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Simbol Test Systems is the one-stop shop for all your fiber optic test equipment and measurement needs. As we are exclusively focused on e-commerce and international distribution of photonic products since 2000, our customers rely on the <a href="AssetRelay">AssetRelay</a> catalog to find our stock listings of thousands of used and refurbished popular test equipment. They know they can get repair, customization and calibration services from our laboratory for their own fiber optic instruments from all renowned brand manufacturers.

If you wish to buy or sell an Anritsu MS9710x family OSA, visit our catalog <u>here</u> to see our current stock.

## Anritsu MS9710B Optical Spectrum Analyzer (OSA) Calibration and Repair Services

With more than 20 years of expertise in repair of OSA, Tunable Lasers, Wavemeters and more, the quality of our services is renowned amongst the service centers community and highly appreciated by our partners and customers. We developed custom software allowing us to perform automatic calibration tests through most of the range of the OSAs. Don't settle for a two-page summary assessment to trust that your OSA is operating on the full range; our report contains the complete table of all results, confirming it has **really** been tested.

#### Anritsu Optical Spectrum Analyzer (OSA) Repair and Calibration Services

The Anritsu OSA goes through a premium calibration to ensure it meets or exceeds manufacturers published specifications. The equipment is shipped with a comprehensive 3-page calibration report including before-and-after data, a calibration sticker and its own dated calibration certificate. A report from other labs with less data points reflects a not completely calibrated unit.

The MS9710B OSA is known to suffer some encoder defects that are not possible to fix due to shortage of the custom part that was made especially for Anritsu. If your unit does not pass calibration, we will quote for its repair and recalibration assuming we can perform the needed repair.

#### List of specifications calibrated

- Optical Alignment
- Wavelength Calibration with Internal Cell
- Wavelength Accuracy cal external source
- Wavelength Resolution Accuracy
- Wavelength Linearity
- Dynamic Range
- Level Accuracy

- Level Flatness
- Return Loss
- Power Linearity
- Stability (Wavelength and Power)
- Polarization Dependency
- Reference Output Power

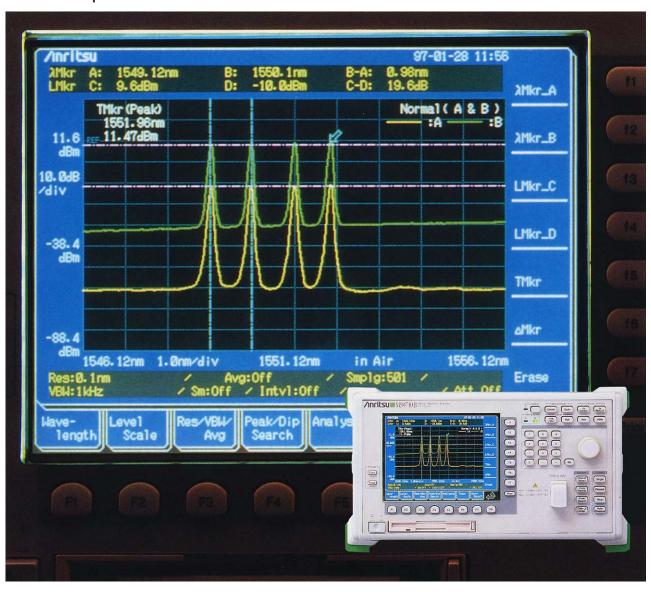
Traceability: Instrumentation used during this calibration is traceable to N.I.S.T (National Institute of Standards and Technology) or C.N.R.C. (Canadian National Research Council.



# MS9710B

## Optical Spectrum Analyzer

0.6 to 1.75 μm



High-Performance, Portable Optical Spectrum Analyzer

## **Compact High Performance**

- 70 dB dynamic range
- −90 dBm guaranteed optical reception sensitivity
- Internal 3.5" FDD (Windows®)
- Tracking with tunable laser source
- Optical pulse measurement
- Full range of WDM application functions

The MS9710B is a diffraction-grating spectrum analyzer for analyzing optical spectra in the 0.6 to 1.75 µm wavelength band. In addition to uses such as measurement of LD and LED spectra, it has functions for measuring the transmission characteristics of passive elements such as optical isolators, as well as the NF/Gain of optical fiber systems.

