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 dBp-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 Q8221 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.
Optical Measuring Instruments and Optical Device Test Systems

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

• Q81212 Light Source Plug-In Unit Specifications
  Photoemittance element: FFP-LD
  Wavelength: 1550 ± 20 nm
  Spectrum halve value: 10 nm or less
  Output power: 0 ± 1 dBm
  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 photoemittance 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.
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
High-Accuracy, High-Sensitivity and High-Speed Optical Power Meter

<table>
<thead>
<tr>
<th>Model</th>
<th>Q82214</th>
<th>Q82215</th>
<th>Q82216</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Type</td>
<td>Short Wavelength General-Purpose</td>
<td>Long Wavelength General-Purpose</td>
<td>Long Wavelength Large-Cable Medium-Sensitivity</td>
</tr>
<tr>
<td>Wavelength Range</td>
<td>400 to 1100 nm</td>
<td>800 to 1750 nm</td>
<td>800 to 1750 nm</td>
</tr>
<tr>
<td>Power Range</td>
<td>80 to +17 dBm*</td>
<td>60 to +10 dBm*</td>
<td>77 to +10 dBm*</td>
</tr>
<tr>
<td>Sensor Element</td>
<td>St 8mm ø</td>
<td>Ge 5mm ø</td>
<td>Ge 5mm ø</td>
</tr>
<tr>
<td>Optical Input Form</td>
<td>Possible (Optical Input Diameter 8mm ø)</td>
<td>Possible (Optical Input Diameter 5mm ø)</td>
<td>Cooled</td>
</tr>
<tr>
<td>Measurement Accuracy**</td>
<td>±3.0%</td>
<td>±3.0%</td>
<td>±3.5%</td>
</tr>
<tr>
<td>At Calibration Wavelength</td>
<td>780 nm</td>
<td>1000 nm</td>
<td>1000 nm</td>
</tr>
<tr>
<td></td>
<td>1 mW</td>
<td>1 mW</td>
<td>1 mW</td>
</tr>
<tr>
<td></td>
<td>0 to 40°C</td>
<td>0 to 40°C</td>
<td>0 to 40°C</td>
</tr>
<tr>
<td>At Wide Wavelength range</td>
<td>±5.0%</td>
<td>±5.0%</td>
<td>±4.5%</td>
</tr>
<tr>
<td></td>
<td>480 to 900 nm</td>
<td>950 to 1600 nm</td>
<td>950 to 1600 nm</td>
</tr>
<tr>
<td></td>
<td>1 mW</td>
<td>1 mW</td>
<td>1 mW</td>
</tr>
<tr>
<td></td>
<td>23±3°C</td>
<td>23±3°C</td>
<td>23±3°C</td>
</tr>
<tr>
<td>Linearity (At Average Time : 1 sec.)</td>
<td>±0.5%±10 pW</td>
<td>±0.5%±10 pW</td>
<td>±0.5%±20 pW</td>
</tr>
<tr>
<td></td>
<td>-54 to +17 dBm</td>
<td>-37 to +10 dBm</td>
<td>-47 to +10 dBm</td>
</tr>
<tr>
<td></td>
<td>23±3°C</td>
<td>23±3°C</td>
<td>23±3°C</td>
</tr>
<tr>
<td>Noise Level***</td>
<td>±1.5%±10 pW</td>
<td>±1.0%±10 pW</td>
<td>±1.0%±20 pW</td>
</tr>
<tr>
<td>At Averaging Time : 1 sec.</td>
<td>±57 to +17 dBm</td>
<td>±40 to +10 dBm</td>
<td>±50 to +10 dBm</td>
</tr>
<tr>
<td></td>
<td>23±3°C</td>
<td>23±3°C</td>
<td>23±3°C</td>
</tr>
<tr>
<td>Return Loss</td>
<td>With APC or slanted Rubbed Connector</td>
<td>60 dB or more</td>
<td>45 dB or more (Typical 47 dB)</td>
</tr>
<tr>
<td></td>
<td>With high return loss adaptor***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>With PC rubbed connector</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dimensions and Mass</td>
<td>approx. 14 dB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connectors to Adaptor</td>
<td>PC</td>
<td>A08012</td>
<td></td>
</tr>
<tr>
<td>Correspondence List</td>
<td>SC</td>
<td>A08090</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ST</td>
<td>A08096</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MU</td>
<td>A08089</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LC</td>
<td>A08054</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Plug-in</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MT Adaptor (Mating to 12-pin SMF)</td>
<td>—</td>
<td>A08187</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(Mating to 12-pin SMF)</td>
</tr>
<tr>
<td>High Return Loss Adaptor</td>
<td>PC</td>
<td>A08028</td>
<td></td>
</tr>
<tr>
<td>Correspondence List**</td>
<td>SC</td>
<td>A08029</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ST</td>
<td>A08030</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Plug-in</td>
<td>A08031</td>
<td></td>
</tr>
<tr>
<td>Connection to the Q8221 Main Unit</td>
<td>Q8203 Interface Plug-in Unit Required.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Level at Max. is when optical input was received with entire sensor area.
** Full Scale of the range Measurable power range is shown above.
* CW : Continuous Optical Measurement Mode used. CHOP : 270 Hz Chopped light Measurement Mode used.
*** Noise Level with CW Mode and at calibration wavelength (With CHOP: Modulation level at FS-1, FS-2, FS-3 is approx. the same as at SLOW).
**** When using PC rubbed connector with return loss 45 dB or more.
## Optical Measuring Instruments and Optical Device Test Systems

