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OPTICAL TEST SET
MT9810B

CE GPIB

Multipurpose Optical Measuring Instruments Supporting Reference Light Sources



Today, as we turn to photonic communications, a variety of optical communication networks, from core to access, are about to be realized. For this reason, there are a wide variety of performance requirements demanded of optical components and optical communications systems making up these rapidly developing optical communication networks.
And the performance and specifications of the sought after evaluation systems vary depending on the field (development, manufacturing, inspection, maintenance) in which these are developed, supplied and implemented.
The MT9810B Optical Test Set is the most fundamental optical measurement instrument with a complete line-up of light sources (DFB-LD, FP-LD, SLD) and optical sensors (high-speed, general-purpose, high-power).
The evaluation system can be configured to fit the users needs. In addition, by combining the optical test set with peripheral devices such as the optical directional coupler and the optical channel selector, the user can construct even more diverse evaluation systems. The MT9810B is a highly accurate and reliable evaluation system that will respond with flexibility to future diverse measurement needs.

• Light source
The DFB-LD complies with ITU-T recommended wavelengths and highly stable 1.31 µm band, 1.55 µm band FP-LD's are also offered. In addition, an SLD light source with a center wavelength of 1.55 µm and an approximately 40 nm wavelength band is provided.

• Optical sensors
There are three optical sensors: high-sensitivity, general-purpose and high-power. Each has sensor head and plug-in models.

• Measurement conditions saving function
Up to 10 sets of measurement conditions can be saved for each channel, permitting the repetition of measurements.

• Clone function
When the same types of units are mounted in Channels 1 and 2, the measurement conditions for one side can be copied onto the other side.

• Measurement of max., min. and variation of optical power
By mounting an optical sensor, the maximum and minimum values of optical power and the variations in its value can be always displayed, eliminating the need for saving the measured optical power various in the memory. Light source stability and PDL (polarization dependent loss) characteristics can be evaluated in real time.

• Recording measured optical power values
By mounting an optical sensor, a maximum of 1000 power measurement values can be saved per channel. The saved measurement values can be read by remote control, permitting various analyses and processings.

• Variable optical power measurement interval
By mounting an optical sensor, the optimum measurement interval can be set according to the applications (1 ms to 99 h 59 min 59 s); for example, a long interval for a long-duration measurement, and a short interval for high-speed measurement.

• Variable optical power measurement bandwidth
By mounting an optical sensor, the bandwidth can be set according to the measured item; for example, the average pulse optical power can be measured by widening the bandwidth, and the variations in optical power at an optical switch can be measured by narrowing the bandwidth. The setting range is between 0.1 Hz to 100 kHz (MU931311A) or 10 kHz (MU931421A/931422A).

• Relative measurement
By mounting an optical sensor, 0 dB is displayed as the measured value on the display when the relative key (Rel) is pressed. It allows the difference from the reference value to be read directly in the loss measurement of an optical fiber or device.

• Reference measurement
By mounting an optical sensor, a relative value based on a reference value (reference) entered using the keys can be displayed. When the light is incident at a distant location in the loss measurement of an optical fiber, the fiber loss can be read directly by entering the reference value of incident light as a reference.

• Controlling optical channel selector
The MN96xxA Optical Channel Selector can be controlled from the MT9810B Optical Test Set by connecting the two via a dedicated cable. It facilitates the measurement if the optical test set and the optical channel selector are at a distance from each other due to the configuration of the measurement system. The cable lengths are available in the range from 1 to 10 m.

• GPIB and RS-232C I/F as standard
GPIB and RS-232C interfaces are provided as standard, permitting remote control of the measurements via a PC. In addition, the LabVIEW® software driver for remote control is provided as standard, enhancing the construction of a remote measurement system.
∗ LabVIEW® is registered trademark of National Instruments Corporation.

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Light source units

• DFB-LD light source unit

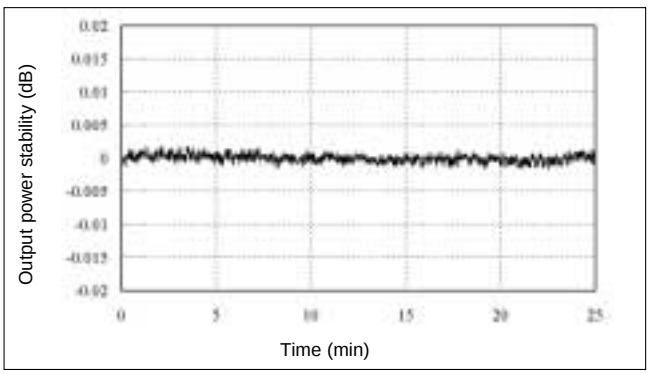
MU952500A/952600A series are 97 wavelengths supporting WDM. The unit is equipped with a high-output and high-stability DFB-LD light source.

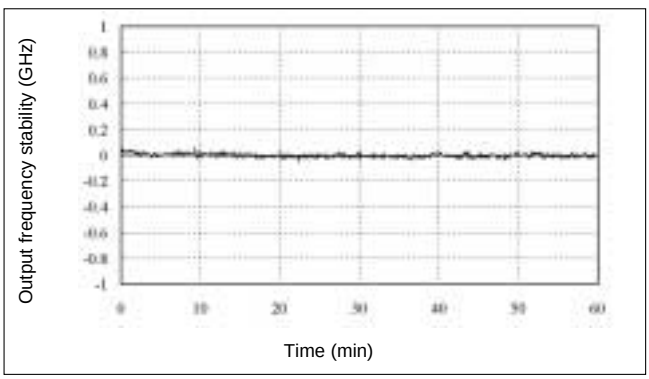
Conforms to wavelengths complying with ITU-T

The unit incorporates a DFB-LD light source that supports D-WDM and complies with ITU-T. Frequencies from 186.3 to 195.9 THz (1609.19 to 1530.33 nm) over a 100 GHz interval are available.

High-power, high-stability

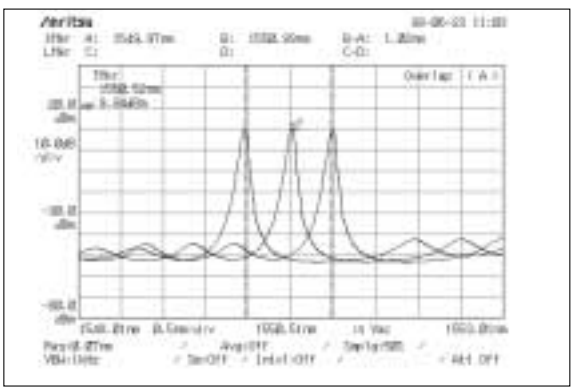
High Power of +10 dBm and high stability of better than or equal to ±0.005 dB are provided. In addition, high stability of better than or equal to ±2 GHz can be achieved for the center frequency (MU952501A/952502A/952503A/952504A/952505A).





