
**User's
Manual**

**Model SU1005A
AQ2160-02
Optical Powermeter**

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1. Before Using the Instrument

1-1. Foreword

Thank you for purchasing the AQ2160-02 Optical Powermeter. This user's manual contains useful information about the instrument's functions and operating procedures and lists important handling precautions. To ensure proper use of the instrument, please read this manual thoroughly before beginning operation. After reading this manual, keep it in a convenient location for quick reference in the event a question arises during operation.

1-2. Features of this Instrument

The AQ2160-02 is a handheld optical powermeter for measuring optical power levels. Optical loss can be measured by using the instrument in conjunction with a AQ4270 series light source. The instrument measures wavelengths in the range from 750 to 1700 nanometers, and target wavelengths can be specified in 5 nm steps. In addition to absolute values, relative values indicating the difference from a reference value can also be measured. Also, measured data can be saved to the instrument's memory for later recall. Data can also be transferred to a PC for analysis via USB. As the AQ is designed to prevent, as much as possible, entry of incorrect settings, it allows even first time users to operate the instrument with confidence.

1-3. Warranty

Prior to shipment, all Yokogawa products must pass strict testing based on the Yokogawa Quality Assurance System. However, should any damage occur during manufacturing or shipping that becomes evident during normal use, please contact the sales office at our headquarters or your nearest Yokogawa representative. Should this product experience any malfunction during the warranty period (within one year from the day of delivery) Yokogawa shall repair the product free of charge. However, this warranty is invalid for malfunction or damage resulting from user error, rework or modifications performed by the user, or natural disasters, even during the warranty period. Also, the warranty for this product is only valid inside Japan.

1-4. Checking the Contents of the Package

Please check the sections listed below before using the instrument. If some sections are missing or otherwise inconsistent with the contents description, please contact your dealer or nearest Yokogawa representative. The package includes the AQ2160-02 Optical Powermeter plus the standard accessories listed in the table below (we recommend that you save the packaging box for future transport of the instrument.).

List of Standard Accessories

No.	Product Name	Qty.
1	User's manual	1
2	AA dry cells (alkaline)	2
3	Neck strap	1
4	Carrying pouch	1
5	USB application software (CD-ROM)	1

The following options are available for purchase separately. Also, adapters are required for the connectors you will be using. For inquiries and ordering, please contact the dealer from which you purchased the instrument.

Options (Sold Separately)

No	Name	Model	Specifications
1	Connector adapter (for the AQ2160-02)	SU2004A-SCC -FCC -STC -LCC -MUC	SC FC ST LC MU
2	Protector	SU2002A	(for the AQ2160)
3	AC adapter	SU2007A-M -C -F -G -J	PSE conforming type (2-pin) UL/CSA standard type (UL2P) VDE standard type (CEE-C2) AS standard type (AS2P) BS standard type (BS2P) angle
4	Soft carrying case	SU2006A	




1-5. Trademarks

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1-6. Safety Symbols

This section describes various symbols that appear in the manual and on the instrument. These symbols convey information necessary for correct operation of the instrument, and for preventing injury to the user and other personnel, and accidents involving, or damage to equipment. Always heed the information provided by these symbols when operating the instrument. If this instrument is used in a manner not specified in this manual, the protective features provided by the instrument may be impaired. Also, Yokogawa assumes no liability for the customer's failure to comply with these requirements.

- The following describes levels of damage that can occur as a result of incorrect operation.

 DANGER	Indicates actions or situations that are likely to result in imminent death or serious injury.
 WARNING	Indicates actions or situations that can lead to death or serious injury.
 CAUTION	Indicates actions or situations that can lead to loss of data, or physical damage to instruments.

- The following explains warning symbols that must be adhered to.

	Prohibited (indicates prohibition of a particular action).		
	Indicates that disassembly is prohibited.		Indicates that use near water, or contact with liquids (spills, etc.) is prohibited.
	Indicates that handling with wet hands is prohibited.		
	Required (indicates something that must be done).		Indicates that the power plug must be removed from the outlet.



Read the manual thoroughly, and follow the instructions given.



If "Caution," "Warning," or "Danger" is indicated in the user's manual, follow the corresponding instructions.











DANGER




	<p>When using an AC power supply for this instrument, always use the AC adapter that came with the instrument. Never use the AC adapter with any other instrument. Doing so could result in damage or injury.</p> <p>=> Fire, electric shock, or malfunction can result.</p>
	<p>Do not use a power supply other than the one specified. Also, do not use with power supply voltages other than those indicated by this manual.</p> <p>=> Fire, electric shock, or malfunction can result.</p>
	<p>When connecting the instrument to commercial power, connect directly to a dedicated power outlet. Do not use extension cords as they can overheat and cause fire.</p>
	<p>Do not bring the power cord near any hot objects.</p> <p>=> The coating on the cord can deteriorate, causing fire or electric shock.</p>
	<p>Do not impair, damage, or attempt to modify the power cord.</p> <p>=> Fire or electric shock can result.</p>
	<p>Never place spent batteries in fire.</p> <p>=> Explosion, fire, or burns can result.</p>
	<p>Do not insert or drop any metal objects into any openings on the instrument, or inside the instrument.</p> <p>=> Fire, electric shock, or malfunction can result.</p>
	<p>The sensor element of this instrument contains indium gallium arsenide (InGaAs). InGaAs powder and vapor is dangerous. Therefore, never incinerate, destroy, break, grind, or apply chemicals to the instrument. Keep separate from general industrial or household waste, and dispose of the instrument according to relevant local laws.</p>



WARNING





	Do not plug too many cords into a single power supply outlet. => Heating of the cables or fire can result.
	Never bend, twist, or pull cables forcefully. => Fire or electric shock can result.
	If the power cord becomes damaged, have it replaced immediately by the dealer from which you purchased the instrument. => Otherwise fire or electric shock can result.
	Never plug in or unplug the power cord with wet hands. => Electric shock can result.
	Insert the power plug securely into the power outlet. => If metal or other objects are allowed to contact the plug, fire or electric shock can result.
	When unplugging the power cord always pull by the plug, never pull by the cord itself. => Pulling the power cord can cause damage leading to fire or electric shock.
	Always unplug the power cord from the outlet, and check that all externally connected wires and cables are removed before moving the instrument. => Otherwise, the cords can become damaged, causing fire or electric shock.
	For safety, always unplug the power cord from the outlet during periods of extended non-use. Also, be sure to unplug the power cord from the outlet during lightning storms. => Fire, electric shock, or malfunction can result.
	Do not use batteries that are not specified for this instrument. Also, do not use old and new batteries at the same time. => Explosion or leakage of the batteries can result, causing fire, injury, or contamination of the surrounding area.

	<p>Check the polarity of the batteries (plus/minus orientation) before installing them. => Incorrect orientation can result in explosion or leakage of the batteries, causing fire, injury, or contamination of the surrounding area.</p>
	<p>Do not bring the instrument into areas with high humidity or large amounts of dust. => Electric shock or malfunction can result.</p>
	<p>Do not place the instrument on unstable or inclined surfaces. => Physical damage can result if the instrument tips over or falls to the ground.</p>
	<p>Do not place the instrument in areas with frequent vibration or physical shock. => Physical damage can result if the instrument tips over or falls to the ground.</p>
	<p>Never place containers holding liquids or metallic objects on top of the instrument. => If water or metal objects spill onto or enter the instrument, fire, electric shock, or malfunction can result.</p>
	<p>Do not allow water or condensation to contact the instrument. => Fire, electric shock, or malfunction can result.</p>
	<p>If you detect any abnormal conditions such as smoke or unusual odors or failure of the screen to display, this may indicate the possibility of fire, electric shock, or malfunction. Immediately turn OFF the power switch and remove the power plug from the outlet, confirm that the abnormality ceases, and contact the dealer from which you purchased the instrument. Do not attempt to repair the instrument yourself, as doing so can be very dangerous.</p>
	<p>If you accidentally drop or damage the instrument, turn OFF the power switch, remove the power plug from the outlet, and contact the dealer from which you purchased the instrument.</p>

	<p>If the instrument experiences an abnormality, do not attempt to repair the instrument yourself. => Electric shock or damage can result. Also, any repairs conducted without authorized consent will not be covered by the product warranty.</p>
	<p>Never disassemble or rework the instrument. => Fire, electric shock, or malfunction can result.</p>
	<p>The light buffer, optical connector, and other sections that connect to the light source can emit dangerous lasers. Take care not to injure your eyes.</p>



CAUTION

	<p>Do not place the instrument in direct sunlight or areas of high temperatures. => The internal temperature of the instrument can rise, causing malfunction.</p>
	<p>Do not swing the instrument by its strap. => Damage or injury can result.</p>
	<p>When placing the strap around your neck, take care not to choke or strangle yourself.</p>
	<p>When handling parts that open and close, such as when changing the battery, take care not to pinch or injure your fingers.</p>

1-7. Specifications

Specifications of the AQ2160-02 Optical Powermeter

Wavelength range	750 nm–1700 nm (can be set in 5 nm steps)
Sensor element	InGaAs (1 mm ϕ)
Compatible fibers	SM (9/125 μ m), GI (50/125 μ m), GI (62.5/125 μ m) fibers
Input type ¹	Connector adapter (optional)
Power range ²	-70 dBm–+10 dBm
Noise level ²	-60 dBm
Accuracy ³	\pm 5%
Measured value display	7-segment, 4-digit display with backlight
Displayed units	Absolute values: dBm, mW, μ W, nW Relative values: dB
Range switching	Automatic
Measurement mode	Select CW light, or chopped light (270 Hz, 1 kHz, 2 kHz)
Measurement interval	Approximately 330 ms
Display resolution	0.01 dB
Relative value measurement	Relative value measurement relative to a set reference value. Relative value measurement based on a displayed measurement.
Backlight	Illuminates while the Backlight key is pressed, and stays on for approximately five seconds thereafter.
Power saving	Power save function turns the power OFF automatically if no key is pressed for ten minutes (function can be turned OFF).
Battery check	Low battery indicator
Resume function ⁴	Restores the settings active when the power was last turned OFF.
Memory function	Measured values, reference values, or measurement conditions can be saved or deleted to or from memory: 1000 (standard memory) + 100 (user memory).
Interface ⁵	USB version 1.1

User calibration function ⁶	Sets a correction value for the amount of attenuation in any fixed optical attenuators used in combination with the instrument.
Power supply	Two AA batteries (alkaline dry cells or nickel metal-hydride rechargeable batteries) ⁷
Operating environment	Operating temperature: 0–50°C Storage temperature: -25–+70°C Relative humidity: 85% or less (no condensation)
Weatherproofing	Conforms to JIS C 0920 (drip-proof) TYPE I and IEC 60529 Ipx1 (the drip test) ⁸
Dimensions and weight	Approximately 75 (W) x 152 (H) x 32 (D) mm and approximately 250 grams (main unit only)
Safety/EMC	Safety: EN61010-1 (Out of conformance since December 1, 2010.) EMC: EN61326-1 ClassB, Table2 (for use in industrial locations)

1. Connector type. Specify FC, SC, LC, MU, or ST.
2. The user calibration function setting varies depending on the fixed optical attenuator used.
3. $T_a = 23 \pm 5^\circ\text{C}$, at reference conditions (@ 1310 nm, -20 dBm). Excluding when setting the user calibration function.
4. Do not remove the batteries or unplug the AC adapter during operation.
5. By connecting to a PC on which the USB application software is installed, saved data can be output in CSV format.
6. Measurement up to +30 dB is possible when using a 20 dB fixed optical attenuator (that supports 1 W).
7. When connecting to the AQ2160-02, use a temperature range of 0–+50 °C. However, the safety standard for the AC adapter specifies an operational temperature of 0–40°C.
8. With the optical input connector cap and DC connector cap completely attached (without gaps).
9. When using USB, use a shielded USB cable of 2 meters in length or less. Attach a ferrite core (TDK: ZCAT1325-0530A or equivalent) on one end of the USB cable, close to the instrument's USB connector.

1-8. Periodic Calibration

Periodic calibration is an effective way to maintain the normal functionality of the instrument over long periods of time, and to enable quick identification of any problems. It is recommended to perform calibration of the instrument once per year.

