575L
POWER METER

RIFOCS CORP.
833 FLYNN ROAD
CAMARILLO, CA 93012
PH: 805 - 389 9800
FX: 805 - 389 9808

Notice of Proprietary Rights

The design concepts and engineering details embodied in this manual, which are property of RIFOCS CORP., are to be maintained in strict confidence; no element or detail of this manual is to be spuriously used, nor disclosed, without the express written permission of RIFOCS CORP. All rights are reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without prior written permission from RIFOCS CORP.

© COPYRIGHT 1996, RIFOCS CORP.
THIRD PRINTING, APRIL 1996, CAMARILLO CALIFORNIA
UNITED STATES OF AMERICA

EC Declaration of Conformity

We

RIFOCS CORPORATION
833 Flynn Road
Camarillo, CA
USA

declare under sole responsibility that the below listed Fiber Optic Instruments, manufactured in the United States of America, meet the intent of the Directive 89/336/EEC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the official Journal of the European Communities:

EN 50081-1 Emissions: EN55022   Radiated, Class B
                              EN 55022   Conducted, Class B
                              EN 60555-2   Power Harmonics

EN 50082-1 Immunity: IEC 801-2   Electrostatic Discharge
                              IEC 801-3   RF Radiated
                              IEC 801-4   Fast Transients
                              IEC 801-5   Surge

Instruments:
          Handheld   250 Series Handheld LED Sources
                        260 Series Handheld Laser Sources
                        330 Series Handheld Optical Attenuator
                        550 Series Handheld Optical Power Meter

          Benchtop   752 Series Benchtop Dual LED Source
                        570 Series Benchtop Optical Power Meter
                        580 Series Benchtop Return Loss Meter

          Modular   670 Series Optical Power Meter Modules
                        610 Series Nearfield/Farfield Scanner
                        650 Series LED Source Modules
                        660 Series Laser Source Modules
                        671 Series Universal Controller Module
                        680 Series Coupler/Splitter

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

viii

1   QUICK START

This section will give the practiced technician an overview of the functionality of the 575L Power Meter as well as a description of the operating procedures. A more detailed description of the functions can be found in section 4.
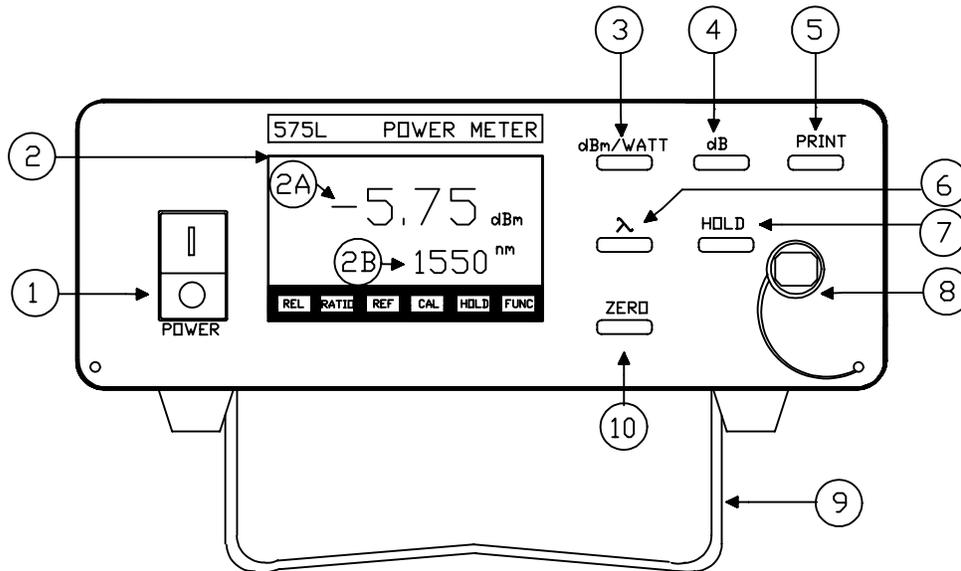
Figure 1-1   Front Panel Assignments.

1.1   Front Panel Description

(Refer to 1)
1.   **Power Switch**
2.   **LCD Display** -   A)   Main Power (Readout in WATTs or dBm)
                           B)   Cal Wavelength (in nanometers) or Reference
                                 Power (dB)
3.   **dBm/WATT** - Select read-outs units in **absolute** dBm or Watt.
4.   **dB** - Selects the **relative** dB mode.
5.   **PRINT** - When properly interfaced to a printer, this switch will activate a
      hard copy label. See section 0 for detailed operating procedures.
6.   **Lambda** - Select calibration wavelengths. Standard settings are 780, 850,
      1300, 1550nm.
7.   **HOLD** - Pressing this button will disable amplifier autoranging. The
      amplifier will be set to a range that was previously defined by accessing
      secondary function #11. The HOLD button is also used to access the
      secondary functions. See section 0 for accessing the secondary functions.

8.   **Power Detector** - Connect the fiber using any of the available Snap on
      Connector (SOC) adaptors.
9.   **Retractable Stand** - Allows the user eye-to-display contact for comfortable
      reading, it folds snugly to the base of the unit for easy storage and transport.
10.   **ZERO** - Zeroes the input power detector. The input power detector must
      be darkened when using this function or the error code -E2- will result.
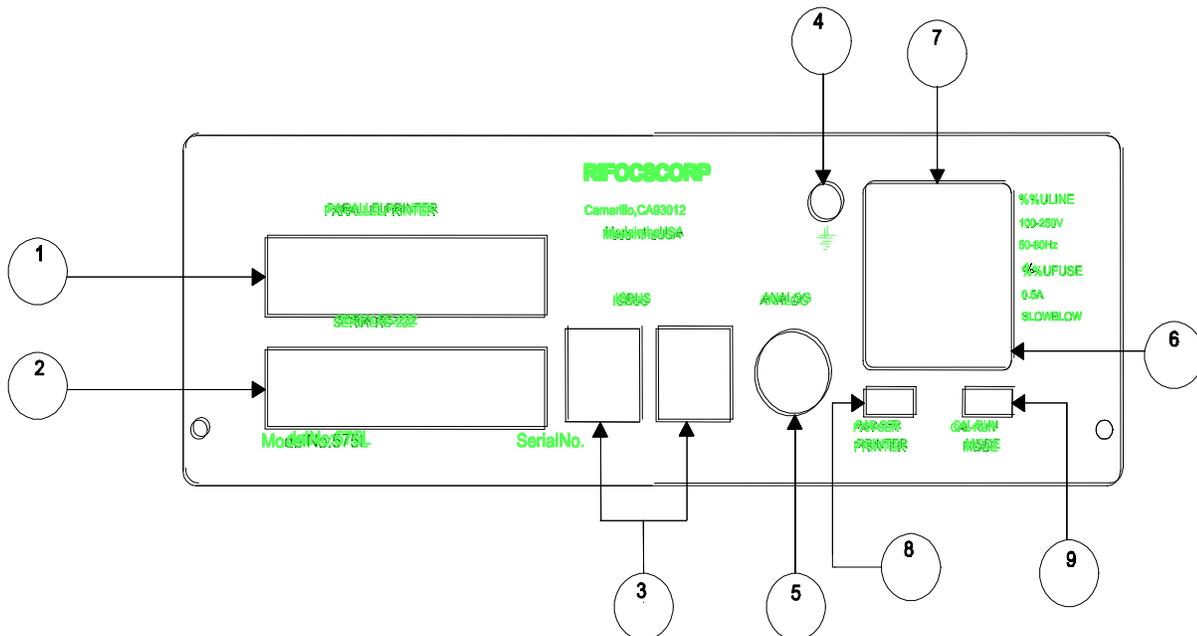
Figure 1-2   Rear Panel Assignments.

1.2   Rear Panel Description   1-3

1.   **Parallel Printer Interface** - This interface allows for connection to a printer for generation of labels and reports. Activated by the PRINT function.

2.   **Serial RS-232 Interface** - This interface allows for remote control of the unit.

3.   **I^{2}C Bus** - The Inter-Integrated Circuit BUS interface of the 575L allows multiple meters to be joined and addressed in series for multi channel test applications. See also section 0 I^{2}C Bus connector pinout.

4.   **Grounding Point**

5.   **Analog Output** - This BNC output provides a voltage of 0..3V corresponding to the power level displayed.

6.   **Line Input** - The unit accepts any line input from 100..250VAC at 50..60Hz.

7.   **0.75A Fuse** - Slow blow. Fuse cover is easily opened with a flat-head screwdriver.

8.   **Par-Ser Printer Switch** - Directs the device to output to either a parallel or serial printer for the label printing function.

9.   **Cal-Run Switch** - Enable calibration mode. For normal operation, this switch should remain in the "RUN" position. For calibration, this switch **must** be in the "CAL" position.

1.3   Secondary Functions

The secondary function sequence is initiated by selecting the "HOLD" switch and keeping it pressed for two seconds. Once the selected secondary function's annunciator is displayed on the LCD (in small digits - ITEM 1 in 3) and the desired parameters set (displayed on the LCD in large digits - ITEM 2 in 3), the function is automatically initiated and the unit will now default back to those selected functions when powered OFF and ON. (Refer to 3 and 4)

1. **Secondary Function Annunciator**
2. **Secondary Function Parameter Annunciator**
3. **dBm/WATT** - Decrements Parameter
4. **dB** - Increments Parameter
5. **ZERO** - Exit Secondary Function Menu
6. **LAMBDA** - Decrements Function
7. **HOLD** - Increments Function
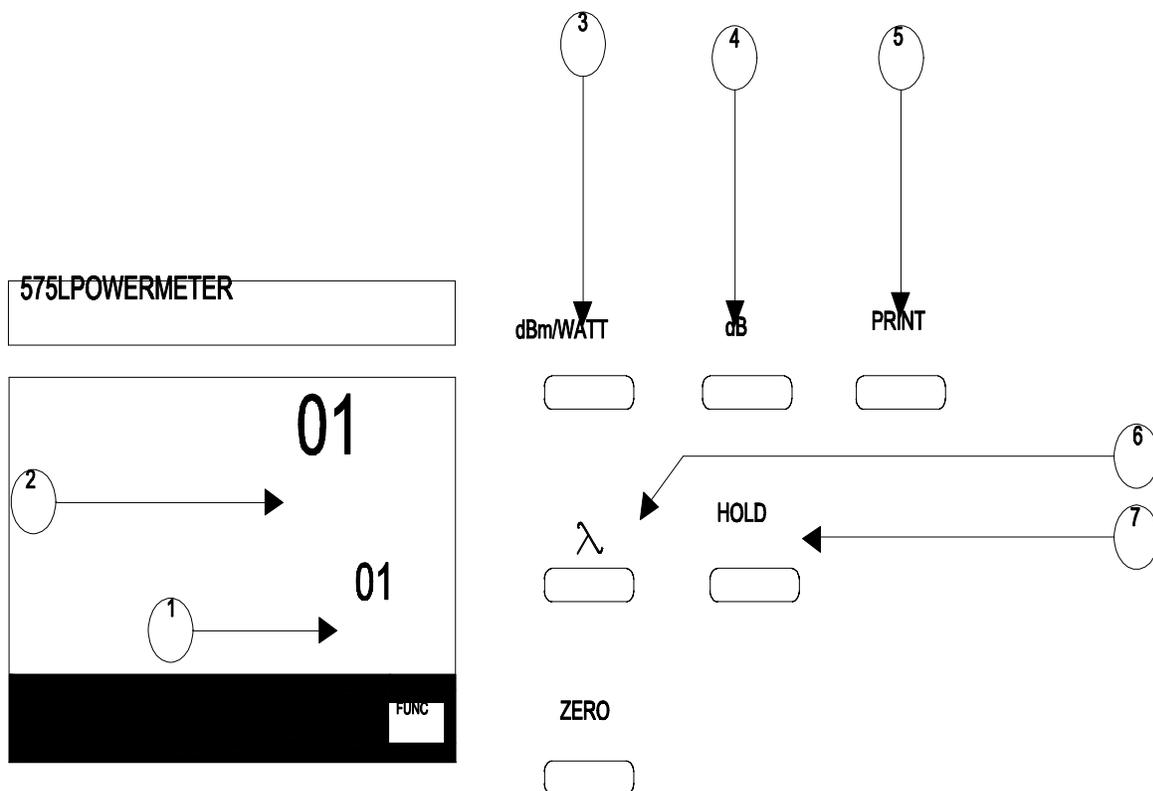
Figure 1-3   Front Panel Button Assignments.

Table 1-1   Secondary Function Quick Reference.

Secondary Function	Description	Parameter
1	Select Label Format	1..7
2	Select Label Serial Number	0..65000
3	Select I^{2}C Address	1..16
4	Select BAUD Rate	1200,2400,4800,9600
5	Select Default Wavelength	600..1600nm
6	Select Default Mode of Operation	dBm, WATT, dBm+Hold, WATT+Hold
7	Set Year	1995..2100
8	Set Date (Day & Month)	DD-MM
9	Set Time	00:00..23:59
10	Select REF/REL + RATIO Mode	
11	Set Range/Hold Configuration	0..7
12	Display Software Revision Level	
13	Set dB mode configuration	1..4
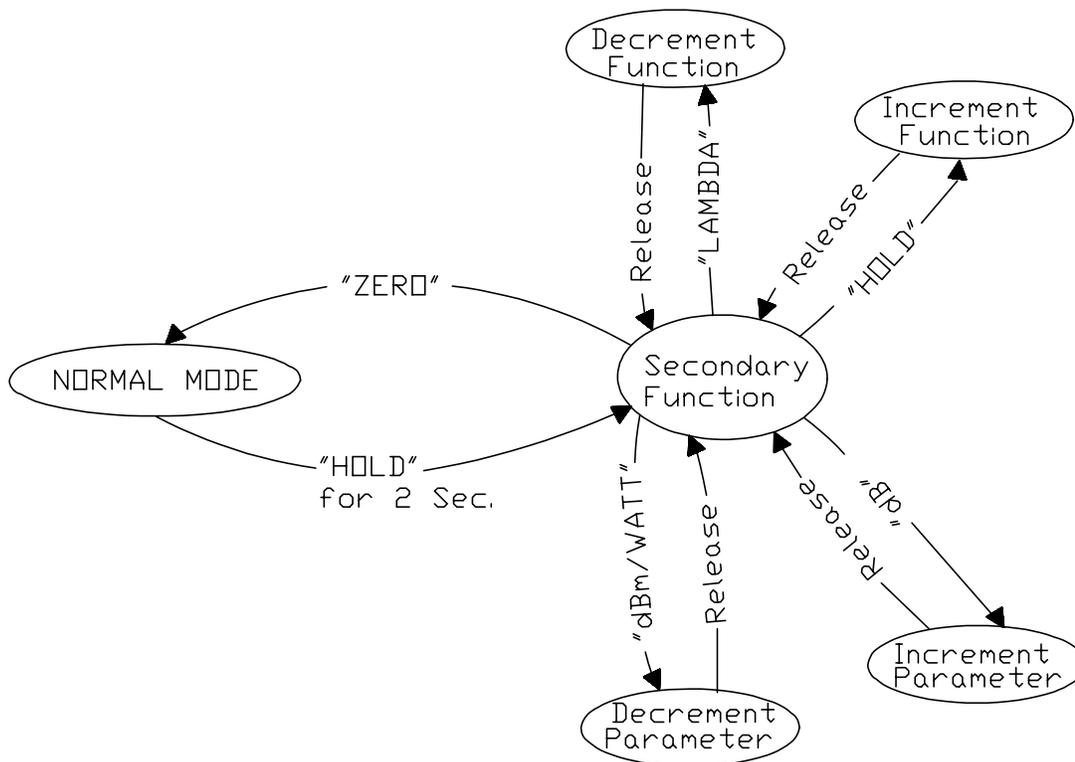
Figure 1-4   Secondary Function State Diagram.