Variable optical frequency

The center frequency of the light source can be varied in the maximum range of ±60 GHz (approx. ±0.5 nm). Moreover, the frequency can be displayed in either frequency or wavelength units. This function allows a required frequency to be set between reference grids.



• FP-LD light source units

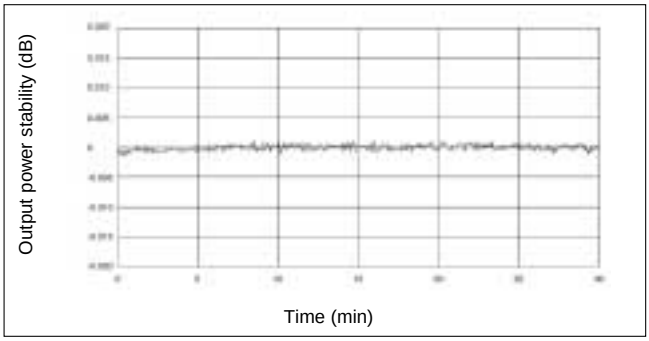
The MU951301A and MU951501A have a wavelength of 1.31 µm and 1.55 µm, respectively. The MU951001A allows the wavelength to be selected as either 1.31 or 1.55 µm.

High-power

The units are general-purpose light sources with a high output of +7 dBm, making them ideal for performing measurements over a high dynamic range.

High-stability

The units provide high output-power stability of better than or equal to ±0.002 dB. They are suitable as light sources for measurements in which high accuracy is required(MU951301A/951501A).



• SLD light source unit

This light source has a center wavelength of 1550 nm and an approximate wavelength band of 40 nm. Optical output power is –3 dBm. The output level is higher than LED light source. A measurement system of MS9710B/C Optical Spectrum Analyzer and SLD light source unit achieves more dynamic range.

On the other hand, when combined with the MN9604C/D Optical Directional Coupler, highly stable reflectance measurements can be performed because of low interference to use SLD light source.

Optical sensor units

High-sensitivity, general-purpose or high-power optical sensors are available. A remote sensor head model and a plug-in model are also provided. Furthermore, besides supporting all optical connectors, the optical input method (connection method) for optical sensors supports bare fiber connection and free-space optical input. The user can select the optical sensor that meets his use environment and purpose.

• General-purpose optical sensor (MU931421A/MU931422A/MA9332A)

MU931421A and MU931422A with measurement ranges of +10 to –80 dBm and MA9332A with a measurement range of +7 to –80 dBm, are highly accurate optical sensors that achieve a measurement accuracy of ±2% and linearity of ±0.01 dB.

MU931422A and MA9332A can be used in measuring fiber with an APC connector, GI fiber and bare fiber. MU931422A is a plug-in model and MA9332A, a sensor head model.

* When using MA9332A, MU931001A or MU931002A sensor adapter is necessary.

• High-power optical sensor (MA9331A/MU931431A)

High-power optical sensors MA9331A and MU931431A have maximum measurement optical inputs of +35 dBm and +33 dBm, respectively. These sensors have NPL (National Physical Laboratory) traceability in conducting calibration at +30 dBm, and are able to measure “high-power” with an even higher level of confidence than conventional high-power optical sensors. And of course all types of corresponding connectors also support fiber with an APC connector, GI fiber and bare fiber. MU931431A is a plug-in model and MA9331A, a sensor head model.

* When using MA9331A, MU931001A sensor adapter is necessary.

For product ordering information, see pages 3 – 6
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Optical input method of the sensor

Item	Model	Type	Various connector	Bare fiber	Space beam
General purpose	MU931421A	Unit	√ *1		
	MU931422A	Unit	√	√	
	MA9332A	Sensor head	√	√	
High power	MU931431A	Unit	√	√	
	MA9331A	Sensor head	√	√	
High sensitivity	MU931311A	Unit	√ *1		
Large diameter PD	MA9333A	Sensor head	√	√	√

∗1: MU931421A/MU931311A does not correspond to MU connector, LC connector, and APC connector.

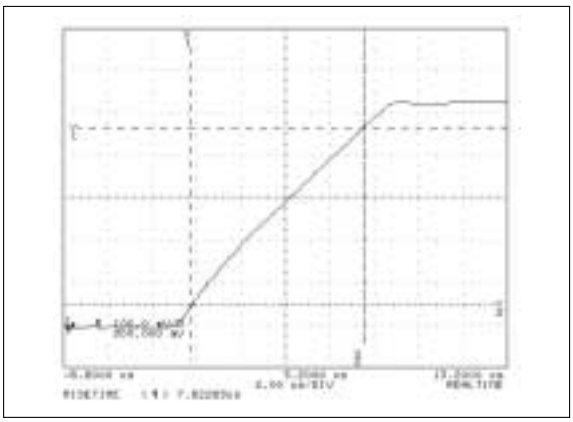
• High-sensitivity optical sensor (MU931311A)
The MU931311A has an optical power range of +10 to –110 dBm and measures high-level to extremely low-level light. It achieves measurement uncertainty of ±2% and linearity of ±0.01 dB. Optical power can be measured with a high degree of accuracy. And of course, this optical sensor is compatible with all connectors.

• Large diameter PD sensor (MA9333A)
This is a sensor head-model optical sensor that has low noise characteristics, and uses an internal photo acceptance unit with a ±5 mm-InGaAs-PD. In addition to SM, GI and POF (plastic fiber), a collimated spatial beam can also be measured directly. This optical sensor also supports bare fiber.
∗ When using MA9333A, MU931002A Sensor Adapter is necessary.

• MA9901A/B Fiber Adapter
Setting can be accomplished without touching the cut fiber edge by using the clamping method, which catches and then fixes the fiber at both ends. Fiber can also be easily attached and removed by pinching the clamp, making this adapter perfect for extended work.

High-resolution optical power measurement
The MT9810B has a panel of high resolution of 1/1000 dB. In addition, the optical power can be measured at a high resolution of 1/10000 dB via GPIB or RS-232C interface.

High-speed analog output
The MU931311A Optical Sensor can send a signal to an analog output terminal with a response speed of approx. 10 µs (The response speed of other optical sensors is approx. 100 µs).