2. Explanation of Functions

2-1 Names of Parts

Optical Input Section

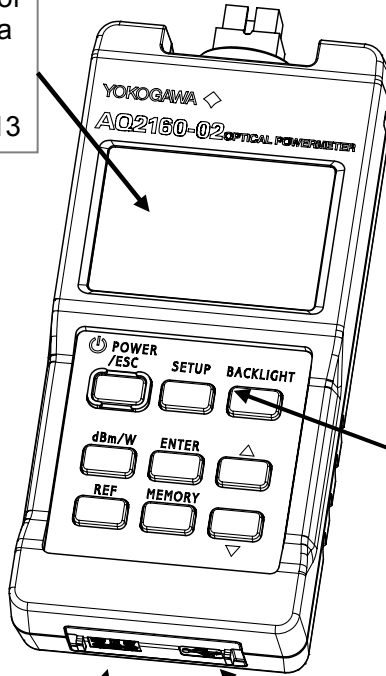
An optical connector for optical power input. Used with an optional connector adaptor.
=> See pages 24 and 64

Strap Hole

For attaching the neckstrap and connector cap attachment lead (one hole on each side of the instrument).
=> See page 26

Display

Displays various kinds of measured data and other information.
=> See page 13



Key Switch

- POWER key
- BACKLIGHT key
- dBm/W key
- REF key
- SETUP key
- ENTER key
- MEMORY key
- UP (▲) key
- DOWN (▼) key

Nine keys for controlling the instrument.
=> See page 11

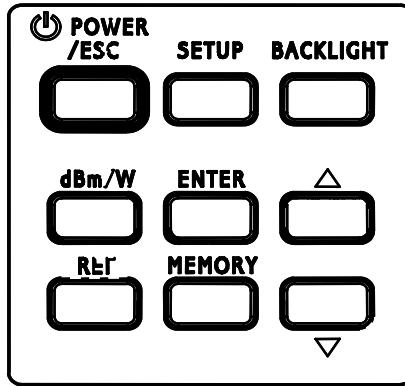
AC Adapter Terminal

Open the cap to connect the AC adaptor (optional)
=> See page 23

USB Connector Terminal (B Type)

Open the cap to connect a USB cable.

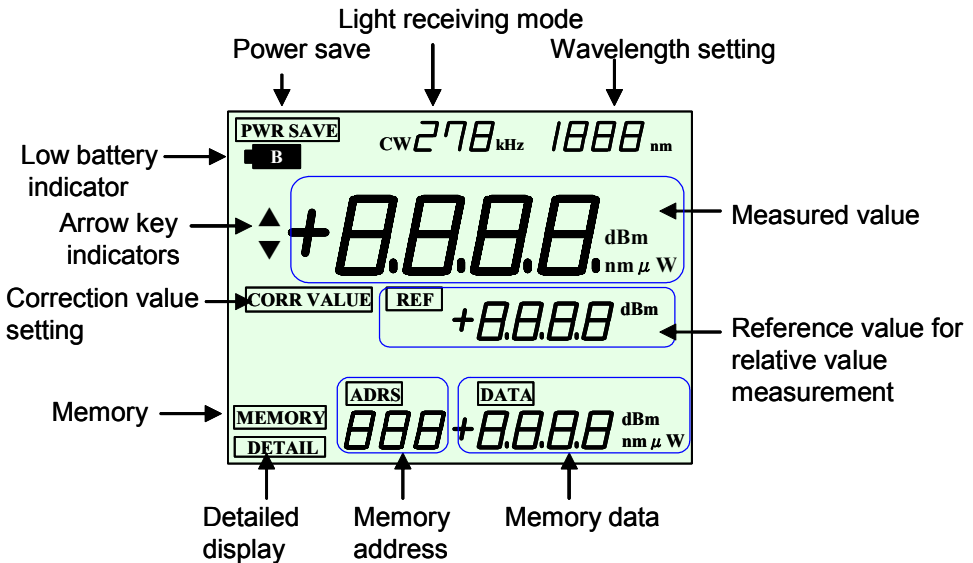
2-2 Keys



POWER/ESC	Power Supply and Escape Key
<p>This key turns the power ON and OFF. Press the key to start the instrument with the power save function enabled. If you hold down the button until the power save indicator (PWR SAVE) disappears, the instrument starts with the power save function disabled. To turn the instrument OFF, hold down the key until the LCD display goes out. You can press the key once during operation to return to normal measurement mode (ESC function).</p>	
BACKLIGHT	Backlight Key
<p>Press this key to turn ON the backlight for five seconds. Or, continue to hold down the key to keep the backlight illuminated indefinitely. When using the AC adapter, the backlight stays on automatically. Press the button again to turn OFF the backlight.</p>	
dBm/W	Unit Selection Key
<p>This key switches the units for absolute value measurement mode (dBm or W). Each time you press the key, the selected units change.</p> <ul style="list-style-type: none"> ·dBm => mW/μW/nW (auto select) => dBm <p>In relative value measurement mode, this key switches to absolute value measurement mode.</p>	
REF	Relative Value Measurement Key
<p>Sets the measured value at the moment the key is pressed as the reference value for relative value measurement. The instrument enters relative value measurement mode (displays the difference in measured values from the reference value) from the next measurement thereafter. Every time the key is pressed, the reference value is updated. REF is displayed along with the relative value measurement reference value (dBm) in the middle of the screen. The relative value (dBm) itself is displayed in the upper part of the screen. Also, in relative value measurement mode, you can press the SETUP key to enter an arbitrary reference value. (Related key: SETUP)</p>	

SETUP	Setup Mode Key
<p>Press this key to change to the Setup mode, in which various settings can be entered. In absolute value measurement mode, measurement conditions can be entered as follows.</p> <ul style="list-style-type: none"> • Light receiving mode setting (switching of the modulation frequency for CW light and chopped light) • Wavelength settings (typical value, or switching of the wavelength in 5 nm steps) • Averaging settings <p>Make selections using the UP/DOWN key, then press ENTER to enter the selection. If no changes are made, press the ENTER key repeatedly until you return to absolute value measurement mode. In relative value measurement mode you can set an arbitrary reference value for relative value measurement (dBm). Select the reference value using the UP/DOWN key, then press ENTER to enter the selection. After entering a setting, the instrument returns to absolute value measurement mode. (Related keys: UP/DOWN, ENTER)</p>	
ENTER	Entry Key
<p>Enters various kinds of selectable settings such as addresses. They key also clears various types of errors (data saving, data deletion, and resume errors). <i>Special operation: Hold down this key while pressing another key.</i> You can hold down the ENTER key while pressing the MEMORY key to perform user memory measurement. Also, if you hold down the ENTER key while pressing the SETUP key, you can execute the user calibration function. (Related keys: UP/DOWN, SETUP, MEMORY)</p>	
▲, ▼	Selection Key (UP/DOWN)
<p>Selects various kinds of settings such as addresses. Press once to change the selection one item UP or DOWN. Hold down to quickly scroll UP or DOWN through the selections. (Related keys: SETUP, MEMORY, ENTER)</p>	
MEMORY	Memory Measurement Key
<p>Pressing this key places the instrument in memory measurement mode. In memory measurement mode, operations related to memory data can be performed in the following order.</p> <ul style="list-style-type: none"> • Memory measurement (save measured data to an arbitrary address as it is being measured). • Memory recall (view any saved data in detail, recall reference values or measurement conditions) • Memory delete (delete any saved data or all data) <p>If no operation is to be performed, you can press the MEMORY key repeatedly until the instrument returns to normal measurement mode.</p>	

2-3 Screens



Power save	PWR SAVE
Displayed when the power save function is set. (Related key: POWER)	
Low Battery Indicator	B
Blinks when the remaining battery charge is too low to provide sufficient power for operation. If it blinks, you must change the batteries immediately. While the indicator is displayed, data saving and deletion, and resuming is disabled.	
Light Receiving Mode	CW278kHz
Displays the specified light receiving mode (CW/270 Hz/1 kHz/2 kHz).	
Wavelength Setting	1888 nm
Displays the set wavelength (nm).	
Arrow Key Indicators	▲ ▼
Displayed when various kinds of selectable settings such as addresses are available. (Related key: UP/DOWN)	
Measured Value	+8.8.8.8.dBm nmμW
Displays the measured value and its units. Messages appearing during errors and entry of settings are also displayed here. (Related keys: dBm/W, REF)	

Correction Value Setting	CORR VAL
Displayed when the correction value is set using the user calibration function.	
Relative Value Measurement Reference Value	REF +8.8.8.8 dBm
Displays the value when in relative value measurement mode. Also displays selection messages during entry of settings. (Related key: REF)	
Memory	MEMORY
Displayed when in memory measurement mode.	
Detailed Display	DETAIL
Displayed when in detailed display mode.	
Memory Address	ADRS
Displays the memory address. The memory addresses are 000-999 and U00-U99 (user memory).	
Memory Data	DATA
Displays the measured value saved to the memory address. When not in memory measurement mode, displays the "AVG" message when setting up averaging.	

2-4 Modes

This instrument has five modes as shown in the table. When the power is turned ON, the instrument starts up in normal measurement mode. You can press the MEMORY key to transition from normal measurement mode into the other modes. When a USB cable is connected, the instrument switches to USB mode automatically. When the USB cable is removed, the instrument displays the screen that was last active when the cable was first connected. If the mode last active was absolute value measurement mode, then that mode is restored. If it was relative value measurement mode, then that mode is restored.

Mode	Functions
Normal measurement mode	Optical power measurement, absolute value measurement, relative value measurement, setting measurement conditions, and changing the displayed units.
Memory measurement mode	Saving measured data, saving measurement conditions, and displaying saved data (addresses and measured data only). Measurement continues even when data is being displayed.
Detailed display mode	Displaying saved data in detail ¹ (displaying not only measured data but also measurement conditions). Measurement using the saved measurement conditions ² .
Data clear mode	Deleting data. You can choose to delete one, or all data items.
USB mode	Uploading saved data to a PC. All memory items can be deleted.

1. A value is displayed under REF, but no value is displayed under CAL (only enabled/disabled is indicated).
2. Including data being detailed-displayed, and excluding when the user calibration setting is active.

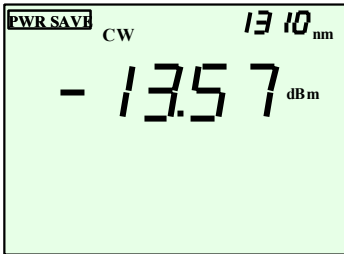
2-4-1 Normal Measurement Mode

Optical power can be measured using absolute or relative values. You can set measurement conditions for each type of measurement.

■ Absolute Value and Relative Value Measurements

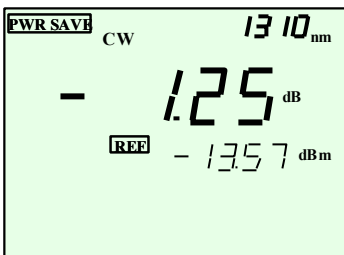
You can perform power measurement and loss measurement. Power measurement involves measurement of absolute values. The units of the measured values are either dBm or W (this instrument uses mW, μ W, or nW). With loss measurement, the difference in optical power levels (dBm) from a reference value is measured. Loss measurement involves measurement of relative values. The units of the measured values are dB. The measured value is displayed in the upper part of the screen (the largest number).

<Display Example>



- Absolute Value Measurement (Power Measurement)

The display indicates that the measured optical power level is -13.57 dBm. With the power save function ON, light receiving mode of CW light, and wavelength setting of 1310 nm.



- Relative Value Measurement (Loss Measurement)

The display indicates that the measured optical power level is -1.25 dB relative to the reference value (-13.57 dBm). If the optical power level drops by 1.25 dB after pressing the REF key, this indicates a 1.25 dB insertion loss in the section under test (optical fiber, optical component, etc.).

■ Setting Measurement Conditions and Switching the Displayed Units

- You can enter settings for the measurement conditions of light receiving mode, measurement wavelength, and averaging (see section 3-3). You can set a reference value (REF) for relative value measurement.
- You can switch the units of display for the measured value to either dB scale (dBm), or linear scale (W).

