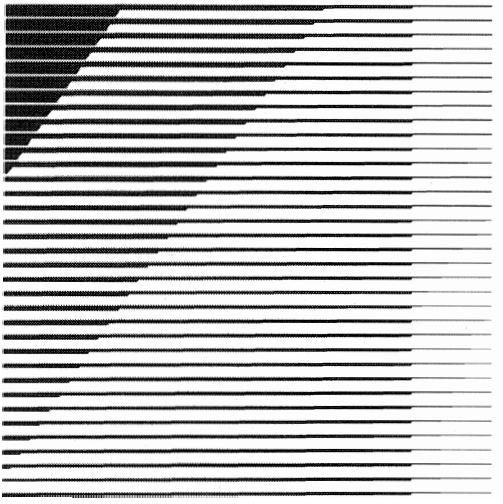
OPERATION MANUAL

TQ8210

Optical Power Meter



This product has been discontinued.
The Operation Manual is provided by ADC Corporation under the agreement with Advantest Corporation.

ADVANTEST®

ADVANTEST CORPORATION


BATT
CHARGE
INPUT
12.345
MAX/dBr
ZERO
AUTO/
MAN
DOWN
UP
dBm
ADVANTEST
OPTICAL POWER METER
TQ8210

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ATTENTION

The product you have purchased is powered by a nickel cadmium battery which is recyclable. At the end of its useful life, under various state and local laws, it is illegal to dispose of this battery into your municipal waste stream.
Please contact RBRC at 1-800-8-BATTERY for information on how to recycle this battery.

CONTENTS

Printed in Japan

1.. INTRODUCTION

1.1 Standard Features

The **TQ8210** is a convenient, lightweight, and portable optical power meter.

It can measure optical power for four different wavelength ranges in the range from 400 to 1650 nm, depending on which of optical sensors **TQ82014, TQ82015, TQ82017,** and **Q82018A** are used.

These wavelength ranges are given below.

	TQ82014	TQ82015	TQ82017	Q82018A
Wave-length (mm)	For short wave-lengths 400–1100	For long wave-lengths 800–1600	Thin-type sensor for short wave-lengths 400–1100	For long wave-lengths 800–1650

The **TQ8210** comes with a Ni-Cd battery pack that can operate continuously for at least 10 hours when no AC power source is available.

The liquid crystal display (LCD) is backlighted for operation in dark places.

The wavelength sensitivity data of the sensors is stored in memory. As a result, automatic wavelength sensitivity compensation can be performed at the wavelength setting and the absolute optical power value can be read directly.

Offset adjustment of an optical sensor is done automatically when the ZERO key is pressed.

Both **AUTO** ranging and **MANUAL** ranging are provided. **AUTO** ranging, automatically selects an optimum range for optical input.

In **MANUAL** ranging, the range switching time can be omitted or digit shifting on the display by range switching can be inhibited, making the display much easier to read.

The dBr, SM, and MAX-Hold functions are also provided. The **dBr** function measures the value relative to a reference level. The Smoothing (**SM**) function facilitates measurement in unstable conditions. The **MAX**-Hold function determines the maximum beam power.

1.2 Available Optical Sensors

(1) **TQ82014** Short Wavelength Beam Sensor

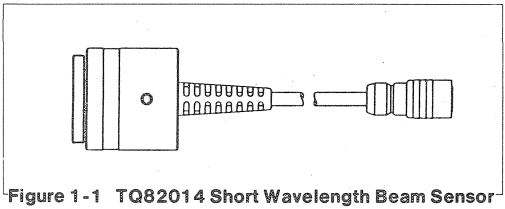


Figure 1-1 TQ82014 Short Wavelength Beam Sensor

With one of the following connector adapters, the **TQ82014** can be used for optical fiber beam measurement.

Connector Adapter
A08013 FC adapter
A08013 D4 adapter
A08014 OF2 adapter

For information about other connectors, contact our sales division.

(2) **TQ82015** Long Wavelength Beam Sensor
For optical fiber beam measurement, use the same connector adapters as for **TQ82014**.

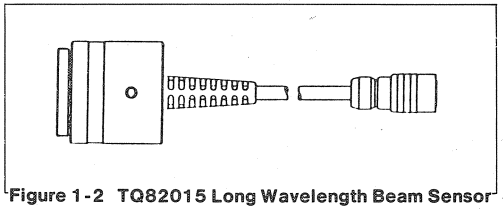


Figure 1-2 TQ82015 Long Wavelength Beam Sensor

(3) **TQ82017** Thin-type Short Wavelength Beam Sensor

For optical power measurement in application devices, the thickness of the sensor has been reduced to 3.2 mm. This sensor also provides the same performance as the **TQ82014**. A sliding cap protects the sensor from possible damage. It is not intended to be a light shield.

