Model 1830-R SERIES

Optical Power Meters

User's Manual

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EU Declaration of Conformity

We declare that the accompanying product, identified with the CE mark, complies with requirements of the Electromagnetic Compatibility Directive, 2004/108/EC and the Low Voltage Directive 2006/95/EC.

Model Numbers: 1830-R and 1830-R-GPIB

Year CE mark affixed: 2011

Type of Equipment: Electrical equipment for measurement, control and laboratory use in industrial locations.

Manufacturer: Newport Corporation
1791 Deere Avenue
Irvine, CA 92606

Standards Applied:

Compliance was demonstrated to the following standards to the extent applicable:

BS EN61326-1: 2006 “Electrical equipment for measurement, control and laboratory use – EMC requirements”.

This equipment meets the CISPR 11:2009+A1:2010 Class A Group 1 radiated and conducted emission limits.

BS EN 61010-1:2010, “Safety requirements for electrical equipment for measurement, control and laboratory use”.

Mark Carroll
Sr. Director, Instruments Business
Newport Corporation
1791 Deere Ave, Irvine, CA92606 USA

Warranty

Newport Corporation warrants that this product will be free from defects in material and workmanship and will comply with Newport's published specifications at the time of sale for a period of one year from date of shipment. If found to be defective during the warranty period, the product will either be repaired or replaced at Newport's option.

To exercise this warranty, write or call your local Newport office or representative, or contact Newport headquarters in Irvine, California. You will be given prompt assistance and return instructions. Send the product, freight prepaid, to the indicated service facility. Repairs will be made and the instrument returned freight prepaid. Repaired products are warranted for the remainder of the original warranty period or 90 days, whichever first occurs.

Limitation of Warranty

The above warranties do not apply to products which have been repaired or modified without Newport's written approval, or products subjected to unusual physical, thermal or electrical stress, improper installation, misuse, abuse, accident or negligence in use, storage, transportation or handling. This warranty also does not apply to fuses, batteries, or damage from battery leakage.

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First printing 2011

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Newport Corporation
1791 Deere Avenue
Irvine, CA, 92606
USA

Part No. 90044527 rev A

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Service Information

This section contains information regarding factory service for the source. The user should not attempt any maintenance or service of the system or optional equipment beyond the procedures outlined in this manual. Any problem that cannot be resolved should be referred to Newport Corporation.

Technical Support Contacts

North America

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Newport Corporation Calling Procedure

If there are any defects in material or workmanship or a failure to meet specifications, promptly notify Newport's Returns Department by calling 1-800-222-6440 or by visiting our website at www.newport.com/returns within the warranty period to obtain a **Return Material Authorization Number (RMA#)**. Return the product to Newport Corporation, freight prepaid, clearly marked with the RMA# and we will either repair or replace it at our discretion. Newport is not responsible for damage occurring in transit and is not obligated to accept products returned without an RMA#.

E-mail: rma.service@newport.com

When calling Newport Corporation, please provide the customer care representative with the following information:

- Your Contact Information
- Serial number or original order number
- Description of problem (i.e., hardware or software)

To help our Technical Support Representatives diagnose your problem, please note the following conditions:

- Is the system used for manufacturing or research and development?
- What was the state of the system right before the problem?
- Have you seen this problem before? If so, how often?
- Can the system continue to operate with this problem? Or is the system non-operational?
- Can you identify anything that was different before this problem occurred?

Table of Contents

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1 Safety Precautions

1.1 Definitions and Symbols

The following terms and symbols are used in this documentation and also appear on the Model 1830-R Series Optical Power Meter where safety-related issues occur.

1.1.1 General Warning or Caution

Figure 1 General Warning or Caution Symbol

The Exclamation Symbol in the figure above appears on the product and in Warning and Caution tables throughout this document. This symbol designates that documentation needs to be consulted to determine the nature of a potential hazard, and any actions that have to be taken.

1.1.2 Electric Shock

Figure 2 Electrical Shock Symbol

The Electrical Shock Symbol in the figure above appears throughout this manual. This symbol indicates a hazard arising from dangerous voltage. Any mishandling could result in irreparable damage to the equipment, and personal injury or death.

1.1.3 European Union CE Mark

Figure 3 CE Mark

The presence of the CE Mark on Newport Corporation equipment means that this instrument has been designed, tested and certified compliant to all applicable European Union (CE) regulations and recommendations.

1.1.4 Alternating voltage symbol

Figure 4 Alternating Voltage Symbol

This international symbol implies an alternating voltage or current.

1.1.5 On

Figure 5 On Symbol

The symbol in the figure above represents a power switch position on a Model 1830-R Series Optical Power Meter. This symbol represents a Power On condition.

1.1.6 Off

Figure 6 Off Symbol

The symbol in the figure above represents a power switch position on the Model 1830-R Series Optical Power Meter. This symbol represents a Power Off condition.

1.1.7 Fuses

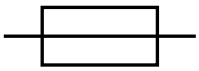

Figure 7 Fuse Symbol

The symbol in the figure above identifies the fuse location on the Model 1830-R Series Optical Power Meter.

1.1.8 USB

Figure 8 USB Symbol

The symbol in the figure above identifies the USB connector location on the Model 1830-R Series Optical Power Meter.

1.1.9 Frame or Chassis

Figure 9 Frame or Chassis Terminal Symbol

The symbol in the figure above appears on the Model 1830-R Series Optical Power Meter. This symbol identifies the frame or chassis terminal

1.1.10 Waste Electrical and Electronic Equipment (WEEE)

Figure 10 WEEE Directive Symbol

This symbol on the product or on its packaging indicates that this product must not be disposed with regular waste. Instead, it is the user responsibility to dispose of waste equipment according to the local laws. The separate collection and recycling of the waste equipment at the time of disposal will help to conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. For information about where the user can drop off the waste equipment for recycling, please contact your local Newport Corporation representative.

1.1.11 Control of Hazardous Substances

Figure 11 RoHS Compliant Symbol

This label indicates the products comply with the EU Directive 2002/95/EC that restricts the content of six hazardous chemicals.

1.2 Warnings and Cautions

The following are definitions of the Warnings, Cautions and Notes that are used throughout this manual to call your attention to important information regarding your safety, the safety and preservation of your equipment or an important tip.

WARNING

Situation has the potential to cause bodily harm or death.

CAUTION

Situation has the potential to cause damage to property or equipment.

NOTE

Additional information the user or operator should consider.

1.2.1 General Warnings

Observe these general warnings when operating or servicing this equipment:

- Heed all warnings on the unit and in the operating instructions.
- Do not use this equipment in or near water.
- This equipment is grounded through the grounding conductor of the power cord.
- Route power cords and other cables so that they are not likely to be damaged.
- Disconnect power before cleaning the equipment. Do not use liquid or aerosol cleaners; use only a damp lint-free cloth.
- Lockout all electrical power sources before servicing the equipment.
- To avoid fire hazard, use only the specified fuse(s) with the correct type number, voltage and current ratings as referenced in the appropriate locations in the service instructions or on the equipment. Only qualified service personnel should replace fuses.
- To avoid explosion, do not operate this equipment in an explosive atmosphere.
- Qualified service personnel should perform safety checks after any service.

1.2.2 General Cautions

Observe these cautions when operating this equipment:

- If this equipment is used in a manner not specified in this manual, the protection provided by this equipment may be impaired.
- To prevent damage to equipment when replacing fuses, locate and correct the problem that caused the fuse to blow before re-applying power.
- Do not block ventilation openings.

- Do not position this product in such a manner that would make it difficult to disconnect the power cord.
- Position the equipment so that access to the mains disconnect On/Off switch is readily available.
- Use only the specified replacement parts.
- Follow precautions for static sensitive devices when handling this equipment.
- This product should only be powered as described in the manual.
- There are no user-serviceable parts inside the Model 1830-R Series Optical Power Meter.
- Adhere to good laser safety practices when using this equipment.

1.2.3 Summary of Warnings and Cautions

The following general warning and cautions are applicable to this instrument:

WARNING

Before operating the Model 1830-R Series Optical Power Meter, please read and understand all of Section 1.

WARNING

Do not attempt to operate this equipment if there is evidence of shipping damage or you suspect the unit is damaged. Damaged equipment may present additional hazards to you. Contact Newport technical support for advice before attempting to plug in and operate damaged equipment.

WARNING

To avoid electric shock, connect the instrument to properly earth-grounded, 3-prong receptacles only. Failure to observe this precaution can result in severe injury.

WARNING

Do not replace the AC Mains power line cord with an inadequately rated one.

WARNING

The Model 1830-R Series Optical Power Meter must be configured for the correct AC Mains power line voltage. Setting the instrument to the wrong line voltage may damage the unit. Such damage may not be covered by the product's warranty.

WARNING

Before cleaning the enclosure of the Model 1830-R Series Optical Power Meter, the AC power cord must be disconnected from the wall socket.

CAUTION

There are no user serviceable parts inside the Model 1830-R Series Optical Power Meter. Work performed by persons not authorized by Newport Corporation will void the warranty. For instructions on obtaining warranty repair or service, please refer to Section 9.

WARNING

If this equipment is used in a manner not specified in this manual, the protection provided by this equipment may be impaired.

WARNING

This instrument is intended for use by qualified personnel who recognize shock hazards or laser hazards and are familiar with safety precautions required to avoid possible injury. Read the instruction manual thoroughly before using, to become familiar with the instrument's operations and capabilities.

WARNING

The American National Safety Institute (ANSI) states that a shock hazard exists when probes or sensors are exposed to voltage levels greater than 42VDC or 42V peak AC. Do not exceed 42V between any portion of the Model 1830-R Series Optical Power Meter (or any attached detector or probe) and earth ground or a shock hazard will result.

CAUTION

The Model 1830-R Series Optical Power Meter is designed to be safe when operated under Normal Environmental Conditions as defined in EN61010-1:2010. Operation under harsher environmental conditions can result in severe injury.

CE	**The Model 1830-R Series Optical Power Meter is intended for use in an industrial laboratory environment. Use of this product in other environments, such as residential, may result in electromagnetic compatibility difficulties due to conducted as well as radiated disturbances.**

CE	**The Model 1830-R Series Optical Power Meter is designed to operate in a controlled electromagnetic environment; i.e., where R.F. transmitters such as mobile telephones may not be used in close proximity.**