1.4   Remote Terminal Commands

The 575L can be remotely controlled with any computer having a compatible RS-232 interface.

Format   BAUD Rate - 1200,2400,4800,9600
                (The 575L default BAUD Rate is 9600)
                Parity - None
                Bits - 8
                Stop Bit - 1
                (Command strings are not case sensitive)

Table 1-2   Remote Command Quick Reference.

COMMAND	DESCRIPTION
AUTO	Enable amplifier auto-ranging
AW	Returns the Amps/WATT of selected wavelength
CAL	Wavelength select
CH	Active remote channel select
dB	Relative log units
dBm	Absolute log units
DEL_LAMDA	Delete a wavelength register
GET_DATE	Returns the date (DY-MN-YR)
GET_LBLNUM	Returns the currently selected label number
GET_LOPASS	Returns the state of the lopass filter
GET_MODE	Returns the default operating mode
GET_SN	Returns the label serial number
GET_TIME	Returns the time (International format)
HOLD	Disable amplifier auto-ranging
INIT_CLOCK	Used after the clock battery has been replaced
LOCAL	Enables the front panel buttons
LOCKOUT	Disables the front panel buttons
LOPASS	Turn on/off A/D low pass filter
PRINT	Prints a label
RANGE	Fixed amplifier range select
READ	Returns the optical power
READ_LABEL	Returns the indicated label format file
RECAL	Recalibrate the 575L (CAL switch must be in CAL position)

Table 1-2   Remote Command Quick Reference (continued).

COMMAND	DESCRIPTION
RESET	Resets the 575L
RESTORE	Loads the EEPROM with its default factory set parameters
SAVE	Make the present operating mode the default
SET_DATE	Set date (DD,MM,YYYY)
SET_LABEL	Label format select
SET_MODE	Sets the default operating mode
SET_SN	Set label serial number
SET_TIME	Set time (HH,MM)
VER	Returns the software revision level
WATT	Select absolute linear units
WAVE_REG	Returns the currently selected wavelength register
WLEN	Returns the wavelength of the indicated wavelength register
ZERO	Zeros the optical input

EXAMPLE 1 - Sets unit to WATT mode (Using an IBM PC compatible computer)

     C:**mode com1:9600,n,8,1,p**[ENTER]   (Format BAUD Rate)
     C:**copy con com1:**[ENTER]   (Enable Remote Command)
       WATT [ENTER]   (Watt Mode Active Command)
       [CTRL][**Z**][ENTER]   (End of file command)

2   GENERAL INFORMATION

The 575L Fiber Optic Power Meter is a high performance, programmable power meter. It is used for all general purpose light power measurements, but particularly for fiber optic applications, in both manual and computer controlled test set-ups.

At the heart of the instrument is a high sensitivity InGaAs detector. Most industry connectors may be interfaced to the 575L by using one of the RIFOCS SNAP-ON (SOC) series connector adapters. Powerful interface features include an RS232 interface which enables the 575L to be controlled from a computer, and an Inter-Integrated Circuit (I^2C) Bus which allows multiple 575Ls to be connected together. The combination of RS232 and I^2C interface makes it possible to control multiple 575Ls with just one computer and only one RS232 port. The 575L also offers the unique feature of allowing multi-channel ratio measurements. It is possible to make ratio (A/B) measurements simultaneously between many channels. Up to 15 channels can be tied together making simultaneous ratio measurements against one reference channel. The 575L can be connected to a printer via either the parallel printer port or the RS232 interface on the unit's back panel. This feature allows the user to get hard copies of power measurements, for example to label the losses of connectors.

MAIN FEATURES

*   Maximum Performance
         (+3dBm to -80dBm)
*   Absolute Power Reading Accuracy (± 0.25dB)
*   Automatic Zeroing
*   Ratio Measurements for up to 15 channels
*   RS232 Interface for Remote Control
*   Inter-Integrated (I^2C) Circuit Bus Interface
*   Parallel Printer Port Interface
*   All Fiber Optic Wavelengths
*   All Fiber Optic Connectors
*   Universal Power Supply (100-250VAC, 50-60 Hz)
*   Daisy Chain Capability

APPLICATIONS

*   Automatic testing for systems and components
*   Connector and Coupler Evaluations
*   Life testing Lasers and Components
*   Measuring Splice Loss
*   Measuring Attenuation
*   Engineering tasks in E-O lab
*   Incoming Inspection of Sources
*   Loss Budget Analysis
*   Quality Control
*   Automated Manufacturing Tests

2.1   Specifications

Table 2-1   Specifications at 18°C to 25°C (continued).

	MODEL	575L	577L	578L
2.2.12	Display	Custom tri-plexed liquid crystal display with 4 digit data field and simultaneous display of cal wavelength		
2.2.13	Measurement Modes	dBm,dB,WATT		
2.2.14	Optical Connector Interface	RIFOCS Snap-On Connector (SOC) series adapters.		
2.2.15	RS232 Interface	Conforms to RS232C standard. 25 pin D connector female		
2.2.16	I^2C Interface	Conforms to the Inter-Integrated (I^2C) Circuit Bus specification		
2.2.17	Parallel Printer Interface	Logic level: 0-5V Drives 1 TTL load 25 pin D connector, female		
2.2.18	Analog Output Interface	0 TO 3V (Amplifier output) Maximum analog output load > 5k ohm tr/tf < 0.1ms for P >= 1μW tr/tf < 1ms for P >= 10nW		
2.2.19	Line Power	100VAC TO 250VAC, 50-60 Hz		
2.2.20	Warm Up Time	5 minutes		
2.2.21	Operating Environment	-5°C to 55°C, 0-95% RH (Non-condensing)		
	Storage Environment	-15°C to 70°C, 0-95% RH (Non-condensing)		

Table 2-1   Specifications at 18°C to 25°C.

	MODEL	**575L**	**577L**	**578L**
2.2.1	Sensor Type	InGaAs	Si	InGaAs
2.2.2	Dynamic Range	+3 to -80dBm	+3 to -75dBm	+20 to -60dBm
2.2.3	Cal Wavelengths	780/850/1300/ 1550nm	635/780/ 850nm	850/980/1300 1480/1550nm
2.2.4	Linearity	±0.05dB		
2.2.5	Absolute Accuracy	±0.25dB at Calibration Conditions		
2.2.6	Stability	< ±0.02dB (10°C to 35°C) < ±0.05dB Operating temperature range		
2.2.7	Resolution	Log: 0.01dB Linear: 0.001nW,uW,mW		
2.2.8	Calibration Traceability	U.S.N.I.S.T		
2.2.9	Recommended Recalibration Period	12 Months		
2.2.10	Settling Time	2 Seconds		
2.2.11	Number of readings/sec (in remote mode)	10 readings per second (typical)		

Table 2-1 Specifications at 18°C to 25°C (continued).

MODEL	575L	577L	578L
Weight/ Dimensions Basic Instrument Shipping Weight	Weight, kg (lbs) Height x Width x Depth cm (in.) 2.15kg (4.75 lbs.) 8 X 19 X 29cm (3.125 x 7.375 x 11.375 in.) 3.40kg (7.5 lbs.) 15 X 28 X 38cm (5.750 x 10.75 x 14.875 in.)		

Specifications subject to change without notice.

2.2   **Specification Definitions**

2.2.1   **SENSOR TYPE:** This provides information on the type of photo detector used at the front end of the instrument for optical power detection. Enhanced InGaAs provides a wide Spectral Range.

2.2.2   **DYNAMIC RANGE:** The measurement region where the instrument does not deviate more than 0.5dB from the absolute linearity curve. The reference point is the 10μW power level.

2.2.3   **CALIBRATION WAVELENGTHS:** The 575L is calibrated at these wavelengths (780nm,850nm,1300nm,1550nm). These are the wavelengths for which absolute calibration data is traceable to the N.I.S.T. An absolute power reading calibration of the power meter is performed using a source of specific wavelength (e.g. 780nm, 850nm, 1300nm, 1550nm) and a specific power level (-30.00dBm). The power reading is adjusted and matched with the power reading of a transfer standard. This provides absolute calibration of these wavelengths which are directly traceable to the N.I.S.T. standard. Additional calibration wavelengths can be added by the user, the 575L can have up to a maximum of 8 calibration wavelengths. Adding additional calibration wavelengths is done with the "RECAL" command, section 6.1.23.

2.2.4   LINEARITY: The power meter linearity is defined as the maximum deviation from the ideal linear response of each 5dB change in power. The linearity specification applies within the range of -3dBm to -65dBm at 1300nm.

2.2.5   ABSOLUTE ACCURACY: This is the total uncertainty of the transfer calibration process. This error is referenced to the N.I.S.T. absolute calibration standard. Specific power level, specific source wavelength, and specific temperature is specified as qualifiers, so that one can verify this specification.

2.2.6   STABILITY: With the 575L measuring a stable input signal, this specification defines the maximum amount of deviation in dB units, that the 575L will measure above or below the actual input signal.

2.2.7   RESOLUTION: This specification defines the smallest power change the power meter can display during the power measurement. Both LOG and LINEAR power measurement mode resolution data is included in this specification.

2.2.8   CALIBRATION TRACEABILITY: The detector's absolute calibration data is directly traceable to N.I.S.T. at one wavelength and one power level.

2.2.9   RECOMMENDED RECALIBRATION PERIOD: This is the recommended time period for re-calibration, in order to maintain accuracy specifications.

2.2.10 SETTLING TIME: This is the amount of time it takes for the 575L to read within 0.10dB of the actual power reading when the input power makes an instant transition from -70dBm to 0dBm.

2.2.11 READINGS PER SECOND (REMOTE MODE): This is the maximum number of power readings that can be read from the 575L in one second.

2.2.12 DISPLAY: The size and type of display is defined in this field. All annunciators and units of measurements are also described in this field.

2.2.13 MEASUREMENT MODES: The 575L can measure light in absolute log units (dBm), relative units (dB) and absolute linear units (mW, μW,nW).

2.2.14 OPTICAL INPUT INTERFACE: This field provides information of the type of connector interface that is available with the 575L power meter.

2.2.15 RS232 INTERFACE: The RS232 Interface of the 575L provides a means of transmitting and receiving data between a host computer or a printer. Serial communication is popular because most computers have at least one serial port. For examples of how the RS232 interface is used see section 5.2.

2.2.16 I^{2}C INTERFACE: The Inter-Integrated I^{2}C Circuit Bus Interface of the 575L provides a means of connecting multiple 575Ls together on a bus. For examples of how the I^{2}C Bus is used see section 5.3.

2.2.17 PARALLEL PRINTER INTERFACE: The parallel printer interface is for printing labels. For a pinout diagram of the parallel printer interface see 5-8 and 5-3.

2.2.18 ANALOG OUTPUT INTERFACE: The analog output provides an electrical signal which can be used to monitor the optical input signal. The analog output signal is calibrated to the power reading being displayed. The connection to the Analog Output is made via a BNC connector.

2.2.19 LINE POWER This specification defines the AC line voltage requirements necessary to operate the 575L.

2.2.20 WARM UP TIME: The 575L must be powered on for this time in order to conform with all the specifications.

2.2.21 ENVIRONMENTAL:

OPERATING TEMPERATURE: This is the temperature range in which the 575L will conform to the specifications after the specified warm up time.

STORAGE TEMPERATURE: This is the temperature range at which the instrument can be stored with the power off, without any damage or any loss of specification to the instrument. It is required that the instrument be brought back to within the operating temperature range before it is turned on.

HUMIDITY: The relative non-condensing humidity levels allowed in the operating temperature range.

2.3   Warranty Information

RIFOCS Corp. warrants this product to be free from defects in material and workmanship for a period of 1 (one) year from date of shipment. During the warranty period we will, at our option, either repair or replace any product that proves to be defective. To exercise this warranty, write or call your local RIFOCS Corp. Representative, or contact RIFOCS Corp. Headquarters. You will be given prompt assistance and return instructions. Send the instrument, transportation prepaid, to the indicated service facility. Repairs will be made and the instrument returned, transportation prepaid. Repaired products are warranted for the balance of the original warranty period, or at least 90 days.

Limitation of Warranty

This warranty does not apply to defects resulting from unauthorized modification or misuse of any product or part. This warranty also does not apply to fuses or AC line cords.

This warranty is in lieu of all other warranties, expressed or implied, including any implied warranty of merchantability of fitness for a particular use. RIFOCS Corp. shall not be liable for any indirect, special or consequent damages.

2.4   Statement of Calibration

This instrument has been inspected and tested in accordance with specifications published by RIFOCS Corp. The accuracy and calibration of this instrument is traceable to the N.I.S.T. through equipment which is calibrated at planned intervals by comparison to certified standards.

The instrument should be calibrated annually in order to maintain specifications. This provides the basis for an effective quality assurances/standards program. These services are available for RIFOCS products for a nominal fee.

3   INITIAL PREPARATION

This section provides information needed for incoming inspection and preparation for use.

3.1   Unpacking And Inspection

The unit was carefully inspected, mechanically, electrically and optically before shipment. When received, the shipping carton should contain the items listed in section 0. Account for and inspect each item. In the event of a damaged instrument, write or call RIFOCS Corp. in Camarillo, California. Please retain the shipping container in case re-shipment is required for any reason.

3.2   Damaged In Shipment

All instruments are insured F.O.B. Camarillo when shipped by RIFOCS. If you receive a damaged instrument you should:

1)   Report the damage to your shipper immediately.
2)   Inform RIFOCS Corporation.
3)   Save all shipping cartons.

Failure to follow this procedure may affect your claim for compensation.

3.3   Standard Contents

1   Model 575L Fiber Optic Power Meter
1   SOC Adapter per specification
1   Certificate of Calibration and Metrology Report
1   Linearity Plot
1   Instruction Manual for Model 575L
1   AC line cord (compatible with available AC line)
1   Package of 0.75 amp fuses containing 2 each
1   Warranty Registration Card (mail immediately after checking out the unit)

3.4   Preparation For Use

The 575L Fiber Optic Test Set is shipped ready for use. The instrument is powered from the AC line (100-250VAC, 50-60Hz). See section 0 for additional information.

4   FRONT PANEL OPERATION

This section includes operating instructions such as: front and rear panel controls, and receiver connections. Refer to the following reference Table concerning the available front panel commands:

Table 4-1   Summary of Front Panel Functions.

