Optical Measuring Instruments and Optical Device Test Systems

High-Accuracy, High-Sensitivity and High-Speed Optical Power Meter

Q8221

- **Various Optical Sensors and Light Sources Available**
- **High Accuracy :**
  ± 2.5% (at the Calibration Point)
  ± 4.5% (over the entire Wavelength Range)
  Linearity: ± 0.5%
- **Low Polarization Dependence :0.003 dB_{p-p}**
- **High Sensitivity : -94 dBm**
- **High Power Input Level : +27 dBm**
- **High Speed Measurement :**
  Sampling Rate of 100 times/sec

Q8221
Optical Multi Power Meter

■ Two-Channel Plug-In System

The Q8821 employs a two-channel plug-in system. Various optical sensors and light sources are available as plug-in units. The two channels of the Q8221 can be used individually or simultaneously. Free combination of optical sensors and light sources enables diverse applications.

■ Ensures Accuracy Over the Entire Range of Power and Wavelength

The optical sensors for Q8221 assure high accuracy of ±2.5% at calibration point. In broad band wavelength region, they assure ±4.5% accuracy by compensating the sensitivity curve over wavelengths of each sensors. Further more, the linearity of ±0.5% is assured. Not only at the calibration point, these sensors also assure at the broad band wavelength region and the level to be measured.

* Calibrations of Q82208,Q82215 and Q82216 at 1550 nm are also available as options (OPT.25).

■ Noise Level : -94 dBm

The Q82208 and Q82232 Optical Sensors achieve high sensitivity by cooling the InGaAs photo-diode. The Q82208 especially achieves -94 dBm. High power can be measured with high linearity up to +10 dBm .

■ Low Polarization Dependency Optical Sensors (Q82232) : 0.003 dBp-p or less

The Q82232 Optical Sensor achieves low polarization dependence of 0.003 dBp-p. By combining with Q8163 Polarization Scrambler, it can be used for high-speed and high precision PDL measurement of the optical devices.

■ Sensors with Less Reflection and High-Return-Loss Adaptor with Minimum Reflection

The Q82208 Optical Sensor uses optical fiber with slant polished ends to suppress reflection (return loss of 50 dB or more). When using a PC polished connector, a high return loss of 45 dB or more can be obtained with the low-loss, high-return-loss adaptor (typical return loss without this adaptor is 14 dB). This sensors fit optical fibers with a core diameter of 10 µm with NA 0.19 or less, making them suitable for measurement of dispersion shift fibers. FC, SC, ST, MU, LC and plug-in connectors are available.

■ High-Speed, High-Throughput Measurement. Max. 100 times/sec.

For all sensors, the Q8221 achieves a sampling speed of 100 times/sec. and a ranging speed (time required to move to a different range) of a maximum of 500 msec (minimum 20 msec). In addition, GPIB output can be transferred at a high speed of 100 times/sec., thus dramatically increasing the throughput of production lines.

■ Recording Function, PDL Measurement Function

Q8221 is capable of storing data containing 400 points with the A and B channels independently. Furthermore, stored data can be directly output to an external plotter as a graph. Also, PDL measurement is very easy with Q8221, because Q8221 can display maximum and minimum values as well as the difference between the maximum and minimum values of the measured data.

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- **Q81212 Light Source Plug-In Unit Specifications**

Photoemittion element : FFP-LD
Wavelength : 1550 ± 20 nm
Spectrum half value : 10 nm or less
Output power : 0 ± 1 dBm*[1]
Output power(Variable) : 0 to -6 dB, in 0.1 dB steps
Stability :
(23 ± 1˚C/1min) ; ± 0.01 dB or less
(Between 0 to 40˚C ± 2˚C/1ch) ; ± 0.05 dB or less
(0 to 40˚C/8h) ; ± 1 dB or less
Output waveform : CW or chopped light ; 270 Hz (± 0.1%) with duty of 50 ± 5%, 2 kHz/4 kHz (± 0.1%) with duty of 50 ± 10%
Output connector : FC type
Preheating time : 60 minutes after power on

*[1] At the photoemittion edge of 2 m fiber (SM 10/125 µm)

Specifications

Optical Power Measurement Specifications

Sensor plug-in channels : 2 (Channels A and B)

Resolution:
dBm/dB display: 0.001 dB (or 0.0001 dB for data output via GPIB)
W display: Max.199,999 counts

Measurement mode:
CW or chopped light (270 Hz) measurement mode selectable

Sensor wavelength sensitivity compensation:
If a wavelength is entered, an internal compensation value for the sensor wavelength sensitivity at that wavelength is automatically applied.

