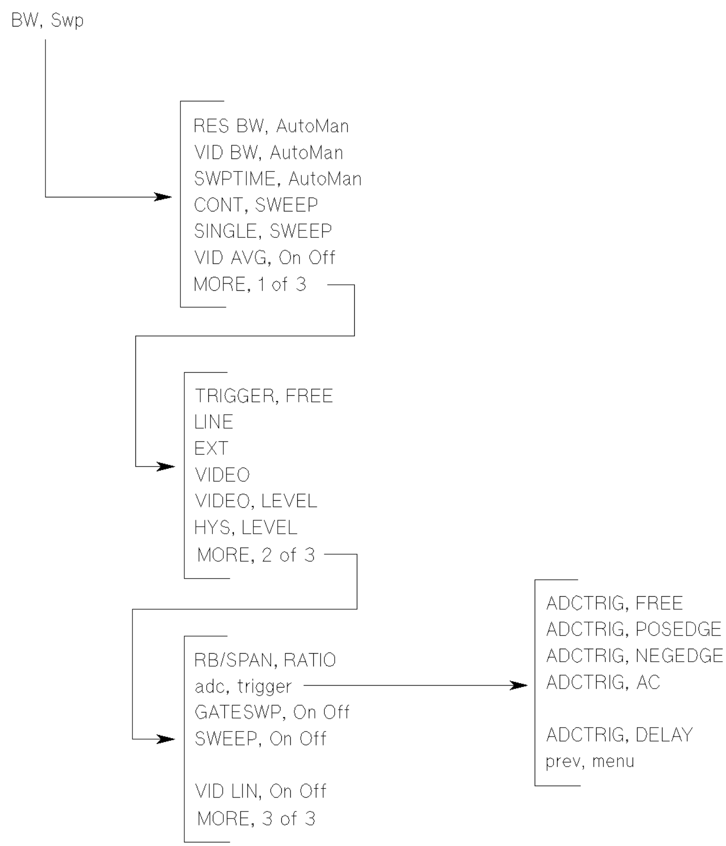
Amptd Menu



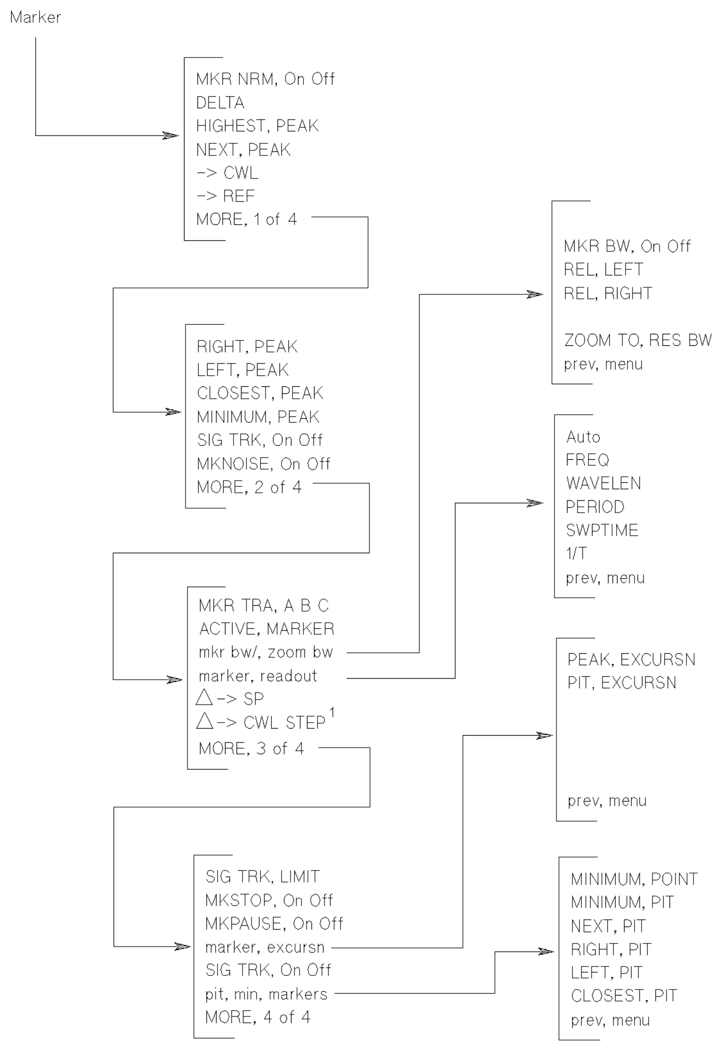
[1] Softkey displayed only in OSA and POWER METER instrument modes.

[2] Softkey displayed only in OSA instrument mode.

BW, Swp Menu


BW, Swp
RES BW, AutoMan
VID BW, AutoMan
SWPTIME, AutoMan
CONT, SWEEP
SINGLE, SWEEP
VID AVG, On Off
MORE, 1 of 3
TRIGGER, FREE
LINE
EXT
VIDEO
VIDEO, LEVEL
HYS, LEVEL
MORE, 2 of 3
RB/SPAN, RATIO
adc, trigger
GATESWP, On Off
SWEEP, On Off
VID LIN, On Off
MORE, 3 of 3
ADCTRIG, FREE
ADCTRIG, POSEDGE
ADCTRIG, NEGEDGE
ADCTRIG, AC
ADCTRIG, DELAY
prev, menu

Marker Menu



[1] Softkey appears only if delta markers are on.

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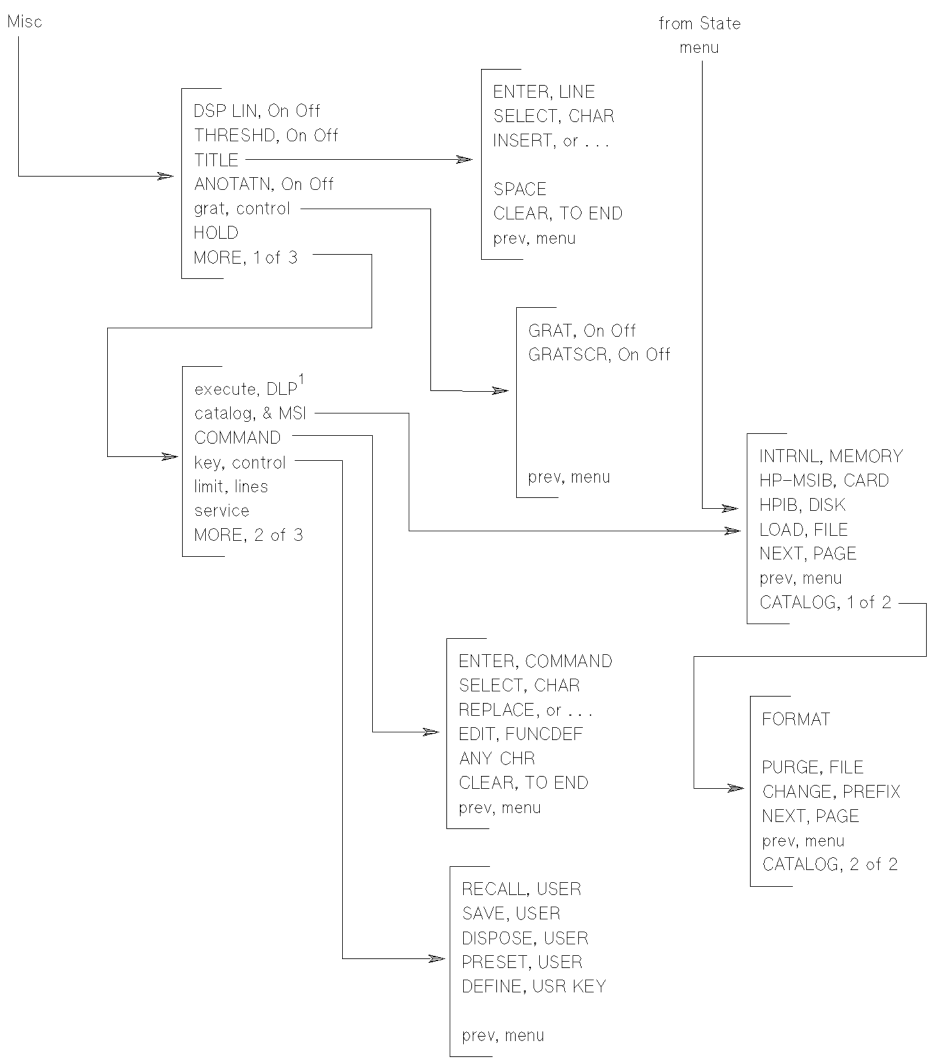
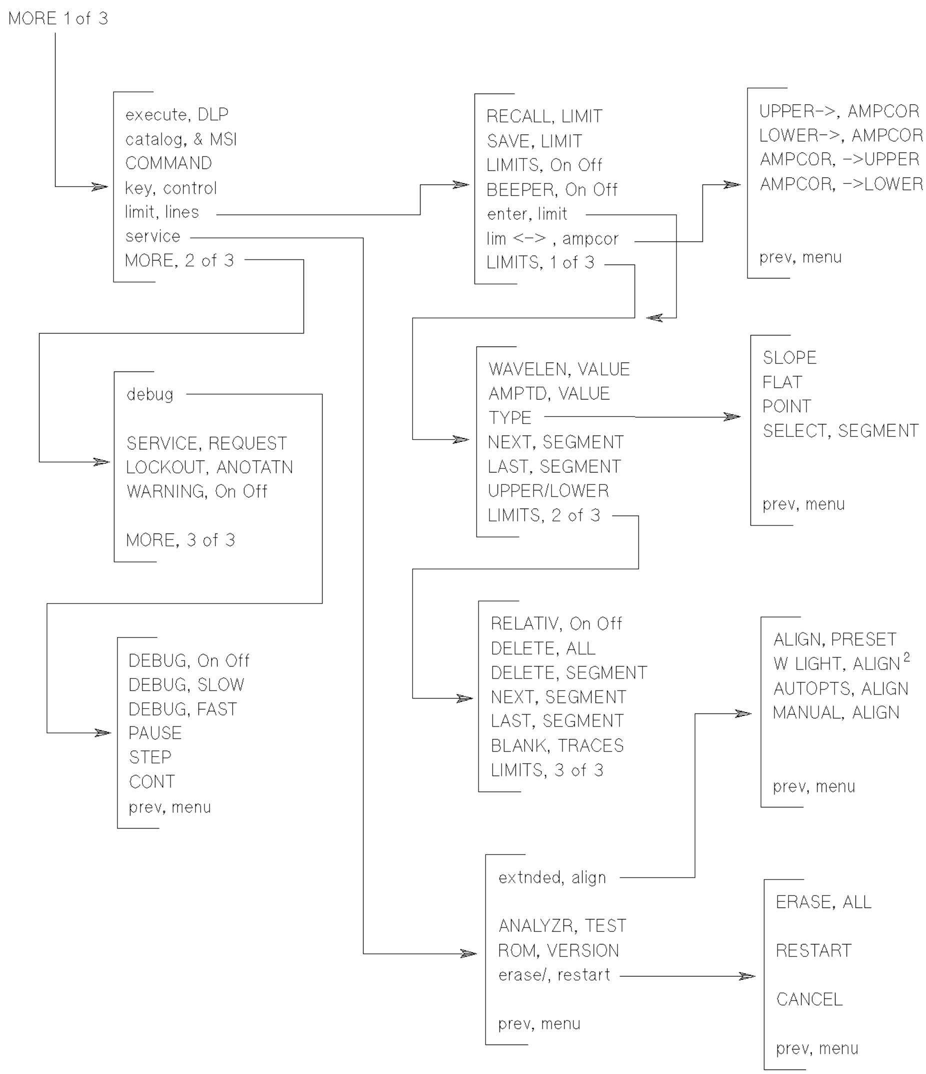
Misc Menu



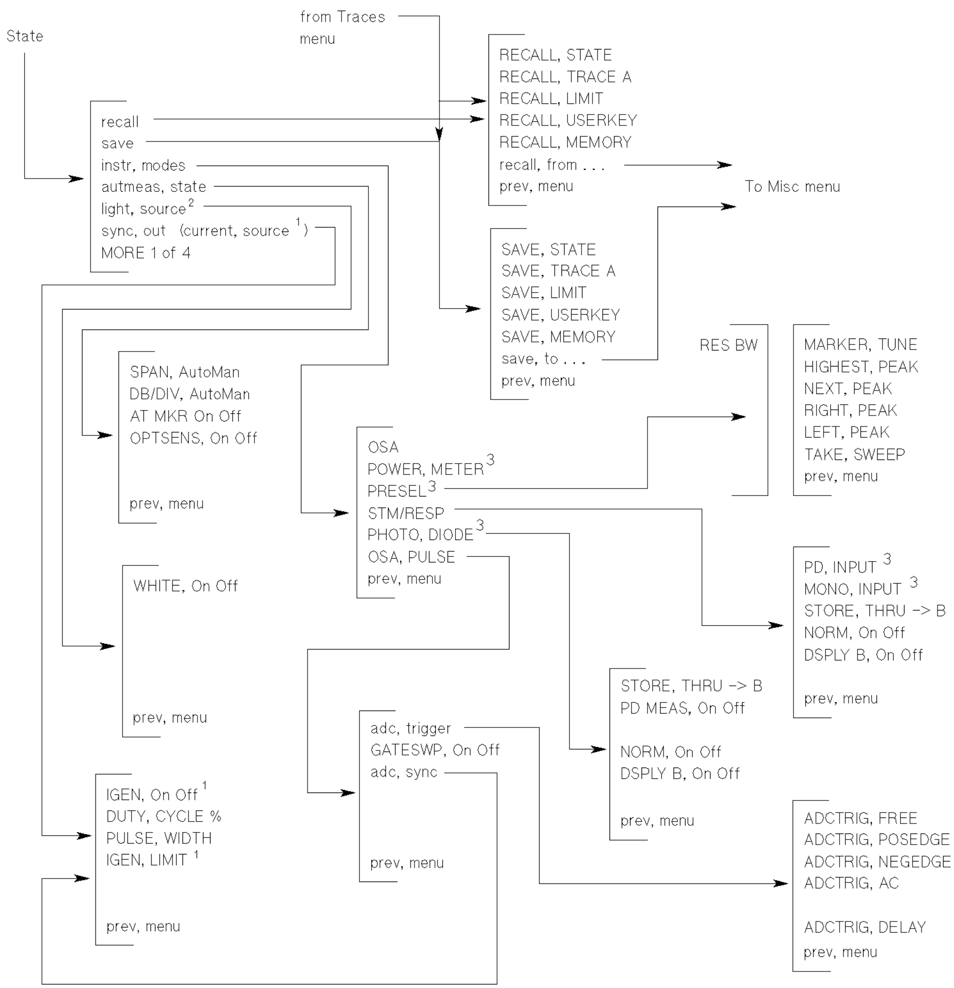
[1] Use of this softkey is not recommended. Run DLPs through the USER menu.

Misc menu (cont'd)



[2] Softkey displayed only on Option 002 instruments.

State Menu

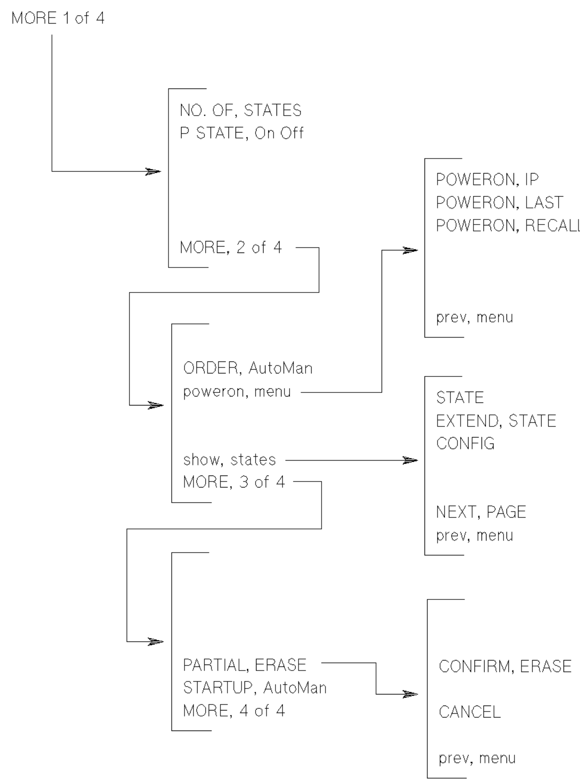


[1] Softkey displayed only on Option 001 instruments.

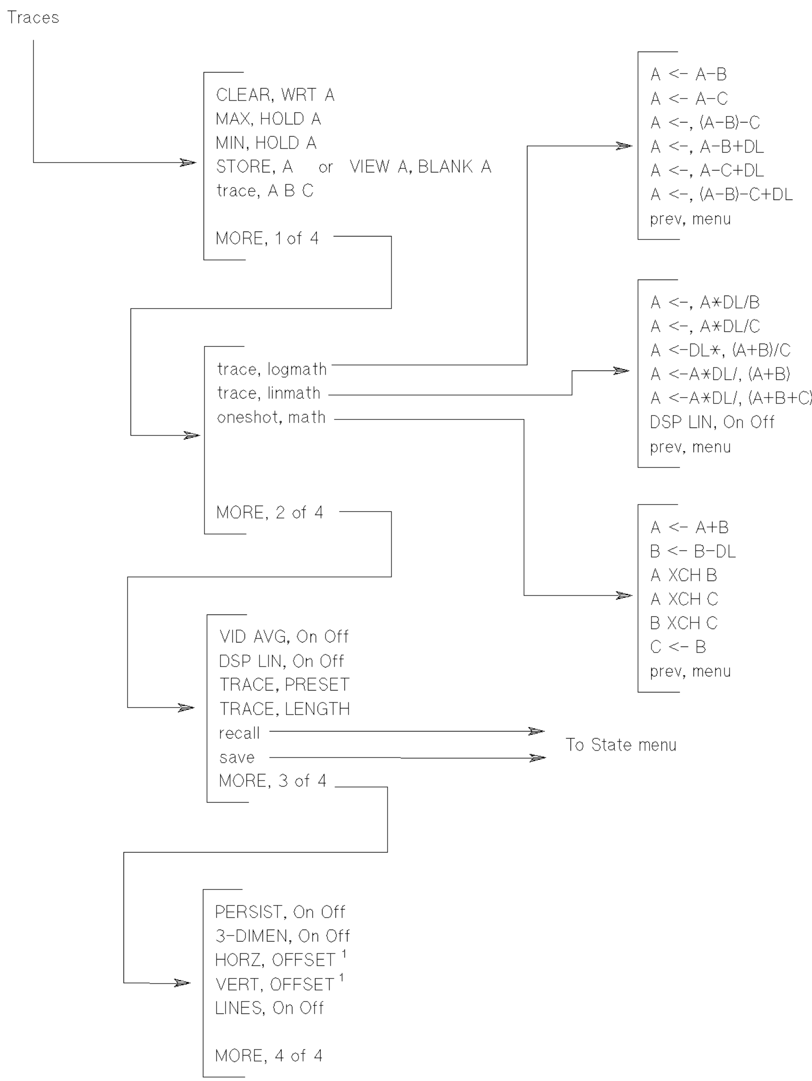
[2] Softkey displayed only on Option 002 instruments.

[3] Softkey displayed only on HP 71451A instruments.

State menu (cont'd)

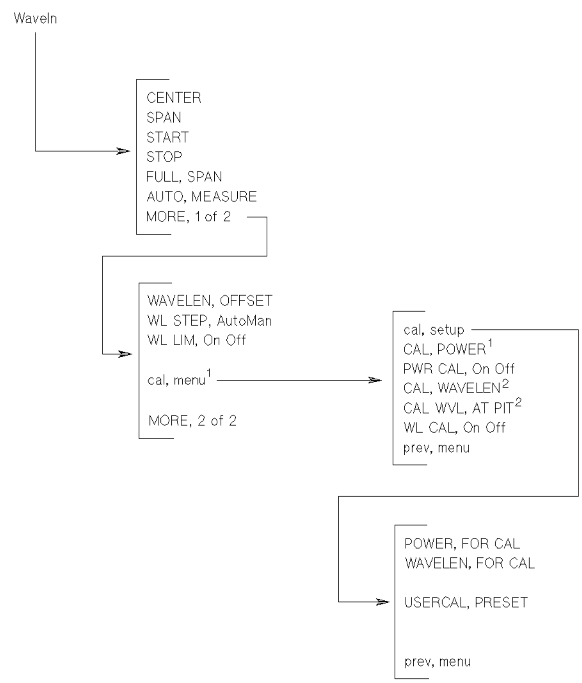


Traces Menu



[1] This softkey appears when "3-DIMEN On Off" is turned on.

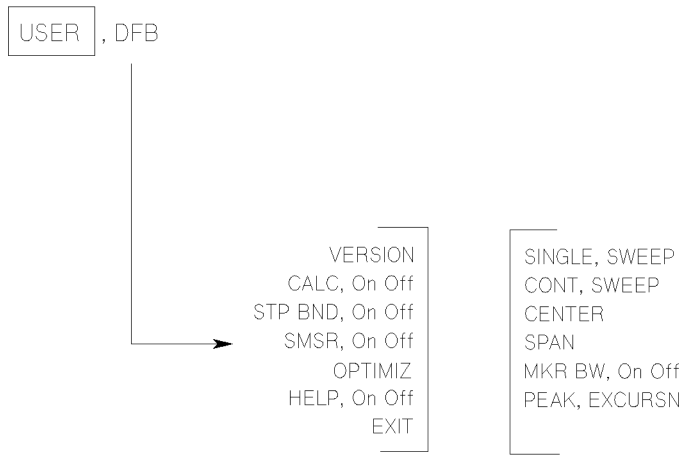
Waveln Menu



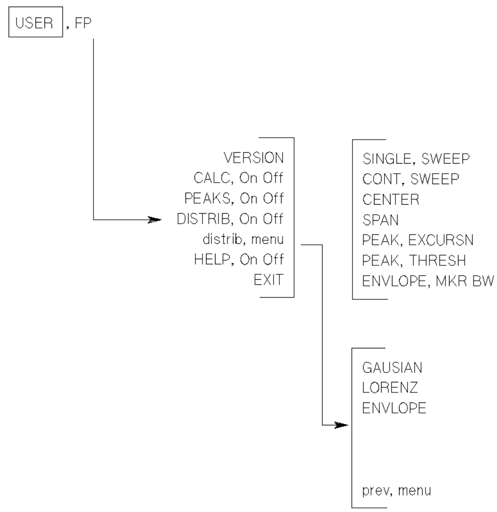
[1] Softkey displayed only in OSA and POWER METER instrument modes.

[2] Softkey displayed only in OSA instrument mode.

USER Menu's DFB Advanced Measurement Program

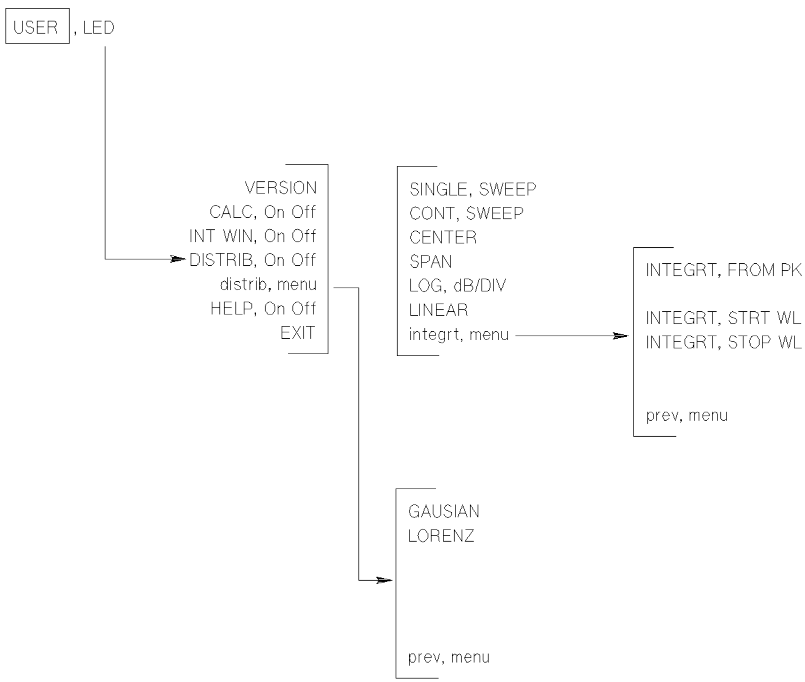


USER Menu's FP Advanced Measurement Program



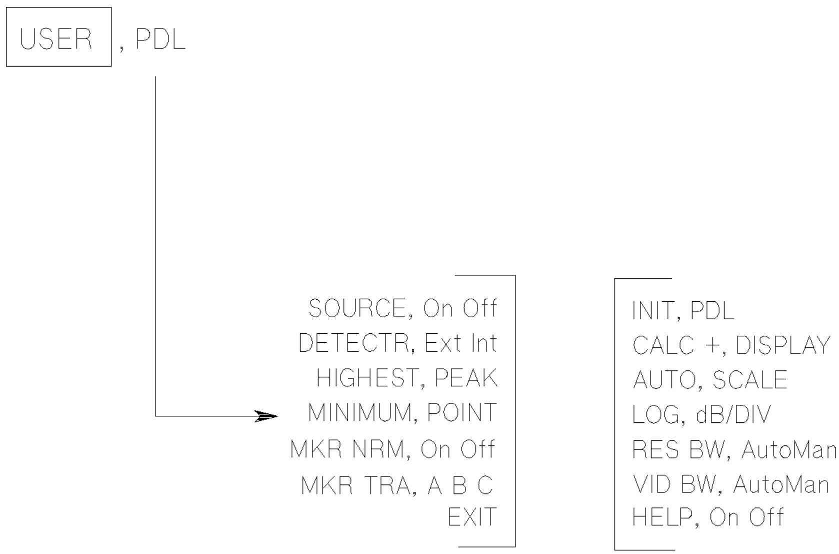
[1] Softkey displayed only when envelope distribution is selected.

USER Menu's LED Advanced Measurement Program



(USER) Menu's PDL Advanced Measurement Program

This program is available on HP 71451B (HP 70951B) instruments as Option 003.



3

Dictionary Reference

Dictionary Reference

This chapter is a dictionary reference of front and rear-panel connectors, front-panel keys, and softkeys. With the exception of a few front-panel keys, softkeys control all instrument functions. Refer to the display's operating manual for information on softkeys located under the (DISPLAY) key.

This chapter is designed for quick access of information. For example, during operation you may find a softkey or hardkey whose function is unfamiliar to you. Note the key name, find the key in this chapter, and read the brief definition. In several places you will find multiple definitions for a softkey. This occurs whenever two sofkeys have the same name but different functions. Make sure you have found the applicable definition. Keys that begin with a symbol are listed at the front of the chapter.

NOTE

Throughout this chapter, HP 71450B/1B/2B refers to the HP 70950B/1B/2B optical spectrum analyzer modules configured with the HP 70004A display.

Alphabetical Listing

(⟵)

Use the (⟵) (backspace) key for the following uses:

- backspacing the cursor while entering text.
- displaying previous softkey menus.

(▲) (▼)

The step keys increase or decrease active parameter values. For example, if sweeptime is the active parameter, pressing (▲) increases the sweep time; pressing (▼) decreases the sweep time.

(Δ)

This custom-keypad key activates the `Marker` menu's `DELTA` function. Delta markers allow you to compare two trace values in both trace domains.

See Also *DELTA* in this chapter.

1/T

Softkey that configures marker readouts to show marker position as the inverse of the marker sweep-time position.

Pressing the `1/T` softkey selects marker readouts as the inverse of sweep time at the marker. In zero span, this function can be used to determine the frequency of a periodic signal. Use delta markers to mark a single cycle of the signal. Then, selecting `1/T` readouts shows the frequency of the periodic signal.

Key Path Press `Marker`, `MORE 1 of 4`, `MORE 2 of 4`, `marker readout`, `1/T`.

3-DIMEN On Off

Softkey that views the 3-dimensional display.

Three-dimensional views provide a graphic measurement history. They offer a view of the input spectra over time. The optical spectrum analyzer displays successive traces with each trace slightly offset. This gives a 3-dimensional "look" with the third dimension showing changes in signal response with time. New traces are placed at the front of the 3-dimensional view as older sweeps progressively move to the last background position.

With 3-dimensional displays, front-panel control may appear sluggish. This is due to the additional time required to obtain and display the trace data. Use the fastest sweeps possible to increase the optical spectrum analyzer's response to front-panel controls. Decreasing the number of three-D levels with the `3-DIMEN On Off` softkey also helps.

3-Dimensional Default Values

	Default Value	Limit
Traces	16	limited by available internal memory (100 maximum)
Horizontal Offset	4	±200
Vertical Offset	10	±200

Normally, 16 traces are displayed to provide the 3-dimensional view. However, you can increase or decrease the number of traces. The number of traces that can be displayed is limited by the amount of available internal memory. Viewing large numbers of traces may require that you increase internal memory by deleting files.

Changing the vertical and horizontal offsets between the traces helps to optimize the 3-dimensional effect. Although offsets as large as 200 can be entered, values of 30 or less are normal for proper display.

Key Path

Press `Traces`, `MORE 1 of 4`, `MORE 2 of 4`, `MORE 3 of 4`, `3-DIMEN On Off`.

Related Programming Command

THREED

A ← A − B

Softkey that subtracts Trace B from Trace A point by point, then stores the results in Trace A.

If trace A is in clear-write mode this function is continuous and occurs every sweep. Results of the subtraction are referenced to 0 dB. This often requires a reference level adjustment. For example, if the reference level is set at −40 dBm, Trace A is at −50 dBm, and Trace B is at −55 dBm, `A ← A - B` places trace A at −5 dB. Because this is off screen, the reference level needs to be adjusted.

This process occurs with each sweep. Placing the optical spectrum analyzer in single sweep mode allows you to view the results of the trace math. Trace math is mainly used to normalize the display during stimulus-response measurements.

Key Path Press `Traces`, `MORE 1 of 4`, `trace logmath`, `A ← A - B`.

Related Programming Command AMB

A ← A+B

Softkey that adds trace A and trace B point by point, then stores the results in trace A.

The results of this function often requires a reference level adjustment. Trace A is placed in view mode. Trace math is mainly used to normalize the display during stimulus-response measurements.

Key Path Press `Traces`, `MORE 1 of 4`, `oneshot math`, `A ← A+B`.

Related Programming Command APB

A ← (A−B)−C

Softkey that subtracts both trace B and trace C from trace A.

If trace A is in clear-write mode this function is continuous and occurs every sweep.

Key Path Press `Traces`, `MORE 1 of 4`, `trace logmath`, `A ← (A-B)-C`.

Related Programming Command AMBMC

A ← (A − B)−C+DL

Softkey that subtracts both trace B and trace C from trace A, then adds the display line.

The trace math is performed on each trace point as the trace is formed. In addition, an initial application of the function is performed before the next trace is taken.

Key Path Press `Traces`, `MORE 1 of 4`, `trace logmath`, `A ← (A-B)-C+DL`.

Related Programming Command AMBMCPL

A ← A − B+DL

Softkey that subtracts trace B from trace A point by point, adds the value of the display line, and then stores the results in trace A. Use this function when placing the results of trace subtraction at a specific location.

To turn on the display line, press `Traces`, `MORE 1 of 4`, `MORE 2 of 4`, and then `DSP LIN On Off` so that `On` is underlined. Use the front-panel knob to position the display line. Place the display line where you desire the result of the trace subtraction to be located.

If trace A is in clear-write mode this function is continuous and occurs every sweep. This function is effective when wanting to place the results of trace subtraction at a specific location. The process is continuous and occurs with each sweep. Placing the optical spectrum analyzer in single sweep mode allows you to view the results of the trace math. Trace math is mainly used to normalize the display during stimulus-response measurements.

Key Path Press `Traces`, `MORE 1 of 4`, `trace logmath`, `A ← A-B+DL`.

See Also *DSP LIN On Off* in this chapter.

Related Programming Command AMBPL

A ← A − C

Softkey that subtracts Trace C from Trace A point by point, then stores the results in Trace A.

If trace A is in clear-write mode this function is continuous and occurs every sweep. Results of the subtraction are referenced to 0 dB. This often requires a reference level adjustment. For example, if the reference level is set at −40 dBm, trace A is at −55 dBm, and trace C is at −50 dBm, `A ← A - C` places trace A at −5 dB. Because this is off screen, the reference level needs to be adjusted.

Placing the optical spectrum analyzer in single sweep mode allows you to view the results of the trace math. Trace math is mainly used to normalize the display during stimulus-response measurements.

Key Path Press `Traces`, `MORE 1 of 4`, `trace logmath`, `A ← A - C`.

Related Programming Command AMC

A ← A − C+DL

Softkey that subtracts trace C from trace A point by point, adds the value of the display line, and then stores the results in trace A.

This function is effective when wanting to place the results of trace subtraction at a specific location. The process is continuous and occurs with each sweep. Placing the optical spectrum analyzer in single sweep mode allows you to view the results of the trace math. Trace math is mainly used to normalize the display during stimulus-response measurements.

To turn on the display line, press `Traces`, `MORE 1 of 4`, `MORE 2 of 4`, and then `DSP LIN On Off` so that `On` is underlined. Use the front-panel knob to position the display line. Place the display line where you desire the result of the trace subtraction to be located.

Key Path

Press `Traces`, `MORE 1 of 4`, `trace logmath`, `A ← A-C+DL`.

See Also

DSP LIN On Off in this chapter.

Related Programming Command

AMCPL

A ← A*DL/(A+B)

Softkey that multiplies trace A by the display line and then divides the result by the sum of traces A and B.

For proper operation, use this function in linear display mode. It allows ratio measurements to be made as a sweep is taken. If trace B has points near the bottom of the screen, overflow or poor precision can occur. If a division by zero is attempted, a division by the smallest representable value is performed instead.

To ensure that correct data is displayed, be sure that a sweep is taken before using this function.

Key Path

Press `Traces`, `MORE 1 of 4`, `trace linmath`, `A ← A*DL/(A+B)`.

Related Programming Command

ADAPBTL

A ← A*DL/(A+B+C)

Softkey that multiplies trace A by the display line and then divides the result by the sum of traces A, B, and C.

For proper operation, use this function in linear display mode. It allows ratio measurements to be made as a sweep is taken. If trace B has points near the bottom of the screen, overflow or poor precision can occur. If a division by zero is attempted, a division by the smallest representable value is performed instead.

To ensure that correct data is displayed, be sure that a sweep is taken before using this function.

Key Path

Press `Traces`, `MORE 1 of 4`, `trace linmath`, `A ← A*DL/(A+B+C)`.

Related Programming Command

ADAPBPCTL

A ← A*DL/B

Softkey that multiplies trace A by the display line value, then divides the result by trace B.

For proper operation, use this function in linear display mode. It allows ratio measurements to be made as a sweep is taken. If trace B has points near the bottom of the screen, overflow or poor precision can occur. If a division by zero is attempted, a division by the smallest representable value is performed instead.

To ensure that correct data is displayed, be sure that a sweep is taken before using this function.

Key Path Press `Traces`, `MORE 1 of 4`, `trace linmath`, `A ← A*DL/B`.

See Also *A ← A*DL/C* in this chapter.

Related Programming Command ADBTL

A ← A*DL/C

Softkey that multiplies trace A by the display line value, then divides the result by trace C.

For proper operation, use this function in linear display mode. If trace C has points near the bottom of the screen, overflow or poor precision can occur. If a division by zero is attempted, a division by the smallest representable value is performed instead. To ensure that correct data is displayed, be sure that a sweep is taken before using this function.

Key Path Press `Traces`, `MORE 1 of 4`, `trace linmath`, `A ← A*DL/C`.

See Also *A ← A*DL/B* in this chapter.

Related Programming Command ADCTL

A ← DL*(A+B)/C

Softkey that multiplies the sum of traces A and B by the display line. Then, this result is divided by trace C. The final results are stored in trace A.

For proper operation, use this function in linear display mode. If trace A is in clear-write mode, the function is continuous and occurs every sweep. Only one trace math operation may be active at any given time. If trace C has points near the bottom of the screen, overflow or poor precision can occur. If a division by zero is attempted, a division by the smallest representable value is performed instead. To ensure that correct data is displayed, be sure that a sweep is taken before using this function.

Key Path

Press `Traces`, `MORE 1 of 4`, `trace linmath`, `A ← DL*(A+B)/C`.

Related Programming Command

APBDCTL

A METER On Off

Softkey that displays the power level of the trace point currently being measured at the optical spectrum analyzer's input.

The displayed value shows the amplitude level for the last acquired trace point. This feature is automatically turned on whenever HP 71451B optical spectrum analyzers are in the Power Meter instrument mode.

Key Path

Press `Amptd`, `MORE 1 of 4`, `MORE 2 of 4`, `A METER On Off`.