COMMAND KEY	DESCRIPTION	SECTION
dBm	Absolute Log Units (dbm)	4.7.1
dB	Relative Log Units (dB)	4.7.2
WATT	Absolute Linear Units (Watts)	4.7.3
\	Select Wavelength	4.8
HOLD	Amplifier Range Hold Function	4.9
ZERO	Zero Detector	4.10
PRINT	Print Label	4.11

Table 4-2 Summary of Front Panel Secondary Functions

Secondary Function Number	Secondary Function Description	Parameter	Section
1	Select Label Format	1-7	4.12.2
2	Select Serial Number	0-65,535	4.12.3
3	Set I^2C Address	1-16	4.12.4
4	Set BAUD Rate	1200, 2400, 4800, 9600	4.12.5
5	Select Default Wavelength	Any calibrated wavelength	4.12.6
6	Set Default Mode	dBm, Watt, dBm+Hold, Watt+Hold	4.12.7
7	Set Year	1993-2100	4.12.8
8	Set Date (dd-mm)	1-1 to 31-12	4.12.9
9	Set Time (international)	0:00 - 23:59	4.12.10
10	Select REF/REL+RATIO Mode	REF mode, REL+RATIO mode neither mode	4.12.11

Table 4-2   Summary of Front Panel Secondary Functions (continued)

Secondary Function Number	Secondary Function Description	Parameter	Section
11	Select the various Default Range Hold Configurations	0-7	4.12.12
12	Display the software revision level	none	4.12.13
13	dB mode configuration	1-4	4.12.14

For Model 575L front and rear panel illustrations refer to 1 and 2. For references to the Model 575L custom LCD, refer to 1 showing all segments and annunciators.

Figure 4-1   LCD segments and annunciators.

4.1   Power-Up

The internal power supply of the Model 575L operates from an AC line voltage in the range of 100-250VAC 50-60Hz. For fuse replacement refer to 1

WARNING

Ground the instrument through a properly earth grounded receptacle before AC operation. Failure to ground the instrument can result in severe injury or death in the event of short circuit or malfunction.

The POWER ON/OFF switch operates on the rocker principle. Pressing the upper portion turns the instrument on. Pushing the lower portion turns the instrument off. Immediately after turning on the power the upper field of the display will show "575L" and the lower field of the display will show the software revision level. The 575L will then display the power reading in dBm or WATT units depending on the default mode of operation.

4.2   EEPROM

The power-on values of various system parameters, the label formats and the current calibration data is stored in the EEPROM. The EEPROM allows storage of these values even after the 575L is turned off, and can retain these values for several years. The 575L checks the EEPROM during its power-up self test. If for some reason the EEPROM loses any of its memory, the 575L will display error code -E1-. Pressing the **[PRINT]** button will clear the error and write factory default data to the EEPROM.

NOTE

If the CAL/RUN switch, located on the 575L rear panel, is in the CAL position all calibration data will be overwritten with dummy values, thus the unit will need to be recalibrated. If the CAL/RUN switch is in the RUN position the calibration data will not be overwritten.

Table 4-3   Factory Parameters Stored in EEPROM

INSTRUMENT FUNCTION	DESCRIPTION	RESTORE DEFAULT VALUES
Display Units	dBm or WATT Units	dBm
Cal Wavelengths	Pre-Defined Cal Register Values (Up to 8)	(#1) 780nm (#2) 850nm (#3) 1300nm (#4) 1550nm
I^2C Address	I^2C Bus Address	1
Serial Number	Auto Incrementing Serial Numbers for Label Printing	10101
Label Format	User-Defined Label Formats (7 Label Formats Possible)	1
RS232 BAUD Rate	Data Rate of the RS232 Interface	9600 BAUD
Zero	Software Zero	Value
Range Hold	Amplifier Range Hold Mode	Off
Range Hold Configuration	8 Possible Range Hold Configurations (0 to 7)	0

4.3   Warm-Up Period

The Model 575L requires a minimum of 5 minutes to stabilize after the power has been turned on, or if there is a change in ambient temperature. Then proceed to section 0 and follow the procedures for zeroing the instrument.
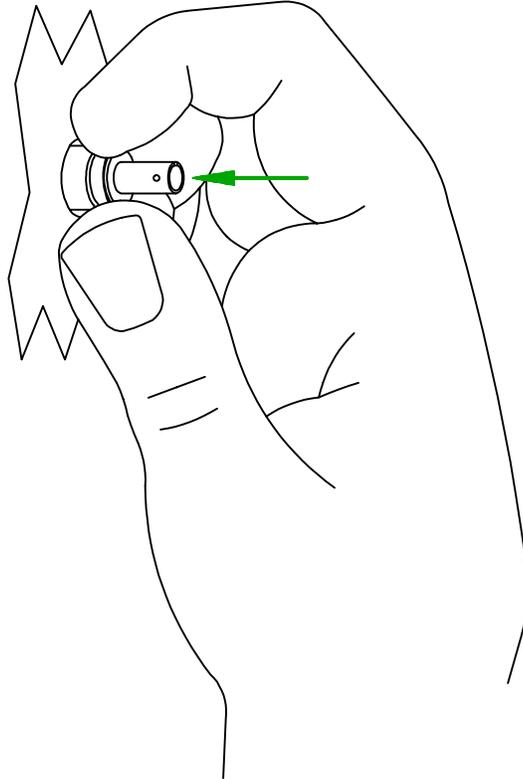
Figure 4-2   Connecting   the   SNAP-ON
                      Adapter.

4.4   Optical Input Port (RCVR)

Fiber Optic connections to the optical input of the 575L are via the SNAP-ON series
of Fiber Optic Adapters, see 2. A substantial amount of force is required to install
and remove the SNAP-ON Fiber Optic Adapter. Consult section 0 for a complete list
of Fiber Optic Adapters available from RIFOCS Corporation.

4.5   How to Zero

Completely darken the optical input of the 575L and press the **[ZERO]** button. The 575L will show -00- in the upper field of the display while it zeros the receiver. When zeroing is complete the **-00-** will disappear. If the optical input is not completely darkened, ie. power > -56 dBm, the 575L will display error code   **-E2-**. Press the **[dBm/WATT]** button to clear this error.

4.6   Zero Drift and Minimum Light Detection

The minimum resolvable light level specification and the most sensitive scale resolution is given in 4. When operating on the most sensitive range at the minimum specified light level, changes in ambient temperature (> 20°C) may require the 575L to be stabilized and re-zeroed.

Table 4-4   Sensitivity Levels of the Power Meter

MODE	MINIMUM RESOLVABLE POWER	MOST SENSITIVE RANGE DISPLAY RESOLUTION
WATT	0.001nW	0.001nW
dBm	-90.00dBm	0.01dBm

4.7   How to Select Measurement Units

This section describes how to select the appropriate optical power measurement units. The user may select either absolute units in dBm or WATTS, or relative units in dB.

4.7.1 dBm - Absolute Log Units

Press the **[dBm/WATT]** button to toggle between absolute power units in dBm or WATT, referenced to the current calibration wavelength. The dBm mode provides an absolute measurement of the incoming optical signal level referenced to the current calibration wavelength (displayed in the lower field of the LCD, below the power reading). Underrange or overrange is indicated by **"LO"** or **"HI"**, respectively.

4.7.2 dB - Relative Log Units

This is the mode for fiber attenuation measurements and connector/splice loss measurements. The user must first be in either the dBm or dB display mode. Pressing the [dB] button will cause the power meter to sample the incoming dBm signal level, store this value internally, and subtract this reference dBm value from the dBm signal level of subsequent inputs. There must be a valid reading on the display to enter the dB mode. The 575L cannot be displaying LO or HI at the time the [dB] button is pressed. Initially, the display value is 0.00 dB because the incoming signal is equal to the reference signal at this time. The dBm reference power level is shown in the lower field of the LCD for easy reference. Maximum display range is ±95.00 dB as long as the maximum power limits are not exceeded. Underrange and overrange are displayed as **"LO"** and **"HI"**, respectively.

NOTE
If **"LO"** or **"HI"** is displayed the 575L might be in the range hold mode.

4.7.3 WATT - Absolute Linear Units

Pressing the [dBm/WATT] button will toggle between WATT and dBm power measurements. When WATT mode is selected, absolute power units in milliwatt (mW), microwatt (μW), and nanowatt (nW) will be used to display the current reading. The 575L will automatically select the units (mW,μW,nW) which provide the highest display resolution. Overrange is indicated by **"HI"**.

4.8   \ - Select Wavelength

Whenever the **[\]** button is pressed, the cal wavelength for the next cal register is selected. Each time the button is pressed, both the cal wavelength and the optical power data fields on the LCD are updated with respect to the new cal wavelength. Up to 8 cal wavelengths can be directly accessed by the operator using this button.

4.9   HOLD - Autoranging / Range Hold

The HOLD function allows the user to control the internal operation of the Amplifier circuitry. Pressing the **[HOLD]** button will toggle the unit between the amplifier range hold mode and the amplifier autoranging mode.   Depending on the configuration of the range hold function (see section 0), pressing the **[HOLD]** button will do one of the following : disable autoranging and hold the amplifier on its current range of amplification; or disable autoranging and set the amplifier to a predefined range of amplification.

4.10   ZERO - Automatic Zeroing
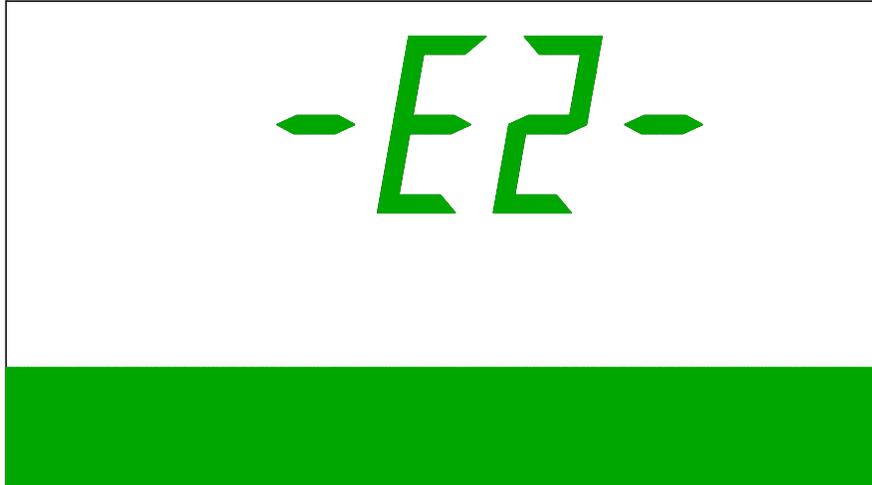
Figure 4-3   Error code -E2- displayed.

The 575L is capable of automatically zeroing its detector. The 575L must be zeroed in order to measure low light levels. (See section 0). To zero the 575L completely darken the optical input and press the **[ZERO]** button. The 575L will show -00- in the upper field of the display while it zeros the receiver. When zeroing is complete the **-00-** will disappear. If the optical input is not completely darkened the 575L will display error code **-E2-**. Press the **[dBm/WATT]** button to clear this error from the display.

NOTE

ZERO should not be confused with dB relative mode.

4.11   PRINT - Print Label

The 575L has the capability of taking a reading from the display and printing that reading on a label. To do this the 575L must be connected to a printer. The serial/parallel switch on the back panel of the 575L must be in the parallel position if printing to a parallel printer or in the serial position if printing to a serial printer.

NOTE

It is assumed that the user has already selected a default label format. The default label format can be set to 1 of 7 possible formats. The process for setting the default label format is covered in section 0. To create a label format it is necessary to connect the 575L to a computer over the RS232 interface. The label format is created on the computer and then down loaded to the 575L. The process for creating label formats is covered in section 6.2.1.

4.12   Secondary Functions

4.12.1 Secondary Functions Menu

For an explanation of how to access and select the secondary functions see section 1.3.

4.12.2 FUNCTION 1 - Selecting the Label Format

The 575L has the capability of printing hard copies (labels) to a parallel or serial printer. The user can store up to 7 different labels in the 575L's non-volatile memory. Each label can have its own unique format. To select a label format go into the secondary functions menu, select secondary function number 1. Press the [dB] button or the [dBm/WATT] button until the desired label format number is displayed on the parameter field of the LCD.

4.12.3 FUNCTION 2 - Setting the Label Serial Number

To set a 5 digit user definable label serial number enter into the secondary functions menu. Select secondary function number 2. Press the [dBm/WATT] button or the [dB] button until the desired serial number is displayed on the parameter field of the LCD. (NOTE: each time a serial number is printed it is incremented.)

4.12.4 FUNCTION 3 - Setting the I^{2}C ADDRESS

To set the I^{2}C address (remote address) enter into the secondary functions menu. Select secondary function number 3. Press the [dBm/WATT] button or the [dB] button until the desired I^{2}C address is displayed on the parameter field of the LCD. (NOTE: each 575L that is connected to the I^{2}C bus must have its own unique address.) Valid addresses are 1-16. The default I^{2}C address as shipped from the factory is 1.

4.12.5 FUNCTION 4 - Setting the BAUD Rate

To set the BAUD Rate of the 575L's RS232 interface port, enter into the secondary functions menu. Select secondary function number 4. Press the [dBm/WATT] button or the [dB] button until the desired BAUD Rate is displayed on the parameter field of the LCD. The 575L's RS232 interface uses the following communications parameters: 8 data bits, 1 stop bit, no parity. The default BAUD Rate as shipped from the factory is 9600.

4.12.6 FUNCTION 5 - Selecting Default Wavelength

The default wavelength of the 575L is the wavelength that is displayed on the LCD when the unit is powered on. To set the default wavelength enter into the secondary functions menu. Select secondary function number 5. Press the [dBm/WATT] button or the [dB] button until the desired wavelength is displayed on the parameter field of the LCD. The default wavelength as shipped from the factory is 1300nm.

4.12.7 FUNCTION 6 - Selecting Default Mode

To set the default mode of operation enter into the secondary functions menu. Select secondary function number 6. Press the [dBm/WATT] button or the [dB] button until the desired parameters are displayed on the parameter field of the LCD. (The default mode as shipped from the factory is dBm)

4.12.8 FUNCTION 7 - Setting the Year

To set the year that is stored in the 575L's internal clock/calendar enter into the secondary functions menu. Select secondary function number 7. Press the [dBm/WATT] button or the [dB] button until the desired year is displayed on the parameter field of the LCD.

4.12.9 FUNCTION 8 - Setting the Date (day-month)

To set the date (day and month) that is stored in the 575L's internal clock/calendar enter into the secondary functions menu. Select secondary function number 8. Press the [dBm/WATT] button or the [dB] button until the desired date is displayed on the parameter field of the LCD.

4.12.10 FUNCTION 9 - Setting the Time

To set the time of the 575L's internal clock/calendar enter into the secondary functions menu. Select secondary function number 9. Press the [dBm/WATT] button or the [dB] button until the desired time is displayed on the parameter field of the LCD. Note that the time is displayed in the international time format. (00.00-23.59)

4.12.11 FUNCTION 10 - Selecting REF/REL+RATIO

Figure 4-4   LCD display while in REL+RATIO mode.