1.3 Location of Labels and Warnings

1.3.1 Rear Panel – Model 1830-R

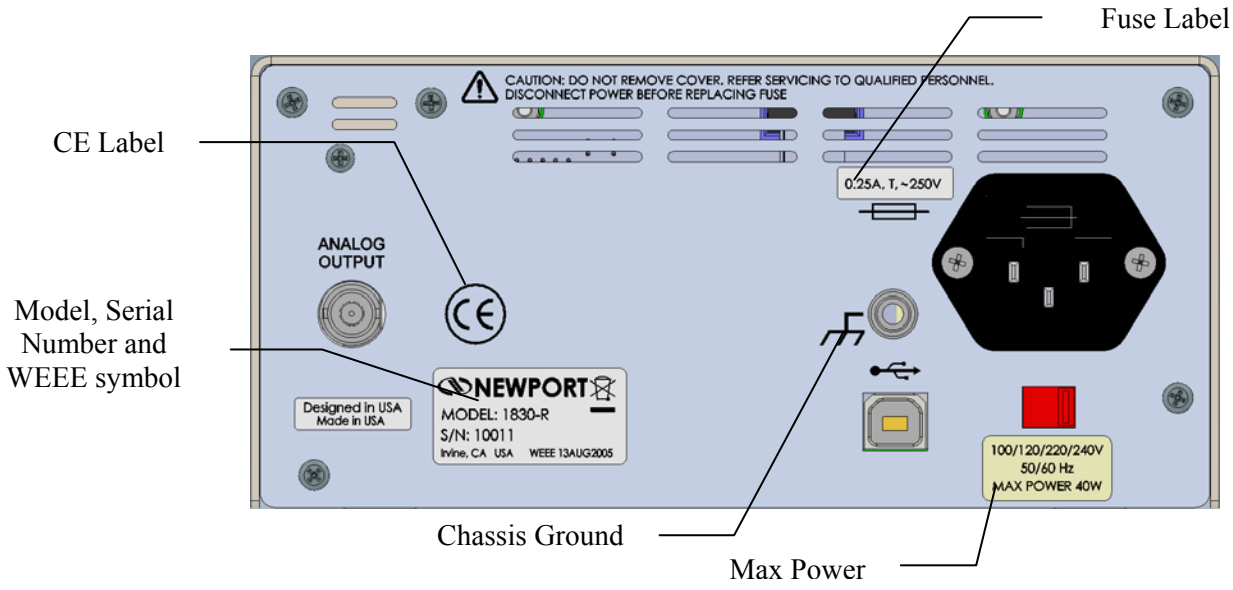

Figure 12 Rear Panel Labels and Warnings

1.3.2 Rear Panel – Model 1830-R-GPIB

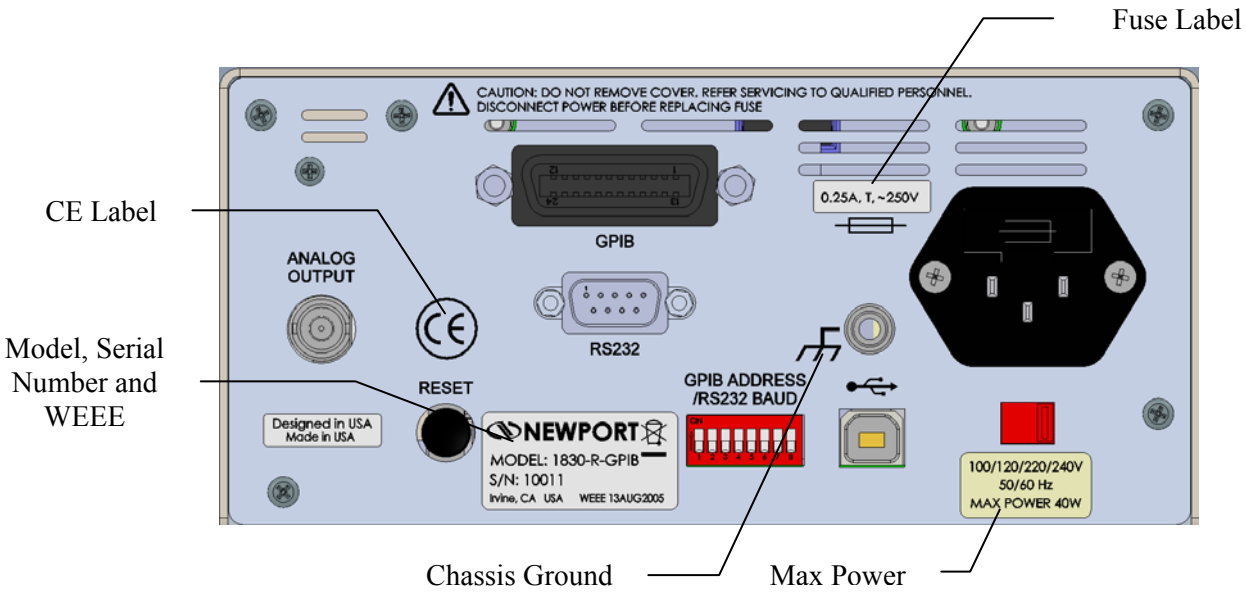

Figure 13 Model 1830-R-GRIB

2 General Information

2.1 System Overview

The 1830-R Series Optical Power Meter is a ±20,000 count A/D resolution, auto-ranging picoammeter. Measurements are displayed on a large 4 1/2 digit display and can also be taken remotely via the USB interface (or RS-232C or IEEE 488 GPIB interfaces, Model 1830-R-GPIB only). The 1830-R Series is designed to take continuous wave optical power measurements and is compatible with all of Newport's 818 and 918D Series Semiconductor photodetectors.

Newport detectors for use with the 1830-R Series have an internal EEPROM chip, in which the responsivities and other information unique to the detectors is stored.

2.2 Scope of this Manual

Please carefully read this instruction manual before using the 1830-R Series Optical Power Meter. Be especially careful to observe the warnings and cautions throughout this manual (see Safety Symbols and Terms). If any operating instructions are not clear, contact Newport Corporation.

This instruction manual contains the necessary information for operation and maintenance of the 1830-R Series Optical Power Meter, as well as information for troubleshooting and obtaining service if necessary. This information is divided into the following sections:

Section 1	Safety Precautions
Section 2	General Information
Section 3	Initial Setup
Section 4	System Operation
Section 5	Performing Measurements
Section 6	Computer Interfacing
Section 7	Remote Command Set
Section 8	Troubleshooting and Maintenance
Section 9	Factory Service
Section 10	Appendix A, Status Reporting System
Section 11	Appendix B, Block Diagram

2.3 Unpacking and Inspection

All 1830-R Series meters are carefully assembled, tested and inspected before shipment. Upon receiving this instrument, check for any obvious signs of physical damage that might have occurred during shipment. Report any such damage to the shipping agent immediately.

NOTE

Retain the original packing materials in case reshipment becomes necessary.

2.4 Preparation for Use

The 1830-R Series Optical Power Meter should have some basic operations performed before measurements are made. These include:

Setting the Line Voltage Selector Switch (Section 3.2)

Detector Connection and Setup (Section 3.3)

2.5 Definitions

A	amps
ADC	analog-to-digital converter
BNC	standard coaxial connector type
degree C	degrees Centigrade
Hz	Hertz (cycles per second)
k	kilo (10_3)
kHz	kilohertz
kΩ	kilo-ohms
µ	micro (10^{-6})
m	milli (10^{-3})
mA	milliamps
mV	millivolts
n	nano (10^{-9})
nA	nanoamps

nm	nanometers
RH	relative humidity
S/N	serial number
µA	microamps
µs	microseconds
V	volts
W	watts

2.6 Specifications

Dimensions:	4.1 x 7.5 x 8.6 in. (104 x 191 x 218 mm)
Weight:	4.5 lb (2.0 kg)
Enclosure:	Metal case, painted
Connectors:	Detector: 15-pin D-Sub Receptacle Analog Output: BNC RS-232: 9-pin D-Sub Plug GPIB: 24 Conductor D USB: Standard USB-B (device)
Power :	100-120, 220-240 VAC ±10%, 50/60 Hz
Absolute Maximum Line Current Rating:	200 mA
Fuse	0.25A, 250VAC, Slow-Blow
Signal Ranges:	Up to 8 decades
Display:	4.5 digit, 7-segment
Display Update Rate:	75 ms
Auto-Ranging Time:	200 ms (typical)
GPIB Bus Transfer Time:	10 ms (typical)
Operating Environment:	Temperature: 5 to +40 degree C Relative Humidity: < 80% RH noncondensing for temperatures up to 31 degree C decreasing linearly to 50% RH noncondensing at 40 degree C Altitude < 2000m Pollution Degree: 2 Indoor use only
Storage Environment: Compatible Detectors:	−20 to +60 degree C; < 90% RH noncondensing

Signal Range[1, 2]	0	1	2	3	4	5	6	7
Full-Scale Current[3]	2 nA	20 nA	200 nA	2 µA	20 µA	200 µA	2 mA	10 mA
Gain	1000 M	100 M	10 M	1 M	100 k	10 k	1 k	100
Resolution	0.1 pA	1 pA	10 pA	100 pA	1 nA	10 nA	100 nA	1 µA
Analog Bandwidth	40 Hz	40 Hz	1.2 kHz	2 kHz	7 kHz	17 kHz	10 kHz	20 kHz
Full-Scale Accuracy[4] (Typical)	0.13 %	0.13 %	0.13 %	0.13 %	0.13 %	0.13 %	0.13 %	0.13 %
Full-Scale Accuracy[4] (Worst Case)	0.25 %	0.25 %	0.25 %	0.25 %	0.25 %	0.25 %	0.25 %	0.25 %

[1]Listed signal ranges specify meter capability. Available signal ranges are detector dependent.
[2]Maximum measurable signal is detector dependent. See description of detector saturation message "SA" in Table 2.
[3]Full scale current may vary due to the Auto-Calibration compensation of amplifier DC offsets.
[4]After 60 minute warm-up, followed by execution of an Auto-Calibration command.

Analog Output

Full-Scale Voltage:	Range 0-6: 2 V into 1 MΩ, 1 V into 50 Ω Range 7: 1 V into 1 MΩ, 0.5 V into 50 Ω
Full-Scale Accuracy:	Range 0-6: ±0.5% Range 7: ±1%
Maximum AC Noise (open input):	Range 0: <4 mVp-p Ranges 1-7: <1 mVp-p

2.7 Measurement Modes

Display Calculation	Display Unit	Comment
$\frac{I}{R}$	W	ZERO Disabled
$\frac{I - I_Z}{R}$	W	ZERO Enabled
$10\ \log\left(\frac{I}{R \cdot 1\text{mW}}\right)$	dBm	ZERO Disabled
$10\ \log\left(\frac{I - I_Z}{R \cdot 1\text{mW}}\right)$	dBm	ZERO Enabled
$10\ \log\left(\frac{I}{I_{STOREEF}}\right)$	dB	ZERO Disabled
$10\ \log\left(\frac{I - I_Z}{I_{STOREEF} - I_Z}\right)$	dB	ZERO Enabled
$\frac{I}{I_{STOREEF}}$	REL	ZERO Disabled
$\frac{I - I_Z}{I_{STOREEF} - I_Z}$	REL	ZERO Enabled

Where I = detector current

I_z = detector background current defined when the ZERO key was pressed

R = responsivity of the detector (A/W)

I_{STOREF} = referenced detector current defined when the STOREF key was pressed

Table 1 Measurement Modes

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3 Initial Setup

3.1 Introduction

This section contains information on how to configure the 1830-R Series Optical Power Meter to your local line voltage and how to connect the detector and calibration module to the meter. It also includes a short discussion about the remote interface and the instrument's power-up and auto-calibration.

3.2 Setting the Line Voltage Selector Switch

The 1830-R Series Optical Power Meter operates with line frequencies of both between 50 and 60 Hz. It can be configured to operate with line voltages of 100-120 VAC or 220-240 VAC. Before turning the meter on, configure it to the local voltage by setting the voltage selection switch on the 1830-R Series instrument's back panel to match the nominal local voltage. The 115 V position should be used for nominal line voltages between 100 and 120 VAC; the 230V position should be used for nominal line voltages between 220 and 240 VAC. See Figure 14. Plug the AC line power cord to the rear of the 1830-R Series instrument and then connect the cord to AC power.

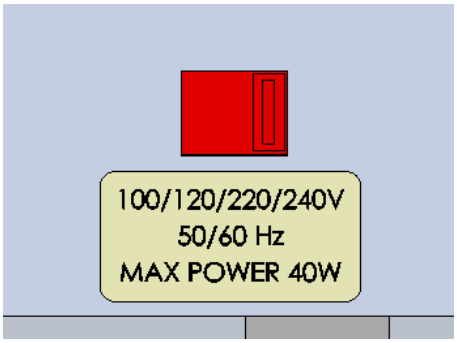

Figure 14 Line Voltage Selection Switch

WARNING

This product is equipped with a 3 wire grounding type plug. Any interruption of the grounding connection can create an electric shock hazard. If you are unable to insert the plug into your wall plug receptacle, contact your electrician to perform the necessary alterations to assure that the green (green-yellow) wire is attached to earth ground.

3.3 Detector Connection and Setup

Connect the detector to the DB15 connector on the front panel of the Model 1830-R Series Optical Power Meter. The backshell of the detector's connector contains an EEPROM with the calibration data for the detector. The Model 1830-R Series meter reads this calibration data from the detector upon power up and when the connector is attached to the instrument.

Figure 15 Calibration Module Connector Port

3.4 Configuring the Computer Interface (1830-R-GPIB only)

The RS-232C baud rate and the IEEE 488 GPIB address must be properly set via the back panel system switches if either interface is to be used. (Model 1830-R does not have these interfaces.) Please refer to Section 6 for detailed instructions. Note that the USB interface is self-configuring; the back panel system switches are ignored when the USB interface is used.

3.5 Power Up / Auto Calibration

Turn on the 1830-R Optical Power Meter by depressing the black power switch button, located in the lower left-hand corner of the front panel, until it clicks and remains in its depressed position. At power-up, the 1830-R Series instrument will perform the following sequence:

1. Momentarily display all the segments on the display
2. Display the software version number

3. Perform an Auto-Calibration, designated by displaying CAL on the display
4. Display the serial number of the detector/calibration module
5. Display the wavelength to which the meter is set

The auto-calibration process involves measuring amplifier offset voltages which arise from aging and temperature effects. These offsets are then appropriately corrected for during normal operation. The 1830-R Series instrument will automatically disconnect the input signal from the amplifier during the auto-calibration mode. To achieve stable readings at the specified accuracy, auto-calibration should be executed after a minimum 60 minute warm-up period. This can be done either by resetting the 1830-R Series instrument with the RESET button on the back of the meter (1830-R-GPIB only; switch is not present on the Model 1830-R), or by sending the auto-calibration remote command, O.