2-4-2 Memory Measurement Mode

Data measured in normal measurement mode and setting conditions can be saved in the instrument's memory. Also, you can display saved data (addresses and measured data only). Measurement continues even while data saved in memory is being displayed.

■ Standard Memory and User Memory

This instrument has two types of memory.

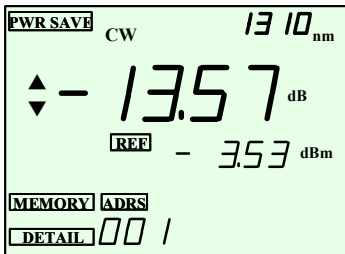
- Standard memory: holds up to 1000 data.
The address are 000 to 999.
- User memory: holds up to 100 data.
The address are U00 to U99.

User memory is available for storing important data and settings. We recommend that you use user memory for critical data that you wish to keep from being easily deleted. The procedure for saving and recalling data is slightly different for standard memory and user memory.

2-4-3 Detailed Display Mode (Memory Recall Mode)

Details on measured data saved in memory or settings can be displayed in this mode. Also, saved measurement conditions can be loaded and applied to the next measurement.

<Display Example> Detailed Display (Memory Recall)



DETAIL and ADRS are displayed, indicating the mode in which measured data saved to memory is displayed in detail. In the example, the data saved in address 001 is -13.57 dB, which is the value relative to the reference value of -3.53 dBm.

2-4-4 Data Clear Mode

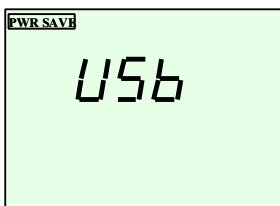
Clears data saved to memory.

You can delete one data at a time (ONE), or all data (ALL).

2-4-5 USB Mode

In this mode, you can upload measured data from the instrument to a PC using the USB interface. The data is transferred in CSV format, so you can process the information on standard PC applications. Also, you can delete all data from unused memory.

<Display Example>



When the instrument detects that a USB cable is connected, the instrument switches automatically to USB mode. In USB mode, all keys are disabled except for the POWER key. When the USB connection is broken, the instrument displays the screen that was last active when the cable was first connected.

The following table shows the USB communication functions of the instrument.

Function			Description
Communication functions	Upload of measured data	Output data	Measured data and common information such as the day of upload and comments (see section 6-3).
		Format	CSV
		Display language	Japanese or English (selected when installing the USB application)
		Output items	Standard memory: 1000 User memory: 100
	All clear	Deletes all data saved on the OPM from the PC.	
Other function	Power save	Can be selected when not starting up the instrument with the AC adapter. When Power save is enabled, the power is turned OFF if no keys are pressed for a ten-minute period.	
PC system requirements	Operating system	Windows 2000, Windows XP. Use a CPU, RAM, and display etc. that is recommended for your operating system.	
	Hard disk	10 MB or more of available space	
	Interface	USB version 1.1 (one unit can be connected)	

USB application software (for data transfers) is included on the accessory CD-ROM (real time measurement via remote control or communications is not included).

2-5 Other Functions

2-5-1 Backlight

Power Condition	Turning ON	Turning OFF
Battery power	Approximately five seconds after pressing the key. Stays on while depressed.	After turning ON, goes out approx. five seconds after releasing the key. Press the key again.
AC adapter	Illuminates continuously after pressing the key.	Does not turn OFF automatically. Press the key again.

The method for turning the backlight ON and OFF differs depending on whether the unit is being powered by batteries or the AC adapter. It is always active when the power is ON, unless the USB cable is connected.

2-5-2 Power Save

Power Condition	Explanation of Function
Battery power	Power automatically turned OFF if no keys are pressed for ten minutes.
Battery power, started up holding key down	The function is disabled when the instrument is turned ON by holding down the Power key.
AC adapter	The function is disabled when powered by the AC adapter.

If the instrument is powered by the AC adapter and batteries (or USB), the Power save function is enabled if the power from the AC adapter fails. When running on battery power (or USB) only, if power from the AC adapter is introduced, the Power save function is disabled.

2-5-3 Battery Check

Power Condition	Explanation of Function
Battery voltage falls below a specified level	Low battery indicator blinks. => Change the batteries immediately.
Battery voltage falls even farther below a specified level	The instrument shuts down automatically, as if no power were being supplied at all.

When using certain types of nickel metal-hydride rechargeable batteries, the instrument may shut down immediately after the low battery indicator blinks.



Data cannot be saved or deleted while the low battery indicator is displayed. The resume value is also not saved.

2-5-4 Resume

The settings that were active when the power was turned OFF are saved and restored the next time the power is turned ON.

The function is disabled when the low battery indicator is displayed. In this case, the instrument saves the settings that were last active when the power was turned OFF normally.

■ The settings that are saved by the Resume function are as follows.

- Absolute/relative value measurement
- Measurement wavelength (typical)
- Measurement wavelength (user specified)
- Measurement mode
- Displayed units
- Relative value measurement reference value
- Averaging ON/OFF
- User calibration ON/OFF
- User calibration value
- Standard memory addresses
- User memory addresses
- Sort keys

* The sort keys are values that identify the order in which data was acquired. Incrementation (the count) of the sort key continues while under power.

- When saving data in Memory Measurement mode, the count values are saved together with the data.
- When processing data on a PC, you can use the count values to sort the data.
- The sort keys cannot be used with the OPM by itself.

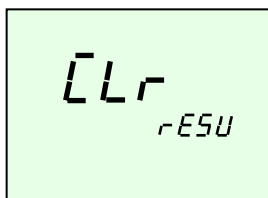
2-5-5 System Reset

This function restores settings such as measurement conditions to their original condition upon shipment from the factory.

Procedure	Display	Description
Turn the power ON while pressing SETUP.	CLr and rESU are displayed, followed by measured values.	Start-up procedure. Hold down until screen displayed.

This function restores the Resume values, and does not initialize the standard and user memories. After resetting the system, the instrument enters normal measurement mode in which the system reset values are used as the initial values.

<Display Example>
System Reset Screen



<Initial Values upon System Reset>

Section	Initial Value
Mode, changing to normal measurement	Absolute value meas.
Measurement wavelength	1310 nm
Measurement mode	CW
Displayed units	dBm
Averaging	OFF
User calibration function setting	OFF
User calibration value	0.00 dB
Standard memory address	000
User memory address	U00
Sort key	0



Even when starting with a system reset, Power save is set if powered by batteries. However, if you hold down the POWER key after executing a system reset, the Power save setting is disabled.

2-5-6 User Calibration

This function displays values compensated by the arbitrarily specified user calibration value (CAL). CAL can be set in the range from -10 dB to 25 dB. The active power range and the setting range for the relative value measurement reference value is shifted by the value of CAL. The CAL value can be entered automatically and edited if necessary. The ON status of the calibration function and the CAL value are saved even when the power is turned OFF.

The following are two examples of usage.

- 1) Measurement of high output level light that exceeds the upper limit of the power range (see 3-6, "High Power Measurement"). In this case, by storing the amount of attenuation from a jointly-used fixed optical attenuator as the CAL value on the instrument, the measured values can be read directly.
- 2) Minute adjustment for differences in instruments when using another optical powermeter. You can cancel out the differences in measured values between two optical powermeters, which is useful for loss measurements.



Measurement of high output light requires a separate fixed optical attenuator in addition to this instrument. Use a fixed optical attenuator that supports the optical levels you will measure.

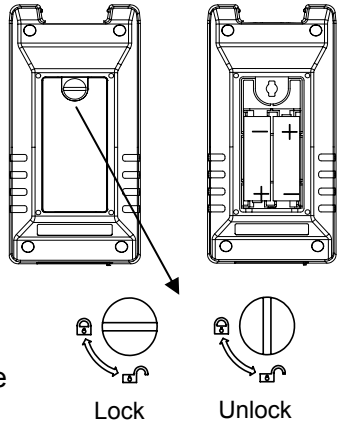
3. Measurement

3-1 Preparing for Measurement

3-1-1 Installing the Batteries

■ Dry Cells

Turn the screw on the rear panel with a coin or other flat object to remove the cover, then install the batteries. Turning the screw locks/unlocks the cover as shown in the figure.



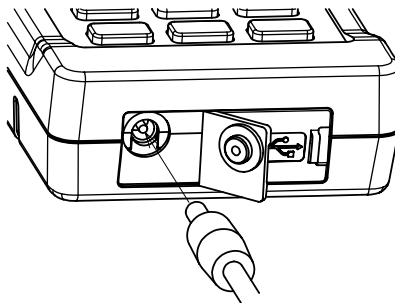
Insert two AA batteries into the holder following the polarity markings. Always close the cover after installing batteries.



If the low battery indicator blinks, you must change the batteries immediately. The instrument runs for approximately forty hours when using alkaline AA batteries (performance may vary depending on the types of batteries used, and operating conditions).

■ AC Adapter

Connect the AC adapter output terminal to the instrument's AC adapter terminal after opening the cap.



3-1-2 Attaching a Connector Adapter

A specialized connector adapter (SU2004A-***, optional) is required for connecting an optical connector to the instrument. Choose an adapter that matches the optical connector you will use.



The screw mechanism that attaches the connector adapter to the instrument is of precision manufacture. Please handle all parts with care so as not to damage the screw threads.

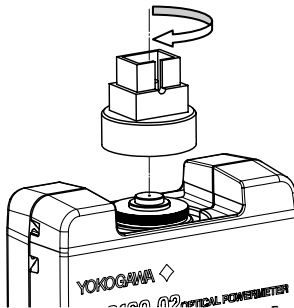


Do not allow dirt to come into contact with the optical input section. Dirt or other foreign particles can influence measurement. Attach the protective cap to the optical input connector when not in use.

- (1) Remove the optical input connector cap.
- (2) Attach a connector adapter (SU2004A-***, optional).
The connector adapter screws onto the connector; hold the adapter upright to align the threads properly, then turn to tighten.



Do not attach the connector adapter at an angle, and do not forcibly turn it any further after it has initially tightened. Doing so can damage the screw threads or sensor.



Reference

It is recommended to clean the inside of the connector adapter using a dedicated swab or other cleaner.

Dedicated swabs for cleaning optical adapters are available from NTT, including the “OPTIPOP-S” (NTT-AT), and the “CLETOP Stick-Type” (NTT-ME).

3-1-3 Connecting the Optical Connector (Optical Fiber)

Insert the optical connector firmly and completely into the connector adapter. If the connection is not sound, measurements will be inaccurate.

- Optical Fiber

- Supports single mode: (9/125 μm) and multimode: GI (50/125 μm), GI (62.5/125 μm).

- Ferrule

- Supports PC and FLAT polish.

- Performance is not guaranteed with angled PC.

- * Regarding support for APC (angled PC) fiber

- (1) There are many kinds of angled PC connector polishes.

- Performance is not guaranteed with angled PC connectors because the measured value depends on the shape of the tip. However, it should be noted that with single mode fiber, measured values using an eight-degree APC connector are nearly identical to those when using a PC connector.

- (2) When connecting an APC connector to the receptacle, defects can, very rarely, be found in the ferrule tip. Such defects are not representative of the overall characteristics of the instrument. Also, APC connectors are intended to create low-reflection J-J connections, and therefore connections with a receptacle cannot be fully guaranteed. If a defect should be found, the cause is most likely a splinter. Consequently, any damage incurred by the instrument or to the customer's optical fiber as a result of a defective APC connector ferrule tip is not covered under warranty.



Always use an optical connector that matches the instrument. Also, before making connections, clean the ends with a dedicated cleaner.

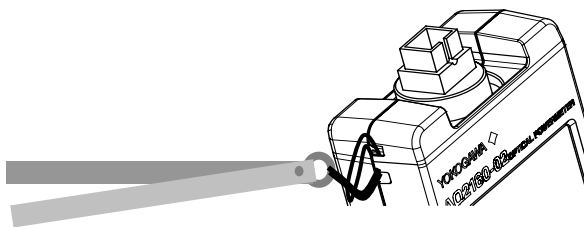
Reference

Dedicated cleaners for cleaning optical connectors are available from NTT, including the NTT-AT "OPTIPOP-R" (NTT-AT), and the "CLETOP Real-Type" (NTT-ME).