The ratio secondary function allows the user to make ratio (A/B) measurements between as many as 15 different channels (units). This is accomplished by setting one 575L as the reference **(REF)** unit, and then connecting from 1 to 15 units to that reference unit with the I^2C cable. The units connected to the reference unit are set up as relative **(REL+RATIO)** units. When the REL+RATIO mode is selected the unit enters the dB mode. The dB reading displayed will be the ratio (A/B) of the light coming into that unit compared to the reference unit. For example, if the reference unit had -10.00 dBm coming into it, and a relative unit had -15.00 dBm coming into it, the relative unit would show -5.00 dB in the upper field of the LCD, and 15.00 dBm in the lower field of the LCD. There can be only one reference unit. The ratio is always taken between the dBm reading of a particular unit compared to the reference unit. To take ratio measurements proceed as follows:

1)   Connect the I^2C cable between all units.
2)   Set up one unit as the reference unit. (The REF annunciator of the LCD is on) If more than one unit has been set up as a reference unit, the E5 error code will be displayed on the LCD.
3)   Set up the other units as relative units. (The REL+RATIO annunciators of the LCD are on)
4)   Each unit, other than the reference unit, will now continuously display the dB ratio of its power compared to the reference. In addition the relative unit's power will be displayed in the secondary field of the display (4). The reference unit will appear to be in normal dBm mode except the **REF** annunciator will be on. (see 4-5)

5)   If a relative unit stops receiving a signal from the reference unit, it will show the E4 error code on the LCD. This can occur if the reference unit is not in the **REF** mode or the I^2C cable is not connected.

Figure 4-5   LCD display while in REF mode.

To put the 575L into the reference mode enter into the secondary functions menu. Select secondary function number 10. Press the [dBm/WATT] button or the [dB] button until the **REF** annunciator is displayed on the LCD. To put the 575L into the relative mode press the [dBm/WATT] button or the [dB] button until the **REL**+**RATIO** annunciators are displayed on the LCD. To take the 575L out of the REF or REL+RATIO mode press the [dBm/WATT] button or the [dB] button until neither the REL or REL+RATIO annunciators are displayed on the LCD.
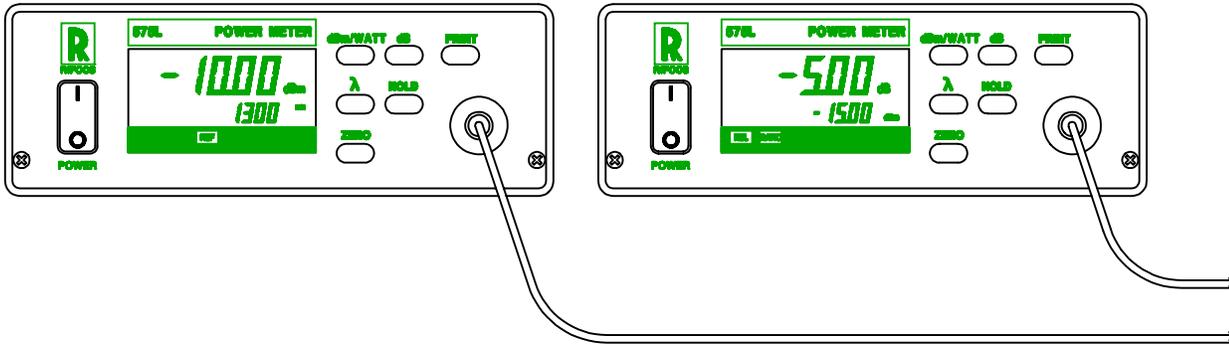
Figure 4-6   Multi-channel ratio (A/B) measurements.

4.12.12 FUNCTION 11 - Range Hold configuration

The Range Hold function can be configured to operate in two different modes. In the 1st mode, when the **[HOLD]** button is pressed the amplifier will stop autoranging and the amplifier will operate on the current range of amplification. In the 2nd mode, when the **[HOLD]** button is pressed the amplifier will stop autoranging and the amplifier will be set to a predefined range of amplification. (Range 1-7) If the **[ZERO]** (exit) button is pressed while in secondary function 11, the range hold function will be configured according to the parameter that is shown on the display. Refer to 5 for an explanation of the parameters. If the **[ZERO]** (exit) button is not pressed while in secondary function 11, the range hold configuration will not be changed.

Table 4-5   Range Hold Configuration Options

Parameter	Description	Measurable input power level @1300nm
0	When the **[HOLD]** button is pressed the amplifier autoranges to find the optimum range, then the amplifier is held on this range of amplification.	Depends on the unit's range of amplification.
1	When the **[HOLD]** button is pressed amplifier autoranging is disabled and the amplifier is set to range 1.	900μW to 2mW
2	When the **[HOLD]** button is pressed amplifier autoranging is disabled and the amplifier is set to range 2.	90μW to 1.5mW
3	When the **[HOLD]** button is pressed amplifier autoranging is disabled and the amplifier is set to range 3.	9μW to 150μW
4	When the **[HOLD]** button is pressed amplifier autoranging is disabled and the amplifier is set to range 4.	900nW to 15μW
5	When the **[HOLD]** button is pressed amplifier autoranging is disabled and the amplifier is set to range 5.	90nW to 1.5μW
6	When the **[HOLD]** button is pressed amplifier autoranging is disabled and the amplifier is set to range 6.	9nW to 150nW
7	When the **[HOLD]** button is pressed amplifier autoranging is disabled and the amplifier is set to range 7.	1nW to 15nW

4.12.13 FUNCTION 12 - Display Software Revision Level

To display the software revision level enter into the secondary functions menu. Select secondary function number 12. The software revision level will be displayed on the parameter field of the LCD. The [dBm/WATT] button and the [dB] button are not used for this secondary function.

575L BENCH TOP POWER METER   RIFOCS CORP.

4.12.14 FUNCTION 13 - Set dB mode configuration

The 575L has four different dB modes. By accessing secondary function 13 the operator can configure the instrument to operate in the desired dB mode. The dB modes operate as follows:

dB mode #1 - Selecting a parameter value of 1 for secondary function 13 configures the instrument for dB mode 1. This is the standard dB mode that is used for making insertion loss measurements. This is the dB mode that must be used when the instrument is used with a 585RL or a 586RL. When the [dB] button of the 575L is pressed the optical power is measured and becomes the dB reference.

dB mode #2 - Selecting a parameter value of 2 for secondary function 13 configures the instrument for dB mode 2. This configuration is used when the instrument is used with the 588RL. When the instrument is in dB mode 2, pressing the [dB] button sends a command to the 588RL to turn on its 1300nm laser. The 575L will wait 5 seconds for the laser to stabilize. Then the input power is measured and becomes the 1300nm dB reference.

dB mode #3 - Selecting a parameter value of 3 for secondary function 13 configures the instrument for dB mode 3. This configuration is used when the instrument is used with the 588RL. When the instrument is in dB mode 3, pressing the [dB] button sends a command to the 588RL to turn on its 1550nm laser. The 575L will wait 5 seconds for the laser to stabilize. Then the input power is measured and becomes the 1550nm dB reference.

dB mode #4 - Selecting a parameter value of 4 for secondary function 13 configures the instrument for dB mode 4. This configuration is used when the instrument is used with the 588RL. When the instrument is in dB mode 4, pressing the [dB] button sends a command to the 588RL to turn on its 1300nm laser. The 575L will wait 5 seconds for the laser to stabilize, then the input power is measured and becomes the 1300nm dB reference. Then the 575L sends a command to the 588RL to turn on its 1550nm laser. The 575L will wait 5 seconds for the laser to stabilize, then the input power is measured and becomes the 1550nm dB reference.

4.13   Error Codes

When the 575L detects an error condition during its operation, the error will be indicated by the appropriate error message being displayed on the 575L's LCD display. 3 shows the LCD display while displaying an error code. 5 lists the error codes that are displayed on the LCD and what they mean. For information on how to recover from an error condition see section 12.2.

4-18

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Table 4-6   Error Codes

ERROR CODE	CONDITION
E1	EEPROM chip is bad. Contact factory for repair.
E2	Zeroing error. Optical input port not completely darkened.
E3	ROM chip is bad. Contact factory for repair.
E4	A relative REL+RATIO unit has stopped receiving a signal from the reference REF unit.
E5	More than one unit configured as a reference REF unit while trying to take multi-channel dB ratio measurements.
E6	The attempted recalibration did not complete successfully. Too much light received at optical input. See section 11.
E7	The attempted recalibration did not complete successfully. Not enough light received at optical input. See section 11.
E8	The attempted recalibration did not complete successfully. The CAL/RUN switch is not in the CAL position. See section 11.
E9	This error indicates that the EEPROM lost some of its data. The factory default values will be loaded into EEPROM. The calibration data stored in EEPROM is not affected.
E26	When the 575L is operated with a 588RL, the 575L must be set to I^2C address 2. The 588RL must be set to I^2C address 1.
E27	This error occurs when a 588RL is unable to retrieve an insertion loss measurement from the 575L, because the user has not yet taken the dB reference with the 575L.
E28	This error is reported if the 575L is not configured to be operated with a 588RL. Access secondary function #13 and configure the 575L for dB mode 4.
E29	This error is reported if the 575L is being used with a 585RL/586RL or 588RL, but is not calibrated at 1300nm or 1550nm.

5 SYSTEM CONFIGURATION

The 575L is equipped with an RS232 interface, an I^2C Bus interface, and a parallel printer interface. The RS232 interface makes it possible to control the 575L from a remote computer. The I^2C interface makes it possible to connect multiple 575Ls together. The printer interface enables the user to print hard copies of power readings and other information to a parallel printer. This section deals with the RS232, I^2C interface, and parallel printer connections.

5.1 Typical Systems

```
            ┌─────────────────────────┐
            │                         │
            │        COMPUTER         │
            │                         │
            │                         │
            │        COM PORT         │
            │         ┌─────┐         │
            └─────────┤     ├─────────┘
                      │     │
                      │     │
                      │     │
            ┌─────────┤     ├─────────┐
            │     RS232 INTERFACE     │
            │                         │
            │                         │
            │          575L           │
            │                         │
            │                         │
            └─────────────────────────┘
```
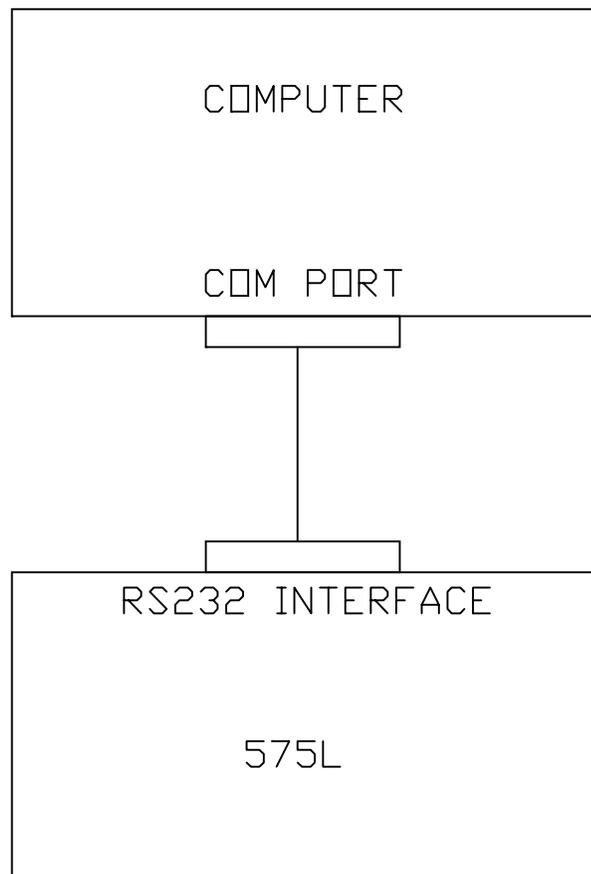
Figure 5-1   A single 575L controlled by a computer.
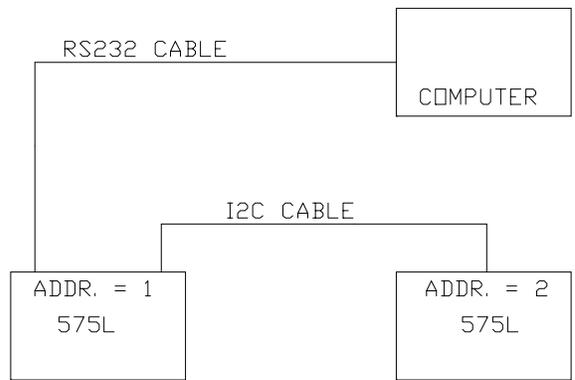
Figure 5-2   Two 575Ls controlled by a computer.
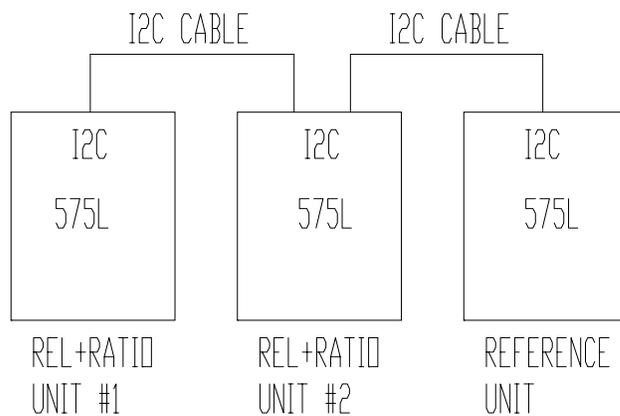
Figure 5-3   Multi-channel dB ratio measurements.

5-3

```
┌─────────────────────────────────┐
│                                 │
│     PARALLEL  PRINTER           │
│                                 │
│     PRINTER  CONNECTOR          │
│                                 │
└────────────┬────────────────────┘
             │
             │
             │
             │
             │
             │
      ┌──────┴──────┐
┌─────┴─────────────────────────────┐
│                                   │
│    PARALLEL  PRINTER              │
│    INTERFACE                      │
│                                   │
│                                   │
│          575L                     │
└───────────────────────────────────┘
```
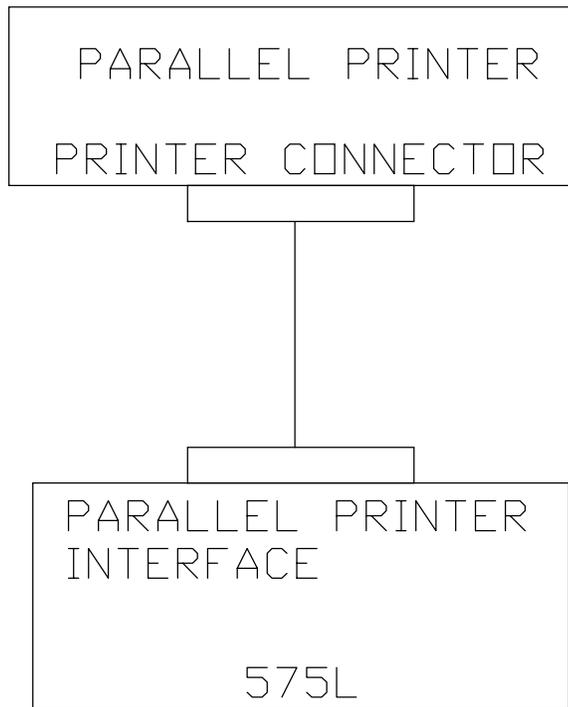
Figure 5-4   A   575L   connected   to   a parallel printer.

5.2   RS232 Interface

Table 5-1   575L RS232 Interface Pinout.