Specifications

• MT9810B Optical Test Set

Display resolution	dBm: 0.001, 0.01, 0.1 dB: 0.001, 0.01, 0.1 W: 5 digits
Display range	–199.999 to +199.999 dBm, ±0.0001 pW to ±10000 W
Display	Fluorescent character display tube, 7 segments (5-1/2 digits), 2 screens, dot matrix (138 x 20 dots), dedicated segments (AUTO, AVG, MOD, CAL, SYS, PRMTR, APPL, REMOTE)
System settings	Remote (GPIB, RS-232C) GPIB: Address RS-232C Data length: 7/8 bits, Stop bit: 1/2 bits Parity bit: None, odd, even Speed: 1200, 2400, 4800, 9600, 14400, 19200 bps Buzzer volume: 4 levels, Contrast: 9 levels Time setting: Year, month, day, hour, minute, second (24 hour display)
Functions	General Settings save: 10 max. (each channel) Settings copy: Between channels (only for same type of unit) Selectable controlled channel Using optical sensor Bar graph display: 60 dots Record measurement: 1000 max. data (each channel) Calculations: Channel subtraction, max./min./(max. – min.) displays, relative value display (measured value reference, numeric value input), calibration value correction
Remote control	GPIB, RS-232C
Laser safety mechanism	Remote inter-lock, optical output control (key control)
Environmental conditions	Operating temperature/humidity: 0˚ to +50˚C/≤90% (no condensation); Storage temperature: –25˚ to +71˚C
Plug-in units	2 max.
LabVIEW® driver	Bundled as standard
Dimensions and mass	213 (W) x 88 (H) x 351 (D) mm, ≤3.5 kg (without units)
Power	100 to 120/200 to 240 Vac (+10%/–15%), ≤70 VA, 47.5 to 63 Hz
EMC	EN61326: 1997/A1: 1998 (Class A) EN61000-3-2: 1995/A2: 1998 (Class A) EN61326: 1997/A1: 1998 (Annex A)
LVD	EN61010-1: 1993/A2: 1995 (Installation Category Ⅱ, Pollution degree 2)

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• **Light sources**

DFB-LD light source

Model	MU952501A/952502A/952503A/952504A/952505A	MU952601A/952602A/952603A/952604A/952605A/952606A
Optical element	DFB-LD	
Applicable optical fiber	SM (ITU-T G.652)	
Specified wavelength range (fp)*1	191.7 to 195.9 THz (1563.86 to 1530.33 nm)	186.3 to 191.6 THz (1609.19 to 1564.68 nm)
Center optical frequency*2	fp ±0.01 THz (approx. ±0.08 nm)	
Spectrum half width*2	≤30 MHz	
Optical output power*2	+10 ±1 dBm	+7 ±1 dBm
Optical power stability	Time stability (short term)*2, *3, *4: ≤±0.005 dB Time stability (long term)*2, *3, *5: ≤±0.02 dB Temperature stability*2, *3, *6: ≤±0.25 dB	Time stability (short term)*2, *3, *4: ≤±0.01 dB Time stability (long term)*2, *3, *5: ≤±0.02 dB Temperature stability*2, *3, *6: ≤±0.25 dB
Center frequency stability	Time stability (short term) *2, *4: ≤±2 GHz (approx. ±0.02 nm) Time stability (long term) *2, *5: ≤±4 GHz (approx. ±0.04 nm)	
Optical frequency tuning	Tuning range: fp ±60 GHz (approx. ±0.48 nm), Step: 1 GHz (approx. 0.01 nm), Accuracy*2: ≤±10 GHz (setting to fp +60 GHz, or fp –60 GHz, 25˚C)	
Internal modulation	Frequency*2: 270 Hz, 1 kHz, 2 kHz ±0.1% Duty: 50% ±5%, Extinction ratio: ≥13 dB	
Optical output attenuation	0.00 to 6.00 dB (0.01 dB steps), accuracy: ≤±0.5 dB (at 25˚C when set to 6.00 dB)	
Laser safety mechanism	IEC60825-1: Class 3A, 21CFR1040.10: Class IIIb	
Optical connector	FC-PC, ST, DIN, HMS-10/A, SC*7 (all PC type)	
Warm-up time	1 h (after optical output on)	
Environmental conditions	Operating temperature/humidity: +15˚ to +35˚C/≤90% (no condensation), Storage temperature: –25˚ to +71˚C	
Dimensions and mass	41 (W) x 78 (H) x 335 (D) mm, ≤700 g	

Note: Wavelengths in vacuum
∗1: Specify an optical frequency (wavelength) and model name from the ordering information.
∗2: At CW, optical attenuation setting (0.00 dB), center optical frequency (fp) using SM fiber (ITU-T G.652) and FC-PC connector
∗3: When return loss seen from light source side is 40 dB min.
∗4: 5 min at constant temperature (at one point 20˚ to 30˚C)
∗5: 1 h at constant temperature
∗6: 8 h at +15˚ to +35˚C
∗7: Specified connector for optical connector option supplied as standard accessory. If connector not specified, FC-PC (Option 37) supplied as standard.

FP-LD light source

Model	MU951301A	MU951501A	MU951001A*1
Optical element	FP-LD		
Fiber	SM (ITU-T G.652)		
Wavelength*2	1310 ±20 nm	1550 ±20 nm	1310/1550 ±20 nm
Spectral half-width*2	≤5 nm	≤10 nm	≤5 nm (1310 nm), ≤10 nm (1550 nm)
Optical output power*2	+7 ±1 dBm		
Optical output power stability	Time stability (short term)*2, *3, *4: ≤±0.002 dB Time stability (long term)*2, *3, *5: ≤±0.02 dB Temperature stability*2, *3, *6: ≤±0.1 dB		Time stability (short term)*2, *3, *4: ≤±0.005 dB Time stability (long term)*2, *3, *5: ≤±0.05 dB Temperature stability*2, *3, *6: ≤±0.15 dB
Internal modulation	Frequency: 270 Hz, 1 kHz, 2 kHz ±0.1%, Duty: 50% ±5%, Extinction ratio: ≥13 dB		
Optical output attenuation	0.00 to 6.00 dB (0.01 dB steps), Accuracy: ≤±0.5 dB (at 25˚C when set to 6.00 dB)		
Laser safety mechanism	IEC60825-1: Class 3A, 21CFR1040.10: Class IIIb		
Optical connector	FC-PC, ST, DIN, HMS-10/A, SC*7 (all PC type)		
Warm-up time	1 h (after optical output on)		
Environmental conditions	Operating temperature/humidity: 0˚ to +50˚C/≤90% (no condensation); Storage temperature: –40˚ to +71˚C (no condensation)		
Dimensions and mass	41 (W) x 78 (H) x 335 (D) mm, ≤700 g		

Note: Wavelengths in vacuum
∗1: Only one MU951001A can be installed into MT9812B.
∗2: At CW, optical attenuation setting (0.00 dB), using SM fiber (ITU-T G.652) and FC-PC connector
∗3: When return loss seen from light source side is 40 dB min.
∗4: 15 min at constant temperature (at one point from 20˚ to 30˚C)
∗5: 6 h at constant temperature
∗6: 8 h at 0˚ to 50˚C
∗7: Specified connector for optical connector option supplied as standard accessory. If connector not specified, FC-PC (Option 37) supplied as standard.