-
- ❗ When using a bare fiber adapter, make sure that it does not protrude beyond the ferrule end. Protruding fibers can damage the optical input section resulting in incorrect measurements.
 - ❗ Incidence of excessive light outside of the optical power measuring range can damage the sensor element.
 - ❗ When not using the instrument, attach the optical input connector cap to protect the connector from dirt, grime, and other foreign particles.
 - 🚫 Looking at the optical fiber, end of the optical connector, or other items that connect to the light source can result in damage to the eyes from lasers. Never peer into these items.

3-1-4 Attaching the Neck Strap

Attach the neck strap by feeding it through the strap attachment holes as shown in the figure.



- 🚫 Do not swing the instrument by its strap. Damage or injury can result. Also, when placing the strap around your neck, take care not to choke or strangle yourself.

3-2 Turning the Power Supply ON and OFF

3-2-1 Turning ON the Power

■ Starting Up in Power Save Mode

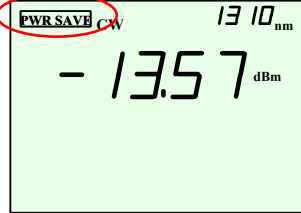
When the power is OFF, press POWER/ESC.

PWR SAVE is displayed in the upper left part of the screen.

<Display Example>

In Power save mode, the power turns OFF if no key is pressed for ten minutes.

However, Power save mode is disabled when using the AC adapter.



■ Starting Up When Power Save Mode Is OFF

When the power is OFF, hold down POWER/ESC until **PWR SAVE** disappears from the screen.

The AC adapter is available as an option (SU2007A-*).



Never use an AC adapter or power cable other than the dedicated one available for use with this instrument, as damage can result.

* This instrument performs a zero adjustment (auto-offset) when the power is turned ON.

For low level measurement (-50 dBm or less), in order to cancel out temperature changes and other effects, it is recommended to power cycle the instrument before measurement to perform the zero adjustment. The zero adjustment need not be performed while shielded from light. The optical connector cap is designed to protect the connector from dirt and collision, and does not provide light shielding.

3-2-2 Turning the Power OFF

Hold down the power key until the LCD display goes out.

Remove the optical connector and attach the optical connector cap.

When using the AC adapter, turn the instrument OFF with the power key before connecting the adapter.

3-3 Entering Measurement Conditions

The following three measurement condition parameters can be set.

- 1) Light receiving mode setting (switching of the modulation frequency for CW light and chopped light)
- 2) Wavelength settings (typical value, or setting of the wavelength in 5 nm steps)
- 3) Averaging settings

These three measurement conditions can be set all at once, but the following explains how to set each one individually.

The conditions set here are stored until the the next time you enter settings, even if the power is turned OFF (Resume Function).

If you make a mistake, press the ESC or SETUP key.

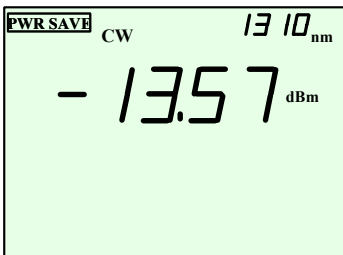
ESC key: Return to normal measurement mode.

SETUP key: Cancel the setting and advance to next item.



The setting procedures described all start from the Initial state (absolute value measurement in normal measurement mode).

<Display Example> Initial state

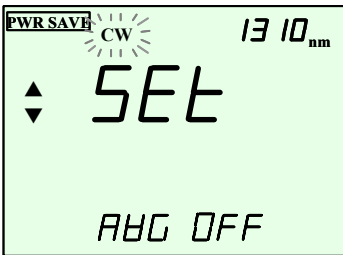


Same screen as when first starting up. Confirm that the screen shows the Initial state, then begin the procedure for entering measurement conditions.

3-3-1 Entering Settings for Light Receiving Mode

Step	Key	Display	Description
1	SETUP	<i>SEL</i> is displayed, and the light receiving mode indicator blinks (ex. "CW" blinks).	Changes to light receiving mode settings.
2	[UP] or [DOWN]	CW => 270Hz => 1kHz => 2kHz => CW	Press the key repeatedly to scroll through the options ([DOWN] scrolls in reverse).
3	ENTER	The mode display stops blinking. The wavelength setting blinks.	Selects the light receiving mode. To set the wavelength, start on step 3 in section 3-3-2.
4	ENTER	<i>AVG</i> ON or OFF blinks.	Changes to the averaging setting.
5	ENTER	<i>SEL</i> changes to the measured value display.	Exits light receiving mode settings.

<Display Example> Light Receiving Mode Selection Screen (Step 1)



If the optical power to be measured is chopped light, you must enter light receiving mode settings on the instrument to match the modulation frequency of that light.

A light receiving mode error is displayed if chopped light of a different modulation frequency than that of the settings is detected, and measurement fails.

When set to CW, chopped light can also be measured.

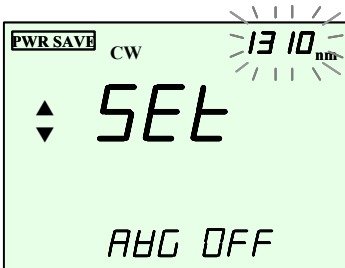
3-3-2 Setting the Wavelength

■ Selecting Typical Values (Specified Typical Wavelength)

Step	Key	Display	Description
1	SETUP	<i>SEL</i> is displayed. The light receiving mode indicator blinks.	Changes to light receiving mode settings.
2	SETUP	The wavelength setting blinks (ex. "850" blinks), and the light receiving mode stops blinking.	Changes to wavelength settings.
3	[UP] or [DOWN]	850nm => 1300nm => 1310nm => 1490nm => 1550nm => 1625nm => 1650nm => previous value =>USR => 850nm	Press the key repeatedly to scroll through the options ([DOWN] scrolls in reverse). Select the desired wavelength. If you select USR, see [2] below.
4	ENTER	The mode display stops blinking. <i>AVG</i> ON or OFF blinks.	Selects the measurement wavelength. To enter averaging settings, see step 4 in section 3-3-3.
5	ENTER	<i>SEL</i> changes to the measured value display.	Exits measurement wavelength settings.

(Note) *Previous value* refers to the previously set detail wavelength settings. This is different from the factory default setting.

<Display Example> Wavelength Setting Selection Screen (Step 2)



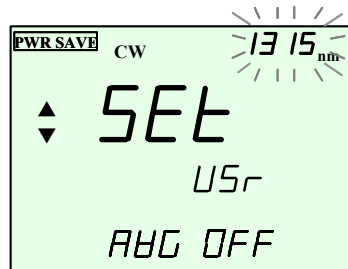
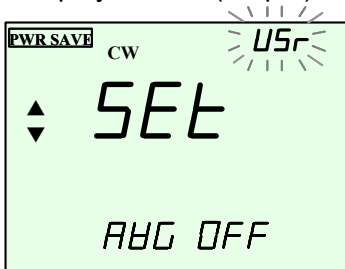
Since the sensor element has wavelength sensitivity characteristics, the instrument stores a correction value corresponding to the wavelength. For accurate measurements, you must set the instrument's wavelength setting to match the wavelength of the optical power to be measured.

■ Selecting the Wavelength Using Detailed Values (in 5 nm Steps)

Step	Key	Display	Description
1	SETUP	<i>SEt</i> is displayed. The light receiving mode indicator blinks.	Changes to light receiving mode settings.
2	SETUP	The wavelength setting blinks (ex. "850" blinks), and the light receiving mode stops blinking.	Changes to wavelength settings.
3	[UP] or [DOWN]	850nm => 1300nm => 1310nm => 1490nm => 1550nm => 1625nm => 1650nm => previous value => USR => 850nm	Press the key repeatedly to scroll through the options ([DOWN] scrolls in reverse). Select USR.
4	ENTER	<i>USr</i> is displayed to the lower right of <i>SEt</i> . The wavelength setting blinks (ex.: "1315")	Changes to the wavelength user settings.
5	[UP] or [DOWN]	750nm => 755nm => 760nm => 765nm => 1690nm => 1695nm => 1700nm	Changes in 5 nm steps. Hold the key down to scroll rapidly.
6	ENTER	The mode display stops blinking. <i>AVG</i> ON or OFF blinks.	Selects the measurement wavelength. Changes to the averaging setting.
7	ENTER	<i>SEt</i> changes to the measured value display.	Exits measurement wavelength settings.

<Display Example>

Wavelength Setting USR Screen (Step 3) 5 nm Step Wavelength Display Screen (Step 6)

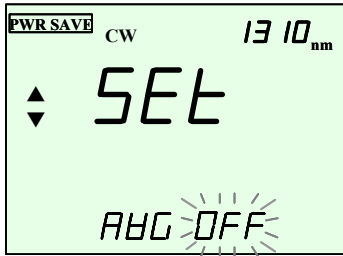


3-3-3 Entering Averaging Settings

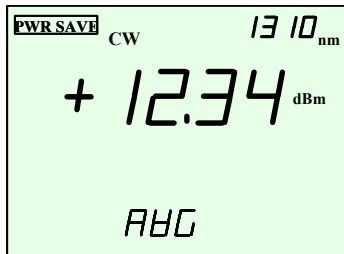
Step	Key	Display	Description
1	SETUP	<i>SET</i> is displayed. The light receiving mode indicator blinks.	
2	SETUP	The wavelength setting blinks (ex. "850" blinks), and the light receiving mode stops blinking.	Changes to wavelength settings.
3	SETUP	<i>AVG</i> ON or OFF blinks.	Changes to the averaging setting.
4	[UP] or [DOWN]	ON and OFF are displayed alternately.	Press the key repeatedly to scroll through the options. Select ON.
5	ENTER	<i>SET</i> changes to the measured value display.	Exits averaging settings.

The measured value blinks for approximately seven seconds, until the averaging buffer is filled.

<Display Example> Averaging Setting ON/OFF Selection Screen (Step 3)



<Display Example> Measurement Screen When Averaging is Turned ON



AVG is not displayed when averaging is turned OFF.

3-4 Power Measurement (Absolute Value Measurement)

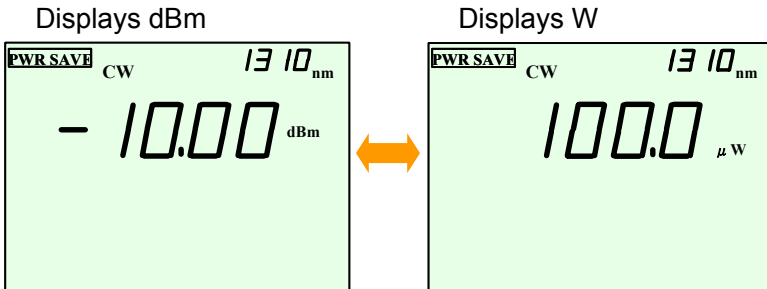
When the power is turned ON, measurement begins. The optical power level is displayed in the measured value display area. If the units are dB, loss measurement (relative value measurement mode) is indicated. Press the dBm/W key to switch to power measurement (absolute value measurement mode).

- Switching the Displayed units
You can switch the units of display for the measured value to either dB scale (dBm), or linear scale (W).

Key	Display	Description
dBm/W	dBm => mW/ μ W/nW (automatically selected)=> dBm	Each time you press the key, the displayed units change.

<Display Example>

Screens When Switching the Displayed Unit



3-5 Loss Measurement (Relative Value Measurement)

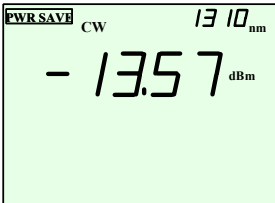
Measures the difference from a reference power level. The reference power level can be set in the following two ways.

- 1) Set measured data as the reference value (section 3-5-1).
- 2) Set an arbitrary value as the reference value (section 3-5-2).



The setting procedures described all start from the Initial state (absolute value measurement in normal measurement mode).