Relative value measurement (dBr):
The value relative to reference value is measured and displayed in dB with a maximum resolution of 0.001 dB (or 0.0001 dB for data output via GPIB).

Unit display: W (mW, µW, nW, pW), dBm, dB

Display of measured value: 5-1/2 digit (7-segment FL Device)

Range : Automatic, manual, remote

Integration time: 100, 20, 7, or 2 msec.

Measurement speed:
Approx. 100 measurements/second (with 2-msec. integration time and one-channel operation)
Approx. 50 measurements/second (with 7-msec. integration time and one-channel operation)
Approx. 30 measurements/second (with 20-msec. integration time and one-channel operation)
Approx. 9 measurements/second (with 100-msec. integration time and one-channel operation)

Level meter:
Displays with up to 11 dots according to measured values.

Calculation function:
A/B, B/A, and CF
W display: Measured values is multiplied by a constant.
dBm display: Offset is possible.

Maximum hold function: Displays the maximum measured value.

Averaging function: The number of averaging can be set to 2 to 256 using the running averaging method.

Light Source Plug-In Unit Specifications

Unit Plug-in channels:
2 (Channels A and B)

Output power adjustment function:
The output power can be set from 0 to -6.0 dB with a setting resolution of 0.1 dB steps.

Output mode: CW or chopped light (270 Hz, 2 kHz, or 4 kHz) mode selectable.

Other Functions

Record function; PDL/PDR* measurement functions: Can store up to 400 measurement data items for each of channels A and B in the backup memory. Stored data items can be read by a personal computer via the GPIB interface. The maximum value, minimum value and the difference of them (Max.-Min.) are displayed.

Memory function: Up to five settings can be stored and read for each of channels A and B.

Direct plotting function: Measurement data items stored by the record function can be plotted directly to an external plotter in the form of graphs.

Brightness adjustment function: The brightness of the display can be adjusted in five steps.

Output functions specifications:

GPIB interface: IEEE488-1978

Analog output: Outputs analog signal which is proportional to the input optical power.

Output voltage: 0 to +2 V(F.S.) for each range

Output impedance: 0.5 Ω or less

Output connector: BNC Connector

General Specifications

Ambient temperature: 0 to +40˚C (85%RH or less)

Storage temperature: -25 to +70˚C

Power requirements: 100 to 240 VAC, 48 to 66 Hz

Power consumption:
50 VA or less (including the plug-in unit and sensors)

Dimensions: Approx. 212 (W) × 88 (H) × 360 (D) mm

Mass: 3.9 kg maximum (including the plug-in unit)

Standard accessories:

Power cable × 1
Fuse × 2
Instruction manual × 1

*PDR: Polarization Dependent Ratio

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Model		**Q82214**		**Q82215**		**Q82216**		
Product Type		Short Wavelength General-Purpose		Long Wavelength General-Purpose		Long Wavelength Large-Caliber Medium-Sensitivity		
Wavelength Range		400 to 1100 nm		800 to 1750 nm		800 to 1750 nm		
Power Range		-80 to +17 dBm*1		-60 to +10 dBm*1		-77 to +10 dBm*1		
Range*2		CW	CHOP	CW	CHOP	CW	CHOP	
	Max.	200 mW	200 mW	20 mW	20 mW	20 mW	20 mW	
	Min.	20 nW	20 nW	2000 nW	2000 nW	20 nW	20 nW	
Sensor Element		Si 8mm ø		Ge 5mm ø		Ge 5mm ø Cooled		
Optical Input Form	Beam	Possible (Optical Input Diameter 8mm ø)		Possible (Optical Input Diameter 5mmø)				
	Fiber	Core Diameter ≤100 µm, NA ≤0.3 PC,APC,and Slanted Rubbed Connectors (Use With Appropriate Connector Adaptor For Each)						
Measurement Accuracy*3, *8		CW	CHOP	CW	CHOP	CW	CHOP	
At Calibration Wavelength		±3.0%	±4.0%	±3.0%	±4.0%	±2.5%	±3.5%	
		780 nm 1 mW 0 to 40°C		1300 nm 1 mW 0 to 40°C		1300 nm 1 mW 0 to 40°C		
At Wide Wavelength range		CW	CHOP	CW	CHOP	CW	CHOP	
		±5.0%	±6.0%	±5.0%	±6.0%	±4.5%	±5.5%	
		480 to 900 nm 1 mW 23±3°C		950 to 1600 nm 1 mW 23±3°C		950 to 1600 nm 1 mW 0 to 40°C		
Linearity (At Averange Time : 1 sec.)		±0.5%±10 pW -54 to +17 dBm 23±3°C		±0.5% ±1 nW -37 to +10 dBm 23±3°C		±0.5%±20 pW -47 to +10 dBm 23±3°C		
		±1.0% ±10 pW -57 to +17 dBm 23±3°C		±1.0% ±1 nW -40 to +10 dBm 23±3°C		±1.0%±20 pW -50 to +10 dBm 23±3°C		
Noise Level*4	At Averaging Time : 1 sec.	-80 dBm		-60 dBm		-77 dBm		
	Without Averaging*5							
	SLOW (approx. 9/sec.)	-75 dBm		-55 dBm		-72 dBm		
	FS-1 (approx. 30/sec.)	-71 dBm		-51 dBm		-68 dBm		
	FS-2 (approx. 50/sec.)	-69 dBm		-48 dBm		-65 dBm		
	FS-3 (approx. 100/sec.)	-66 dBm		-45 dBm		-62 dBm		
Polarization Dependence (at wavelength 1550 nm)		—		0.03 dBp-p (Typical)*6		0.03 dBp-p (Typical)*6		
Return Loss	With APC,or slanted Rubbed Connector	60 dB or more						
	With high return loss adaptor*7	45 dB or more (Typical 47 dB)						
	With PC rubbed connector	approx. 14 dB						
Dimensions and Mass		Approx. 60(W) × 43(H) × 110(D) mm, 270 g or less						
Connectors to Adaptor Correspondence List	FC	A08012						
	SC	A08090						
	ST	A08096						
	MU	A08369						
	LC	A08654						
	Plug-in	—						
	MT Adaptor (Mating to 12-pin SMF)	—		A08187 (Mating to 12-pin SMF)				
High Return Loss Adaptor Correspondence List*9	FC	A08328						
	SC	A08329						
	ST	A08330						
	Plug-in	A08331						
Connection to the Q8221 Main Unit		Q82203 Interface Plug-in Unit Required. Connection Cable Available as Accessory with Q82203						

*1 Level at Max. is when optical input was received with entire sensor area.
*3 Full Scale of the range Measurable power range is shown above
*3 CW : Continuous Optical Measurement Mode used. CHOP : 270 Hz Chopped light Measurement Mode used.
*4 Noise Level with CW Mode and at calibration wavelength (With CHOP Mode,noise level at FS-1, FS-2, FS-3 is approx. the same as at SLOW.)
*5 SLOW : Integration Time , 100 msec FS-1 : Integration Time, 20 msec FS-2 : Integration Time, 7 msec FS-3 : Integration Time, 2 msec
*6 Typical Figure (Not Specified)
*7 When using PC rubbed connector with return loss 45 dB or more.