SLD light source

Model	MU954501A
Optical element	SLD
Fiber	SM fiber (ITU-T G.652)
Wavelength*1	1550 ±20 nm
Spectral half-width*1	≥40 nm
Optical output power*1	–3 ±1 dBm

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Optical output power stability	Time stability (short term)*1, *2, *3: ±0.01 dB Time stability (long term)*1, *2, *4: ±0.1 dB Temperature stability*1, *2, *5: ±0.5 dB
Optical output attenuation	0.00 to 6.00 dB (0.01 dB steps), Accuracy: ≤±0.5 dB (at 25˚C when set to 6.00 dB)
Internal modulation	Frequency: 270 Hz, 1 kHz, 2 kHz ±0.1%, Duty: 50% ±5%, Extinction ratio: ≥13 dB
Warm-up time	1 h (after optical output on)
Optical connector*6	FC, ST, DIN, HMS-10/A, SC (all PC type)
Laser safety mechanism	IEC60825-1: Class 1, 21CFR1040.10: Class I
Environmental conditions	Operating temperature/humidity: 0˚ to +50˚C/≤90% (no condensation) Storage Temperature: –40˚ to +71˚C
Dimensions and mass	41 (W) x 78 (H) x 335 (D) mm, ≤700 g

Note: Wavelengths in vacuum, please contact us for 1310 nm SLD light source.
*1: At CW, optical attenuation setting (0.00 dB), using SM fiber (ITU-T G.652) and FC-PC connector
*2: When return loss seen from light source side is 40 dB min.
*3: 15 min at constant temperature
*4: 6 h at constant temperature
*5: 8 h at 0˚ to 50˚C
*6: Specified connector for optical connector option supplied as standard accessory. If connector not specified, FC-PC (Option 37) supplied as standard.

Laser product safety protection
The MU952501A/952502A/952503A/952504A/952505A, MU952601A/952602A/952603A/952604A/952605A/952606A, MU951301A/951501A/951001A, and MU954501A are laser products and safety protection conforming to optical safety standards IEC 60825-1 and 21CFR1040.10 (USA) is incorporated; the following warning label is affixed to the product.

• 21CFR1040.10 warning label

MU952501A/952502A/952503A/952504A/952505A



MU951501A



MU952601A/952602A/952603A/952604A/952605A/952606A



MU951001A

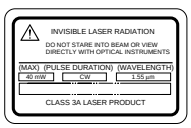


MU951301A

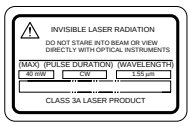


• IEC 60825-1 warning label

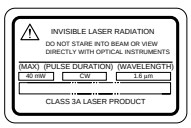
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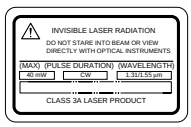
MU951501A



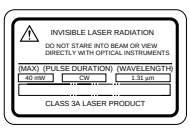
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MU951001A



MU951301A



MU954501A



• Optical sensors (unit)

Model	MU931311A	MU931421A	MU931422A
Element	InGaAs-PD		
Input type	Fiber		
Applicable optical fiber	SM (ITU-T G.652)		9/125 to 62.5/125 μm (NA: ≤0.29) PC, APC polish conformity
Wavelength range	800 to 1600 nm	750 to 1700 nm	
Optical power measurement range*1	CW: +10 to –110 dBm MOD: +7 to –90 dBm	CW: +10 to –80 dBm MOD: +7 to –90 dBm	
Noise level*2	≤–93 dBm	≤–73 dBm	
Polarization dependency*3	≤±0.01 dB		≤±0.025 dB
Return loss*3	≥40 dB		—
Optical power measurement uncertainty	Reference conditions*4: ±2%, Operating conditions*5: ±3.5%		

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Model	MU931311A	MU931421A	MU931422A
Linearity*6	±0.05 dB (+10 to 0 dBm) ±0.01 dB ±0.3 pW (0 to –90 dBm)	±0.05 dB (+10 to 0 dBm) ±0.01 dB ±30 pW (0 to –70 dBm)	
Calibration factor input	–99.999 to +99.999 dB		
Wavelength sensitivity correction	Measurement wavelength input in 0.01 nm units		
Zero set operation	Automatic zero calibration		
Range select	Auto, manual		
Modulated light reception	CW/MOD selectable, MOD: 270 Hz, 1 kHz, 2 kHz		
Measurement interval*7	1, 10, 20, 50, 100, 200, 500 ms, 1 s to 99 h 59 min 59 s		
Average setting	Off, 2, 5, 10, 20, 50, 100, 200, 500, 1000 times		
Analog output*8	Approx. +2 V		
Bandwidth select*9	Auto, manual Manual setting: 0.1, 1, 10, 100 Hz, 1, 10, 100 kHz (CW mode only)	Auto, manual Manual setting: 0.1, 1, 10, 100 Hz, 1, 10 kHz (CW mode only)	
Optical connector*10	FC-PC, ST, DIN, HMS-10/A, SC (all PC type)		FC, ST, DIN, HMS-10/A, SC, MU, LC
Environmental conditions	Operating temperature/humidity: 0˚ to +50˚C/≤90% (no condensation), Storage temperature/humidity: –40˚ to +71˚C/≤95% (no condensation)		
Dimensions and mass	41 (W) x 78 (H) x 335 (D) mm, ≤700 g	41 (W) x 78 (H) x 335 (D) mm, ≤550 g	

∗1 Wavelength: 1300 nm
∗2 Measurement interval: 100 ms, average: 10 times, peak to peak noise, wavelength: 1300 nm
∗3 SM fiber (ITU-T G.652), return loss: ≥45 dB, wavelength: 1550 nm
∗4 Reference conditions
SM fiber (ITU-T G.652), master FC connector
Power level: 100 µW (–10 dBm), CW light, wavelength: 1300 nm, ambient temperature: 23˚ ±2˚C, at day of calibration,
Warm-up: 1 h (MU931311A) and 30 min (MU931421A/931422A)
∗5 Operating conditions
SM Fiber (ITU-T G.652), master FC connector, CW light, any wavelength in 1000 to 1600 nm (MU931311A) and 1000 to 1650 nm (MU931421A/931422A), power level: 100 µW (–10 dBm), ambient
temperature: 23˚ ±5˚C, within 1 year after calibration, warm-up: 1 h (MU931311A) and 30 min (MU931421A/931422A), Uncertainty increase by 1% if either an APC connector or NA ≤0.29 fiber is used with the MU931422A.
∗6 Measurement conditions: Constant temperature within 23˚ ±5˚C, bandwidth: auto/0.1/1/10 Hz, any wavelength in 1000 to 1600 nm (MU931311A) and 1000 to 1650 nm (MU931421A/931422A), CW light, power level: 100 µW (–10 dBm) reference, warm-up: 1 h (MU931311A) and 30 min (MU931421A/931422A)
∗7 Only record measurements for measurement interval of ≤100 ms
∗8 Full-scale value for each measurement range
∗9 Approx. 3 dB bandwidth. Response time at bandwidth setting of 100 kHz varies according to analog output amplitude
∗10 Specify connector for optical connector option supplied as standard accessory. If connector not specified, FC-PC (Option 37) supplied as standard.