PIN NUMBER	DESCRIPTION	DIRECTION
Pins 1, 8-19, 21-25	No Connection	
Pin 2	RxD	Input (to 575L)
Pin 3	TxD	Output (from 575L)
Pin 4	RTS	Input
Pin 5	CTS	Output
Pin 6	DSR	Output (This line is always +9V)
Pin 7	Ground	
Pin 20	DTR	Input

SERIAL RS-232

PIN 25   PIN 1

Figure 5-5   RS232 Connector Pinout.

The 575L RS232 interface is designed to communicate using 8 data bits, 1 stop bit, no parity. 1 and 5 show how the RS232 interface is wired. The 575L uses the CTS/RTS handshaking lines for flow control, the XON/XOFF protocol is not supported. 2 shows how the cable, for connecting between a PC compatible computer and the 575L, is wired.

Table 5-2   RS232 Interface Cable.

Host PC			Cable	575L Cable Connector (Male DB-25)	
	Cable Connector Pin				
SIGNAL	PC / XT (FEMALE DB-25)	PC / AT (FEMALE DB-9)		Pin	Signal
TxD	2	3	>> Data to 575L	2	RxD
RxD	3	2	<< Data to Host	3	TxD
RTS	4	7	Handshake	4	RTS
CTS	5	8	Handshake	5	CTS
DSR	6	6	<< DSR to Host	6	DSR
GND	7	5		7	GND
DTR	20	4	>> DTR to 575L	20	DTR

5.3   I^{2}C Bus Connections

The I^{2}C interface is wired as shown in 6. The I^{2}C Bus cable is shown in 6.
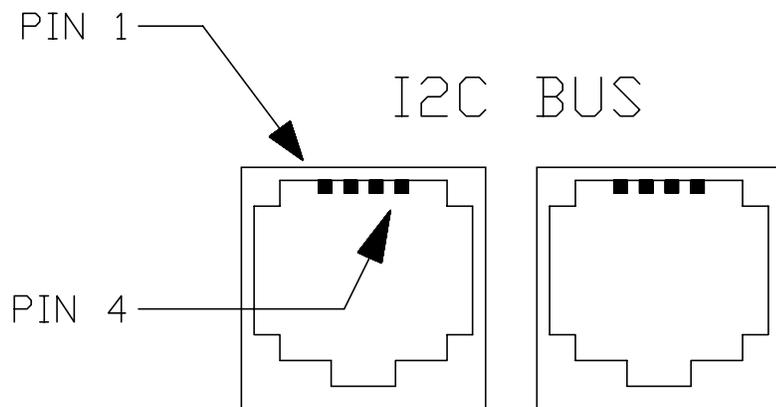
PIN #	DESCRIPTION
1	CLOCK
2, 3	GROUND
4	DATA

Figure 5-6   I^{2}C Bus Interface Pinout

P1 (Modular Plug 6P4C)   P2 (Modular Plug 6P4C)
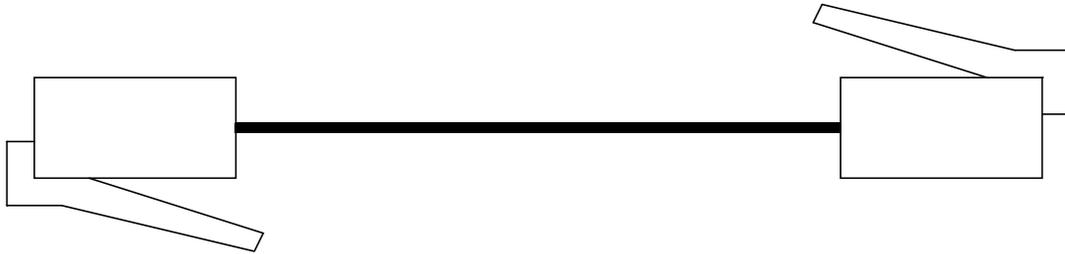
P1 pin#	P2 pin#
1	1
2	2
3	3
4	4

Figure 5-7   I^{2}C Bus Cable.

NOTE

The I^{2}C Bus cable is not compatible with the wiring of the standard modular telephone jack cables.
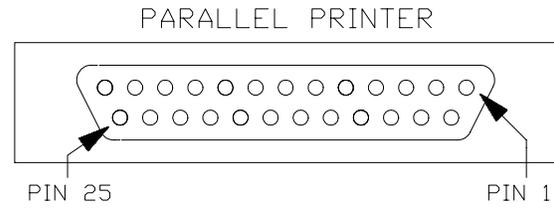
Figure 5-8   Parallel   Printer   Connector Pinout.

Table 5-3   Parallel Printer Connector Wiring.

PIN NUMBER	PIN DESCRIPTION	DIRECTION
1	!Strobe	Output
2	Data 1	Output
3	Data 2	Output
4	Data 3	Output
5	Data 4	Output
6	Data 5	Output
7	Data 6	Output
8	Data 7	Output
9	Data 8	Output
10	!Ack	Input
11	Busy	Input
12	Ground	
13	No Connection	
14	No Connection	
15	No Connection	
16	No Connection	
17	No Connection	
18-25	Ground	

6   REMOTE OPERATION

Table 6-1   Summary of Remote Commands

COMMAND	DESCRIPTION	PARAMETER	SECTION
AUTO	Select autoranging	None	6.1.1
AW	Returns the AMPS/WATT value of the specified wavelength register	1-8	6.1.2
CAL	Wavelength select	+,-,(600-1600)	6.1.3
CH	Send remote commands to the specified I^{2}C address	1-16	6.1.4
DB	Select relative log units	None	6.1.5
DBM	Select absolute log units	None	6.1.6
DEL_LAMDA	Deletes the calibrated wavelength of the specified wavelength register	1-8	6.1.7
GET_DATE	Returns the date (dd-mm-yyyy)	None	6.1.8
GET_LBLNUM	Returns the currently selected label number	None	6.1.9
GET_LOPASS	Returns the state of the lopass filter (on/off)	None	6.1.10
GET_MODE	Returns the default operating mode	None	6.1.11
GET_SN	Returns the label serial number	None	6.1.12
GET_TIME	Returns the time (International format)	None	6.1.13
HOLD	Select range hold	None	6.1.14
INIT_CLOCK	Used after the clock battery has been replaced	None	6.1.15

Table 6-1 Summary of Remote Commands (continued)

COMMAND	DESCRIPTION	PARAMETER	SECTION
LOCAL	Enables the front panel buttons	None	6.1.16
LOCKOUT	Disables the front panel buttons	None	6.1.17
LOPASS	Disable/enable the 575L's lowpass filter at A/D input	0-1	6.1.18
PRINT	Prints a label	None	6.1.19
RANGE	Select range hold and set amplifier to specified range	1-7	6.1.20
READ	Returns power reading	None	6.1.21
READ_LABEL	Returns the indicated label format file	1-7	6.1.22
RECAL	Perform the optical calibration at the specified wavelength, wavelength register, and input power (μW)	Wavelength register (1-8) Wavelength value (600-1600) Input Power (0.50-150.00)	6.1.23
RESET	Resets the 575L	None	6.1.24
RESTORE	Loads EEPROM with factory default values	None	6.1.25
SAVE	Make the present operating mode the default	None	6.1.26
SET_DATE	Set the 575L internal calendar date (Day-Month-Year)	1-1-1993 to 31-12-2100	6.1.27
SET_LABEL	Select a printer label format	1-7	6.1.28

Table 6-1   Summary of Remote Commands (continued)

COMMAND	DESCRIPTION	PARAMETER	SECTION
SET_MODE	Sets the default operating mode	0-3	6.1.29
SET_SN	Set serial number	0-65535	6.1.30
SET_TIME	Set the 575L internal clock time	00:00-23:59	6.1.31
VER	Returns the software revision level	None	6.1.32
WATT	Select absolute linear units	None	6.1.33
WAVE_REG	Returns the currently selected wavelength register	None	6.1.34
WLEN	Returns wavelength of the specified wavelength register	1-8	6.1.35
ZERO	Zero the detector	None	6.1.36

The 575L is supplied with an RS232 interface and an I^2C Bus interface. This makes it possible to control one or more 575Ls from a single computer. This section describes how to operate and control the 575L from a remote computer.

6.1   Remote Commands

The 575L can be controlled by remote over the RS232 interface. To communicate with the 575L over the RS232 interface first select one of four BAUD Rates (1200,2400,4800,9600). The BAUD Rate selection is covered in section 0. Then connect the 575L to a computer with an RS232 cable. Make sure the computer is set to the same BAUD Rate as the 575L. Command strings can be sent as either upper or lower case.

6.1.1 THE "AUTO" REMOTE COMMAND

To enable amplifier autoranging send the string "auto".

6.1.2 THE "AW" REMOTE COMMAND

If the user wants to know what the AMPS/WATT value for a particular wavelength is, the string "aw,n" is sent, where n corresponds to the wavelength register (1 <= n <= 8). The 575L will then transmit back a value in the 3rd field of the 575L data return string. The value will be a number 1-4095. The AMPS/WATT value is calculated by dividing the return value by the constant 3358. Thus if a value of 3000 was returned by the 575L, the amps/watt would be 0.89 (ie 3000/3358).

6.1.3 THE "CAL" REMOTE COMMAND

To select an alternate calibration wavelength by remote the "cal" command is used. There are 3 different ways of using the "cal" command. Sending the string "cal,+" selects the next available calibration wavelength. Sending the string "cal,-" selects the previously available calibration wavelength. To randomly select a calibration wavelength send the string "cal,xxxx". For example if 1300nm is one of the calibration wavelengths, then send the string "cal,1300" to select that wavelength.

6.1.4 THE "CH" REMOTE COMMAND

This command is used when two or more 575Ls are connected together on the I^2C Bus. Refer to 1 for the following example.
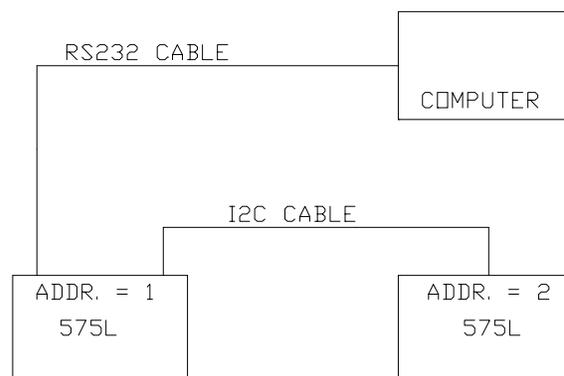

Figure 6-1   Two 575Ls controlled by a computer.

If the user wants to control 575L #2 with the computer, send the string "ch,2", now all remote command will be sent to 575L #2.

6.1.5 THE "DB" REMOTE COMMAND

The 575L can be put into the dB mode by remote over the RS232 interface. This is done by sending the string "db".

6.1.6 THE "DBM" REMOTE COMMAND

The 575L can be put into the dBm mode by remote over the RS232 interface. This is done by sending the string "dbm".

6.1.7 THE "DEL_LAMDA" REMOTE COMMAND

To delete a calibration wavelength from the 575L send the string "del_lambda,n" where $1 <= n <= 8$. NOTE: the n represents one of the eight wavelength registers.

6.1.8 THE "GET_DATE" REMOTE COMMAND

To get the date from the 575L send the string "get_date". The 575L will return the date that is stored in its internal calendar. The date will be returned in the 3rd field of the 575L data return string.
For example this is what the data return string would look like if the date was October 12, 1993: "1,3,**12-10-1993**,7,0,850,0". See 6-3 and 6-4 for examples of the data return string.

6.1.9 THE "GET_LBLNUM" REMOTE COMMAND

To get the currently selected label number send the "get_lblnum" string. The label number will be returned in the 3rd field of the 575L data return string. For example if the currently selected label number is 6 the data return string would look like this: "1,3,**6**,7,0,850,0". See 6-3 and 6-4 for examples of the data return string.

6.1.10 THE "GET_LOPASS" REMOTE COMMAND

To get the state of the low pass filter (on or off) send the string "get_lopass". The state of the low pass filter will be returned in the 3rd field of the 575L data return string (0=off/1=on). For example if the low pass filter is on, the data return string would look like this: 1,3,**1**,7,0,850,0. See 6-3 and 6-4 for examples of the data return string.

6.1.11 THE "GET_MODE" REMOTE COMMAND

To get the default operating mode of the 575L send the string "get_mode". The default operating mode will be returned in the 3rd field of the 575L data return string. The value returned will 0-3 where
0 = WATT mode
1 = dBm mode
2 = WATT+HOLD mode
3 = dBm+HOLD mode

For example if the default operating mode is dBm, the data return string would look like this: "1,3,**1**,7,0,850,0". See 6-3 and 6-4 for examples of the data return string.

6.1.12 THE "GET_SN" REMOTE COMMAND

To get the label serial number, send the "get_sn" string. The label serial number will be returned in the 3rd field of the 575L data return string. For example if the label serial number = 10101, the data return string would look like this: "1,3,**10101**,7,0,850,0". See 6-3 and 6-4 for examples of the data return string.

6.1.13 THE "GET_TIME" REMOTE COMMAND

To get the time from the 575L, send the "get_time" string. The time that is stored in the 575L's internal clock will be returned in the 3rd field of the 575L data return string. For example if the time = 14:55, the data return string would look like this: "1,3,**14:55**,7,0,850,0". See 6-3 and 6-4 for examples of the data return string.

6.1.14 THE "HOLD" REMOTE COMMAND

To select the range hold function by remote send the string "hold". To exit this mode send string "auto".

6.1.15 THE "INIT_CLOCK" REMOTE COMMAND

The 575L's internal clock/calendar circuit is powered by a rechargeable AA size 1.25V Nicad battery. Normally the user should never need to replace the battery, however if it is replaced, it will be necessary to initialize the clock/calendar. This is done by sending the string "init_clock".

6.1.16 THE "LOCAL" REMOTE COMMAND

To enable the 575L front panel buttons send the string "local".

6.1.17 THE "LOCKOUT" REMOTE COMMAND

To disable the 575L front panel buttons send the string "lockout".

6.1.18 THE "LOPASS" REMOTE COMMAND

To turn on/off an internal low pass filter at the A/D input send the string "lopass,n". If n=1 the low pass filter is turned on, if n=0 the low pass filter is turned off.

6.1.19 THE "PRINT" REMOTE COMMAND

To print a label send the string "print".

6.1.20 THE "RANGE" REMOTE COMMAND

To set the amplifier to one of its seven ranges of amplification send the string "range,n" where $1 <= n <= 7$. The auto ranging is disabled after the range command is received.

6.1.21 THE "READ" REMOTE COMMAND

To get a power reading from a remote 575L send the string "read". The power reading will be returned in the 3rd field of the 575L data return string. For example this is what the data return string would look like if power = -10.00dBm: "1,3,**-10.00**,7,0,850,0". See 6-3 and 6-4 for examples of the data return string.

6.1.22 THE "READ_LABEL" REMOTE COMMAND

To read the contents of a label format file, send the string "read_label,n" where n corresponds to the label number (1 <= n <= 7).

6.1.23 THE "RECAL" REMOTE COMMAND

To recalibrate the 575L send the string "recal,x,yyyy,zzzz" where x = he wavelength register that is being recalibrated (1 <= x <= 8), yyyy = the calibration wavelength (600 <= yyyy <= 1600), and zzzz = the calibration power level measured in uW (0.50 <= zzzz <= 150.0).