Related Programming Command

AMETER

A UNITS AutoMan

Softkey that selects the display units for the amplitude scale.

Normally, the optical spectrum analyzer automatically selects the amplitude units according to whether the scale is logarithmic (dBm) or linear (watts). In this condition, `Auto` in the softkey label is underlined. When you use this key to manually select the display units, `Man` is underlined. You can select either units in dB or Watts.

Key Path

Press `Amptd`, `units menu`, `A UNITS AutoMan`.

Related Programming Command

AUNITS

A XCH B

Softkey that exchanges the contents of trace A and trace B registers.

Key Path

Press `Traces`, `MORE 1 of 4`, `oneshot math`, `A XCH B`.

Related Programming Command

AXB

A XCH C

Softkey that exchanges the contents of the trace B and trace C registers.

Key Path Press `Traces`, `MORE 1 of 4`, `oneshot math`, `A XCH C`.

Related Programming Command AXC

ACT

Front-panel indicator light.

The active (ACT) indicator lights whenever the optical spectrum analyzer is being displayed. The indicator is only operative when there is a display in the system.

ACTIVE MARKER

Softkey that selects the active marker.

Up to five markers can be simultaneously displayed. If multiple markers are displayed, use this softkey to select which marker is active for front-panel changes. For example, to select marker 2, press `ACTIVE MARKER`, (2), and then `ENTER`.

Key Path Press `Marker`, `MORE 1 of 4`, `MORE 2 of 4`, `ACTIVE MARKER`.

adc sync

Softkey that presents a menu for synchronizing an external light source, that has pulse modulation capability, with the optical spectrum analyzer's analog-to-digital converter.

This menu controls a TTL signal available at the rear-panel ADC SYNC OUT connector. (The connector has a 50 Ω output impedance.) You can adjust the signal's pulse width and duty cycle. Pulse width determines the time that the light source is turned on. Duty cycle determines the ratio of "on" and "off" time and is entered as a percentage:

$$duty\ cycle = \left(\frac{pulse\ width}{pulse\ period}\right)(100)$$

For the ADC SYNC OUT output to be active, the optical spectrum analyzer's wavelength span must be greater than 0 nm. (When the span is set to 0 nm and the duty cycle is less than 100%, this output is disabled.)

The pulse period may increase slightly during measurements to allow the optical spectrum analyzer to perform various internal tasks. Consider the following when selecting pulse width and duty cycle values:

- Duty cycle affects the average power dissipated by the light source.
- Pulse width affects the power produced by the light source during its "on" time.
- Optical spectrum analyzer measurements are performed near the trailing edge of the pulse.

Pulse widths can range from 1 μs to 6.5 ms. However, not all combinations of pulse widths and duty cycles are available. The optical spectrum analyzer limits and adjusts these parameters as needed to maintain the following conditions:

- Pulse must be off for at least 200 μs.
- Sweep time cannot be longer in seconds than the number of trace measurement points.

For pulsed measurements, sweep times cannot be longer than 1 second per trace point. This is 800 seconds for the default value 800 trace points. The following equation shows how sweep time is approximately related to trace length, pulse width, and duty cycle:

$$sweep\ time \simeq (trace\ length)\left[\frac{(pulse\ width)(100)}{duty\ cycle}\right]$$

UNCAL indicates narrow pulses

Although the pulse widths can be set as narrow as 1 μs, if the width is too narrow for the optical spectrum analyzer's circuitry, the displayed response may not faithfully represent the input light. To indicate this condition, the UNCAL message is displayed.

The video-bandwidth setting limits the minimum pulse width that can be used while still maintaining an amplitude calibrated display. (Video bandwidth is dependent on the top of screen amplitude level which is determined by reference-level position, reference level, and the dB-per-division setting in logarithmic mode and the reference level in linear mode.) The minimum pulse widths available are shown in the following table.

Video Bandwidth	Minimum Recommended Pulse Width
700 kHz	1 μs
600 kHz	1 μs
60 kHz	10 μs
20 kHz	30 μs
200 Hz	3 ms

Key Path Press `State`, `MORE 1 of 4`, `instr modes`, `OSA PULSE`, `adc sync`.

See Also *OSA PULSE* in this chapter.

ADC SYNC OUT

A rear-panel output connector.

A TTL/CMOS compatible output which allows the user to synchronize an event external to the instrument (such as DUT power) to the instrument data acquisition. This is useful for laser chip testing where power dissipation prohibits continuous operation. There is one output pulse for each horizontal point (bucket) on the display variable from 1 μs to 6.5 ms in 100 ns steps. The connector is a standard SMB coaxial male jack with its outer conductor connected directly to the rear panel (earth ground). The connector has a 50 Ω output impedance.

adc trigger

Softkey that presents a menu for synchronizing the optical spectrum analyzer to a pulsed light source.

The softkeys in the menu select the type of triggering for the analog-to-digital converter (ADC). The TTL-compatible trigger signal from the light source is connected to the rear-panel `EXT TRIG IN` connector.

Softkey	Type of Triggering
ADCTRIG FREE	External triggering is ignored. The ADC is triggered during sweeps by the optical spectrum analyzer's internal clock.
ADCTRIG POSEDGE	ADC is triggered by the rising edge of the external trigger signal.
ADCTRIG NEGEDGE	ADC is triggered by the falling edge of the external trigger signal.
ADCTRIG AC	ADC is alternately triggered by rising and filling edges of the external trigger signal. The amplitudes measured on opposite edges are subtracted and

the absolute value of the result becomes the trace amplitude value.

The `adc trigger` menu also allows you to delay internal and external ADC triggering from the start of the sweep. Refer to `ADCTRIG DELAY` in this chapter.

External trigger frequency can affect measurement accuracy

When using external ADC triggering in non-zero spans, the frequency of the external trigger signal can affect measurement accuracy. The trigger signal's frequency must be greater than

$$frequency > \frac{1.5(trace\ length)}{sweep\ time}.$$

In some cases, a factor as high as 2.0 may be required instead of 1.5. If the ADC trigger rate is too low for the current combination of trace length and sweep time, the warning message `16005 Sweep too fast` is displayed. This warning is reported once for every sweep where the external trigger doesn't occur often enough.

Avoid oversweeping the video bandwidth

When using external ADC triggering, displayed video bandwidths are not accurate and care must be taken not to over sweep the actual video bandwidth. Use the following equation to estimate the actual video bandwidth:

$$video\ bandwidth \approx \frac{(factor)(displayed\ bw)(external\ trigger\ frequency)}{27,000}$$

where:

factor is a function of the external trigger frequency. *factor* is always less than 1.0 and may be as low as 0.5.

To obtain the proper sweep time, estimate the actual video bandwidth (as described above), and then set the optical spectrum analyzer's bandwidth to that setting. Then, examine the coupled sweep time. The value returned to the computer is the proper sweep time setting.

Key Path

Press `BW Swp`, `MORE 1 of 3`, `MORE 2 of 3`, `adc trigger`.

Press `State`, `MORE 1 of 4`, `instr modes`, `OSA PULSE`, `adc trigger`.

See Also *ADCTRIG AC*, *ADCTRIG DELAY*, *ADCTRIG FREE*, *ADCTRIG NEGEDGE*, and *ADCTRIG POSEDGE* in this chapter.

Related Programming Command ADCTRG

ADCTRIG AC

Softkey that selects external ADC triggering.

The trigger occurs alternately on the rising and falling edges on the external trigger signal. The amplitudes measured on opposite edges are subtracted and the absolute value of the result becomes the trace amplitude value.

Key Path Press `State`, `MORE 1 of 4`, `instr modes`, `OSA PULSE`, `adc trigger` `ADCTRIG AC`.

Press `BW Swp`, `MORE 1 of 3`, `MORE 2 of 3`, `adc trigger` `ADCTRIG AC`.

See Also *adc trigger* in this chapter.

Related Programming Command ADCTRG AC

ADCTRIG DELAY

Softkey that delays external triggering of the analog-to-digital converter (ADC) after the trigger edge.

Key Path

Press `State`, `MORE 1 of 4`, `instr modes`, `OSA PULSE`, `adc trigger` `ADCTRIG DELAY`.

Press `BW Swp`, `MORE 1 of 3`, `MORE 2 of 3`, `adc trigger` `ADCTRIG DELAY`.

See Also

adc trigger in this chapter.

Related Programming Command

ADCTRGDLY

ADCTRIG FREE

Softkey that selects internal triggering of the ADC.

Key Path

Press `State`, `MORE 1 of 4`, `instr modes`, `OSA PULSE`, `adc trigger` `ADCTRIG FREE`.

Press `BW Swp`, `MORE 1 of 3`, `MORE 2 of 3`, `adc trigger` `ADCTRIG FREE`.

See Also

adc trigger in this chapter.

Related Programming Command

ADCTRG FREE

ADCTRIG NEGEDGE

Softkey that selects external ADC triggering.

The trigger occurs on the falling edge on the external trigger signal.

Key Path

Press State, MORE 1 of 4, instr modes, OSA PULSE, adc trigger ADCTRIG NEGEDGE.

Press BW Swp, MORE 1 of 3, MORE 2 of 3, adc trigger ADCTRIG NEGEDGE.

See Also

adc trigger in this chapter.

Related Programming Command

ADCTRG NEGEDGE

ADCTRIG POSEDGE

Softkey that selects external ADC triggering.

The trigger occurs on the rising edge on the external trigger signal.

Key Path

Press State, MORE 1 of 4, instr modes, OSA PULSE, adc trigger ADCTRIG POSEDGE.

Press BW Swp, MORE 1 of 3, MORE 2 of 3, adc trigger ADCTRIG POSEDGE.

See Also

adc trigger in this chapter.

Related Programming Command

ADCTRG POSEDGE

ALIGN PRESET

Softkey that returns alignment to factory default settings.

Improper alignments occur if the alignment signal is removed during the procedure. Pressing `ALIGN PRESET` corrects this condition by returning the optical spectrum analyzer to its factory default settings. (Press the `Amplitude` menu's `AUTO ALIGN` softkey to start an automatic alignment.)

Key Path

Press `Misc`, `MORE 1 of 3`, `service`, `extnded align`, `ALIGN PRESET`.

See Also

AUTO ALIGN in this chapter.

Related Programming Command

ALIGNPRST

AMP REF OFFSET

Softkey that adjusts the displayed amplitude level, using a relative-amplitude offset value.

Offsets are typically used to make measurements relative to the input of a device under test rather than the input of the optical spectrum analyzer. Although all amplitude readouts are offset, detected trace amplitudes are not effected. The amplitude offset range is ±300 dBm.

CAUTION

Using an amplitude reference offset can mask an overdriven input and cause inaccurate measurements. The optical spectrum analyzer adjusts all internal hardware based on the original reference level and does not incorporate the offset value. Before using the amplitude reference offset function, be sure to verify that the input signal is not excessive for the reference range setting that is used during the measurement.

The optical spectrum analyzer adds offsets to all amplitude readouts including the marker, threshold, reference level, display-line, and calibration-power readouts. Offsets are stored and recalled with save and recall softkeys SAVE STATE and RECALL STATE. ROFFSET appears at the top of the display. The offset also affects any amplitude information returned to a computer during remote-control operations. To enter an offset, use the numeric keypad, and terminate the entry using the dB softkey. The offset value can be changed in increments of one graticule division using the ▲ and ▼ keys. Use the front-panel knob to change the offset value sequentially.

To eliminate an offset, activate the amplitude-reference offset function and enter zero, or press INSTR PRESET.

Key Path

Press Amptd, MORE 1 of 4, AMP REF OFFSET.

Related Programming Command

ROFFSET

AMPCOR ->LOWER

Softkey that copies amplitude-correction values into a lower limit-line table.

Use this function to return previously loaded amplitude-correction values to the lower limit-line table for modification.

The amplitude corrections must first be entered into the lower limit-line table, using the limit-line softkey functions. The limit line is then stored as amplitude-correction values, using the LOWER-> AMPCOR softkey.

After the correction values are stored in the limit-line table, they can be modified, using the appropriate limit-line softkey functions.

Use the `LOWER-> AMPCOR` softkey to store and enable the amplitude-correction values.

Key Path

Press `Misc`, `MORE 1 of 3`, `limit lines`, `lim <-> ampcor`, `AMPCOR ->LOWER`.

See Also

LOWER-> AMPCOR, *UPPER-> AMPCOR*, and *AMPCOR On Off* in this chapter.

Related Programming Command

CORTOLIM

AMPCOR-> UPPER

Softkey that copies amplitude-correction values into an upper limit-line table.

Use this function to return previously loaded amplitude-correction values to the upper limit-line table for modification.

The amplitude corrections must first be entered into the upper limit-line table, using the limit-line softkey functions. The limit line is then stored as amplitude-correction values, using the `UPPER-> AMPCOR` softkey.

After the correction values are stored in the limit-line table, they can be modified, using the appropriate limit-line softkey functions.

Use the `UPPER-> AMPCOR` softkey to store and enable the amplitude-correction values.

Key Path

Press `Misc`, `MORE 1 of 3`, `limit lines`, `lim <-> ampcor`, `AMPCOR -> UPPER`.

See Also *UPPER-> AMPCOR*, *LOWER-> AMPCOR*, and *AMPCOR On Off* in this chapter.

Related Programming Command CORTOLIM

AMPCOR On Off

Softkey that turns on and off the use of amplitude corrections.

The amplitude corrections must first be entered via a computer or by using the limit-line table. When using the limit-line table, limit lines are stored as amplitude-correction values, using the `UPPER-> AMPCOR` softkey.

Key Path Press `Amptd`, `MORE 1 of 4`, `MORE 2 of 4`, `MORE 3 of 4`, `AMPCOR On Off`.

See Also *UPPER-> AMPCOR* and *LOWER-> AMPCOR* in this chapter.

Related Programming Command AMPCOR

Amptd

Softkey that presents a menu of softkeys that control the optical spectrum analyzer's sensitivity and amplitude scale.

AMPTD VALUE

Softkey that enters the beginning amplitude value of the currently selected limit-line segment.

Key Path

Press `Misc`, `MORE 1 of 3`, `limit lines`, `LIMITS 1 of 3`, `AMPTD VALUE`.

See Also

TYPE and *WVLEN VALUE* in this chapter.

Related Programming Command

LIMIAMP

ANALOG OUT

A rear-panel output connector.

An output of the transimpedance amplifier. This output directly provides a voltage equal to the photocurrent in the diode multiplied by the transimpedance value. The connector is a standard SMB coaxial male jack with its outer conductor connected directly to the rear panel (earth ground).

ANALYZR TEST

Softkey that initiates a self-test routine.

The routine determines if the optical spectrum analyzer is working properly. Any errors are reported automatically on the display screen.

Key Path Press `Misc`, `MORE 1 of 3`, `service`, `ANALYZR TEST`.

Related Programming Command TEST

ANOTATN On Off

Softkey that turns the displayed annotation on and off.

All annotation showing amplitude values, wavelength values, and instrument settings are blanked. The clock remains displayed at the top of the screen. The clock can be blanked using softkeys accessed with the (DISPLAY) key. Refer to the "Controlling Annotation, Printing, and Plotting" chapter in the *User's Guide* for information on blanking the clock.

Key Path Press `Misc`, `ANOTATN On Off`.

ANY CHR

Softkey that enters any ASCII character as part of a programming command.

Remote programming commands can be entered from the front panel using the `Misc` menu's COMMAND selection. The `ANY CHR` softkey provides the ability to enter characters not normally available for selection. Enter a character by typing its 3-digit decimal ASCII code.

Key Path Press `Misc`, `MORE 1 of 3`, `COMMAND`, `ANY CHR`.

See Also *COMMAND* in this chapter.

AT MKR On Off

Softkey that allows the automatic measurement routine to execute on a unique signal in a multiple signal environment.

The automatic measurement routine (press AUTO MEASURE or the `Waveln` menu's `AUTO MEASURE` softkey) automatically tunes the optical spectrum analyzer to a signal. To identify the signal, the routine looks for the largest signal in the current trace. If `AT MKR On Off` is pressed so that `On` is underlined, and a marker is turned on, the automatic measurement routine looks for the signal closest to the marker in the current trace.

Key Path Press `State`, `autmeas state`, `AT MKR On Off`.

See Also *AUTO MEASURE* and *autmeas state* in this chapter.

Related Programming Command AUTOMMKR

autmeas state

Softkey that presents a menu which allows you to modify the automatic measurement routine.

The automatic measurement routine automatically tunes the optical spectrum analyzer for optimum display of an input signal. The resulting wavelength span is calculated to display most of the signal's energy. (To start the routine, press the `Waveln` menu's `AUTO MEASURE` softkey.) Normally, `AUTO MEASURE` locates a signal according to the following steps:

1. Locates largest signal in the full wavelength span.
2. Centers signal on the display by adjusting center wavelength, sensitivity, and reference level.
3. Reduces the wavelength span so that most (or all) of the signal power is displayed.
4. Sets the amplitude scale to 10 dB/division.

Three `autmeas state` menu softkeys alter the above steps: `SPAN AutoMan`, `DB/DIV AutoMan`, `AT MKR On Off`, and `OPTSENS, On Off`.

The `SPAN AutoMan` softkey sets the wavelength span used upon completion of the automatic measurement routine. Press `SPAN AutoMan` so that `Man` is underlined, and enter the desired span. When `Auto` is underlined, the optimum spanwidth is automatically calculated. An instrument preset sets the softkey to `Auto`.

The `DB/DIV AutoMan` softkey changes the final amplitude scale used upon completion of the automatic measurement routine. Press `DB/DIV AutoMan` so that `Man` is underlined, and enter the desired scale. When `Auto` is underlined, the default 10 dB-per-division is used. An instrument preset sets the softkey to `Auto`.

When the `AT MKR On Off` softkey is on, the automatic measurement routine uses the closest peak to the marker. Of course, a marker must be on. An instrument preset sets the softkey to `Off`.

When the `OPTSENS On Off` softkey is turned on, the automatic measurement routine uses a lower sensitivity setting in order to reduce the displayed noise. One example of using this feature is to allow the viewing of sidemodes on a DFB laser upon the completion of the automatic measurement.

Key Path Press `State`, `autmeas state`.

Auto

Softkey that determines the values measured by the marker.

Normally, the optical spectrum analyzer selects the proper marker readout based on the current instrument state, when the `Auto` softkey is underlined. The marker annotation can be manually selected to indicate one of the following trace values:

- Frequency
- Wavelength
- Period
- Sweeptime
- $\frac{1}{T}$

Return to normal automatic marker annotation by pressing the `Auto` softkey has `Auto` underlined or by pressing (INSTR PRESET).

Key Path Press `Marker`, `MORE 1 of 4`, `MORE 2 of 4`, `marker readout`, `Auto`.

(AUTO ALIGN)

This custom keypad feature initiates an automatic alignment routine.

The alignment positions the optical spectrum analyzer's internal optics for optimum signal gain. This feature is identical to pressing the `AUTO ALIGN` softkey under the `Amptd` menu softkey. If no marker is present, `AUTO ALIGN` performs the alignment using the largest signal in full span. If a marker is on, it uses the signal found at that wavelength.

Related Programming Command AUTOALIGN

AUTO ALIGN

Softkey that initiates an automatic alignment routine. The alignment positions the optical spectrum analyzer's internal optics for optimum signal gain and amplitude accuracy. Pressing this softkey is identical to pressing the (AUTO ALIGN) key located on the custom keypad. If no marker is present, AUTO ALIGN performs the alignment using the largest signal in full span. If a marker is on, it uses the signal found at that wavelength.

Key Path Press Amptd, AUTO ALIGN.

Related Programming Command AUTOALIGN

(AUTO MEASURE)

Initiates an automatic measurement routine.

The measurement locates the largest signal present at the input connector and tunes the optical spectrum analyzer to the signal. This is accomplished by centering the signal on the display and then narrowing the span to either 100, 50, or 20 nm as determined by the signal width. With the autmeas state menu, you can modify the algorithm used by the routine to locate a signal. This feature is identical to pressing the AUTO MEASURE softkey under the Waveln menu softkey.

This automatic measurement routine is normally the best way to adjust sensitivity while maintaining the fastest sweep rates.

See Also

autmeas state in this chapter.

Related Programming Command

AUTOMEAS

AUTO MEASURE

Softkey that initiates an automatic measurement routine.

The measurement locates the largest signal present at the input connector and tunes the optical spectrum analyzer to the signal. This is accomplished by centering the signal on the display and then narrowing the span to either 100, 50, or 20 nm as determined by the signal width. With the `autmeas state` menu, you can modify the algorithm used by the routine to locate a signal. Pressing this softkey is identical to pressing the (AUTO MEASURE) key located on the custom keypad.

This automatic measurement routine is normally the best way to adjust sensitivity while maintaining the fastest sweep rates.

Key Path

Press `Waveln`, `AUTO MEASURE`.

Related Programming Command

AUTOMEAS

AUTO SCALE

Softkey that automatically scales the displayed signal during a polarization dependent loss (PDL) measurement.

NOTE

For use with Option 003, Swept Polarization Dependent Loss (PDL) Kit.

Prior to initializing the PDL measurement, AUTO SCALE positions the peak of trace A to the reference level and selects the scaling (that is, dB/division) based upon the minimum signal level of trace A.

When INIT PDL is pressed, AUTO SCALE positions the peak of trace B (that is, the maximum signal) to the reference level and selects the scaling based upon the minimum point in trace C (that is, the minimum signal).

When CALC + DISPLAY is selected, AUTO SCALE positions the peak of trace A as a result of trace B minus trace C by selecting the minimum dB/division which keeps the maximum signal below the top graticule.

Key Path Press USER, PDL, AUTO SCALE.

Related Programming Command PDLSCALE

AUTOPTS ALIGN

Softkey that runs an automatic alignment routine for the fiber positioner's tracking table.

This softkey runs the alignment over a user-specified wavelength range. To align the 900 nm to 1700 nm range, refer to W LIGHT ALIGN in this chapter.

You must enter the stop and start wavelengths before pressing this softkey. These wavelengths are included in the alignment. The alignment requires a white light source and takes about 2 or 3 minutes to complete. Before initiating the alignment, you must connect a white-light source to the front-panel input connector.

To run this alignment, you must observe the following requirements:

- Set the start and stop wavelengths within the input range of 600 nm to 1700 nm.
- Ensure that the span of the alignment is greater than 10 nm.

If the above conditions are not met, a "Bad Wavelength Range" error message is displayed.

The alignment occurs at equally spaced points between the start and stop wavelengths. No points are separated by more than 50 nm.

The alignment replaces current correction data with new data, and the AUTO ALIGN data is zeroed. The resulting correction data may be viewed by: pressing State, MORE 1 of 3, MORE 2 of 3, show states, and then EXTEND STATE.

If an AUTO ALIGN is executed after this alignment, the AUTOPTS ALIGN data is shifted by AUTO ALIGN.

Key Path Press Misc, MORE 1 of 3, service, extnded align, AUTOPTS ALIGN.

See Also *ALIGN PRESET*, *AUTO ALIGN*, *MANUAL ALIGN*, and *W LIGHT ALIGN* in this chapter.

Related Programming Command ALIGN

AUTORNG On Off

Softkey that turns automatic ranging on or off. Normally, the optical spectrum analyzer automatically selects the greatest sensitivity possible that does not require amplification changes during the sweep. If you manually increase the sensitivity level, the sweep pauses to allow this change in gain. This is known as autoranging. If desired, autoranging can be disabled using the `AUTORNG On Off` softkey. This softkey also indicates the state of autoranging for a given sensitivity and video bandwidth setting. If autoranging is on, an asterisk appears next to the `SENS` screen annotation.

Key Path Press `Amptd`, `MORE 1 of 4`, `AUTORNG On Off`.

Related Programming Command AUTORNG

AUTZERO On Off

Softkey that turns off zeroing between traces.

Zeroing is a process that compensates for temperature-related current drift in the optical spectrum analyzer. The optical spectrum analyzer zeroes its active transimpedance amplifiers between each sweep. Zeroing increases amplitude accuracy but also increases sweep retrace time.

Key Path Press `Amptd`, `MORE 1 of 4`, `MORE 2 of 4`, `AUTZERO On Off`.

See Also *ZERO* in this chapter.

Related Programming Command AUTZERO

B ← B-DL

Softkey that subtracts the value of the display line from trace B, then stores the result in trace B.

To observe the result of this trace math, be sure to place the optical spectrum analyzer in single sweep mode. Use this feature to position the trace on the screen. To turn on and position the display line, press `Misc`, `DSP LIN On Off`, and use the front-panel knob to position the line.

Key Path Press `Traces`, `MORE 1 of 4`, `oneshot math`, `B-DL->B`.

See Also *DSP LIN On Off* in this chapter.

Related Programming Command BML

B XCH C

Softkey that exchanges the contents of the trace B and trace C registers.

Key Path Press `Traces`, `MORE 1 of 4`, `oneshot math`, `B XCH C`.

Related Programming Command BXC

BEEPER On Off

Softkey that turns on and off an alarm for alerting you that a signal has crossed a displayed limit line.

When `BEEPER On Off` is set to `On`, the analyzer beeps when the trace data exceeds the upper or lower limits defined in the limit-line table. `FAIL` is also displayed at the top of the display. If the trace data passes the test limits, `PASS` is displayed.

Key Path Press `Misc`, `MORE 1 of 3`, `limit lines`, `BEEPER On Off`.

See Also *LIMITS On Off* in this chapter.

Related Programming Command LIMIBEEP, BP

BLANK A

Softkey that prevents trace A data from being displayed.

This softkey is displayed after `STORE A` is pressed and disappears when `CLEAR WRT A` or (INSTR PRESET) is pressed. When pressed, the softkey toggles between `VIEW A` and `BLANK A`. This gives you the ability to view or blank stored trace data. The data is stored in temporary trace memory locations. (Use the `trace A B C` softkey to select trace memory.) While blanked traces are removed from the display, the trace data still remains in reserved memory.

Key Path Press `Traces`, `BLANK A`.

See Also *CLEAR WRT A* in this chapter.

Related Programming Command BLANK

BLANK B

Softkey that prevents trace B data from being displayed.

This softkey is displayed after `STORE B` is pressed and disappears when `CLEAR WRT B` or (INSTR PRESET) is pressed. When pressed, the softkey toggles between `VIEW B` and `BLANK B`. This gives you the ability to view or blank stored trace data. The data is stored in temporary trace memory locations. (Use the `trace A B C` softkey to select trace memory.) While blanked traces are removed from the display, the trace data still remains in reserved memory.

Key Path Press `Traces`, `BLANK B`.

See Also *CLEAR WRT A* in this chapter.

Related Programming Command BLANK

BLANK C

Softkey that prevents trace C data from being displayed.

This softkey is displayed after `STORE C` is pressed and disappears when `CLEAR WRT C` or (INSTR PRESET) is pressed. When pressed, the softkey toggles between `VIEW C` and `BLANK C`. This gives you the ability to view or blank stored trace data. The data is stored in temporary trace memory locations. (Use the `trace A B C` softkey to select trace memory.) While blanked traces are removed from the display, the trace data still remains in reserved memory.

Key Path Press `Traces`, `BLANK C`.

See Also *CLEAR WRT C* in this chapter.

Related Programming Command BLANK

BLANK TRACES

Softkey that prevents the display of trace A, B, and C during creation or editing of limit lines.

Blanking the traces can make it easier to view the limit lines you are creating or editing.

Key Path Press `Misc`, `MORE 1 of 3`, `limit lines`, `LIMITS 1 of 3`, `LIMITS 2 of 3`, `BLANK TRACES`.

Related Programming Command BLANK

BW, Swp

Softkey that presents a menu for controlling instrument sweep, bandwidth, and triggering.

C ← B

Softkey that places the contents of trace B into trace C.

Key Path Press `Traces`, `MORE 1 of 4`, `oneshot math`, `C ← B`.

cal menu

Softkey that presents a menu for performing user calibration at a set wavelength and power level.

This user calibration calibrates the optical spectrum analyzer at a specific wavelength and power level. It requires that you first display a stable source within the 600 to 1700 nm range. The calibration source must have a known wavelength and power.

> **This calibration is not required**
>
> Your optical spectrum analyzer meets all its published specifications without the running of these user calibrations. These calibrations are provided for those situations where you desire maximum performance at a specific wavelength or power level.

The wavelength calibration is not a simple offset applied to all wavelengths but uses the trigonometric diffraction grating equation to correct all wavelengths in a calculated manner. The power offset is a simple offset applied equally to all wavelengths. It is good measurement practice to calibrate the optical spectrum analyzer as close as possible to the wavelength where you plan to make your measurements.

The optical spectrum analyzer's maximum calibration adjustment is about 2 nm in wavelength. If a larger adjustment is attempted, error 2023 `Illegal Cal signal` is displayed.

During a power calibration, the light source's output power is first measured with a power meter. Then, the fiber-optic cable is disconnected from the power meter and connected to the optical spectrum analyzer. Because the optical spectrum analyzer is slightly polarization sensitive, power calibrations should be performed by persons knowledgeable of the effects of polarization on optical power measurements. Moving fiber-optic cables changes polarization, the output power may vary. To ensure the output power does not vary, use a polarization controller. Use the polarization controller to maintain the same polarization between the measurement of the light source's power and the optical spectrum analyzer's calibration. Calibrate for the average output power value.

At any time, you can turn off the use of either wavelength or power calibration data. You can also reenter or erase the calibration from memory. Separate power calibration data is obtained from calibrations performed during optical spectrum analyzer and power-meter instrument modes. For more information on calibrating the optical spectrum analyzer, refer to "Calibrating the Optical Spectrum Analyzer" located in Chapter 1 of the *HP 71450B/1B/2B Optical Spectrum Analyzers User's Guide* .

Locating the calibration signal

During a calibration, the optical spectrum analyzer expects a signal to be near its previous calibration. The factory default and calibration offset limits are:

Power .... −5 dBm ±5 dB
Wavelength .... 1300 ±2 nm

If the signal is not within these limits, use POWER FOR CAL to enter the power and WAVELEN FOR CAL to enter the wavelength. If you calibrate only power, the approximate wavelength of the source must also be entered. If you calibrate only wavelength, the approximate power of the source must also be entered. Of course, if you are calibrating both wavelength and power, you will enter exact values. You can use markers to obtain a approximate wavelength and power values.

Key Path

Press Wavelen , MORE 1 of 2 , cal menu .

Press Amptd , MORE 1 of 4 , cal menu .

CAL POWER

Softkey that performs a power calibration at a set wavelength.

To ensure an accurate power calibration, do an AUTO ALIGN before performing this calibration routine. To remind you of this, the following message is displayed whenever this softkey is pressed: "*Improper cal may degrade performance.*" Use the POWER FOR CAL softkey to enter the exact power of the source.

Separate power calibration data is obtained from calibrations performed during optical spectrum analyzer and power-meter instrument modes. For more information on calibrating the optical spectrum analyzer, refer to "Calibrating the Optical Spectrum Analyzer" located in Chapter 1 of the *HP 7145B/1B/2B Optical Spectrum Analyzers User's Guide* .

Locating the calibration signal

During a power calibration, the optical spectrum analyzer factory defaults expect a 1300 nm signal. If the calibration signal is not 1300 ±2 nm, use WAVELEN FOR CAL to enter the correct value. (Use markers to obtain a wavelength value.)

Key Path

Press Wavelen, MORE 1 of 2, cal menu, CAL POWER.

Press Amptd, MORE 1 of 4, cal menu, CAL POWER.

See Also

cal menu in this chapter.

cal setup

Softkey that presents a menu for specifying the power and wavelength used for user calibrations.

Key Path

Press `Wavelen`, `MORE 1 of 2`, `cal menu`, `cal setup`.

Press `Amptd`, `MORE 1 of 4`, `cal menu`, `cal setup`.

CAL WAVELEN

Softkey that performs a wavelength calibration at a set wavelength and amplitude.

To ensure an accurate wavelength calibration, do an [AUTO ALIGN] before performing this calibration routine. To remind you of this, the following message is displayed whenever this softkey is pressed: "*Improper cal may degrade performance.*" Use the `WAVELEN FOR CAL` softkey to enter the exact wavelength of the source.

For more information on calibrating the optical spectrum analyzer, refer to "Calibrating the Optical Spectrum Analyzer" located in Chapter 1 of the *HP 71450B/1B/2B Optical Spectrum Analyzers User's Guide* .

Locating the calibration signal

During a wavelength calibration, the optical spectrum analyzer defaults expect a signal at −5 dBm ±5 dB. If the power is not within this limit, enter the approximate power using the `POWER FOR CAL` softkey prior to the wavelength calibration. (Use markers to obtain the power level.)

Key Path

Press `Wavelen`, `MORE 1 of 2`, `cal menu`, `CAL WAVELEN`.

Press `Amptd`, `MORE 1 of 4`, `cal menu`, `CAL WAVELEN`.

See Also

cal menu in this chapter.

CAL WVL AT PIT

Softkey that performs a wavelength calibration at a signal pit.

After pressing this softkey, use the marker keys (or numeric keypad) to enter the pit wavelength.

Key Path

Press `Wavelen`, `MORE 1 of 2`, `cal menu`, `CAL WVL AT PIT`.

Press `Amptd`, `MORE 1 of 4`, `cal menu`, `CAL WVL AT PIT`.

See Also

CAL WAVELEN in this chapter.

Related Programming Command

CAL

CALC + DISPLAY

Softkey that calculates the peak-to-peak polarization dependent loss and displays the result. After the calculation is performed, the measurement is stopped and the result is displayed as trace A. Trace A is the result of trace B (maximum) minus trace C (minimum).

NOTE

Only for use with Option 003, Swept Polarization Dependent Loss (PDL) Kit.

Key Path Press (USER), PDL, CALC + DISPLAY.

Related Programming Command PDLCALC

CALC On Off

Softkey that turns the calculation of advanced-measurement program results on and off.

The DFB, FP, and LED advanced-measurement programs measure and characterize DFB lasers, Fabry-Perot lasers, and LEDs. At the completion of each sweep, advanced-measurement programs recalculate and update the measurement results shown at the top of the display. Use this softkey to prevent this updating.

Key Path Press (USER), DFB, CALC On Off.

Press (USER), FP, CALC On Off.

Press (USER), LED, CALC On Off.

See Also *DFB*, *FB*, and *LED* in this chapter.

CANCEL

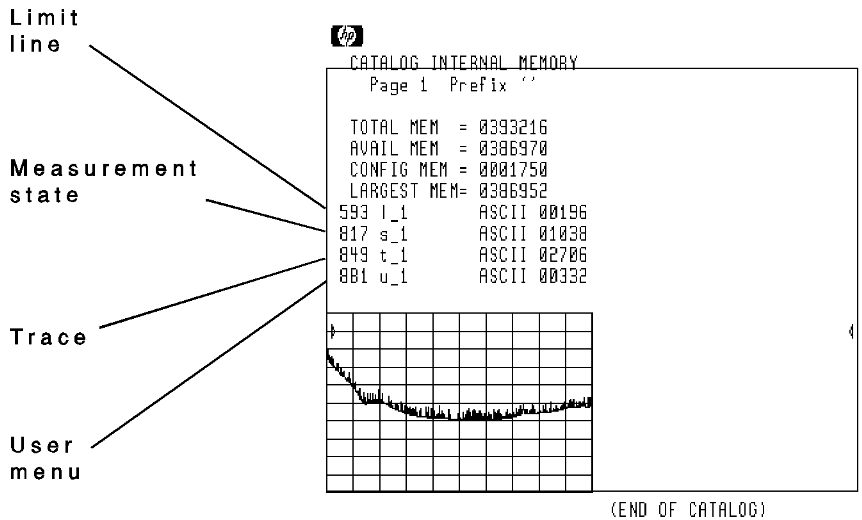
Softkey that cancels the various memory-erase operations.

See Also *FORMAT* and *PARTIAL ERASE* in this chapter.

catalog & MSI

Softkey that displays the contents of the currently selected user memory.

The display lists names of entries, their size and type, and the amount of available memory. Use `INTRNL MEMORY`, `HP-MSIB CARD`, and `HPIB DISK` softkeys to select memory before executing `catalog & MSI`.



Catalog of internal memory showing file types.

Catalog of User Memory

Stored Article	Storing and Recalling Keys and Programming Commands	File Type	Default File Prefix
Instrument State	SAVE STATE, RECALL STATE, LOAD	ASCII	s_
Program	SAVE PROGRAM, RECALL PROGRAM, LOAD	ASCII	d_
Trace	SAVE TRACE A, RECALL TRACE A, LOAD	ASCII	t_
(USER) Menu	SAVE USERKEY, SAVE USER, RECALL USERKEY, RECALL USER, LOAD	ASCII	u_
Limit-line	SAVE LIMIT, RECALL LIMIT, LOAD	ASCII	l_
User-defined trace †	TRDEF or LIMILINE command	TRACE	none
User-defined variable †	VARDEF command	VAR	none
User-defined function †	FUNCDEF command	FUNC	none
Active user-defined function †	ACTDEF command	AFUNC	none
On-end-of-sweep algorithm †	ONEOS command	ONEOS	none
Trace-amplitude correction offsets †	AMPCOR command	AMPCOR	none

† Indicates article can be stored in internal memory only.