• Optical sensor (sensor head)

Model	MU931001A + MA9332A	MU931002A + MA9332A/MA9333A
Element	InGaAs-PD	
Input type	Fiber	
Applicable optical fiber	9/125 to 62.5/125 µm (NA: ≤0.29), PC, APC polish conformity	
Wavelength range	750 to 1700 nm	
Optical power measurement range*1	CW: +7 to –80 dBm, MOD: +4 to –70 dBm	CW: +7 to –80 dBm
Noise level*2	≤–73 dBm	
Polarization dependency*3	≤±0.017 dB (MA9332A), ≤±0.013 dB (MA9333A)	
Optical power measurement accuracy	Reference conditions*4: ±2%, Operating conditions*5: ±3.5%	
Linearity*6	±0.05 dB (+7 to 0 dBm), ±0.01 dB ±30 pW (0 to –70 dBm)	
Zero set operation	Automatic zero calibration	
Wavelength sensitivity correction	Measurement wavelength input in 0.01 nm units	
Modulated light reception	CW/MOD selectable, MOD: 270 Hz, 1 kHz, 2 kHz	—
Measurement interval*7	1 ms to 99 h 59 min 59 s	
Average setting	2 to 1000 times	
Analog output*8	Approx. +2 V	
Bandwidth select*9	Auto, manual Manual setting: 0.1, 1, 10, 100 Hz, 1, 20 kHz (CW mode only)	Auto, manual Manual setting: 1, 10, 100 Hz, 1, 20 kHz (CW mode only)
Optical connector*10	FC, ST, DIN, HMS-10/A, SC, MU, LC	
Environmental conditions	Operating temperature/humidity: 0˚ to +50˚C/≤90% (no condensation) Storage temperature/humidity: –40˚ to +71˚C/≤95% (no condensation)	
Dimensions and mass	MU931001A/MU931002A: 41 (W) x 78 (H) x 335 (D) mm, ≤500 g MA9332A/MA9333A: 65 (W) x 80 (H) x 110 (D) mm, ≤750 g	

∗1 Wavelength: 1550 nm
∗2 Measurement interval: 100 ms, average: 10 times, peak to peak noise, wavelength: 1550 nm
∗3 SM fiber (ITU-T G.652), power level: 100 µW (–10 dBm), return loss: ≥45 dB, wavelength: 1550 nm

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∗4 Reference conditions
SM fiber (ITU-T G.652), master FC connector
Power level: 100 µW (–10 dBm), CW light, wavelength: 1550 nm, ambient temperature: 23˚ ±2˚C
At day of calibration, warm-up: 30 min, 1 h (when using MA9333A)
∗5 Operating conditions
SM Fiber (ITU-T G.652), master FC connector, power level: 100 µW (–10 dBm)
CW light, wavelength: 1000 to 1650 nm, ambient temperature: 23˚ ±5˚C, within 1 year after calibration
warm-up: 30 min, 1 h (when using MA9333A)
Uncertainty increase by 1% if either an APC connector or NA ≤0.29 fiber is used.
∗6 Measurement conditions
Constant temperature within 23˚ ±5˚C, any wavelength in 1000 to 1650 nm, CW light, power level: 100 µW (–10 dBm) reference
Bandwidth: auto/0.1/1/10 Hz (0.1 Hz: MU931001A only), warm-up: 30 min, 1 h (when using MA9333A)
∗7 Only record measurements for measurement interval of ≤20 ms
∗8 Full-scale value for each measurement range
∗9 Approx. 3 dB bandwidth
∗10 Specify connector for optical connector option supplied as standard accessory. If connector not specified, FC (Option 37) supplied as standard.

• Optical sensor (high-power)

Model	MU931001A + MA9331A	MU931431A
Element	InGaAs-PD	
Input type	Fiber	
Applicable optical fiber	9/125 to 62.5/125 µm (NA: ≤0.29), PC, APC polish conformity	
Wavelength range	940 to 1640 nm	
Optical power measurement range*1	CW: +35 to –50 dBm	CW: +33 to –50 dBm
Noise level*2	≤–43 dBm	
Polarization dependency*3	PC connector: ≤±0.005 dB, APC connector: ≤±0.025 dB	PC connector: ≤±0.025 dB, APC connector: ≤±0.05 dB
Optical power measurement accuracy	Reference conditions*4: ±3%, Operating conditions*5: ±4%	Reference conditions*4: ±4%, Operating conditions*5: ±5%
Linearity*6	±0.05 dB ±30 nW (+35 to –40 dBm)	±0.05 dB ±30 nW (+33 to –40 dBm)
Zero set operation	Automatic zero calibration	
Wavelength sensitivity correction	Measurement wavelength input in 0.01 nm units	
Measurement interval*7	1 ms to 99 h 59 min 59 s	
Average setting	2 to 1000 times	
Analog output*8	Approx. +2 V	
Bandwidth select*9	Auto, manual Manual setting: 0.1, 1, 10, 100 Hz, 1, 20 kHz	
Optical connector*10	FC, ST, DIN, HMS-10/A, SC, MU, LC	
Environmental conditions	Operating temperature/humidity: 0˚ to +40˚C/≤90% (no condensation) Storage temperature/humidity: –40˚ to +71˚C/≤95% (no condensation)	
Dimensions and mass	MU931001A: 41 (W) x 78 (H) x 335 (D) mm, ≤500 g MA9331A: 65 (W) x 80 (H) x 110 (D) mm, ≤750 g	41 (W) x 78 (H) x 335 (D) mm, ≤880 g

∗1 Wavelength: 1550 nm
∗2 Measurement interval: 100 ms, average: 10 times, peak to peak noise, wavelength: 1550 nm
∗3 SM fiber (ITU-T G.652), return loss: ≥45 dB, wavelength: 1550 nm
∗4 Reference conditions,
Connector adapter, SM fiber (ITU-T.G.652), APC connector
Power level 1 W (+30 dBm), CW light, and wavelength 1550 nm
Ambient temperature 23 ±2˚C, humidity 60 % ±10 %
Warm-up time 30 minutes, day of calibration.
∗5 Operating conditions
Connector adapter, SM fiber (ITU-T G.652), APC connector, power level: 1 W (30 dBm)
CW light, wavelength: 980 ±1 nm, 1240 to 1340 nm, 1440 to 1640 nm
Ambient temperature: 23˚ ±5˚C, within 6 months after calibration
warm-up: 30 min
Uncertainty increase by 1% if either NA ≤0.29 fiber is used.
2 % added when wavelength besides above are used (However, humidity 60 % ±10 %)
∗6 Measurement conditions
Constant temperature within 23˚ ±5˚C, any wavelength in 1000 to 1650 nm, CW light, power level: 1 W (+30 dBm) reference
Bandwidth: auto/0.1/1/10 Hz, warm-up: 30 min
∗7 Only record measurements for measurement interval of ≤20 ms
∗8 Full-scale value for each measurement range
∗9 Approx. 3 dB bandwidth
∗10 Specify connector for optical connector option supplied as standard accessory.
If connector not specified, FC (Option 37) supplied as standard.