6.1.24 THE "RESET" REMOTE COMMAND

To reset the 575L, send the string "reset". The 575L will be initialized to its default operating mode.

6.1.25 THE "RESTORE" REMOTE COMMAND

Sending the string "restore" will load the 575L EEPROM with factory set default values.

6.1.26 THE "SAVE" REMOTE COMMAND

To make the current operating parameters the default send the string "save".

6.1.27 THE "SET_DATE" REMOTE COMMAND

To set the date of the 575L's internal clock/calendar send the string "set_date,dy,mn,year" where 1 <= dy <= 31 , 1 <= mn <= 12 and 1993 <= year <= 2100.

6.1.28 THE "SET_LABEL" REMOTE COMMAND

To select a label by remote send the string "set_label,n" where n corresponds to the label number (1 <= n <= 7).

6.1.29 THE "SET_MODE" REMOTE COMMAND

To set the default operating mode of the 575L, send the string "set_mode,n" where 0 <= n <= 3. The value of n corresponds to the following modes:
0 = WATT mode
1 = dBm mode
2 = WATT+HOLD mode
3 = DBM+HOLD mode

6.1.30 THE "SET_SN" REMOTE COMMAND

To set the label serial number by remote send the string "set_sn,nnnnn" where 0 <= nnnnn <= 65535.

6.1.31 THE "SET_TIME" REMOTE COMMAND

To set the time of the 575L's internal clock/calendar send the string "set_time,hr,min" where 0 <= hr <= 23 and 0 <= min <= 59.

6.1.32 THE "VER" REMOTE COMMAND

To get the software revision level from a remote 575L send the string "ver". The revision will be returned in the 3rd field of the 575L data return string. For example this is what the data return string would look like if the revision level is 1.02: "1,3,**575L-V1.02**,7,0,850,0". See 6-3 and 6-4 for examples of the data return string.

6.1.33 THE "WATT" REMOTE COMMAND

The 575L can be put into the WATT mode by remote over the RS232 interface. This is done by sending the string "WATT".

6.1.34 THE "WAVE_REG" REMOTE COMMAND

To get the currently selected wavelength register send the string "wave_reg". The value of the wavelength register (1-8) will be returned in the 3rd field of the 575L data return string. For example if the currently selected wavelength register = 8, the data return string would look like this: "1,1,**8**,7,0,850,0". See 6-3 and 6-4 for examples of the data return string.

6.1.35 THE "WLEN" REMOTE COMMAND

If the user wants to know what wavelength is stored in a particular wavelength register the string "wlen,n" is sent, where n corresponds to the wavelength register (1 <= n <= 8). The wavelength will be returned in the 3rd field of the 575L data return string. For example this is what the data return string would look like if wavelength = 1300: "1,3,**1300**,7,0,850,0". See 6-3 and 6-4 for examples of the data return string.

6.1.36 THE "ZERO" REMOTE COMMAND

To zero the 575L's detector send the string "zero". If the detector is not completely darkened an error will result.

6.2   Creating and Loading Label Format Files

The 575L has the capability of printing hard copies (labels) to a parallel or serial printer. The user can store up to 7 different labels in the 575L's non-volatile memory (EEPROM). This section describes how to create a label format, and how to down load it to the 575L.

6.2.1 Creating a Label Format File

The label format file is created by using a text editor and by following certain rules. The 1st character in the label format file **must** always be the '@' character followed immediately by a number from 1-7. The number specifies which label the file will be stored as, ie Label 1, Label 2, Label 3, Label 4, Label 5, Label 6, Label 7. The last character in the file must always be the '~' (tilde) character, this is the label end of file character. The file size must not exceed 256 characters.

The following example shows how to create a label format file.

@1

.

. (label format data goes here)

.

~

It is possible to print on a label the following parameters:

1) Power
2) Wavelength
3) Time
4) Date
5) Serial number
6) Special ASCII characters

To print these parameters on a label refer to 6-2.

Table 6-2   Format Specifiers for Label Printing

Control Sequence	Description
%P	This will print the power reading. If the unit is in dB mode then the dB reading is printed.
%R	This will print the reference power if the unit is in the dB mode. If the unit is not in the dB mode nothing will be printed.
%W	This will print the currently selected calibration wavelength.
%S	This will print the serial number. The serial number will be incremented each time it is printed. To set the serial number from the front panel see Section 3.13.3. To set the serial number by remote see Section 6.2.13.
%D	This will print the date, (mmm-dd-yyyy).
%d	This will print the date, (dd-mmm-yyyy). To set the date from the front panel see Section 3.13.8 and 3.13.9. To set the date by remote see Section 6.2.17.
%T	This will print the time using the international format. To set the time from the front panel see Section 3.13.10. To set the time by remote see Section 6.2.16.
%t	This will print the time using the standard format.

Table 6-2   Format Specifiers for Label Printing (continued)

Control Sequence	Description

/nnn	This will print the ASCII code corresponding to the 3 digit decimal number nnn. (Note: 3 digits must follow the '/' character). If you want to print a '/' character, you must type it in as "//".
	 EXAMPLE:
	   /218 will print ⌐
	
	   /179 will print |
	
	   /192 will print ⌐
	
	   // will print /

@	The '@' character must always be the 1st character in a label format file. This lets the 575L know that the text following the '@' is label format data.
~	The '~' character is used as the label format file End-Of-File flag. The '~' character must always be the last character in the label format file.

The following example shows a label format file.

```
--------------------------------------------------------
@1
RIFOCS Corporation
Power:          %P
Wavelength:  %W
Time:  %T
Date:           %D
sn:             %S
~
--------------------------------------------------------
```

6-13

NOTE
All characters are taken literally except for the Control Sequence Characters in 2.

6.2.2 Down Loading a Label Format File

Once the file has been created it can be down loaded via the RS232 data link. Make sure that the computer and the 575L are set up to communicate at the same BAUD Rate. To set the BAUD Rate of the 575L see section 0.

The 575L RS232 interface is designed to communicate using 8 data bits, 1 stop bit, no parity. 1 and 5 shows how the RS232 interface is wired.
The following example shows how a label format file would be down loaded to a 575L from an IBM compatible computer:

"c:\copy label.dat com1:"

where label.dat is the label format file that was created in section 0.

6.3   Data Format

Whenever a command is sent to the 575L a data return string will be sent back, with the exception of the "read_label" command which sends back the contents of the indicated label format file.
When the 575L sends the data return string to the host computer the data is in a format as shown below.

"I^{2}C addr., mode, return value, range, hold, wavelength, error/status"

Table 6-3   Return String Data Format (continued)

PARAMETER	VALUE
Currently selected wavelength	(600-1600nm)
Error	(0-23) 0 = No errors 1 = EEPROM error. This indicates that the EEPROM chip is bad. Contact factory for repair. 2 = Zeroing error. Optical input port not completely darkened. 3 = ROM error. This indicates that the ROM chip has lost some of its data. Contact factory for repair. 4 = A relative REL+RATIO unit has stopped receiving a signal from the reference REF unit. 5 = More than one unit configured as a reference REF unit while trying to take multi-channel dB ratio measurements. 6 = Calibration error. Too much light was present at the optical input during calibration. 7 = Calibration error. Not enough light was present at the optical input during calibration. 8 = Calibration error. CAL/RUN switch is not in the CAL position. 9 = EEPROM error. Some of the EEPROM memory was lost. The factory default EEPROM values will be loaded into EEPROM. 10 = dB command sent when the 575L was displaying HI or LO. 11 = Power level too high to measure. 12 = Power level too low to measure. 13 = Tried to change wavelengths while unit in dB mode.

Table 6-3   575L Return String Data Format (continued)

PARAMETER	VALUE
Error	14 = Invalid wavelength sent with the "cal" command. 15 = An unrecognized command was received. 16 = Illegal number format received. 17 = A command parameter is outside of its accepted range. 18 = Too few parameters were sent with a command. 19 = Too many parameter were sent with a command. 20 = The command string was not terminated correctly. 21 = Parameter string was too long. 22 = Improper character at string location. 23 = Device at indicated I^2C address not responding. 25 = Invalid I^2C address.

Table 6-4   575L Data Return String Examples

Return String	Description
10,1,-50.06,6,0,850,0	This is the string returned after the "READ" command was sent to the 575L. I^2C address = 10 Mode = 1 (dBm) Power reading = -50.06 Amplifier range = 6 Range hold = 0 Wavelength = 850 (nm) Error/status = 0
10,2,-00.04,6,0,850,0	This is the string returned after the "READ" command was sent to the 575L. I^2C address = 10 Mode = 2 (dB) Power reading = -00.04 Amplifier range = 6 Range hold = 0 Wavelength = 850 (nm) Error/status = 0
10,3,+8.697E-09,6,0,850,0	This is the string returned after the "READ" command was sent to the 575L. I^2C address = 10 Mode = 3 (WATT) Power reading = +8.697E-09 Amplifier range = 6 Range hold = 0 Wavelength = 850 (nm) Error/status = 0

Table 6-4   575L Data Return String Examples (continued)

Return String	Description
10,1,1300,6,0,850,0	This is the string returned after the "WLEN,2" command was sent to the 575L. I^2C address = 10 Mode = 3 (WATT) Wavelength returned = 1300 (nm) Amplifier range = 6 Range hold = 0 Wavelength = 850 (nm) Error/status = 0
10,3,575L-V1.00,6,0,1300,0	This is the string returned after the "VER" command was sent to the 575L. I^2C address = 10 Mode = 3 (WATT) Software revision = 575L-V1.00 Amplifier range = 6 Range hold = 0 Wavelength = 1300 (nm) Error/status = 0
10,3,3024,6,0,1300,0	This is the string returned after the "AW,2" command was sent to the 575L. I^2C address = 10 Mode = 3 (WATT) AMPS/WATT value = 3024 Amplifier range = 6 Range hold = 0 Wavelength register = 1300 (nm) Error/status = 0

Table 6-4   575L Data Return String Examples (continued)

Return String	Description
1,1,17:28,6,0,850,0	This is the string returned after the "GET_TIME" command was sent to the 575L. I^2C address = 1 Mode = 1 (dBm) time = 17:28 (International format) Amplifier range = 6 Range hold = 0 Wavelength = 850 (nm) Error/status = 0
1,1,12-10-1993,6,0,850,0	This is the string returned after the "GET_DATE" command was sent to the 575L. I^2C address = 1 Mode = 1 (dBm) Date = 12-10-1993 (Oct 12, 1993) Amplifier range = 6 Range hold = 0 Wavelength = 850 (nm) Error/status = 0
1,1,4,6,0,850,0	This is the string returned after the "GET_LBLNUM" command was sent to the 575L. I^2C address = 1 Mode = 1 (dBm) Label number = 4 Amplifier range = 6 Range hold = 0 Wavelength = 850 (nm) Error/status = 0

Table 6-4   575L Data Return String Examples (continued)

Return String	Description
1,1,1,6,0,850,0	This is the string returned after the "GET_LOPASS" command was sent to the 575L. I^2C address = 1 Mode = 1 (dBm) Low pass = 1 (filter turned on) Amplifier range = 6 Range hold = 0 Wavelength = 850 (nm) Error/status = 0
1,1,0,6,0,1300,0	This is the string returned after the "GET_MODE" command was sent to the 575L. I^2C address = 1 Mode = 1 (dBm) Default mode = 0 (WATT) Amplifier range = 6 Range hold = 0 Wavelength = 1300 (nm) Error/status = 0
1,1,10101,6,1,1300,0	This is the string returned after the "GET_SN" command was sent to the 575L. I^2C address = 1 Mode = 1 (dBm) Label s/n = 10101 Amplifier range = 6 Range hold = 1 Wavelength = 1300 (nm) Error/status = 0

Table 6-4   575L Data Return String Examples (continued)

Return String	Description
1,1,3,6,0,1300,0	This is the string returned after the "WAVE_REG" command was sent to the 575L. I^2C address = 1 Mode = 1 (dBm) Wavelength register = 3 Amplifier range = 6 Range hold = 0 Wavelength = 1300 (nm) Error/status = 0

6.4   Using a Terminal Emulation Program with the 575L

The 575L can be controlled from a host computer with a terminal emulation software package such as Procomm or Telix. The following instructions explain how to control the 575L by remote with the Procomm software package.

1)   Start the Procomm program on the host computer.
2)   Verify that the communications parameters are set correctly. Press ALT+P to view the currently selected communications parameters.
3)   Put the host computer into the chat mode by pressing ALT+O. The host computer screen will now be split into a local section and a remote section. Remote commands can be sent to the 575L (from the local section of the host computer screen) and return data string will appear in the remote section of the host computer screen.

6.5   Programming Example in BASIC

```
'*************************************************************************
'
' Program Filename: 575DEMO1.BAS
'
' Purpose: This program gives user of the 575L a working example of how to control the '
'  575L from a computer using the BASIC programming language.
'
'
' Date: 7/8/93
'
' Compiler: Microsoft QuickBasic
'
' Description of program operation:
'  This program puts the 575L into the dBm mode and displays the data return string.
'
'*************************************************************************
'********************** MAIN PROGRAM **********************************
   CLS
   OPEN "com1:9600,n,8,1" FOR RANDOM AS #1          ' Com1 is connected to the 575L
   PRINT #1, "dbm"                                  ' Send the dBm command to 575L
   LINE INPUT #1, temp$                       ' Get data return string back from 575L
   LOCATE 20, 13, 1                            ' Position cursor on computer screen
   PRINT temp$                                       ' Display data return string
   CLOSE #1
END                                                          ' End of program
```

7   APPLICATIONS

This section illustrates the different applications of the 575L Fiber Optic Power Meter for measurement of sources, emitters, photoreceivers, fiber cable transmission, connector and splice loss.

7.1   Optical Power Measurement

The output power of an optical source is measured by simply coupling the output end of a fiber to the input of the power meter as shown in 2. Be sure you have the correct Snap-On fiber optic adapter on the optical input of the power meter. Be sure you know the source wavelength and are using a power meter calibrated for the same wavelength.

7.2   End-To-End Loss Measurement

There is no single value of attenuation for a fiber; there is simply an attenuation value associated with a specific measurement method. All measurement methods recreate certain conditions, especially launch conditions into multimode fibers. Also wavelength and spectral width are important. Repeated measurements on the same fiber with the same measurement method will produce the same value. Users of fiber should recognize that not all attenuation measurement techniques are equivalent. When attempting to correlate in-house measurements with those of the fiber manufacturer, it is necessary to test with the same attenuation method that was used by the fiber manufacturer.

A few more conditions must be correct before proper measurements can be made. Because of differential mode attenuation, the loss measured in multimode fibers depends on how the optical power is distributed among modes in the fiber. Under some launch conditions "leaky" (radiative) modes may be excited. This means that light launched into a fiber at steep angles is attenuated more than light which is launched into a fiber at shallow angles. To reduce the variation among loss measurements, efforts should be made to excite a mode distribution at the input end of the fiber which simulates the condition under actual use. The effect of modal distribution in an attenuation measurement should not be underestimated.

The Electronic Industries Association (EIA) has developed Fiber Optic Test Procedures (FOTP) for the standardization of these measurements. Method B is the most used procedure of FOTP-171. It is used for testing cable assemblies with the same connectors on each end. This method is used to screen out any cable assembly which has a higher loss from other cable assemblies. This test procedure is illustrated in 7-2 and 7-3.