Q8221

		
Q82232	**Q82208**	Model
Long Wavelength High-Sensitivity Low Polarization	Long Wavelength High-Sensitivity	Product Type
900 to 1650 nm	800 to 1700 nm	Wavelength Range
-94 to +10 dBm		Power Range
CW: 20 mW / CHOP: 20 mW	CW: 20 mW / CHOP: 20 mW	Range*2 Max.
200 pW / 200 nW	200 pW / 200 nW	Min.
In GaAs Cooled		Sensor Element
Not Possible		Beam Fiber / Optical Input Form
Core Diameter ≤10 μm, NA ≤ 0.19 PC Rubbed Connector	Core Diameter ≤ 62.5mm, NA ≤0.21 PC, APC, and Slanted Rubbed Connectors	
CW ± 2.5% / CHOP ± 3.5% — 1550 nm, 1 mW, 0 to 40°C	CW ± 2.5% / CHOP ± 3.5% — 1300 nm, 1 mW, 0 to 40°C	Measurement Accuracy*3 *8 At Calibration Wavelength
CW ± 4.5% / CHOP ± 5.5% — 950 to 1600 nm, 1 mW, 0 to 40°C	CW ± 4.5% / CHOP ± 5.5% — 1000 to 1650 nm, 1 mW, 0 to 40°C	At Wide Wavelength range
± 0.5% ± 0.4 pW, -72 to +10 dBm, 0 to 40°C		Linearity (At Average Time : 1 sec.)
+1.0% ±0.4 pW, -75 to +10 dBm, 0 to 40°C		
-94 dBm		At Averaging Time : 1 sec. — Noise Level*4
-93 dBm	-91 dBm	Without Averaging*5
		SLOW (approx. 9/sec.)
-90 dBm	-90 dBm	FS-1 (approx. 30/sec.)
-88 dBm	-87 dBm	FS-2 (approx. 50/sec.)
-85 dBm	0.02 dBp-p or less	FS-3(approx. 100/sec.)
0.003 dBp-p or less	(Typical 0.015 dBp-p)	Polarization Dependence (at wavelength 1550 nm)
—	50 dB or more	With APC, or slanted Rubbed Connector — Return Loss
—	43 dB or more (Typical 45 dB)	With high return loss adaptor*7
approx. 14 dB	approx. 14 dB	With PC rubbed connector
Approx. 60 (W) × 43 (H) × 135(D) mm, 590 g or less	Plugs into Q8221	Dimensions and Mass
A08340 (Standard Accessory)	A08161(Standard Accessory)	FC — Connectors to Adaptor Corre-spondence List
A08338	A08162	SC
A08339	A08163	ST
A08371	A08370	MU
A08655	A08653	LC
—	Jack-type Possible	Plug-in
—		MT Adaptor (Mating to 12-pin SMF)
Usage of high return loss adaptors are not possible	A08328	FC — High return loss adaptor Corre-spondence List*9
Usage of high return loss adaptors are not possible	A08329	SC
Usage of high return loss adaptors are not possible	A08330	ST
Usage of high return loss adaptors are not possible	A08331	Plug-in
Q82203 Required Connection Cable Available as Accessory with Q82203	Q82203 Not Required	Connection to the Q8221 Main Unit

*8 Calibrations of Q82215,Q82216 and Q82208 are also available as options (OPT82215+25,OPT82216+25,OPT82208+25). Measurement accuracy value for the option sensors are the same as in the chart above at 1550 nm calibration wavelength.
*9 Connection loss with single mode fiber is 0.07 dB(typical)