In addition to its basic features, the superior stability and reliability of the diffraction grating (patent pending) easily pass the severe specifications required for precise measurement of WDM communications methods, particularly in the 1.55 µm band. This analyzer has the dynamic range, reception sensitivity and sweep speed requested by users, backed by Anritsu's high-level technology. The high sensitivity meets the exacting demands placed on today's measuring instruments. In particular, the excellent wavelength and level specifications fully meet the dense WDM requirements in the 1.55 µm band. In addition to having a much wider dynamic range, its compact portability (approx. 50% lighter) eliminates the large cumbersome image of earlier analyzers by perfectly combining portability with high performance. In addition to the high reliability and excellent basic performance, this analyzer has a full range of application functions to support accurate measurement in the fastest possible time.

#### 70 dB dynamic range

The measurement dynamic range of the MS9710B in the normal measurement mode at a wavelength 1 nm from the peak wavelength is 62 dB. In the high-dynamic-range measurement mode, better than

70 dB can be achieved. The analyzer demonstrates its excellence in SMSR measurement of DFB-LDs, as well as in evaluation of narrow-band optical band pass filters.

Massurament made	Dynamic range			
Measurement mode	1 nm from peak	0.5 nm from peak		
High dynamic range	70 dB	60 dB		
Normal	62 dB	58 dB		

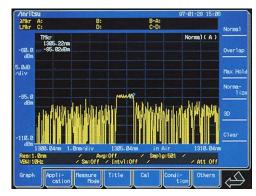
High-dynamic-range measurement example with DFB-LD spectrum passed via narrow-band BPF.



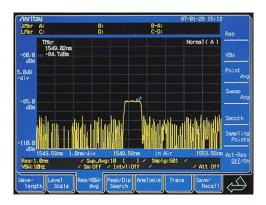


#### -90 dBm guaranteed optical reception sensitivity

The MS9710B has achieved an improved S/N over a wide range by taking thorough countermeasures to noise and stray light. The RMS noise level at wavelengths from 1.25 to 1.6 µm is –90 dBm max. The screen display below is the waveform obtained when measuring a 1.55 µm DFB-LD optical source of –85 dBm; only 25 seconds are required for the measurement.



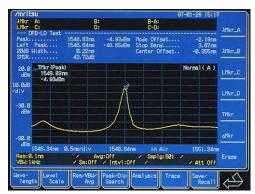
In addition, the S/N can be improved using sweep averaging. The screen display below shows the wave- form after 10 averagings; the S/N is improved by more than 5 dB.



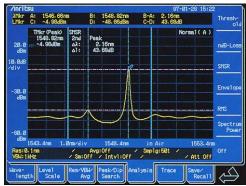
#### **Full function lineup**

In addition to its excellent basic functions, the MS9710B comes with a full lineup of other useful functions summarized in the following table.

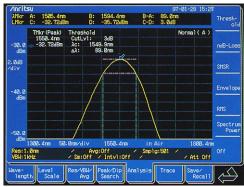
Device analysis	For analyzing and evaluating waveforms of optical elements (DFB-LDs, FP-LDs, LEDs)
Waveform analysis	For waveform analysis by RMS and threshold methods; SMSR, half-width evaluation, WDM waveform analysis
Application measurement	EDFA NF and gain measurement, PMD measurement (See applications.)
Modulation, pulsed light measurement	Max. frequency range (VBW) = 1 MHz (See applications.)
Markers	Multimarkers: Marker function for max. 128 points (See applications.) Zone markers: For waveform analysis in zone Peak/dip search: Search for a peak or dip
Power monitor	Also functions as optical power meter
Vacuum wavelength display	Converts displayed wavelength to value in vacuum
External interfaces	GPIB, RS-232C



