Q8221
Optical Multi Power Meter

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

- Various Optical Sensors and Light Source 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
Flexible to User’s Diversified Needs for Optical Power Measurement

Features

Flexible Combination-Two-Channel, Plug-in System.
The Q8221 uses a two-channel, plug-in system. Various types of optical sensors and light sources are available as plug-in units. The two channels can be used either independently or simultaneously. The Q8221 can handle a variety of applications by using the desired combination of optical sensors and light sources.

High Measurement Accuracy.
Ensures Accuracy Over the Entire Range of Power and Wavelength.
The optical sensors for Q8221 assure high accuracy of ±2.5% at calibration point (for short wavelength sensor: Q82214 is calibrated at 780nm, for long wavelength sensors: Q82208, Q82215 and Q82216 are calibrated at 1300nm, Q82227 and Q82232 are calibrated at 1550nm). In broad band wavelength region, they assure ±4.5% accuracy by compensating the sensitivity curve over wavelengths of each sensors. Furthermore, the linearity of ±0.5% is assured. Not only at the calibration point these sensors assure also broad band wavelength region and the level to be measured.

* Calibrations of Q82208, Q82215 and Q82227 at 1550 nm are also available as options (OPT.25).

High-Sensitivity Sensors
Noise Level: -94 dBm.
The Q82208 and Q82232 Optical Sensors achieves 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 with all three types. These sensors are designed to satisfy user’s diversified requests for the polarization dependency, return loss and sensor type. They can correspond to a wide variety of measurement requirements.

<table>
<thead>
<tr>
<th>Sensor Model</th>
<th>Polarization Dependency</th>
<th>Return Loss</th>
<th>Sensor Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q82208</td>
<td>0.02 dBp-p</td>
<td>45 dB(typical)</td>
<td>Plug-in Type</td>
</tr>
<tr>
<td>Q82232</td>
<td>0.003 dBp-p</td>
<td>14 dB</td>
<td>Pull-out Cable Type</td>
</tr>
</tbody>
</table>

High Power Input Optical Sensor (Q82227)
Maximum Input Power: +27 dBm
The Q82227 is for long-wavelength, high-sensitivity, and high power light. The sensor is capable of measuring light input up to +27 dBm. Thus, it is suitable for measuring output from optical-fiber amplifiers, the pumping light source of optical-fiber amplifiers, and high-output devices such as LDs for optical CATVs. Also, noise level for Q82227 is -80 dBm, therefore, it can corresponds to measurement where wide dynamic range is necessary.
Low Polarization Dependency Optical Sensors (Q82232): 0.003 dBp-p or less

The high-sensitivity 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

If input light was reflected back, the influence on the system results in inaccurate measurement. 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 by using the low-loss, high-return-loss adaptor (typical return loss without this adaptor is 14 dB). This sensor fits 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 Resolution Measurement.
Display 0.001 dB/0.0001 dB GPIB Output.
Both absolute power measurement (dBm) and relative power measurement (dBr) are displayed with a resolution of 0.001 dB. During GPIB output, data can be output with a resolution of 0.0001 dB.

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.

Applications

Measurement of Polarization Dependent Loss (PDL) in Optical Couplers by Simple Operation

High-speed and high-accuracy measurement of polarization dependent loss (PDL) can be made. The system supplies output of the DFB-LD light source with stable wavelength at stable level to the DUT via the isolator and the polarization controller, then inputs the output from the DUT to the Q82232. Measurement results are directly output to a PC via the GPIB using the recording function. The maximum and minimum values as well as PDL (maximum value minus minimum value) can be displayed on the Q8221 panel by simple push-button operation. Measurement time required is less than 1 sec. at PDL=0.2 dB, which improves throughput dramatically.