<Display Example> Initial state



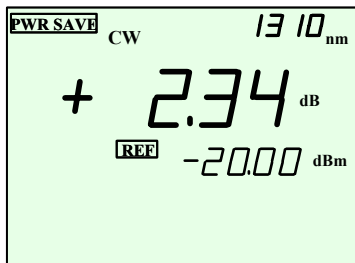
Same screen as when first starting up. Confirm that the screen shows the Initial state before beginning the procedure.

3-5-1 Setting the Displayed Measured Value as the Reference Value

Key	Display	Description
REF	The relative value (dB) is displayed in large numbers, along with the REF indicator and the relative value measurement reference value (dBm) in the middle of the screen.	Each time the key is pressed, the measured value at that moment is set as the reference value.

<Display Example>

Relative Value Measurement Screen
(Measured data as the reference value)



* Reference value not displayed during an under/overrange, or light receiving mode error.

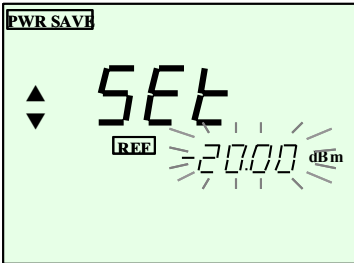
* To return to absolute value measurement, press dBm/W.

3-5-2 Setting an Arbitrary Value as the Reference Value

Step	Key	Display	Description
1	REF	The relative value (dB) is displayed in large numbers, along with the REF indicator and the relative value measurement reference value (dBm) in the middle of the screen.	Each time the key is pressed, the measured value at that moment is set as the reference value.
2	SETUP	<i>SET</i> is displayed. The reference value blinks.	
3	[UP] or [DOWN]	Every time the key is pressed, the reference value changes.	Sets an arbitrary reference value (-70 dBm to 10 dBm). Hold the key down to scroll rapidly.
4	ENTER	<i>SET</i> changes to the measured value display.	Exits arbitrary reference value setting.

<Display Example>

Absolute Value Measurement Screen (Step 3)
(Arbitrary reference value set)



3-6 High Power Measurement

The amount of attenuation in the fixed optical attenuator used is stored as the user calibration value (CAL), and you can perform “high power measurement” of power that exceeds the upper limit of the measurement power range. When performing high power measurement, do not input light that exceeds the measurement maximum value in the following equation.

$$\begin{aligned} \text{Measurement max. value} &= \text{upper limit of power range} + \text{amount of} \\ &\text{attenuation in the fixed optical attenuator} \\ +X' \text{ dBm} &= +10 \text{ dBm} + X \text{ dB} \end{aligned}$$

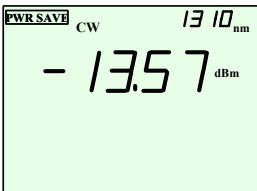
The CAL value can be set in the following two ways.

- 1) Enter the amount of attenuation in the fixed optical attenuator directly (section 3-6-1).
- 2) Enter the amount of attenuation as measured by relative value measurement (section 3-6-2).



The setting procedures described all start from the Initial state (absolute value measurement in normal measurement mode).

<Display Example> Initial state



Same screen as when first starting up. Confirm that the screen shows the Initial state before beginning the procedure.



For effective use with the instrument, it is recommended to use a fixed optical attenuator with 20 dB of attenuation, and a maximum allowable optical input level of 1 W or more. With such devices, do not input light that exceeds +30 dB.



Do not look inside the optical connector nor peer into the optical device. Doing so can result in injury to the eyes from lasers. Take necessary precautions.



Clear this function before measuring optical levels of +10 dB or lower.

3-6-1 Measuring after Editing the CAL Value

Enter the amount of attenuation in the fixed optical attenuator as the CAL value.

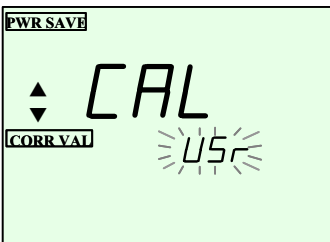
Step	Key	Display	Description
1	Press SETUP while pressing ENTER.	CORR VAL and CAL are displayed. The relative value measurement reference value blinks.	Changes to CAL setting.
2	[UP] or [DOWN]	=> Previous value (initial value is 0.00 dB) => USR => OFF => previous value	Press repeatedly to scroll through options ([DOWN] scrolls in reverse). Select USR.
3	ENTER	USR is displayed to the lower right of CAL . The relative value measurement reference value blinks.	Changes to CAL value user setting. CAL can be directly input.
4	[UP] or [DOWN]	The number in the relative value measurement reference value display changes. CAL setting (-10.00 dB–25.00). Set according to the amount of attenuation in the fixed optical attenuator.	Changes in 0.01 dB steps. Hold the key down to change the value rapidly.
5	ENTER	The mode display stops blinking. The measured value is displayed. CORR VAL display and absolute value measurement mode.	Selects the CAL value. Exits CAL value setting.

Hereafter, the level of the measured light input from the fixed optical attenuator is read directly.

* When selecting the previous value and pressing ENTER, the instrument returns to absolute value measurement mode without setting a new correction value.

<Display Example>

CAL Function Selection Screen (Step 2)



CAL Value Selection Screen (Step 3)



3-6-2 Measuring after Automatic Setting of the CAL Value

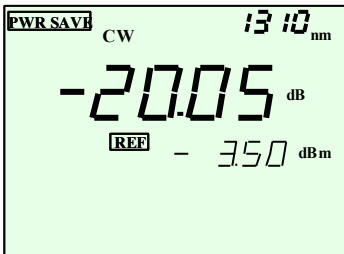
The amount of attenuation in the fixed optical attenuator measured in relative value measurement is automatically set as the CAL value.

Step	Operation/Key	Display	Description
1	Input an arbitrary light for measurement (10 dB or less) without connecting a fixed optical attenuator.	Displays the measured value of optical power for the input light.	Absolute value measurement mode is active.
2	REF	REF is displayed along with the input optical power (dBm) in the middle of the screen.	The input optical power is set as the relative value measurement reference value.
3	Connect a fixed optical attenuator, then input the same light for measurement.	The amount of attenuation in the fixed optical attenuator is measured and displayed (as a negative value).	Relative value measurement mode with the fixed optical attenuator connected.
4	Press SETUP while pressing ENTER.	CORR VAL display and absolute value measurement mode.	The measured amount of attenuation in the fixed optical attenuator is set as the CAL value (negative value).

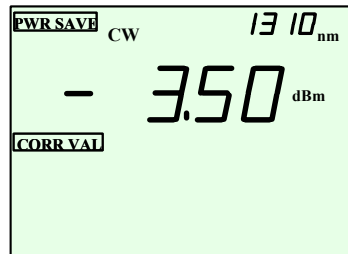
Hereafter, the level of the measured light input from the fixed optical attenuator is read directly.

<Display Example>

CAL Value/Amount of Attenuation Measurement Screen (Step 3)



CAL Function Measurement Screen (Step 4)



When inputting high output light to the optical connector, any dirt or particles adhering to the end of the fiber may be fused to it, and damage can result.

Clean the ends of the fibers before use.

- * To display the currently set CAL value press SETUP while holding down ENTER (in absolute value measurement mode, step 4 above) in which **CORR VAL** is displayed.

<Display Example> Display of the Currently Set CAL Value



- * However, any saved CAL value (the CAL value currently *not* set) is not displayed even in detailed display. You can confirm the value by transferring it to a PC using the USB application software.

3-6-3 Clearing the CAL Value

Step	Key	Display	Description
1	Press SETUP while pressing ENTER.	CORR VAL and CAL are isplayed. The relative value easurement reference value blinks.	Changes to CAL value clearing.
2	[UP] or [DOWN]	=> Previous value (currently set value) => USR => OFF => previous value	Press the key repeatedly to scroll through the options ([DOWN] scrolls in reverse). Selects OFF.
3	ENTER	Absolute value measurement mode. Displays the measured value. CORR VAL goes out.	Clears the CAL value. Exits clearing of the CAL value.



When removing the fixed optical attenuator and returning to normal measurement mode, you must turn OFF the instrument and confirm that CORR VAL is no longer displayed. Measured values will not be displayed correctly in normal measurement mode if CORR VAL is displayed.

<Display Example>

CAL Value Clearing Screen (Step 2)



4. Saving Measured Data

You can perform optical power measurement and saving of measured data while memory addresses and memory data are displayed.

The addresses to save to can be set arbitrarily.

After saving data, the address is automatically incremented. However, if the last address is (999 or U99) it is overwritten, and the address is not incremented (if a numerical value is not displayed in the DATA area, this indicates an address in which no data has been saved.).



All procedures start from normal measurement mode (see section 2-4-1).

Confirm that the instrument is in normal measurement mode (absolute value measurement or relative value measurement) before beginning the procedure.

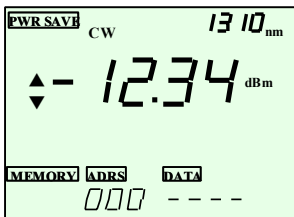
4-1 Saving to Standard Memory

Step	Key	Display	Description
1	MEMORY	MEMORY ADRS DATA are displayed. The address is shown in the ADRS field.	Changes to memory measurement mode.
2	[UP] or [DOWN]	[UP]: Increase, [DOWN]: Decrease. 1000 data can be set to addresses 000 to 999.	Specifies the address to save to. Hold the key down to scroll through addresses.
3	ENTER	<i>SAVE</i> is displayed. Measured value displayed in DATA field, <i>YES</i> blinks.	Displays data to be saved.
4	[UP] or [DOWN]	<i>YES</i> or <i>NO</i> blinks, depending on which one was selected.	Confirms whether to execute the save.
5	ENTER	<i>YES</i> : Address increases by 1 <i>NO</i> : Address number does not change.	YES: Execute the save. NO: Do not save.
6	ESC	Returns to normal measurement mode. Displays the measured value.	Exits memory measurement mode.

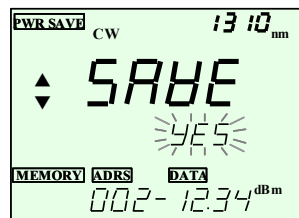
To continue saving, press ENTER and repeat the procedure. Press ESC to cancel the procedure midstream. Returns to normal measurement mode.

<Display Example>

Measurement Screen during Mem. Meas. (Step 1)



Data Save Screen (Step 3)



4-2 Saving to User Memory

User memory is available for storing particularly important data and settings.

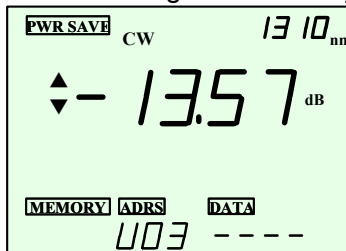
Step	Key	Display	Description
1	Press MEMORY while pressing ENTER.	MEMORY ADRS DATA are displayed. Address is shown in the ADRS field.	Changes to memory measurement mode.
2	[UP] or [DOWN]	[UP]: Increase, [DOWN]: Decrease. 100 data can be set to addresses U00 to U99.	Specifies the address to save to. Hold the key down to scroll through addresses.
3	ENTER	<i>SAVE</i> is displayed. Measured value displayed in DATA field, <i>YES</i> blinks.	Displays data to be saved.
4	[UP] or [DOWN]	<i>YES</i> or <i>NO</i> blinks, depending on which one was selected.	Confirms whether to execute the save.
5	ENTER	<i>YES</i> : Address increases by 1 <i>NO</i> : Address number does not change.	YES: Execute the save. NO: Do not save.
6	ESC	Returns to normal measurement mode. Displays the measured value.	Exits memory measurement mode.

To continue saving, press ENTER and repeat the procedure. Press ESC to cancel the procedure midstream. Returns to normal measurement mode.

User memory addresses are displayed as U_ _.

<Display Example>

Measurement Screen during User Memory Measurement (Step 1)



5. Recalling and Deleting Saved Measurement Data

5-1 Recalling Saved Data



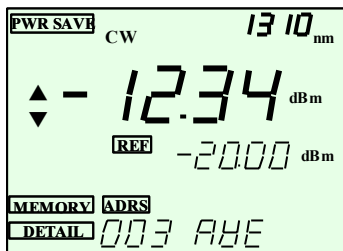
All procedures start from normal measurement mode (see section 2-4-1). Confirm that the instrument is in normal measurement mode (absolute value measurement or relative value measurement) before beginning the procedure.