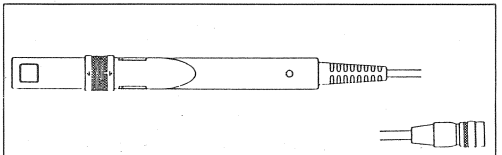


Figure 1-3 TQ82017 Thin-type Short Wavelength Beam Sensor

(4) **Q82018A** Long Wavelength Beam Sensor

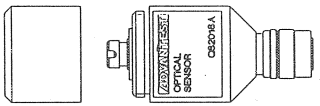


Figure 1-4 Q82018A Long Wavelength Beam Sensor

Use an extra sensor cable **A01905** to extend the sensor from **Q82018A**.

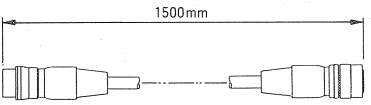


Figure 1-5 A01905 Sensor Cable

2. MEASUREMENT PROCEDURE

2.1 Measurement Flowchart

This section explains the measurement procedure according to the following flowchart. Panel descriptions are provided on page 10.

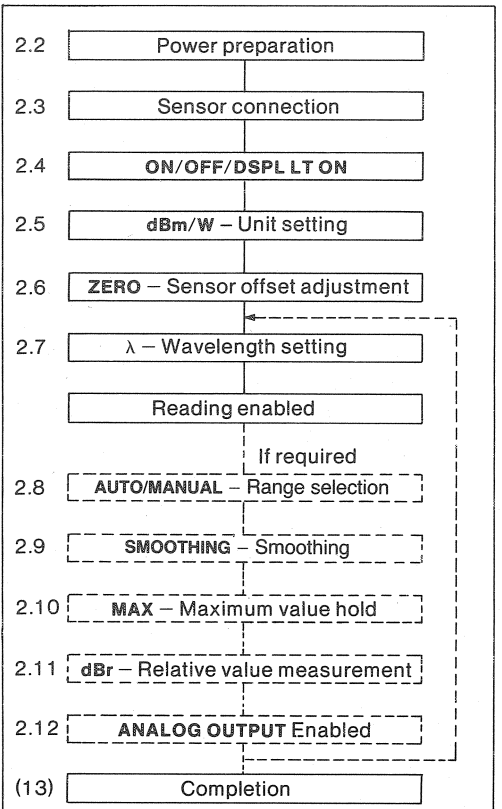
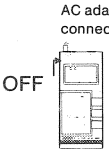


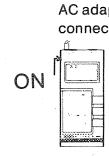
Figure 2-1 Measurement Flowchart

2.2 Power Preparation



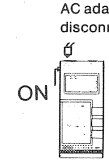
(a)

Internal NiCd battery is charged. Fully charged in 48 hrs. You can keep the adapter connected even after full charge.



(b)

Operates from AC source. NiCd battery is under charge control (not to exceed approximately one tenth of the full charge).



(c)

NiCd battery driven. When the **BATT** indicator lights up, connect the AC adapter to charge the battery.

2.3 Sensor Connection

Connect an optical sensor to the **INPUT** connector. Lightly press the sensor against the connector and turn the sensor until it engages the connector. Then insert the black rubber part to lock the sensor into place. To disconnect the sensor, grasp the metallic part and pull it straight out.

Caution

Before connecting the sensor, be sure the POWER switch is set to **OFF**.

Note

"**ERR 2**" appears on the display if the POWER switch is set to **ON** with no sensor connected.

2.4 ON/OFF/DSPL LT ON Switch

Turn on the POWER switch. In dark locations, set it to **DSPL LT ON** (Display Light On).

At POWER **ON**, the panel displays the model name and the lowest three digits of the connected sensor for about one second.

At POWER **ON**, the **TQ8210** is set to the following values. However, for a function with a circle (○), the value set before the last POWER **OFF** remains effective.

○	**RANGE**	: **AUTO**
	MAX/dBr	: Both OFF
○	**ZERO**	: Adjusted value stored last
	dBm/W	: Depends on switch setting
○	Number of **smoothing**	: 1 (no smoothing)
○	λ	: **TQ82014:** 850 nm
		: **TQ82015:** 1300 nm
		: **TQ82017:** 850 nm
		: **Q82018A:** 1300 nm

- **Initialization**

To initialize the **TQ8210**, turn the POWER switch **ON** while holding down the MAX/dBr key. The panel then displays the version of ROM stored first, the model name, and the sensor name. The initialization then clears the setting values stored in memory.

If the sensor is replaced the **TQ8210** is initialized the next time power is turned **ON**.

2.5 W/dBm Switch

The **W/dBm** switch selects an appropriate indication unit. Note that 1 mW = 0 dBm.

2.6 ZERO Key

The ZERO key is used to memorize the sensor offset value and to cancel the offset.

Cover the sensor input. For **TQ82014, TQ82015**, and **Q82018A** put on the cap on the sensor input. For **TQ82017**, closing the sliding cover is not enough for light shielding. To cover the **TQ82017** sensor input completely, cover the sensor with additional material.

While the light is covered, press the ZERO key. The **TQ8210** then displays "**NULL**" during input of the offset value for four or five seconds, and then returns to the normal measurement mode.