• MA9901A Fiber Adapter

Fiber	ø250 µm strand (Clad diameter: ø125 mm)
Dimensions and mass	20 (W) x 22.5 (H) x 29.5 (D) mm, ≤30 g

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Ordering information

Specify the model order number, name and quantity when ordering.

Model/Order No.	Name	
	Main frame	
MT9810B	Optical Test Set	
	Standard accessories	
W1886AE	MT9810B operation manual:	1 copy
W1887AE	MT9810B remote control operation manual:	1 copy
J0895	RCA short pin (for remote inter-lock):	1 pc
J0896	RCA plug (for remote inter-lock):	1 pc
Z0391	Key (for laser output control):	2 pcs
F0011	Fuse, 2 A (for 100 to 120 Vac):	2 pcs
F0008	Fuse, 1 A (for 200 to 240 Vac):	2 pcs
	Power cord, 2.6 m:	1 pc
B0425	Blank panel:	1 pc
	Application parts	
J0006	GPIB cable, 0.5 m	
J0007	GPIB cable, 1 m	
J0008	GPIB cable, 2 m	
J0009	GPIB cable, 4 m	
J0655A	RS-232C cable (9P-25P, cross)	
J0654A	RS-232C cable (9P-9P, cross)	
J0897B	8P modular cable, 1 m	
J0897C	8P modular cable, 2 m	
J0897D	8P modular cable, 5 m	
J0897E	8P modular cable, 10 m	
B0438B	Rack mount Kit	
B0438	Rack mount Kit	
B0425	Blank panel	
B0427	Protect cover	
	[Light sources]	
	Main frame	
MU952501A	DFB-LD Light Source*1	
MU952502A	DFB-LD Light Source*1	
MU952503A	DFB-LD Light Source*1	
MU952504A	DFB-LD Light Source*1	
MU952505A	DFB-LD Light Source*1	
MU952601A	DFB-LD Light Source*1	
MU952602A	DFB-LD Light Source*1	
MU952603A	DFB-LD Light Source*1	
MU952604A	DFB-LD Light Source*1	
MU952605A	DFB-LD Light Source*1	
MU952606A	DFB-LD Light Source*1	
MU951301A	FP-LD Light Source	
MU951501A	FP-LD Light Source	
MU951001A	Switchable FP-LD Light Source	
	Standard accessory	
	Optical connector adapter*2	
	Options	
MU952501A-01	Light source (fp: 193.10 THz, 1552.52 nm)	
MU952501A-02	Light source (fp: 193.20 THz, 1551.72 nm)	
MU952501A-03	Light source (fp: 193.30 THz, 1550.92 nm)	
MU952501A-04	Light source (fp: 193.40 THz, 1550.12 nm)	
MU952501A-05	Light source (fp: 193.50 THz, 1549.32 nm)	
MU952501A-06	Light source (fp: 193.60 THz, 1548.51 nm)	
MU952501A-07	Light source (fp: 193.70 THz, 1547.72 nm)	
MU952501A-08	Light source (fp: 193.80 THz, 1546.92 nm)	
MU952501A-09	Light source (fp: 193.90 THz, 1546.12 nm)	
MU952501A-10	Light source (fp: 194.00 THz, 1545.32 nm)	
MU952502A-01	Light source (fp: 192.10 THz, 1560.61 nm)	
MU952502A-02	Light source (fp: 192.20 THz, 1559.79 nm)	
MU952502A-03	Light source (fp: 192.30 THz, 1558.98 nm)	
MU952502A-04	Light source (fp: 192.40 THz, 1558.17 nm)	
MU952502A-05	Light source (fp: 192.50 THz, 1557.36 nm)	
MU952502A-06	Light source (fp: 192.60 THz, 1556.55 nm)	
MU952502A-07	Light source (fp: 192.70 THz, 1555.75 nm)	
MU952502A-08	Light source (fp: 192.80 THz, 1554.94 nm)	
MU952502A-09	Light source (fp: 192.90 THz, 1554.13 nm)	
MU952502A-10	Light source (fp: 193.00 THz, 1553.33 nm)	
MU952503A-07	Light source (fp: 191.70 THz, 1563.86 nm)	
MU952503A-08	Light source (fp: 191.80 THz, 1563.05 nm)	
MU952503A-09	Light source (fp: 191.90 THz, 1562.23 nm)	
MU952503A-10	Light source (fp: 192.00 THz, 1561.42 nm)	
MU952504A-01	Light source (fp: 194.10 THz, 1544.53 nm)	
MU952504A-02	Light source (fp: 194.20 THz, 1543.73 nm)	
MU952504A-03	Light source (fp: 194.30 THz, 1542.94 nm)	
MU952504A-04	Light source (fp: 194.40 THz, 1542.14 nm)	
MU952504A-05	Light source (fp: 194.50 THz, 1541.35 nm)	
MU952504A-06	Light source (fp: 194.60 THz, 1540.56 nm)	
MU952504A-07	Light source (fp: 194.70 THz, 1539.77 nm)	
MU952504A-08	Light source (fp: 194.80 THz, 1538.98 nm)	
MU952504A-09	Light source (fp: 194.90 THz, 1538.19 nm)	
MU952504A-10	Light source (fp: 195.00 THz, 1537.40 nm)	
MU952505A-01	Light source (fp: 195.10 THz, 1536.61 nm)	
MU952505A-02	Light source (fp: 195.20 THz, 1535.82 nm)	
MU952505A-03	Light source (fp: 195.30 THz, 1535.04 nm)	
MU952505A-04	Light source (fp: 195.40 THz, 1534.25 nm)	
MU952505A-05	Light source (fp: 195.50 THz, 1533.47 nm)	
MU952505A-06	Light source (fp: 195.60 THz, 1532.68 nm)	
MU952505A-07	Light source (fp: 195.70 THz, 1531.90 nm)	
MU952505A-08	Light source (fp: 195.80 THz, 1531.12 nm)	
MU952505A-09	Light source (fp: 195.90 THz, 1530.33 nm)	
MU952601A-01	Light source (fp: 191.10 THz, 1568.77 nm)	
MU952601A-02	Light source (fp: 191.20 THz, 1567.95 nm)	
MU952601A-03	Light source (fp: 191.30 THz, 1567.13 nm)	
MU952601A-04	Light source (fp: 191.40 THz, 1566.31 nm)	
MU952601A-05	Light source (fp: 191.50 THz, 1565.50 nm)	
MU952601A-06	Light source (fp: 191.60 THz, 1564.68 nm)	
MU952602A-01	Light source (fp: 190.10 THz, 1577.03 nm)	
MU952602A-02	Light source (fp: 190.20 THz, 1576.20 nm)	
MU952602A-03	Light source (fp: 190.30 THz, 1575.37 nm)	
MU952602A-04	Light source (fp: 190.40 THz, 1574.54 nm)	
MU952602A-05	Light source (fp: 190.50 THz, 1573.71 nm)	
MU952602A-06	Light source (fp: 190.60 THz, 1572.89 nm)	
MU952602A-07	Light source (fp: 190.70 THz, 1572.06 nm)	
MU952602A-08	Light source (fp: 190.80 THz, 1571.24 nm)	
MU952602A-09	Light source (fp: 190.90 THz, 1570.42 nm)	
MU952602A-10	Light source (fp: 191.00 THz, 1569.59 nm)	
MU952603A-01	Light source (fp: 189.10 THz, 1585.36 nm)	
MU952603A-02	Light source (fp: 189.20 THz, 1584.53 nm)	
MU952603A-03	Light source (fp: 189.30 THz, 1583.69 nm)	
MU952603A-04	Light source (fp: 189.40 THz, 1582.85 nm)	
MU952603A-05	Light source (fp: 189.50 THz, 1582.02 nm)	
MU952603A-06	Light source (fp: 189.60 THz, 1581.18 nm)	
MU952603A-07	Light source (fp: 189.70 THz, 1580.35 nm)	
MU952603A-08	Light source (fp: 189.80 THz, 1579.52 nm)	
MU952603A-09	Light source (fp: 189.90 THz, 1578.69 nm)	
MU952603A-10	Light source (fp: 190.00 THz, 1577.86 nm)	
MU952604A-01	Light source (fp: 188.10 THz, 1593.79 nm)	
MU952604A-02	Light source (fp: 188.20 THz, 1592.95 nm)	
MU952604A-03	Light source (fp: 188.30 THz, 1592.10 nm)	
MU952604A-04	Light source (fp: 188.40 THz, 1591.26 nm)	
MU952604A-05	Light source (fp: 188.50 THz, 1590.41 nm)	
MU952604A-06	Light source (fp: 188.60 THz, 1589.57 nm)	
MU952604A-07	Light source (fp: 188.70 THz, 1588.73 nm)	
MU952604A-08	Light source (fp: 188.80 THz, 1587.88 nm)	
MU952604A-09	Light source (fp: 188.90 THz, 1587.04 nm)	
MU952604A-10	Light source (fp: 189.00 THz, 1586.20 nm)	
MU952605A-01	Light source (fp: 187.10 THz, 1602.31 nm)	
MU952605A-02	Light source (fp: 187.20 THz, 1601.46 nm)	
MU952605A-03	Light source (fp: 187.30 THz, 1600.60 nm)	
MU952605A-04	Light source (fp: 187.40 THz, 1599.75 nm)	
MU952605A-05	Light source (fp: 187.50 THz, 1598.89 nm)	
MU952605A-06	Light source (fp: 187.60 THz, 1598.04 nm)	
MU952605A-07	Light source (fp: 187.70 THz, 1597.19 nm)	
MU952605A-08	Light source (fp: 187.80 THz, 1596.34 nm)	
MU952605A-09	Light source (fp: 187.90 THz, 1595.49 nm)	
MU952605A-10	Light source (fp: 188.00 THz, 1594.64 nm)	
MU952606A-03	Light source (fp: 186.30 THz, 1609.19 nm)	
MU952606A-04	Light source (fp: 186.40 THz, 1608.33 nm)	
MU952606A-05	Light source (fp: 186.50 THz, 1607.47 nm)	
MU952606A-06	Light source (fp: 186.60 THz, 1606.60 nm)	
MU952606A-07	Light source (fp: 186.70 THz, 1605.74 nm)	
MU952606A-08	Light source (fp: 186.80 THz, 1604.88 nm)	
MU952606A-09	Light source (fp: 186.90 THz, 1604.03 nm)	
MU952606A-10	Light source (fp: 187.00 THz, 1603.17 nm)	
	Applications parts	
J0617B	Replaceable optical connector (FC, user replaceable)	
J0618D	Replaceable optical connector (ST, user replaceable)	
J0618E	Replaceable optical connector (DIN, user replaceable)	
J0618F	Replaceable optical connector (HMS-10/A, user replaceable)	
J0619B	Replaceable optical connector (SC, user replaceable)	
Z0282	Ferrule cleaner	
Z0283	Ferrule cleaning tape (6 pcs/set)	
Z0284	Adapter cleaner (stick type, 200 pcs/set)	
	Main frame	
MU954501A	SLD Light Source	
	Standard accessory	
	Optical connector adapter*2	
W2023AE	MU954501A instruction manual	