Step	Key	Display	Description
1	MEMORY	MEMORY ADRS DATA are displayed. Address is shown in the ADRS field.	Changes to memory measurement mode.
2	MEMORY	DETAIL is displayed. Saved data including measured values and conditions saved to the displayed addresses.	Changes to detailed display mode. Recalls saved data.
3	[UP] or [DOWN]	[UP]: Increase, [DOWN]: Decrease. 1000 data can be recalled from addresses 000 to 999.	Specifies the address from which to recall data. Hold the key down to scroll rapidly through addresses.
4	ESC	Returns to normal measurement mode. Displays the measured value.	Exits detailed display mode.

* The saved CAL value is not displayed even in detailed display, but you can display the currently specified CAL value (see “*” in section 3-6-2). Also, you can check the CAL value by transferring it to a PC using the USB application software (see section 6-3).

* When recalling data from user memory addresses U00 through U99, press the MEMORY key while holding down the ENTER key in step 1 for user memory measurement.

<Display Example> Saved Data Detailed display Screen (Step 2)



5-2 Setting Measurement Conditions Based on Saved Data (All Set)

You can load saved data, display the data's measurement conditions in detail, and apply those conditions to the next measurement (All set).



All procedures start from normal measurement mode (see section 2-4-1).

Confirm that the instrument is in normal measurement mode (absolute value measurement or relative value measurement) before beginning the procedure.

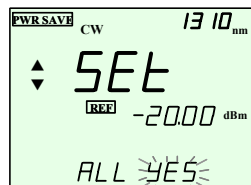
Step	Key	Display	Description
1	MEMORY	MEMORY ADRS DATA are displayed. The address number is shown in the ADRS field.	Changes to memory measurement mode.
2	MEMORY	DETAIL is displayed. Saved data including measured values and conditions saved to displayed addresses.	Changes to detailed display mode. See saved data.
3	[UP] or [DOWN]	[UP]: Increase, [DOWN]: Decrease. 1000 data from addresses 000 to 999 can be displayed in detail.	Specifies the address from which to display data in detail. Hold the key down to scroll rapidly through addresses.
4	ENTER	<i>YES</i> displayed to lower right of <i>SET</i> .	Changes to measurement condition settings.
5	[UP] or [DOWN]	<i>YES</i> or <i>NO</i> blinks, depending on which one was selected.	Confirms whether to set measurement conditions.
6	ENTER	Normal measurement mode. Displays the measured value. <i>YES</i> : Measurement conditions of saved data. <i>NO</i> : Measurement conditions do not change.	YES: Enters the setting. NO: No setting entered.

* For user memory addresses U00 through U99, press the MEMORY key while holding down the ENTER key in step 1 for user memory measurement. Procedures hereafter the same.

* This function is invalid when setting up the user calibration function, or for that function's saved data.

<Display Example>

All Set Confirmation Screen for Saved Data



5-3 Deleting Saved Data

Saved data can be deleted one at a time.



All procedures start from normal measurement mode (see section 2-4-1).

Confirm that the instrument is in normal measurement mode (absolute value measurement or relative value measurement) before beginning the procedure.

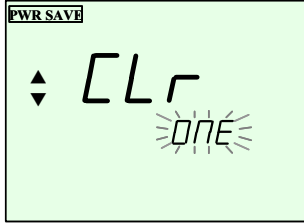
Step	Key	Display	Description
1	MEMORY	MEMORY ADRS DATA are displayed. The address is shown in the ADRS field.	Changes to memory measurement mode.
2	MEMORY	DETAIL is displayed. Saved data including the measured values and conditions saved to the displayed addresses.	Changes to detailed display mode. See saved data.
3	MEMORY	<i>ONE</i> blinks to the lower right of <i>CLR</i> .	Changes to memory measurement mode.
4	ENTER	The address number blinks.	Accepts the data selected for deletion.
5	[UP] or [DOWN]	[UP]: Increase, [DOWN]: Decrease. 1000 data can be deleted from addresses 000 to 999.	Specifies the address from which to delete data. Hold the key down to scroll rapidly through addresses.
6	ENTER	<i>YES</i> is displayed to lower right of <i>CLR</i>	Enters the saved data to be deleted.
7	[UP] or [DOWN]	<i>YES</i> or <i>NO</i> blinks, depending on which one was selected.	Confirms deletion.
8	ENTER	Returns to the screen in which <i>CLR</i> and <i>ONE</i> to the lower right of CLR, blink. To continue deleting, repeat the steps.	YES: Perform the deletion NO: Cancel the deletion
9	ESC	Returns to normal measurement mode. Displays the measured value.	Exits memory deletion mode.

* For deletion of saved data from user memory addresses U00 through U99, press the MEMORY key while holding down the ENTER key in step 1 for user memory measurement.

Procedures thereafter are the same.

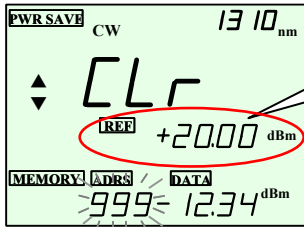
<Display Example>

Data Deletion Method Selection Screen (Step 3)



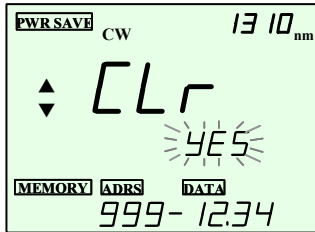
<Display Example>

Data Deletion Address Selection Screen (Step 5)



Displayed for relative measurement data.

Data Deletion Confirmation Screen (Step 7)



5-4 Deleting All Saved Data at Once

Deleting All Saved Data



All procedures start from normal measurement mode (see section 2-4-1).

Confirm that the instrument is in normal measurement mode (absolute value measurement or relative value measurement) before beginning the procedure.

Step	Key	Display	Description
1	MEMORY	MEMORY ADRS DATA are displayed. The address is shown in the ADRS field.	Changes to memory measurement mode.
2	MEMORY	DETAIL is displayed. Saved data including the measured values and conditions saved to the displayed addresses.	Changes to detailed display mode. See saved data.
3	MEMORY	<i>CLR</i> and <i>ONE</i> to the lower right of CLR, blink.	Changes to memory deletion mode.
4	[UP] or [DOWN]	Changes to a blinking <i>ALL</i> .	Choose to delete all.
5	ENTER	<i>YES</i> is displayed to the lower right of <i>CLR</i> . <i>Std</i> and <i>ALL</i> are displayed.	Selects all saved data for deletion from standard memory.
6	[UP] or [DOWN]	<i>YES</i> or <i>NO</i> blinks, depending on which one was selected.	Confirms whether to delete all
7	ENTER	Returns to the screen in which <i>CLR</i> and <i>ONE</i> to the lower right of CLR, blink.	YES: Executes the deletion. NO: Cancels the deletion.
8	ESC	Returns to normal measurement mode. Displays the measured value.	Exits memory deletion mode.

* For deletion of all saved data from user memory addresses U00 through U99, press the MEMORY key while holding down the ENTER key in step 1 for user memory measurement.

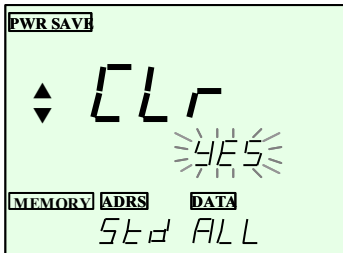
Procedures thereafter are the same.

<Display Example> Data Deletion Method Selection Screen

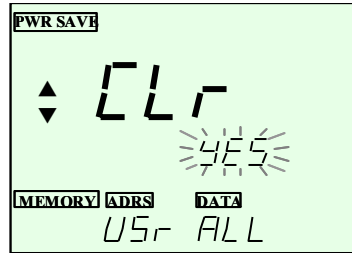


<Display Example> All Deletion Confirmation Screen

Addresses 000–999
(Standard)



Addresses U00–U99
(User)



6. Transferring Data

6-1 Preparation

- 1) Install the USB application software (included) on the PC (see section 7-1 for the installation procedure).
- 2) Turn the instrument ON, then connect the instrument to the PC using a USB cable (insert the cable connector completely and firmly into the receptacle). The instrument automatically enters USB mode, and USB is displayed (see section 2-4-5).
* Recommended USB cable: Shielded cable of 2 m or more in length.

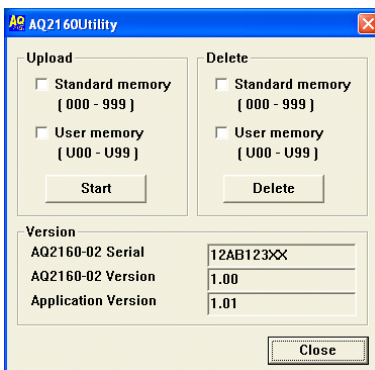


When operating the instrument while connected to a PC using a USB cable (without the AC adapter), a maximum of 500 mA of current is consumed when establishing USB communications. When using a battery-driven PC, remember that the instrument consumes power from the PC's battery. Also, error-free data uploading via USB is not guaranteed if using an AC adapter other than the one dedicated for use with the instrument. Always use the dedicated AC adapter. When not using an AC adapter and leaving the Power save function ON, the AQ2160-02 may shut down during transmission of data (no data is lost on the AQ2160-02 itself).

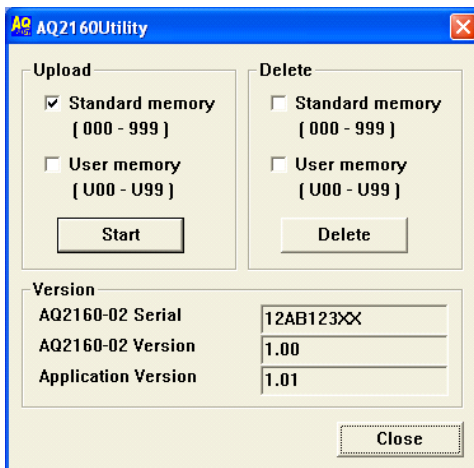
6-2 Uploading Measured Data

- 1) Confirm that the instrument is connected to the PC. From the Windows **Start** menu, choose **All Programs > AQ2160Utility** to start the USB application software. The explanation that follows is based on Windows XP.

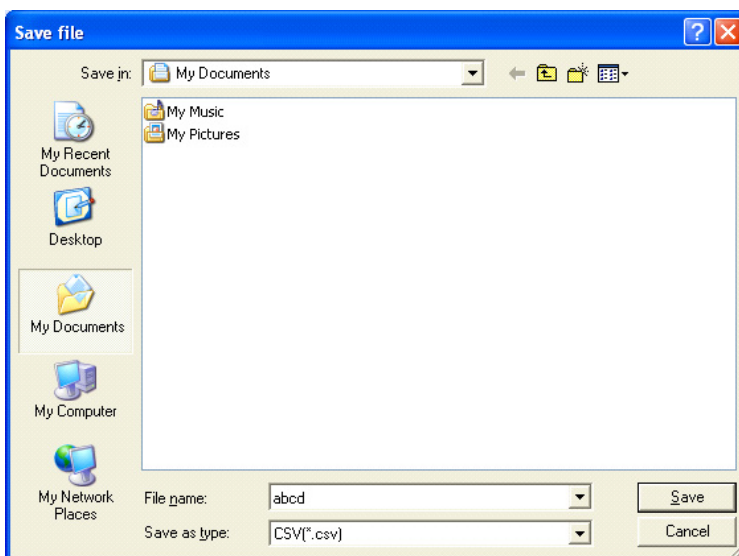
The following main screen is displayed.



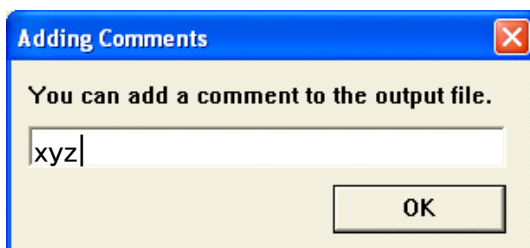
-
- 2) Select a memory address for the upload.
Select Standard memory or User memory in the Upload group.
The example given shows when Standard memory is selected.
You can select to upload both types of memory if desired.