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4 System Operation

4.1 Introduction

This section contains the information needed to operate the 1830-R Series Optical Power Meter via the front panel key pad. The meanings of the display annunciators and the operation of all keys are discussed later in this section.

4.2 Digital Display

The 1830-R Series Optical Power Meter has a large 5 digit + indicators, LED display which can be seen at large angles of view. Figure 16 illustrates the layout of the 1830-R Series meter's display. Table 2, on the following page, explains the meaning of the various annunciators and messages on the display.

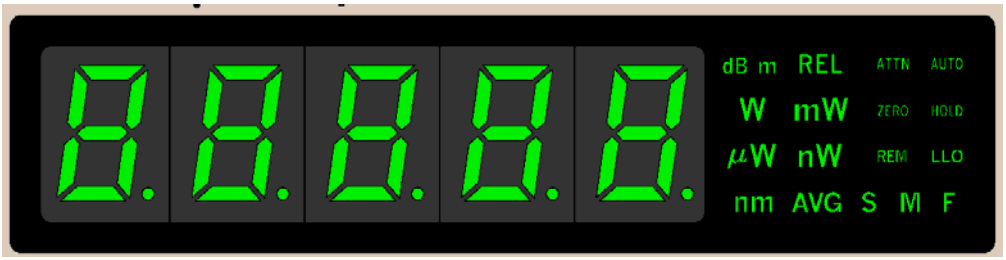

Figure 16 The 1830-R Series Display

Annunciator/Message	Comment
SN	This annunciator denotes *serial number* and is displayed at turn-on when the detector's serial number is displayed.
dB	This annunciator specifies that dB measurements are being displayed.
dBm	This annunciator specifies that dBm measurements are being displayed.
REL	This annunciator specifies that *relative* measurements are being displayed.
W	This annunciator specifies that measurements in units of *watts* are being displayed.

mW	This annunciator specifies that measurements in units of *milliwatts* are being displayed.
µW	This annunciator specifies that measurements in units of *microwatts* are being displayed.
nW	This annunciator specifies that measurements in units of *nanowatts* are being displayed.
nm	This annunciator indicates *nanometer* whenever the wavelength is displayed.
ATTN	The responsivity in use includes the effect of the detector's OD3 attenuator.
AUTO	**Automatic signal ranging is activated.**
ZERO	**Background signal subtraction (zeroing) is activated.**
HOLD	**No new readings will be displayed, nor be available on the remote interface bus.**
REM	**The meter has received a command/query either through the USB, IEEE 488 or the RS-232C bus.**
LLO	**The meter has been set to local-lockout from the remote interface bus and will not respond to any front panel keys.**
AVG: S M F	**Either Slow, Medium, or Fast numerical averaging for the displayed measurement is activated.**
OL	**This message indicates that the input signal level exceeds the capability of the present signal range. Either use auto-ranging or increment the signal range until the OL message goes away.**
SA	**This message indicates that the input signal level exceeds the specified saturation current of the detector being used with the meter. This level is detector dependent.**
CAL	**This message indicates that the meter is currently performing an auto-calibration. The auto-calibration process involves measuring amplifier offset voltages. See Section 3.5 for more details.**

Table 2 1830-R Series Display Annunciators/Messages

4.3 Front Panel Key Functions

The front panel key pad of the 1830-R Series Optical Power Meter, Figure 17, provides access to all the basic measurement functions. Table 3 and Sections 4.3.1 through 4.3.14 list and describe in detail each key function. For power-up default conditions, please see Table 4 at the end of this section.

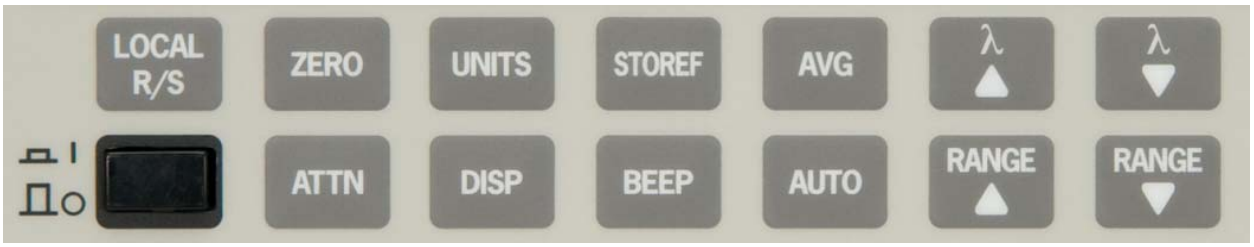

Figure 17 Front Panel Key Pad

Keypad	Remote Command	Description
(LOCAL)	**L0**	Enables local mode.
R/S	**G0, G1**	Run/Stop signal acquisition.
ZERO	**Z0, Z1**	Zero the display by subtracting the present reading from all subsequent readings.
UNITS	**U1-U4**	Cycles between the four available measurement units (Watt, dB, dBm, Relative).
STOREF	**S**	Stores last measurement for future dB or relative measurements.
AVG	**F1-F3**	Cycles between Slow, Medium, or Fast numerical averaging of readings that are within a certain percentage of each other.
λ▲	**Wnnnn**	Increments the calibration wavelength in use.
λ ▼	**Wnnnn**	Decrements the calibration wavelength in use.
I O	**None**	Turns the meter on/off.
ATTN	**A0, A1**	Sets the responsivity value for either: 1) detector alone, or 2) detector and OD3 optical attenuator.
DISP	**K0, K1**	Turns the display ON/OFF. When the display is off, a dot LED blinks to show that the unit is active but the display is off.
BEEP	**B0, B1**	Turns the variable frequency beeper on/off.
AUTO	**R0, R1-R8**	Turns the automatic signal ranging on/off.
RANGE ▲	**Rx**	Increments the signal range and disables the automatic signal ranging.
RANGE ▼	**Rx**	Decrements the signal range and disables the automatic signal ranging.

Table 3 1830-R Key Functions and Associated Remote Commands

4.3.1 (LOCAL) R/S Local Mode Run/Stop

This key serves two purposes:

1. When the meter receives a command through either USB, RS-232C or the IEEE 488 GPIB interface, the meter is automatically put into remote mode and the REM annunciator is displayed. Now all front panel keys are disabled except this (LOCAL) key which, when pressed, puts the meter back into the local mode. The meter can also be put in the local mode by sending the remote command, L0.
2. When the meter is in the local mode, pressing this key will toggle between run/stop acquisition modes. The HOLD annunciator is displayed when the meter is in the stop acquisition mode.

4.3.2 ZERO Offset Subtraction

This key turns the offset subtraction on and off. When turned on, the ZERO annunciator is displayed and the last measurement is saved as P_z and subtracted from all subsequent measurements P. This causes subsequent measurement calculations shown on the display and available on the remote interface to use the value ($P - P_z$) instead of P.

Offset subtraction allows one to remove the effects of ambient DC signals, by zeroing the display before making a measurement. A second ZERO key press turns off the ZERO annunciator and stops offset subtraction.

4.3.3 UNITS Display Units

Measurements can be displayed in units of watts **W**, decibels **dB** or **dBm**, and relative **REL**. Pressing the UNITS key repeatedly cycles the display through these four units.

The **W** mode is a straightforward measurement which converts the current from the detector into a power reading via the responsivity of the detector at the set wavelength.

The **dB** mode uses the relationship $dB = 10 * \log(P / P_{ref})$, where P is the most recent measurement and P_{ref} is the reference measurement. At power-up the reference for the **dB** mode is a level equivalent to 1mW. This can be changed by pressing STOREF, which makes the most recent measurement the new P_{ref}.

The **dBm** mode uses the relationship $dBm = 10 * \log(P / 1mW)$, where P is the most recent measurement.

The **REL** mode uses the relationship (P / P_{ref}), where P is the most recent measurement and P_{ref} is the reference measurement. At power-up the reference for the **REL** mode is a level equivalent to 1mW. This can be changed by pressing STOREF, which makes the most recent measurement the new P_{ref}.

If a relative measurement is greater than 9,999.9, the unit displays the measurement in the following format: **x.xx. y.** The displayed value must be interpreted as **x.xx * 10^{y}**. Similarly, if a relative measurement is less than 0.01, the unit displays the measurement in the following format: **x.xx.–y.** The displayed value must be interpreted as **x.xx * 10^{-y}**.

4.3.4 STOREF Store Reference Value

Pressing STOREF causes the most recent measurement P to be stored as P_{ref} for subsequent use in relative measurement calculations. When the units are **dB** and STOREF has been pressed, the displayed value is the function 10 * log(P/P_{ref}). When the units are **REL** and STOREF has been pressed, the displayed value is the ratio P/P_{ref}.

P_{ref} is always a power reading stored in the units of Watts. Pressing STOREF causes a new P_{ref} to overwrite the existing P_{ref} value.

4.3.5 AVG Numerical Averaging

Pressing AVG causes the numerical averaging feature to cycle through slow **S**, medium **M**, and fast **F** modes. The slow mode takes the last 16 measurements that are within ±9 counts of the oldest measurement and averages them for the displayed reading. The medium mode averages the last 4 measurements, and the fast mode does ***no*** averaging.

The averaging buffer is a sliding buffer that always maintains 16 or 4 measurements, depending on the mode. Initially the buffer is completely filled with the same measurement, and thereafter subsequent measurements replace the older measurements in the buffer. If, at any time, a single measurement is acquired that is not within ±9 counts of the oldest measurement, the averaging algorithm starts over, not retaining any of the previous measurements.

4.3.6 λ Wavelength Increment

Pressing this key once causes the wavelength to be displayed. If the key is pressed again or held down, the wavelength will increment or scroll, respectively.

The detector calibration module contains responsivity data at discrete wavelengths for its associated detector. By entering the wavelength which is being measured, the correct responsivity value is used by the 1830-R Series instrument in calculating the measured power. When a wavelength falls between two calibration points, linear interpolation is used to approximate the true responsivity value.

Upon the initial power-up on a new calibration module, the meter defaults to the shortest wavelength available for that specific detector. *Whenever the calibration wavelength is changed, this new wavelength is written to the PROM in the calibration module and is used as the default wavelength at subsequent power-ups.*

4.3.7  Wavelength Decrement

Same as Wavelength Increment except that this key decrements the wavelength.

4.3.8  Power

This key turns the power to the 1830-R Series Optical Power Meter ON and OFF. To turn the meter ON, depress the key until it clicks. To turn the meter OFF, press the key again until it clicks and rebounds to its original position.

4.3.9  Optical Attenuator

This key selects whether the responsivity value for the detector-alone, or the value for the detector-with-attenuator is used. When the attenuator mode is on, the ATTN annunciator is lit and the responsivity value for the detector-with-attenuator is used. When the attenuator mode is off, the ATTN annunciator is off and the detector-alone responsivity value is used.

4.3.10  Display ON/OFF

This key cycles the display between OFF and ON. When the display is off, a dot LED blinks to show that the unit is active but the display is off.

4.3.11 BEEP Audible Beeper

This key turns the variable frequency beeper on and off. The frequency of this tone varies as a function of the optical power being measured. The real-time audible feedback is very helpful when trying to maximize optical through-put.

4.3.12 AUTO Automatic Signal Ranging

This key enables and disables the auto-range feature. When auto-range is enabled, the AUTO annunciator is displayed and the amplifier gain in the 1830-R Series instrument will be automatically controlled to maximize the analog-to-digital converter resolution. When auto-range is disabled, the AUTO annunciator is turned off and the signal range is left in its present state. Signal ranging can be manually controlled by the RANGE(▲) and RANGE(▼) keys, as described below.

NOTE

The 1830-R Series Optical Power Meter has 8 signal ranges (R1-R8) which are one decade apart. The ranges available are detector dependent. For example, when using the instrument with Newport's 818-IR, the lowest available range is R3. This is due to the fact that this germanium detector inherently has a large noise equivalent power (NEP).

4.3.13 RANGE ▲ Manual Range Up

This key enables the user to manually decrease the amplifier gain by one decade, allowing the input of larger optical signals without saturating the amplifier. If the meter is in the auto-range mode just prior to pressing this key, the meter will be forced into the manual-range mode and the range will be incremented.