DFB-LD waveform analysis



Waveform analysis in zone marker



Half-width measurement by threshold method

#### Relying on 1.55 µm transmission band

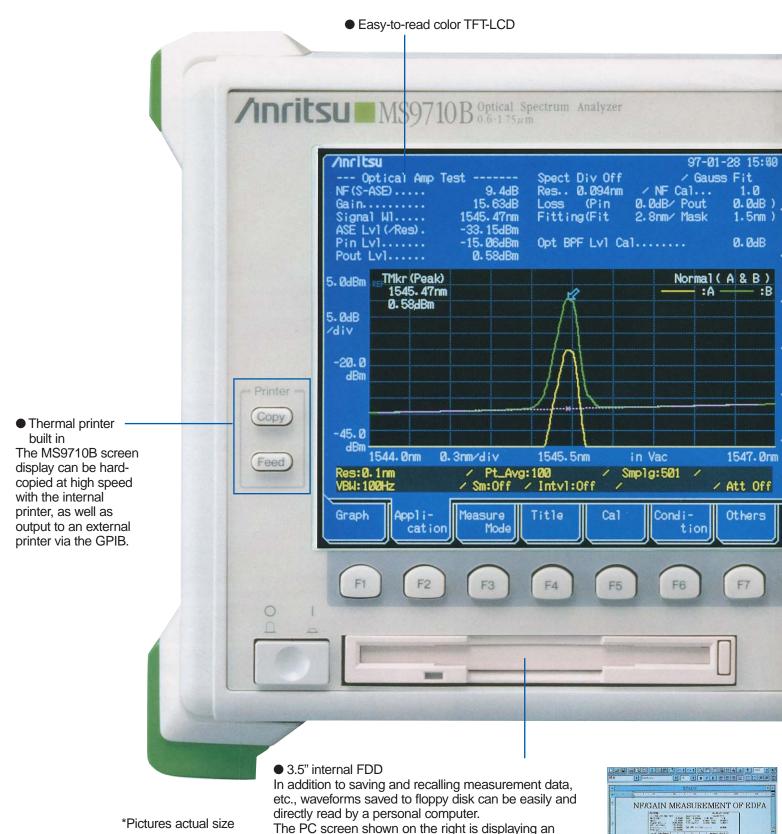
As a result of the need for increased transmission capacity, R&D into large-capacity transmission techniques is becoming more active and Wavelength Multiplexing (WDM) is at the stage of actual usage. This WDM transmission technology requires quantitative measurement of the wavelength transmission characteristics between each channel.

Measuring instruments for this purpose require much more accurate wavelength and level measurement. Furthermore, accurate measurement of fiber-amplifier NF requires extremely good polarized light dependency and level linearity specifications.

The MS9710B design has achieved excellent wavelength and level specifications for this purpose in the 1.53 to 1.57  $\mu$ m wavelength band. In particular, the wavelength accuracy can be calibrated automatically using an optional internal reference wavelength light source; the post-calibration accuracy is better than  $\pm 0.05$  nm. Evaluation of WDM systems requires measurement without repeated calibration at each measurement and the MS9710B achieves high-accuracy measurement with high repeatability.

#### 1.53 to 1.57 µm specifications

min operations		
Wavelength accuracy	±0.05 nm (after calibration with optional light source)	
Wavelength linearity	±0.02 nm	
Wavelength resolution	<0.07 nm +10%	
Wavelength flatness	±0.1 dB	
Polarized light dependency	±0.05 dB	
Level linearity	±0.05 dB (0 to -50 dBm)	



\*Pictures actual size

The PC screen shown on the right is displaying an image of the MS9710B screen saved to floppy disk. Screen images can be saved to FD media and output as Windows® bitmap-format files. In addition, since the data can be output in text-file format, it can be manipulat-

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ed easily using spreadsheet software.



Option is installed.