Key Path Press Misc, MORE 1 of 3, catalog & MSI.

See Also *INTRNL MEMORY*, *HP-MSIB CARD*, and *HPIB DISK* in this chapter.

Related Programming Command CATALOG, DSPMODE CAT, MEM

(CENTER)

Specifies the wavelength displayed at the center of the screen.

When activated, the wavelength at center screen can be changed using the front-panel knob, step keys, or numeric keypad. This feature is identical to pressing the CENTER softkey under the Waveln menu softkey.

Related Programming Command

CENTERWL

CENTER

Softkey that specifies the wavelength displayed at the center of the screen.

When activated, the wavelength at center screen can be changed using the front-panel knob, step keys, or numeric keypad. This function is identical to the custom-keypad's (CENTER) key.

Key Path

Press Waveln, CENTER.

Press (USER), DFB, CENTER.

Press (USER), FP, CENTER.

Press (USER), LED, CENTER.

Related Programming Command

CENTERWL

CHANGE PREFIX

Softkey that changes the prefix attached to files when they are stored in memory. Each file has an identifying prefix, which distinguishes one type of file, and its contents, from the other file types.

File Prefixes

File Type	File Prefix
Instrument state	s_
Program	d_
Trace	t_
USER menu	u_
Limit-line	l_

CHANGE PREFIX activates character-editing softkeys that are used to modify characters in the default file prefixes. These editing softkeys are also used for the title softkey functions.

Key Path

Press Misc , MORE 1 of 3 , catalog & MSI , CATALOG 1 of 2 , CHANGE PREFIX .

Related Programming Command

PREFX

CHOP On Off

Softkey that turns "chop" mode on and off.

To compensate for the effect of stray light, the optical spectrum analyzer uses a special "chop" mode. Large input signals can reduce dynamic range by producing stray light inside the optical spectrum analyzer's internal monochromator. This stray light raises the displayed noise floor which reduces the dynamic range. In chop mode, the optical spectrum analyzer's photodetector is zeroed before each measurement. (This effectively measures and subtracts the effect of any stray light and noise from each measured trace point.) Chop mode is *not required* for the optical spectrum analyzer to meet its dynamic range specifications. However, dynamic range can be improved with chop mode turned on. Video averaging is often required when using chop mode to obtain a complete trace. Chop mode will increase the sweep time to 40 seconds or longer.

Chop mode also compensates for electronic drift during long sweeps. Chop mode is automatically turned on whenever the sweep time is 40 seconds or longer. For many measurements, stray light and electronic drift will not be a problem. If needed, you can disable chop mode.

Key Path

Press `Amptd`, `MORE 1 of 4`, `CHOP On Off`.

Related Programming Command

CHOP

CLEAR TO END

Softkey that deletes all characters from the cursor to the end of the data line.

Use the ▲ and ▼ step keys to move the cursor along the text in the data line.

Key Path

Press `Misc`, `TITLE`, `CLEAR TO END`.

Press `Misc`, `MORE 1 of 3`, `COMMAND`, `CLEAR TO END`.

CLEAR WRT A

Softkey that continuously updates trace A with new data obtained from scanning the input spectra.

Trace A data is updated after each sweep. Initially, clear-write clears the trace register, setting all trace amplitudes equal to the bottom graticule line. When the trigger initiates a sweep, the trace register is updated as the sweep progresses. You can select the traces B or C using the `trace A B C` softkey.

Key Path Press `Traces`, `CLEAR WRT A`.

Related Programming Command CLRW

CLEAR WRT B

Softkey that continuously updates trace B with new data obtained from scanning the input spectra.

Trace B data is updated after each sweep. Initially, clear-write clears the trace register, setting all trace amplitudes equal to the bottom graticule line. When the trigger initiates a sweep, the trace register is updated as the sweep progresses. You can select the traces A or C using the `trace A B C` softkey.

Key Path Press `Traces`, `CLEAR WRT B`.

Related Programming Command CLRW

CLEAR WRT C

Softkey that continuously updates trace C with new data obtained from scanning the input spectra.

Trace C data is updated after each sweep. Initially, clear-write clears the trace register, setting all trace amplitudes equal to the bottom graticule line. When the trigger initiates a sweep, the trace register is updated as the sweep progresses. You can select the traces A or B using the `trace A B C` softkey.

Key Path Press `Traces`, `CLEAR WRT C`.

Related Programming Command CLRW

CLOSEST PEAK

Softkey that moves the active marker to the closest signal peak.

You can specify the minimum amplitude excursion defined as a peak using the `PEAK EXCURSN` softkey.

Key Path Press `Marker`, `MORE 1 of 4`, `CLOSEST PEAK`.

See Also *PEAK EXCURSN* in this chapter.

Related Programming Command MKPK CP

CLOSEST PIT

Softkey that moves the active marker to the closest signal pit (minimum).

You can specify the minimum amplitude excursion (up-down-up) defined as a pit using the PIT EXCURSN softkey.

Key Path

Press Marker, MORE 1 of 4, MORE 2 of 4, MORE 3 of 4, pit,min markers, CLOSEST PIT.

See Also

PIT EXCURSN in this chapter.

Related Programming Command

MKPK CPIT

COMMAND

Softkey that accesses a menu for entering, editing, and executing short programming routines.

When a computer is not available, use the COMMAND softkeys to perform the following tasks:

- Execute a command whose function is not available from the front panel.
- Create a user-defined function.
- Edit a user-defined function.

Ideally, programming commands should be executed via HP-IB with the use of a computer. To execute a series of programming commands, spell the desired commands, separating each command by a semicolon character. Then, execute the commands by pressing the ENTER COMMAND softkey.

- Use the ▲ and ▼ step keys to move the cursor along the displayed text.
- The ← key moves the cursor to beginning of any text.

- Use the front-panel knob to pick each character from the character list.

The SELECT CHAR softkey places selected characters at the displayed cursor. The SELECT CHAR softkey is displayed when DELETE or... or REPLACE or... is selected. The title menu's third softkey toggles between INSERT or... , REPLACE or... , and DELETE or... .

View a stored user-defined function for editing by entering the function name and then pressing EDIT FUNCDEF . (User-defined functions are subroutines which execute a series of analyzer commands. Down-loadable programs contain one or more user-defined functions.) Once again, user-defined functions are created or changed more easily using a computer. However, the COMMAND softkeys can be useful when the user-defined functions, or their changes, are brief.

CAUTION Do not use the EDIT FUNCDEF softkey to edit user-defined functions comprising more than 239 characters. This can destroy the function.

Use the ANY CHAR softkey to enter any character not available for selecting. Enter the decimal value for the character. Refer to the "Tables and Charts" chapter in this manual for a table of character codes.

Overwriting programming commands

Do not name traces, variables, and functions the same name as standard programming commands. This overrides the programming command so that it cannot be used. No error message is generated by this condition. Standard commands that have been overridden are unavailable to a remote controller and cannot be used by a DLP until the user-defined function is eliminated. Use the DISPOSE programming command to remove the user-defined function.

Automatically adding functions to user menus

Names of user-defined functions that end in an underscore character automatically places the function on the user-softkey menu when the function is defined. Reading a user-defined function named in this manner from external memory also places the function on the user-softkey menu automatically.

Key Path Press `Misc`, `MORE 1 of 3`, `COMMAND`.

See Also Refer to the programming manual for information on remote programming.

CONFIG

Softkey that shows the configuration of the optical spectrum analyzer module in the modular measurement system (MMS).

Items shown include the following module information:

HP-MSIB address
Firmware revision number
Options
Serial number

Key Path Press `State`, `MORE 1 of 4`, `MORE 2 of 4`, `show states`, `CONFIG`.

Related Programming Command CONFIG, DSPMODE CONFIG

CONFIRM DELETE

Softkey that erases the contents of the limit-line table after DELETE ALL has been pressed.

Key Path

Press Misc, MORE 1 of 3, limit lines, LIMITS 1 of 3, LIMITS 2 of 3, DELETE ALL, CONFIRM DELETE.

CONFIRM ERASE

Softkey that erases memory when pressed.

This softkey is displayed when memory is being erased.

Key Path

Press State, MORE 1 of 4, MORE 2 of 4, MORE 3 of 4, PARTIAL ERASE, CONFIRM ERASE.

CONT

Softkey that resumes operation of a halted program.

Use this softkey when debugging user-defined functions. User-defined functions are short programs (or part of larger programs) that are usually downloaded from a computer via HP-IB to the optical spectrum analyzer. Short user-defined functions can be created using the COMMAND softkey. After PAUSEing or STEPing a program, use the CONT softkey to continue normal execution of the code.

Key Path Press `Misc`, `MORE 1 of 3`, `MORE 2 of 3`, `debug`, `CONT`.

See Also *debug* in this chapter.

CONT SWEEP

Softkey that sweeps the measurement range when the trigger conditions are met.

When `CONT SWEEP` is pressed, sweeps continuously repeat as long as trigger conditions are met. The "MEASURE" indicator light on the front panel of the optical spectrum analyzer module is on when the sweep is in progress. The indicator is off between sweeps. When an advanced-measurement program is running, the measured data is updated after each sweep.

Key Path Press `BW,Swp`, `CONT SWEEP`.

Press (USER), `DFB`, `CONT SWEEP`.

Press (USER), `FP`, `CONT SWEEP`.

Press (USER), `LED`, `CONT SWEEP`.

Related Programming Command CONTS

current source

Softkey that presents a menu for controlling the Option 001 pulsed current source.

NOTE

This softkey is only displayed on Option 001 optical spectrum analyzers.

Use the current source to supply the bias of a lightwave source. The current can be dc or pulsed and can be used for the following:

- Reducing device heat-dissipation (in pulse mode)
- Measuring spectrum as a function of bias
- Making L-I curves
- Determining laser threshold

The parameters of the current source are as follows:

Output current .... 0 ±200 mA (source or sink)
Resolution .... 50 μA steps
Output impedance .... 50 Ω
Duty cycle .... 0—100%

For a complete listing of specifications for the current source, refer to the "Specifications and Characteristics" chapter in this manual. The current source is available at the rear-panel: CURRENT SOURCE connector. Current limiting is available to protect sensitive devices. The default limit is set to ±50 mA. In addition, a TTL signal having the same pulse width and duty cycle as the current source is available at the rear panel ADC SYNC OUT connector. Setting the current source's pulse parameters also sets the ADC SYNC OUT parameters. Connect the ADC SYNC OUT signal to light source's that have a TTL compatible pulse-input connector.

For the ADC SYNC OUT and CURRENT SOURCE output signals to be active, the optical spectrum analyzer's wavelength span must be greater than 0 nm. (When the span is set to 0 nm and the duty cycle is less than 100%, these outputs are disabled.)

The CURRENT SOURCE and ADC SYNC OUT outputs have one pulse for each trace point. The displayed data is synchronized to the trailing edge of the pulse. This ensures that the light source has maximum time to stabilize. You can adjust this time by setting the pulse width.

Observe current source load requirements

If the current source does not correctly pulse the light source, you may be exceeding the current source's load handling capability. Refer to the "Specifications and Characteristics" chapter in this manual for information on load limits.

Cables used for pulse measurements

To reduce electrical noise, be sure to ground the cable that connects the rear panel with the light source. The rear panel's SMB connector is already grounded. Ground the connector at the light-source end of the cable.

The Hewlett-Packard part number for an SMB (f) to BNC (m) cable is 85680-60093.

Pulse width determines the time that the light source is turned on. Duty cycle determines the ratio of "on" and "off" time and is entered as a percentage:

$$duty\ cycle = \left(\frac{pulse\ width}{pulse\ period}\right)(100)$$

The pulse period may increase slightly during measurements to allow the optical spectrum analyzer to perform various internal tasks. Consider the following when selecting pulse width and duty cycle values:

- Duty cycle affects the average power dissipated by the light source.
- Pulse width affects the power applied to the light source during its "on" time.
- Measurements are performed near the trailing edge of the pulse.

Pulse widths can range from 1 μs to 6.5 ms. However, not all combinations of pulse widths and duty cycles are available. The optical spectrum analyzer limits and adjusts these parameters as needed to maintain the following conditions:

- Pulse must be off for at least 200 μs.
- Sweep time cannot be longer in seconds than the number of trace measurement points.

For pulsed measurements, sweep times cannot be longer than 1 second per trace point. This is 800 seconds for the default value 800 trace points. The following equation shows how sweep time is approximately related to trace length, pulse width, and duty cycle:

$$sweep\ time \simeq (trace\ length)\left[\frac{(pulse\ width)(100)}{duty\ cycle}\right]$$

UNCAL indicates narrow pulses

Although the pulse widths can be set as narrow as 1 μs, pulse widths narrower than 20 μs occur too fast for the optical spectrum analyzer's digital processing to accurately display. The displayed response may not faithfully represent the input light. To indicate this condition, the message UNCAL is displayed.

The video bandwidth setting limits the minimum pulse width that can be used while still maintaining an amplitude calibrated display. (Video bandwidth is dependent on the sensitivity setting.) The minimum pulse widths available are shown in the following table.

Video Bandwidth	Minimum Pulse Width
2 MHz	20 μs
800 kHz	20 μs
80 kHz	20 μs
9 kHz	71 μs
800 Hz	800 μs

Key Path Press `State`, `current source`.

See Also *IGEN On Off*, *IGEN LIMIT*, *DUTY CYCLE*, and *PULSE WIDTH*.

CURRENT SOURCE

A rear-panel output connector.

This output connector is on HP 70950B/1B/2B optical spectrum analyzer modules with Option 001 installed. The connector is a standard SMB coaxial male jack with its outer conductor connected directly to the rear panel (earth ground). The current source can be gated with the same capability as the ADC SYNC OUT connector.

-> CWL

Softkey that sets the center wavelength equal to the marker wavelength. Use this softkey to move a signal at the marker to the center of the display. Pressing this softkey is identical to pressing the custom keypad's [TO CENTER] key.

Key Path Press `Marker`, `-> CWL`.

Related Programming Command MKCWL

Δ ->CWL STEP

Softkey that sets the center-wavelength step size equal to the difference between the reference and active marker wavelengths.

The delta markers must be displayed in order for this key to appear. If the `Waveln` menu's `CENTER` function is active (or the custom keypad's (CENTER) key is pressed), pressing (▲) or (▼) steps the optical spectrum analyzer's center wavelength. Use the `Δ -> CWL STEP` softkey to make the amount of wavelength step equal to the difference between any displayed delta markers.

Key Path Press `Marker`, `MORE 1 of 4`, `MORE 2 of 4`, `Δ -> CWL STEP`. (Delta markers must be on.)

See Also *DELTA* and *MKR NRM On Off* in this chapter.

Related Programming Command MKSS

DB/DIV AutoMan

Softkey that changes the amplitude scale used by the automatic measurement routine. The automatic measurement routine, accessed by pressing (AUTO MEASURE) or the `Waveln` menu's `AUTO MEASURE` softkey, normally sets the amplitude scale to 10 dB per division. To change the scale used, press `DB/DIV AutoMan` so that `Man` is underlined, then enter a new scale value. For example, you could change the scale to 5 dB per division.

Key Path Press `State`, `autmeas state`, `DB/DIV AutoMan`.

See Also *AUTO MEASURE* and *autmeas state* in this chapter.

Related Programming Command AUTOMDB

dBm

Softkey that selects amplitude units in decibels relative to 1 mW.

When selected, all displayed amplitude scale and marker annotation values read in dBm.

Key Path Press `Amptd`, `units menu`, `dBm`.

debug

Softkey that accesses the program-debugging softkey functions.

Use the `debug` menu to locate errors in down-loadable programs (DLPs). DLPs are short programs that are usually downloaded from a computer via HP-IB to the optical spectrum analyzer. Short DLPs that consist of one user-defined function can be created using the `COMMAND` softkey.

When the debug menus's `DEBUG On Off` softkey is turned on, debugging is applied at the following times:

- When sending DLPs via HP-IB to the optical spectrum analyzer.
- When running internally stored DLPs.

If a DLP is being sent over HP-IB and a faulty programming command is sent, the optical spectrum analyzer displays the faulty command at the bottom of the display. If a DLP is running, programming commands are displayed beneath the graticule as they are executed. If a faulty programming command is encountered, program execution is stopped, and the faulty command is the last command shown on the display.

Activate the debugging routine before starting the DLP. Since the debug routine slows execution of analyzer commands, it should be turned off when not needed.

The debug routine has a fast and slow setting that is activated by pressing either DEBUG FAST or DEBUG SLOW.

Use the PAUSE softkey to stop the program momentarily. Pressing CONT resumes program operation, unless a programming error is encountered. Use the STEP softkey to step through the program one command at a time. Once program execution is halted by a programming error, no further remote input is possible until CONT or DEBUG On Off is pressed or a device clear is sent. Examples of device clear are:

HP Basic: `CLEAR 723;`

HP 82335A Command Library (C-Language): `IOCLEAR(723);`

Key Path Press Misc, MORE 1 of 3, MORE 2 of 3, debug.

DEBUG FAST

Softkey that starts debugging the current DLP at a fast rate.

When a faulty analyzer command is encountered, program execution is stopped and the faulty command is displayed at the bottom of the screen.

Key Path Press Misc, MORE 1 of 3, MORE 2 of 3, debug, DEBUG FAST.

See Also *debug* and *DEBUG SLOW* in this chapter.

Related Programming Command DEBUG FAST

DEBUG On Off

Softkey that activates debugging of DLPs.

For a discussion on debugging, refer to the `debug` softkey in this chapter.

Key Path Press `Misc`, `MORE 1 of 3`, `MORE 2 of 3`, `debug`, `DEBUG ON Off`.

See Also *debug* in this chapter.

Related Programming Command DEBUG

DEBUG SLOW

Softkey that starts debugging the current DLP at a slow rate.

Command execution is slow enough to allow each programming command to be monitored when executed. When a faulty analyzer command is encountered, program execution is stopped. The faulty command is the last command shown at the right end of the data line.

Key Path Press `Misc`, `MORE 1 of 3`, `MORE 2 of 3`, `debug`, `DEBUG SLOW`.

See Also *debug* and *DEBUG FAST* in this chapter.

Related Programming Command DEBUG SLOW

DEFINE USR KEY

Softkey that builds (USER) menus and defines keys of unrecognized key panels.

You can create your own key definitions by using DEFINE USR KEY to perform the following tasks:

- Copy optical spectrum analyzer keys to your menu.
- Create keys for starting DLPs.
- Remove unwanted user-menu keys.
- Define the keys of an unrecognized custom keypad.

The "Creating a User Menu" chapter of the *User's Guide* explains how to perform each of these tasks.

Key Path Press Misc, MORE 1 of 3, key control, DEFINE USR KEY.

See Also *key control* in this chapter.

Related Programming Command KEYDEF

DELETE ALL

Softkey that erases any currently loaded limit lines.

Use this feature to prepare the limit-line table for new data entry by erasing the table's contents. A CONFIRM DELETE softkey protects the data from accidental erasure.

Key Path

Press `Misc`, `MORE 1 of 3`, `limit lines`, `LIMITS 1 of 3`, `LIMITS 2 of 3`, `DELETE ALL`.

Related Programming Command

LIMIDEL

DELETE CHAR

Softkey that deletes the character at the displayed cursor.

When entering titles or commands, this softkey allows you to make corrections to the text. The `DELETE CHAR` softkey is displayed when `DELETE or...` is selected. (The title menu's third softkey toggles between `INSERT or...`, `REPLACE or...`, and `DELETE or...`.) Use the ▲ and ▼ step keys to move the cursor along the displayed text.

Key Path

Press `Misc`, `TITLE`, `DELETE CHAR`.

Press `Misc`, `MORE 1 of 3`, `COMMAND`, `DELETE CHAR`.

DELETE or . . .

Softkey that displays the `DELETE CHAR` softkey for deleting characters from the text.

When entering titles or commands, you may need to delete characters. Use the step keys to position the cursor under the character that is to be deleted. Then, use the `DELETE CHAR` softkey to remove the desired character.

When pressed, the `DELETE or...` softkey toggles between `INSERT or...`, `REPLACE or...`, and `DELETE or...`.

Key Path

Press `Misc`, `TITLE`, `DELETE or...`.

Press `Misc`, `MORE 1 of 3`, `COMMAND`, `DELETE or...`.

See Also

COMMAND and *TITLE* in this chapter.

DELETE SEGMENT

Softkey that erases the selected limit-line segment.

Key Path

Press `Misc`, `MORE 1 of 3`, `limit lines`, `LIMITS 1 of 3`, `LIMITS 2 of 3`, `DELETE SEGMENT`.

See Also

limit lines in this chapter.

Related Programming Command

LIMISDEL

DELTA

Softkey that displays a delta marker relative to a reference marker.

The delta marker displays the separation between the delta and reference markers in terms of wavelength, frequency, period, sweeptime, or $\frac{1}{T}$. In zero span, the separation is in time or wavelength.

Key Path

Press `Marker`, `DELTA`.

See Also *marker readout* in this chapter.

Related Programming Command MKD

DETECTR Ext Int

Softkey that specifies the receive device to be either optical or electrical thus selecting either optical-to-optical testing or optical-to-electrical testing.

NOTE

Only for use with HP 70952B Option 003, Swept Polarization Dependent Loss (PDL) Kit.

`Int` selects the internal optical photodetector; `Ext` selects the rear-panel electrical transimpedance input.

Key Path Press (USER), `PDL`, `DETECTR Ext Int`.

Related Programming Command PDLDEV, PDL_DEV?

DFB

Softkey that turns on the DFB advanced-measurement program.

This advanced-measurement program characterizes DFB (distributed feedback) lasers. A series of measurements is performed on the displayed response at the end of each sweep. The advanced-measurement program is stored in the optical spectrum analyzer's internal memory and can be erased. Backup copies of the program are supplied on both card and disk formats. If you need to reinstall the program, refer to the chapter "Measuring Signals" in the *User's Guide*.

Battery Power

Automatic measurement programs are stored in battery powered memory. If the internal battery loses power, the programs are erased from memory. With normal use, the internal battery lasts for several years. To replace the internal battery, return the optical spectrum analyzer to a Hewlett-Packard service center.

Including side modes

The peak excursion value (in dB) determines which side modes are for DFB measurements. To be accepted, each trace peak must rise, and then fall, by at least the peak excursion value above a given spectral component. Setting the value to high will result in failure to include the smaller responses near the noise floor. Setting the value too low causes all spectral components to be accepted, but unwanted responses, including noise spikes and the second peak of a response with a slight dip, could be erroneously included.

A peaks function can be used to show which spectral components are selected by the peak excursion value. A vertical line from the bottom of the grid to each counted spectral component of the signal.

DFB Measurements	bandwidth	Displays the bandwidth of the main spectral component of the DFB laser. Due to the narrow line width of most DFB lasers, the result of this measurement for an unmodulated laser is the chosen resolution bandwidth of the optical spectrum analyzer.
	cntr offset	Indicates how well the main mode is centered in the stop band. This value equals the wavelength of the main spectral component minus the mean of the upper and lower stop band component wavelengths.
	mode offset	Is the wavelength separation (in nanometers) between the main spectral component and the next highest mode.
	peak amp	Is the power level of the laser's main spectral component.
	peak waveln	Is the wavelength of the main spectral component of the laser.
	SMSR	SMSR (Side Mode Suppression Ratio) is the amplitude difference between the main spectral component and the largest side mode.
	stop band	The wavelength spacing between the upper and lower side modes adjacent to the main mode.

Key Path Press (USER), DFB .

Related Programming Command DFB_

(DISPLAY)

Presents a menu for controlling system level functions such as: HP-MSIB addressing, communication, and configuration.

The (DISPLAY) front-panel key accesses all system and display functions. The (MENU) front-panel key accesses instrument functions. Press the (MENU) key to return to the optical spectrum analyzer menus. The (USER) front-panel key accesses your own custom menu. To learn how to create your own menu, refer to the chapter "Creating a User Menu" in the *User's Guide*.

See Also The *HP 70004A Display Operation* manual.

DISPOSE USER

Softkey that erases a file containing user-menu softkeys from memory.

To erase a file, press DISPOSE USER, followed by the file number, and then press ENTER.

Key Path Press Misc, MORE 1 of 3, key control, DISPOSE USER.

See Also *SAVE USER* in this chapter.

distrib menu

Softkey that displays a menu for selecting statistical distributions.

The FP and LED advanced-measurement programs can display a trace showing the power distribution of the input spectrum. Both Gaussian or Lorenzian distributions are available with the LED program. Gaussian, Lorenzian, and envelope distributions are available with the FP program. The default is Gaussian.

Key Path Press (USER), FP, distrib menu.

Press (USER), LED, distrib menu.

See Also *DISTRIB On Off*, *FP*, and *LED* in this chapter.

DISTRIB On Off

Softkey that displays a power distribution trace.

The FP and LED advanced-measurement programs measure and characterize Fabry-Perot lasers and LEDs. When measuring LEDs, this softkey displays a trace that is based on the total power, power distribution, and mean wavelength of the LED. By default, this trace has a Gaussian spectral distribution and represents a Gaussian approximation to the measured spectrum.

When measuring FP lasers, this softkey displays a trace that is based on the total power, individual wavelength, mean wavelength, and mode spacing of the laser. By default, this trace has a Gaussian spectral distribution and represents a continuous approximation to the actual, discrete spectrum.

Although the default trace is a Gaussian distribution, Lorenzian, and envelope distributions are also available.

Key Path Press (USER), `FP`, `DISTRIB On Off`.

Press (USER), `LED`, `DISTRIB On Off`.

See Also *distrib menu*, *FP*, and *LED* in this chapter.

DSP LIN On Off

Softkey that positions a horizontal line on the display.

The display line can be used to show a test limit or simplify amplitude-level readings. Press `DSP LIN On Off` to view the display line and its current amplitude setting. Use the numeric keypad, the (▲) and (▼) keys, or the front-panel knob to adjust the display-line position. Set the `DSP LIN On Off` softkey to `Off` to blank the line without changing its position. Pressing (INSTR PRESET) blanks the display line and sets its position at the reference level.

Key Path

Press `Misc`, `DSP LIN On Off`.

Press `Traces`, `MORE 1 of 4`, `MORE 2 of 4`, `DSP LIN On Off`.

Press `Traces`, `MORE 1 of 4`, `trace linmath`, `DSP LIN On Off`.

Related Programming Command

DL

DSPLY B ON OFF

Softkey that turns on or off the display of trace B.

When using the stimulus response instrument mode, trace B shows the reference trace used for normalized measurements.

Key Path

Press `State`, `instr modes`, `STM/RESP`, `DSPLY B ON OFF`.

Press `State`, `instr modes`, `PHOTO DIODE`, `DSPLY B ON OFF`.

DUTY CYCLE %

Softkey that changes the duty cycle of the signal available at the rear-panel `ADC SYNC OUT` and `CURRENT SOURCE` connectors.

The `ADC SYNC OUT` output is a TTL compatible signal for pulsing a light source. The `CURRENT SOURCE` connector is a pulsed current source that is only present on Option 001 optical spectrum analyzers. Use the current source as a bias source for a laser. Optical spectrum analyzer measurements are synchronized at the end of the "on" portion of the ADC SYNC OUT or CURRENT SOURCE pulses.

Key Path

Press State, sync out, DUTY CYCLE %.

Press State, current source, DUTY CYCLE %. (Option 001)

Press State, MORE 1 of 4, instr modes, OSA PULSE, adc sync, DUTY CYCLE %.

See Also

current source and *sync out* in this chapter.

Related Programming Command

IGENDTYCY

EDIT FUNCDEF

Softkey that displays a user-defined function for editing.

CAUTION

Do not use the EDIT FUNCDEF softkey to edit user-defined functions comprising more than 239 characters. This can destroy the function.

Key Path

Press Misc, MORE 1 of 3, COMMAND, EDIT FUNCDEF.

See Also

COMMAND in this chapter.

ENTER COMMAND

Softkey that allows commands to be executed from the front panel.

Key Path Press `Misc`, `MORE 1 of 3`, `COMMAND`, `ENTER COMMAND`.

See Also *COMMAND* in this chapter.

enter limit

Softkey that displays the limit-line table for creating limit lines.

The `enter limit` softkey allows a set of limit lines to be defined by the user. To enter values into the table, position the cursor using the `FREQ VALUE`, `AMPTD VALUE`, `TYPE`, `NEXT SEGMENT`, and `LAST SEGMENT` softkeys.

Key Path Press `Misc`, `MORE 1 of 3`, `limit lines`, `enter limit`.

Related Programming Command LIMIEDIT, LIMILINE, LIMISEG

ENTER LINE

Softkey that enters a title created by the user on the display. The title is displayed until an instrument preset is performed or the title is modified using the `TITLE` menu.

Key Path Press `Misc`, `TITLE`, `ENTER LINE`.

See Also *TITLE* in this chapter.

ENVLOPE

Softkey that selects an envelope statistical distribution for the power distribution trace.

The envelope selects the peak signal and connects it to the next peak, right and left, thus forming the power envelope of the source.

Key Path Press (USER), `FP`, `distrib menu`, `ENVLOPE`.

See Also *DISTRIB On Off*, *FP*, and *LED* in this chapter.

Related Programming Command FP_

ENVLOPE MKR BW

Softkey that sets the Fabry-Perot laser envelope bandwidth amplitude. This softkey only appears when the envelope distribution curve is selected. The bandwidth is measured at the specified amplitude level down from the peak. The default amplitude level is −3 dB.

Key Path Press (USER), `FP`, `ENVLOPE MKR BW`.

See Also *FP* in this chapter.

Related Programming Command FP_MKBW

ERASE ALL

Softkey that erases all internal user memory.

The function is used to declassify the optical spectrum analyzer. All volatile memory is erased including serial number, user-entered correction factors, and any optical spectrum analyzer settings saved in memory registers. You can also use this function to restore the optical spectrum analyzer when it is not operating properly and the source of the problem cannot be identified. Erasing all memory eliminates any error or illegal state that may be resident in memory. If the system operates normally after erasing memory, no further troubleshooting is necessary.

CAUTION The ERASE ALL softkey erases all user memory. Any memory protection provided by other system softkey functions is disabled when this function is used.

After erasing user memory, press DISPLAY and then the DISPLAY PRESET softkey to reestablish the desired instrument configuration.

After pressing this key, you will have to reenter the optical spectrum analyzer's serial number. Also, perform an automatic alignment using the AUTO ALIGN key. Refer to the *User's Guide* for information on entering the serial number and performing automatic alignments.

Key Path Press Misc, MORE 1 of 3, service, erase/ restart, ERASE ALL.

erase/ restart

Softkey that presents a menu that is used for erasing internal memory.

Key Path Press `Misc`, `MORE 1 of 3`, `service`, `erase/ restart`.

See Also *ERASE ALL* in this chapter.

ERR

Front-panel indicator light.

The error (ERR) indicator lights whenever the optical spectrum analyzer has a problem (error).

execute DLP

CAUTION Use of this softkey is *not* recommended. Run downloadable programs (DLPs) through the (USER) menu.

Using this softkey to access the DLPs may cause erratic and unpredictable behavior.

Softkey that alphabetically lists all DLPs stored in internal memory. To access a DLP, press the (USER) key.

Key Path Press Misc, MORE 1 of 3, execute DLP.

EXIT

Softkey that turns off an advanced-measurement program.

Use this softkey to leave the DFB, FP, LED, and PDL advanced-measurement programs. These programs are loaded at the factory under the (USER) menu.

Key Path

Press (USER), DFB, EXIT.

Press (USER), FP, EXIT.

Press (USER), LED, EXIT.

Press (USER), PDL, EXIT. *HP 70952B Option 003 only.*

Related Programming Command DFB_, FP_, LED_, PDLEXIT

EXT

Softkey that selects external triggering.

Sweeps must be triggered in order to begin. External triggering triggers the sweep using an external signal. Connect the signal to the optical spectrum analyzer module's rear-panel **EXT TRIG IN** connector. The connector is TTL compatible. Minimum and maximum trigger signal values are 0V and +5V.

Three other trigger methods are available: free, line, and video. With free run triggering, the sweep is triggered using an internally generated trigger signal. Free run triggering ensures continuously triggered sweeps. Line triggering uses the ac power-line voltage to trigger the sweep. Video triggering triggers the sweep using the detected video signal. You can adjust the video triggering voltage using the VIDEO LEVEL softkey.

Key Path Press BW,Swp , MORE 1 of 3 , EXT .

Related Programming Command TM EXT

EXT TRIG IN

A rear-panel input connector.

An input that allows the user to (1) synchronize a sweep of the optical spectrum analyzer with an external event when the analyzer is in the external trigger mode, or (2) gate the analog-to-digital conversion (ADC) data displayed on screen when the analyzer is in the gated sweep mode. The required levels are TTL compatible. The external trigger mode is triggered on the positive edge and the gated sweep mode gates when the level is at its high state. The connector is a standard SMB coaxial male jack with its outer conductor connected directly to the rear panel (earth ground).

EXTEND STATE

Softkey that lists module-level operating values for each module of the instrument.

Key Path Press State , MORE 1 of 4 , MORE 2 of 4 , show states , EXTEND STATE .

Related Programming Command DSPMODE EXTEND

extnded align

Softkey that presents a menu of optional and extended alignment functions.

Key Path Press `Misc`, `MORE 1 of 3`, `service`, `extnded align`.

FLAT

Softkey that determines limit-line interpolation.

Selecting FLAT draws a zero-slope line between the beginning points of two segments. This produces limit-line values that are equal in amplitude for all wavelengths between the two points.

Key Path Press `Misc`, `MORE 1 of 3`, `limit lines`, `LIMITS 1 of 3`, `TYPE`, `FLAT`.

See Also *TYPE* in this chapter.

FORMAT

Softkey that erases, then initializes the currently selected memory.

If internal memory is selected, FORMAT erases unprotected files and articles. If a disk drive is selected, FORMAT erases and initializes the floppy disk. If a memory card is selected, FORMAT erases and initializes the card with the logical-interchange-file (LIF) format.

Key Path

Press Misc, MORE 1 of 3, catalog & MSI, CATALOG 1 of 2, FORMAT.

See Also

P STATE On Off in this chapter.

Related Programming Command

FORMAT

FP

Softkey that turns on the Fabry-Perot advanced-measurement program.

This advanced-measurement program characterizes Fabry-Perot (FP) lasers. A series of measurements is performed on the displayed response at the end of each sweep. The advanced-measurement program is stored in the optical spectrum analyzer's internal memory and can be erased. Backup copies of the program are supplied on both card and disk formats. If you need to reinstall the program, refer to the chapter “Measuring Signals” in the *User's Guide*.

Battery Power

Automatic measurement programs are stored in battery powered memory. If the internal battery loses power, the programs are erased from memory. With normal use, the internal battery lasts for several years. To replace the internal battery, return the optical spectrum analyzer to a Hewlett Packard service center.

FP Measurements

FWHM — FWHM (Full Width at Half Maximum) describes the spectral width of the half-power points of the laser, assuming a continuous, Gaussian power distribution. The half-power points are those where the power-spectral density is one-half that of the peak amplitude of the computed Gaussian curve.

$$FWHM = 2.355\ \sigma$$

where σ is Sigma as defined below.

mean waveln — The wavelength representing the center of mass of selected peaks. The power and wavelength of each spectral component are used to calculate the mean wavelength.

$$Mean\ Wavelength = \sum_{i=1}^{N} P_i \left(\frac{\lambda_i}{P_o}\right)$$

where P_o is total power as defined in this section.

mode spacing — The average wavelength spacing between the individual spectral components of the laser. The display shows the mode spacing in both wavelength and frequency.

peak amp — The power level of the peak spectral component of the laser.

peak waveln — The wavelength of the peak spectral component.

sigma — An rms calculation of the spectral width of the laser based on a Gaussian distribution. If a Lorenzian distribution is selected, Sigma is not displayed. The power and wavelength of each spectral component is used to calculate mean wavelength.

$$sigma = \sqrt{\sum_{i=1}^{N} P_i \frac{\left(\lambda_i - \overline{\lambda}\right)^2}{P_o}}$$

where:

$\overline{\lambda}$ is the mean wavelength (FWHM) as defined above.

P_i is the power of a single peak.

P_o is total power as defined in this section.

total power — The summation of the power in each of the selected peaks, or modes, that satisfy the peak-excursion and peak-threshold criteria.

$$Total\ Power = \sum_{i=1}^{N} P_i$$

Key Path Press (USER), `FP`.

Related Programming Command FP_

FREQ

Softkey that configures marker readouts in frequency.