After the sensor offset value has been stored, sensor offset adjustment need not be performed even if the indication unit (**dBm/W**) is changed.

Note

If the ZERO key is pressed and the light is not completely covered (9% or more of full-scale power), the panel displays "**Err 1**" and does not perform offset adjustment.

Note

Whenever the sensor is replaced, perform the above offset adjustment.

Note

If the **BATT** indicator lights, the adjusted offset value may not be valid.

2.7 Wavelength (λ) Key

When the wavelength of the light to be measured is input, the **TQ8210** can compensate for the nonlinearity errors of the connected sensor. An example of inputting a wavelength of 780 nm is given below.

Operation	Large LCD	Small LCD
Normal mode	—12.30dBm	850nm
λ	+0.00dBr	850 nm
The λ key pressed 7 times.	—0.42dBr	780nm
λ	—11.88dBm	780nm

When the measurement value is displayed in **W**, no unit accompanies the compensation values because they are coefficients.

Each time the UP or DOWN key is pressed, the wavelength is incremented or decremented in an internally determined step.

The **TQ8210** has an analog meter. This analog meter roughly determines measurement values before making accurate digital measurements. Note that the analog meter has no sensor compensation function.

Sections 2.8 to 2.12 describe operations that are required under certain conditions.

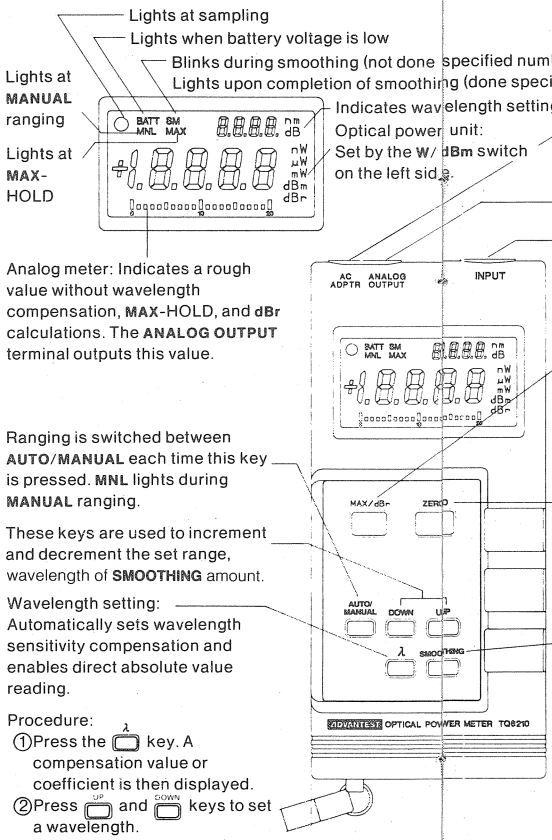


Figure 2-2 Front Panel

2.8 AUTO/MANUAL Key

(1) Differences between **AUTO/MANUAL** ranges

AUTO range	Depending on the measured value, this mode automatically selects a range to display it with maximum readability.
MANUAL range	In this mode, the range is fixed. Use the **UP** and **DOWN** keys to select a range. The advantage of using this mode is that you are free from range switching time and digit shifting.

(2) Switching between **AUTO/MANUAL** ranges

Operation	Mode	**MNL** display
Initial state	**AUTO** range	None
AUTO MANUAL	**MANUAL** range	**MNL**
AUTO MANUAL	**AUTO** range	None

(3) Ranges switching in **MANUAL** mode

Operation	Mode	**MNL** display
Initial state	**AUTO** range	None
AUTO MANUAL	**MANUAL** range	**MNL**
UP	Range **UP**	**MNL**
DOWN	Range **DOWN**	**MNL**

Note

If a **MANUAL** range overflows, "1 " is displayed to indicate that a higher range must be selected. For **dBm** display, "**Lo**" is displayed if the measured value is below the minimum limit of the set range.

2.9 SMOOTHING Key

Smoothing measurements, thus reducing superimposed noise.

An example of performing 10 smoothing operations is given below.

(1) Performing 10 smoothing operations

Operation	Large LCD	SMOOTHING Indicator	Description
Normal mode	−12.34dBm	OFF	
SMOOTHING	1	OFF	Number of SMOOTHING operations: 1
UP	2	OFF	Number of SMOOTHING operations: 2
UP x 4	10	OFF	Number of SMOOTHING operations: 10
SMOOTHING	−12.35dBm	Blinking	SMOOTHING started
	−12.36dBm	Lighted	SMOOTHING completed

Smoothing is performed after the **SM** indicator is lit.

Up to 20 smoothing operations can be specified using the **UP** and **DOWN** keys. The number of operations are increased as follows:

1 → 2 → 3 → 5 → 7 → 10 → 12 → 15 → 17 → 20

Note

While the **SM** indicator is blinking, some of the specified SM operations are not completed. Do not use an intermediate value displayed before the **SM** indicator lights.

Note

If the current range, wavelength, or indication unit is changed during smoothing, smoothing, restarts and the **SM** indicator begins blinking.