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Model/Order No.	Name
	Applications parts
J0617B	Replaceable optical connector (FC, user replaceable)
J0618D	Replaceable optical connector (ST, user replaceable)
J0618E	Replaceable optical connector (DIN, user replaceable)
J0618F	Replaceable optical connector (HMS-10/A, user replaceable)
J0619B	Replaceable optical connector (SC, user replaceable)
Z0282	Ferrule cleaner
Z0283	Ferrule cleaning tape (6 pcs/set)
Z0284	Adapter cleaner (stick type, 200 pcs/set)
	[Optical sensor]
	Main frame
MU931311A	Optical Sensor
MU931421A	Optical Sensor
	Standard accessory
	Optical connector adapter*2
	Applications parts
J0617B	Replaceable optical connector (FC, user replaceable)
J0618D	Replaceable optical connector (ST, user replaceable)
J0618E	Replaceable optical connector (DIN, user replaceable)
J0618F	Replaceable optical connector (HMS-10/A, user replaceable)
J0619B	Replaceable optical connector (SC, user replaceable)
Z0282	Ferrule cleaner
Z0283	Ferrule cleaning tape (6 pcs/set)
Z0284	Adapter cleaner (stick type, 200 pcs/set)
J0635B	Optical fiber cord (both-end FC-PC type with connector, RL >50 dB, SM), 2 m
MZ8012A	Connector Cleaning Set
J0127A	Coaxial cord (BNC-P · RG-58A/U · BNC-P), 1 m
J0003A	Coaxial cord (SMA-P · 3D-2W · SMA-P), 1 m
J0901A	HRM-517 (09) conversion connector (SMA-P · BNC-J)
J0902A	HRM-518 (09) conversion connector (SMA-J · BNC-P)
	Main frame
MU931422A	Optical Sensor (MA9005A Connector Adapter attached)
	Standard accessory
	Optical connector adapter (for MU931311A/931421A)*2
W1624AE	MU931422A operation manual
	Applications parts
MA9005A-32	Connector adapter (MU, user replaceable)
MA9005A-33	Connector adapter (LC, user replaceable)
MA9005A-37	Connector adapter (FC, user replaceable)
MA9005A-38	Connector adapter (ST, user replaceable)
MA9005A-39	Connector adapter (DIN, user replaceable)
MA9005A-40	Connector adapter (SC, user replaceable)
MA9005A-43	Connector adapter (HMS-10/A, user replaceable)
MA9013A	Fiber Adapter (for bare fiber)
MA9901A	Fiber Adapter (for bare fiber)
MA9902A	Connector Adapter (for MA9901A)
Z0282	Ferrule cleaner
Z0283	Ferrule cleaning tape (6 pcs/set)
Z0284	Adapter cleaner (stick type, 200 pcs/set)
J0635B	Optical fiber cord (both-end FC-PC type, with connector, RL >50 dB, SM), 2 m
MZ8012A	Connector Cleaning Set
J0127A	Coaxial cord (BNC-P · RG-58A/U · BNC-P), 1 m
J0003A	Coaxial cord (SMA-P · 3D-2W · SMA-P), 1 m
J0901A	HRM-517 (09) conversion connector (SMA-P · BNC-J)
J0902A	HRM-518 (09) conversion connector (SMA-J · BNC-P)
	Main frame
MU931431A	Optical Sensor
	Standard accessory
	Optical connector adapter*2
W1896AE	MU931431A operation manual
	Applications parts
MA9005B-32	Connector adapter (MU, user replaceable)
MA9005B-33	Connector adapter (LC, user replaceable)
MA9005B-37	Connector adapter (FC, user replaceable)
MA9005B-38	Connector adapter (ST, user replaceable)
MA9005B-39	Connector adapter (DIN, user replaceable)
MA9005B-40	Connector adapter (SC, user replaceable)
MA9005B-43	Connector adapter (HMS-10/A, user replaceable)
MA9013A	Fiber Adapter (for bare fiber)
MA9901B	Fiber Adapter (for bare fiber)
MA9902B	Connector Adapter (for MA9901B)
J0178A	AG adapter
J0952A	Conversion cord (FC · PC-FC · APC), 1 m
J0954A	Conversion cord (SC · PC-SC · APC), 1 m