ADVANCEST’s original polarization-variance method.
By adopting the high-speed, optical-fiber polarization scramble unit, Q8163 Optical Polarization Scrambler achieves:
- High-speed polarization variance
- Low fluctuation of insertion loss
- Low insertion loss
- High reliability

<Major Specifications>
High-speed polarization variable: 500 rotations of the Poincaré sphere per second or more
Low fluctuation of insertion loss: ±0.005 dB or less
Low insertion loss: 3 dB or less

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Low insertion loss: 3 dB or less
Sample Configurations
Remove proof cap is used to prevent the mis-removing the high return loss adaptor from the sensor adaptor when removing the fiber connector.
### Specifications

#### Q8221 Optical Sensor Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>Q82214</th>
<th>Q82215</th>
<th>Q82216</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Product Type</strong></td>
<td>Short Wavelength General-Purpose</td>
<td>Long Wavelength General-Purpose</td>
<td>Long Wavelength Large Caliber Medium-Sensitivity</td>
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<tr>
<td><strong>Wavelength Range</strong></td>
<td>400 to 1100nm</td>
<td>800 to 1750nm</td>
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<tr>
<td><strong>Power Range</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CW</td>
<td>CHOP</td>
<td>CW</td>
</tr>
<tr>
<td></td>
<td>20mW</td>
<td>20mW</td>
<td>20mW</td>
</tr>
<tr>
<td><strong>Sensor Element</strong></td>
<td>Si 8mm</td>
<td>Ge 5mm</td>
<td>Ge 5mm</td>
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<td><strong>Optical Input Form</strong></td>
<td>Possible (optical input diameter 8mm)</td>
<td>Possible (optical input diameter 5mm)</td>
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<tr>
<td><strong>Beam</strong></td>
<td></td>
<td></td>
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<tr>
<td><strong>Fiber</strong></td>
<td>Core Diameter</td>
<td>60 to 10dBm</td>
<td>81 to 10dBm</td>
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<td><strong>Measurement Accuracy</strong></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>CW</td>
<td>CHOP</td>
<td>CW</td>
</tr>
<tr>
<td></td>
<td>780nm</td>
<td>1mW</td>
<td>0 to 40°C</td>
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<tr>
<td></td>
<td>54 to 17dBm</td>
<td>23 to 3°C</td>
<td>480 to 900nm</td>
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<td><strong>Noise Level</strong></td>
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</tr>
<tr>
<td></td>
<td>CW</td>
<td>CHOP</td>
<td>CW</td>
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<tr>
<td></td>
<td>80dBm</td>
<td>60dBm</td>
<td>75dBm</td>
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<tr>
<td><strong>Return Loss</strong></td>
<td></td>
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</tr>
<tr>
<td>With APC or slanted Rubbed Connector</td>
<td>60dB or more</td>
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<td></td>
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<tr>
<td>With high return loss adaptor</td>
<td>45dB or more (Typical 47dB)</td>
<td></td>
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</tr>
<tr>
<td>With PC rubbed connector</td>
<td>approx. 14dB</td>
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<td></td>
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<tr>
<td><strong>Dimensions and Mass</strong></td>
<td>Approx. 60(W) x 43(H) x 110(D)mm 270g or less</td>
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<td>**Connectors to Adaptor **</td>
<td>A08612</td>
<td>A08690</td>
<td>A08696</td>
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<tr>
<td><strong>Correspondence List</strong></td>
<td>ST</td>
<td>MU</td>
<td>LC</td>
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<tr>
<td><strong>Plug-in</strong></td>
<td>A08664</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>MT Adaptor (Mating to 12-pin SMF)</strong></td>
<td>A08187</td>
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<tr>
<td><strong>High Return Loss Adaptor Correspondence List</strong></td>
<td>A08638</td>
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<td></td>
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<tr>
<td><strong>Connection to the Q8221 Main Unit</strong></td>
<td>Q82202 or Q82203 Interface Plug-in Unit Required, Connection Cable Available as Accessory with Q82202, or Q82203</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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1. Level at Max. is when optical input was received with entire sensor area.
2. Full Scale of the range. Measurable power range is shown above.
3. CW:Continuous Optical Measurement Mode used. CHOP:270Hz 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 and FS-3 is approx. the same at SLOW).
5. Level at Max. is when optical input was received with entire sensor area.
6. SLOWS:Continuous Optical Measurement Mode used. CHOP:270Hz Chopped Light Measurement Mode used.
7. Typical Figure (Not Specified)
8. When using PC rubbed connector with return loss 45dB or more.
### Table: Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>Long Wavelength High-Sensitivity High-Power</th>
<th>Long Wavelength High-Sensitivity Low Polarization</th>
<th>Long Wavelength High-Sensitivity Low Polarization - 10 dBm, NA 0.19 PC and Slanted Rubbed Connectors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q82227</td>
<td>900 to 1650nm</td>
<td>800 to 1700nm</td>
<td>800 to 1700nm</td>
</tr>
<tr>
<td>Q82232</td>
<td></td>
<td></td>
<td>850 to 1700nm</td>
</tr>
<tr>
<td>Q82208</td>
<td></td>
<td></td>
<td>850 to 1700nm</td>
</tr>
</tbody>
</table>