Frequency is related to wavelength as shown in the following equation:

$$frequency = \frac{300 \times 10^6 m/s}{wavelength}$$

Normally, the optical spectrum analyzer selects the proper marker readout based on the current instrument state. (The `READ AutoMan` softkey has

Auto underlined.) The marker annotation can be selected to indicate one of the following trace values:

- Frequency
- Wavelength
- Period
- Sweeptime
- $\frac{1}{T}$

Key Path Press Marker, MORE 1 of 4, MORE 2 of 4, marker readout, FREQ.

FULL SPAN

Softkey that sets the measurement span to the limits of the optical spectrum analyzer.

The start wavelength is set to 600 nm and the stop wavelength is set to 1700 nm. This softkey provides an easy method of returning the optical spectrum analyzer to full span without having to perform an instrument preset or manually enter the values.

Key Path Press Waveln, FULL SPAN.

Related Programming Command FS

GATESWP On Off

Softkey that allows the gating of measurement data via the rear-panel EXT TRIG IN connector.

When measuring pulsed light, the pulses should be synchronized with an optical spectrum analyzer as described in "Pulsing a Light Source" in the

"Displaying Signals (Part 2)" chapter of the *User's Guide*. If the pulsed light is not synchronized, invalid data may be obtained when the light source is off.

Gated sweeps make it easy to determine which trace points contain valid data. If the data for a trace point is measured when the pulsed light is off, the trace point is displayed at the bottom of the screen. (The trace data value is loaded with a minimum value.) Connect a TTL compatible gating signal from the light source to the rear-panel `EXT TRIG IN` connector. When the signal is high, measurement data for a trace point is displayed. When the TTL signal is low, the trace point is loaded with a minimum value that results in the trace point being displayed at the bottom of the screen.

Gating the sweep does not prevent or change the timing of measurements during a sweep. The number of measurements taken for a sweep is equal to the number of trace points (trace length). The default trace length is 800 points. (You can change the trace length in the Traces menu.) Use the following equation to determine the approximate time between measurements:

$$time\ between\ measurements \approx \frac{sweep\ time}{trace\ length}$$

You should allow for at least one pulse for every trace measurement. Because the timing between measurements varies slightly, having two or more pulses reduces the chance that a measurement will occur when the gating signal is TTL low. Each light pulse must be on for at least 40 μs to ensure enough time to complete the measurement.

If your particular measurement setup results in trace points being displayed at the bottom of the screen, do the following to obtain a complete trace of data. Select maximum holding for the trace, and let the optical spectrum analyzer sweep several times.

During zero-span sweeps, gated sweeps can be configured so that the trace points are displayed only when the external trigger signal is high. That is, the sweep stops whenever the trigger signal is low. To use this feature, set the video bandwidth to manual mode (VD MAN). Be aware that this can result in two adjacent points being separated by an unknown amount of time.

Key Path

Press `BW,Swp`, `MORE 1 of 3`, `MORE 2 of 3`, `GATESWP On Off`.

Press `State`, `MORE 1 of 4`, `instr modes`, `OSA PULSE`, `adc trigger`, `GATESWP On Off`.

See Also *TRACE LENGTH* and *OSA PULSE* in this chapter.

Related Programming Command GATESWP

GAUSIAN

Softkey that selects a Gausian statistical distribution for the power distribution trace.

Key Path Press (USER), `FP`, `distrib menu`, `GAUSIAN`.

Press (USER), `LED`, `distrib menu`, `GAUSIAN`.

See Also *DISTRIB On Off*, *FP*, and *LED* in this chapter.

grat control

Softkey that presents a menu for controlling the displayed graticule.

Key Path Press `Misc`, `grat control`.

See Also *GRAT On Off* and *GRATSCR On Off* in this chapter.

GRAT On Off

Softkey that turns the displayed graticule on and off.

Key Path Press `Misc`, `grat control`, `GRAT On Off`.

Related Programming Command GRAT

GRATSCR On Off

Softkey that controls the positioning of the horizontal graticule lines.

Whenever this function is off (or a linear display scale is used), the horizontal graticule lines are evenly spaced between the bottom and top of screen values. However, if this function is turned on while a logarithmic scale is displayed, the analyzer positions the horizontal graticules on multiples of the current dB-per-division setting. As the reference level is changed, the graticules move on the display.

Key Path Press `Misc`, `grat control`, `GRATSCR On Off`.

Related Programming Command GRATSCRL

HELP On Off

Softkey that displays on-line definitions.

Pressing this softkey displays short definition of softkeys in the DFB, FP, LED, and PDL advanced-measurement programs.

Key Path

Press (USER), `DFB`, `HELP On Off`.

Press (USER), `FP`, `HELP On Off`.

Press (USER), `LED`, `HELP On Off`.

Press (USER), `PDL`, `HELP On Off`. *HP 70952B Option 003 only.*

See Also

DFB, *FB*, *LED*, and *PDL* in this chapter.

HIGHEST PEAK

Softkey that moves a trace marker to the highest detected signal peak.

Key Path

Press `Marker`, `HIGHEST PEAK`.

Press `State`, `instr modes`, `PRESEL`, `HIGHEST PEAK`.

Press (USER), `PDL`, `HIGHEST PEAK`. *HP 70952B Option 003 only.*

See Also

PEAK EXCURSN and *MKR TRA A B C* in this chapter.

Related Programming Command

MKPK HI

(HOLD)

Deactivates an active function to prevent accidental setting changes.

In addition to protecting against accidental changes, (HOLD) removes the active function readout from the display and turns off the inverse video of an active softkey. Pressing the (HOLD) twice blanks the right-hand side menu softkeys. For example, if the CENTER softkey in the Waveln menu has just been set to 1200 nm, CENTER remains the active function. So if the knob is turned or the step keys are accidentally pressed, the center wavelength changes to a new value. Pressing (HOLD) protects the center wavelength from knob or step key changes. Pressing (HOLD) a second time blanks the right-side softkeys.

This feature is identical to pressing the HOLD softkey under the Misc menu softkey.

Related Programming Command

HD

HOLD

Softkey that deactivates an active function to prevent accidental setting changes.

The action of the HOLD and (HOLD) keys are identical.

Key Path

Press Misc, HOLD.

See Also

The previous definition of *HOLD* in this chapter.

Related Programming Command

HD

HORZ OFFSET

Softkey that sets the horizontal offset of 3-dimensional trace displays.

Changing the vertical and horizontal offsets between the traces helps to optimize the 3-dimensional effect. Although offsets as large as 200 can be entered, values of 30 or less are normal for proper display.

Key Path

Press `Traces`, `MORE 1 of 4`, `MORE 2 of 4`, `MORE 3 of 4`, `3-DIMEN On Off`, `HORZ OFFSET`.

See Also

3-DIMEN On Off and *VERT OFFSET* in this chapter.

Related Programming Command

THREEDH

HP-MSIB CARD

Softkey that accesses memory on cards and other HP-MSIB devices.

Although this feature is mainly used to select a card inserted in the display's front-panel card slot, you can also select memory devices located on the HP-MSIB bus.

Card

To locate and catalog the card, the card's HP-MSIB address must be correctly entered. The default factory shipped value is 4. The address of the front-panel card slot is identical to the HP-MSIB column address of the display. To confirm the value for optical spectrum analyzers, press (DISPLAY), `Address Map`, and then rotate the front-panel knob to scroll the address map so that the box labeled `70004A DISPLAY` is visible. Note the column address for the display box.

Catalog Another HP 70004A Display

Because the `HP-MSIB CARD` softkey locates and catalogs devices on the HP-MSIB bus, you can use it to catalog the mass memory of a remote HP 70004A display. The two displays cannot have the same HP-MSIB address. For example, suppose that an HP-IB disk drive is connected to the remote HP 70004A display HP-IB connector. The disk must be selected as the remote display's mass memory. (On the remote display, press the `HPIB DISK` softkey, and enter the address of the disk drive.) Connect the two displays via an HP-MSIB cable. On the local display, press the `HP-MSIB CARD` softkey, and enter the HP-IB address (column) of the remote display. The catalog of the disk drive's contents will be listed on the local display.

Specifying the HP-MSIB Address

New addresses must be specified as a single number. Since most storing devices are at row address 0 on HP-MSIB, the number that `HP-MSIB CARD` specifies is the column address.

Key Path

Press `Misc`, `MORE 1 of 3`, `catalog & MSI`, `HP-MSIB CARD`.

Related Programming Command

MSI

HPIB DISK

Softkey that accesses an HP-IB external memory device (for example, a disk drive) connected via HP-IB to the system.

The HP-IB connector is located on the HP 70004A display's rear panel. If the optical spectrum analyzer module is in an HP 70001A mainframe, the connector is on the mainframe's rear panel. Because cataloging the HP-IB disk involves controlling the bus, do not connect any other controller to the bus; HP-IB protocol does not allow more than one controller on the HP-IB bus.

Use `HPIB DISK` to specify the HP-IB address, unit, and volume number of the disk drive. The default is HP-IB address 0, unit 0, and volume 0. Enter new values in the following sequence: first number (HP-IB address), second number (unit), and third number (volume).

```
A.UV
```

Enter a period between the first and second numbers.

Example Address Entries

Address	Unit	Volume	Valid Entry
1	0	0	1
0	1	0	0.1
1	0	1	1.01

The entry range for each value are as follows:

HP-IB address .... 0 – 7
Unit number .... 0 – 9
Volume number .... 0 – 9

Key Path

Press `Misc`, `MORE 1 of 3`, `catalog & MSI`, `HPIB DISK`.

Related Programming Command

MSI

HSWP IN/OUT

A rear-panel input and output connector.

This connector is for the High Sweep (HSWP) signal. HSWP has an identical function with HSWP signals on other modular measurement system (MMS) modules. It allows for synchronization between the optical spectrum analyzer and other instruments. The connector is a standard SMB coaxial male jack with its outer conductor connected directly to the rear panel (earth ground).

HSWP is an open collector TTL input. When low, the instrument stops taking data, and the trace is stopped. When the signal returns to a high state, the measurement begins again.

HYS LEVEL

Softkey that defines the change in video-signal level required for video triggering.

A sweep occurs when the detected signal satisfies three video triggering conditions: direction, hysteresis, and level. Direction indicates the signal is increasing or decreasing. Hysteresis indicates the amount of signal change towards the specified amplitude trigger threshold value (level).

The `HYS LEVEL` softkey specifies direction and hysteresis. Triggering occurs on the falling edge of the signal when video hysteresis is set for a negative value. For example, pressing `HYS LEVEL` and entering −5 dB sets video triggering for a decreasing signal and 5 dB of hysteresis.

The hysteresis level is preset to +3 dB and cannot exceed ±300 dB. The smallest value allowed is 0.01 dB.

Key Path Press `BW,Swp`, `MORE 1 of 3`, `HYS LEVEL`.

See Also *VIDEO* and *VIDEO LEVEL* in this chapter.

Related Programming Command VTH

IGEN LIMIT

Softkey that controls current limiting of the Option 001 current source.

NOTE

This softkey is only displayed on Option 001 optical spectrum analyzers.

Use this softkey to protect lightwave sources from excessive current. Enter the absolute value for the maximum amount of current. The current source output is available at the rear-panel's `CURRENT SOURCE` connector. The default current limit is ±50 mA. The maximum output current is ±200 mA.

CAUTION

Use the front-panel knob or numeric keys when changing the current limit. Using the ▼ and ▲ keys may result in accidentally stepping the current limit to an excessive value.

Key Path

Press `State`, `current source`, `IGEN LIMIT`.

Press `State`, `MORE 1 of 4`, `instr modes`, `OSA PULSE`, `adc sync`, `IGEN LIMIT`.

See Also

current source in this chapter.

Related Programming Command

IGENLIMIT

IGEN On Off

Softkey that turns on or off and sets the value of the current source.

NOTE

This softkey is only displayed on Option 001 optical spectrum analyzers.

The current source's output is available at the rear-panel `CURRENT SOURCE` connector.

CAUTION

Use the front-panel knob or numeric keys when changing the current level. Using the ▼ and ▲ keys may result in accidentally stepping the current to an excessive value.

Key Path

Press `State`, `current source`, `IGEN On Off`.

Press `State`, `MORE 1 of 4`, `instr modes`, `OSA PULSE`, `adc sync`, `IGEN On Off`.

See Also

current source or *IGEN LIMIT* in this chapter.

Related Programming Command

IGEN

INIT PDL

Softkey that initializes the polarization dependent loss (PDL) measurement procedure.

NOTE

Only for use with HP 70951B Option 003, Swept Polarization Dependent Loss (PDL) Kit.

The traces are initialized to measure PDL, continuous sweep mode is activated, and the results are displayed as follows:

- Trace A contains the detected signal.
- Trace B contains the maximum signal.
- Trace C contains the minimum signal.

Key Path

Press USER, PDL, INIT PDL.

Related Programming Command

PDLINIT

INSERT or . . .

Softkey that displays the SELECT CHAR softkey for inserting characters into text.

When entering titles or commands, you select characters to place at the cursor. Use the step keys to position the cursor. However, make sure that the cursor does not position outside the single quote characters.

When pressed, the INSERT or... softkey toggles between INSERT or..., SELECT or..., and REPLACE or... and defines what action occurs with characters at the cursor.

Key Path

Press Misc, TITLE, INSERT or....

Press Misc, MORE 1 of 3, COMMAND, INSERT or....

See Also

COMMAND and *TITLE* in this chapter.

INSTR

Assigns the HP 70004A display's front-panel keys to selected master modules.

HP 70004A displays can display up to 4 windows with each window showing the display of a master module. (HP 70950B/1B/2B optical spectrum analyzer modules are examples of master modules.) For example, suppose you had an MMS mainframe with an HP 70820A microwave transition analyzer master module installed. After connecting the MMS mainframe to the HP 70004A display, you could display the screen of both analyzers on the HP 70004A display in separate windows. The INSTR key allows you to move front-panel key control between each master module in the system. Refer to the display's operation manual for information on building and displaying windows.

When the INSTR key is pressed, the display draws colored boarders around the currently defined windows. Window location, pen number, and the normal colors assigned to those windows are defined in the following table.

INSTR Key Window Assignments

Window	Location	Pen Number	Normal Color
1	Lower Left	2	Yellow
2	Upper Left	3	Cyan
3	Upper Right	4	Pink
4	Lower Right	5	Green

Next to each displayed window is a softkey containing the first seven characters in the instrument's model number on the first line, and the module's HP-MSIB address (row, column) on the second. This softkey is displayed in reverse video in the same color as the associated window border. Press the softkey, and the keyboard is offered to that window's master module. If the module accepts the keyboard, it displays its menu keys as if the MENU key had been pressed.

HP 71450B/1B/2B optical spectrum analyzers come configured with only one master module and so only one window is displayed.

See Also

"Front-Panel Fixed-Label Keys" and "Address Map Menu" chapters in the *HP 70004A Display Operation Manual*.

instr modes

Softkey that selects the type of instrument operations performed by the instrument.

Depending on the model number, up to six operating modes are available:

- optical spectrum analyzer
- stimulus response measurement
- fast pulse
- power meter *(HP 71451B only)*
- preselector *(HP 71451B only)*
- photo detector test *(HP 71451B only)*

Key Path

Press `State`, `instr modes`.

See Also

OSA, *OSA PULSE*, *PHOTO DIODE*, *POWER METER*, *PRESEL*, and *STM/RESP*.

Related Programming Command

INSTMODE

INSTR PRESET

Resets the optical spectrum analyzer to a known preset state.

Pressing INSTR PRESET aborts any current operations and clears the HP-IB output queue. This function will not modify the HP-IB or HP-MSIB interfaces, the display's address map, or calibration data.

Related Programming Command

IP

INT WIN On Off

Softkey that displays the trace points used to calculate FWHM and power.

The LED advanced measurement program calculates full width at half maximum (FWHM) and total power based on the integration of a portion of the trace data. Pressing this softkey so that `On` is underlined, displays the trace points used in the calculations. By default all trace points within 20 dB of the peak response are used in the integration. You can change this value using the `integrt menu` softkey.

Key Path Press (USER), `LED`, `INT WIN On Off`.

See Also *integrt menu* in this chapter.

INTEGRT FROM PK

Softkey that selects integration points based on amplitude level from peak response.

Key Path Press (USER), `LED`, `integrt menu`, `INTEGRT FROM PK`.

See Also *integrt menu* in this chapter.

integrt menu

Softkey menu that selects the trace points for calculating FWHM and power.

The LED advanced measurement program calculates full width at half maximum (FWHM) and total power based on the integration of a portion of the trace data. This softkey accesses a menu for defining the trace points included in the integration. (The default integration includes all trace points within 20 dB of the peak response.) You can view a trace of the included trace points at the same time they are selected. Simply press the `INT WIN On Off` softkey so that `On` is underlined.

Press `INTEGRT FROM PK` to integrate all trace points within a specified value from the peak response. The value can be entered either in dBc or as a multiplier. For example, to include all the trace points within half the power level of the peak, enter −3 `dB` (dBc) or 0.5 `X`.

Press `INTEGRT STRT WL` to define the starting wavelength for trace points included in the integration.

Press `INTEGRT STOP WL` to define the ending wavelength for trace points included in the integration.

Key Path Press (USER), `LED`, `integrt menu`.

See Also *INT WIN On Off* and *LED* in this chapter.

INTEGRT STOP WL

Softkey that sets the upper limit of integration points based on the ending wavelength.

Key Path Press (USER), `LED`, `integrt menu`, `INTEGRT STOP WL`.

See Also *integrt menu* in this chapter.

INTEGRT STRT WL

Softkey that sets the lower limit of integration points based on the starting wavelength.

Key Path Press (USER), `LED`, `integrt menu`, `INTEGRT STRT WL`.

See Also *integrt menu* in this chapter.

INTRNL MEMORY

Softkey that selects the optical spectrum analyzer's internal memory for memory operations.

All files including traces, limit lines, and instrument states will be saved to and recalled from internal memory.

Key Path Press `Misc`, `MORE 1 of 3`, `catalog & MSI`, `INTRNL MEMORY`.

See Also *catalog & MSI* in this chapter.

Related Programming Command MEM, MSI

key control

Softkey that accesses a menu for creating, saving, and recalling user-defined menus.

The user menu appears when the front-panel USER key is pressed. You can copy any optical spectrum analyzer softkey to the user menu for easy access. The key-control menu contains the following softkeys for controlling user menus:

RECALL USER recalls a previously saved user menu from the default memory. User-menu files are prefixed with the characters u_ so that they can be easily distinguished from other file types. After locating the desired user menu, enter the menu's number, and then press ENTER.

SAVE USER saves the current user menu in a file. Enter a number to identify the file. The file is placed in default memory. (Select default memory using the Misc menu's catalog & MSI menu.) The prefix u_ is automatically attached to the file for easy identification.

DISPOSE USER erases a file containing user-menu softkeys from memory. Enter the file number, and then press ENTER.

PRESET USER returns the user menu to its factory default softkeys. The default user menu contains a DEFINE USR KEY softkey which is identical to the one listed in this menu. DEFINE USR KEY copies a softkey to the user menu. After pressing this softkey, press all the softkeys needed to reach the softkey you want to copy. Then, press the softkey to be copied and the press the USER key.

Key Path

Press `Misc`, `MORE 1 of 3`, `key control`.

LAST SEGMENT

Softkey that enters a limit-line segment at the end of the limit-line table.

Using this softkey to enter the last limit line ensures that the line will not be drawn past the indicated point.

Key Path

Press `Misc`, `MORE 1 of 3`, `limit lines`, `LIMITS 1 of 3`, `LAST SEGMENT`.

Press `Misc`, `MORE 1 of 3`, `limit lines`, `LIMITS 1 of 3`, `LIMITS 2 of 3`, `LAST SEGMENT`.

Related Programming Command

LIMIBOT

LCL

Softkey that returns local front-panel control.

Remote programming can prevent the optical spectrum analyzer from responding to front-panel key presses. The (LCL) key reestablishes front-panel control.

LED

Softkey that turns on the LED advanced-measurement program.

This advanced-measurement program characterizes LEDs. A series of measurements is performed on the displayed response at the end of each sweep. The advanced-measurement program is stored in the optical spectrum analyzer's internal memory and can be erased. Backup copies of the program are supplied on both card and disk formats. If you need to reinstall the program, refer to the chapter "Measuring Signals" in the *User's Guide*.

Battery Power

Automatic measurement programs are stored in battery powered memory. If the internal battery loses power, the programs are erased from memory. With normal use, the internal battery lasts for several years. To replace the internal battery, return the optical spectrum analyzer to a Hewlett Packard service center.

Distribution Trace

A trace can be displayed that is based on the total power, power distribution, and mean wavelength of the LED. This trace has a Gaussian spectral distribution and represents a Gaussian approximation to the measured spectrum.

LED Measurements

3 db width — Describes the spectral width of the LED based on the separation of two wavelengths. Each wavelength has a power-spectral density equal to one-half the peak power-spectral density. The 3 dB width is determined by finding the peak of the LED spectrum, and dropping down 3 dB on each side.

FWHM — (Full Width at Half Maximum) describes the spectral width of the half-power (−3 dB) points of the LED, assuming a continuous, Gaussian power distribution. The half-power points are those where the power-spectral density is one-half that of the peak amplitude.

$$FWHM = 2.355\,\sigma$$

where σ is Sigma as defined below.

mean (3db) The average of the two wavelengths that are 3 dB (half-power) below the peak wavelength.

mean (FWHM) The wavelength representing the center of mass of the trace points. The power and wavelength of each trace point are used to calculate the mean (FWHM) wavelength.

$$Mean\ (FWHM) = \sum_{i=1}^{N} P_i \left(\frac{trace\ point\ spacing}{resolution\ bandwidth}\right)\left(\frac{\lambda_i}{P_o}\right)$$

where:

λ_i is the wavelength of a single trace point.

P_i is the power of a single trace point.

P_o is total power as defined in this section.

peak waveln The wavelength at which the peak of the LED's spectrum occurs.

PK dens (1nm) The power-spectral density (normalized to a 1 nm bandwidth) of the LED at the peak wavelength.

sigma An rms calculation of the spectral width of the led based on a Gaussian distribution. The power and wavelength of each trace point, between the displayed markers, are used to calculate sigma.

$$sigma = \sqrt{\sum_{i=1}^{N} P_i \left(\frac{trace\ point\ spacing}{resolution\ bandwidth}\right)\left[\frac{\left(\lambda_i - \overline{\lambda}\right)^2}{P_o}\right]}$$

where:

$\overline{\lambda}$ is mean wavelength (FWHM) as defined in this section.

λ_i is the wavelength of a single trace point.

P_i is the power of a single trace point.

P_o is total power as defined in this section.

total power — The summation of the power at each trace point between the indicating markers, normalized by the ratio of the trace point spacing/resolution bandwidth. This normalization is required because the spectrum of the LED is continuous, rather than containing discrete spectral components (as a laser does).

$$Total\ Power = \sum_{i=1}^{N} P_i \left(\frac{trace\ point\ spacing}{resolution\ bandwidth} \right)$$

where:

P_i is the power of a single trace point.

Key Path Press (USER), LED.

Related Programming Command LED_

LEFT PEAK

Softkey that moves a marker left on the display to the next signal peak.

To locate a peak, the peak's amplitude must be at least 3 dB above the noise floor. This default 3 dB peak-excursion value can be changed using the PEAK EXCURSN softkey.

Key Path Press Marker, MORE 1 of 4, LEFT PEAK.

Press State, instr modes, PRESEL, LEFT PEAK.

See Also *PEAK EXCURSN* in this chapter.

Related Programming Command MKPK NL

LEFT PIT

Softkey that moves a marker left on the display to the next signal pit.

Pit identification (minimum amplitude excursion) is defined by the `PIT EXCURSN` softkey. To locate a pit using the default pit excursion value, the signal must fall and then rise by 3 dB.

Key Path Press `Marker`, `MORE 1 of 4`, `MORE 2 of 4`, `MORE 3 of 4`, `pit,min markers`, `LEFT PIT`.

See Also *PIT EXCURSN* in this chapter.

Related Programming Command MKPK NLPIT

light source

Softkey that accesses the `WHITE On Off` softkey which turns on or off the internal white light source. The white light source output is available on the front panel.

> **NOTE**
>
> This softkey is only displayed on Option 002 optical spectrum analyzers.

Key Path Press `State` , `light source` .

lim <-> ampcor

Softkey that accesses a menu for loading and editing amplitude-correction values to and from limit-line tables.

Use the softkeys in this menu to copy amplitude-correction values to and from limit-line tables. Because amplitude-correction values can be placed in limit lines, you can create, edit, save, and recall them using the limit-line menu. Amplitude corrections can also be saved in memory from a computer via HP-IB.

Two sets of amplitude correction values for the same wavelength range can be stored as an upper- and lower-limit line. Each set of amplitude corrections can be recalled using either the `LOWER-> AMPCOR` or `UPPER-> AMPCOR` softkey. Only one set of corrections can be entered as an “AMPCOR” value at a time.

Key Path Press `Misc` , `MORE 1 of 3` , `limit lines` , `lim <-> ampcor` .

limit lines

Softkey that displays a menu for creating, editing, and displaying limit lines.

Limit lines are displayed lines showing acceptable limits for a displayed response. In production settings, limit lines can be used for pass/fail testing. You define the shape (including upper and lower limits) of the limit lines; each limit line consists of a series of line segments that you define by entering wavelength and amplitude values. If the response is outside the limit lines, a failure message is displayed and a audio beep is sounded. You can turn off the beep by pressing `BEEPER On Off` so that `Off` is underlined.

The limit-line menu contains three pages of softkeys. The `lim <-> ampcor` softkey has a special purpose of allowing you to copy limit-line data to and from amplitude correction memory. In this manner you can create and edit amplitude correction factors.

Once created, activate limit lines by pressing the `LIMITS On Off` softkey. You can also save and recall limit lines to and from default memory.

Key Path Press `Misc`, `MORE 1 of 3`, `limit lines`.

See Also *lim <-> ampcor* in this chapter.

LIMITS On Off

Softkey that turns on and off limit-line testing.

When limit-line testing is on, and the trace data exceeds the upper or lower limits, `FAIL` is displayed at the top of the display. If trace data passes the test limits, `PASS` is displayed. A beeper alarm can also be set to indicate when the trace data exceeds the upper or lower limits. See the `BEEPER On Off` softkey description for more information.

Key Path Press `Misc`, `MORE 1 of 3`, `limit lines`, `LIMITS On Off`.

Related Programming Command LIMITEST

LINE

Softkey that triggers the sweep using the ac power-line voltage.

Line triggering synchronizes the sweeps with the line frequency. Three other trigger methods are available: free, ext, and video. With free run triggering, the sweep is triggered using an internally generated trigger signal. Free run triggering ensures continuously triggered sweeps. External triggering uses a TTL signal that you provide at the module's rear-panel **EXT TRIG IN** connector. Video triggering triggers the sweep using the detected video signal. You can adjust the video triggering voltage using the `VIDEO LEVEL` softkey.

Key Path Press `BW,Swp`, `MORE 1 of 3`, `LINE`.

Related Programming Command TM LINE

LINEAR

Softkey that selects a linear amplitude scale.

The graticule is scaled in linear units proportional to the input power. The bottom of the graticule line represents zero watts. Therefore, with 10 graticule lines, each division represents 10% of the input signal at the top of the screen.

Key Path

Press `Amptd`, `LINEAR`.

Press (USER), `LED`, `LINEAR`.

See Also

LOG dB/DIV in this chapter.

Related Programming Command

LN

LINES On Off

Softkey that turns on or off the interpolation of data between trace measurement points.

The optical spectrum analyzer displays digitized trace information. Each sweep of trace information consists of a series of unique measurement points. The default trace length is 800 points. During normal operation, values between these measurement points are interpolated from the data and drawn on the display. This gives the visual effect of a continuous trace. Use this softkey to turn off line interpolation.

Key Path

Press `Traces`, `MORE 1 of 4`, `MORE 2 of 4`, `MORE 3 of 4`, `LINES On Off`.

Related Programming Command

LINES

LOAD FILE

Softkey that recalls a file stored in memory.

The softkey's operation is identical to the `State` menu's recall softkeys. To load a file, first look up the file's name by viewing the catalog of user-memory. The catalog of memory should be displayed whenever the `LOAD FILE` softkey is displayed. Each file has an identifying prefix, which distinguishes one type of file, and its contents, from the other file types.

File Prefixes

File Type	File Prefix
Instrument state	s_
Program	d_
Trace	t_
(USER) menu	u_
Limit-line	l_

A number is listed to the left of each file name in the catalog. Use this number to recall the file. Press `LOAD FILE`, followed by the entry number, then press `ENTER`.

Key Path Press `Misc`, `MORE 1 of 3`, `catalog & MSI`, `LOAD FILE`.

See Also *catalog & MSI* in this chapter.

Related Programming Command LIMIRCL, LOAD, RCLD, RCLS, RCLT, RCLU

LOCKOUT ANOTATN

Softkey that prevents the display of annotation. The annotation cannot be displayed again until either an instrument preset is performed or the system power is cycled. Annotation for instrument states that have been saved using the `SAVE STATE` softkey will be blanked when recalled. If the

POWERON IP LAST is set for LAST before the power is turned off, the annotation remains blanked when power is reapplied.

Key Path Press Misc, MORE 1 of 3, MORE 2 of 3, LOCKOUT ANOTATN.

See Also *ANOTATN On Off* in this chapter.

Related Programming Command ANNOFF

LOG dB/DIV

Softkey that selects a logarithmic amplitude scale.

The amplitude scale reads in decibels and can be set from 0.01 to 20 dB per division.

Key Path Press Amptd, LOG dB/DIV.

Press (USER), LED, LOG dB/DIV.

Press (USER), PDL, LOG dB/DIV. *HP 70951B Option 003 only.*

See Also *LINEAR* in this chapter.

Related Programming Command LG

LORENZ

Softkey that selects a Lorenzian statistical distribution for the power distribution trace.

Key Path

Press USER, `FP`, `distrib menu`, `LORENZ`.

Press USER, `LED`, `distrib menu`, `LORENZ`.

See Also

DISTRIB On Off, *FP*, and *LED* in this chapter.

LOWER-> AMPCOR

Softkey that stores a lower-limit line as amplitude-correction values for a specific wavelength range.

Pressing the softkey replaces any corrections that were previously entered and activates the new amplitude corrections. The amplitude corrections must first be entered into the lower limit-line table, using the limit-line softkey functions.

To design amplitude corrections and enter them into the limit-line table, first divide the wavelength range into segments. Each segments should exhibit an amplitude that either remains flat or has a measurable slope. Start creating segments at the lowest wavelength point. For wavelength segments that slope, record the wavelength and amplitude of the beginning point and end point of the segment. For wavelength segments that are flat, record the wavelength and amplitude of the first point of the segment only. Enter these correction values into the lower limit-line table using the limit-line softkey functions.

After the correction values have been entered in the lower limit-line table, press the `LOWER-> AMPCOR` softkey to store and enable the amplitude-correction values.

Storing amplitude corrections

Limit-line files can be used to store amplitude-correction values for future use.

Key Path Press `Misc`, `MORE 1 of 3`, `limit lines`, `lim <-> ampcor`, `LOWER-> AMPCOR`.

See Also *AMPCOR ->LOWER* in this chapter.

Related Programming Command LIMTOCOR

LSN

Front-panel indicator light.

The listen (LSN) LED lights when the optical spectrum analyzer is receiving data or instructions over the Hewlett-Packard Interface Bus (HP-IB). In addition, depending on the instructions received from the computer, the LSN, TLK, or SRQ indicators will also light.

MANUAL ALIGN

Softkey that performs an (AUTO ALIGN) at specified wavelengths.

This softkey runs an (AUTO ALIGN) at a specified wavelength. (A maximum of 32 alignments can be performed.) To align the 900 nm to 1700 nm range, refer to W LIGHT ALIGN in this chapter. Or, to perform an alignment over a user-specified range, refer to AUTOPTS ALIGN in this chapter.

Before initiating the alignment, connect a white-light source to the front-panel input connector.After pressing this softkey, use the marker to indicate the wavelength for the alignment.

The alignment replaces current correction data with new data, and the `AUTO ALIGN` data is zeroed. The resulting correction data may be viewed by: pressing `State`, `MORE 1 of 3`, `MORE 2 of 3`, `show states`, and then `EXTEND STATE`.

The data being added to the correction table is tested to see if it results in a correction curve which is too steep. If it fails this test, an error is reported, and the data is not added to the table (neither is the `AUTO ALIGN` data zeroed).

If an `AUTO ALIGN` is executed after this alignment, all of the alignment correction data will be shifted. Thus, `AUTO ALIGN` can be invoked after manual alignment. In the rare case where the `AUTO ALIGN` yields zero data value corrections, the command will fail, indicating that no `AUTO ALIGN` data exists.

Key Path Press `Misc`, `MORE 1 of 3`, `service`, `extnded align`, `MANUAL ALIGN`.

See Also *ALIGN PRESET*, *AUTOPTS ALIGN*, *AUTO ALIGN*, *MANUAL ALIGN*, and *W LIGHT ALIGN* in this chapter.

Related Programming Command ALIGN

Marker

Softkey that presents a menu for accessing and controlling trace markers.

marker excursn

Softkey that presents a menu that is used to define the minimum amplitude excursions that must occur in order for markers to locate a “peak” or “pit”.

Key Path Press `Marker`, `MORE 1 of 4`, `MORE 2 of 4`, `MORE 3 of 4`, `marker excursn`.

See Also *PEAK EXCURSN* and *PIT EXCURSN* in this chapter.

marker readout

Softkey that selects the measurement parameter indicated by the marker.

Normally, the optical spectrum analyzer automatically selects the proper annotation depending on the current instrument state. (The `Auto` softkey is selected.) The marker annotation can be selected to indicate one of the following trace values:

- Auto
- Frequency
- Wavelength
- Period
- Sweeptime
- $\frac{1}{T}$

Key Path Press `Marker`, `MORE 1 of 4`, `MORE 2 of 4`, `marker readout`.

Related Programming Command MKREAD

MARKER TUNE

Softkey that tunes the wavelength of the preselector.

NOTE

MARKER TUNE is only displayed when using an HP 70951A optical spectrum analyzer module.

During the preselector instrument mode, the optical spectrum analyzer acts as an optical filter at a fixed wavelength. The output is available at the front-panel MONOCHROMATOR connector. Although the optical spectrum analyzer is not sweeping the displayed input range, the last sweep remains displayed in order to show the input spectrum. A displayed marker indicates the wavelength of the preselection. With this softkey selected, use the front-panel knob, step keys, or numeric keypad to change the preselector wavelength. Press TAKE SWEEP to update the displayed response at any time. The amount of filtering is determined by the resolution bandwidth setting. If the resolution bandwidth is selected, MARKER TUNE must be reselected to tune the monochromator. Marker movement will not tune the monochromator unless MARKER TUNE is active.

Key Path Press State, instr modes, PRESEL, MARKER TUNE.

See Also *RES BW AutoMan* in this chapter.

Related Programming Command MKTUNE

MAX HOLD A

Softkey that updates trace A with the maximum values from each successive sweep.

After a sweep, the current amplitude value of each trace point are compared to each corresponding value detected during the previous sweep. The maximum values are retained. This results in the display of the maximum values obtained over time. Maximum holding can be used to show signal drift over a period of time.

Key Path Press `Traces`, `MAX HOLD A`.

Related Programming Command MXMH

MEAS

Front-panel indicator light.

The measure (MEAS) indicator lights as the optical spectrum analyzer sweeps the wavelength range and blanks during retrace.

(MENU)

Displays the HP 71450B/1B/2B optical spectrum analyzer's softkeys.

If the (DISPLAY) front-panel key is pressed, softkey menus dedicated to controlling display functions are displayed. Press the (MENU) key to return to optical spectrum analyzer menus.

MIN HOLD A

Softkey that updates trace A with the minimum values from each successive sweep.

After a sweep, the current amplitude value of each trace point are compared to each corresponding value detected during the previous sweep. The minimum values are retained. This results in the display of the minimum values obtained over time. Minimum holding can be used to show signal drift over a period of time.

Key Path Press `Traces`, `MIN HOLD A`.

Related Programming Command MINH

MINIMUM PEAK

Softkey that places the active marker on the smallest displayed signal peak.

Key Path Press `Marker`, `MORE 1 of 4`, `MINIMUM PEAK`.

See Also *MINIMUM PIT* and *PEAK EXCURSN* in this chapter.

Related Programming Command MKPK MI

MINIMUM PIT

Softkey that places the active marker on the smallest displayed signal pit. This location may not be the minimum point.

Key Path

Press `Marker`, `MORE 1 of 4`, `MORE 2 of 4`, `MORE 3 of 4`, `pit,min markers`, `MINIMUM PIT`.

See Also

MINIMUM PEAK and *PIT EXCURSN* in this chapter.

Related Programming Command

MKPK MIPIT

MINIMUM POINT

Softkey that moves a marker to the lowest detected level on the trace.