The following 5 steps outline the procedure for performing end-to-end loss measurements:

1.)   Connect an LED Source to your launch cable with an EMS (Equilibrium Mode Simulator) performed on this cable. The LED source must overfill the launch cable both spatially and angularly. Connect the other end of your launch cable to your reference cable via an inline adapter. The other end of your cable connects to the RCVR optical port of the 575L power meter via the proper Snap-On series fiber optic adapter. Measure and record the optical power in dBm exhibited at the end of your reference cable. This is your initial power level (P_o). See 7-2.

IN ≫ 50/125 graded index fiber

Mandrel Wrap

OUT ≫

20mm
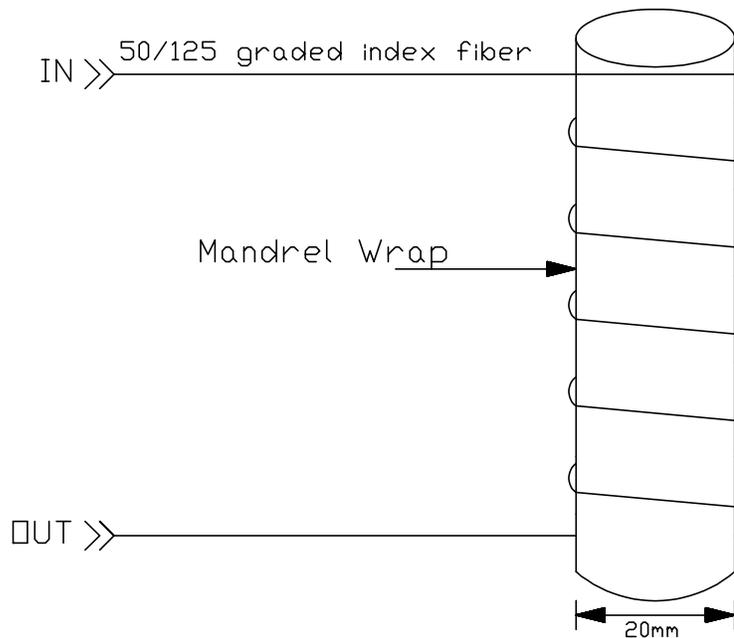
The input fiber of the EMS apparatus must be overfilled both spatially and angularly.

Figure 7-1   EMS Apparatus (Mandrel Wrap).

Note:

An EMS is an apparatus, such as a Mandrel Wrap, or suitable optics capable of simulating within a short fiber the equilibrium mode distribution exiting a long fiber under steady state conditions. Example: Five wraps of 50/125 graded index fiber on a 20mm (0.788-inch) diameter rod simulates the far field output radiation pattern of a fiber one kilometer in length. Consult FOTP-50 for further information.

2.)   The cable assembly to be tested is inserted between the reference launch cable and reference receive cable

3.)   Measure and record the power (P_1) in dBm exhibited on the power meter in the test data.

4.)   Now reverse the test cable. Measure and record a reading as previously described. This will ensure that any reversibility is accounted for in the measurement.

5.)   The loss of this cable assembly is:

 $$(dB)\ L = dBm\ (P_o) - dBm\ (P_{avg})$$

Note:

In practice the dB function could be used to perform this test. For example in step 1 instead of measuring and recording the optical power in dBm, just press the dB button. The optical power will be displayed in dBm by the small digits of the 575L LCD. The big digits of the 575L LCD will display 0.00dB. In step 3 the loss of the test cable will be displayed (in dB) by the big digits of the 575L LCD.
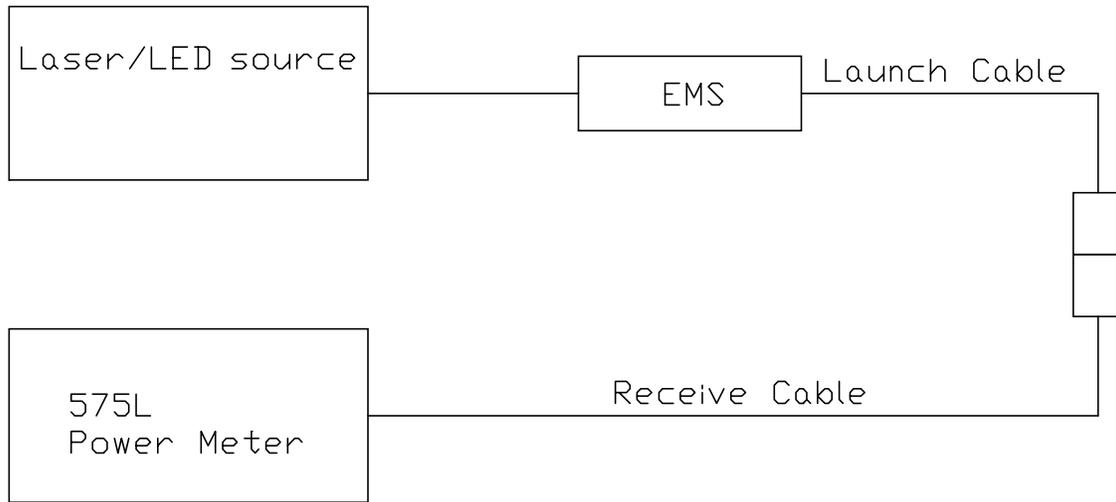
EMS = Equilibrium Mode Simulator

**Figure 7-2   Initial Reference Power Level.**
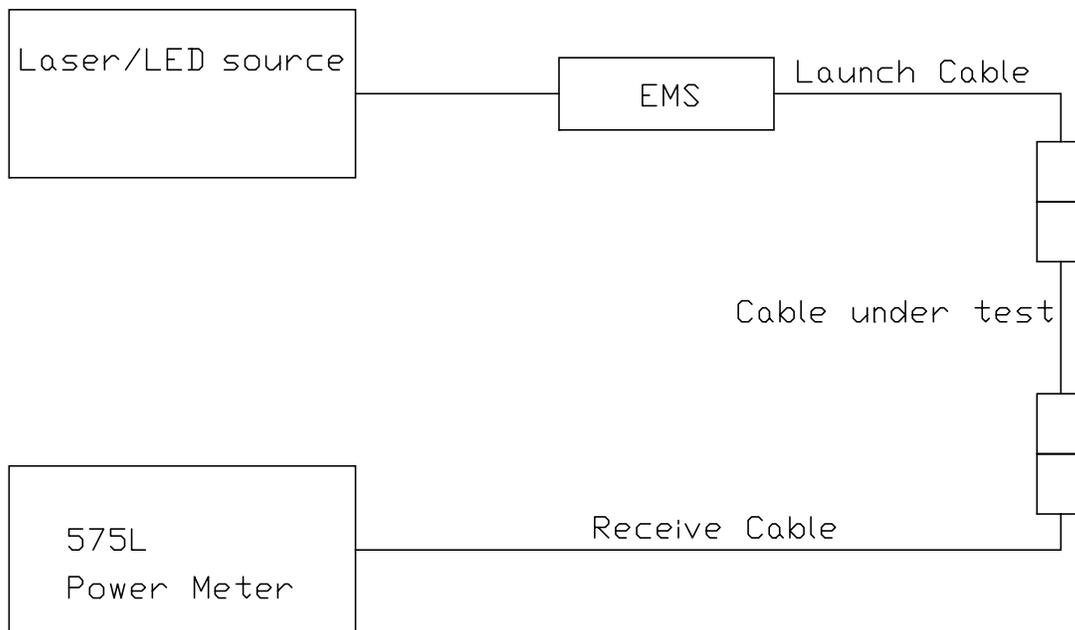
EMS = Equilibrium Mode Simulator

Figure 7-3   Test Cable Power Level.

7.4   Connector and Component Loss Measurement

The theory of measuring loss in a connector or splice is quite simple: Measure (in dBm) the power into the connector or splice and the power out of the connector or splice. The difference (in dB) is the connector or splice loss. In practice, the measurement technique can strongly influence the results, as discussed earlier. Two major variables are mode distribution and wavelength.

Method B is the most used procedure of FOTP-34 (see 7-4). This method is intended to determine the interconnecting device loss when installed in a long length optical link (steady state modal conditions). The "long launch" conditions are simulated by conditioning the output of the source with an Equilibrium Mode Simulator (EMS). The measurement is made by measuring the power (P_o, in dBm) out of the source side of the connector or splice, then measuring the optical power (P_1, in dBm) after the interconnect device is inserted. The loss of the connecting device is:

(dB) Loss = dBm (P_o) - dBm (P_1)
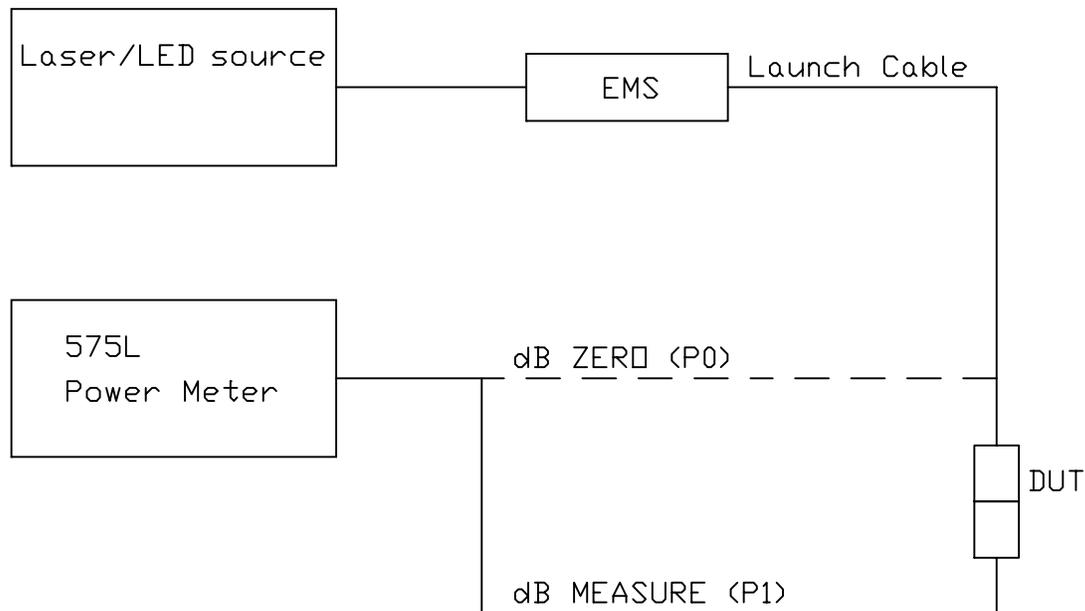
```
EMS = Equilibrium Mode Simulator.  In this case the EMS is used
      for simulating a long length of fiber. A 1km spool of fiber
      could be used instead.

DUT = Device Under Test.
```

Figure 7-4   Block Diagram of Component Insertion Loss Measurement.

7.5   References

The user may obtain a complete index of the available Fiber Optic Test Procedures (FOTP) by requesting Component Bulletin No. 9-E - Reference Guide for Fiber Optic Test Procedures by writing to the following address:

Electronic Industries Association
2001 Eye Street, N.W.
Washington, D.C.

8   THEORY OF OPERATION

This section contains an overall functional description of the 575L Power Meter.

8.1   Functional Description

Basically, the 575L is a microprocessor-based picoammeter with a high performance, low noise, solid state InGaAs (Indium Gallium Arsenide) photodiode on its front end. The basic components of the instrument are shown in 1.
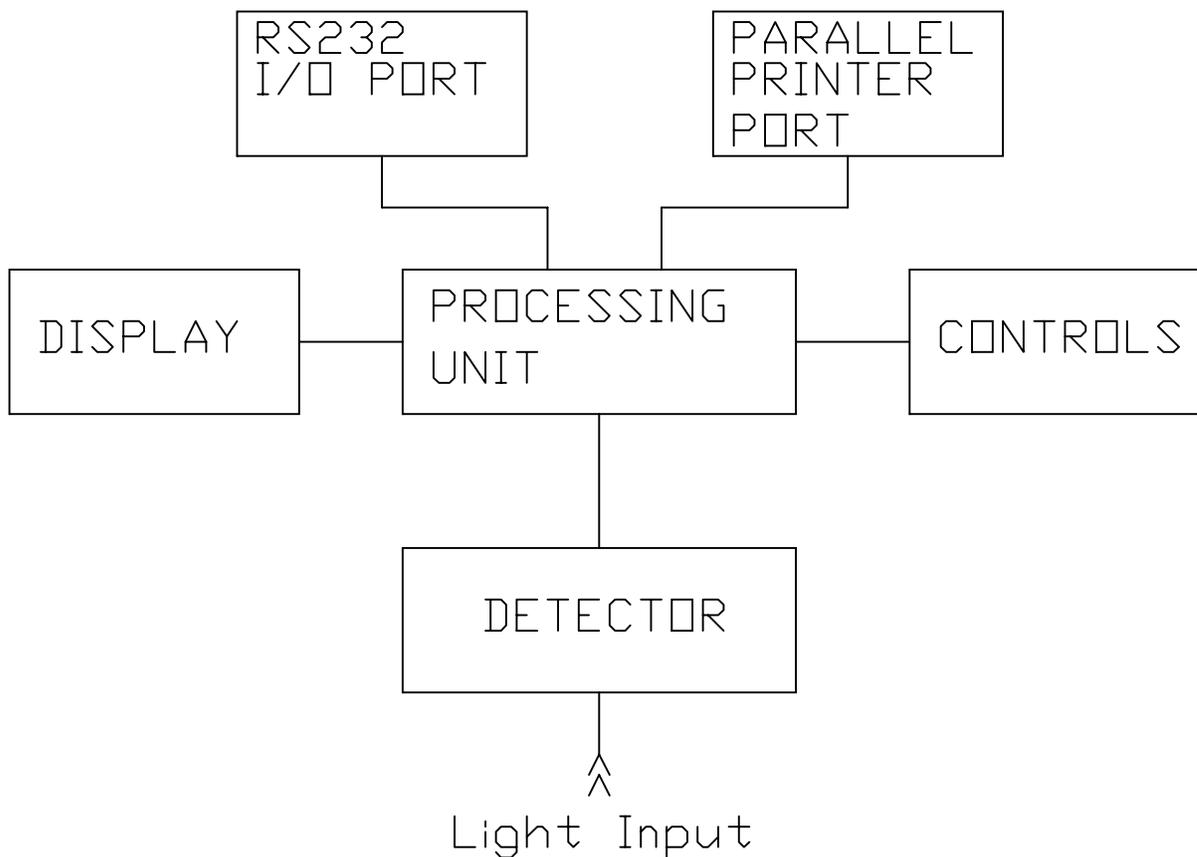

Figure 8-1   Basic Components of the 575L.

8.2   Optical Detector

Essentially the optical detector is a transducer used to collect and convert optical irradiance into an electrical signal (current). The term responsivity (R) is used to describe the sensitivity of the detector, and is the ratio of the ouput current to the input power. Responsivity is generally stated in terms of AMPS/WATT at a given wavelength.

The detector can be calibrated over the range 600nm to 1600nm. The sensitivity typically peaks at about 1500nm, with approximately 0.9μA per 1μW.