To cancel the smoothing setting, set the number of smoothing operations to 1 as follows:

(2) To cancel smoothing

Operation	Large LCD	SMOOTHING Indicator	Description
Normal mode	−12.55dBm	ON	SMOOTHING indicator
SMOOTHING	10	ON	Number of SMOOTHING operations: 10
Press and hold the DOWN key	1	ON	Number of SMOOTHING operations: 1
SMOOTHING	−12.55dBm	OFF	SMOOTHING canceled

2.10 Maximum Value Holding

The **MAX**-Hold function holds and displays the maximum measured value. To execute the **MAX**-Hold function, set the indication unit to **W** and press the MAX/REL key. The **MAX** indicator then lights during execution.

To cancel the **MAX**-Hold function, press the MAX/REL key again.

An example of using **MAX**-Hold is as follows.

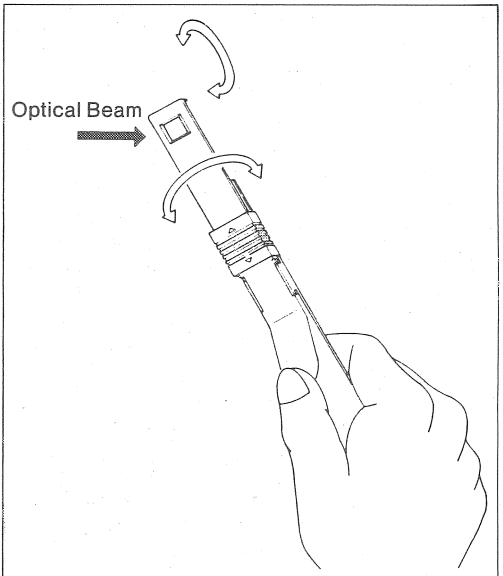


Figure 2-3 Measurement of optical beam by using MAX-Hold function

Measurement of an optical beam depends on the angle at which the sensor is held, as shown in Figure 2-3. To measure the optical beam accurately, set the indication unit to **W**, press the MAX/REL key, and execute the **MAX-Hold** function. The maximum measured value can then be obtained automatically by moving the sensor in various directions.

2.11 Relative Value Measurement

If the indication unit is set to **dBm** and the MAX/REL key is pressed, the latest measured value is used as a reference (0 dB) for subsequent measured values. The operations required for this relative value measurement are given in the table on the next page.

Execution of Relative Value Measurement

Operation	Large LCD	Unit	Description
Normal mode	—8.14	**dBm**	Unit: **dBm**
MAX/dBr	+ 0.00	**dBr**	Reference value registration
Subsequent value	—1.53	**dBr**	Relative value measurement
MAX/dBr	—9.67	**dBm**	Relative value measurement canceled

To return to the normal mode from the **dBr** measurement mode, press the MAX/dBr key again.

2.12 ANALOG OUTPUT Terminal

The **ANALOG OUTPUT** terminal provides the output of the I-V converter (proportional to the optical power). The output voltage is between 0 and 2 V and the output impedance is 10 Ω or less.

The output voltage is proportional to the analog indication on the LCD display. The maximum value of 2 V corresponds to the full-scale indication on the LCD display.

The wavelength sensitivity compensation, **MAX**-Hold, and **dBr** functions are not applied to the **ANALOG OUTPUT**.

3. THEORY OF OPERATION

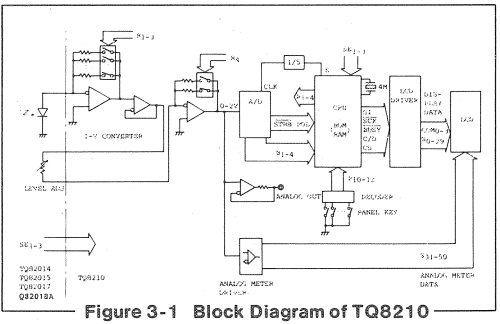


Figure 3-1 Block Diagram of TQ8210

When light strikes the photodiode, the photodiode passes electric current proportional to the intensity of the light. The current is converted into voltage and input to the A/D converter. The output signal from the A/D converter is sent to the CPU, sensor sensitivity compensation is performed for the optical wavelength, then the signal is output to the LCD driver as optical power data. The LCD driver converts the optical power data into LCD driver signals, and the LCDs display the optical power.

The converted signal is output to the external circuit through the buffer amplifier as an analog signal. Because the LCD display includes an analog meter, the optical power can be displayed as a bar graph.

The representative values for sensors (TQ82014, TQ82015, TQ82017, and TQ82018) are stored in the ROM as sensor sensitivity compensation data for the optical wavelength. Thus, each sensor can be used to measure absolute optical power values only if the optical wavelength currently being measured is input.

Sensor identification codes (SE1 to SE3) are assigned to sensors. When power is first turned on, the CPU reads the code to determine which sensor is connected.