Key Path

Press `Marker`, `MORE 1 of 4`, `MORE 2 of 4`, `MORE 3 of 4`, `pit,min markers`, `MINIMUM POINT`.

Press (USER), `PDL`, `MINIMUM POINT`. *HP 70951B Option 003 only.*

See Also

MKR TRA A B C in this chapter.

Related Programming Command

MKMIN

MK STOP On Off

Softkey that stops the sweep at the marker.

Use this feature to reduce the time needed to complete a sweep. The sweeps continue until the marker position is reached. Then, a new sweep is started.

Key Path Press `Marker`, `MORE 1 of 4`, `MORE 2 of 4`, `MORE 3 of 4`, `MK STOP On Off`.

Related Programming Command MKCONT

MKNOISE On Off

Softkey that displays the rms noise level at the marker.

The optical spectrum analyzer can measure the noise spectral density at the marker position. The noise level is normalized to a 1 nanometer bandwidth and compensates for the resolution bandwidth variation that occurs with wavelength. This function uses sample detection and averages 32 trace points (16 to each side of the current marker location) to avoid noise spikes. This function is useful for measuring the spontaneous emission light from LEDs, lasers, or optical amplifiers.

Key Path Press `Marker`, `MORE 1 of 4`, `MKNOISE On Off`.

Related Programming Command MKNOISE

MKPAUSE On Off

Softkey that pauses the sweep at the marker position.

The time of the pause can be set from 0 to 1000 seconds. After turning this softkey on, enter the time to pause the signal. To turn off marker pause, press MKPAUSE On Off so that Off is underlined. The MKR NRM On Off function does not change the time interval selected for the marker-pause function.

Invalid data

Trace data to the right of the marker may be invalid when the marker-pause function is on.

Key Path Press Marker, MORE 1 of 4, MORE 2 of 4, MORE 3 of 4, MKPAUSE On Off.

Related Programming Command MKPAUSE

MKR BW On Off

Marker menu softkey that is used to measure a signal's bandwidth.

You can select the amplitude offset used to determine the bandwidth. Use the REL LEFT and REL RIGHT softkeys to position markers 1 and 2 at the desired amplitude offset from the signal's peak.

If marker 1 is at a signal peak, marker 2 is placed 3 dB down on the left side of the signal's response. Marker 3 is placed 3 dB down on the right side of the signal's response. (In linear mode, the marker is placed at half the power of the signal's peak.) Both markers are active and can be positioned simultaneously using the front-panel knob, step keys, or numeric keypad.

Key Path Press `Marker`, `MORE 1 of 4`, `MORE 2 of 4`, `mkr bw/zoom bw`, `MKR BW On Off`.

Related Programming Command MKBWA

MKR BW On Off

Softkey that sets the amplitude at which the DFB advanced-measurement program's bandwidth value is measured.

The DFB laser's bandwidth is measured at a default value of −20 dBc. (Markers are placed −20 dBc from the peak value on each skirt of the laser's response. The bandwidth is the wavelength separation between these two markers.) Using the `MKR BW On Off` softkey, you can specify the amplitude offset at which the bandwidth is measured. Enter the value as a negative dB offset. For example, to enter a 3 dBc value, press (−), (3), `dB`. To enter the offset as a multiplier (for example $\frac{1}{2}$ power), enter the value 0.5; press (.), (5) `X`.

Two displayed markers identify the bandwidth. If the slope of the response is very steep, these two peaks may not appear at the same amplitude. This is due to a limited amount of trace points available for measuring the data. To increase resolution, decrease the wavelength span.

Key Path Press (USER), `DFB`, `MKR BW On Off`.

See Also *DFB* in this chapter.

Related Programming Command

MKBWA

mkr bw/zoom bw

Softkey that accesses the marker bandwidth and zoom bandwidth softkeys.

Use the marker bandwidth and zoom bandwidth softkeys to perform either of the following:

- Determine the bandwidth of signals
- Automatically reduce the span to 0 Hz at the signal's wavelength.

Key Path

Press `Marker`, `MORE 1 of 4`, `MORE 2 of 4`, `mkr bw/zoom bw`.

See Also

MKR BW On Off and *ZOOM TO RES BW* in this chapter.

MKR NRM On Off

Softkey that displays an active marker on a trace.

Use the front-panel knob, step keys, or numeric keypad to position the marker at a specific wavelength. In zero span, the marker is placed at the specified time. The wavelength and amplitude at the marker is shown in the upper-right corner of the graticule. To turn off all markers, press `MKR NRM On Off` so that `Off` is underlined. An instrument preset turns off all markers and their annotation.

Key Path

Press `Marker`, `MKR NRM On Off`.

Press (USER), `PDL`, `MKR NRM On Off`. *HP 70951B Option 003 only.*

See Also *marker readout* in this chapter.

Related Programming Command MKN, MKOFF

MKR TRA A B C

Softkey that positions the active marker on trace A, B, or C.

Key Path Press `Marker`, `MORE 1 of 4`, `MORE 2 of 4`, `MKR TRA A B C`.

Press `USER`, `PDL`, `MKR TRA A B C`. *HP 70951B Option 003 only.*

Related Programming Command MKTRACE

MONO INPUT

Softkey that selects the front-panel `MONOCHROMATOR INPUT` connector as the active input for stimulus-response measurements.

> **NOTE**
>
> This softkey is only displayed on HP 71451B instruments.

Key Path Press State , instr modes , STM/RESP , MONO INPUT .

See Also *instr modes* in this chapter.

Related Programming Command SRINPUT NORMAL

MONOCHROMATOR INPUT

Front-panel input connector.

Connect the input light to this HP 71451B optical spectrum analyzer connector (HP 70951B modules). On HP 71450B/2B optical spectrum analyzers, this connector is labeled OPTICAL INPUT. This connector is the input of the optical spectrum analyzer's internal monochromator. This input is used for basic optical spectrum analysis, preselector mode, stimulus-response mode, and photodetector mode. The connector has a corresponding LED that indicates when the input is active (indicating a signal is available).

MONOCHROMATOR OUTPUT

Front-panel output connector.

This is the external output of the monochromator on the HP 71451B optical spectrum analyzer (HP 70951B modules). This output is used during the preselector, stimulus response, and photodetector modes. It has a corresponding LED that indicates when the output is active (expecting a signal to be output).

NEXT PAGE

Softkey that displays another page of screen data.

Displayed listings, for example catalogs of memory or limit-line tables, often are to long to fit on the display. In this case, the listing is shown on separately displayed "pages". Press NEXT PAGE to display the next listing of data.

Key Path Misc, MORE 1 of 3, catalog & MSI, NEXT PAGE.

NEXT PEAK

Moves a displayed marker to the next-highest signal peak.

NEXT PEAK

Softkey that moves a displayed marker to the next-highest signal peak.

Normally, the optical spectrum analyzer defines a peak as any change in trace amplitude that rises and then falls at least 3 dB. This is known as the peak's excursion. You can change the definition from 3 dB by using the PEAK EXCURNS softkey.

Key Path Press Marker, NEXT PEAK.

Press State, instr modes, PRESEL, NEXT PEAK.

See Also *PEAK EXCURSN* in this chapter.

Related Programming Command MKPK NH

NEXT PIT

Softkey that moves a displayed marker to the next-deepest signal pit.

By default, the optical spectrum analyzer defines a pit as any change in trace amplitude that falls and then rises at least 3 dB. This is known as the pit excursion value. You can change the definition from 3 dB by using the `PIT EXCURNS` softkey.

Key Path Press `Marker`, `MORE 1 of 4`, `MORE 2 of 4`, `MORE 3 of 4`, `pit,min markers`, `NEXT PIT`.

See Also *PIT EXCURSN* in this chapter.

Related Programming Command MKPK NHPIT

NEXT SEGMENT

Softkey that selects the next row in the limit-line table for data entry.

Use the `LAST SEGMENT` softkey to enter additional segments.

Key Path

Press Misc, MORE 1 of 3, limit lines, LIMITS 1 of 3, NEXT SEGMENT.

Press Misc, MORE 1 of 3, limit lines, LIMITS 1 of 3, LIMITS 2 of 3, NEXT SEGMENT.

Related Programming Command

LIMINEXT

NO. OF STATES

Softkey that reserves a number of instrument-state files for saving instrument states.

Normally, instrument-state files are dynamically created as you save them. Using this softkey reserves and creates a number of instrument-state files in memory. Each file is initialized with the current instrument state. Once created, you can save and recall instrument states to these files. For example, if you enter 3, three files are created having the following names: s_1, s_2, and s_3. If one of these files already exists, its contents will not be effected. If NO. OF STATES is again used to reduce the files to 0, files s_1, s_2, and s_3 will be erased.

Pressing (INSTR PRESET) does not erase instrument-state files. Since instrument-state files occupy large amounts of memory, reducing the number of instrument-state files conserves memory space. Decreasing the number of files, deletes any files present with file numbers higher than the new limit. This results in lost state data.

Key Path

Press State, MORE 1 of 4, NO. OF STATES.

Related Programming Command

NSTATE

NORM On Off

Softkey that turns trace normalization on or off.

Trace normalization is available in the stimulus-response and photodiode instrument modes. Photodiode mode is only available on HP 71451B optical spectrum analyzers. When trace normalization is turned on, the operation depends on whether a logarithmic or linear display is selected:

Logarithmic display	`A ← A – B` is executed, and the reference level is set to 0 dB.
Linear display	The reference level offset and display line are set to place the current reference trace at the top of the screen and set equal to a value of 1.000X. Next, the `A ← A*DL/B` trace math function is turned on. This normalizes the current trace to 1.000X.

Turning off trace normalization simply disables the trace math enabled when NORM ON was executed. Note that turning off normalization in linear mode does not reset ROFFSET or DL to their previous values.

Key Path

Press `State`, `instr modes`, `PHOTO DIODE`, `NORM On Off`.

Press `State`, `instr modes`, `STM/RESP`, `NORM On Off`.

See Also

instr modes in this chapter.

Related Programming Command

NORM

NORMAL ON/OFF

Turns on the markers and places an active marker on the trace, returns the marker function to the normal single marker, or turns off the marker function.

This custom keypad key is identical in operation to the `MKR NRM On Off` softkey.

See Also *MKR NRM On Off* in this chapter.

oneshot math

Softkey that displays a menu of "single action" trace-math functions that are performed once per key press.

When invoked, each function places the displayed trace in view mode so that the data is not overwritten by the next sweep. This is in contrast to the functions in the "trace logmath" and "trace linmath" menus that, while on, are continuously applied to each sweep.

Key Path Press `Traces`, `MORE 1 of 4`, `oneshot math`.

OPTICAL INPUT

Front-panel input connector.

Connect the input light to this HP 71450B/2B optical spectrum analyzer connector (HP 70950B/2B modules). On HP 71451B optical spectrum analyzers, this connector is labeled MONOCHOMATOR INPUT. This connector is the input of the optical spectrum analyzer's internal monochromator.

OPTIMIZ

Softkey that ensures the DFB advanced-measurement program locates the laser's side modes.

The DFB advanced-measurement program performs measurements on DFB lasers. In order to accomplish the measurements, the program must be able to locate the laser's side modes. Upon entering the program, the sensitivity is automatically adjusted. If the sensitivity is changed (and is not adequate to locate the side modes), pressing this softkey automatically adjusts the sensitivity to locate the side modes. This key does not affect the measurement wavelength span.

Key Path Press (USER), DFB, OPTIMIZ.

See Also *DFB* in this chapter.

OPTSENS On Off

Softkey that optimizes the automatic measurement routine for sensitivity.

When this function is turned on, the automatic measurement routine uses a lower sensitivity setting in order to reduce the displayed noise. One example of using this feature is to allow the viewing of sidemodes on a DFB laser upon the completion of the automatic measurement.

Key Path Press State, autmeas state, OPTSENS On Off.

See Also *autmeas state* in this chapter.

Related Programming Command

AUTOMOPT

ORDER AutoMan

Softkey that allows second order use of the diffraction grating modes or limits operation to first order.

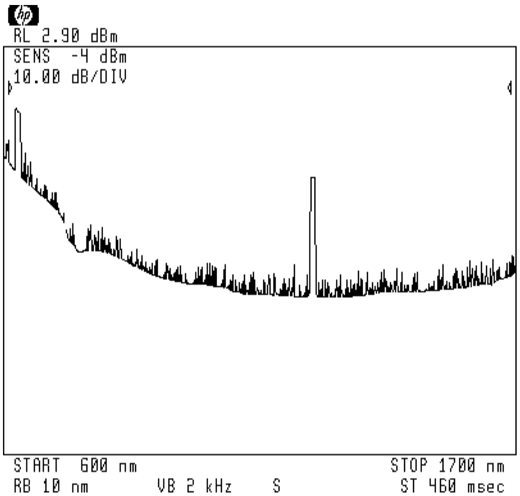
The main use of the `ORDER AutoMan` softkey is to help determine if a displayed signal is a true or multiple response. Diffraction-grating based optical spectrum analyzers may display multiple images of the input signal. These multiple images depend on the input wavelength. Changing the diffraction-grating order removes multiple responses from the display.

The following tables shows the relationship between input wavelength and multiple displayed responses. For example, a signal at 700 nm will be displayed at both 700 nm and 1400 nm. Also, a signal at 1500 nm will be displayed at 1500 nm and 750 nm. Also note that the input wavelength causing the multiple response can be outside the input range of the optical spectrum analyzer. For example an input at 300 nm would cause a displayed image at 600 nm.

Input Wavelength versus Multiple Images

Input Wavelength	Wavelengths of Displayed Responses
$\lambda \leq 850$ nm	λ, 2λ
$\lambda \geq 1200$ nm	λ, $\frac{\lambda}{2}$

The following figures show the displayed response of a 632.7 nm helium-neon laser. An image response is clearly visible at 1265.4 nm.



Full span view: laser and 1265 nm image.

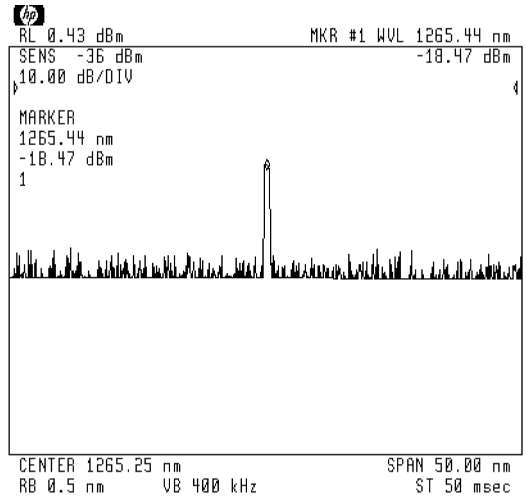
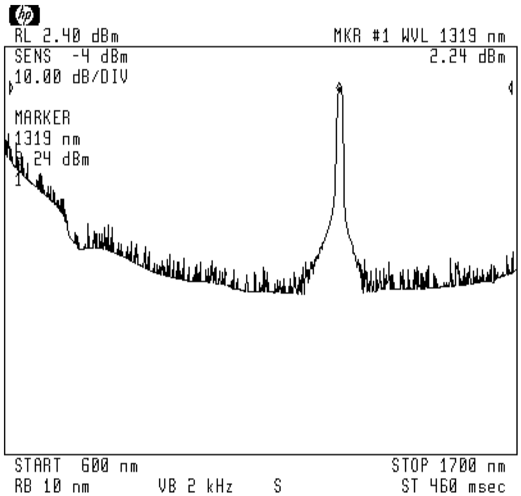


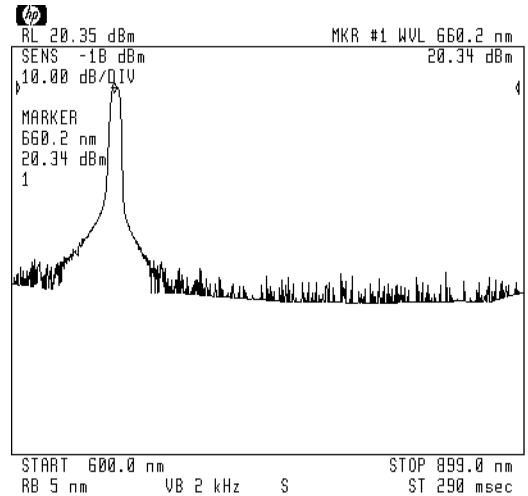
Image response at 1265 nm

In the following figures, a 1319 nm Fabry-Perot laser results in a multiple image at 660 nm because of the use of second order with the stop wavelength less than 900 nm. Unlike the helium-neon laser, the Fabry-Perot laser's sub-multiple image can not be seen in full span. This is due to the grating order used for this sweep. (The following paragraphs discuss grating orders.) In full-span sweeps, if a light source is within the input wavelength range the following is true:

- Multiple images are displayed (light source $\leq$ 850 nm)
- Sub-multiple images are *not* displayed (light source $\geq$ 1200 nm)



Full span view: 1319 nm Fabry-Perot laser.



Sub-multiple response at 660 nm

Diffraction-Grating Modes

The optical spectrum analyzer's internal monochromator operates in either the 1st or 2nd order diffraction-grating mode. The mode selected is based on the following instrument conditions:

Full λ span .... 1st order
Stop λ < 900 nm (RES BW = 10 nm) .... 1st order
Stop λ < 900 nm (RES BW $\neq$ 10 nm) .... 2nd order

The optical spectrum analyzer never switches the order during a sweep. Notice that in full span (1st order) the monochromator loss near 600 nm is greater than if 2nd order is used.

Change the order to test a sub-multiple images

If the optical spectrum analyzer's stop wavelength is less than 900 nm (and the resolution bandwidth is not 10 nm) the optical spectrum analyzer is in 2nd order and you can test for sub-multiples. Press `ORDER AutoMan` so that `Off` is underlined. (This always sets the 1st order mode.) If the displayed image disappears, it is a sub-multiple and not a true response.

Key Path

Press `State`, `MORE 1 of 4`, `MORE 2 of 4`, `ORDER AutoMan`.

Related Programming Command
GRATORDER

OSA

Softkey that selects normal optical spectrum analysis.

Optical spectrum analysis is one of six operating modes available on HP 71451B optical spectrum analyzers and three modes available on HP 71450B/2B optical spectrum analyzers. Input light is connected to the front-panel MONOCHROMATOR INPUT connector for measurement. The front-panel MONOCHROMATOR OUTPUT and PHOTODETECTOR INPUT connectors are not used in OSA mode.

Key Path
Press State, instr modes, OSA.

See Also
instr modes in this chapter.

OSA PULSE

Softkey that places the optical spectrum analyzer in an operation mode that is optimized for making accurate fast pulse measurements.

Pulse measurement operation is one of six operating modes available on HP 71451B optical spectrum analyzers (three modes on HP 71450B/2B instruments). OSA PULSE mode is identical to normal operation except that the range of the internal transimpedance amplifier is limited in order to select wide bandwidth and fast settling characteristics.

One example of using this mode is measuring the signal-to-noise ratio (SNR) of EDFA systems by measuring the amplified spontaneous emission (ASE) level immediately (10 μs) after the modulation is turned off.

Key Path Press `State`, `instr modes`, `OSA PULSE`.

See Also *instr modes* and *TRNSZLK On Off* in this chapter.

Related Programming Command INSTMODE

P STATE On Off

Softkey that protects the contents of instrument-state files.

When set to on, instrument-state files cannot be altered or deleted except during some programming applications. An instrument preset does not affect the setting of this softkey.

Key Path Press `State`, `MORE 1 of 4`, `P STATE On Off`.

Related Programming Command PSTATE

PARTIAL ERASE

Softkey that erases all volatile contents of internal memory.

This function erases all files in internal memory. This includes any downloadable programs, measurement states, limit lines, traces, and amplitude corrections. Calibration offsets and serial-number information are not erased by this function.

Key Path

Press State, MORE 1 of 4, MORE 2 of 4, MORE 3 of 4, PARTIAL ERASE.

Related Programming Command

PERASE

PAUSE

Softkey that pauses execution of a DLP during debugging.

After pausing the DLP, press the CONT softkey to continue program execution.

Key Path

Press Misc, MORE 1 of 3, MORE 2 of 3, debug, PAUSE.

Related Programming Command

PAUSE

PD INPUT

Softkey that activates the front-panel PHOTODETECTOR INPUT connector normally used for stimulus-response measurements.

NOTE

This softkey is only displayed on HP 71451B instruments.

Key Path Press State, instr modes, STM/RESP, PD INPUT.

See Also *instr modes* in this chapter.

Related Programming Command SRINPUT DIODE

PD MEAS ON OFF

Softkey that displays the power distribution of a photo diode.

> **NOTE**
>
> This softkey is only displayed when using an HP 70951B optical spectrum analyzer module.

This softkey is used during the photo-diode instrument mode. After storing the trace of watts-per-wavelength, press this softkey to display the response of the photo diode being tested. The displayed response shows the logarithm of the ratio of output current (in amperes) to input light power (in watts).

Key Path Press State, instr modes, PHOTO DIODE, PD MEAS ON OFF.

Related Programming Command PDMEAS

PDL

Softkey that runs the polarization dependent loss (PDL) measurement program by performing the following:

1) selects a sweep from 1250 to 1600 nm.

2) selects video-bandwidth manual mode which enables sample detection.

3) displays the PDL softkey menu and initializes the internal PDL variables.

NOTE

Only for use with HP 70951B Option 003, Swept Polarization Dependent Loss (PDL) Kit.

The polarization dependent loss is measured by viewing the output spectrum of the device under test. Any change in input polarization causes a change in signal amplitude. These PDL softkeys allow the difference between the measured minimum and the maximum signal amplitude (the peak-to-peak polarization dependent loss of the device) to be easily measured.

The procedure to make the PDL measurement is as follows:

(1) Turns on the white light source (`SOURCE On Off`).

(2) Sets the start and stop wavelengths.

(3) Sets the resolution bandwidth (`RES BW AutoMan`).
Press `AUTO SCALE` as needed.

(4) Sets the video bandwidth (`VID BW AutoMan`).

(5) Starts the PDL measurement (`INIT PDL`).

(6) Adjusts the polarization state controller.
Press `AUTO SCALE` as needed.

(7) Displays the results (`CALC + DISPLAY`).
Press `AUTO SCALE` as needed.

This procedure can also be displayed on the instrument by pressing the HELP softkey under the PDL softkey menu.

To display additional help text via the instrument, press one of the following softkeys: INIT PDL , CALC + DISPLAY , AUTO SCALE , SOURCE On Off , DETECTR Ext Int , and EXIT .

Key Path Press (USER), PDL .

Related Programming Command PDL_

PEAK EXCURSN

Softkey that defines a peak for marker peak search functions.

For marker search functions, a signal peak is defined as a rise and fall in the displayed response of at least 3 dB. This is the default peak excursion value. Using PEAK EXCURSN , you can change the default from 3 dB. However, realize that reducing the peak-excursion to values less than 3 dB often causes the marker-peaking functions to identify noise spikes as signals. Perform the following to reduce the noise floor variance to a value less than the peak-excursion rate:

- Use video averaging.
- Reduce the video bandwidth.

Key Path Press Marker , MORE 1 of 4 , MORE 2 of 4 , MORE 3 of 4 , marker excursn , PEAK EXCURSN .

Press (USER), DFB , PEAK EXCURSN .

Press (USER), FP , PEAK EXCURSN .

See Also *DFB*, *FP*, *POS PK*, *VID AVG On Off*, and *VID BW AutoMan* in this chapter.

Related Programming Command MKPX

(PEAK SEARCH)

Places an active marker on the highest amplitude trace point.

This custom keypad key is identical in operation to the HIGHEST PEAK softkey.

See Also *HIGHEST PEAK* in this chapter.

PEAK THRESH

Softkey for Fabry-Perot (FP) advanced-measurement program that selects an amplitude window for measurement data.

In the FP advanced-measurement program, data below the threshold level is not used to calculate the displayed measurement results. The threshold value is entered as either −dBc [decibels relative to the carrier (main mode)] or as a multiplier. For example, to exclude modes 10 dB below the main mode, enter either −10 dB or 0.1 X.

The default threshold value is −90 dBc.

To display the modes included by the threshold value, press PEAKS On Off so that On is underlined. Any modes that are above the threshold value are identified with a vertical line drawn from their peak to the bottom of the display. As you change the threshold value, more or less peaks will be identified.

Key Path Press USER, FP, PEAK THRESH.

See Also *FP* in this chapter.

PEAKS On Off

Softkey that displays which response peaks are used in measurement calculations.

The FP advanced-measurement program measures and characterizes Fabry-Perot lasers. The displayed measurement results are based on the peaks identified in the current trace data. Use this softkey to show which peaks were identified. Valid peaks are identified by a vertical line drawn from the peak of each valid response to the bottom of the display.

Valid peaks are located using the peak-excursion value. This value defines the amount a trace must rise and fall to be identified as a peak. The default peak-excursion value is 3 dB. You can change this value using the PEAK EXCURSN softkey.

Key Path Press USER, FP, PEAKS On Off.

See Also *FP* and *PEAK EXCURSN* in this chapter.

PERIOD

Softkey that configures marker readouts in period.

The period is the time required for light to travel one wavelength as shown in the following formula:

$$period = \frac{wavelength}{300 \times 10^6 m/s}$$

Period is the reciprocal of the frequency at the marker. Normally, the optical spectrum analyzer selects the proper marker readout based on the current instrument state.The marker annotation can be selected to indicate one of the following trace values:

- Frequency
- Wavelength
- Period
- Sweeptime
- $\frac{1}{T}$

Key Path Press `Marker`, `MORE 1 of 4`, `MORE 2 of 4`, `marker readout`, `PERIOD`.

PERSIST On Off

Softkey that simulates analog displays.

When set to on, `PERSIST On Off` provides a visual effect similar to the persistence of analog cathode-ray-tube scopes. Each trace displays the current sweep of active trace data and the six previous sweeps of active trace information. `PERSIST On Off` does not affect stored trace data and is a visual aid only.

To enhance the persistence effect, set sample-detection mode with `SAMPLE` and set `LINES On Off` to `Off`. Spurious signals hidden in modulated signals can often be seen using this technique.

Key Path Press `Traces`, `MORE 1 of 4`, `MORE 2 of 4`, `MORE 3 of 4`, `PERSIST On Off`.

See Also *SAMPLE* and *LINES On Off* in this chapter.

Related Programming Command PERSIST

PHOTO DIODE

Softkey that selects instrument operation for testing photo diode detectors.

NOTE

PHOTO DIODE is only displayed when using an HP 70951B optical spectrum analyzer module. HP 71450B/52B optical spectrum analyzers (HP 70950B/52B modules) can not be used in this mode.

Photo diode testing is one of six operating modes available on HP 71451B optical spectrum analyzers. Photo diode testing characterizes the output current of photo detectors. The photo detector's output is connected to the rear-panel TRANS-Z IN connector on the HP 70951B module.

Key Path Press State, instr modes, PHOTO DIODE.

See Also *instr modes* in this chapter.

PHOTODETECTOR INPUT

Front-panel input connector.

This is the external input to the photodetector on the HP 71451B optical spectrum analyzer (HP 70951B modules). This input is used for the stimulus-response and power-meter modes. Because the input light bypasses the monochromator, it is not filtered by the resolution-bandwidth filters. An LED next to the connector indicates when the connector is active (expecting a signal to be input).

PIT EXCURSN

Softkey that defines a local minimum trace point as a pit for marker pit search functions.

For marker search functions, a signal pit is defined as having a fall and then a rise in the displayed response of at least 3 dB. This is the default pit excursion value. Using `PIT EXCURSN`, you can change the default from 3 dB. Reducing the pit-excursion to values less than 3 dB often may cause the marker-piting functions to identify noise spikes as pits. Perform the following to reduce the noise floor variance to a value less than the pit-excursion rate:

- Use video averaging.
- Reduce the video bandwidth.

Key Path

Press `Marker`, `MORE 1 of 4`, `MORE 2 of 4`, `MORE 3 of 4`, `marker excursn`, `PIT EXCURSN`.

See Also

PEAK EXCURSN in this chapter.

Related Programming Command MKPITX

pit,min markers

Softkey that presents a menu that provides functions for locating signal pits and the minimum trace point.

Key Path Press `Markers`, `MORE 1 of 4`, `MORE 2 of 4`, `MORE 3 of 4`, `pit,min markers`.

[PLOT]

Plots the display on a Hewlett-Packard plotter.

When pressed, [PLOT] sends vector plot data (HPGL graphics format) over HP-IB to the plotter specified in the [DISPLAY] menu. Press the [DISPLAY] front-panel key and then the `Hard Copy` and `plotter address` softkeys to change the default plotter address. Press the [MENU] front-panel key to return to the optical spectrum analyzer menus.

The plotter's default HP-IB address is set to address 5. The default plotter limits are those of the HP 7470A and HP 7475A plotters. These allow 0.5 inch margins on standard A-size paper (8.5 by 11 inches).

See Also The "Hard Copy Menu" chapter in the *HP 70004A Display Operation Manual*.

POINT

Softkey that determines limit-line interpolation.

Selecting POINT specifies a limit value for only the beginning point of each limit-line segment.

Key Path Press `Misc`, `MORE 1 of 3`, `limit lines`, `LIMITS 1 of 3`, `TYPE`, `POINT`.

See Also *TYPE* in this chapter.

POWER FOR CAL

Softkey that enters the light source's power level for user calibrations.

User calibrations calibrate the optical spectrum analyzer at a specific wavelength and power. This softkey is used to enter the power level of the calibrated light source. User calibration is not the same as factory calibration. Factory calibration calibrates the optical spectrum analyzer across its entire wavelength range. For more information on calibrating the optical spectrum analyzer, refer to "Calibrating the Optical Spectrum Analyzer" located in Chapter 1 of the *HP 71450B/1B/2B Optical Spectrum Analyzers User's Guide* .

Key Path Press `Wavelen`, `MORE 1 of 2`, `cal menu`, `cal setup`, `POWER FOR CAL`.

Press `Amptd`, `MORE 1 of 4`, `cal menu`, `cal setup`, `POWER FOR CAL`.

See Also *CAL ALL* in this chapter.

Related Programming Command CALPWR

POWER METER

Softkey that selects instrument operation as a power meter.

NOTE

This softkey is only displayed when using an HP 70951B optical spectrum analyzer module.

Power meter operation is one of six operating modes available on HP 71451B optical spectrum analyzers. Power-meter mode displays the broadband power of the input light over time. The input light is directly connected to the optical spectrum analyzer's photodetector. This bypasses the internal monochromator and prevents any filtering by the resolution bandwidth filters. With power-meter mode, you can perform the following:

- Measure total power of broadband light sources.
- Monitor power as a function of time.

Monitoring power enables you to observe both long and short term drift and to perform real-time adjustments. Power-meter mode places the optical spectrum analyzer in the following settings:

Sweep time	10s
Amplitude units	logarithmic
Amplitude scale	5 dB/division
Video bandwidth	100 Hz

Input light is connected to the front-panel `PHOTODETECTOR INPUT` connector for measurement. The front-panel `MONOCHROMATOR INPUT` and `MONOCHROMATOR OUTPUT` connectors are not used in power-meter mode.

Key Path Press `State`, `instr modes`, `POWER METER`.

See Also *instr modes* and *AMETER On Off* in this chapter.

POWERON IP

Softkey that specifies that the instrument be placed in its preset and default state whenever it is turned on.

Key Path Press `State`, `MORE 1 of 4`, `MORE 2 of 4`, `poweron menu`, `POWERON IP`.

See Also *POWERON LAST* and *POWERON RECALL* in this chapter. Refer also to "Tables and Charts" chapter in this manual for a description of the preset state.

Related Programming Command POWERON

POWERON LAST

Softkey that specifies the instrument's state immediately after being turned on.

The restored instrument state is the last state before power was removed.

Key Path Press `State`, `MORE 1 of 4`, `MORE 2 of 4`, `poweron menu`, `POWERON LAST`.

See Also *POWERON IP* and *POWERON RECALL* in this chapter. state.

Related Programming Command POWERON

poweron menu

Softkey that presents a menu that is used for selecting the instrument's state after it is turned on.

Key Path Press `State`, `MORE 1 of 4`, `MORE 2 of 4`, `poweron menu`.

POWERON RECALL

Softkey that restores state-register 0 each time the instrument is turned on.

After the optical spectrum analyzer is turned on, its settings are automatically changed to the stored values.

Key Path Press `State`, `MORE 1 of 4`, `MORE 2 of 4`, `poweron menu`, `POWERON RECALL`.

See Also *POWERON IP* and *POWERON LAST* in this chapter.

Related Programming Command RCLS

PRESEL

Softkey that selects instrument operation as a preselector.

> **NOTE**
>
> This softkey is only displayed when using an HP 70951B optical spectrum analyzer module.

Preselector operation is one of six operating modes available on HP 71451B optical spectrum analyzers. The input spectrum is filtered and output at the front-panel MONOCHROMATOR OUTPUT connector. The optical spectrum analyzer acts as a tunable transmission filter. To accomplish this, the light output from the optical spectrum analyzer's internal monochromator is switched to the front-panel MONOCHROMATOR OUTPUT connector. During preselection, the input spectrum is not detected by the optical spectrum analyzer.

When preselection mode is selected, a single sweep of trace data is displayed. The trace shows the approximate power versus wavelength at the front-panel MONOCHROMATOR INPUT connector. A trace marker shows the wavelength that the preselector (monochromator) is tuned to. As you tune the preselector, the trace marker moves to show the selected wavelength of the signal at the MONOCHROMATOR OUTPUT connector.

Key Path Press `State`, `instr modes`, `PRESEL`.

See Also *instr modes* and *MARKER TUNE* in this chapter.

PRESET USER

Softkey that restores the default user-menu softkeys.

The default softkeys shown when (USER) is pressed can be overwritten with your own custom keys. Use this function to restore the following default softkeys: DEFINE USR KEY, RECALL USER, and SAVE USER

NOTE

The user menu might contain softkeys that you wish to keep. Do not execute PRESET USER if you want to keep the current menu of user softkeys.

Key Path Press Misc, MORE 1 of 3, key control, PRESET USER.

Related Programming Command KEYPST

prev menu

Softkey that returns the last displayed softkeys.

You can also press the front-panel (←) key to retrace the path of last keys pressed.

(PRINT)

Prints the display on a Hewlett-Packard graphics printer.

When pressed, (PRINT) sends raster print data over HP-IB to the printer specified in the (DISPLAY) menu. Select printer types by pressing the (DISPLAY) front-panel key and then the `Hard Copy` and `printer config` softkeys. Press the (DISPLAY) front-panel key and then the `Hard Copy` and `printer address` softkeys to change the default printer address. The printer's default HP-IB address is set to address 1. Press the (MENU) front-panel key to return to the optical spectrum analyzer menus.

The print data is formatted in the HP-PCL (printer command language) graphics format.

See Also

The "Hard Copy Menu" chapter in the *HP 70004A Display Operation Manual*.

PULSE WIDTH

Softkey that adjusts the pulse width of the rear panel `ADC SYNC OUT` or `CURRENT SOURCE` connectors.

The signal at the `ADC SYNC OUT` connector is TTL compatible and can be used to pulse a light source. Option 001 optical spectrum analyzer have a built in current source for biasing light sources. The current source's output is available at the rear panel `CURRENT SOURCE` connector as DC or pulsed current.

Key Path

Press `State`, `sync out`, `PULSE WIDTH`.

Press `State`, `current source`, `PULSE WIDTH`. (Option 001)

Press `State`, `MORE 1 of 4`, `instr modes`, `OSA PULSE`, `adc sync`, `PULSE WIDTH`.

See Also

current source in this chapter.

Related Programming Command

IGENPW

PURGE FILE

Softkey that erases files from default memory. To erase a file, press `PURGE FILE`, and enter the number identifying the file. In the catalog, the files are numbered in ascending order to the left of the file names.

Key Path

Press `Misc`, `MORE 1 of 3`, `catalog & MSI`, `CATALOG 1 of 2`, `PURGE FILE`.

Related Programming Command

DISPU

PWR CAL On Off

Softkey that turns on or off the use of any user-calibration derived power correction offset.

User calibration results in wavelength and power correction offset. When this softkey is turned on, the power correction offset is applied to all measured data. Separate power calibration data is obtained from calibrations performed during optical spectrum analyzer and power-meter instrument modes. For more information on calibrating the optical spectrum analyzer, refer to "Calibrating the Optical Spectrum Analyzer" located in Chapter 1 of the *HP 71450B/1B/2B Optical Spectrum Analyzers User's Guide* .

Key Path Press `Wavelen` , `MORE 1 of 2` , `cal menu` , `PWR CAL On Off` .

Press `Amptd` , `MORE 1 of 4` , `cal menu` , `PWR CAL On Off` .

See Also *CAL ALL* and *CAL POWER* in this chapter.