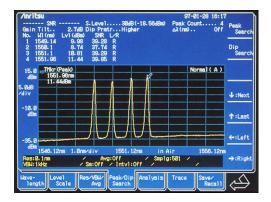
35 dB min.). The input connector can be removed and refitted easily for fast clean-

ing.

## **Applications for Every Need**

#### Spectrum analysis for WDM communication system

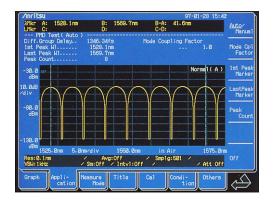
Difficult problems in WDM transmission technology are the wavelength characteristics for the gain, and signal-to-noise ratio (SNR) between each channel. In evaluation, it is very important to measure this quantitatively. The MS9710B permits extremely quick and simple waveform analysis of up to 300 spectra. The waveform and level (SNR) of each peak exceeding the set threshold is displayed. The screen display below shows an example of the gain tilt.



#### Polarization mode dispersion

An important factor determining the upper limit of the transmission bit rate is the polarization mode dispersion (PMD). PMD is measured in the time and wavelength domains. The MS9710B can be used as a fixed analyzer to perform simple and automated measurement in the wavelength domain and immediately computes the PMD by data processing from the measured waveform. The wavelength difference ( $\lambda_2$ – $\lambda_1$ ) between the peak wavelength ( $\lambda_1$ ) and the wavelength at the Nth peak ( $\lambda_2$ ) are read directly and the PMD is calculated from the following equation.

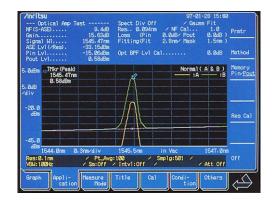
$$PMD = K \ \frac{N\text{--}1}{C} \ x \ \frac{\lambda 1 \cdot \lambda 2}{\Delta \lambda} \ \text{where: K is the mode coupling factor and C} \\ \text{is the speed of light (m/s).}$$



#### NF measurement of fiber amplifier (EDFA)

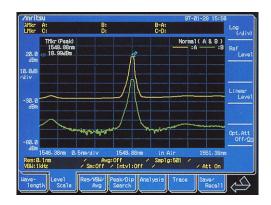
NF measurement by the optical method using an optical spectrum analyzer measures the light input and output to and from the EDFA. NF is determined by the beat noise between the optical signal and the Amplified Spontaneous Emission (ASE) as well as by the beat noise between the ASE.

Since the MS9710B measures the ASE level with very high accuracy, three methods can be used to measure NF: 1. Pulse measurement (JIS Method: Under discussing), 2. Level calibration using fitting, and 3. Polarized light nulling. Moreover, measurement can be performed with the required dynamic range, level linearity and polarization dependency.



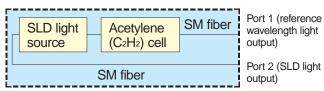
#### Built-in attenuator for high-power optical sources

When the built-in attenuator is added, optical inputs of up to +20 dBm can be measured. And since the attenuation is automatically corrected internally, there is no need for the user to calibrate the measurement. The screen display below shows the measurement of a +20 dBm optical spectrum amplified by an EDFA.



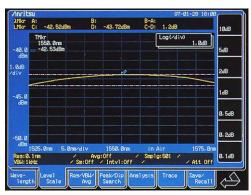
#### Convenient light source option (refer wavelength light for better accuracy)

Any one of the Wavelength reference & SLD light source (Option 13), SLD light source (Option 14), Wavelength reference light source (Option 05), and white light source (Option 02) can be installed in the MS9710B. The block diagram of the SLD light source & reference wavelength light source option is shown below. This option has two separate output ports: Port 1 for wavelength calibration, and Port 2 for measuring transmission characteristics. When the MS9710B is calibrated automatically by inputting the reference light for the wavelength, post-calibration wavelength accuracy in the 1.52 to 1.57  $\mu$ m range is better than  $\pm 0.05$  nm. This is very useful in precision absolute measurement of the wavelengths of light sources used in WDM systems.