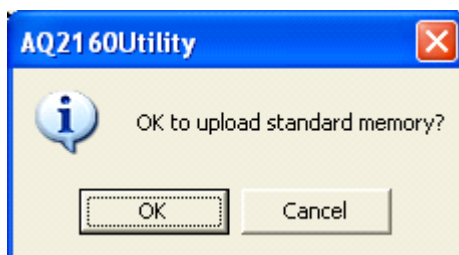
- 3) Click **Start**.
The Save file dialog box opens.



-
- 4) Specify a save destination, enter a file name, and click **Save**.
 - 5) Enter a comment to include in the CSV file.
In the example, the comment, “xyz” has been entered.




- 6) Click **OK**.
The comment entry screen disappears, and is replaced by a confirmation screen.

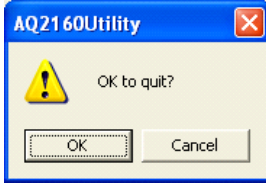


- 7) Click **OK**. The upload begins.
When the upload is complete, a message appears.



 Do not attempt to open any uploaded files while other files are being uploaded.

- 8) Click **OK** to display the main screen again.
 To exit, click **Close**.
 The main screen disappears, and is replaced by a confirmation screen.
 Click **OK** to quit.



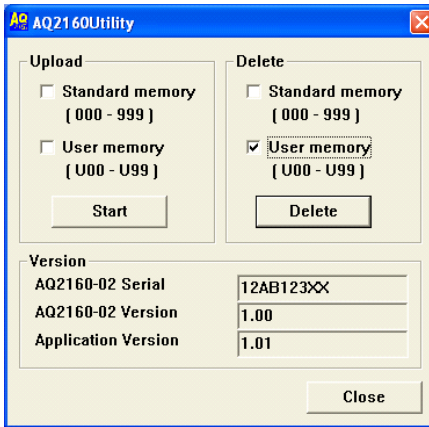
6-3 Uploaded Results

The data is output in CSV format. The following example shows uploaded data that has been opened in EXCEL.

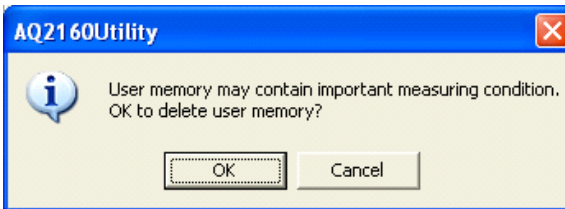
Microsoft Excel - Abcd													
File Edit View Insert Format Tools Data Window Help													
A1 = YOKOGAWA AQ2160-02 OPTICAL POWERMETER Measurement Data													
	A	B	C	D	E	F	G	H	I	J	K	L	M
1	YOKOGAWA	AQ2160-02 OPTICAL POWERMETER Measurement Data											
2	Upload date: dd-mmm-yyyy hh:mm												
3	Comment: .sz												
4	S/N: 12AB123XX												
5						Absolute Value		Relative Value					
6	Address	Wavelength(nm)	Measure Mode	Averaging	User Calibration Value[dB]	Measurement	Unit	Range Error	Measurement[dB]	Range Error	Reference Value[dBm]	Sort Key	
7	0	1310	C/W			-2.31	dBm					223	
8	11	1310	C/W			24.78	uW					254	
9	2	1310	C/W						6		-16	335	
10	3	1310	C/W			2.3	794.7 uW					496	
11	4	1310	C/W			2.3	-80.52 dBm	U				532	
12	5	1550	270Hz	ON		-5.39	dBm					1200	
13	6	1550	1kHz						-3.26		-5.94	1409	
14	7												
15	8												
16	9												
17	10												
18	11												

6-4 Deleting All Unnecessary Data after Upload

- 1) Select a memory address range for deletion from the main screen. The example given shows when User memory is selected (you can select to delete both types of memory at once if desired).

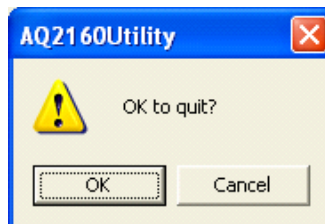


- 2) Click **Delete**. A confirmation screen is displayed. Check the items to be deleted, then click **OK**. Hereafter, follow the onscreen instructions as you did for uploading.



The deletion is complete.

Click **OK** to quit.



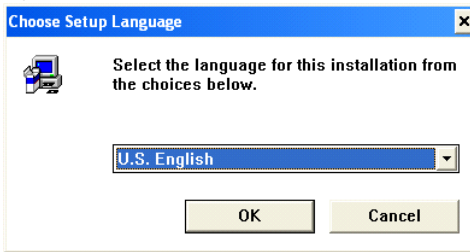
7. Installing the USB Software

7-1 PC System Requirements

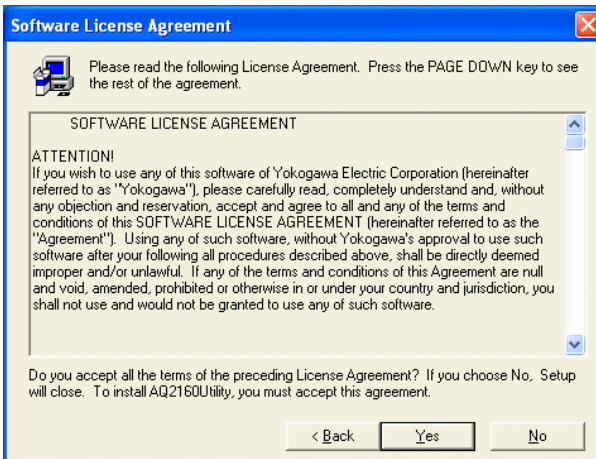
Operating system	Use a CPU, RAM, and display etc. that is recommended for your operating system.
Hard disk	10 MB or more of available space
Interface	USB version 1.1 (one unit of the AQ2160-02 can be connected)

7-2 Installing the USB Application Software

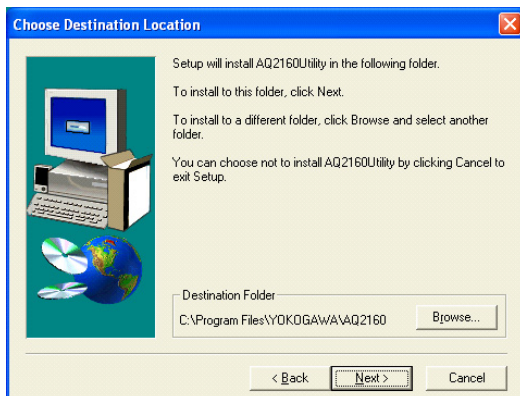
- 1) Navigate to **Application > disk1** in the CD-ROM included with the instrument, then execute (double-click) **Setup.exe**. A screen for selecting the language for the PC screen is displayed.



- 2) Select the desired language, then click **OK** to advance to the Software License Agreement screen.



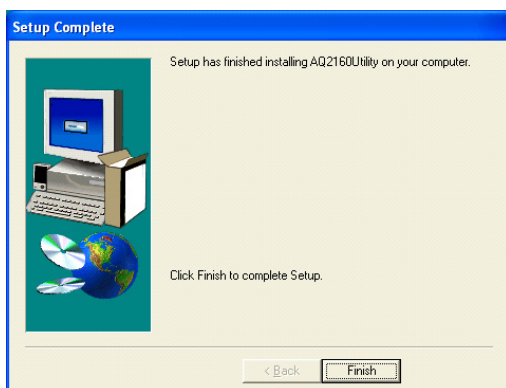
- 3) Click **Yes** to advance to the Choose Destination Location screen.



- 4) Click **Next** to advance to the Select Program Folder screen.



- 5) Click **Next** to begin the installation.



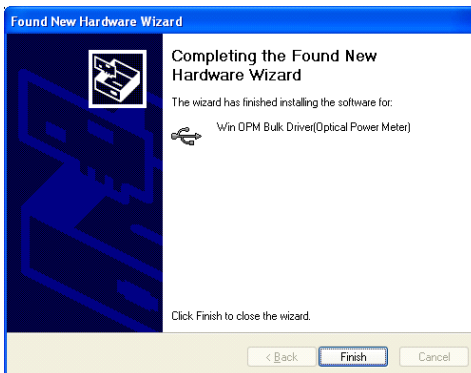
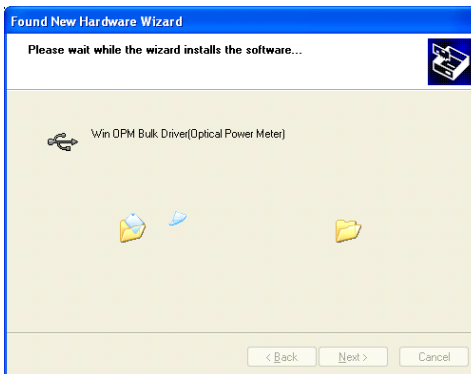
- 6) Click **Finish** to complete the installation.

7-3 Installing the Drivers

- 1) Turn the instrument and the PC ON, then connect the instrument to the PC using a USB cable. The Found New Hardware Wizard launches on the PC.



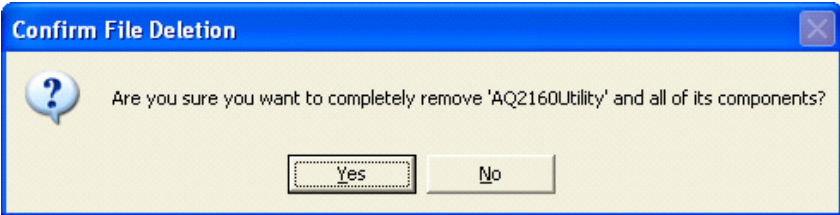
- 2) Click **Next** to begin the installation.



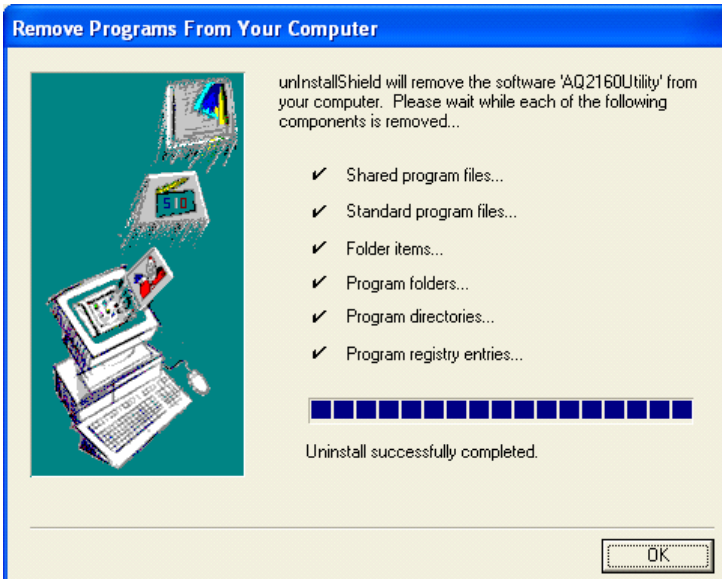
- 3) Click **Finish** to complete the installation.

7-4 Uninstalling the Software

- 1) Choose **Add or Remove Programs** from the Windows control panel, then click the **Change or Remove Programs** icon.
- 2) Select **AQ2160Utility**, then click the **Remove** button.

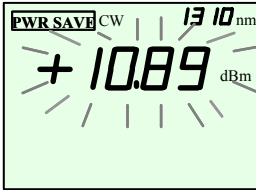


- 3) Click **Yes** to remove the program.



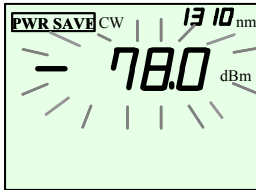
- 4) Click **OK** to exit the uninstallation.

8. Error Messages



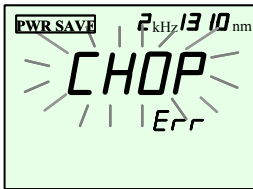
Overrange Error

If the optical power level being measured exceeds the measureable range, the plus sign value blinks indicating an overrange.