**Power Range**
- CW: 0 to 10dBm
- CW: 0 to 10dBm
- CW: 0 to 10dBm

**Beam and Optical Input Form**
- Fiber
- PC and Slanted Rubbed Connectors
- PC, APC, and Slanted Rubbed Connectors

**Measurement Accuracy**
- At Calibration Wavelength:
  - Q82227: 1.0% ± 0.5%
  - Q82232: 1.0% ± 0.5%
  - Q82208: 1.0% ± 0.5%

- At Wide Wavelength range:
  - Q82227: 1.0% ± 0.5%
  - Q82232: 1.0% ± 0.5%
  - Q82208: 1.0% ± 0.5%

**Noise Level**
- Without Averaging *
  - 20dB or more
- With APC, or slanted Rubbed Connector
  - 40dB or more
- With high return loss adaptor*
  - 60dB or more

**Dimensions and Mass**
- A08330 (Standard Accessory)
  - FC
- A08339
  - ST
- A08371
  - MU
- A08655
  - LC

**Polarization Dependence**
- at wavelength 1550nm
  - 0.03dBp or less
  - 0.05dBp or less

**Return Loss**
- 50dB or more
- With high return loss adaptor

**Plug-in**
- PC
- High return loss adaptor

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*Calibrations of Q82215, Q82216, and Q82217 are available as options (OPT82215+25, OPT82216+25, OPT82217+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 0.07dB (typical).**
Specifications

Q81212 Light Source Plug-In Unit

Photoemittion element: FP-LD
Wavelength: 1550 ±20nm
Spectrum half value: 10nm or less
Output power: 0 ±1 dBm (At the photoemittion edge of 2m fiber (SM 10/125 μm))
Output power (Variable): 0 to -6dB, in 0.1dB steps
Stability: ±0.01 dB or less (23±1ºC/1min)
±0.05 dB or less (Between 0 to 40ºC ±2ºC/1h)
±1 dB or less (0 to 40ºC/8h)
Output waveform: CW or chopped light; 270Hz (±0.1%) with duty of 50 ±5%, 2kHz/4kHz (±0.1%) with duty of 50 ±10%
Output connector: FC type
Preheating time: 60 minutes after power on

Optical Power Measurement

Sensor plug-in channels: 2 channels (Channels A and B)
Resolution: 0.001 dB at dBm or dB read out (0.0001 dB when data output using GPIB) Max. 199,999 count at W read out
Measurement Mode: CW, or Chopped light (270Hz±0.2%) 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. (0.0001 dB when data output using GPIB)
Units display: W (mW, μW, nW, pW), dBm, dB
Display of measured value: 5-1/2-digit (7 segment FL Device)
Range setting: Automatic, manual, or remote
Integration time: 100msec, 20msec, 7msec, 2msec
Measurement speed: Approx. 100 measurements/s (with an integration time of 2 msec, 1 channel operation), Approx. 50 measurements/s (with an integration time of 7 msec, 1 channel operation), Approx. 30 measurements/s (with an integration time of 20 msec, 1 channel operation), Approx. 9 measurements/s (with an integration time of 100 msec, 1 channel operation)
Level meter: Displays with 11 dots according to the measurement value.
Calculation Function: A/B, B/A, CF (When W is selected as unit, the measurement value is multiplied by a constant; When dBm is selected, offset is possible)
Maximum hold function: Displays the maximum measurement value.
Averaging Function: The number of averaging can be set to 2 to 256 times according to the need using the running averaging method.