4.3.14 RANGE ▼ Manual Range Down

This key enables the user to manually increase the amplifier gain by one decade. If the meter is in the auto-range mode just prior to pressing this key, the meter will be forced into the manual-range mode and the range will be decremented.

4.4 Default Meter Configuration

Upon power-up or pressing the RESET button on the back of the meter, the 1830-R Series Optical Power Meter will configure itself as listed in Table 4.

Keypad Function	Default Power-Up Condition
(LOCAL)	Local
R/S	Signal Acquisition is on. (Run)
ZERO	ZERO is off.
UNITS	Watts
STOREF	1 mW
AVG	Medium Averaging
λ ▲	Lowest available, or last set wavelength
λ ▼	Lowest available, or last set wavelength
ATTN	ATTN is off. (Detector Alone)
DISP	Display on
BEEP	BEEP is off
AUTO	Auto-Ranging enabled

Table 4 1830-R Series Default Power-Up Conditions

5 Performing Measurements

5.1 Introduction

This section contains detailed information on how to make various optical power measurements with the 1830-R Series instrument.

5.2 Photodetector Considerations

This section describes detector and attenuator characteristics, optical and electrical considerations, and environmental influences on optical measurements. In general, the accuracy of measurement with the 1830-R Series Optical Power Meter is limited by the calibration accuracy of the detector calibration. Making accurate measurements of optical power is however, also dependent upon properly setting up the 1830-R Series instrument, controlling temperature and illumination conditions, and understanding the factors that affect power measurement.

5.2.1 Detector Calibration and Accuracy

Newport Corporation calibrates its detectors using secondary standards directly traceable to the United States National Institute of Science and Technology (NIST). The details and uncertainty of the calibration procedure vary with each detector model, but a detailed description of the calibration results is supplied with each individually calibrated detector.

In general, detector calibration uncertainty varies with wavelength. Each detector will have some variation in the response over different sections of its surface. Therefore, for the most reproducible measurements, light should illuminate the detector as uniformly as possible over 80% of the detector's active area.

CAUTION

Avoid focusing a light source onto the detector surface. Inaccurate readings and possible detector damage may result. Consult your detector manual for information on detector saturation or damage thresholds.

NIST traceability recommends that detectors be re-calibrated on one year intervals. As individual detector responses change with time, especially in the ultraviolet spectral range, re-calibration is necessary to assure confidence

in the accuracy of the measurement. The same detector should always be used for measurements which are to be directly compared, in order to obtain reproducible results.

5.2.2 Quantum Detector Temperature Effects

Semiconductor based photodiode detector characteristics (For example, Newport's 818 and918D Series detectors) are significantly affected by temperature. At longer wavelengths, these quantum detectors typically lose sensitivity with increasing temperature. However the detector dark current increases exponentially with temperature. For silicon detectors, dark current is generally on the order of a few picoamps at room temperatures. With uncooled germanium detectors, however, this dark current is on the order of a nanoamp, or typically 1,000 to 10,000 times greater than silicon. These dark currents can be zeroed at any moment in time via the ZERO key on the 1830-R Series instruments. Since dark currents drift with temperature, the ZERO should be adjusted just prior to taking any measurements. The noise or drift in the dark current sets a lower bound on the measurement resolution which can be achieved with any given detector.

If the detector temperature is constant, sensitivity changes and dark current drifts are significantly reduced. In addition, if the detector is cooled, the dark current and dark current noise will decrease. For the most accurate measurements, particularly with germanium detectors, the user can cool the detector to approximately 0 °C and control the temperature to within ± 1 °C.

5.2.3 Ambient and Stray Light

Ambient and stray light striking the detector will be measured by the 1830-R Series instruments, and should be considered when making sensitive measurements. Ambient light can be distinguished from dark current (or the detector/meter noise floor) by turning off or blocking the source and covering the detector face with an opaque material such as a piece of black metal. Using the human hand to cover the detector is not advised because it emits a significant amount of infrared radiation, and because it radiates a temperature significantly different from ambient. With the detector covered, a reading of the dark current may be made. Next, remove the material which is covering the detector and take another reading. The difference is the ambient light level.

The effects of ambient light are greatly reduced when using a fiber connectorized signal input to the detector. If free-space beam measurements are desired, using an attenuator will reduce stray light and often improve the source signal to ambient signal noise level. Wavelength-specific filters, such as optical cutoff, bandpass, or spike filters can also be used if the signal wavelength spectrum permits. Other techniques to reduce stray light include using apertures, placing the detector in a box or other housing to shield the surface from light which is not coming from the source, and turning off room and other lights.

NOTE

Changes in ambient light levels can occur from such factors as turning room lights on or off, or by moving people or equipment. Remember, if you can see your detector element, then your detector can see the light bouncing off your shirt!

5.3 Setting the Wavelength

In order to obtain accurate optical power measurements, it is necessary to set the calibration wavelength to the wavelength of the light incident upon the photodetector. This calibration wavelength is indicated in nanometers on the LCD display at power-up and whenever the λ▼/λ▲ keys are pressed. Upon power-up, the calibration wavelength used will be the last value entered into the meter (if this is the initial power-up on your calibration module, the wavelength will default to the shortest available wavelength).

To change the wavelength, do the following: Determine the wavelength of the light being measured to the nearest nanometer. If the source is broadband, use either a value near the center wavelength of the light or the wavelength with greatest intensity. Pressing the λ▼/λ▲ keys will increase or decrease the calibration wavelength by 1nm. Wavelength will continue to change as long as the wavelength key is depressed.

NOTE

Different detectors are sensitive over different wavelength ranges. See the appropriate detector manual and calibration data to determine the range of wavelengths available for the detector being used. The responsivities stored in the calibration module span only the wavelength range appropriate for the detector and are specific to that detector.

5.4 Setting the Attenuator Mode

Most Newport photodiode detectors are provided with calibrated optical attenuators. The responsivities for an attenuator/detector combination are stored in the calibration module. An 818 Series detector requires a manual setting, while a 918D Series detector attenuator position is automatically recognized by the 1830-R Series Power Meters. To measure optical powers above the saturation limit of the detector (see appropriate photodetector manual), use the optical attenuator that was shipped with your detector. When the attenuator mode is selected, the following occurs:

a. The ATTN annunciator is displayed.

b. The responsivity for the detector-with-attenuator is used in calculating the optical power being measured.

If the attenuator is subsequently removed, the ATTN key should be pressed to turn the attenuator mode off. All measurements will now be computed using the responsivity for the detector alone.

NOTE

The transmission characteristics of each attenuator are different; the user must therefore be careful to use ONLY the attenuator and detector pair with the same serial numbers for which the particular calibration module is calibrated.

5.5 Performing Basic Measurements

5.5.1 4.5.1 Power Measurements

The 1830-R Series Optical Power Meter's most basic measurement mode is in the units of Watts. Power measurements may be made with background correction, which is initiated by pressing the ZERO key. The following equation illustrates this relationship:

Watt reading = Net Applied Power

$= (I - I_z) / R$

where

I = detector input current

I_z= detector background current defined when the ZERO key was pressed

R = responsivity of the detector (A/W) (or detector with attenuator)

a. Select the Watt measurement mode, auto-range, and a wavelength. Use manual ranging if you want manual control of the range; over-range is indicated by an OL message.

b. Block the light to be measured.

c. Initiate background correction by pressing the ZERO key. Display should read approximately zero, but will fluctuate depending upon the variations in the amount of light reaching the detector and the detector dark current fluctuations.

d. Illuminate the detector with the optical signal to be measured.

e. Take the reading from the display.

5.5.2 4.5.2 Logarithmic Measurements (dB and dBm)

The 1830-R Series instrument can make logarithmic measurements referenced to any measured power level or to a 1 mW power level by changing the measurement units to **dB** or **dBm,** respectively.

NOTE

Log measurements should always be made on the lowest possible range (without over-ranging). Readings on high ranges will not allow optimum calculations of the logarithm. When in doubt, use auto-range.

NOTE

When using log measurements with background correction, the signal after the subtraction of the stored offset power level may be negative. In this case, OL will be displayed since the log of a negative number is not defined. This will be automatically cleared when the signal becomes positive.

5.5.2.1 Logarithmic Measurements Using Reference Powers (dB)

The dB measurement mode displays the absolute value of 10 times the logarithm (base 10) of the input power, referenced to a power level which is selected by pressing the STOREF key. The following equation illustrates this relationship:

$$\text{dB reading} = 10 * \log [\text{Net Applied Power}/\text{Net Referenced Power}(=\text{STOREF})]$$

$$= 10 * \log [((I - I_z)/R)/((I_{STOREF} - I_z)/R)]$$

where

I = detector input current

I_z = detector background current defined when the ZERO key was pressed

I_{STOREF} = referenced detector current defined when the STOREF key was pressed

R = responsivity of the detector (A/W) (or detector with attenuator)

To make dB measurements with background correction, proceed as follows:

a. Select the dB measurement mode, auto-range, and a wavelength.

b. Block the light to be measured.

c. Initiate background correction by pressing the ZERO key. Display should read approximately zero, but will fluctuate depending upon the variations in the amount of light reaching the detector and the detector dark current fluctuations.

d. Illuminate the detector with the optical signal to be used as the reference signal.

e. Press the STOREF key.

f. Illuminate the detector with the optical signal to be measured.

g. Take the reading from the display.

5.5.2.2 Logarithmic Measurements Using 1 mW Reference (dBm)

The dBm measurement mode displays the absolute value of 10 times the logarithm (base 10) of the input power, referenced to 1mW. The following equation illustrates this relationship:

$$\text{dBm reading} = 10 * \log [\text{Net Applied Power}/1\text{mW}]$$

$$= 10 * \log [((I - I_z)/R)/1\ \text{mW}]$$

where

I = detector input current

I_z = detector background current defined when the ZERO key was pressed

R = responsivity of the detector (A/W) (or detector with attenuator)

Using this 1mW reference power, the dBm reading span is from −90 dBm to +10 dBm (1 pW to 10 mW), when the detector responsivity equals 1 A/W.

To make dBm measurements (relative to 1 mW optical power) with background correction, proceed as follows:

a. Select the dBm measurement mode, auto-range, and a wavelength.

b. Block the light to be measured.

c. Initiate background correction by pressing the ZERO key. Display should read approximately zero, but will fluctuate depending upon the variations in the amount of light reaching the detector and the detector dark current fluctuations.

d. Illuminate the detector with the optical signal to be measured.

e. Take the reading from the display.

5.5.3 Relative Measurements

The relative mode REL is selected by pressing the UNITS key until the **REL** annunciator turns on. The referenced power is selected at any time by pressing the STOREF key. The following equation illustrates this relationship:

$$\text{REL reading} = \text{Net Applied Power}/\ \text{Net Referenced Power(=STOREF)}$$

$$= ((I - I_z)/R)/((I_{STOREF} - I_z)/R)$$

where

I = detector input current

I_z= detector background current defined

when the ZERO key was pressed I= referenced detector current defined when

STOREF

the STOREF key was pressed

R = responsivity of the detector (A/W) (or detector with attenuator)

To make relative measurements with background correction, proceed as follows:

a. Select the REL measurement mode, auto-range, and a wavelength.

b. Block the light to be measured.

c. Select background correction by pressing the ZERO key. Display should read approximately zero, but will fluctuate depending upon the variations in the amount of light reaching the detector and the detector dark current fluctuations.

d. Illuminate the detector with the optical signal to be used as the reference signal.

e. Press the **STOREF** key.

f. Illuminate the detector with the optical signal to be measured.

g. Take the reading from the display.

5.6 Common Measurement Errors

The most common sources of optical power measurement errors are listed in 0 below.

Type of Error	What should be done?
Radiometry	Check that all of the light is actually hitting the detector.
Ambient Light	Check that any ambient light was ZERO'ed before the measurement was made.
Wavelength Calibration	Check that the proper wavelength has been set.
Detector Saturation	Check that the optical power density remains below the detector's saturation threshold.
Meter Configuration	Check that the 1830-R Series Optical Power Meter was powered-up with the calibration module properly connected. Check that the optical attenuator mode (ATTN annunciator) is properly enabled/disabled.

Table 5 Common Measurement Errors

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6 Computer Interfacing

6.1 Introduction

The Model 1830-R-GPIB has three computer interface ports: USB-Device, GPIB and RS-232C. The Model 1830-R has one computer interface port: USB-Device. The GPIB interface conforms to the IEEE 488.1 hardware standard. All commands for the 1830-R Series instrument are device dependent commands. In this manual, we interchangeably use either GPIB or IEEE 488 when referring to the IEEE 488 bus.