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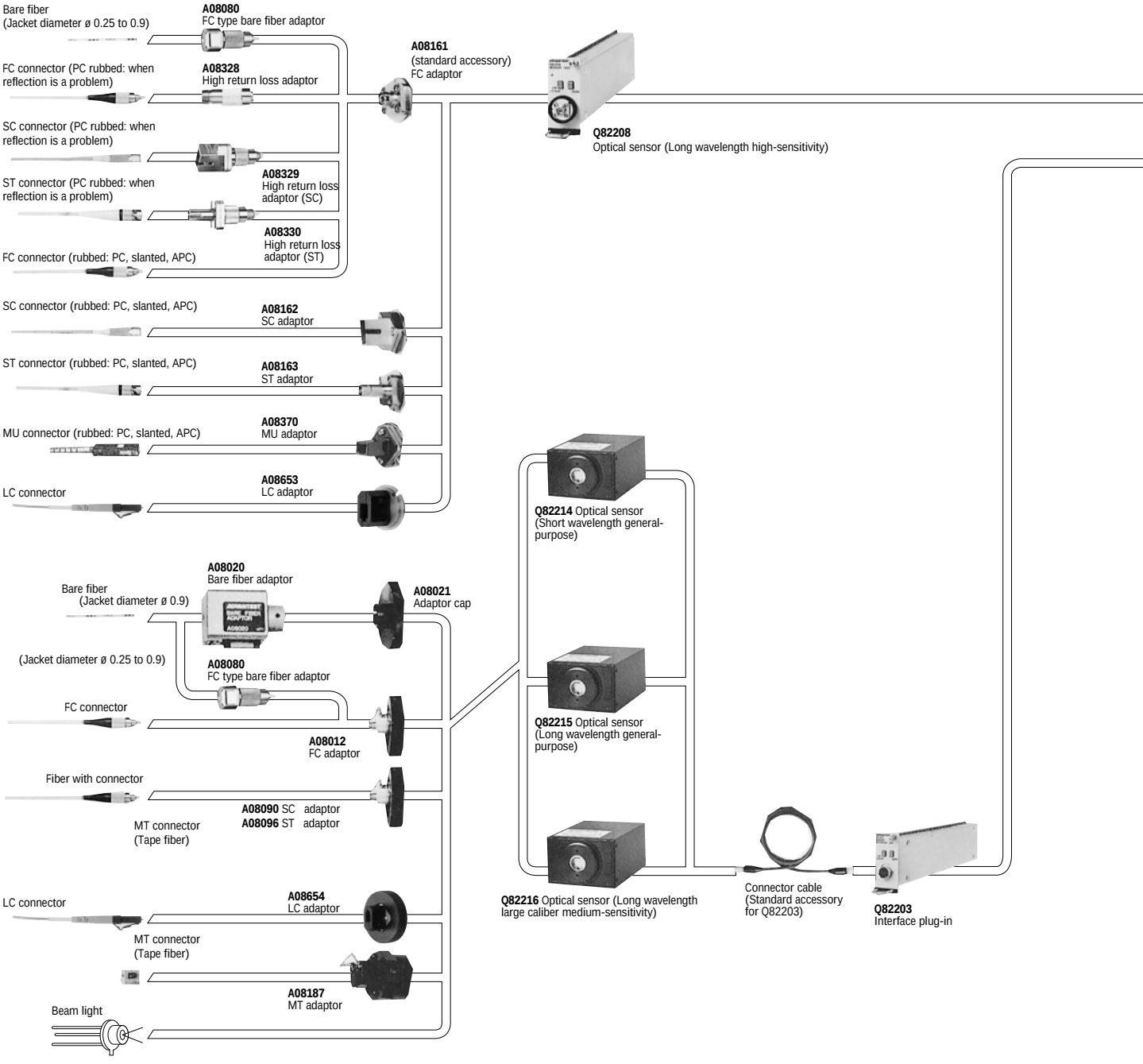

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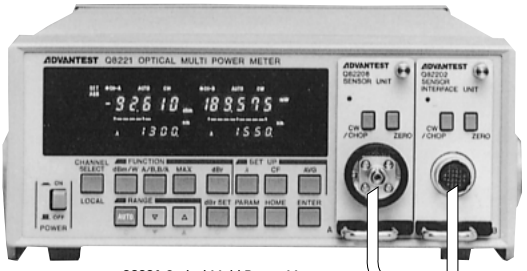

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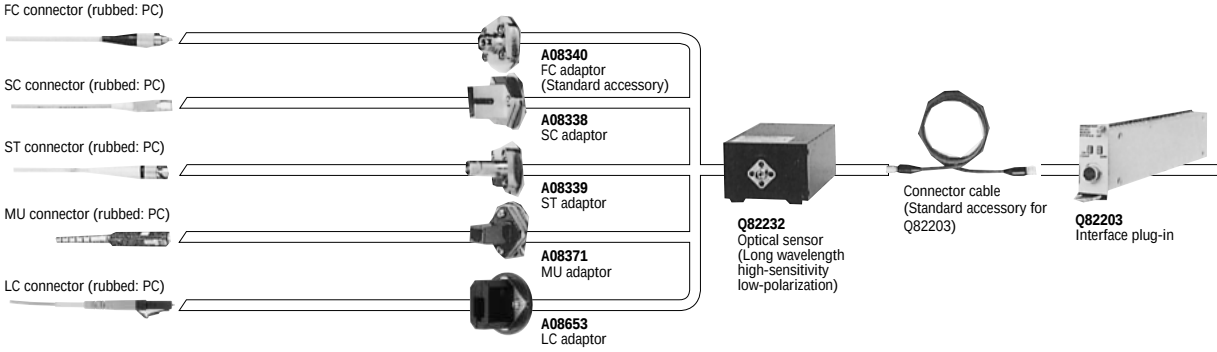

※ Remove proof cap is used to prevent the mis-removing the high return loss adaptor from the sensor adaptor when removing the fiber connector.