Related Programming Command CALCOR

RB/SPAN RATIO

Softkey that specifies the ratio between the resolution-bandwidth and span settings.

Normally, the resolution bandwidth is coupled to the wavelength span, so that the optical spectrum analyzer automatically selects the proper resolution bandwidth. The ratio is determined as follows:

$$resolution\ bandwidth = (span)(N)$$

The preset value for N is 0.01. Use `RB/SPAN RATIO` to select another value for N between 10^{-100} and 10^{100}. To uncouple the resolution bandwidth from the span, press the `RESOL AutoMan` softkey so that `Auto` underlined.

Key Path Press `BW,Swp` , `MORE 1 of 3` , `MORE 2 of 3` , `RB/SPAN RATIO` .

See Also *RESOL AutoMan* in this chapter.

Related Programming Command RBR

recall

Softkey that accesses a menu for recalling files from memory.

You can recall instrument states, traces, limit lines, and user-menu files. To load a file, press the key for the desired file type, and then enter the file number. If you do not remember the file's number, press `recall from` to view a catalog of user-memory. `recall from` opens the `Misc` menu's catalog softkeys. You can also select user memory from this menu. Each file in the catalog has an identifying prefix, which distinguishes one type of file (and its contents) from the other file types.

File Prefixes

Prefix	File Type
d_	down-loadable program
l_	limit-line
s_	instrument state
t_	trace
u_	user menu

A number is listed to the left of each FILE name in the catalog. Use this entry number to recall the file. Press `LOAD FILE`, followed by the entry number, then press `ENTER`.

Key Path Press `State`, `recall`.

Press `Traces`, `MORE 1 of 4`, `MORE 2 of 4`, `recall`.

See Also *catalog & MSI* in this chapter.

recall from . . .

Softkey that presents a menu for cataloging and changing default memory.

Key Path Press `State`, `recall`, `recall from...`.

See Also *catalog & MSI* and *recall* in this chapter.

RECALL LIMIT

Softkey that loads a stored limit-line file into the limit-line table.

The limit-line file is recalled from the currently selected user memory. To recall a file, press `RECALL LIMIT`, enter the file number using the numeric keypad, then press `ENTER`. The `l_` prefix identifies limit-line files.

Key Path Press `Misc`, `MORE 1 of 3`, `limit lines`, `RECALL LIMIT`.

Press `State`, `recall`, `RECALL LIMIT`.

See Also *catalog & MSI* in this chapter.

Related Programming Command LIMIRCL

RECALL MEMORY

Softkey that loads non-ASCII downloadable program data to internal memory.

This function recalls non-ASCII, internal-memory data from a card or disk. Non-ASCII, internal-memory entries are data associated with down-loadable programs. These include all user-defined traces, variables, functions, on-end-of-sweep algorithms, and amplitude-correction factors. The default memory must be set to a card or disk.

Recalling the data involves entering a file number. The `d_` prefix identifies down-loadable program files. If you need to determine a file number, press `recall from` to view a catalog of user-memory. `recall from` opens the `Misc` menu's catalog softkeys. You can also select user memory from this menu.

Key Path Press `State`, `recall`, `RECALL MEMORY`.

See Also *catalog & MSI* in this chapter.

Related Programming Command RCLD

RECALL STATE

Softkey that sets the instrument state to the settings saved in a state file.

The state file is recalled from the currently selected user memory.

To recall a file, press RECALL STATE, enter the file number using the numeric keypad, then press ENTER. The `s_` prefix identifies instrument state files.

Key Path Press State, recall, RECALL STATE.

See Also *catalog & MSI* in this chapter.

Related Programming Command RCLS

RECALL TRACE A

Softkey that loads trace data from a file into trace A.

When cataloging memory, the `t_` prefix identifies trace files. Before recalling the file, you must first stop trace updating to prevent erasing the recalled data. The following two methods stop trace updating:

- Activate single-sweep mode. Press BW, Swp, SINGLE SWEEP.
- Place Trace A in view mode. Press Traces, STORE A, or verify that the VIEW-A/BLANK-A softkey is set to VIEW A.

Key Path Press State, recall, RECALL TRACE A.

See Also *catalog & MSI* in this chapter.

Related Programming Command RCLT

RECALL USER

Softkey that loads a set of user-defined softkeys into the (USER) menu.

The current menu of user-defined softkeys is cleared. To recall a file, press RECALL USER, enter the file number using the numeric keypad, then press ENTER. The u_ prefix identifies user-menu files. The operation of RECALL USER and RECALL USERKEY, accessed under the State softkey, are identical.

Key Path Press Misc, MORE 1 of 3, key control, RECALL USER.

See Also *RECALL USERKEY* in this chapter.

Related Programming Command RCLU

RECALL USERKEY

Softkey that loads a set of user-defined softkeys into the (USER) menu.

The operation of RECALL USERKEY and RECALL USER are identical.

Key Path Press State, recall, RECALL USERKEY.

See Also *RECALL USER* in this chapter.

Related Programming Command RCLU

-> REF

Softkey that sets the reference level equal to the marker amplitude.

This softkey is identical in operation to the TO REF LEVEL key.

Key Path Press Marker , -> REF .

Related Programming Command MKRL

REF LEVEL

Sets the reference level.

Enter the desired reference level value using the front-panel knob, step keys, or numeric keypad. The operation of this key is identical to the REF LVL softkey except that the Amptd menu is not invoked.

REF LVL

Softkey that specifies the reference level value at the reference-level position. The reference-level position is indicated by two triangles. The default position is one major graticule from the top of the display. Use the Amptd menu's REF LVL POSN softkey to change the reference-level position.

Key Path Press `Amptd`, `REF LVL`.

See Also *REF LVL POSN* and *ATTEN AutoMan* in this chapter.

Related Programming Command RL

REF LVL POSN

Softkey that changes the reference-level position.

The reference-level position indicates the position of the reference level amplitude value with two displayed triangles. The reference-level position can be moved using the knob, step keys, or numeric keypad. The default position is one major graticule from the top of the display.

Key Path Press `Amptd`, `MORE 1 of 4`, `REF LVL POSN`.

See Also *REF LVL* in this chapter.

Related Programming Command RLPOS

REL LEFT

Softkey that positions the left-side marker for measuring the bandwidth of a signal.

Key Path

Press `Marker`, `MORE 1 of 4`, `MORE 2 of 4`, `mkr bw/ zoom bw`, `REL LEFT`.

See Also

MKR BW On Off in this chapter.

Related Programming Command

MKAL

REL RIGHT

Softkey that positions the right-side marker for measuring the bandwidth of a signal.

Key Path

Press `Marker`, `MORE 1 of 4`, `MORE 2 of 4`, `mkr bw/ zoom bw`, `REL RIGHT`.

See Also

MKR BW On Off in this chapter.

Related Programming Command

MKAR

RELATIV On Off

Softkey that specifies relative or absolute limit-line values.

Limit-line values can represent either absolute amplitude and wavelength values or values that are relative to the current reference-level and center-wavelength settings. When `RELATIV On Off` is pressed so that `On` is underlined, all limit-line data are relative.

Key Path Press `Misc`, `MORE 1 of 3`, `limit lines`, `LIMITS 1 of 3`, `LIMITS 2 of 3`, `RELATIV On Off`.

Related Programming Command LIMIREL

REPLACE or . . .

Softkey that displays the `SELECT CHAR` softkey for replacing characters.

When entering titles or commands, you select characters to place at the cursor. Use the step keys to position the cursor. However, make sure that the cursor does not position outside the single quote characters.

When pressed, the `REPLACE or...` softkey toggles between `INSERT or...`, `SELECT or...`, and `REPLACE or...` and defines what action occurs with characters at the cursor.

Key Path Press `Misc`, `TITLE`, `REPLACE or...`.

Press `Misc`, `MORE 1 of 3`, `COMMAND`, `REPLACE or...`.

See Also *COMMAND* and *TITLE* in this chapter.

(RES BW)

Manually sets the resolution bandwidth filtering.

Resolution bandwidth determines the ability to resolve displayed signals. This key's operation is identical to the `RES BW AutoMan` softkey except that the `BW,Swp` menu is not invoked.

See Also *RES BW AutoMan* in this chapter.

RES BW AutoMan

Softkey that manually sets the resolution bandwidth filtering.

Resolution bandwidth determines the ability to resolve displayed signals. Resolution bandwidth filtering occurs before detection of the light. Enter resolution bandwidths from 0.1 nm to 10 nm using the front-panel knob, step keys, or numeric keypad. Using the numeric keypad, you can reduce the resolution bandwidth to 0.08 nm. However, this setting is uncalibrated.

When the softkey is pressed so that `Auto` is underlined, the optical spectrum analyzer automatically selects the resolution bandwidth based on the span setting. The ratio used to determine the resolution bandwidth used for the current span can be changed using the `RB/SPAN RATIO` softkey.

Key Path Press `BW,Swp`, `RES BW AutoMan`.

Press (USER), `PDL`, `RES BW AutoMan`. *HP 70952B Option 003 only.*

Related Programming Command RB, RBR

See Also *RB/SPAN RATIO* in this chapter.

RESTART

Softkey that performs an automatic MMS configuration routine.

The first time the the optical spectrum analyzer is turned on, it establishes and checks the communications links with the display. Thereafter, these configuration steps are skipped at turn on, unless the MMS configuration has changed. When `RESTART` is pressed, an instrument preset occurs, and the configuration steps are performed.

Key Path Press `Misc`, `MORE 1 of 3`, `service`, `erase/ restart`, `RESTART`.

See Also *STARTUP AutoMan* in this chapter.

Related Programming Command STARTUP

RIGHT PEAK

Softkey that moves a marker right on the display to the next signal peak.

To locate a peak, the peak's amplitude must be at least 3 dB above the noise floor. This default 3 dB peak-excursion value can be changed using the `PEAK EXCURSN` softkey.

Key Path Press `Marker`, `MORE 1 of 4`, `RIGHT PEAK`.

Press `State`, `instr modes`, `PRESEL`, `RIGHT PEAK`.

See Also *PEAK EXCURSN* in this chapter.

Related Programming Command MKPK NR

RIGHT PIT

Softkey that moves a marker right on the display to the next signal pit.

Pit identification (minimum amplitude excursion) is defined by the `PIT EXCURSN` softkey. To locate a pit using the default pit excursion value, the signal must fall and then rise by 3 dB.

Key Path Press `Marker`, `MORE 1 of 4`, `MORE 2 of 4`, `MORE 3 of 4`, `pit,min markers`, `RIGHT PIT`.

See Also *PIT EXCURSN* in this chapter.

Related Programming Command MKPK NRPIT

RMT

Front-panel indicator light.

This remote (RMT) indicator lights when the optical spectrum analyzer is controlled by a computer over the Hewlett-Packard Interface Bus. In addition, depending on the instructions received from the computer, the LSN, TLK, or SRQ indicators will also light.

ROM VERSION

Softkey that displays the date code of the read-only memory (ROM).

Read-only memory determines the optical spectrum analyzer's measurement capabilities and MMS compatibility. You may need to know this number when communicating with Hewlett Packard.

Key Path Press `Misc`, `MORE 1 of 3`, `service`, `ROM VERSION`.

Related Programming Command REV

save

Softkey that accesses a menu for saving traces, instrument states, limit lines, and user menu files to memory.

To save a file, press the softkey for the desired file type, and then enter the file number. Do not enter a number of a file that already exists. If you do, the file's data will be overwritten. If you need to determine a file number, press `save to` to view a catalog of user-memory. `save to` opens the `Misc` menu's catalog softkeys. You can also select user memory from this menu. Each file in the catalog has an identifying prefix, which distinguishes one type of file (and its contents) from the other file types.

File Prefixes

Prefix	File Type
d_	down-loadable program
l_	limit-line
s_	instrument state
t_	trace
u_	user menu

Key Path

Press State , save .

Press Traces , MORE 1 of 4 , MORE 2 of 4 , save .

SAVE LIMIT

Softkey that stores the contents of the limit-line table in a limit-line file.

Files are stored in default memory. Internal memory is selected as default memory when the optical spectrum analyzer is first turned on. To save a file, press the key for the desired file type, and then enter the file number. Do not enter a file number that already exists with a l_ prefix. If you do, the file's data will be overwritten. The l_ prefix identifies limit-line files. If you need to determine a file number, press save to to view a catalog of user-memory.

save to opens the Misc menu's catalog softkeys. You can also select user memory from this menu. Each file in the catalog has an identifying prefix, which distinguishes one type of file (and its contents) from the other file types.

File Prefixes

Prefix	File Type
d_	down-loadable program
l_	limit-line
s_	instrument state
t_	trace
u_	user menu

Key Path

Press Misc , MORE 1 of 3 , limit lines , SAVE LIMIT .

Press State , save , SAVE LIMIT .

Related Programming Command LIMISAV, STOR

SAVE MEMORY

Softkey that stores all non-ASCII, internal-memory, files to external memory.

This function saves non-ASCII, internal-memory files to a card or disc. Non-ASCII, internal-memory files are data associated with down-loadable programs. These include all user-defined traces, variables, functions, on-end-of-sweep algorithms, and amplitude-correction factors. The default memory must not be set to internal.

Saving the data involves entering a file number. Do not enter a file number that already exists with a `d_` prefix. If you do, the file's data will be overwritten. The `d_` prefix identifies down-loadable program files. If you need to determine a file number, press `save to` to view a catalog of user-memory. `save to` opens the `Misc` menu's catalog softkeys. You can also select user memory from this menu.

Key Path Press `State`, `save`, `SAVE MEMORY`.

Related Programming Command SAVED, STOR

SAVE STATE

Softkey that saves the current instrument state in a file. Files are stored in default memory. Internal memory is selected as default memory when the optical spectrum analyzer is first turned on. To save a instrument state file, press `SAVE STATE`, enter a number using the numeric keypad, then press `ENTER`.

Saving instrument states involves entering a file number. Do not enter a file number that already exists with a `s_` prefix. If you do, the file's data will be overwritten. The `s_` prefix identifies instrument state files. If you need to determine a file number, press `save to` to view a catalog of user-memory. `save to` opens the `Misc` menu's catalog softkeys. You can also select user memory from this menu.

Key Path Press `State`, `save`, `SAVE STATE`.

Related Programming Command SAVES, STOR

save to . . .

Softkey that presents a menu for cataloging or changing default memory.

Default memory can be selected to be internal memory, a memory card, or an external HP-IB disk drive.

Key Path Press `State`, `save`, `save to...`.

See Also *catalog & MSI* and *recall* in this chapter.

Related Programming Command STORE

SAVE TRACE A

Softkey that stores trace A in a file.

If desired, use single-sweep mode to capture one complete sweep of trace data before storing the file. Files are stored in default memory. (Internal memory is selected as default memory when the optical spectrum analyzer is first turned on.) Saving Trace A involves entering a file number. The `t_` file-name prefix identifies trace files. Do not enter a file number that already exists with a `t_` prefix. If you do, the previous file's data will be overwritten.

If you need to determine a file number, press `save to` to view a catalog of user-memory. `save to` opens the `Misc` menu's catalog softkeys. You can also select user memory from this menu.

Key Path Press `State`, `save`, `SAVE TRACE A`.

Related Programming Command SAVET, STOR

SAVE USER

Softkey that stores the current menu of user softkeys in a file.

Files are stored in default memory. Internal memory is selected as default memory when the optical spectrum analyzer is first turned on. Saving user menus involves entering a file number. The `u_` file-name prefix identifies user-menu files. Do not enter a file number that already exists with a `u_` prefix. If you do, the file's data will be overwritten. If you need to determine a file number, press `save to` to view a catalog of user-memory. `save to` opens the `Misc` menu's catalog softkeys. You can also select user memory from this menu.

The operation of `SAVE USER` and `SAVE USERKEY`, accessed under `State`, are identical.

Key Path Press `Misc`, `MORE 1 of 3`, `key control`, `SAVE USER`.

See Also *EDIT FUNCDEF* in this chapter.

SAVE USERKEY

Softkey that stores the current menu of user-defined softkeys in a file.

The operation of SAVE USERKEY and SAVE USER, accessed under the Misc softkey, are identical.

Key Path

Press State, save, SAVE USERKEY.

See Also

SAVE USER in this chapter.

Related Programming Command

SAVEU, STOR

SELECT CHAR

Softkey that places selected characters at the displayed cursor. Use the front-panel knob to select characters from the character list which appears on the display when the Misc menu's TITLE or COMMAND softkeys. Use the ▲ and ▼ step keys to move the cursor along the displayed text. If characters are entered outside the displayed quotes, delete them or press TITLE to begin again.

The SELECT CHAR softkey is displayed when DELETE or... or REPLACE or... is selected. (The title menu's third softkey toggles between INSERT or..., REPLACE or..., and DELETE or....)

Key Path

Press Misc, TITLE, SELECT CHAR.

Press Misc, MORE 1 of 3, COMMAND, SELECT CHAR.

See Also *COMMAND* and *TITLE* in this chapter.

SELECT SEGMENT

Softkey that moves the limit-line editing field to the next limit-line segment.

Key Path Press `Misc`, `MORE 1 of 3`, `limit lines`, `LIMITS 1 of 3`, `TYPE`, `SELECT SEGMENT`.

See Also *limit lines* in this chapter.

(SENS)

Sets the sensitivity.

The (SENS) key is located on the custom keypad. With the exception of being able to place sensitivity in the automatic coupled mode, the function of the (SENS) and `SENS AutoMan` keys are identical.

See Also *SENS AutoMan* in this chapter.

SENS AutoMan

Softkey that sets the sensitivity.

The sensitivity setting indicates the smallest signal amplitude guaranteed to be displayed across the current displayed wavelength range. Due to instrument tolerances, the sensitivity's annotation is a nominal value. Because sweep time is coupled to sensitivity, increasing sensitivity slows the sweep speed.

Normally, the optical spectrum analyzer automatically selects the greatest sensitivity possible that does not require any autoranging during the sweep. If you manually increase the sensitivity level, autoranging turns on. If desired, autoranging can be disabled. Manual mode is indicated by an asterisk next to the `SENS` screen annotation.

Notice that the sensitivity indicated for the full span (600 nm to 1700 nm) is around −5 dBm. This indicates the worst case condition at 600 nm which is due to signal loss in the monochromator. Sensitivity at other displayed wavelengths in full span is far greater. The monochromator loss in full span, results from the monochromator operating in its first grating order. If the stop wavelength is set to less than 900 nanometers, the monochromator operates in the second grating order which dramatically improves the sensitivity.

Key Path Press `Amptd`, `SENS AutoMan`.

See Also *AUTORNG On Off* and *VID BW AutoMan* in this chapter.

Related Programming Command SENS

service

Softkey that presents a menu for obtaining knowledge about system parameters, module level parameters, and module HP-MSIB addresses.

The data displayed by pressing ROM VERSION and ANALYZER TEST is valuable to service personnel and is not needed during normal operation. Interpreting some of the displayed parameters requires knowledge of the measurement techniques employed by the optical spectrum analyzer.

In addition to reading system parameters, you can erase all user memory with the ERASE ALL softkey.

CAUTION The ERASE ALL softkey erases all user memory. Any memory protection provided by other system softkey functions is disabled when this function is used.

Key Path Press Misc, MORE 1 of 3, service.

See Also *show states* in this chapter.

SERVICE REQUEST

Softkey that enables the service request mode.

The softkey function is sometimes used during remote control of the optical spectrum analyzer. Pressing the softkey sets the message bit in the status-byte register true. An unconditional controller interrupt is sent on the HP-IB.

Key Path Press Misc, MORE 1 of 3, MORE 2 of 3, SERVICE REQUEST.

show states

Softkey that displays a menu for obtaining current instrument-state information.

Three menu softkeys give you the ability to view the following information on any module in the MMS system:

- Measurement and hardware settings
- HP-MSIB addresses
- Any module options

Key Path Press `State`, `MORE 1 of 4`, `MORE 2 of 4`, `show states`.

See Also *service*, *CONFIG*, *EXTEND STATE*, and *STATE* in this chapter.

SIG TRK LIMIT

Softkey that sets the amplitude variation tolerated by the signal-tracking functions.

The optical spectrum analyzer can track drifting signals. (Refer to *SIG TRK On Off* in this chapter.) During signal tracking, the spectrum analyzer continuously reevaluates the marker amplitude to see if the marker is still marking the same signal. Otherwise, the marker may move to an adjacent signal during the tracking process. The tracking-limit softkey controls the amplitude variation tolerated by the signal-tracking functions. The tracking limit can vary from 0 to 300 dB. The preset tracking limit is 5 dB.

Key Path Press `Marker`, `MORE 1 of 4`, `MORE 2 of 4`, `MORE 3 of 4`, `SIG TRK LIMIT`.

Related Programming Command MKTV

SIG TRK On Off

Softkey that keeps a marked signal at the center of the display.

Use signal tracking while changing spans or monitoring drifting signals. When tracking a signal that is close to another signal of similar amplitude, the signal tracking limit may need to be changed using the `SIG TRK LIMIT` softkey. `SIG TRK LIMIT` sets the amplitude variation tolerated by `SIG TRK On Off`.

Key Path Press `Marker`, `MORE 1 of 4`, `SIG TRK On Off`.

Press `Marker`, `MORE 1 of 4`, `MORE 2 of 4`, `MORE 3 of 4`, `SIG TRK On Off`.

See Also *SIG TRK LIMIT* in this chapter.

Related Programming Command MKTRACK

SINGLE SWEEP

Softkey that initiates one sweep of the measurement range.

Use this function to sweep the input measurement range once and then display the data. Press `SINGLE SWEEP` to repeat another sweep or press `CONT SWEEP` to begin continuous sweeping. When an advanced-measurement program is running, a single sweep updates the displayed measurement data. Single sweep can be used to reduce mechanical wear of the optical spectrum analyzer's internal monochromator. Trigger conditions must be met in order for a single sweep to occur.

Key Path

Press `BW,Swp`, `SINGLE SWEEP`.

Press (USER), `DFB`, `SINGLE SWEEP`.

Press (USER), `FP`, `SINGLE SWEEP`.

Press (USER), `LED`, `SINGLE SWEEP`.

Related Programming Command

SNGLS

SLOPE

Softkey that determines limit-line interpolation.

Selecting SLOPE draws a sloped line between the beginning points of two segments. Limit-line values for all wavelengths between the two points are interpolated.

Key Path

Press `Misc`, `MORE 1 of 3`, `limit lines`, `LIMITS 1 of 3`, `TYPE`, `SLOPE`.

See Also

TYPE in this chapter.

SMSR On Off

Softkey that displays a trace showing the DFB laser's side mode used to calculate SMSR.

SMSR (Side Mode Suppression Ratio) is the amplitude difference between the main spectral component of the DFB laser and the largest side mode. When this softkey is `On`, vertical lines show the main spectral component and the largest side mode used to calculate the SMSR.

Key Path Press (USER), `DFB`, `SMSR On Off`.

See Also *DFB* in this chapter.

SOURCE On Off

Softkey that turns on or off the internal white light source.

> **NOTE**
>
> Only for use with HP 70951B Option 003, Swept Polarization Dependent Loss (PDL) Kit.

Key Path Press (USER), `PDL`, `SOURCE On Off`.

Related Programming Command PDLSRC, PDL_SRC?

SPACE

Softkey that enters a space character.

When entering titles or commands, use the `SPACE` softkey to enter a space character.

Key Path Press `Misc`, `TITLE`, `SPACE`.

See Also *TITLE* and *COMMAND* in this chapter.

Δ->SPAN

Softkey that sets the measurement span equal to the wavelength separation of delta markers. Delta markers must be displayed before using this function. The start wavelength is set equal to the marker having the shortest wavelength. The stop wavelength is set equal to the marker having the longest wavelength.

Key Path Press `Marker`, `MORE 1 of 4`, `MORE 2 of 4`, `Δ->SP`.

Related Programming Command MKSP

(SPAN)

Sets the wavelength span.

Use the (SPAN) and (CENTER) keys to define the wavelength measurement range. The span is set symmetrically about the center wavelength. If you set the wavelength span to 100 μm, the optical spectrum analyzer's wavelength-per-division is $\frac{10\ \mu m}{div}$ $(\frac{100\ \mu m}{10\ div})$.

The wavelength measurement range can also be set using the (START) and (STOP) keys. The (SPAN) key is equivalent to using the `Waveln` menu's `SPAN` softkey.

See Also *SPAN* in this chapter.

SPAN

Softkey that sets the wavelength span.

Use the `SPAN` and `CENTER` keys to define the wavelength measurement range. The span is set symmetrically about the center wavelength. If you set the wavelength span to 100 μm, the optical spectrum analyzer automatically adjusts the wavelength-per-division to $\frac{10\ \mu m}{div}$ $(\frac{100\ \mu m}{10\ div})$. The resolution of the wavelength readout decreases with an increase in the span setting.

When the span is set to 0 nm, the display's horizontal axis represents time instead of wavelength. A span of 0 nm (called zero span mode) configures the optical spectrum analyzer as a fixed tuned receiver.

When reducing the span, use the step keys to reduce the value by small increments. If the wavelength span is changed by large increments, the position of displayed signals can change appreciably, or even move off of the display. When changing the wavelength span by larger increments, use the signal-tracking function to keep the desired signal at the center of the display.

The wavelength measurement range of the horizontal axis can also be set using the START and STOP keys. The SPAN key is equivalent to using the custom keypad's (SPAN) softkey.

Key Path

Press Waveln , SPAN .

Press (USER), DFB , SPAN .

Press (USER), FP , SPAN .

Press (USER), LED , SPAN .

See Also

SIG TRK On Off in this chapter.

Related Programming Command

SP

SPAN AutoMan

Softkey that changes the wavelength span set by the automatic measurement routine.

The automatic measurement routine (press (AUTO MEASURE) or the Waveln menu's AUTO MEASURE softkey) automatically sets the span so that all significant power in the signal is displayed. Using this function, you can manually set the span used. The automatic measurement routine uses your span instead of calculating an optimum span.

Key Path

Press State , autmeas state , SPAN AutoMan .

See Also

AUTO MEASURE and *autmeas state* in this chapter.

Related Programming Command AUTOMSP

SRQ

Front-panel indicator light. This service request (SRQ) indicator lights when the optical spectrum analyzer has requested service from a computer over the Hewlett-Packard Interface Bus.

(START)

Sets the start wavelength.

Use the (START) and (STOP) keys to define the wavelength measurement range of the horizontal axis. Sweeps begin at the shortest wavelength (start) and end at the longest wavelength (stop). The measurement range of the horizontal axis can also be set using the (CENTER) and (SPAN) keys. The (START) key is equivalent to using the Waveln menu's START softkey.

START

Softkey that sets the start wavelength.

Use the START and STOP keys to define the wavelength measurement range of the horizontal axis. Sweeps begin at the shortest wavelength (start) and end at the longest wavelength (stop). The measurement range of the horizontal axis can also be set using the CENTER and SPAN keys. The START key is equivalent to using the custom keypad's START softkey.

Key Path Press `Waveln`, `START`.

Related Programming Command STARTWL

STARTUP AutoMan

Softkey that controls the automatic modular measurement system configuration that occurs when the optical spectrum analyzer is turned on.

In the default AUTOmatic mode, the first time the the system is turned on the optical spectrum analyzer establishes and checks the communications links with the display. Thereafter, these configuration steps are skipped at turn on, unless the MMS configuration has changed.

When MANual is selected, each time the optical spectrum analyzer is turned on, the MMS configuration is performed. To perform a one-time running of the MMS configuration, refer to `RESTART` in this chapter.

Key Path Press `State`, `MORE 1 of 4`, `MORE 2 of 4`, `MORE 3 of 4`, `STARTUP AutoMan`.

See Also *RESTART* in this chapter.

Related Programming Command STARTUP

State

Softkey that presents a menu for instrument configuration and the saving and recalling of files.

The State menu provides configuration selections for many optical spectrum analyzer features including the following:

- Automatic measurement control (AUTO MEAS)
- Current source control (Option 001 instruments)
- Setting the power-on state
- Selects the 1st diffraction grating wavelength mode
- Viewing instrument configuration

The State menu also allows you to select from several instrument operating modes with the `instr modes` softkey.

STATE

Softkey that lists the state of current measurement settings under operator control.

The displayed list includes wavelength ranges, bandwidth settings, offsets, serial number, and the firmware version date.

Key Path

Press `State`, `MORE 1 of 4`, `MORE 2 of 4`, `show states`, `STATE`.

Related Programming Command

DSPMODE STATE

STEP

Softkey that executes downloadable program (DLP) commands one at a time.

Use this function when debugging DLP programs to observe the execution of each programming command. This enables you to test algorithms and observe measurement techniques or errors in logic. Press `CONT` to resume normal execution of the program.

Key Path Press `Misc`, `MORE 1 of 3`, `MORE 2 of 3`, `debug`, `STEP`.

STM/RESP

Softkey that selects instrument operation for performing stimulus-response measurements.

Stimulus response is one of the available operating modes. To perform stimulus-response measurements, you must have a light source. Although a white-light source provides the widest wavelength input for stimulus-response measurements, you can also use an LED or erbium amplifier as a noise source over a limited spectral range.

During stimulus-response measurements, a device's response to light is measured. Before testing, the system is calibrated (normalized) to remove any system errors.

Key Path Press `State`, `instr modes`, `STM/RESP`.

See Also *instr modes* in this chapter.

Related Programming Command MEASURE

STOP

Sets the stop wavelength.

Use the STOP and START keys to define the wavelength measurement range. Sweeps begin at the shortest wavelength (start) and end at the longest wavelength (stop). The wavelength measurement range can also be set using the CENTER and SPAN keys. The STOP key is equivalent to using the `Waveln` menu's `STOP` softkey.

See Also *STOP* in this chapter.

Related Programming Command STOPWL

STOP

Softkey that sets the stop wavelength.

Use the STOP and START keys to define the wavelength measurement range. Sweeps begin at the shortest wavelength (start) and end at the longest wavelength (stop). The wavelength measurement range can also be set using the CENTER and SPAN keys. The STOP key is equivalent to using the custom keypad's (STOP) softkey.

Key Path Press Waveln, STOP.

Related Programming Command STOPWL

STORE A

Softkey that stores the trace in temporary memory.

The stored trace data can be used for trace comparisons and in trace math. However, when power is removed from the optical spectrum analyzer, the data is lost. To store a trace in permanent memory, press save in the Traces menu.

The STORE A softkey stops trace updating, stores the trace in temporary memory, and then displays the VIEW A/BLANK A softkey. Viewing the trace displays the stored data on the screen. Blanking the trace removes the trace from the screen but does not erase the stored trace data. Trace B and Trace C have a corresponding store softkey function. To start trace updating, and redisplay the `STORE A` softkey, press `CLEAR WRT A`. The stored trace data is lost.

The `trace A B C` selects the active trace for the trace-processing functions.

Key Path Press `Traces`, `STORE A`.

STORE THRU->B

Softkey that stores the calibration response into trace B.

During the stimulus-response and photo-diode instrument modes, the calibration (through) response must be saved for trace normalization. Normalization compensates for the wavelength response of the measurement system. The resulting measurement shows amplitude deviation that is caused by the device being tested and not by the optical spectrum analyzer, fiber-optic cables, or any other devices.

Key Path Press `State`, `instr modes`, `STM/RESP`, `STORE THRU->B`.

Press `State`, `instr modes`, `PHOTO DIODE`, `STORE THRU->B`.

Related Programming Command STORREF

STP BND On Off

Softkey that displays a trace showing the DFB laser's stop bandwidth.

The DFB advanced-measurement program measures the laser's stop bandwidth. This is the wavelength spacing between the upper and lower side modes that are adjacent to the main mode. When this softkey is `On`, vertical lines indicate the peak, left side mode, and right side mode used to calculate the stop band.

Key Path Press (USER), `DFB`, `STP BND On Off`.

See Also *DFB* in this chapter.

SWEEP On Off

Softkey that turns the sweep on and off.

Turning the sweep off prevents the updating of the displayed trace data. Sweeps are immediately stopped, and the rear-panel `HSWP` signal is disabled.

Key Path Press `BW,Swp`, `MORE 1 of 3`, `MORE 2 of 3`, `SWEEP On Off`.

See Also *HSWP* in this chapter.

Related Programming Command SWEEP

SWPTIME

Softkey that configures marker readouts in sweep time.

When the `Auto` is selected, the optical spectrum analyzer automatically selects the proper marker readout based on the current instrument settings. Pressing the `SWPTIME` softkey sets marker readouts in sweep time. The left side of the graticule corresponds to 0 seconds. The right side corresponds to the total sweep time.

Key Path Press `Marker`, `MORE 1 of 4`, `MORE 2 of 4`, `marker readout`, `SWPTIME`.

SWPTIME AutoMan

Softkey that sets the sweep time.

The sweep time is the amount of time required for the optical spectrum analyzer to sweep the current measurement range. Depending on the instrument settings, the sweep time can be from 110 μs to 1000 seconds. During normal operation, the optical spectrum analyzer automatically sets the sweep time according to the sensitivity, resolution-bandwidth, video-bandwidth, and span settings and trace length. This is known as coupling, and it yields optimum amplitude accuracy.

If you enter a sweep time with `SWPTIME AutoMan` softkey, sweep time is uncoupled. The uncalibrated warning, `UNCAL`, appears on the display whenever the sweep time selected adversely affects accuracy. To reestablish coupling and accuracy, press `SWPTIME AutoMan` so that `Auto` is underlined. Coupling is also reactivated when (INSTR PRESET) is pressed.

Key Path Press `BW,Swp`, `SWPTIME AutoMan`.

Related Programming Command ST

sync out

Softkey that presents a menu for controlling an external pulsed current source.

NOTE

This softkey is not displayed on Option 001 optical spectrum analyzers.

This menu controls a TTL signal available at the rear-panel ADC SYNC OUT connector. (The connector has a 50 Ω output impedance.) You can adjust the signal's pulse width and duty cycle. Pulse width determines the time that the light source is turned on. Duty cycle determines the ratio of "on" and "off" time and is entered as a percentage:

$$duty\ cycle = \left(\frac{pulse\ width}{pulse\ period}\right)(100)$$

For the ADC SYNC OUT output to be active, the optical spectrum analyzer's wavelength span must be greater than 0 nm. (When the span is set to 0 nm and the duty cycle is less than 100%, this output is disabled.)

The pulse period may increase slightly during measurements to allow the optical spectrum analyzer to perform various internal tasks. Consider the following when selecting pulse width and duty cycle values:

- Duty cycle affects the average power dissipated by the light source.
- Pulse width affects the power produced by the light source during its "on" time.
- Optical spectrum analyzer measurements are performed near the trailing edge of the pulse.

Pulse widths can range from 1 μs to 6.5 ms. However, not all combinations of pulse widths and duty cycles are available. The optical spectrum analyzer limits and adjusts these parameters as needed to maintain the following conditions:

- Pulse must be off for at least 200 μs.
- Sweep time cannot be longer in seconds than the number of trace measurement points.

For pulsed measurements, sweep times cannot be longer than 1 second per trace point. This is 800 seconds for the default value 800 trace points. The following equation shows how sweep time is approximately related to trace length, pulse width, and duty cycle:

$$sweep\ time \simeq (trace\ length)\left[\frac{(pulse\ width)(100)}{duty\ cycle}\right]$$

`UNCAL` indicates narrow pulses

Although the pulse widths can be set as narrow as 1 μs, pulse widths narrower than 20 μs occur too fast for the optical spectrum analyzer's digital processing to accurately display. The displayed response may not faithfully represent the input light. To indicate this condition, the message `UNCAL` is displayed.

The video-bandwidth setting limits the minimum pulse width that can be used while still maintaining an amplitude calibrated display. (Video bandwidth is dependent on the sensitivity setting.) The minimum pulse widths available are shown in the following table.

Video Bandwidth	Minimum Pulse Width
2 MHz	20 μs
800 kHz	20 μs
80 kHz	20 μs
9 kHz	71 μs
800 Hz	800 μs

Key Path

Press `State`, `sync out`.

See Also *DUTY CYCLE*, *PULSE WIDTH*, and *current source* in this chapter.

TAKE SWEEP

Softkey that updates the displayed trace in preselector mode.

N O T E

This softkey is only displayed when using an HP 70951B optical spectrum analyzer module.

During the preselector instrument mode, the optical spectrum analyzer acts as a tunable filter (preselector) for the input light. Although the sweep is stopped and the optical spectrum analyzer is placed in zero span, the last sweep of the input range remains displayed. This shows the center wavelength of the preselection. The `TAKE SWEEP` softkey allows you to update the displayed trace with a new sweep. During the sweep, the instrument operates as an optical spectrum analyzer.

Key Path Press `State`, `instr modes`, `PRESEL`, `TAKE SWEEP`.

THRESHD On Off

Softkey that blanks traces below an amplitude threshold level.

This function is a visual aid. It blanks all displayed trace information below an amplitude threshold level. Stored trace data is not effected. Manually specify the desired threshold level in dBm by using the numeric keypad, the step keys, or knob. Threshold values remain unchanged until a new value is entered or an instrument preset is performed.