(1) I-V converter

The I-V converter converts the electric current passing through the sensor into voltage. The range is divided into eight ranges (20 nW to 200 mW). The feedback resistor is selected for each range with the R1 to R4 signals. Table 3-2 shows the relationship between the ranges and the R1 to R4 signals. The sensor level is calibrated with the potentiometer LEVEL ADJ in the sensor.

(2) A/D converter

The A/D converter uses a one-chip A/D converter with a 2-V full scale and 4 1/2 digits. After A/D conversion, STRB is output. The CPU detects this signal and reads the converted data from the A/D converter.

(3) CPU

The CPU includes ROMs and RAMs. It performs the following: (1) Range switching for the I-V converter, (2) data reading from the A/D converter, (3) wavelength sensitivity compensation, (4) display data output to the LCD driver, and (5) panel key detection. The ROM in the CPU contains wavelength sensitivity correction data (representative values). The data set immediately before power off is backed up with the RAM in the CPU.

When power is first turned on, the CPU reads sensor identification codes (SE1 to SE3), and determines which sensor is connected. (See Table 3-2.)

(4) LCD driver

The LCD driver receives data that is serially transferred from the CPU, and operates the LCDs.

Table 3-1 Relationship between ranges and R1 to R4

	R_1	R_2	R_3	R_4	K_1	U_4	U_5	U_6	
200 mW	0	0	0	0	ON	OPEN	0	0X	0Y
20 mW	0	0	0	1	OFF	1	1	0X	0Y
2 mW	0	0	1	0	OFF	2	2	0X	0Y
200 μW	0	0	1	1	OFF	3	3	0X	0Y
20 μW	0	1	0	0	OFF	4	4	0X	0Y
2 μW	0	1	1	0	OFF	5	5	0X	0Y
200 nW	0	1	1	0	OFF	6	6	0X	0Y
20 nW	1	1	1	0	OFF	6	6	1X	1Y

Table 3-2 Sensor identification codes

	SE_1	SE_2	SE_3
TQ82014	0	0	1
TQ82015	0	1	0
TQ82017	0	1	1

4. MESSAGE LIST

Message	Meaning	Corrective action
"**Err 1**"	The ZERO key was pressed without covering the sensor.	Cover the sensor and press the ZERO key again. However, **TQ82017** cannot be completely covered by the slide cover.
"**Err2**"	Power was turned **ON** without connecting a sensor.	Turn power **OFF**, connect a sensor, and turn power **ON** again.
"**1** "	The selected **MANUAL** range overflowed.	Select a higher range.
"**LO**"	In the **dBm** mode, a value less than the minimum limit was measured.	
"**NULL**"	Zero calibration is being performed.	

If "**Err 1**" or "**Err 2**" cannot be corrected, contact your nearest Advantest representative.

5. TEST EQUIPMENT AND TOOLS

Test equipment

Name	Model No.	Manu-facturer	During diagnosis	During inspection
Optical power meter	TQ8215	Advantest	Required	Required
Power meter sensor (for short wavelength)	TQ82014	Advantest	Required	Required
Power meter sensor (for long wavelength)	TQ82015	Advantest	Required	Required
LED light source (main unit)	TQ81310	Advantest	Required	Required
LED light source (for short wavelength)	TQ81311	Advantest	Required	Required
LED light source (for long wavelength)	TQ81312	Advantest	Required	Required
Digital voltmeter	TR6841	Advantest	Required	
Oscilloscope	2465	Tektronix	Required	

Tools

Name	Model No.	Manu-facturer	During diagnosis	During inspection
Dummy fiber			Required	Required

6. TROUBLESHOOTING

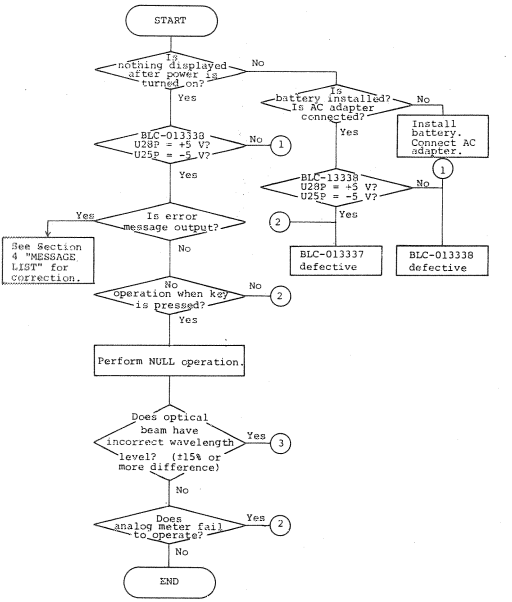
6.1 Simplified Troubleshooting Table

The following table shows troubleshooting for some typical problems on the meter. For other problems, contact your nearest Advantest representative.