Interface Plug-in

A/D error: ±0.01% ±5 count

Light Source Plug-in Unit

Unit plug-in channels: 2 channels (Channels A and B) maximum
Output power adjustment function: The output power can be varied from 0 to -6.0 dB, with a setting resolution of 0.1dB.
Output mode: CW or Chopped light (270Hz, 2kHz, 4kHz) mode selectable.

Other Functions

Record functions, PDL/PDR*: Can store up to 400 measurement data for each of channels A and B in the backup memory. The stored data can be read from a personal computer via the GPIB interface. Values in the memory can be displayed also as Max., Min., (Max.-Min.)
Memory function: Up to five settings for each of channels A and B can be stored and read.
Direct plotting function: The measurement data stored by the record function can be plotted directly on an external plotter in the form of graphs.
Brightness control function: The brightness of the indicator can be adjusted in five steps.

Output functions

GPIB interface: IEEE488-1978
Analog output: Outputs an analog signal proportional to the input optical power.
Output voltage: 0 to +2V (P.5) for each range
Output impedance: 0.3 Ω or less
Output terminal: BNC connector

General Specifications

Ambient conditions: 0 to +40ºC, RH 85 % or less
Storing conditions: -25 to +70ºC
Power Requirements: 100 to 240 V AC, 48 to 66 Hz
Power Consumption: 50 VA or less (including the plug-in and sensors)
Dimensions: Approx.212(W) x 88(H) x 360(D)mm
Mass: 3.9kg or less (including the plug-in unit)

Standard Accessories

Power cable: 1
Fuse: 2
Instruction Manual: 1

Optional Accessories

A02463: Rack Mount Set (EIA single)
A02464: Rack Mount Set (EIS twin)
A02263: Rack Mount Set (JIS single)
A02264: Rack Mount Set (JIS twin)
OCS-F2SW-2: Optical Fiber Cord (GI 50/125 μm, 2m)
OCS-F2SPS-2: Optical Fiber Cord (SM 10/125 μm, 2m)

*PDR: Polarization Dependent Radio

Optical Adaptors Dimensions

A08012 FC Adaptor
A08080 FC type Bare fiber adaptor
A08020 Bare fiber adaptor
A08021 Adaptor cap
A08328 High return loss adaptor
Q8221 Optical Sensors Dimensions

### Specifications

- **max optical input diameter (A):** 8.5mm / 5mm / 5mm
- **distance to central protection glass (B):** 2mm / 1.3mm / 0.9mm
- **distance to central optical input surface (C):** 3.1mm / 3.1mm / 3.1mm

### Product Types

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Q82214</th>
<th>Q82215</th>
<th>Q82216</th>
</tr>
</thead>
<tbody>
<tr>
<td>max optical input diameter</td>
<td>8.5mm</td>
<td>5mm</td>
<td>5mm</td>
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<tr>
<td>distance to central protection glass</td>
<td>2mm</td>
<td>1.3mm</td>
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<tr>
<td>distance to central optical input surface</td>
<td>3.1mm</td>
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<table>
<thead>
<tr>
<th>Product Type</th>
<th>Sensor</th>
<th>Model</th>
<th>Accessories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface</td>
<td>For Q82214/15/16</td>
<td>Q82202</td>
<td>Connection Cable</td>
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<td>For Q82214/15/16/27/32</td>
<td>Q82203</td>
<td>Connection Cable</td>
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<td>Optical Sensor</td>
<td>For Q82214/15/16</td>
<td>Q82214</td>
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<td>For Q82215</td>
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<td>Bare Fiber Adaptor Cap</td>
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<tr>
<td></td>
<td>Remove Proof Cap</td>
<td>For Q8227</td>
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Please be sure to read the product manual thoroughly before using the products. Specifications may change without notification.