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

<table>
<thead>
<tr>
<th>Model</th>
<th>Product Type</th>
<th>Wavelength Range</th>
<th>Power Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q82232</td>
<td>Long Wavelength High-Sensitivity Low Polarization</td>
<td>900 to 1650 nm</td>
<td>-94 to +10 dBm</td>
</tr>
<tr>
<td>Q82208</td>
<td>Long Wavelength High-Sensitivity</td>
<td>800 to 1700 nm</td>
<td>-94 to +10 dBm</td>
</tr>
</tbody>
</table>

### Model Q82232 Specifications

- **Sensor Element**: Optical Fiber
- **Beam Form**: Optical
- **Input Form**: Fiber
- **Core Diameter**: <10 µm, NA < 0.19
- **PC Rubbed Connector**
- **Beam Alignment**: Aperture Width: 10 mm, Aperture Height: 10 mm

### Model Q82208 Specifications

- **Sensor Element**: Optical Fiber
- **Beam Form**: Optical
- **Input Form**: Fiber
- **Core Diameter**: ≤ 62.5 µm, NA ≤ 0.21
- **PC, APC, and Slanted Rubbed Connectors**
- **Beam Alignment**: Aperture Width: 10 mm, Aperture Height: 10 mm

### Measurement Accuracy

- **At Calibration Wavelength**
  - ± 2.5% CW
  - ± 3.5% CHOP
- **At Wide Wavelength range**
  - ± 2.5% CW
  - ± 3.5% CHOP
- **At Average Time : 1 sec.**
  - ± 0.5% ± 0.4 pW
  - ± 2.5% CW
  - ± 3.5% CHOP

### Return Loss

- **Without Averaging**: -99 dBm
- **With APC or slanted Rubbed Connector**: -90 dBm
- **With high return loss adaptor**: -85 dBm
- **Typical 0.015 dBp-p**

### Polarization Dependence

- **(Typical 0.015 dBp-p)**
- **With APC or slanted Rubbed Connector**: -90 dBm
- **With high return loss adaptor**: -85 dBm

### Dimensions and Mass

- **Approx. 60 (W) × 43 (H) × 135 (D) mm**
- **590 g or less**

### Connectors to Adaptor Correspondence List

- **FC**
- **SC**
- **ST**
- **MU**
- **LC**
- **Jack-type Possible**
- **Plug-in MT Adaptor (Mating to 12-pin SMF)**

### Usage of High Return Loss Adaptors

- Not Possible

### Connection Cable Available as Accessory

- **Q82203 Required**
- **Q82203 Not Required**

---

**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.**

**Connection loss with single mode fiber is 0.07 dB (typical).**
Optical Measuring Instruments and Optical Device Test Systems

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

Q8221

Bare fiber
(Jacket diameter ø 0.25 to 0.9)

PC connector (PC rubbed: when reflection is a problem)

SC connector (PC rubbed: when reflection is a problem)

ST connector (PC rubbed: when reflection is a problem)

FC connector (rubbed: PC, slanted, APC)

SC connector (rubbed: PC, slanted, APC)

ST connector (rubbed: PC, slanted, APC)

MU connector (rubbed: PC, slanted, APC)

LC connector

A08080 FC type bare fiber adaptor

A08328 High return loss adaptor

A08329 High return loss adaptor (SG)

A08330 High return loss adaptor (ST)

A08162 SC adaptor

A08163 ST adaptor

A08370 MU adaptor

A08653 LC adaptor

A08020 Bare fiber adaptor

A08021 Adaptor cap

A08040 FC type bare fiber adaptor

A08059 SC adaptor

A08066 ST adaptor

A08012 FC adaptor

A08117 MT adaptor

A08040 Fiber with connector

MT connector (Tape fiber)

A08090 SC adaptor

A08096 ST adaptor

A08090 Interface plug-in

A08320 Optical sensor (Long wavelength large caliber medium-sensitivity)

A082214 Optical sensor
(Short wavelength general-purpose)

A082215 Optical sensor
(Short wavelength general-purpose)

A082216 Optical sensor
(Long wavelength high-sensitivity)

A082208 Optical sensor (Long wavelength high-sensitivity)
Optical Measuring Instruments and Optical Device Test Systems

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

Q8221 Optical Multi Power Meter

- FC connector (rubber: PC)
- SC connector (rubber: PC)
- ST connector (rubber: PC)
- MU connector (rubber: PC)
- LC connector (rubber: PC)

- Connector cable (Standard accessory for Q82203)
- Optical sensor (Long wavelength high-sensitivity low-polarization)
- Interface plug-in

- A08340 FC adaptor (Standard accessory)
- A08338 SC adaptor
- A08339 ST adaptor
- A08371 MU adaptor
- A08653 LC adaptor

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