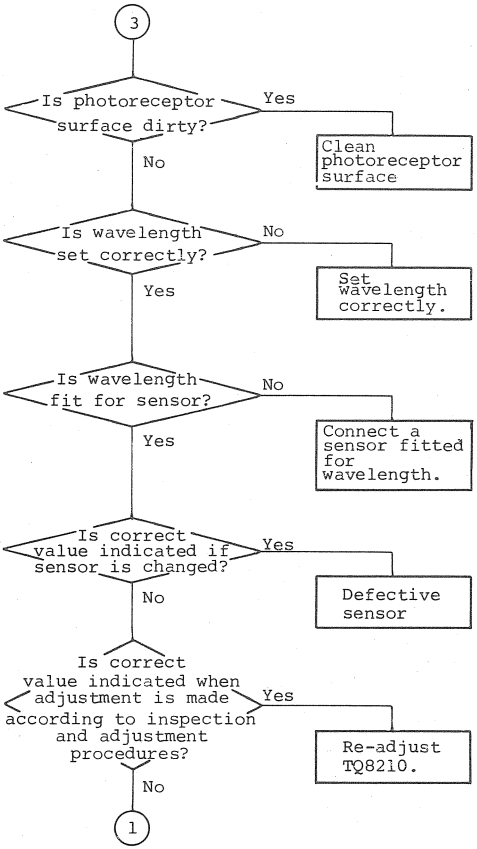
Note that repairs made for problems listed in the following table shall be billed.

Problem	Cause	Solution
The LCD digital indication does not equal the analog indication.	This is not a malfunction. The λ compensation and the **MAX** and **dBr** calculation are not applicable to the analog indication.	Use the analog indication for visual checking and the digital indication for accurate measurement.
In the **AUTO** ranging mode, sampling and display sometimes halt.	This is not malfunction. It is due to range switching.	
The smoothing function cannot canceled by pressing the **SMOOTHING** key.	**SMOOTHING** count has not been set to 1.	Set the **SMOOTHING** count to 1, as described on page 14.
The **MAX-HOLD** function cannot be executed by pressing the MAX/HOLD key.	The indication unit is set to **dBm**.	Set the indication unit to **W**.
The **dBr** mode cannot be selected by pressing the MAX/HOLD key.	The indication unit is set to **W**.	Set the indication unit to **dBm**.

6.2 Diagnostic Flowchart

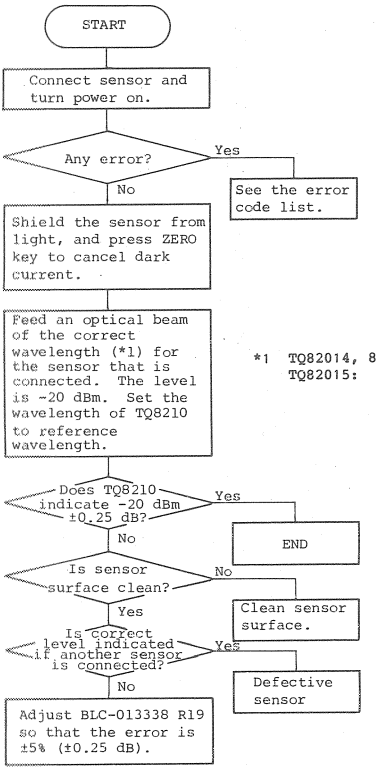


Flowchart 1 Error diagnosis



Flowchart 1 Error diagnosis

7. INSPECTION AND CALIBRATION



Flowchart 2 Inspection and calibration

8. SPECIFICATIONS

TQ8210 mainframe	Resolution	0.005 to 0.1% (W measurement), 0.01 dB (dBm measurement)
	Display	LCD: backlighted for dark locations Wavelength readout: 4 digits (nm) Power readout: 4-1/2 digits (mW, μW, nW, dBm, dBr)
	Range switching	Automatic or manual
	Measurement speed	2 measurements/s or faster
	MAX/dBr functions	**MAX** (available for W measurement): The maximum measured value is held. **dBr** (available for dBm measurement): The value relative to a reference level is indicated.
	Wavelength sensitivity compensation	Automatic compensation for sensor sensitivity at set wavelength
	Smoothing function	Digital smoothing (by 2 to 20 moving averages)
	Offset zero	Sensor offset is stored in memory and automatically compensated.
	Analog output	Output voltage: 0 to 2 V; wavelength sensitivity compensationn not done Output impedance: 10Ω or less Connector: Earphone jack
	Operating conditions	0 to 40°C, 85% RH or less
	Storage temperature	—25 to +70°C
	Power	Internal Ni-Cd battery Operation period: Display light On: 8 hours or more Display light off: 10 hours or more (charged 48 hours at POWER OFF) AC adapter (charges the Ni-Cd battery pack)
	Dimensions	80(W) x 180(L) x 35(H) mm
	Weight	400 g maximum