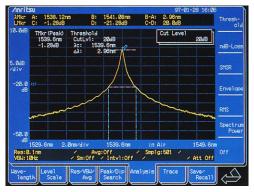
Block diagram of SLD light source & reference wavelength light

The following diagram shows the spectrum of the SLD light output from Port 2. When this light source is used instead of the earlier white light source for measurement of the wavelength transmission characteristics of optical receiver elements, it is possible to achieve a 20 dB wider dynamic range.



Spectrum of SLD light source

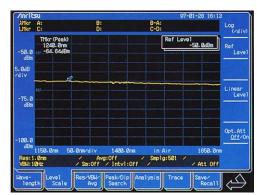
The following figure shows an example of measuring the transmission characteristics of optical band pass filter using the SLD light.



Measurement of optical band pass filter

If this dynamic range is not required, a lower-cost white light source can be installed instead.

The following figure shows the spectrum of the white light source using SM fiber (for GI fiber, refer to the specifications of Option 02).



Spectrum of white light source

Note: The optical input section of the MS9710B is designed for connecting single-mode fibers. There is the MS9780A Optical Spectrum Analyzer which have the optical input section designed for connecting multimode fibers ( $50/62.5 \, \mu m$ ).

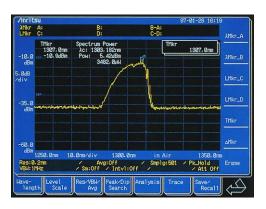
#### Measurement of modulated and pulsed light

The synchronization signal for the measured modulated/pulsed light is input to the external input trigger on the rear panel. With this analyzer, the data can be held by this sync signal. As a result, the spectrum of the modulated or pulsed light can be measured accurately without data loss.

In addition, an optical source that does not have a sync signal can be measured in the same manner by setting an appropriate gate time. The waveform in the diagram below shows measurement of an

optical pulse (OTDR's light source) with a pulse width of 1 µs and a duty of 1%.

However, for accurate spectrum measurement, the VBW must be set to a wider bandwidth than the modulation frequency of the measured light. The maximum settable VBW in the MS9710B is 1 MHz. (Refer to the specifications page for the relationship between VBW, received light sensitivity and sweep time.)