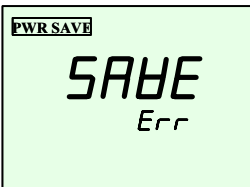
Underrange Error

If the optical power level being measured falls below the measureable range, the minus sign value blinks indicating an underrange.



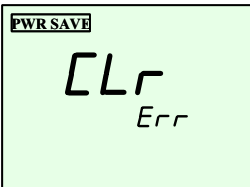
Light Receiving Mode Error (Chopped Light Error)

If chopped light of a modulation frequency different than that of the specified light receiving mode is received, "CHOP" blinks. Change the light receiving mode setting (see page 18) to match the modulation frequency to clear the error.



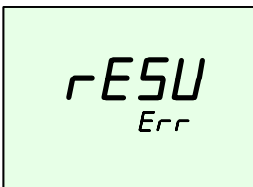
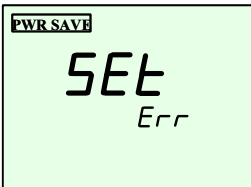
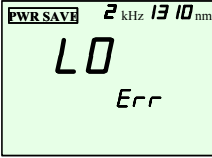
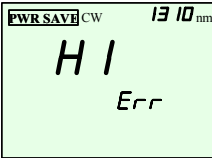
Data Save Error (Save Error)

Displayed when an error occurs while saving data. Press ENTER to clear the error and return to the previous setting of normal measurement mode.



Data Delete Error (Clear Error)

Displayed when an error occurs while deleting data. Press ENTER to clear the error and return to the previous setting of normal measurement mode.



Reference Value Out of Range Error

Displayed when the measured value used for setting or updating the relative measurement reference value is outside the valid range.

Exceeds the upper limit: High level error.
Falls below the lower limit: Low level error.

Low Battery Error

Displayed when attempting to save or delete data while the battery indicator is displayed. The error appears for one second, then the screen returns to the previous screen.

CAL Value Automatic Setting Error

- 1) Displayed when attempting to automatically set the CAL value a second time during relative value measurement. Clear the CAL value (see section 3-6-3).
- 2) Displayed when the instrument attempts to automatically set a CAL value outside the valid range (-10.00 dB–25.00 dB). Change the fixed optical attenuator to one having an amount of attenuation that will bring the CAL value into the valid range.

Resume Error

If the Resume value was not saved successfully, the Resume error appears the next time the instrument is started. Press the ENTER key for normal measurement mode. Or, turn OFF the power switch and restart. The system reset initial value is set (see section 2-5-5).

Calibration Value Error

Displayed when, for some reason, the instrument's internal calibration value becomes corrupted during use. Have the instrument repaired immediately.

9. Handling Precautions

The following describes precautions that must be taken during use of the instrument.

This instrument utilizes ultra-precision optical components.

In order for performance to be guaranteed, please take note of the following.

9-1 Precautions during Use

- 1) Do not drop or expose the instrument to excessive physical shock. The instrument is protected with plastic casing, but contains fragile optical components.
- 2) Do not place the instrument in direct sunlight, or in high-temperature or highly humid locations such as inside of a car for long periods of time.
- 3) Do not bring the instrument close to strong electromagnetic waves. Doing so can lead to malfunction.
- 4) Do not use the instrument and mobile phones simultaneously in the same vicinity.
- 5) The instrument is portable and can be used outdoors under battery power, but is not waterproof. Never operate the instrument in the rain.
- 6) Never disassemble the instrument.
- 7) Use an optical connector that matches the instrument. Forcibly attaching a connector can damage the optical input section.
- 8) Do not peer into the ends of the optical fiber, optical connector, or other parts connected to the light source. Doing so can result in damage to the eyes from lasers. Take appropriate caution when handling.
- 9) Incidence of excessive light outside of the optical power measuring range can damage the sensor element. Be aware that especially with low duty, high-peak pulses, when the optical power is expressed as an average value, the value appears low, but the instantaneous power can be quite high.
- 10) Performance is not guaranteed with angled PC ferrules. There are many kinds of angled PC connector polishes. Performance is not guaranteed with angled PC connectors because the measured value depends on the shape of the tip.

-
- 11) If the optical connector connected to the optical input connector is damaged, dirty, or otherwise compromised, the instrument will be unable to perform as expected. At worst, this may cause damage to the instrument's optical connector.
 - 12) When attaching the optical connector, take care not to damage the optical input end.
 - 13) If the optical input end or connector is soiled with dirt or grime, clean the end with specialized optical connector cleaner.
 - 14) When not using the instrument, attach the optical connector cap to protect the connector from dirt, grime, and other foreign particles.
 - 15) To prevent damage when attaching or removing the optical input connector cap, do so carefully so as not to rub or apply pressure to the connector with the cap.

9-2 Precautions When Using the Batteries

- 1) If the plus or minus terminal of the battery holder is dirty, contact with the battery will be weakened, possibly causing the power to cut out. If dirty, wipe the plus and minus terminals clean with a dry cloth.
- 2) Do not allow the batteries to come into contact with water (including rain water and sea water). Also, do not apply strong physical shocks.
- 3) Shorting the plus and minus terminals of the batteries with metal or other conductive objects causes a large current to flow that can damage the batteries and emit heat. Take care not to short the terminals when handling the batteries.
- 4) Disassembling the batteries or placing them in fire is extremely dangerous and must never be attempted.
- 5) Do not discard spent batteries together with general household waste (unless your local laws permit doing so).
- 6) Check the polarity/orientation of the batteries carefully before inserting them into the battery holder. Incorrectly oriented batteries can result in damage to the instrument.
- 7) Remove the batteries during periods of extended non-use. Leakage from batteries can occur, resulting in damage to the instrument.
- 8) The instrument does not perform battery recharging. Please use a separate, dedicated charger for nickel metal-hydride rechargeable batteries.
- 9) Always operate the instrument in a way that is appropriate for the type of batteries you are using.

9-3 Precautions When Using the AC Adapter

Use the AC adapter that came with the instrument, and the country-specific power cable that was packaged together with the AC adapter. To use the cable and adapter, insert the power cable firmly into the inlet on the AC adapter, and connect the output cable firmly to the AC adapter terminal on the instrument. Also, only use these items indoors. Use them in the same temperature range as is required for the instrument (however, the safety standard for the AC adapter specifies an operational temperature of 0–40°C.). Never use an AC adapter or power cable other than the dedicated ones available for use with this instrument, as damage can result.

9-4 Disposing of the Instrument

The sensor element of this instrument contains indium gallium arsenide (InGaAs). InGaAs powder and vapor is hazardous. Therefore, never incinerate, destroy, break, grind, or apply chemicals to the instrument. Keep separate from general industrial or household waste, and dispose of the instrument according to relevant local laws.

10. If You Suspect a Malfunction

The following should be checked if the instrument is not functioning as expected.

10-1 The instrument doesn't work even though the power is ON.

- 1) Are the correct batteries installed?
 - Use only AA alkaline dry cells or nickel metal-hydride rechargeable batteries.
 - Check the polarity/orientation of the batteries.
- 2) Is one or both of the batteries spent?
 - Replace both batteries (at the same time).
Leakage can occur when using an old and new battery together, and can result in damage to the instrument.)
- 3) Is the power cord for the AC adapter (optional) connected correctly?
- 4) Are you using the dedicated AC adapter that came with the instrument?
 - Never use an AC adapter or power cable other than the dedicated ones available for use with this instrument, as damage can result.

10-2 Normal measured values are not displayed.

- 1) Do the instrument's measurement conditions match the light being measured?
→ Edit the measurement conditions using the SETUP key.
- 2) Is CORR VAL blinking?
→ Turn the user calibration function OFF during normal measurement.
- 3) Is the optical connector (optical fiber) connected correctly?
→ Check the connections. Insert the optical connector firmly and completely into the receptacle.
If the connection is not sound, measurements will be inaccurate.
- 4) Are the ends of the optical connector fibers damaged or dirty?
→ Clean them with a dedicated optical connector cleaner. Using fibers with damaged ends can result in erroneous measurement.

10-3 Cannot transfer data via USB.

- 1) Did you install the USB driver on the PC?
→ Use the accessory CD-ROM.
- 2) Is the USB cable properly connected?
- 3) Are you using the dedicated AC adapter?

10-4 When the instrument starts up, the backlight automatically blinks and does not stop.

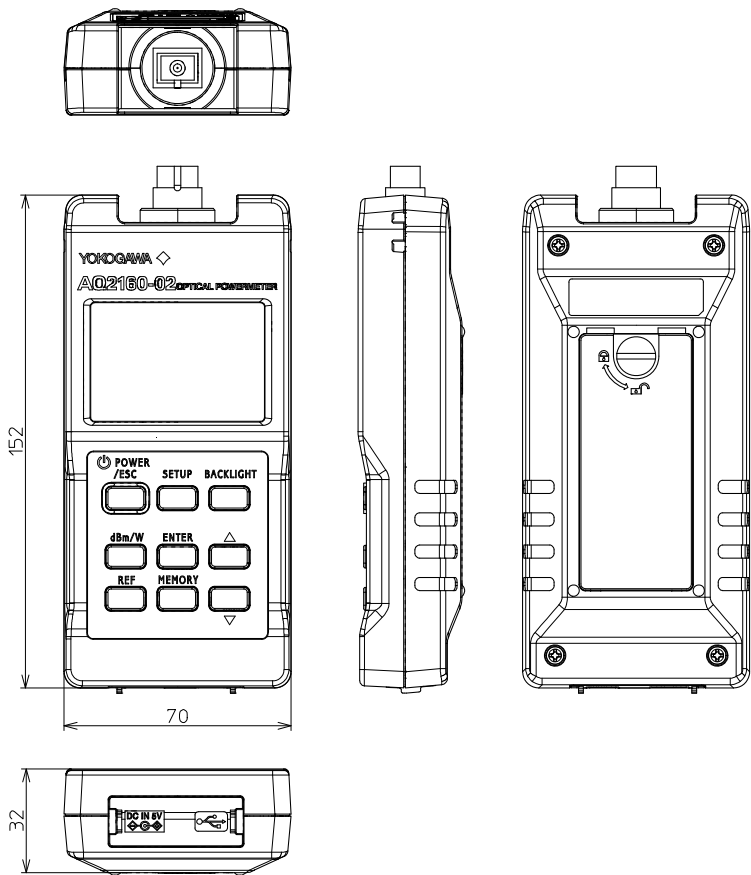
- The instrument's self-diagnostic function has detected an error.
- Contact the dealer from which you purchased the instrument for repairs.
- Do not attempt to repair the instrument yourself, as doing so can be very dangerous.

10-5 All set can not be executed.

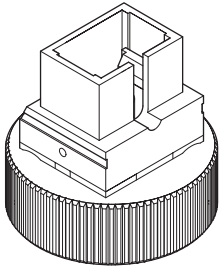
- Is the CAL value set? Clear the value.

10-6 Can not save or delete measured values.

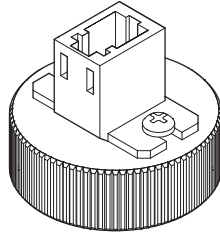
- Are the batteries spent?



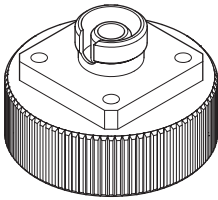
Outline drawing of the AQ2160-02 Optical Powermeter
(with the SU2004A-SCC connector adapter installed)



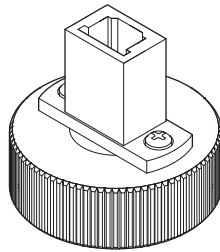
SCC



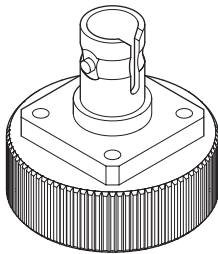
LCC



FCC



MUC



STC

Outline drawing of the SU2004A-*** connector adapter

Product Inquiry

For inquiries regarding YOKOGAWA's measurement instrument products, access "T&M Worldwide Network" on the Web page at the URL indicated below. Then, contact your nearest YOKOGAWA dealer or representative shown on the page.

<http://www.yokogawa.com/tm/>