	Model	TQ82014	TQ82015	TQ82017	Q82018A
Sensor	Wave-length	400 – 1100nm	800 – 1600nm	400 – 1100nm	800 – 1650nm
	Optical input limit	−60 to +17dBm (1nW to 50mW)	−40 to +10dBm (100nW to 10mW)	−60 to +17dBm (1nW to 50mW)	−60 to 0dBm (1nW to 1mW)
	Photo-receptor	Si Photo-diode	Ge Photo-diode	Si Photo-diode	InGaAs PIN Photo-diode
	Optical input area	8mmo	5mmo	10×10mm	–
	Range	10dB step 8 ranges	10dB step 5 ranges	10dB step 8 ranges	10dB step 6 ranges
	Measure-ment accuracy	±5% (850nm, −20dBm)	±5% (1300nm, −20dBm)	±5% (850nm, −20dBm)	±5% (1300nm, −20dBm)

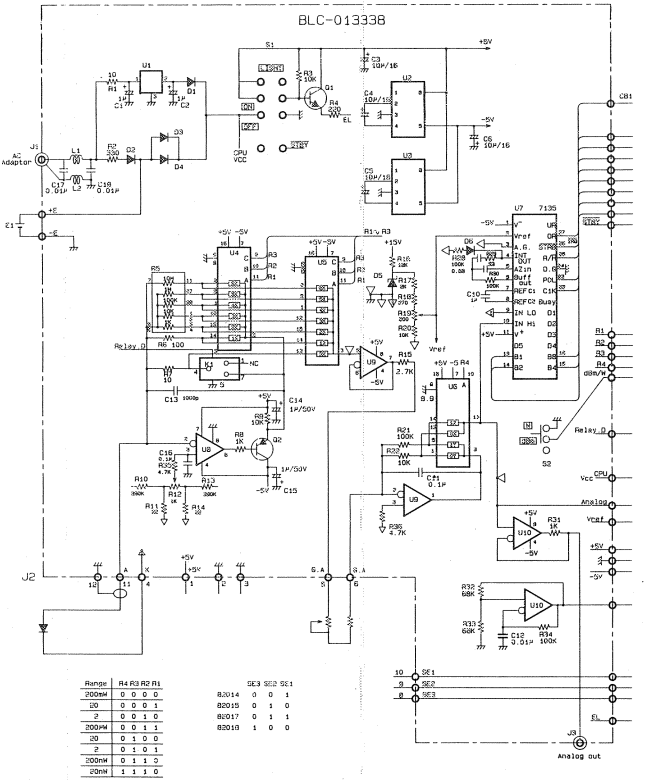
Accessories

Item	Stock No.	Remarks
AC Adapter	A08017	AC100V
AC Adapter	A08019	200V~245V
Analog output cable	A01225	
Instruction manual	E8210	