Please see the General Guidelines sections for using either the USB (Section 6.4), RS-232C (Section 6.5), or GPIB (Section 6.6) interfaces. These sections include important information on using these interfaces properly.

6.2 Computer Interface Terminology

Key abbreviations and concepts used in the command reference section of this manual are listed below:

<EOI> End or Identify

An IEEE488.1 signal sent with the end-of-string character.

<CR> Carriage Return

The ASCII decimal "13" byte.

<LF> Line Feed

An ASCII decimal "10" byte.

<NL> New Line

Defined in the IEEE 488 standard as the ASCII decimal "10" byte.

<SRQ> Service Request

The 1830-R-GPIB generates an <SRQ> to tell the GPIB controller that a serial poll is needed. Any device on the GPIB bus may assert the <SRQ> line. Bit 6 (decimal 64) will be high in the serial poll byte returned from a device requesting service. To determine if a device has generated an SRQ, an "AND" operation could be performed on the Status Byte :

IF ((*serial poll*) AND 64) = 64 THEN → device is requesting service, where *serial poll* is the integer returned from a GPIB serial poll.

Whitespace

Optional between commands and between parameters. Whitespace is any character with a binary value less than or equal to an ASCII space character (except the <NL> character).

Numerical types

Numerical parameters are passed and returned as the actual ASCII characters in the string representation of the number. The 1830-R Series instrument accepts numeric values in decimal format only.

6.3 Entering Remote Computer Interface Mode

When a command or query is received by the computer interface ports, the 1830-R Series Optical Power Meter automatically goes into the remote interface mode. The REM annunciator on the 1830-R Series instrument's display will light up to indicate that the instrument is in remote interface mode.

When in remote mode, the 1830-R Series instrument can be issued a "L1" command. The LLO annunciator on the 1830-R Series instrument's display will also light up to indicate that the 1830-R Series instrument is in the local-lockout mode. This mode disables the 1830-R Series instrument's front panel keypad's ability to affect system operation. Locking out the front panel keys is useful in applications where the user does not want inadvertent key presses to affect his application setup. "L0" command disables the local-lockout feature. The local-lockout mode can also be disabled by powering-up the meter again, or by pressing the "RESET" button located at the back of the meter.

6.4 USB Communication (1830-R and 1830-R-GPIB)

Before connecting the instrument to a host PC using a standard USB-A to USB-B cable, the user should install the application included in the software CD that accompanies the Power Meter. The application automatically installs the correct USB drivers. Communication can be done through this interface by using the application or by developing software in the user's preferred programming language. The software CD contains communication drivers and example programs in the following programming languages: LabVIEW and C#.NET

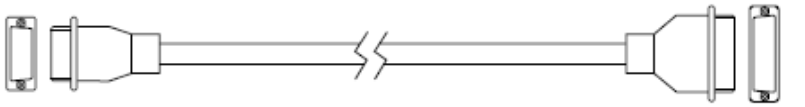
6.4.1 USB Command Termination:

Commands and queries sent to the 1830-R Series instrument through the USB port must be terminated by a <LF> (line feed).

All responses sent by the 1830-R Series instrument are terminated with a <LF> (line feed).

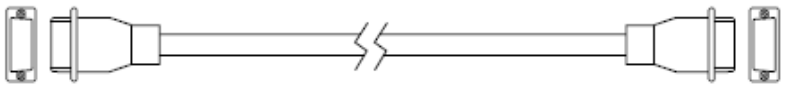
6.5 RS-232C Communication (1830-R-GPIB only)

Before communicating with 1830-R-GPIB through the RS-232C port, proper cable connections must be made. Figure 18 shows the cable connections for communicating between the RS-232C port on the 1830-R-GPIB and an RS-232C port on a computer. (The cable to be used depends on whether the computer's RS-232C port has a DB-9 or DB-25 connector).



CABLE TERMINATORS (RS-232)
9 pin to 25 pin

9 PIN PIN NO.	CODE	DESCRIPTION	25 PIN PIN NO.
1	DCD	CARRIER DETECT	8
2	RXD	RECEIVE DATA	3
3	TXD	TRANSMIT DATA	2
4	DTR	DATA TERM. READY	20
5	GND	SIGNAL GROUND	7
6	DSR	DATA SET READY	6
7	RTS	REQUEST TO SEND	4
8	CTS	CLEAR TO SEND	5
9	RI	RING IND.	22



CABLE TERMINATORS (RS-232)
9 pin to 9 pin

9 PIN PIN NO.	CODE	DESCRIPTION	9 PIN PIN NO.
1	DCD	CARRIER DETECT	1
2	RXD	RECEIVE DATA	2
3	TXD	TRANSMIT DATA	3
4	DTR	DATA TERM. READY	4
5	GND	SIGNAL GROUND	5
6	DSR	DATA SET READY	6
7	RTS	REQUEST TO SEND	7
8	CTS	CLEAR TO SEND	8
9	RI	RING IND.	9

Figure 18 RS-232 Cable Connectors

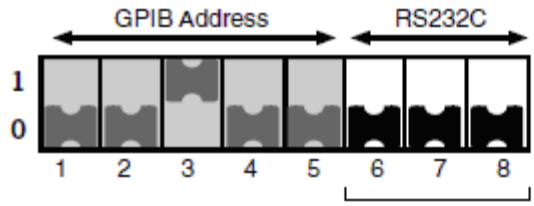
6.5.1 Setting the Baud Rate

Once cable connections are made, the baud rate for communication must be set. Valid baud rates are 9600, 4800, 2400 and 1200. The parity, data bits, and stop bits are fixed at: no parity, 8 data bits, and 1 stop bit.

RS-232C Parameters

Baud Rate	115200, 57600, 38400, 19200, 9600, 4800, 2400, 1200
Parity	none
Data Bits	8
Stop Bits	1

Choose the appropriate baud rate by setting the rear panel system switches to the desired parameters, as shown in Figure 19.



0 0 0 Baud Rate = 9600
1 0 0 Baud Rate = 4800
0 1 0 Baud Rate = 2400
1 1 0 Baud Rate = 1200
0 0 1 Baud Rate = 115200
1 0 1 Baud Rate = 57600
0 1 1 Baud Rate = 38400
1 1 1 Baud Rate = 19200
Default RS-232C Baud Rate = 9600

Figure 19 RS-232C Baud Rate Selector Switches

6.5.2 RS-232C Command Termination:

Commands and queries sent to the 1830-R-GPIB through the RS-232C port must be terminated by a <LF> (line feed).

All responses sent by the 1830-R-GPIB are terminated with a <LF> (line feed).

6.5.3 5.4.3 General Guidelines for Using the RS-232C Port

- The RS-232C port can communicate with a dumb terminal or a personal computer running any one of the many communications programs available. You may also control your 1830-R-GPIB using a personal computer running high level programming languages such as C#.NET and lab automation software such as LabVIEW.
- *When a dumb terminal type of device is used to communicate with the 1830-R-GPIB via the RS-232C, the echo mode is especially useful.* When the "Echo Mode" for the RS-232C port is enabled, all characters sent to the 1830-R-GPIB and error messages will be echoed. The 1830-R-GPIB will generate a '>' prompt for every line. As the user enters commands, the line may be edited by using the backspace key (sending an ASCII decimal 08 code) or by using the DEL key (sending an ASCII decimal 127 code).
- When the 1830-R-GPIB is being controlled by a high level programming language, the echo mode should be disabled. When the "Echo" mode is disabled, the 1830-R-GPIB does not generate a prompt or echo characters back to the interface.

NOTE:

The 1830-R-GPIB's default mode for RS-232C communication is with echo disabled.

- Since the 1830-R-GPIB's output buffer size is limited to sixty four (64) bytes, it is recommended that when a query is made, the response to that query be read before other commands are issued.
- Only one command/query may be sent to the 1830-R-GPIB per bus transaction.
- 1830-R-GPIB system errors can be identified by reading the 1830-R-GPIB's Status Byte Register. (See Section 10/Appendix A)

6.6 GPIB Communication (1830-R-GPIB only)

A variety of third party GPIB communication hardware and software, such as plug-in GPIB computer boards and LabVIEW software from National Instruments are available. The 1830-R-GPIB should work with any of these as long as they adhere to the IEEE 488.1 standard. This manual assumes the user is familiar with one of these third party hardware/software packages. We refer to GPIB and IEEE 488 interchangeably.

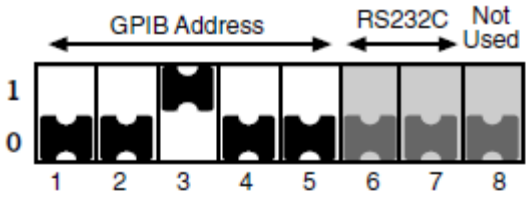
6.6.1 Setting the GPIB Address

The Model 1830-R-GPIB's GPIB interface port can be connected to the GPIB bus via a standard IEEE 488 cable. Before communicating with the instrument's GPIB port, the 1830-R-GPIB's GPIB address must be set.

Choose the appropriate GPIB address by setting the rear panel system switches to the desired address, as shown in Figure 20.

NOTE

Cycle the power off and on or press the RESET button located at the back of the meter whenever the GPIB address is changed.



GPIB Bus Address	SW 1	SW 2	SW 3	SW 4	SW 5	
1:	1	0	0	0	0	
2:	0	1	0	0	0	
3:	1	1	0	0	0	
4:	0	0	1	0	0	Default GPIB Address=4
5:	1	0	1	0	0	
6:	0	1	1	0	0	
7:	1	1	1	0	0	
8:	0	0	0	1	0	
9:	1	0	0	1	0	
10:	0	1	0	1	0	
11:	1	1	0	1	0	
12:	0	0	1	1	0	
13:	1	0	1	1	0	
14:	0	1	1	1	0	
15:	1	1	1	1	0	
16:	0	0	0	0	1	
17:	1	0	0	0	1	
18:	0	1	0	0	1	
19:	1	1	0	0	1	
20:	0	0	1	0	1	
21:	1	0	1	0	1	
22:	0	1	1	0	1	
23:	1	1	1	0	1	
24:	0	0	0	1	1	
25:	1	0	0	1	1	
26:	0	1	0	1	1	
27:	1	1	0	1	1	
28:	0	0	1	1	1	
29:	1	0	1	1	1	
30:	0	1	1	1	1	

Figure 20 GPIB Address Selector Switches

6.6.2 GPIB Command Termination:

Commands and queries sent to the 1830-R-GPIB through the GPIB bus should be terminated by sending an <NL><EOI> (<NL> is equivalent to an <LF>).

All responses sent by the 1830-R-GPIB are terminated with the concurrent transmission of a <NL><EOI>.

6.6.3 General Guidelines for Using the GPIB Port

The GPIB port can communicate with computers and other devices that have GPIB ports that follow the IEEE 488.1 standards. Third party add-on boards and software can be used to allow a personal computer to communicate with the 1830-R-GPIB through the IEEE 488 port. With these add-on boards and software, high-level language programs, can also be written to control the 1830-R-GPIB through the IEEE 488 port. For those who wish to minimize the need for conventional "programming", Newport provides free instrument driver software for plug-in-and-run compatibility with LabVIEW. Call Newport for more information.

Some of the issues which should be kept in mind while developing the IEEE 488 software interface for the 1830-R-GPIB, are as follows:

- A query is a command that invokes a response from the 1830-R-GPIB. All queries are terminated with a question mark (?).
- Since the 1830-R-GPIB's output buffer size is limited to sixty four (64) bytes, it is recommended that the response to a query be read before other commands are issued.
- Before reading the response, the MAV bit in the status byte should be checked by means of a serial poll to make sure that the data is available. (See Appendix A, Status Reporting System)
- Only one command/query may be sent to the 1830-R-GPIB per bus transaction.

6.6.4 Procedure for Reading Only New Measurements

When you want to retrieve only new measurements from the GPIB bus, use the following sequence of commands, serial polls, and queries:

1. Send the Command: **C,** this will clear the status byte register.
2. Serial Poll the 1830-R-GPIB until the Read Done bit goes high (decimal 128).
3. Send the Query: **D?,** this is a Data Query and responds with the last signal acquisition.
4. Serial Poll until the Message Available (MAV) bit goes high. (decimal 16)
5. Perform a GPIB read.