## **Specifications**

#### ♦ MS9710B

Fiber	10/125 μm SM fiber (ITU-T G. 652)
Optical connector*1	User replaceable: FC, SC, ST, DIN, HMS-10A Factory option (not user replaceable): E2000 (Diamond), EC (Radial), FC-APC, SC-APC, HRL-10
Wavelength	Range: 600 to 1750 nm  Accuracy: ±0.2 nm (1530 to 1570 nm, after wavelength calibration) ±0.3 nm (600 to 1750 nm, after wavelength calibration) ±0.05 nm (1530 to 1570 nm, resolution: 0.07 to 0.2 nm, after calibration with wavelength reference light source option) ±0.1 nm (1530 to 1570 nm, resolution: 0.5 to 1 nm, after calibration with wavelength reference light source option)  Stability: ±5 pm (smoothing: 11 points, 1 minute, at half-width center wavelength) Linearity: ±20 pm (1530 to 1570 nm) Read resolution: 5 pm (display resolution: 1 pm) Setting resolution: 0.07, 0.1, 0.2, 0.5, 1 nm (filter: 3 dB bandwidth) Resolution accuracy*2: ±≤2.2% (resolution: 0.5 nm, 1550 ±20 nm), ±≤7% (resolution: 0.2 nm, at other wavelength) ±≤3% (resolution: 0.2 nm, 1550 ±20 nm), ±≤15% (resolution: 0.2 nm, at other wavelength) ±≤7% (resolution: 0.1 nm, 1550 ±20 nm), ±≤30% (resolution: 0.1 nm, at other wavelength)
Level	Measurement range:  -65 to +10 dBm ( 600 to 1000 nm, 0° to +30°C, VBW: 10 Hz, sweep averaging: 10 times)  -85 to +10 dBm (1000 to 1250 nm, 0° to +30°C, VBW: 10 Hz, sweep averaging: 10 times)  -90 to +10 dBm (1250 to 1600 nm, 0° to +30°C, VBW: 10 Hz, sweep averaging: 10 times)  -75 to +10 dBm (1600 to 1700 nm, 0° to +30°C, VBW: 10 Hz, sweep averaging: 10 times)  -55 to +10 dBm (1700 to 1750 nm, 0° to +30°C, VBW: 10 Hz, sweep averaging: 10 times)  -65 to +20 dBm (1100 to 1600 nm, attenuator: on)  Accuracy: ±0.4 dB (1550 nm, -23 dBm, resolution: ≥0.1 nm)  Stability: ±0.02 dB (1300/1550 nm, -23 dBm, resolution: ≥0.1 nm, 1 minute, constant temperature, no polarization shift)  Linearity: ±0.05 dB (1550 nm, 0 to -50 dBm)  Flatness: ±0.1 dB (1530 to 1570 nm)
Polarization dependency	±0.05 dB (1.55 µm band, resolution: ≥0.5 nm), ±0.1 dB (1.3 µm band, resolution: ≥0.5 nm)
Dynamic range	70 dB (±1 nm, resolution: 0.07 nm, 1.55 µm band, high-dynamic range mode measurement, 20° to 30°C) 60 dB (±0.5 nm, resolution: 0.07 nm, 1.55 µm band, high-dynamic range mode measurement, 20° to 30°C) 62 dB (±1 nm, resolution: 0.07 nm, 1.55 µm band, normal mode measurement) 58 dB (±0.5 nm, resolution: 0.07 nm, 1.55 µm band, normal mode measurement)
Optical return loss	≥35 dB (1.3/1.55 µm band)
Sweep	Sweep width: 0, 0.2 to 1,200 nm Sweep speed*3 (typical): 0.5 s (sweep width: 500 nm, normal mode measurement, VBW: 10 kHz)
Display	6.4" color TFT-LCD
Memory	A, B (2 trace), 3.5" FDD (for Windows®)
Printer	Internal (thermal type)
Interface	GPIB, RS-232C
Main functions	Optical pulse measurement, power monitor, wavelength auto-calibration
Operating conditions	Operating temperature: 0° to +50°C (FDD: 5° to 50°C), storage temperature: −20° to +60°C, Relative humidity: ≤90% (no condensation)
Operating conditions Power	
. 0	Relative humidity: ≤90% (no condensation)
Power	Relative humidity: ≤90% (no condensation)  85 to 132 Vac/170 to 250 Vac, 47.5 to 63 Hz, 150 VA (max.)

 $<sup>^{\</sup>star 1}\!\!:$  One of these connectors is attached. Please specify when ordering.

<sup>\*2:</sup> Actual screen resolution

<sup>\*3:</sup> Typical value for reference; not guaranteed specification

### ♦ White light source (Option 02)

Optical output	≥-59 dBm/1 nm (multimode/fiber input)*1
Wavelength range	900 to 1600 nm
Operating temperature	18° to 28°C

#### ◆ Wavelength reference & SLD light source (Option 13)

Wavelength range	1450 to 1650 nm
Output level	>-40 dBm/nm (1550 nm ±10 nm)
Output level	>-60 dBm/nm (1450 to 1650 nm)
	±0.04 dB (MS9710B setting resolution:
Output level stability*2	1 nm, no polarization change, constant
Output level stability	temperature, measured for 20 min at
	1550 nm)
Spectrum half width	>70 nm (typical: 90 nm)
Optical connector	User replaceable type (FC, SC, ST,
Optical connector	DIN, HMS-10/A)
Operating temperature	0° to 40°C
Wavelength reference	1530 nm band Acetylene