To display the entire range, press `THRESHD On Off` so that `Off` is underlined.

Key Path Press `Misc`, `THRESHD On Off`.

Related Programming Command TH

TITLE

Softkey that displays a menu used for writing messages on the display.

- Turn the front-panel knob to move the character-select cursor.
- Press the ▼ and ▲ keys (beneath the front-panel knob) to move the command-entry cursor.
- Press `SELECT CHAR` to enter a character at the character-select cursor.
- Press the numeric keypad to enter numbers or a minus sign.
- Press `SPACE` to add a space character.
- The `INSERT or . . .` softkey determines the action of the `SELECT CHAR` softkey. Choices are INSERT a character, REPLACE an existing character, or DELETE a character.

- Use the CLEAR TO END softkey to remove characters from the command-entry cursor to the end of the command.

Key Path Press Misc, TITLE.

Related Programming Command TITLE

TLK

Front-panel indicator light.

This remote (TLK) indicator lights when the optical spectrum analyzer is sending data or instructions over HP-IB.

TO CENTER

Moves the wavelength at the marker to center screen.

This custom keypad key sets the center wavelength equal to the marker wavelength. Use this key to move a marked signal to the center of the display. Pressing this key is identical to pressing the Marker menu's -> CWL softkey.

TO REF LEVEL

Moves the amplitude at the marker to the reference level.

This custom keypad key sets the reference level equal to the amplitude value of the marker. Use this key to move a marked signal to the top of the display. Pressing this key is identical to pressing the `Marker` menu's `-> REF` softkey.

trace A B C

Softkey that selects the active trace for writing, processing, or storing.

Three traces are available: A, B, and C. Trace menu softkeys operate on the active trace. When the optical spectrum analyzer is first turned on, Trace A is in clear-write mode, and traces B and C are blanked.

Key Path Press `Traces`, `trace A B C`.

See Also *TRACE PRESET* in this chapter.

TRACE LENGTH

Softkey that changes the number of trace points measured for traces A, B, and C.

The default number of trace measurement points is 800. Trace length can vary from 3 to 2048. The optical spectrum analyzer interpolates values displayed between the measurement points. To turn trace interpolation off, use the `LINES On Off` softkey.

Key Path Press `Traces`, `MORE 1 of 4`, `MORE 2 of 4`, `TRACE LENGTH`.

See Also `LINES On Off` in this chapter.

Related Programming Command TRDEF

trace linmath

Softkey that displays a menu of linear trace-math functions that are for use when the amplitude scale is set to linear units.

While these functions are turned on, they are continuously applied to each sweep. This is in contrast to the functions in the "oneshot math" menu that are applied once per key press.

Key Path Press `Traces`, `MORE 1 of 4`, `trace linmath`.

trace logmath

Softkey that displays a menu of logarithmic trace-math functions that are for use when the amplitude scale is set to logarithmic units.

While these functions are turned on, they are continuously applied to each sweep. This is in contrast to the functions in the "oneshot math" menu that are applied once per key press.

Key Path Press `Traces`, `MORE 1 of 4`, `trace logmath`.

TRACE PRESET

Softkey that resets trace functions to their default state.

The optical spectrum analyzer is configured as follows:

- All traces lengths are set to 800.
- Trace A is in clear-write mode.
- Traces B and C are blanked.
- Trace math is turned off.

Key Path Press `Traces`, `MORE 1 of 4`, `MORE 2 of 4`, `TRACE PRESET`.

Related Programming Command TRPST

Traces

Softkey that presents a menu for controlling traces.

The optical spectrum analyzer has three traces: A, B, and C. The `Traces` menu allows you to manipulate traces. Some of the functions available are as follows:

- Viewing and blanking traces.
- Storing and recalling Trace A.
- Using video averaging.
- Setting display lines and thresholds.
- Using trace math for normalization.

- Changing trace length and persistence.

Trace functions can be set to their default state by pressing (INSTR PRESET) or the `Traces` menu's `TRACE PRESET` softkey.

TRANS-Z IN

A rear-panel input connector.

The `TRANS-Z IN` connector is used in the photodetector instrument mode. Photodetector instrument mode measures a photodetector's responsivity versus wavelength. This mode is only available on HP 71451B optical spectrum analyzers (HP 70951B modules). The photodetector's output is connected, though `TRANS-Z IN`, directly to the optical spectrum analyzer's internal transimpedance amplifier. The transimpedance amplifier converts current to a power level that is displayed on screen. The actual display shows the photodetector's output normalizing with the calibrated internal photodiode.

The `TRANS-Z IN` connector is a standard SMB coaxial male jack with its outer conductor connected directly to the rear panel (earth ground).

See Also *PHOTO DIODE* in this chapter.

TRIGGER FREE

Softkey that selects free run triggering.

Sweeps must be triggered in order to begin. With free run triggering, the sweep is triggered using an internally generated trigger signal. Free run triggering ensures continuously triggered sweeps.

Three other trigger methods are available: line, external, and video. Line triggering uses the ac power-line voltage to trigger the sweep. External triggering uses a TTL compatible signal that you provide at the module's rear-panel **EXT TRIG IN** connector. Video triggering triggers zero-span sweeps using the detected video signal.

Key Path Press `BW,Swp`, `MORE 1 of 3`, `TRIGGER FREE`.

Related Programming Command TM FREE

TRNSZLK On Off

Softkey that locks the optical spectrum analyzer's internal transimpedance amplifier.

Locking the transimpedance amplifier limits its range to ensure wide bandwidth and fast settling characteristics. This allows the optical spectrum analyzer to make accurate fast pulse measurements. Placing the optical spectrum analyzer into the `OSA PULSE` intrument mode automatically locks the transimpedance amplifier.

Normally, the `TRNSZLOCK On Off` is set to `Off`, and the full transimpedance range of 1 kΩ to 1 MΩ is available. However, when locking is selected, the amplifier is limited to the 1 kΩ and 10 kΩ values.

Key Path Press `Amptd`, `MORE 1 of 4`, `TRNSZLK On Off`.

See Also *OSA PULSE* in this chapter.

Related Programming Command TRNSZLOCK

type

Softkey that selects the type of lines used for limit lines.

Limit-line segments can be horizontal (flat), a sloped, or a point identified by the wavelength entered for the segment.

Selecting FLAT draws a zero-slope line between the beginning points of two segments. This produces limit-line values that are equal in amplitude to the next point.

Selecting SLOPE draws a sloped line between the beginning points of two segments, producing limit-line values for all wavelengths between the two points.

Selecting POINT specifies a limit value for only the beginning point of the segment.

Key Path

Press `Misc`, `MORE 1 of 3`, `limit lines`, `LIMITS 1 of 3`, `TYPE`.

See Also

FREQ VALUE and *AMPTD VALUE* in this chapter.

Related Programming Command

LIMITYPE

units menu

Softkey that selects the amplitude scale's units.

Amplitude units can be either dBm or Watts. Amplitude units are displayed in annotation for the reference level, marker, display line, and threshold. When `Auto` is underlined in the menu's `A UNITS AutoMan` softkey label, the optical spectrum analyzer automatically selects the factory preset amplitude units.

Key Path Press `Amptd`, `units menu`.

UPPER-> AMPCOR

Softkey that stores an upper limit line as amplitude-correction values for a specific wavelength range.

Pressing the softkey replaces any corrections that were previously entered and activates the new amplitude corrections. The amplitude corrections must first be entered into the upper limit-line table, using the limit-line softkey functions.

To design amplitude corrections and enter them into the limit-line table, first divide the wavelength range into segments. Starting at the lowest wavelength, enter the correction value for the start of each segment. Enter these correction values into the upper limit-line table using the limit-line softkey functions. After the correction values have been entered in the upper limit-line table, press the `UPPER-> AMPCOR` softkey to store and enable the amplitude-correction values.

An instrument preset turns off the use of amplitude correction values. Use the `AMPCOR On Off` to turn amplitude corrections on again.

> **Storing amplitude corrections**
>
> Limit-line files can be used to store amplitude correction values for future use.

Key Path Press `Misc`, `MORE 1 of 3`, `limit lines`, `lim <-> ampcor`, `UPPER -> AMPCOR`.

See Also *AMPCOR ->UPPER* and *AMPCOR On Off* in this chapter.

Related Programming Command LIMTOCOR

UPPER/LOWER

Softkey that specifies whether the limit-line data is for upper or lower limit-lines.

Both upper and lower limit lines can be displayed at the same time.

Key Path Press `Misc`, `MORE 1 of 3`, `limit lines`, `LIMITS 1 of 3`, `UPPER/LOWER`.

Related Programming Command LIMIHALF

(USER)

Front-panel key that presents the (USER) menu.

The (USER) menu contains advanced measurement programs that are loaded at the factory. These program characterize LEDs, Fabry-Perot lasers, and Distributed Feedback lasers. In addition, you can customize the (USER) menu by:

- Copying to it frequently used (MENU) softkeys.
- Adding softkeys to start down-loadable programs.

See Also

"Creating a User Menu" chapter in the *User's Guide*.

"Creating Downloadable Programs" chapter in the *Programmer's Guide* to learn how to write downloadable programs.

USERCAL PRESET

Softkey that presets the user calibration data.

All user calibration data is erased from memory and the instrument is returned to factory preset conditions. This is true for calibration data obtained from both optical spectrum analyzer and power-meter instrument modes. To temporarily prevent the application of user calibration data, refer to `PWR CAL On Off` and `WL CAL On Off` in this chapter.

Key Path

Press `Wavelen`, `MORE 1 of 2`, `cal menu`, `cal setup`, `USERCAL PRESET`.

Press `Amptd`, `MORE 1 of 4`, `cal menu`, `cal setup`, `USERCAL PRESET`.

Related Programming Command

CAL

VERSION

Softkey that displays an advanced-measurement program's version number.

You may need to know this number when communicating with Hewlett Packard.

Key Path

Press (USER), DFB , VERSION .

Press (USER), FP , VERSION .

Press (USER), LED , VERSION .

See Also

DFB, *FB*, and *LED* in this chapter.

VERT OFFSET

Softkey that sets the vertical offset of 3-dimensional trace displays.

Changing the vertical and horizontal offsets between the traces helps to optimize the 3-dimensional effect. Although offsets as large as 200 can be entered, values of 30 or less are normal for proper display.

Key Path

Press Traces , MORE 1 of 4 , MORE 2 of 4 , MORE 3 of 4 , 3-DIMEN On Off , VERT OFFSET .

See Also

3-DIMEN On Off and *HORZ OFFSET* in this chapter.

Related Programming Command

THREEDV

VID AVG On Off

Softkey that turns on video averaging.

Use VID AVG On Off to view low-level signals without increasing the sweep time. Video averaging reduces the noise-floor level, but does not affect the sweep time, bandwidth, or any other analog characteristic of the optical spectrum analyzer. Increasing the number of sweeps averaged further reduces the displayed noise. Video averaging operates only on trace A.

When activated, averaging turns the averaging counter to 1, and then begins averaging the trace as it sweeps. The active readout indicates the number of sweeps averaged; the default is 100. To change the default, press `VID AVG On Off`, and enter a value for the desired number of sweeps.

Press `ENTER` to terminate the entry. If the measurement range is changed before video-averaging is completed, the video-average counter is reset to 1.

Key Path

Press `BW,Swp`, `VID AVG On Off`.

Press `Traces`, `MORE 1 of 4`, `MORE 2 of 4`, `VID AVG On Off`.

Related Programming Command

VAVG

VID BW AutoMan

Softkey that manually sets the video bandwidth filtering.

Video bandwidth filtering occurs after detection of the light. Decreasing the video bandwidth, decreases the displayed noise level. Increasing the video bandwidth, increases the displayed noise level and allows faster sweeps.

When `VID BW AutoMan` is pressed so that `Auto` is underlined, the video bandwidth is coupled to the sensitivity setting. The optical spectrum analyzer automatically adjusts the video bandwidth as required by the sensitivity setting. Digital filtering is used unless a hardware filter is selected. When `Man` is underlined, the video bandwidth is uncoupled, and the video bandwidth can be manually set. Also, digital filters are used. An asterisk appears next to the video bandwidth annotation indicating that the video bandwidth is in the manual mode. Set the softkey to automatic to reestablish coupling.

Enter video bandwidths from 3 kHz to 100 MHz using the front-panel knob, step keys, or numeric keypad. The range of video bandwidth available in `Auto` mode is much greater than can be set manually from the front panel.

Key Path

Press `BW,Swp`, `VID BW AutoMan`.

Press (USER), `PDL`, `VID BW AutoMan`. *HP 70952B Option 003 only.*

See Also

SENS AutoMan in this chapter.

Related Programming Command

VB

VID LIN On Off

Softkey that displays or hides video-trigger lines.

If `VID LIN On Off` is set to `On`, the display shows two horiontal video trigger display lines:

Trigger Level Line	A white line is placed at a level which corresponds to the current video trigger level. On HP 70004A displays, the line is the same color as defined for MARKERS. This is determined by the display's "Adjust Color" menu. On monochrome displays, a dot-dash line is used.
Hysteresis Offset Line	An orange line is offset from the trigger level line so as to indicate the size and polarity of video hysteresis necessary to cause a video trigger. On HP 70004A displays, the line is the same color as defined for ADVISE (UNCAL annotation). On monochrome displays, a sparse dot line is used.

Key Path Press BW Swp , MORE 1 of 3 , MORE 2 of 3 , VID LIN On Off .

Related Programming Command VTDL

VIDEO

Softkey that triggers zero-span sweeps using the input signal.

Sweeps must be triggered in order to begin. Video triggering triggers the sweep using the detected and filtered input signal. This signal is called the video signal. If the wavelength span is not 0 nm, triggering will be TRIGGER FREE even if VIDEO is selected.

A sweep occurs when the video signal satisfies the video triggering conditions which are direction, hysteresis, and level. You can adjust the video triggering level using the VIDEO LEVEL softkey. Hysteresis and direction define when the detected signal increases or decreases (direction) a specified amount (hysteresis) when approaching a specified amplitude (trigger level). For example, if video hysteresis is +5 dB and the trigger level is −90 dBm, the analyzer sweeps when the detected signal level changes from −95 dBm to −90 dBm.

Three other trigger methods are available: free, ext, and line. With free run triggering, the sweep is triggered using an internally generated trigger signal. Free run triggering ensures continuously triggered sweeps. External triggering uses a TTL signal that you provide at the module's rear-panel EXT TRIG IN connector. Line triggering synchronizes the sweeps with the line frequency.

Key Path Press BW,Swp , MORE 1 of 3 , VIDEO .

See Also *HYS LEVEL* and *VIDEO LEVEL* in this chapter.

Related Programming Command TM VID

VIDEO LEVEL

Softkey that specifies the trigger level for the video triggering.

The video-trigger level is preset to −100 dBm and cannot exceed ±300 dBm. The smallest resolution allowed is ±0.01 dB.

Key Path Press BW,Swp , MORE 1 of 3 , VIDEO LEVEL .

See Also *HYS LEVEL* and *VIDEO* in this chapter.

Related Programming Command VTL

VIEW A

Softkey that displays trace data that has been temporarily stored.

When pressed, the softkey toggles between VIEW A and BLANK A . This gives you the ability to view or blank stored trace data. Viewed traces are not updated as sweeps occur. The data is stored in a temporary trace memory location. Although blanked traces are removed from the display, the trace data remains in reserved memory. Use the trace A B C softkey to select either trace A, B, or C to view or blank.

VIEW A is displayed after STORE A is pressed and disappears when CLEAR WRT A or INSTR PRESET is pressed.

Key Path Press Traces , VIEW A .

See Also *CLEAR WRT A* and *STORE A*in this chapter.

Related Programming Command VIEW

VIEW B

Softkey that displays trace data that has been temporarily stored.

When pressed, the softkey toggles between VIEW B and BLANK B . This gives you the ability to view or blank stored trace data. Viewed traces are not updated as sweeps occur. The data is stored in a temporary trace memory location. Although blanked traces are removed from the display, the trace data remains in reserved memory. Use the trace A B C softkey to select either trace A, B, or C to view or blank.

VIEW B is displayed after STORE B is pressed and disappears when CLEAR WRT B or INSTR PRESET is pressed.

Key Path Press Traces , VIEW B .

See Also *CLEAR WRT B* and *STORE B*in this chapter.

VIEW C

Softkey that displays trace data that has been temporarily stored.

When pressed, the softkey toggles between VIEW C and BLANK C . This gives you the ability to view or blank stored trace data. Viewed traces are not updated as sweeps occur. The data is stored in a temporary trace memory location. Although blanked traces are removed from the display, the trace data remains in reserved memory. Use the `trace A B C` softkey to select either trace A, B, or C to view or blank.

`VIEW C` is displayed after `STORE C` is pressed and disappears when `CLEAR WRT C` or `INSTR PRESET` is pressed.

Key Path

Press `Traces`, `VIEW C`.

See Also

CLEAR WRT C and *STORE C*in this chapter.

W LIGHT ALIGN

Softkey that runs an automatic alignment routine for the fiber positioner's tracking table (900 nm to 1700 nm).

NOTE

This softkey is only displayed on Option 002 optical spectrum analyzers.

The alignment usually requires 2 to 3 minutes to execute. Be sure to connect the white light source output to the HP 71450B/52B's OPTICAL INPUT (or HP 71451B's MONOCHROMATOR INPUT) before issuing the ALIGN command. The alignment determines tracking corrections at 17 equally spaced wavelengths between 900 nm and 1700 nm. Current correction data is replaced with new data, and the `AUTO ALIGN` data is zeroed. The resulting correction data may be viewed by: pressing `State`, `MORE 1 of 3`, `MORE 2 of 3`, `show states`, and then `EXTEND STATE`.

If an `AUTO ALIGN` is executed after this alignment, all of the alignment correction data will be shifted. Thus, `AUTO ALIGN` may be done after the white light alignment without removing the benefits of the extended alignment.

Key Path

Press `Misc`, `MORE 1 of 3`, `service`, `extnded align`, `W LIGHT ALIGN`.

See Also

ALIGN PRESET, *AUTOPTS ALIGN*, and *MANUAL ALIGN* in this chapter.

Related Programming Command

ALIGN

WARNING On Off

Softkey that displays or hides warning messages.

Warning messages alert the user to situations where the optical spectrum analyzer may be improperly used. Use this softkey to allow or prevent the display of these messages.

Key Path

Press `Misc`, `MORE 1 of 3`, `MORE 2 of 3`, `WARNING On Off`.

Related Programming Command

WARNCTRL and USERWARN

WATT

Softkey that selects linear amplitude units in watts.

When selected, all displayed amplitude scale and marker annotation values read in watts.

Key Path Press `Amptd`, `units menu`, `WATT`.

See Also *units menu* in this chapter.

WAVELEN

Softkey that configures marker readouts in wavelength.

Normally, the optical spectrum analyzer selects the proper marker readout based on the current instrument state. The marker annotation can be selected to indicate one of the following trace values:

- Frequency
- Wavelength
- Period
- Sweeptime
- $\frac{1}{T}$

Key Path Press `Marker`, `MORE 1 of 4`, `MORE 2 of 4`, `marker readout`, `WAVELEN`.

WAVELEN FOR CAL

Softkey that enters the light source's wavelength for a user calibration.

User calibrations calibrate the optical spectrum analyzer at a specific wavelength and power. This softkey is used to enter the wavelength of the calibrated light source. User calibration is not the same as factory calibration. Factory calibration calibrates the optical spectrum analyzer across its entire wavelength range. For more information on calibrating the optical spectrum analyzer, refer to "Calibrating the Optical Spectrum Analyzer" located in

Chapter 1 of the *HP 71450B/1B/2B Optical Spectrum Analyzers User's Guide*
.

Refer to the "Displaying Signals (Part 1)" chapter of the *User's Guide* for complete information on performing user calibrations.

Key Path

Press `Wavelen`, `MORE 1 of 2`, `cal menu`, `cal setup`, `WAVELEN FOR CAL`.

Press `Amptd`, `MORE 1 of 4`, `cal menu`, `cal setup`, `WAVELEN FOR CAL`.

See Also

CAL ALL and *CAL WAVELEN* in this chapter.

Related Programming Command

CALWL

WAVELEN OFFSET

Softkey that offsets the wavelength annotation.

Wavelength offsets only affect the displayed annotation. The actual measurement range or the wavelength response of the displayed trace are not effected. `WLOFFSET` is displayed at the bottom of the screen to indicate that an offset is applied.

Key Path

Press `Waveln`, `MORE 1 of 2`, `WAVELEN OFFSET`.

Related Programming Command

WLOFFSET

WAVELEN VALUE

Softkey that enters a wavelength value into the limit-line table.

The wavelength value determines the beginning of a limit-line segment.

Key Path

Press `Misc`, `MORE 1 of 3`, `limit lines`, `LIMITS 1 of 3`, `WAVELEN VALUE`.

See Also

TYPE and *AMPTD VALUE* in this chapter.

Related Programming Command

LIMIWL

Waveln

Softkey that displays a menu for changing wavelength settings and for performing automatic measurements.

See Also

AUTO MEASURE in this chapter.

WHITE On Off

NOTE

This softkey is only displayed on Option 002 optical spectrum analyzers.

Softkey that turns on or off the internal white light source. The white light source output is available on the front panel.

Key Path

Press `State`, `light source`, `WHITE On Off`.

Related Programming Command

LIGHT

WL CAL On Off

Softkey that turns on and off the use of any user-calibration derived wavelength correction offset.

User calibration results in wavelength and power correction offset. When this softkey is turned on, the wavelength correction offset is applied at all wavelengths.

Key Path

Press `Wavelen`, `MORE 1 of 2`, `cal menu`, `WL CAL On Off`.

Press `Amptd`, `MORE 1 of 4`, `cal menu`, `WL CAL On Off`.

See Also

CAL ALL in this chapter.

Related Programming Command

CALCOR

WL LIM On Off

Softkey that expands the wavelength range. The optical spectrum analyzer displays input wavelengths from 600 nm to 1700 nm. Pressing `WL LIM On Off` so that `Off` is underlined expands the wavelength range. The expanded wavelength range is from 350 nm to 2000 nm. Wavelength and amplitude measurements between 350 nm and 600 nm and between 1700 nm and 2000 nm are not calibrated.

	Wavelength Range
normal	600 nm—1700 nm
expanded	350 nm—2000 nm

Key Path Press `Waveln`, `MORE 1 of 2`, `WL LIM On Off`.

Related Programming Command WLLIMIT

WL STEP AutoMan

Softkey that changes the center wavelength in increments.

When any function is active for changing wavelength, and ▲ or ▼ is pressed, the wavelength is stepped by a predetermined amount. The default step size is 10 percent of the wavelength span. The default step size is selected whenever the `WL STEP AutoMan` softkey is pressed so that `Auto` is underlined. To change the step size, press `WL STEP AutoMan` so that `Man` is underlined, and enter a value. Available step sizes vary with the span setting. To disable the ▲ and ▼ step keys, enter 0 Hz for the step size.

Instrument preset resets the step size to the default setting.

Key Path Press `Waveln`, `MORE 1 of 2`, `WL STEP AutoMan`.

Related Programming Command SS

X

Softkey used for entering values as a multiplier.

For example, instead of entering an amplitude value of 3 `dB`, you could use the `X` softkey to enter a 0.5 multiplier. (Press: `0`, `.`, `5`, `X`.)

ZERO

Softkey that increases amplitude accuracy by compensating for temperature drift.

The optical spectrum analyzer zero's its active transimpedance amplifiers between each sweep. Zeroing compensates for current drift caused by temperature changes. This softkey initiates a more complete compensation than is performed between sweeps. It is identical to compensation that occurs when the optical spectrum analyzer is first turned on.

Key Path Press `Amptd`, `MORE 1 of 4`, `MORE 2 of 4`, `ZERO`.

See Also *AUTZERO On Off* in this chapter.

Related Programming Command ZERO

ZOOM TO RES BW

Softkey that views a signal in a 0 Hz span at the resolution bandwidth you specify.

Using ZOOM TO RES BW makes it easy to display modulation on a signal in the time domain. You must first place a marker on the signal peak of interest before using this function. Then, press ZOOM TO RES BW and enter a resolution bandwidth value. After pressing MHz, kHz, or Hz to terminate the entry, the optical spectrum analyzer reduces the span to 0 Hz at the marked signal, and then adjusts the resolution bandwidth.

Key Path

Press Marker, MORE 1 of 4, MORE 2 of 4, mkr bw/ zoom bw, ZOOM TO RES BW.

Related Programming Command

ZOOMRB

4

Error Messages

Error Messages

This chapter defines all possible error messages displayed on the optical spectrum analyzer's screen. These error messages can be the result of incorrect operating procedures, illegal programming commands, or hardware failures. Normally, the optical spectrum analyzer removes error messages from the screen as soon as the error conditions are corrected. If you have a computer, error messages can also be retrieved via HP-IB by executing the `ERR?` programming command. Refer to the *Programmer's Guide* for information on the ERR? command and programming.

In addition, this chapter lists the default warning messages that appear on the display.

Contents

User Application Errors (0001 – 0999)

The optical spectrum analyzer reports these errors when it cannot decipher a command in a user-application program. User-application programs consists of remote programming messages that are loaded into RAM. Refer to the *Programmer's Guide* for information on programming.

Operating Errors (2000 – 2999)

Operating errors occur when the spectrum analyzer is operated incorrectly.

2000 `No errors` This message is returned from querying the system when no error is present in the system.

2001 `Illegal command`. The remote command sent over the bus or executed as part of a DLP was not a legal remote command. This error could also occur if a User Variable (VARDEF), which did not exist, was used as a parameter in a remote command.

To solve this problem, check for missing terminators, and the proper number of parameters. Also verify that delimited strings are properly ended. Use the `debug` softkey or the DEBUG command to locate the programming error. Refer to the `debug` softkey description in the *User's Guide* and the DEBUG command description in the *Programmer's Guide* .

2002 `Illegal parameter`. This is a user-generated system protocol error.

2003 `Missing parameter`. The command being executed requires more parameters than were provided, or a user variable VARDEF used as a parameter for a function was not found.

To solve this problem, use the `debug` softkey or the DEBUG command to locate the programming error. Refer to the `debug` softkey description in the *User's Guide* and the DEBUG command description in the *Programmer's Guide* .

2004 `Illegal character`. Refer to chapter 6 for a table of valid character codes.

2005 `Illegal character set`. Refer to chapter 6 for a table of valid character codes.

2006 `Parm out of range`. A change was made to an instrument setting that was beyond the capabilities of the hardware. This could be remote, DLP, or front panel changes.

To solve this problem, use the `debug` softkey or the DEBUG command to locate the programming error. Refer to the `debug` softkey description in the *User's Guide* and the DEBUG command description in the *Programmer's Guide* .

2007 `Missing terminator`. Many programming commands and decision constructs require the use of termination characters. For example, the TITLE command uses termination characters to delimit the text string. Also, FUNCDEFs require termination characters. This error indicates a missing termination character. Refer to the *Programmer's Guide* for more information.

2009 `Protocol error`. Internal error due to illegal communication. Due to a hardware failure.

To solve this problem, please document all details possible that lead up to the error and contact your HP representative.

2010 `Cmd out of sequence`. Internal error due to process synchronization. Possible hardware failure.

To solve this problem, please document all details possible that lead up to the error and contact your HP representative.

2011 `Memory overflow`. There is not enough available memory for the operation. Examples would be adding a VARDEF, FUNCDEF, or ACTDEF sending AMPCOR data adding new modules to a system that was almost out of memory because of FUNCDEF's, etc.

To solve this problem, some items must be removed from memory. Analyze DLP's to see if there are extra characters (spaces, etc.) that could be removed.

2013 `Item not found` or `XXXXX not found`. The `XXXXX` will be replaced by the name of the item that was not found. A request was made to operate on an item in memory that was not located.

To solve this problem, use the `debug` softkey or the DEBUG command to locate the programming error. Refer to the `debug` softkey description in the *User's Guide* and the DEBUG command description in the *Programmer's Guide* .

2014 `Duplicate identifier`. A variable, trace, or DLP name matches a reserved spectrum analyzer command.

To solve this problem, use the `debug` softkey or the DEBUG command to locate the programming error. Refer to the `debug` softkey description in the *User's Guide* and the DEBUG command description in the *Programmer's Guide* .

2015 `Too many entries`. Too many user definitions

More entries have been made in an internal table then was reserved. This often occurs when there are too many entries in a limit line table.

To solve this problem:

Use the LIMILINE command to allocate more space for limit line entries.

2016 `Label too long`. A user generated key label that has more than 14 characters, or a FUNCDEF, VARDEF, or ACTDEF with more than 12 characters will generate this error.

To solve this problem, the system will truncate the text to the correct number of characters and execute the requested function. Use the `debug` softkey or the DEBUG command to locate the programming error. Refer to the `debug` softkey description in the *User's Guide* and the DEBUG command description in the *Programmer's Guide* .

2018 `State protected`. This error occurs if a user stored instrument state that is protected was requested to be removed from memory. The state will not be removed. Also, if the number of user states is reduced using NSTATE, all states above the requested number will be deleted. If any of those states were protected, the NSTATE command will be ignored and this error will occur.

To solve this problem, unprotect any states no longer needed.

2019 `Illegal marker type`. The command executed does not apply to the marker mode of the markers on the display. For example, if a normal marker is on screen, and the "Marker delta into span" function is activated, the function cannot be executed, and the error will occur.

To solve this problem, refer to the programming or operation manual for the function being executed to determine the proper marker type for the operation.

2020 `No active marker`. This error occurs when Marker Delta is moved to Center Frequency Step Size (MKSS) while no markers are active.

2021 `Bad IF/ENDIF nesting`

To solve this problem:

Use the `debug` softkey or the DEBUG command to locate the programming error. Refer to the `debug` softkey description in the *User's Guide* and the DEBUG command description in the *Programmer's Guide* .

2022 `REPEAT/UNTIL error`

To solve this problem, use the `debug` softkey or the DEBUG command to locate the programming error. Refer to the `debug` softkey description in the *User's Guide* and the DEBUG command description in the *Programmer's Guide* .

2023 `Illegal Cal signal`. Calibration signal did not match expected limits. Refer to chapter 1 of the *User's Guide*.

2024 `Illegal HP-MSIB comm`. Illegal HP-MSIB communication

An HP-MSIB protocol violation has occurred.

To solve this problem, document all steps leading up to the error condition and contact your HP representative.

2025 `System error (slave)` HP-MSIB communications with a slave module has created this error.

To solve this problem,

- Record the error number and the hexadecimal code.
- Record all events that led up to the occurrence of the error message.
- Record the HP model numbers of the modules in the system.
- Record the firmware version.
- Contact the nearest HP Sales and Service Office for assistance.

2027 `Service mode -- do IP`. This is a user-generated system protocol error. The bandwidth or reference select is not in their AUTO modes. (For service use only.)

2029 `Command syntax error`. This error is generated when MSIB packet syntax is incorrect, or when a BDLP call is does not have the proper syntax.

To solve this problem, please document all the steps that led up to this error and contact your HP representative.

2030 `Scaling overflow` The user has requested a scale factor that is too large in the DWINDOW command.

To solve this problem, refer to the DWINDOW command description in the *Programmer's Guide* .

2031 `Too many errors`. The error buffer has been filled.

2032 `Hardware not present`. A function was requested that required hardware not available in the system.

To solve this problem, use the `debug` softkey or the DEBUG command to locate the programming error. Refer to the `debug` softkey description in the *User's Guide* and the DEBUG command description in the *Programmer's Guide* .

2034 `Test switch on`. The module test switch is in the "test" position. All RAM is erased at each power cycle.

To solve this problem, set the module test switch to the "normal" position.

2035 `Illegal operation`. The command cannot be performed as written or does not affect the current measurement conditions.

To solve this problem, use the `debug` softkey or the DEBUG command to determine which command generated the error message. Refer to the `debug` softkey description in the *User's Guide* and the DEBUG command description in the *Programmer's Guide* .

2036 `HP-IB multiple cntlr` A DLP used an OUTPUT command or the spectrum analyzer attempted to access the disk when another device had control of the HP-IB.

To solve this problem, remove the other device from the HP-IB.

2037 `No instr resp`. No HP-IB instrument response from an OUTPUT command or mass storage (such as SAVE or RECALL) to an HP-IB disk.

To solve this problem, verify that the HP-IB address is correct.

2039 `User stack overflow`. There is not enough RAM space remaining for the operation requested. Often nested DLPs are calling too deeply. For example, DLP "A" calls DLP "B" which calls DLP "C", and so forth.

To solve this problem, DLP program should be redesigned using fewer nesting levels.

2040 `Partial USTATE data`. A recalled user state is not complete.

2042 `Not stored, A–X->A`

To solve this problem, use the `debug` softkey or the DEBUG command to locate the programming error. Refer to the `debug` softkey description in the *User's Guide* and the DEBUG command description in the *Programmer's Guide* .

2044 `Not stored: open 1st`. The data for the short is entered before the data for the open when normalizing for swept response.

To solve this problem, store the data for the open first. Refer to the STORREF command.

2045 `HP-IB bus error`. HP-IB protocol violation.

To solve this problem, verify cables and computer for proper operation.

2048 `Userdef protected`. User-defined function or (USER) key is protected.

To solve this problem, use the `debug` softkey or the DEBUG command to locate the programming error. Refer to the `debug` softkey description in the *User's Guide* and the DEBUG command description in the *Programmer's Guide* .

2049 `Battery failed`. The battery backed up RAM was not valid.

To solve this problem, return to Hewlett-Packard for servicing.

2050 `Ampcr/span too large`. Amplitude-correction data too large

2051 `File not found` A user state was not found in memory.

To solve this problem, check the state number or name.

2052 `File already exists`.

2053 `storage device`. The address of the selected storage device is incorrect. Refer to "Connecting an External HP-IB Drive" in chapter 10 of the *User's Guide* for information on addressing external disk drives. If an HP-MSIB card is the selected storage device, make sure the card is in the front-panel card slot and that the card's address is the same value as the display's HP-IB address.

2054 `write protect`. Mass storage device is write protected.

2055 `bad file`. File cannot be read.

2056 `bad revision`. A recalled state is from a different firmware revision and cannot be used.

2057 `volume full`. The mass storage device is full.

To solve this problem, remove some files from the mass storage device.

2058 `bad volume` or `illegal volume`.

2059 `directory full`. The directory of the mass storage device is full.

To solve this problem, remove some files from the mass storage device.

2063 `Bad cal wavelength` The wavelength correction required for a wavelength calibration was too great. Only small wavelength errors may be corrected using the wavelength calibration feature.

To solve this problem, specify a different wavelength for calibration or use a different light source.

2064 `Signal not found`. The automeasure or autoalignment routine did not find a valid signal.

To solve this problem, connect a light source to the front-panel `MONOCHROMATOR INPUT` connector (`OPTICAL INPUT` on HP 71450B/2B instruments.) Or, use a trace marker to specify a signal for the automeasure or autoalignment routine to use.

2066 `Illegal mode for cal`. The optical spectrum analyzer only allows power and wavelength calibrations in certain instrument modes. This error occurs when one of these calibrations is requested in the wrong instrument mode.

To solve this problem, change the instrument mode to one of the selections shown on the screen.

2067 `Invalid Traj Corrns`. The slope of the trajectory corrections from one point to another is too steep. This error may indicate a problem with the optical spectrum analyzer's monochromator or fiber micro-positioner.

To solve this problem, do an align preset to remove trajectory corrections. If this does not fix the problem, return the optical spectrum analyzer for servicing.

2069 `Bad Wavelength Range`. Some commands (for example `ALIGN AUTOPTS`) require start and stop wavelength settings for proper operation. This error occurs when the valid range is exceeded.

To solve this problem, change the start and stop wavelengths to be within the valid range of the command.

2070 `Sweep too fast`. The selected sweep time is too fast to produce accurate data. The frequency of the trigger signal is too low. This error only occurs in non-zero spans. Refer to "adc trigger" in Chapter 3.

To solve this problem, increase the external trigger frequency or sweep time. Sweep time must be increased if trigger frequency is abouve 20 kHz to 50 kHz.

Hardware-Warning Errors (6000 – 6999)

Hardware-warning errors occur when the hardware is faulty. The optical spectrum analyzer can still make measurements, but the accuracy of the measurement cannot be guaranteed.

6000 `EAROM unprotected`. The memory-enable write switch is set to the WRITE position. It is not set to the PROTECT position.

To solve this problem, set the memory-enable write switch to the PROTECT position.

6001 `Confidence test passed`

6002 `A6 RAM checksum (battery)`

6007 `MSIB NMAA received`. HP-MSIB "no module at address" received

The module attempted to establish communication with a module at an incorrect address. The system responded with an NMAA (no module at address).