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7 Remote Command Set

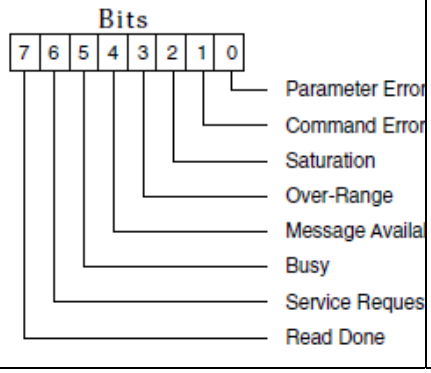
7.1 Summary of Command/Query Set

The following commands and queries are case insensitive. When using 1830-C compatible commands, no spaces are allowed between the letter-command and the parameter or question mark (?).

When using 1936-C compatible commands, a space is required between command and its parameter. The commands MUST contain all of the letters shown in upper-case; lower-case letters in the commands are optional, and may be used for clarity.

Only one command/query is allowed per bus transaction.

1830-C Compatible Command	Command Description	1936-C Compatible Command
A0	Attenuator off	PM:ATT 0
A1	Attenuator on	PM:ATT 1
A?	Attenuator query (returns: 0, 1)	PM:ATT?
B0	Beep off	BEEP 0
B1	Beep on	BEEP 1
B?	Beep query (returns: 0, 1)	BEEP?
C	Clear Status Byte Register	*CLS
D?	Data Query	PM:Power?
E0	Echo off	ECHO 0
E1	Echo on	ECHO 1
E?	Echo query (returns: 0, 1)	ECHO?
F1	Filter S (Slow)	PM:DIGITALFILTER 1
F2	Filter M (Medium)	PM:DIGITALFILTER 2
F3	Filter F (Fast)	PM:DIGITALFILTER 3
F?	Filter query (returns : 1, 2, 3)	PM:DIGITALFILTER?
G0	Hold	PM:RUN 0

G1	Go	PM:RUN 1
G?	Go query (returns: 0, 1)	PM:RUN?
K0	Display off	DISP:BRIGHT 0
K1	Display on	DISP:BRIGHT 1
K?	Display query (returns: 0, 1)	DISP:BRIGHT?
L0	No local lockout	LOCAL 0
L1	Local lockout	LOCAL 1
L?	Local lockout query (returns: 0, 1)	LOCAL?
M	Service Request Enable Register (Mask)	*SRE
M?	Service Request Enable Register Query	*SRE?
O	Auto-calibration	O
Q?	Status Byte Register Query (returns: 0 – 255) 	*STB? (See Appendix A - Status Reporting System, for details)

R0	Auto Range	PM:AUTO 1
R1	Signal Range 1 (Highest signal range)	PM:RANge 0
R2	Signal Range 2	PM:RANge 1
R3	Signal Range 3	PM:RANge 2
R4	Signal Range 4	PM:RANge 3
R5	Signal Range 5	PM:RANge 4
R6	Signal Range 6	PM:RANge 5
R7	Signal Range 7	PM:RANge 6
R8	Signal Range 8 (Lowest signal range)	PM:RANge 7

R?	Signal range query (returns: 1-8)	PM:AUTO? OR PM:RANge?
S	Store reference	PM:REF:STOre
U1	Units W	PM:UNITS 2
U2	Units dB	PM:UNITS 9
U3	Units dBm	PM:UNITS 6
U4	Units REL	PM:UNITS 12
U?	Units query (returns: 1, 2, 3, 4)	PM:UNITS?
Wnnnn	Set wavelength to nnnn	PM:Lambda nnnn
W?	Wavelength query (returns: nnnn)	PM:Lambda?
Z0	Zero off	PM:ZERO 0
Z1	Zero on	PM:ZERO 1
Z?	Zero query (returns: 0, 1)	PM:ZERO?
	Identification string query	*IDN?
	Reset instrument	*RST
	GPIB Address query	ADDRess?
	Error string query	ERRSTR?

7.2 Detailed Description of Commands and Queries

A*n* or PM:ATT *n*
Attenuator On/Off

Function: Selects between the responsivity values associated with the photodetector alone or for the photodetector-attenuator combination. These values are stored within the calibration module.

Syntax: A*n* or PM:ATT *n*

Parameter: *n* = 0 Use the calibration module's responsivity values associated with the **photodetector-alone.**

n = 1 Use the calibration module's responsivity values associated with the **photodetector-attenuator** combination.

Type: integer

Related Commands: A? or PM:ATT? – Attenuator query

A? or PM:ATT?
Attenuator Query

Function: Reports whether the 1830-R Series Optical Power Meter is using the responsivity associated with the photodetector-alone or the photodetector-attenuator combination.

Syntax: A? or PM:ATT?

Returns: 0 photodetector-alone responsivities are used.

1 photodetector-attenuator responsivities are used.

Related Commands: A*n* or PM:ATT *n* – Selects the responsivity associated with the photodetector-alone or photodetector-attenuator combination

B*n* or BEEP *n*
Beep On/Off

Function: This command is used to turn the audio output on/off. The audio output frequency is proportional to the intensity of the input power signal.

Syntax: B*n* or BEEP *n*

Parameter: *n* = 0 Beeper is off

n = 1 Beeper is on.

Type: integer

Related Commands: B? or BEEP?-Beeper query

B? or BEEP?
Beeper Query

Function: Reports whether the 1830-R Series Optical Power Meter is using the responsivity associated with the photodetector-alone or the photodetector-attenuator combination.

Syntax: B? or BEEP?

Returns: 0 beeper is off.

1 beeper is on.

Related Commands: B*n* or BEEP *n* – Turn the beeper on/off.

C or *CLS
Clear Status Byte Register

Function: This command is used to clear the status byte register. All bits, except the MAV bit, are set low by sending this command. The status byte register contents are described in Q? or *STB? command and Appendix A - Status Reporting System.

Syntax: C or *CLS

Parameter: None

Related Commands: Q? or *STB? – Status Byte Register query

D? or PM:Power?
Data Query

Function: This query responds with the power level of the input signal.

Syntax: D? or PM:Power?

Parameter None

Returns: The format of the returned data string is: ±d.ddddE ±dd.

Example: *Send*: D?

Resp: 0.0000E-09

Related Commands: A*n*, A? – Set/query the attenuator setting

R*n*, R? – Set/query the range setting

U*n*, U? – Set/query the units of measurements

E*n* or ECHO *n*
Echo Mode On/Off

Function: This command is used to turn the power meter's echo mode on/off. The echo mode applies to RS-232C communication only. In this mode all the characters that are received over the RS-232C are transmitted ("echoed") back to the user. This mode is useful when interfacing the 1830-R-GPIB to a dumb terminal.

Syntax: E*n* or ECHO *n*

Parameter: *n* = 0 Turn the echo mode off

n = 1 Turn the echo mode on

Type: Integer

Related Commands: E? or ECHO? – Echo mode query

E? or ECHO?
Echo Mode Query

Function: This query informs the user whether the power meter's echo mode is on or off. When the echo mode is on, then all the characters that are received over the RS-232C are transmitted back to the user.

Syntax: E? or ECHO?

Parameter: None

Returns: 0 echo mode is off

1 echo mode is on

Related Commands: En – Turn the echo mode on/off.

F*n* or PM:DIGITALFILTER *n*
Filter

Function: This command is used to set how many measurements are averaged for the displayed reading. When the slow speed filter is selected, the 1830-R Series instrument displays the average of the last 16 measurements. When using the medium filter, the 1830-R Series instrument displays the average of the last 4 measurements. The fast filter does no averaging.

Syntax: F*n* or PM:DIGITALFILTER *n*

Parameter: n = 1 use the slow filter to average the last 16 me

n = 2

n = 3

Type: Integer

Related Commands: F? or PM:DIGITALFILTER? – Filter status query

F? or PM:DIGITALFILTER?
Filter Status Query

Function: This query informs the user about the current settings for the filter parameter. The filter setting dictates how many measurements are averaged for the displayed reading. In the slow mode, the reading is the average of the last 16 measurements, while in the medium mode the reading is the average of the last 4 measurements. No averaging is done in the fast mode.

Syntax: F? or PM:DIGITALFILTER?

Parameter: None

Returns: 1 The readings are being averaged in slow mode

2 The readings are being averaged in medium mode

3 The readings are not being averaged

Related Commands: F*n* or PM:DIGITALFILTER *n* – Set how many measurements are averaged for the displayed reading

G*n* or PM:RUN *n*
Go On/Off

Function: This command is used to enable/disable the 1830-R Series Optical Power Meter from taking new readings. During disable mode, no 1830-R Series instrument parameters can be changed.

NOTE:

-"Run" and "Go" words are used interchangeably and they represent the same 1830-R Series instrument function.

-"Stop" and "Hold" words are used interchangeably and they represent the same 1830-R Series instrument function.

Syntax: G*n* or PM:RUN *n*

Parameter: n = 0 Power Meter is in Hold mode, i.e. does not take new readings

n = 1 Power Meter is in Go mode, i.e. takes new readings

Type: Integer

Related Commands: G? or PM:RUN? – Go query

G? or PM:RUN?
Go Query

Function: This query informs the user whether the 1830-R Series Optical Power Meter is in the Run or Hold mode. If the meter is in the "Run" mode, the 1830-R Series instrument will continue acquiring new measurements. In the "Hold" mode, it stops acquiring new measurements.

NOTE:

-"Run" and "Go " words are used interchangeably and they represent the same 1830-R Series instrument function.

-"Stop" and "Hold" words are used interchangeably

Syntax: G? or PM:RUN?

Parameter: None

Returns: 0 Power Meter is in Hold mode

1 Power Meter is in Run mode

Related Commands: G*n* or PM:RUN *n* – Set power meter to either Run/Hold mode

K*n* or DISP:BRIGHT *n*
Display On/Off

Function: This command is used to turn the display on/off. The power meter will continue to take measurements when the display is turned off.

Syntax: K*n* or DISP:BRIGHT *n*

Parameter: n = 0 Turns the display off. An LED at the left-bottom corner of the display will be flashed in this state to inform the user that the unit is taking measurements.

n = 1 Turns the display on.

Type: Integer

Related Commands: K? or DISP:BRIGHT? – Query the display state.

K? or DISP:BRIGHT?
Display State Query

Function: This query responds with the current status of 1830-R Series instrument's display. The display can be turned on/off.

Syntax: K? or DISP:BRIGHT?

Parameter: None

Returns: 0 display is off

1 display is on

Related Commands: K*n* or DISP:BRIGHT *n* – Turn the display on/off.

L*n* or LOCAL *n*
Local lockout On/Off

Function: This command is used to enable/disable the 1830-R Series instrument's local-lockout function. When the local-lockout function is enabled, any front panel key presses would have no effect on system operation. The instrument's front panel display has a "LLO" annunciator, and it lights up when the local-lockout function is enabled.

This feature is useful when conducting an experiment and the user does not want inadvertent key presses to affect the system operation.

Syntax: L*n* or LOCAL *n*

Parameter: n = 0 Local-lockout is off

n = 1 Local-lockout is on

Type: Integer

Related Commands: L? or LOCAL? – Query the present status of local-lockout function

L? or LOCAL?
Local lockout query

Function: This query informs the user whether 1830-R Series Optical Power Meter's local-lockout function is enabled/disabled. The local-lockout function, when enabled, locks out any front panel key presses from affecting the system operation. The 1830-R Series instrument's front panel display has a "LLO" annunciator, and it lights up when the local-lockout function is enabled.

Syntax: L? or LOCAL?

Parameter None

Returns: 0 Local-lockout function is disabled.

1 Local-lockout function is enabled.

Related Commands: L*n* or LOCAL *n* – Enable/disable the 1830-R Series Optical Power Meter's local-lockout function.

M*n* or *SRE *n*
Service Request Enable Register (Mask)

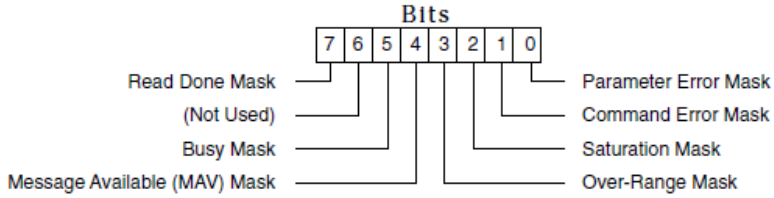
Function: The Service Request Enable Register is used to define the conditions that will generate an IEEE 488.1 service request, <SRQ>. This register performs a bit-wise AND'ing operation with the Status Byte Register.