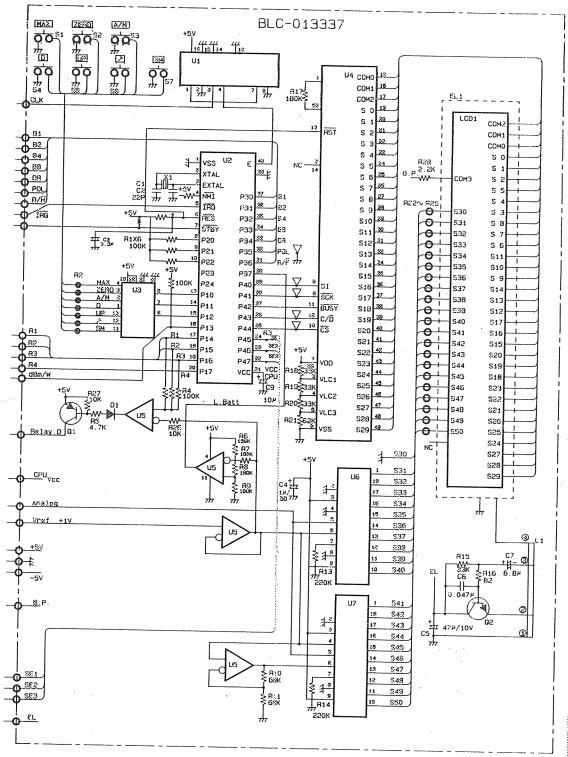
TQ8210

BLC-013338

Parts No.	ADVANTEST Stock No.	Parts No.	ADVANTEST Stock No.
C1 -2	CTA-AC1U50V	S1	KSL-000798-1
C3 -6	CTA-AC10U16V	S2	KSL-000438-1
C8	CFM-AHR68U100V-1	U1	SIA-78L006-1
C9 -10	CFM-AH1U100V-1	U2 -3	SIA-7660-1
C11	CSM-AG1U50V-2	U4	SIA-74HC4051-1
C12	CSM-AFR01U50V-2	U5	SIM-4051-18
C13	CSM-AE1000P50V	U6	SIA-4052-1
C14	CTA-AC1U50V	U7	SIA-AD7135-1
C15	CTA-AC1U50V	U8	SIA-OPA111-1
C16	CSM-AGR1U50V	U9	SIA-OP220G-1
C17 -18	CSM-AFR01U50V	U10	SIA-442-1
D1 -2	SDS-1S953		
D3 -4	SDS-1SS99		
D5	SDZ-LM385BXZ-1		
D6	SDS-1S953		
E1	DBP-001169-1		
J1	JCI-AF003JX04-3		
J2	JCS-CD012JX01-1		
J3	JCI-AF004JX02-3		
K1	KRL-000733-1		
L1 -2	LCL-T00084A		
Q1	STN-2SC1815-55		
Q2	STP-2SA1015		
R1	RCB-AH10		
R2	RCB-AH330		
R3	RCB-AG10K		
R4	RCB-AG220		
R5	RHB-000007		
R6	RMF-AB100QBJ-2		
R7	RMF-AB10QCG-2		
R8	RCB-AG1K		
R9	RCB-AG10K		
R10	RCB-AG390K		
R11	RCB-AG22		
R12	RVR-CD1K-1		
R13	RCB-AG390K		
R14	RCB-AG22		
R15	RMF-AB2R7KCJ-2		
R16	RCB-AG18K		
R17	RMF-AB2KFG-2		
R18	RCB-AG270		
R19	RVR-CD200-1		
R20	RMF-AB10KFG-2		
R21	RMF-AB100KBJ-2		
R22	RMF-AB10KCJ-2		
R28	RCB-AG100K		
R29	RCB-AG33		
R30	RCB-AG100K		
R31	RCB-AG1K		
R32 -33	RCB-AG68K		
R34	RCB-AG100K		
R35	RCB-AG4R7K		
R36	RCB-AG4R7K		



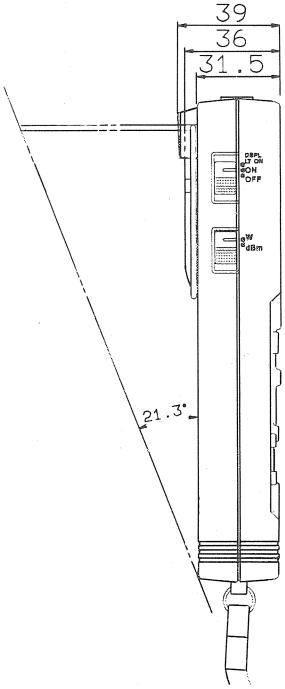
← BCL-013338



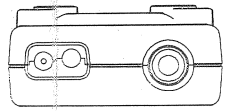
TQ8210
OPTICAL POWER METER
BLC-013337/ BLC-013338

TQ8210
BLC-013337

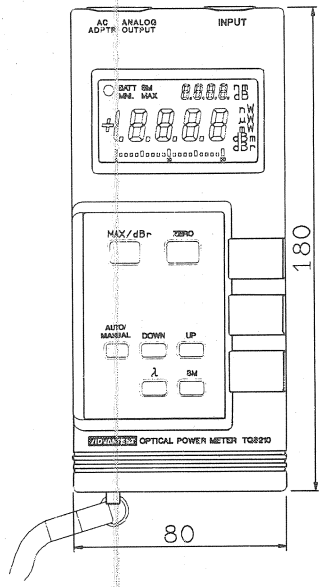
Parts No.	ADVANTEST Stock No.	Parts No.	ADVANTEST Stock No.
C1 -2	CSM-AC22P50V		
C3	CTA-AC3R3U16V		
C4	CTA-AC1U50V		
C5	CCK-AA47U10V-1		
C6	CSM-AFR047U50V		
C7	CTA-AC6R8U35V		
C8	CTA-AC10U16V		
CB1	RCB-002043X01-1		
D1	SDS-15953		
EL1	NEE-000207-1		
L1	LTP-000794-1		
N1	NLC-000214-1		
Q1	STP-2SA1015		
Q2	STN-2SC1815-55		
R1 -4	RAY-AL100K6		
R5	RCB-AG487K		
R6	RCB-AG150K		
R7	RCB-AG100K		
R8	RCB-AG180K		
R9	RCB-AG100K		
R10 -11	RCB-AG68K		
R13 -14	RCB-AG220K		
R15	RCB-AG33K		
R16	RCB-AG82		
R17	RCB-AG180K		
R18 -20	RCB-AG33K		
R21	RCB-AG62K		
R22 -25	RAY-AL100K6		
R26 -27	RCB-AG10K		
R28	RCB-AG2R2K		
S1 -7	KSE-000799-1		
U1	SIM-74HC390		
U2	SIM-63701-2		
U3	SIM-74HC148		
U4	SIM-7225-1		
U5	SIA-324-1		
U6 -7	SIA-3914-1		
X1	DXE-001128-1		



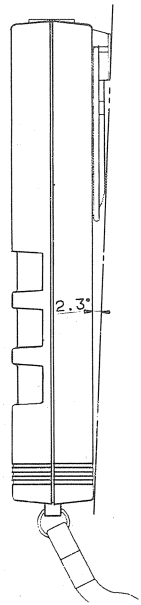
SIDE VIEW



TOP VIEW



FRONT VIEW



SIDE VIEW

Unit : mm

8210EXTI-603-A

TQ8210
EXTERNAL VIEW

MANUAL No. FOE-8324193G02

ADVANTEST®

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