Model/Order No.	Name
	Main frame
MA9331A	Optical Sensor
	Standard accessory
	Optical connector adapter*2
	Applications parts
MA9008A-32	Connector adapter (MU, user replaceable)
MA9008A-33	Connector adapter (LC, user replaceable)
MA9008A-37	Connector adapter (FC, user replaceable)
MA9008A-38	Connector adapter (ST, user replaceable)
MA9008A-39	Connector adapter (DIN, user replaceable)
MA9008A-40	Connector adapter (SC, user replaceable)
MA9008A-43	Connector adapter (HMS-10/A, user replaceable)
MA9013A	Fiber Adapter
MA9901B	Fiber Adapter
MA9903A	Connector Adapter (for MA9901B)
Z0282	Ferrule cleaner
Z0283	Ferrule cleaning tape (6 pcs/set)
Z0284	Adapter cleaner (stick type, 200 pcs/set)
MZ8012A	Connector Cleaning Set
	Main frame
MA9332A	Optical Sensor
MA9333A	Optical Sensor
	Standard accessory
	Optical connector adapter*2
	Applications parts
MA9005A-32	Connector adapter (MU, user replaceable)
MA9005A-33	Connector adapter (LC, user replaceable)
MA9005A-37	Connector adapter (FC, user replaceable)
MA9005A-38	Connector adapter (ST, user replaceable)
MA9005A-39	Connector adapter (DIN, user replaceable)
MA9005A-40	Connector adapter (SC, user replaceable)
MA9005A-43	Connector adapter (HMS-10/A, user replaceable)
MA9013A	Fiber Adapter (for bare fiber)
MA9901A	Fiber Adapter (for bare fiber)
MA9902A	Connector Adapter (for MA9901A)
Z0282	Ferrule cleaner
Z0283	Ferrule cleaning tape (6 pcs/set)
Z0284	Adapter cleaner (stick type, 200 pcs/set)
MZ8012A	Connector Cleaning set
	[Sensor adapter]
	Main frame
MU931001A	Sensor Adapter
	Standard accessory
J1073A	Optical sensor connect cable, 1.5 m
W1895AE	MU931001A/MA9331A/MA9332A operation manual
	Applications parts
J0127A	Coaxial cord (BNC-P · RG-58A/U · BNC-P), 1 m
J0003A	Coaxial cord (SMA-P · 3D-2W · SMA-P), 1 m
J0901A	HRM-517 (09) conversion connector (SMA-P · BNC-J)
J0902A	HRM-518 (09) conversion connector (SMA-J · BNC-P)
	Main frame
MU931002A	Sensor Adapter
	Standard accessory
J1073A	Optical sensor connect cable, 1.5 m
	Applications parts
J0127A	Coaxial cord (BNC-P · RG-58A/U · BNC-P), 1 m
J0003A	Coaxial cord (SMA-P · 3D-2W · SMA-P), 1 m
J0901A	HRM-517 (09) conversion connector (SMA-P · BNC-J)
J0902A	HRM-518 (09) conversion connector (SMA-J · BNC-P)
	Optical connector options (for light sources and optical sensors)
[Model]-32	MU connector (user replaceable)
[Model]-33	LC connector (user replaceable)
[Model]-37	FC connector (user replaceable)
[Model]-38	ST connector (user replaceable)
[Model]-39	DIN connector (user replaceable)
[Model]-40	SC connector (user replaceable)
[Model]-43	HMS-10/A connector (user replaceable)

∗1: Specify an optical frequency (wavelength) and model name when ordering.
∗2: When ordering, the option specified connector is supplied as standard. Specified the option number after the light source or optical sensor model number. If a connector is not specified, a FC (Option 37) connector is supplied as standard. These are applied to DFB-LD unit, FP-LD unit, SLD unit and optical sensor. However, MU and LC connecter option are only apply to MU931422A, MA9331A, MA9332A and MA9333A.

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