When an event occurs that causes a bit to be set in the Status Byte Register and its corresponding bit is set in the Service Request Enable Register, an <SRQ> will be generated once for the given event. When the <SRQ> is asserted and a serial poll of the 1830-R-GPIB is performed, bit 6 and the

bit(s) that initiated the <SRQ> will be set high in the byte returned by the serial poll. A serial poll will clear the <SRQ> until it is again asserted by a new event in the Status Byte Register.

At power-up the default is M0, which means that the <SRQ> will not be asserted regardless of any bits that are set in the Status Byte Register.

See Appendix A - Status Reporting System, for a detailed description of the Status Reporting System.



Syntax: M*n* or *SRE *n*

Parameter: n = 0 – 255

Type: Integer

Example: M0 An <SRQ> will not be asserted.

M16 Only the MAV bit will assert an <SRQ>

M255 Any bit in the Status Byte Register will assert an <SRQ>.

Related Commands: M? or *SRE? – Service Request Enable Register query

Q? or *STB? – Status Byte Register query

M? or *SRE?
Service Request Enable Register Query

Function: This query informs the user how the Service Request Enable Register is configured. See the M*n* command for a description of the Service Request Enable Register.

At power-up the default is M0, which means that the <SRQ> will not be asserted regardless of any bits that are set in the Status Byte Register.

See Appendix A for a detailed description of the Status Reporting System.

Syntax: M? or *SRE?

Parameter: None

Returns: 000 – 255

Example: *Send:* M?

Resp: 000 An <SRQ> will not be asserted.

Send: M?

Resp: 016 Only the MAV bit will assert an <SRQ>.

Send: M?

Resp: 255 Any bit in the Status Byte Register will assert an <SRQ>.

Related Commands: M*n* or *SRE *n* – Service Request Enable Register

Q? or *STB? – Status Byte Register query

O
Auto-Calibration

Function: This command is used to calibrate the 1830-R Series Optical Power Meter for future measurements. The auto-calibration process involves measuring amplifier offset voltages which arise from aging and temperature effects. These offsets are then appropriately corrected for during normal operation. The 1830-R Series instrument will automatically disconnect the input signal from the amplifier during the auto-calibration mode. To achieve stable readings at the specified accuracy, auto-calibration should be executed after a minimum 60 minute warm-up period.

The status byte register can be used to monitor the completion of the auto-calibration process, because during the auto-calibration the BUSY bit remains high.

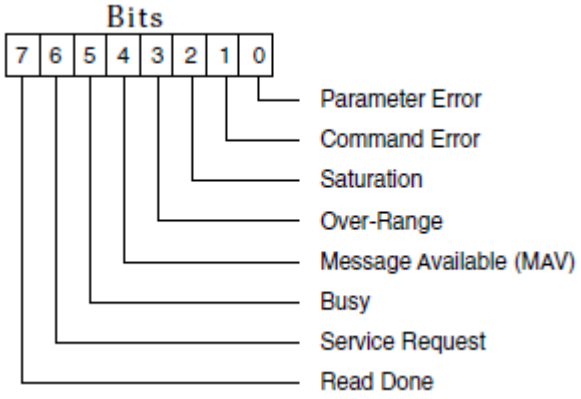
Syntax: O

Parameter: None

Related Commands: Q? or *STB? – Status Byte Register query

Q? or *STB?
Status Byte Register Query

Function: Reports the value of 1830-R Series Optical Power Meter's status byte. This query informs the user about 1830-R Series instrument's current system status. All bits in the status byte register, except the MAV bit, can be cleared using the clear status command, C. See Appendix A for a detailed description of each bit and the Status Reporting System.



(See Appendix A - Status Reporting System for details)

Syntax: Q?

Parameter None

Returns 0 – 255

Example

Send: Q?

Resp: 01 Parameter error

Send: Q?

Resp: 02 Command error

Send: Q?

Resp: 04 Input signal has saturated the photodetector

Send: Q?

Resp: 8 Input signal exceeds the max level for signal range

Send: Q?

Resp: 16 1830-C is ready with the response to a query

Send: Q?

Resp: 32 1830-C is busy auto-ranging or is in power-up state.

Send: Q?

Resp: 128 1830-C is ready with new power reading

Send: Q?

Resp: 144 A new power reading is available and MAV bit is high.

Related Commands: All commands and queries

R0 or PM:AUTO *n*
Auto Range

Function: This command is used to enable the 1830-R Series Optical Power Meter's auto-ranging mode. In the auto-ranging mode, the meter automatically switches between various signal ranges in response to input signal variations.

Syntax: R0 or PM:AUTO 1

Parameter: n = 0 Turn auto-ranging off.

n = 1 Turn auto-ranging on.

Type: Integer

Example:

R0	Turn auto-ranging on.
PM:AUTO 1	Turn auto-ranging on.
PM:AUTO 0	Turn auto-ranging off.

Related Commands: R? or PM:AUTO? – Range query

R*n* or PM:RANGE *m*
Range Setting

Function: This command is used to set the current signal range for the input signal.

R1 command selects the lowest signal range for the input signal. R8 selects the highest signal range.

As each range is incremented by one, the signal gain decreases by a decade.

NOTE:

The lowest range for the Germanium, 818-IR and 918D-IR, detectors is R3.

Syntax: R*n* or PM:RANGE *m*

Parameter: n = 1 or m = 0 Lowest manual signal range (highest amplifier gain)

n = 8 or m = 7 Highest manual signal range (lowest amplifier gain)

Type: Integer

Related Commands: R? or PM:RANGE? – Range query

R? or PM:RANGE?
Signal Range Query

Function: This query informs the user about 1830-R Series Optical Power Meter's current signal range setting

NOTE:

The lowest range for the Germanium, 818-IR and 918D-IR, detectors is R3.

Syntax: R? or PM:RANGE?

Parameter: None

Returns: When R? command is issued to query signal range, the response from power meter can vary from 1 – 8.

When PM:RANGE? command is issued to query signal

range, the response from power meter can vary from 0 – 7.

Example: *Send:* R?

Resp: 1 Power meter is in the lowest signal range

Send: PM:RANGE?

Resp: 0 Power meter is in the lowest signal range

Related Commands: R*n* or PM:RANGE *m* – Set the power meter signal range.

S or PM:REF:STORE
Store Reference

Function: Sets the current input signal power level as the power reference level for any future dB or relative measurements. Each time the S command is sent, the current input signal becomes the new reference level.

Syntax: S or PM:REF:STORE

Parameter: None

Related Commands: U*n* or PM:UNITS – Set the units of measurement

U*n* or PM:UNITS *m*
Units

Function: This command is used to set the units of measurements. The

units can be either Watts, dB, dBm or REL. The definitions for the units are given in Section 2.7.

Syntax: U*n* or PM:UNITS *m*

Parameter: n = 1 or m = 2 Measurement unit is Watts

n = 2 or m = 9 Measurement unit is dB

n = 3 or m = 6 Measurement unit is dBm

n = 4 or m = 12 Measurement unit is REL

Type: integer

Example:

U1	Measure the input signal in Watts
PM:UNITS 2	Measure the input signal in Watts
U2	Measure the input signal in dB
PM:UNITS 9	Measure the input signal in dB

Related Commands:
U? – Query the present measurement units
S – Set the reference signal power level
W*nnnn* – Set the wavelength of measurement

U? or PM:UNITS?
Units Query

Function: This query informs the user about 1830-R Series Optical Power Meter's present measurement units. The units can be either Watts, dB, dBm, or REL.

Syntax: U? or PM:UNITS?

Parameter: None

Returns: When U? command is issued:

1 Measurement unit is Watts
2 Measurement unit is dB
3 Measurement unit is dBm
4 Measurement unit is REL

When PM:UNITS? command issued:

2 Measurement unit is Watts
9 Measurement unit is dB
6 Measurement unit is dBm
12 Measurement unit is REL

Example: *Send:* U?
Resp: 1 Measurement units are Watts
Send: PM:UNITS?

Resp: 2 Measurement units are Watts

Related Commands: U*n* – Set the power meter's measurement units
S – Set the reference signal power level
W*nnnn* – Set the wavelength of measurement

W*nnnn* or PM:Lambda *nnnn*
Set Wavelength to *nnnn*

Function: This command is used to set the wavelength of the input signal. The 1830-R Series Optical Power Meter uses the responsivity value within the calibration module, corresponding to the wavelength selected, for its calculations.

Syntax: W*nnnn* or PM:LAMBDA *nnnn*

Parameter: *nnnn* The wavelength of the input signal

Type: integer

Range: Depends on the detector used

Example: W280 Set the wavelength to 280nm.

Related Commands: W? or PM:Lambda? – Query the power meter's present wavelength setting.

W? or PM:Lambda?
Wavelength Query

Function: This query informs the user about 1830-R Series Optical Power Meter's current wavelength setting.

Syntax: W? or PM:Lambda?

Parameter: None

Returns: *nnnn* Present wavelength in nm

Example: *Send:* W?

Resp: 633 Present wavelength is set to 633nm.

Related Commands: W*nnnn* or PM:Lambda *nnnn* – Set the wavelength for measurement.

Zn or PM:ZERO *n*
Zero On/Off

Function: Turn the zero function on/off. Zero function is used for subtracting any background power levels from future measurements. When it is activated, the 1830-R Series Optical Power Meter uses the next power reading as its background value, and it subtracts this value from any future power readings.

Syntax: *Zn* or PM:ZERO *n*

Parameter: n = 0 zero function is off

n = 1 zero function is on

Type: Integer

Related Commands: Z? or PM:ZERO? – Zero function query

Z? or PM:ZERO?
Zero Function Query

Function: This query informs the user whether 1830-R Series Optical Power Meter's zero function is on/off. Zero function is used for subtracting the background power levels from any future measurements.

Syntax: Z? or PM:ZERO?

Parameter: None

Returns: 0 zero function is off

1 zero function is on

Related *Zn* or PM:ZERO *n* – Turn the zero function on/off.

Commands:

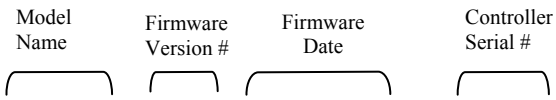
*IDN?
Identification String Query

Function: This query will cause the instrument to return an identification string.

Syntax: *IDN?

Parameter: None

Returns:



NEWPORT XXXX vYYY mm/dd/yy, SNZZZZ

*RST
Power Meter Reset

Function: This command performs a soft reset of the instrument.

Syntax: *RST

Parameter: None

Returns: None

Related Commands: *IDN? – Query the power meter's identification string.

ADDRess?
GPIB Address Query

Function: This query returns the power meter's GPIB address. ON 1830-R-GPIB Optical Power Meter, the GPIB address can be changed by selecting different DIP switch settings located on the instrument's rear panel.

Syntax: ADDRess?

Parameter: None

Returns: 1 – 31 Power meter's GPIB address.

ERRSTR?
Error String Query

Function: This query returns a single error code along with the corresponding error text string that occurred since the last error query.

Error Code	Error String
0	No Error
1	Invalid Detector
2	Invalid Calibration Data
116	Syntax Error
126	Wrong # of Params
201	Value Out of Range

Syntax: ERRSTR?

Parameter: None

Returns: *Error code, "text"* Error code, and text for error code as per Appendix A, 0 if no errors

8 Troubleshooting and Maintenance

8.1 Troubleshooting Guide

The following troubleshooting guide is intended to isolate and solve problems with the power meter so that, to the greatest extent possible, the return of the power meter/detector system to Newport will be unnecessary. For the problems that cannot be resolved with information in this manual, or for other situations that are not covered in this section, please call Newport's Application Engineers for advice. If necessary, see Section 9 for details on returning your entire system to Newport for service.

Symptom	Possible Fault/Correction
Display shows E 001	Invalid detector. Change the detector with a Newport Photodiode detector.
Display shows E 002	Invalid calibration data. Change the detector with a Newport Photodiode detector, or return the detector for recalibration.
Blank display.	Voltage selector switch not in the correct position or a fuse blown. Turn the unit off. Set the voltage selector in the right position. Replace the fuses.
Display shows 000 as the serial number at power-up.	No calibration module connected at power-up. Power off the meter, check that the module is properly inserted, and then power-up again.
Display shows "OL".	Indicates that the signal is too large for the selected signal range. Select a higher range, use auto-ranging, or use an attenuator if one is available.
Display shows "SA".	Indicates that the input signal level exceeds the specified saturation current of the detector being used with the meter. This level is detector dependent.
Reading is different than expected.	See 0 Common Measurement Errors.
Reading never changes.	Calibration module not properly inserted at power-up. Meter not in the run mode - press the R/S key.