To solve this problem, if using MSIB communication, verify the address if the module you are trying to communicate with is correct. Otherwise, document all steps that led to the error condition and contact your HP representative.

6008 `Confidence test failed`

6009 `No module label`

6010 `Err in MDOC response`. An error in module-output capabilities response has occurred.

To solve this problem, return to Hewlett-Packard for servicing.

6014 `DSP parm error`. An internal firmware error occurred in the data-acquisition firmware. The 2-digit hexadecimal code listed with the error may assist Hewlett-Packard in diagnosing the problem.

To solve this problem, report the error (including the 2-digit hexadecimal code) to your field service representative.

Hardware-Broken Errors (7000 – 7999)

Hardware-broken errors occur with faulty hardware.

7000 **ROM check error**. The programmed checksum of the ROM does not agree with the computed checksum.

To solve this problem, because this could only be caused by a hardware failure. Return to Hewlett-Packard for servicing.

7009 **ROM 2 check error**

7033 **Power supply error**. One or more of the +5 V, −12 V, or −5 V voltages are out of spec.

7036 **HP-MSIB error**

7047 **RAM failure**. The RAM self test detected a failure in the system RAM.

To solve this problem, return to Hewlett-Packard for servicing.

7051 **Slit failed**. The slit wheel motor or associated hardware has failed. The 2-digit hexadecimal code indicates the nature of the failure and may assist Hewlett-Packard in diagnosing the problem.

To solve this problem, return to Hewlett-Packard for servicing.

7052 **Grating failed**. The diffraction grating rotation motor or associated hardware has failed. The 2-digit hexadecimal code indicates the nature of the failure and may assist Hewlett-Packard in diagnosing the problem.

To solve this problem, return to Hewlett-Packard for servicing.

7053 `Bad spect ROM`. The calibration-data ROM for the monochromator has failed. The 2-digit hexadecimal code indicates the nature of the failure and may assist Hewlett-Packard in diagnosing the problem.

To solve this problem, return to Hewlett-Packard for servicing.

7054 `Bad DSP ROM`. The calibration-data ROM for the data acquisition hardware has failed. This is probably due to faulty hardware. The 2-digit hexadecimal code indicates the nature of the failure and may assist Hewlett-Packard in diagnosing the problem.

To solve this problem, return to Hewlett-Packard for servicing.

7055 `Cal failed`. The optical spectrum analyzer could not calibrate the data acquisition hardware. This is probably due to faulty hardware. The 2-digit hexadecimal code indicates the nature of the failure and may assist Hewlett-Packard in diagnosing the problem. If the displayed 2-digit code is not shown in the following list, you will probably need to return the instrument to Hewlett-Packard for servicing. The following 2-digit hexadecimal codes originate from preforming an alignment to adjust the fiber-positioner tracking table. (Refer to the ALIGN programming command.)

Code	Definition
0B	Trajectory Table Overflow: This error indicates an attempt to add a point to an already-full trajectory correction table. Neither the table or the current autoalign data are altered. Trajectory correction table data may be viewed via the extended state display (EXTEND STATE softkey).
2B	Invalid Corrections: The data being added to the correction table would cause the correction curve to become too steep. Neither the table or the current (AUTO ALIGN) data are altered. This can happen when executing the function after a long period of time has elapsed since the last alignment or after the instrument has received a substantial mechanical shock. It can usually be remedied by executing an (AUTO ALIGN).

7056 `Bad flatness`. The flatness correction data in one of the calibration ROMs is faulty. The 2-digit hexadecimal code indicates the nature of the failure and may assist Hewlett-Packard in diagnosing the problem.

To solve this problem, return to Hewlett-Packard for servicing.

7057 `DSP Error`. An internal error occurred in the data acquisition hardware or firmware. The 4-digit hexadecimal code indicates the nature of the failure and may assist Hewlett-Packard in diagnosing the problem.

To solve this problem, report this error (including the 4-digit hexadecimal code) to you field-service representative.

Computation Errors (8000 – 8999)

Computation errors occurs during illegal math operations. For all of these computation errors, Use the `debug` menu or the DEBUG command to locate the programming error. Refer to the `debug` softkey description in Chapter 3. Or, refer to the DEBUG command description in the *Programmer's Guide* .

8000 `Divide by zero`

8001 `Float pt overflow`. Floating-point overflow. Absolute value of number exceeds $1.797{,}693{,}134{,}862{,}315 \times 10^{308}$.

8002 `Log of zero`

8003 `Log of negative`

8004 `Integer overflow`. Number is less than −32,768 or greater than 32,767.

8005 `Square root error`

8006 `Modulus of zero`

8999 `Float pt underflow`. Floating-point underflow. Number is between 0 and $\pm 2.225{,}073{,}858{,}507{,}202 \times 10^{-308}$

Factory-Use Only Errors (9000 – 9999)

These errors are for factory use only. If any of the 9000 – 9999 error messages occur, perform the following:

- Record the error number and the hexadecimal code.
- Record all events that led up to the occurrence of the error message.
- Record the HP model number of the optical spectrum analyzer and the display.
- Record the firmware version.
- Contact the nearest HP Sales and Service Office for assistance.

Warning Messages (16001 – 16012)

Warnings indicate that a user might not be performing a task properly.

16001 `Simulated hardware`. System hardware is missing. The instrument attempts to simulate the missing hardware in order to continue operation.

16002 `Trace length changed (due to ADC switch)`. The trace length has been changed to accommodate a change in the analog-to-digital converter (ADC).

16003 `Usable RBW limited`. The range of available resolution bandwidths has been reduced due to instrument settings or conditions.

16004 `Usable VBW limited`. The range of available video bandwidths has been reduced due to instrument settings or conditions.

16006 `No current state 0`. The optical spectrum analyzer attempted to recall a state register that was empty. The `POWERON RECALL` command or `POWERON RECALL` softkey has been used and then the instrument's power recycled. This causes the optical spectrum analyzer to attempt to recall state register 0.

16007 `Possible compression`. Instrument settings have resulted in a condition that may result in signal compression.

16008 `No autoalign data`. The display of this warning message results from executing the ALIGN programming command. The MANUAL argument performs an automatic alignment and transfers the resulting X and Y digital-to-analog converter (DAC) offsets to the fiber positioner's trajectory correction table. In rare situations where these offsets are zero, this warning is displayed.

16011 `Span too large`. The wavelength span has set the start and stop wavelengths outside the tunning range of the optical spectrum analyzer.

16012 `PSDAC adjust past RL`.

5

Concepts

Concepts

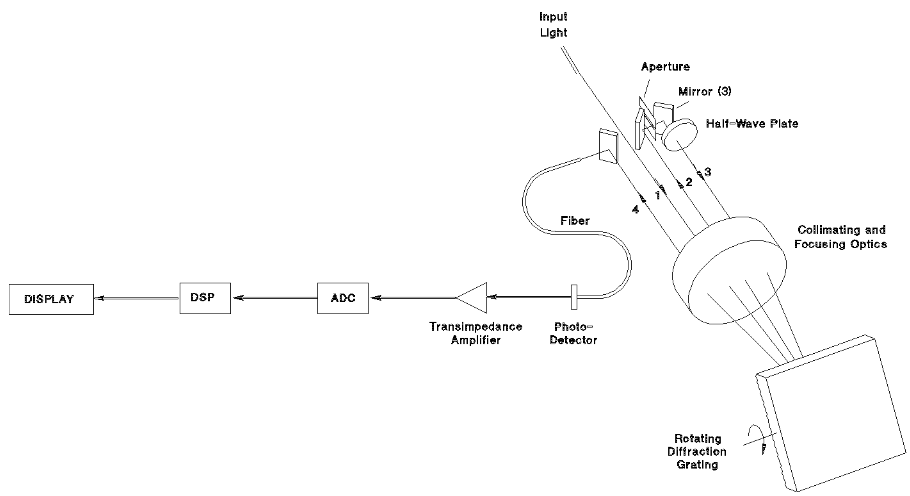
This chapter presents information for those who want a deeper understanding of optical spectrum analysis theory and application.

Contents

Block Diagram

The HP 71450B/1B/2B optical spectrum analyzers use a unique wavelength selection scheme—the double-pass monochromator. The double-pass monochromator provides the dynamic range advantage of the double monochromator and the sensitivity and size advantages of the single monochromator.

The following figure shows the basic block diagram of the optical spectrum analyzer.

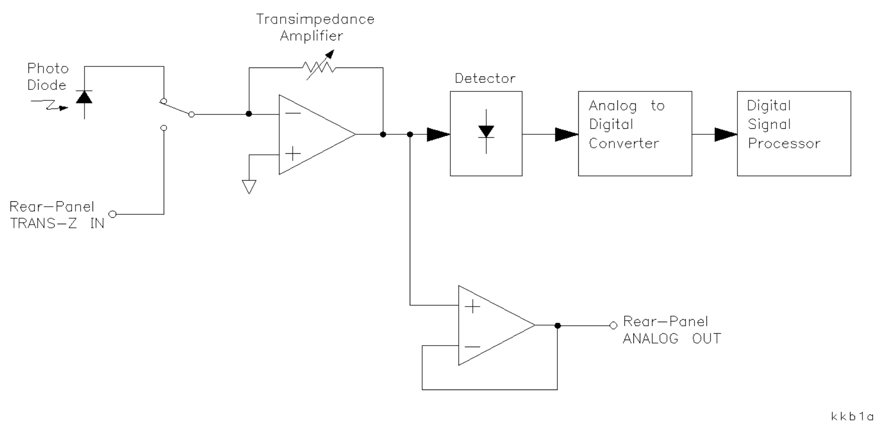


Light Path through Double-Pass Monochromator

The input light is first collimated by the optical element and dispersed by the diffraction grating. This results in a spatial distribution of the light, based on wavelength. The diffraction grating is positioned such that the desired wavelength passes through the aperture. The width of the aperture determines the bandwidth of wavelengths allowed to pass to the detector. Various apertures are available to provide resolution bandwidths of 0.08 nm and 0.1 nm to 10 nm in a 1, 2, 5 sequence.

Following the monochromator is the photodetector, which acts as a power detector converting optical power to an electrical current. This electrical current is converted to a voltage by the transimpedance amplifier. Because the transimpedance amplifier is the main noise source, it determines the optical spectrum analyzer's internal noise level and sensitivity. A digital signal processing block digitizes the electrical signal and applies video filtering. This filtering reduces noise and helps to determine the sensitivity. After filtering, the conversion to logarithmic amplitude values is performed.

As shown in the following figure, the transimpedance amplifier can be switched between two different inputs: the internal photo-diode, or the rear panel **TRANS-Z IN** connector.



The transimpedance amplifier's output is sent to a peak/sample detector and the rear-panel **ANALOG OUT** connector. Video filtering is applied to reduce noise by the digital signal processor.

Detection Techniques

The HP 71450B/1B/2B optical spectrum analyzers have two detection techniques: peak and sample. Peak detection is beneficial for maintaining the fastest sweep times and displaying narrow aspect ratio signals. Sample detection is beneficial for obtaining best measurement accuracy and measuring low level signals. The presence a of an S in the bottom center of the screen annotation indicates sample mode.

Peak detection finds and displays the maximum signal level present during each trace point interval. Peak detection is used if video filtering is not required to achieve the desired level of sensitivity. However, there is one exception: if an auto-coupled sweep time is limited by either maximum motor speed or the 50 ms auto-coupling limit, then sample detection is used with as narrow a digital video bandwidth as possible in order to achieve maximum sensitivity for the chosen sweep time. This exception only applies when both sweep time and video bandwidth are auto-coupled.

Sample detection displays a filtered version of the sampled data at the end of each trace point interval. The filter function is varied with the video bandwidth function from 0.1 Hz up to 3 kHz. Increased filtering provides greater sensitivity.

The detection mode is automatically determined by the optical spectrum analyzer. You can adjust the settings of video bandwidth, sensitivity, or sweep time to obtain the desired detection mode. Sample detection can be forced at any time by putting video bandwidth in manual. Peak detection can usually be obtained by placing sensitivity and video bandwidth in auto. For more information, refer to “Sensitivity Coupling States” in this chapter.

Sensitivity Coupling States

In this section, we'll examine the six basic data acquisition states of HP 71450B/1B/2B optical spectrum analyzers. Each state represents a combination of sensitivity, video bandwidth, and autoranging settings. We'll also see how this affects the video detection used. A table is provided in this section to show the coupling interaction between these states.

Sensitivity coupling

Sensitivity is mainly controlled through three functions: sensitivity, autoranging, and video bandwidth. (The associated softkeys are `SENS AutoMan`, `AUTORNG On Off`, and `VID BW AutoMan`.)

Definition of sensitivity

In HP 71450B/1B/2B Optical Spectrum Analyzers, sensitivity is defined as the minimum detectable signal level. Sensitivity determines the low end of the signal measurement range. The sensitivity is the level at which the DC photocurrent in the detector is equal to six times the RMS value of the noise (equivalent noise current at the photodetector). This DC photocurrent also equates to the peak-to-peak value of the noise current. The actual dBm or power value is corrected for the monochromator loss and is the expected sensitivity level at the optical input. In general, the peak-to-peak noise on the trace is:

$$noise\ (dB) = 10\ log \frac{k + 0.5}{k - 0.5}$$

where:
noise is the p-p noise.
k is the power ratio of the measured signal level to the sensitivity level.

At the sensitivity level (k = 1), the peak-to-peak noise is 4.8 dB. Another useful point is where the peak-to-peak noise is 1 dB. This occurs at k = 4.36 which gives a signal value 6.4 dB above the sensitivity level. To achieve the specified sensitivity, you may have to lower the sensitivity value a few dB to achieve the instrument specifications.

Sensitivity has two states: auto and manual. In the IP state, sensitivity is in the auto condition, and remains there until the user enters a sensitivity or puts the instrument in manual mode. Sensitivity always refers to the sensitivity of the worst case wavelength within the current span of the instrument.

When in the auto state, the actual sensitivity is computed by the optical spectrum analyzer and displayed. In the manual state, the user requests a specific level of sensitivity, and the analyzer makes the necessary settings to achieve the requested sensitivity. In this case, the actual sensitivity may be significantly better than the requested and displayed sensitivity.

Sensitivity and video bandwidth cannot be in manual simultaneously. Selecting manual sensitivity forces video bandwidth to automatic. Selecting manual video bandwidth forces automatic sensitivity.

Sensitivity varies as a function of (among other things) the transimpedance gain. This dependence of sensitivity results from the signal-to-noise improvement with increasing gain and the reduced transimpedance bandwidth associated with that gain increase. The available transimpedances range from 1 kΩ to 100 MΩ in decade steps.

Definition of top-of-screen amplitude

Top-of-screen amplitude is the amplitude represented at the top graticule line on the display. When using a linear display scale it is simply equal to the reference level. When using a log display scale, top-screen amplitude is given by the following formula:

$$top\ of\ screen\ amplitude = rl + lg\left(10 - rlpos\right)$$

where:

rl is the reference level in dBm.

lg is the log display scaling in $\frac{dB}{div}$.

rlpos is the reference level position setting (0-10).

The reference level position setting determines which horizontal graticule line represents the reference level, 0 being bottom-of-screen, and 10 being top-of-screen. The default setting is 9.

If only one transimpedance is used for a sweep (no autoranging), the optical spectrum analyzer chooses the transimpedance gain which prevents signal compression at top-of-screen amplitude levels. This calculation is based on the lowest loss wavelength within the span, while the calculated sensitivity value is based on the highest loss wavelength within the span.

Autoranging coupling

If more than one transimpedance is required for the measurement range, the optical spectrum analyzer determines two transimpedance gains and allows measured level-dependent switching between the two gains during the sweep. The low gain transimpedance is determined by compression at top-of-screen and the high gain transimpedance is determined by the desired sensitivity. Autoranging between the 1 kΩ and 100 MΩ transimpedances is not allowed.

The autoranging function has two states: on and off. The “off” state forces the use of a single transimpedance gain for the entire sweep, while the “on” state allows (but does not force) the use of two transimpedances. The state can be changed directly with the autorange function key, but can also be changed through sensitivity and video bandwidth settings. (Refer to the state coupling table in this section.)

Video bandwidth coupling

The video bandwidth is normally in the auto state, and only uses sample detection and digital filtering (if required), to achieve a desired level of sensitivity. Selecting manual video bandwidths forces sample detection and digital filtering and allows the user to enter the desired bandwidth from 0.1 Hz up to 3 kHz. The displayed video bandwidth (annotated VB on screen) is either the analog bandwidth of the transimpedance amplifier or the digital filter value, whichever is less.

Definition of measurement range

Measurement range is the difference between the signal amplitude at top-of-screen amplitude, and the sensitivity level. With manual sensitivity settings or wide spans, the sensitivity (and hence, the measurement range) may be better than indicated by the displayed values.

The following table shows the possible combinations of the sensitivity coupling states. Each row in the table is a possible state. The last row (where both sensitivity and video bandwidth are manually set) is an illegal state that cannot be achieved.

Coupling of Sensitivity, Video Bandwidth, and Autoranging
(Directional lines show instrument changes for key presses.)

Sensitivity Setting	Video Bandwidth Setting	Autoranging Setting	Video Detection Used[1,2]
auto[3]	auto	off	peak
man	auto	on	peak/sample
auto	man	off	sample
auto	auto	on	peak
auto	man	on	sample
man	auto	off	peak/sample
man[4]	man	on/off	--

1. "peak" indicates peak detection is used (unless greater sensitivity can be achieved with narrower video bandwidths without increasing sweep speed.)

2. "peak/sample" indicates peak detection is used if the desired sensitivity can be achieved without the use of narrower video bandwidths.

3. Top row of settings indicates instrument-preset state.

4. The combination of manual sensitivity and manual video bandwidth settings in this row are not allowed.

State 1: Instrument Preset

This is the normal state of the optical spectrum analyzer. Autoranging is turned off. Peak detection is used, unless sample detection provides better sensitivity for the same sweep time. The displayed sensitivity value is an accurate prediction of the actual worst-case sensitivity. This value follows changes in top-of-screen level and is calculated for the worst case wavelength within the entered wavelength span. Because of this, you can achieve the best sensitivity by placing the displayed signal at the top of the screen.

State 2: Manual Sensitivity with Autoranging

This is the preferred method for controlling sensitivity and measurement range (top-of-screen values and sensitivity). (Top-of-screen level is a function of reference level, logarithmic scale, and the reference-level position.) After the desired sensitivity is entered, the optical spectrum analyzer determines if autoranging is necessary and sets the system up for the best sweep time. This may result in autoranging to a variety of combinations of transimpedances. The low gain transimpedance is determined for no compression at the top-of-screen value. The high gain transimpedance is the one with the highest bandwidth (lowest gain) which achieves the entered sensitivity without the use of video filtering. In this range of sensitivity values, the actual sensitivity can be significantly better than the entered and displayed value. It will always be at least as good as the entered value.

As the sensitivity is lowered, the system steps through the transimpedance ranges giving quantized steps in the actual sensitivity. This occurs until the unfiltered sensitivity of the highest gain amplifier is reached. At this point, video bandwidths are used to achieve further reductions in sensitivity. Entered and actual values will correlate with further sensitivity reductions.

This state is generally used while measuring DFB lasers for side mode suppression.

State 3: Manual Video Bandwidth without Autoranging

Setting the optical spectrum analyzer in this state is ideal for making critical relative amplitude measurements with limited dynamic range (<50 dB). When autoranging is off, transimpedance values are determined so that there is no compression at the top-of-screen value. Also, with autoranging off, improved scale fidelity is available as specified in chapter 1. Filtering can be used to decrease the measurement uncertainty (increase signal-to-noise). It can also have advantages for measurements falling just short of the desired amplitude measurement range, but where autoranging is undesirable. For this application there is also an advantage to moving the signal nearer to the top-of-screen by adjusting the reference level; you may also want to set the reference level position to 10 and use the marker to reference level function.

State 4: Auto Video Bandwidth and Autosensitivity with Autoranging

This state is identical to the instrument-preset state except that autoranging is allowed. This ensures the fastest sweeps possible with wide measurement range. The video bandwidth and sensitivity are autocoupled.

State 5: Manual Video Bandwidth with Autoranging

In this state, video bandwidth is manually selected (0.1 Hz to 3 kHz) while achieving a wide measurement range. Unlike state 2 where the sensitivity is manually set with autoranging on, this state always autoranges from the 100 MΩ to the lowest gain needed, transimpedances unless the low gain is 1 kΩ. If the low gain is 1 kΩ, the transimpedances ranges from 10 MΩ.

This state is useful for making measurements of spontaneous emission sources (such as LEDs or white-light sources) where you may want to set the bandwidth and sweep time based on expected maximum amplitude swings verses wavelength. Refer to “Sweep Time Operation” in this chapter.

State 6: Manual Sensitivity without Autoranging

This is similar to using state 3 (manual video bandwidth without autoranging) except that sensitivity is manually set. If a new value of sensitivity is entered, autoranging is forced “on.”

Sweep Time Operation

Sweep time can be operated either in an auto-coupled mode or set manually. In auto-coupled mode, the sweep time is automatically chosen by the optical spectrum analyzer to be the fastest possible while maintaining dynamic range specifications. (Refer to the specifications listed in Chapter 1.) In manual mode, you can set any sweep time between the minimum and maximum limits. If the manual setting is less than the instrument's automatic setting, the `UNCAL` indication appears on the display.

The maximum sweep time is based on trace length (one second per trace point). The derivation of the minimum sweep time is more complex and affects the optical spectrum analyzer's selection of peak or sample detection. This is described in "Sensitivity Coupling States" in this chapter. Minimum sweep time is determined by the following:

- Fastest grating rotation motor speed.
- Data acquisition system's sample rate.
- An auto-coupled mode limit of 50 ms.

Auto-coupled sweep times can never be faster than 50 ms and are controlled by the following settings:

- Span.
- Sensitivity.
- Video bandwidth.
- Resolution bandwidth.

When incoherent signals (such as white-light sources or LEDs) are measured or used in the stimulus-response mode, users can manually set the sweep time to obtain faster sweeps while still maintaining calibrated wavelength and amplitude accuracy. To accomplish this, use the equation shown on the following page.

$$sweep\ time > \frac{(slope)(span)}{27.3\ (VBW)}$$

where:

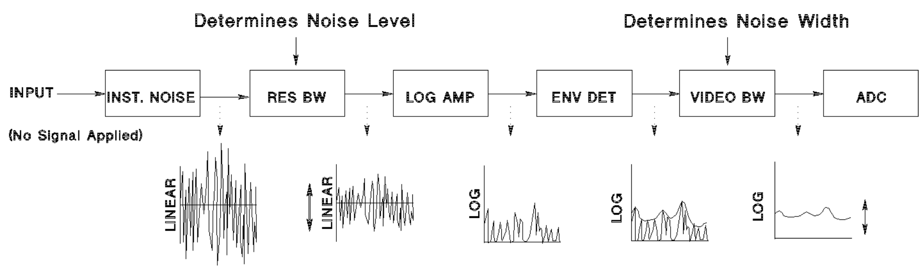
sweep time is in seconds.

slope is the maximum expected signal amplitude change in $\frac{dB}{nm}$.

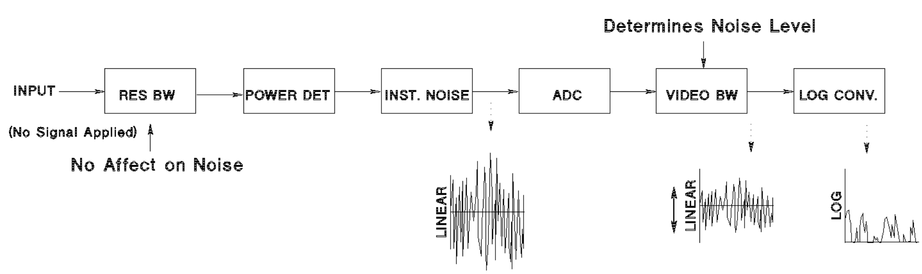
span is the measurement span in nm.

VBW is the video bandwidth in Hz

The operation of optical spectrum analyzers is very similar to microwave spectrum analyzers; however there are some differences, especially in relationship to the sensitivity of the analyzer. The following figures show the key signal-processing blocks of the optical spectrum analyzer and the equivalent blocks of a typical microwave spectrum analyzer.



Microwave Spectrum Analyzer



Optical Spectrum Analyzer

The order of the key signal processing elements is different, and this difference is most noticed in the sensitivity level of the analyzers. As can be seen in the figure, the most significant source of internal noise for the microwave spectrum analyzer is at the front-end of the instrument, from the input attenuator and mixer to the IF amplifiers. The resolution bandwidth then determines the rms value of the broadband internal noise. Reducing the resolution bandwidth reduces the instrument noise level. The signal is then converted to a logarithmic scale by the log amplifier and the envelope of that signal is detected by the detector. The noise signal seen on screen is this envelope of the original internal noise. As a result, the resolution bandwidth, which had changed the rms value of the original noise, changes the average value of the displayed noise. The video bandwidth filter then determines the peak-to-peak width of the displayed noise, without changing the average level.

The most significant source of internal noise for the optical spectrum analyzer comes after the resolution bandwidth filters and the detector. The resolution bandwidth has no direct effect on the internal noise level. Following digitization, the video bandwidth filter is applied to the internal noise. Since this noise has not been affected by the detector, the average noise level is still 0 V. The video filter in the optical spectrum analyzer affects the rms value of the internal noise but the average remains 0 V. This is the same effect that the resolution bandwidth filter had on the internal noise at that point in the microwave spectrum analyzer. The filtered signal is then converted to a logarithmic scale for display. The average value of the displayed internal noise is 0 W. This is because the noise source follows the detector, which is equal to minus infinity dBm. As a result, the optical analyzer's noise floor differs because, due to the envelope detector, the microwave spectrum analyzer has a non-zero average noise level. It is the peaks of the noise floor that determine the optical spectrum analyzer's sensitivity. The sensitivity is defined as 6 times the rms noise level. In order to keep the display from being too cluttered, the internal noise is clipped 10 dB below the sensitivity point.

In summary, microwave spectrum analyzers have a non-zero average noise level that is determined by the resolution bandwidth, and the displayed width of the noise is determined by the video bandwidth. The sensitivity of the microwave spectrum analyzer is defined as the average noise level. Optical spectrum analyzers have a zero average (minus infinity dBm) noise level that is not affected by the resolution bandwidth, but the rms level of the noise is determined by the video bandwidth. The sensitivity of the optical spectrum analyzer is defined as 6 times the rms of the noise.

For convenience, operators of HP 71450B/1B/2B optical spectrum analyzers can enter the desired sensitivity, and as a result, the appropriate instrument settings, including video bandwidth and sweep time, are automatically determined and set. For a complete discussion of this coupling, refer to "Sensitivity and Video Bandwidth Coupling" in this chapter.

6

Tables and Charts

Tables and Charts

Contents

Accessories Supplied with the Product

Accessory	HP Part Number
32K Memory card[1]	0950-1964
Memory card holder[1]	9222-1545
Operation verification diskette	5010-7701
Advanced measurement programs - memory card	5010-7709
Advanced measurement programs - 3.5 diskette	5010-7710
Front handle kit[1]	5062-3991
Custom keypad	70950-60033
8 mm hex-ball driver, 1-3/4 inch shaft[1]	8710-1651
Optical cable, *Option 002*	1005-0218
Optical cable, *Option 002*	1005-0219
Protective plastic caps, *Option 010*[2]	5040-9351
Rack slide kit, *Option 810*	5062-7086
Flange kit, *Option 810*	5062-3979
Rack flange kit, *Option 810*	5062-4073

1 Provided with HP 71450B/1B/2B instruments.

2 These caps protect front-panel connectors that do not have fiber optic adapters attached.

Front-panel Fiber Optic Adapters

Adapter Style	HP Model Number
FC/PC bare fiber adapter	HP 81000 FB
Diamond HMS-10/HP	HP 81000 AI
FC/PC	HP 81000 FI
D4	HP 81000 GI
SC	HP 81000 KI
DIN 47256	HP 81000 SI
ST	HP 81000 VI
Biconic	HP 81000 WI

Optic Accessories

Description	HP Model Number
Optical isolator/1310 nm	HP 81210 LI
Optical isolator/1550 nm	HP 81310 LI
Fiber-optics handbook	5952-9654

Mainframe/Display Accessories

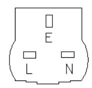
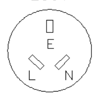
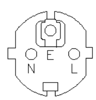
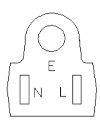
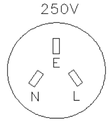
Description	HP Model Number HP Part Number
Fuse, 6.3 A, 250 V	2110-0703
Panel-mainframe front blank, 1/8 module width	5061-9006
Display cleaner, thin-film cleaner	8500-2163
BNC (m) to SMB (f) cable, 1.0 m	85680-60093
HP-MSIB interconnect cable, 0.5 m	HP 70800A
HP-MSIB interconnect cable, 1.0 m	HP 70800B
HP-MSIB interconnect cable, 2.0 m	HP 70800C
HP-MSIB interconnect cable, 6.0 m	HP 70800D
HP-MSIB interconnect cable, 30 m	HP 70800E

Module Removal Tool

Description	HP Part Number
8 mm hex-ball driver, 6-1/2 inch shaft	8710-1307
8 mm hex-ball driver, 1-3/4 inch shaft	8710-1651

Optical Spectrum Analyzer Options

Option	Description
001	Built-in programmable current source.
002	Built-in white light source.
003	Swept Polarization Dependent Loss (PDL) Kit. (HP 71451B/HP 70951B only)
011	Diamond HMS-10/HP front-panel fiber optic connector
013	DIN front-panel fiber optic connector
014	ST front-panel fiber optic connector
017	SC front-panel fiber optic connector
051	EDFA Interpolation Measurement Program (standard on HP 71452B)
052	EDFA Time Domain Extinction Measurement Program (standard on HP 71452B)
053	EDFA Gain Peak Measurement Program (standard on HP 71452B)
122	This option for the HP 71452B provides improved dynamic range and specified noise marker bandwidth accuracy in 0.2 nm resolution.
1CM	Rack flange kit for mounting the optical spectrum analyzer, without handles, in a standard instrument rack (HP part number 5062-3979).
0B1	Additional set of user's manuals: Installation and Verification, Quick Start Guide, User's Guide, Programmers Guide, Reference, and Quick Reference Guide.
0B3	Service manual. Includes assembly level service manual and component level information. This option also includes service information for the HP 70004A display.

PLUG TYPE **	CABLE HP PART NUMBER	PLUG DESCRIPTION	CABLE LENGTH CM (INCHES)	CABLE COLOR	FOR USE IN COUNTRY
250V 	8120-1351 8120-1703	Straight* BS1363A 90°	229 (90) 229 (90)	Mint Gray Mint Gray	Great Britain, Cyprus, Nigeria, Singapore, Zimbabwe
250V 	8120-1369 8120-0696	Straight* NZSS198/ASC112 90°	201 (79) 221 (87)	Gray Gray	Argentina, Australia, New Zealand, Mainland China
250V 	8120-1689 8120-1692	Straight* CEE7-Y11 90°	201 (79) 201 (79)	Mint Gray Mint Gray	East and West Europe, Central African Republic, United Arab Republic (unpolarized in many nations)
125V 	8120-1348 8120-1538	Straight* NEMA5-15P 90°	203 (80) 203 (80)	Black Black	United States Canada, Japan (100 V or 200 V), Brazil, Colombia, Mexico, Phillipines, Saudia Arabia, Taiwan
	8120-1378 8120-4753 8120-1521 8120-4754	Straight* NEMA5-15P Straight 90° 90°	203 (80) 230 (90) 203 (80) 230 (90)	Jade Gray Jade Gray Jade Gray Jade Gray	
250V 	8120-5182 8120-5181	Straight* NEMA5-15P 90°	200 (78) 200 (78)	Jade Gray Jade Gray	Israel

* Part number for plug is industry identifier for plug only. Number shown for cable is HP Part Number for complete cable, including plug.

** E = Earth Ground; L = Line; N = Neutral.

FORMAT80

Line-power Cables

ASCII Characters for Displayed Titles and Text (1 of 3)

Code	Char	Code	Char	Code	Char	Code	Char	Code	C har	Code	Char
0	N_U	20	D_4	40	(	60	<	80	P	100	d
1	S_M	21	M_K	41	)	61	=	81	Q	101	e
2	S_X	22	S_Y	42	*	62	>	82	R	102	f
3	(blank text)	23	E_B	43	+	63	?	83	S	103	g
4	E_T	24	C_N	44	,	64	@	84	T	104	h
5	E_Q	25	E_M	45	-	65	A	85	U	105	i
6	A_K	26	S_B	46	.	66	B	86	V	106	j
7	B_L	27	E_C	47	/	67	C	87	W	107	k
8	B_S	28	F_S	48	Ø	68	D	88	X	108	l
9	H_T	29	G_S	49	1	69	E	89	Y	109	m
10	L_F	30	R_S	50	2	70	F	90	Z	110	n
11	V_T	31	U_S	51	3	71	G	91	[	111	o
12	F_F	32	(space)	52	4	72	H	92	\	112	p
13	(carriage return)	33	!	53	5	73	I	93	]	113	q
14	S_O	34	"	54	6	74	J	94	^	114	r
15	S_X	35	#	55	7	75	K	95	_	115	s
16	B_L	36	$	56	8	76	L	96	‘	116	t
17	D_1	37	%	57	9	77	M	97	a	117	u
18	D_2	38	&	58	:	78	N	98	b	118	v
19	D_3	39	'	59	;	79	O	99	c	119	w

ASCII Characters for Displayed Titles and Text (2 of 3)

Code	Char	Code	Char	Code	Char	Code	Char	Code	C har	Code	Char
120	x	140	^{k}	160	ÿ	180	υ	200	Γ	220	÷
121	y	141	^{x}	161	α	181	Φ	201	Π	221	$\neq$
122	z	142	$_{i}$	162	β	182	χ	202	Ψ	222	¿
123	{	143	$_{j}$	163	γ	183	Ψ	203	Φ	223	Á
124	|	144	$_{k}$	164	δ	184	ω	204	$\oint$	224	É
125	}	145	$_{x}$	165	ϵ	185	Ω	205	$\int$	225	Í
126	~	146	$^{+}$	166	ζ	186	$\frac{1}{2}$	206	£	226	Ó
127		147	/	167	η	187	$\frac{1}{4}$	207	$\in$	227	Ú
128	^{0}	148	$^{-}$	168	θ	188	$\leq$	208	e	228	á
129	^{1}	149	Ä	169	ι	189	$\equiv$	209	C	229	é
130	^{2}	150	Ë	170	κ	190	$\geq$	210	c	230	í
131	^{3}	151	Ï	171	λ	191	$\uparrow$	211	Ñ	231	ó
132	^{4}	152	Ö	172	μ	192	$\downarrow$	212	ñ	232	ú
133	$_{0}$	153	Ü	173	ν	193	$\Rightarrow$	213	©	233	À
134	$_{1}$	154	ä	174	ξ	194	$\Leftarrow$	214	¢	234	È
135	$_{2}$	155	ë	175	o	195	$\triangle$	215	$\surd$	235	Ì
136	$_{3}$	156	ï	176	π	196	$\bigtriangledown$	216	Σ	236	Ò
137	$_{4}$	157	ö	177	ρ	197	$\angle$	217	$\simeq$	237	Ù
138	^{i}	158	ü	178	σ	198	Ξ	218	∞	238	à
139	^{j}	159	Ÿ	179	τ	199	Υ	219	$\pm$	239	è

ASCII Characters for Displayed Titles and Text (3 of 3)

Code	Char	Code	Char	Code	Char	Code	Char	Code	Char	Code	Char
240	ì	243	Â	246	Ô	249	ê	252	û	255	◇
241	ò	244	Ê	247	Û	250	î	253	△		
242	ù	245	Î	248	â	251	ô	254	÷		

Controlling Text in Titles

ASCII Codes	Description
7	Sound beep.
8	Back space (B_S) or move pen back by one character width.
12	Form feed (F_F) or clear line of text, then move pen to left side of line.
13	Carriage return (C_R). Moves pen to left side of display, to beginning of line.
E_CC	Move pen right by one character.
E_CG	Move pen to the left side of the display (carriage return).
E_CK	Clear to the end of the line.
E_CY	Causes subsequent escape-code characters to be displayed instead of executed. Exception is ASCII 13 (carriage return.)
E_CZ	Turns off E_CY mode so that escape-code characters action indicated in table.
E_C&dA	Turn on blinking.
E_C&dB	Turn on inverse video.
E_C&dC	Turn on inverse video and blinking.
E_C&dD	Turn on underline.
E_C&dE	Turn on underline and blinking.
E_C&dF	Turn on underline and inverse video.
E_C&dG	Turn on underline, inverse video, and blinking.
E_C&d@	Turn off underline, inverse video, and blinking enhancements.

† E_C indicates ASCII code for escape (27).

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