#### ♦ SLD light source (Option 14)

•	' '
Wavelength range	1450 to 1650 nm
Output level	>-40 dBm/nm (1550 nm ±10 nm)
Output level	>-60 dBm/nm (1450 to 1650 nm)
	±0.04 dB (MS9710B setting resolution:
Output level stability*2	1 nm, no polarization change, constant
	temperature, measured for 20 min at
	1550 nm)
Spectrum half width	>70 nm (typical: 90 nm)
Optical connector	User replaceable type (FC, SC, ST,
Optical confidential	DIN, HMS-10/A)
Operating temperature	0° to 40°C

#### ◆ Wavelength reference light source (Option 05)

•	•	` '	,
Wavelength reference	1530 nm band /	Acetylene	

### VBW, sweep speed, minimum light reception sensitivity\*3

VBW	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz
Sweep speed (typ.)	30 s	5 s	0.5 s	0.5 s	0.5 s	0.5 s
Minimum light reception sensitivity*4	-90 dBm	-80 dBm	-70 dBm	-60 dBm	-50 dBm	-40 dBm

<sup>\*1: -65</sup> dBm (typ.) measured with MS9710B (at 1 nm wavelength resolution) which has single-mode fiber at the input

Note: Warm-up to the MS9710B for about 5 minutes to ensure stable operation.

The above specifications were obtained 2 hours after power-on.

<sup>\*2:</sup> Measured after one hour warm-up

<sup>\*3:</sup> Data for reference; not guaranteed specifications

<sup>\*4:</sup> RMS noise level (1.25 to 1.6 µm)

## **Ordering Information**

Please specify model/order number, name and quantity when ordering.

Model/Order No.	Name	
MS9710B	Main frame Optical Spectrum Analyzer	
F0012 Z0312 W1283AE W1284AE MX971002S MX971002G B0329G	Standard accessories Optical connector adapter*1: Power cord, 2.5 m: Fuse, 3.15 A (for 100/200 Vac system): Printer paper: MS9710B operation manual: Remote control operation manual: LabVIEW® driver (RS-232C): LabVIEW® driver (GPIB): Front cover:	1 pc 1 pc 2 pcs 2 rolls 1 copy 1 copy 1
MS9710B-02 MS9710B-05 MS9710B-06 MS9710B-10 MS9710B-13 MS9710B-13 MS9710B-25 MS9710B-26 MS9710B-27 MS9710B-31 MS9710B-37 MS9710B-38 MS9710B-39 MS9710B-40 MS9710B-40	Options White light source*2 Wavelength reference light source*2 Monitor output Functional addition (Frequency display, ta Wavelength reference & SLD light source SLD light source*2 FC-APC connector*3 SC-APC connector*3 E2000 connector*3 EC (Radial) connector*3 FC connector*4 ST connector*4 DIN connector*4 SC connector*4 HMS-10/A connector*4 HMS-10/A connector*4 HRL-10 connector*3	ble display) *2
J0654A J0655A J0007 J0617B J0618D J0618E J0618F J0619B J0635B Z0282 Z0282 Z0283 Z0284 B0330C	Application parts RS-232C cable 9P-9P RS-232C cable 9P-9P RS-232C cable 9P-25P GPIB cable, 1 m Replaceable optical connector (FC) Replaceable optical connector (DIN) Replaceable optical connector (HMS-10//Replaceable optical connector (SC) FC-PC • FC-PC 2M-SM (FC-PC optical fiber cord, 2 m, SM) Ferrule cleaner Tape for ferrule cleaner (for Z0282) Cleaner for optical adapter (stick type) Tilt stand	N)

<sup>\*1:</sup> Specify the connector to be supplied as the standard connector when ordering the above options. If the connector is not specified, the FC connector (MS9710B-37) is supplied as standard.

Windows® is a registered trademark of Microsoft Corporation. LabVIEW® is a registered trademark of National Instruments.

<sup>\*2:</sup> Factory option; Two units cannot be installed simultaneously. Exchangeable-type optical connectors (FC, SC, ST, DIN, HMS-10/A) are supplied when specified at ordering. One conversion cord is supplied for connecting other optical connectors to the FC connector.

<sup>\*3:</sup> Factory option

<sup>\*4:</sup> User replaceable



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