RS-232 communication does not seem to work.	Check the echo mode state, the string termination character, and the back panel baud rate switch settings. Check the RS-232 cable connection and cable pinouts on Figure 18. Make sure that the device talking to the meter is setup for 8 data bits, no parity, and 1 stop bit.
GPIB communication errors	Check the GPIB address, the GPIB cable connections, and the string termination character.
A program does not compile in the QuickBASIC environment	National Instruments IBCONF file had some other device name for DEV4 or the IBCONF file was not configured properly for the 1830-R-GPIB. The QBIB.OBJ file was not compiled and linked with the QuickBASIC environment. To accomplish this step, follow the National Instruments manual commands: C:\QB45>link /q qbib.obj, qbib.qlb,, bqlb45.lib C:\QB45>qb /l qbib.qlb The pathname for the QBDECL.BAS should be modified per the user's computer system.
Your IEEE application software program does not seem to be to communicate with the 1830-R-GPIB.	Use the National Instruments IBIC program to communicate with the 1830-R-GPIB. Typical communicating with the 1830-R-GPIB. sequence of operation would be as follows: C:\>ibic IBFIND dev4 IBWRT "d?\n" IBRD 20

Table 6 Symptom/Fault Troubleshooting Guide

8.2 Cleaning Procedure

When cleaning the body of this instrument, use only a mild soap and water solution on a damp cloth.

CAUTION

Do not use acetone or other organic solvents on the 1830-R Series Optical Power Meter. Organic solvents attack the ABS plastic case.

8.3 Re-Calibration Schedule

The 1830-R Series Optical Power Meter calibration accuracy is warranted for a period of 1 year. After 1 year, the meter should be returned to Newport Corporation for re-calibration and NIST traceability recertification. Newport detectors also require recertification at one year intervals.

9 Factory Service

9.1 Introduction

This section contains information regarding obtaining factory service for the 1830-R Series Optical Power Meter. The user should not attempt any maintenance or service of this instrument and/or accessories beyond the procedures given in Section 8: Troubleshooting and Maintenance. Any problems which cannot be resolved using the guidelines listed in Section 8 should be referred to Newport Corporation factory service personnel. Contact Newport Corporation or your Newport representative for assistance. The 1830-R Series Optical Power Meter contains no user serviceable parts. Its calibration accuracy is warranted for a period of 1 year.

9.2 Obtaining Service

To obtain information concerning factory service, contact Newport Corporation or your Newport representative. Please have the following information available:

1. Instrument model number (On front panel)
2. Instrument serial number (On rear panel)
3. Description of the problem.

If the instrument is to be returned to Newport Corporation, you will be given a Return Number, which you should reference in your shipping documents. Please fill out a copy of the service form, located on the following page, and have the information ready when contacting Newport Corporation. Return the completed service form with the instrument.

9.3 Service Form

Newport Corporation U.S.A.
Office: 800-222-6440
FAX: 949/253-1479

Name _____ Return Authorization #_____
(Please obtain RA# prior to return of item)

Company _____
(Please obtain RA # prior to return of item)

Address _____ _____Date _____

Country _____ Phone Number _____

P.O. Number _____ FAX Number _____

Item(s) Being Returned:

Model # _____ Serial # _____

Description _____

Reason for return of goods (please list any specific problems):

_____

_____

_____

_____

_____

10 Appendix A - Status Reporting System

10.1 Status Reporting System

Below is a graphical representation of the 1830-R-GPIB's Status Reporting System for the GPIB bus. The two registers involved are the *Status Byte Register* and the *Service Request Enable Register*.

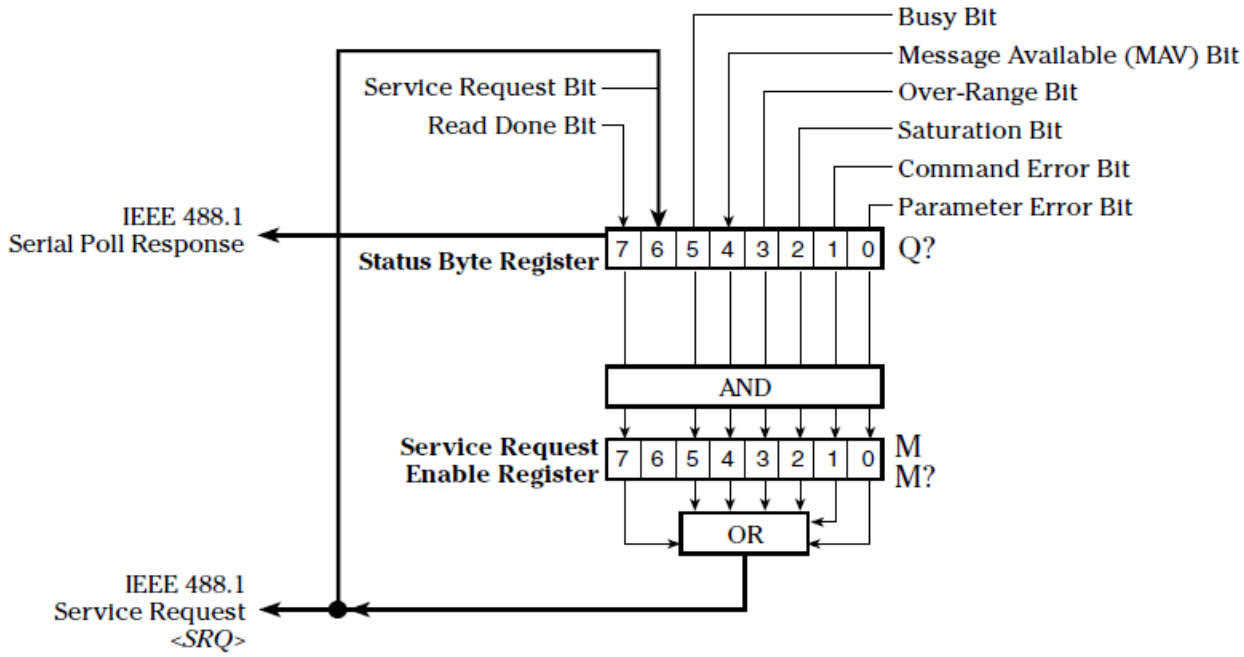


Figure 21 The 1830-R-GPIB's Status Reporting System for the GPIB Bus

The *Status Byte Register* is used to record a summary of the 1830-R-GPIB's current condition for the Status Reporting System. The status of the 1830-R-GPIB is returned to the controller when a serial poll is performed. The register is bit mapped, meaning that each condition is represented by a bit of different binary weight (...,8,4,2,1). When a bit is set high, (has a value of 1) the condition is true. The bits are cleared (set to zero) based on the conditions described for each bit. Additionally, all the bits in the Status Byte Register, except for the MAV bit, can be cleared by using the Clear Status Byte Register command, C.

The *Service Request Enable Register* is used to define the conditions of the Status Byte Register that will generate an IEEE 488.1 service request, <SRQ>. This register performs a bit-wise AND'ing operation with the Status Byte Register. When an event occurs that causes a bit to be set high in the Status Byte Register and its corresponding bit is set high in the Service Request Enable Register, an <SRQ> will be generated once for the given event. When the <SRQ> is asserted and a serial poll of the 1830-R-GPIB is performed, bit 6 and the bit(s) that initiated the <SRQ> will be set high in the byte returned by the serial poll. A serial poll will clear the <SRQ> until it is again asserted by a new event in the Status Byte Register.

NOTE

When using RS-232C, the service request <SRQ> and the serial poll features are not available. However the state of the status byte register can be obtained by the query, Q?.
Below is a description of each bit of the Status Byte Register.

PARAMETER ERROR:

This bit goes high whenever a valid command is issued but the command's parameters are out of range, e.g. U9.

This bit is cleared by Q? or by the C command.

COMMAND ERROR:

This bit goes high whenever a bad command is sent regardless of the parameters, e.g. H1.

When the meter is in the HOLD mode, good commands which try to change the measurement parameters will set this bit high.

This bit is cleared after an Q? or by the C command.

SATURATION:

This bit goes high whenever the photodetector is saturated, i.e. further increase in the input signal level does not cause any change in the measurement readings.

This bit goes low when the input signal is below the photodetector's saturation level.

OVER-RANGE:

This bit goes high whenever the input signal exceeds the maximum signal level for the present signal range.

This bit goes low when the signal level is within range.

MESSAGE AVAILABLE, (MAV):

This bit goes high when any message is ready to be transmitted over the interface. This bit is set only when the 1830-R-GPIB is ready to respond with data for an issued query.

This bit goes low after the 1830-R-GPIB completes sending the message.

BUSY:

This bit goes high whenever the 1830-R-GPIB is in auto-ranging mode and ischanging ranges, when the 1830-R-GPIB is in power-up initialization mode, or when the meter is performing an auto-calibration.

This bit goes low whenever the above three conditions do not exist.

SERVICE REQUEST:

When the status byte is read by means of a serial poll, this bit is set when the 1830-R-GPIB is requesting service.

When the status byte is read by means of the Q? query, this bit will be set if any bit in the status byte is set and its corresponding bit is set in the

Service Request Enable Register.

When the SERVICE REQUEST bit changes state from low to high, the 1830-R-GPIB automatically asserts a service request <SRQ>.

READ DONE:

This bit goes high when a new reading has been taken by 1830-R-GPIB that is not an over-range, or did not saturate the photodetector, and was not taken while ranging.
This bit is cleared by D? or by the C command.

11 Appendix B - Block Diagram

11.1 Simplified 1830-R Series Functional Block Diagram

A simplified block diagram of the 1830-R is shown in Figure 22. The heart of the 1830-R is a current to voltage converter followed by an A/D converter that translates the conditioned analog input signals into a form usable by the microcomputer. The microcomputer performs all necessary system control and calculations required to display the correct reading.

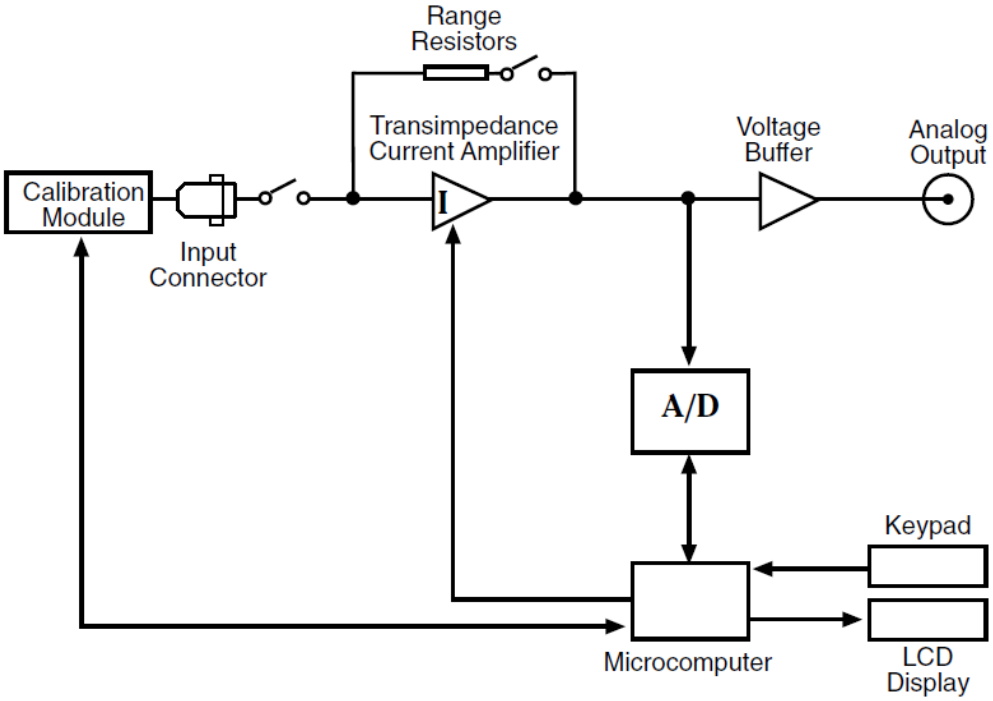


Figure 22 Simplified Functional Block Diagram

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