In simple terms, the internal CPU reads the photocurrent generated by the detector via the analog to digital converter (A/D), and divides it by the responsivity data for that particular wavelength. The result is the absolute optical power as shown in the equation below:

Power (WATTS) = I/R

where I = photocurrent, in AMPS.
R = responsivity, in AMPS/WATT.

The 575L electronics are divided among two circuit boards - CPU and Display. This section briefly describes the basic operation of each electronic block.

8.3   CPU Board

The CPU board centers around a derivative of the 8051 microcontroller.

Memory
Memory is composed of ROM (program memory), RAM (program data memory) and EEPROM (for calibration data and system parameter storage).

Amplifier
The amplifier is a transimpedence amplifier used to convert detector current to voltage. The amplifier has seven decades of gain. The output of this amplifier is passed to the A/D circuit. The A/D converts the signal to a digital value which can be read by the microcontroller.

Analog Output
The output of the amplifier is also sent to the analog output BNC connector located on the rear panel of the 575L. This analog output voltage is calibrated to the actual power being displayed by the power meter. The voltage level at the analog output BNC connector is determined by the optical input power, and by the present range of amplification.

Table 8-1   Relationship of the power reading to the analog output voltage.

Amplifier Range	575L Display (in WATT mode)	Analog Output
1	900.0μW to 2.000mW	0.09V to 0.20V
2	90.00μW to 1.500mW	0.09V to 1.50V
3	9.000μW to 150.0μW	0.09V to 1.50V
4	900.0nW to 15.00μW	0.09V to 1.50V
5	90.00nW to 1.500μW	0.09V to 1.50V
6	9.000nW to 150.0nW	0.09V to 1.50V
7	0.900nW to 15.00nW	0.09V to 1.50V

RS232 Interface

The RS232 interface makes it possible to control the 575L from a computer. The interface meets all RS232C and V.28 specifications. Refer to 5 and 1 for the wiring of the RS232 interface.

Inter-Integrated (I^2C) Circuit Bus

The I^2C Bus interface consists of a serial data (SDA) line and a serial clock (SCL) line which carry information between devices connected to the bus, and a ground line which connects the grounds between devices connected to the bus. Basically this interface makes it possible to connect multiple 575Ls together. Refer to 6 for the wiring of the I^2C interface.

Parallel Printer Interface

With the parallel printer interface it is possible to print data to a parallel printer. Refer to 8 and 3 for the wiring of the printer interface.

Power Supply Circuit

All power supply requirements are furnished via the linear power supply circuit. This circuit provides regulated ±5VDC. The power supply circuit has an input voltage range of 100-250 VAC, 50-60 Hz.

8.4 Display Board

The custom LCD (liquid crystal display), associated display driver, and the push buttons make up the major components of the Display Board. In operation the microcontroller outputs data to the board which is processed by the display driver and drives the tri-plexed LCD. When a user presses a button on the front panel that information is sent from the Display Board to the microcontroller.

9   ACCESSORIES

The 575L is shipped from the factory with an instrument manual, a Snap-On (SOC) series adapter, an optical metrology report, the AC line cord and spare fuses. The AC line cord supplied with the 575L is the 3-prong US=type (specify if a different configuration is required for over seas).

9.1   Fiber Optic Adapters

The fiber optic adapters listed in this section snap on to the optical input port. 2 shows an adapter being connected to the 575L's optical input port. It is important to note that the adapter and the optical port are keyed, so it is necessary to line them up before pressing the adapter onto the optical port. A substantial amount of force is required to remove the adapter from the optical port. When removing the SOC adapter it is necessary to firmly hold the instrument with one hand while pulling the adapter off with the other hand.

Table 9-1   RIFOCS Snap-On (SOC) series adapters

RIFOCS SOC Model	Description
1001	BLANK ADAPTER
1010	DIN 47256
1020	FC-PC
1030	ST
1040	DIAMOND HMS-10/HP
1050	DIAMOND HMS-0 (3.5mm)
1060	SC
1081	VFO
1082	BICONIC
1086	DIAMOND HMS-10/A (2.5mm SMA)
1087	SMA 905/906
1089	D4

9.2   Rack Mount Adapter

The rack mount adapter can hold two bench top instruments side by side in a 19 inch wide rack system.

9.3   Interface Cables

There are two different RS232 cables which are available for the 575L from RIFOCS as well as an I^{2}C Bus interface cable. Refer to table 9-2 for the RIFOCS part number and description of the cables.

Table 9-2   RIFOCS Interface Cables

P/N	Description	Cable Wiring
931	D25 female to D25 female, 3m	
932	D25 female to D9 female, 3m	
933	Multimeter bus (I^{2}C interface cable), 3m	Refer to Table 5-5
935	D25 male to D25 female, 3m	Refer to Table 5-2
936	D25 male to D9 female, 3m	Refer to Figure 5-2

Note:

The I^{2}C Bus interface cable looks like a telephone jack cable, however it is not compatible with the wiring of the standard modular telephone jack cable.

10   PERFORMANCE VERIFICATION

This section contains the information necessary to verify that the 575L is performing within the published specifications. Ideally performance verification should be performed when the instrument is first received to ensure that no damage or change in calibration has occurred during shipment. The verification procedure may also be performed whenever instrument accuracy is suspect or following calibration. If performance for any calibrated wavelength is outside of the specified limits, re-calibration can be performed as described in section 0.

NOTE
If the instrument does not meet the specifications and is still under warranty (less than 12 months since the data of shipment), contact RIFOCS Corporation to determine the action to be taken.

10.1   Environmental Conditions

All measurements should be made at an ambient temperature between 18°C and 25°C (65° to 77°F) with a relative humidity of less than approximately 70%.

10.2   Recommended Test Equipment

The procedures described in this section are for verifying the performance of the 575L at 1300nm. The recommended equipment list is given in 1. For verifying the calibration at other wavelengths, you will have to substitute other laser sources with the proper central or peak wavelength.

The test set-up requires a stable source at the wavelength to be calibrated, a precision optical attenuator, and reference standard such as a calibrated radiometer or photodiode. The source must be a highly stable laser source with at least ±5nm accuracy. A precision optical attenuator is required to verify linearity of the 575L. The reference standard should be one provided by your country's National Standards Laboratory (such as U.S. National Institute of Standards and Technology) or a commercial calibration lab providing similar services.

Table 10-1   Recommended Test Equipment

EQUIPMENT	SPECIFICATIONS
N.I.S.T. Secondary Transfer Standard for Optical Fiber Power (STSOFPM) Measurements	Accuracy: ±2% at 1550nm, 1300nm, 850nm, 780nm
RIFOCS Model 666R Laser Source or equivalent	Single-mode laser source, laser pigtailed using SMF-28 fiber Peak wavelength: 1550nm
RIFOCS Model 665R Laser Source or equivalent	Single-mode laser source, laser pigtailed using SMF-28 fiber Peak wavelength: 1300nm
RIFOCS Model 667R Laser Source or equivalent	Multi-mode laser source, laser pigtailed using SMF-28 fiber Peak wavelength: 850nm
RIFOCS Model 664R Laser Source or equivalent	Multi-mode laser source, laser pigtailed using SMF-28 fiber Peak wavelength: 780nm
Photodyne Model 1975XQ-010J SM Optical Attenuator or equivalent	Single-mode optical attenuator with FC-PC connectors on the optical ports Accuracy: Greater of ±0.20dB or ±2% Max. Insertion loss: Less than 5dB
RIFOCS single-mode fiber optic cable assembly P/N 2020-101-05 (Qty. 2)	Single-mode cable assembly terminated with FC-PC connectors on both ends Core/Cladding dia: 9/125μm
Computer with an RS232 interface, and a serial communications package installed.	The computer must have a serial port which conforms to the RS232-C standard.
RIFOCS Snap-On Fiber Optic Adapter	FC-PC adapter for the 575L

10.3   Initial Conditions

If the instrument has been subject to temperatures below 18°C (65°F) or above 25°C (77°F), allow sufficient time for the instrument to reach temperatures within this range. Generally, it takes one hour to stabilize an instrument that is 10°C (18°F) outside of this range.

10.4   Equipment Set-Up

1 shows how the appropriate equipment should be hooked together. Connect the output of the Model 665 Laser Source to the input of the attenuator using one of the single mode patch cables. Connect one end of the second patch cable to the output of the attenuator. The uncoupled end should be initially connected to the Transfer Standard.

D.U.T. =   Device Under Test.
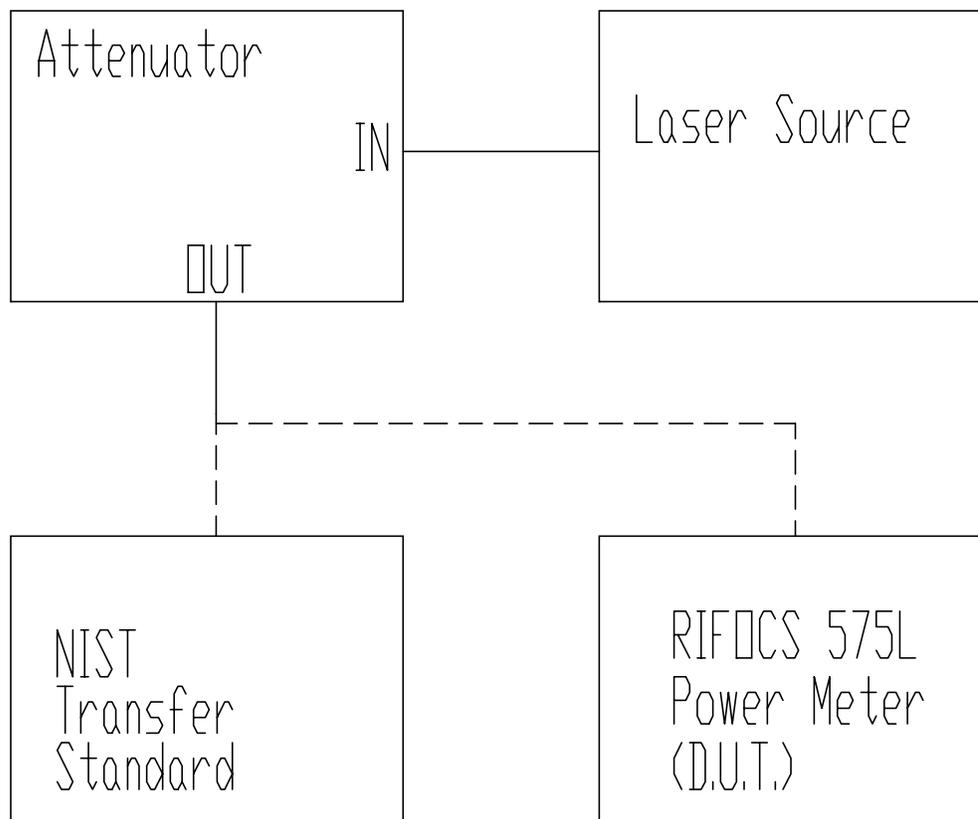
Figure 10-1   Diagram of equipment set-up for calibration.

10.5 Verifying Calibration Accuracy

Proceed as follows to check the accuracy of the 575L:

10.5.1 Set the attenuator to the proper cal wavelength (1300nm). Following this step, the instrument should indicate the -0.00dB attenuation setting.

10.5.2 Adjust the 665 Laser Source for maximum power output. This power is displayed on the Transfer Standard.

10.5.3 The highest signal to noise ratio is required to verify proper performance. At least 0.00dBm (after connector losses) optical power is required at the photodiode end of the patch cord to verify the full linearity of the 575L (to be tested in the following section). Less signal power will require reducing the testable range of the verification procedure.

10.5.4 Zero the 575L by darkening the optical input port and pressing the **[ZERO]** button.

10.5.5 Set the 575L to dBm units.

10.5.6 Use the UP/DOWN and dB functions of the 1975XQ to obtain a 10.00µW reading on the Transfer Standard. This is the absolute calibration power level.

10.5.7 Disconnect the fiber optic cable from the Transfer Standard and connect to the optical input of the 575L. The 575L should produce a stable reading between -19.75dBm and -20.25dBm. Subtract this reading from -20.00dBm to obtain the calibration offset factor (OFFSET).

10.6 Verifying Linearity

Proceed as follows to check the linearity of the 575L:

10.6.1 Press the **[RESET]** on the 1975XQ to reset the attenuation to -0.00dB. The calibration wavelength should still read 1300nm.

10.6.2 Set the 1975XQ **UP/DOWN STEP** parameter to 5.00dB. This will make it easy to step through the linearity test using the STEP function.

10-4

10.6.3 To verify proper linear operation of the 575L over its dynamic range, requires 1mW (0.00dBm) of optical power as measured by the Transfer Standard. Adjust the power controls of the 665 Laser Source until a reading of 1.000mW ±0.005mW is obtained. If less than 1 mW is available the user will have to derate the dB range of this verification test by that difference and correct the tolerances.

10.6.4 Use the 1975XQ UP function to sequence through each 5dB step. Record the Transfer Standard readings (in dBm units) to column 2 of 2.

10.6.5 Press **[RESET]** on the 1975XQ to reset the attenuation to 0.00dB.

10.6.6 Zero the 575L by darkening the optical input port and pressing the **[ZERO]** button.

10.6.7 Set the 575L to dBm units.

10.6.8 Disconnect the fiber optic cable from the Transfer Standard and connect to the optical input of the 575L. The meter should read the same value as observed at the 0.00dB setting of Step 4 within ±0.50dB.

10.6.9 Use the 1975XQ UP function to sequence through each 5dB step again. Record the power meter readings in column 3 of 2.

10.6.10   Calculate the deviation by computing the results for column 4. For each attenuator setting, compute the following result:

Transfer Std -   D.U.T.-   Offset
(Col 2)   (Col 3)   (From section 10.5.7)

To verify proper operation within specifications, the results of column 4 should fall within the ranges of column 5 of 10-2 for 780nm and 850nm, and 10-3 for 1300nm - 1550nm.

Table 10-2   Linearity Test Chart for 780nm, 850nm.

1975XQ dB Setting	Transfer Standard dBm Reading	575L dBm Reading	dB Deviation (section 0)	Tolerance (dB)
- 0.00	dBm		dB	±0.2
- 5.00				±0.2
- 10.00				±0.2
- 15.00				±0.2
- 20.00				±0.2
- 25.00				±0.2
- 30.00				±0.5
- 35.00				±0.5
- 40.00				±1.0
- 45.00				±1.0
- 50.00				±1.5
- 55.00				±1.5

Table 10-3   Linearity Test Chart for 1300nm-1550nm.

1975XQ dB Setting	Transfer Standard dBm Reading	575L dBm Reading	dB Deviation (section 0)	Tolerance (dB)
- 0.00	dBm		dB	±0.2
- 5.00				±0.2
- 10.00				±0.2
- 15.00				±0.2
- 20.00				±0.2
- 25.00				±0.2
- 30.00				±0.2
- 35.00				±0.2
- 40.00				±0.5
- 45.00				±0.5
- 50.00				±1.0
- 55.00				±1.0
- 60.00				±1.5
- 65.00				±1.5
- 70.00				±1.5

10.7 Verifying Analog Output Accuracy

2 shows how the equipment should be hooked together. Connect the output of the 665 Laser Source to the input of the 1975XQ using one of the single mode patch cables. Connect one end of the second patch cable to the output of the 1975XQ. The unconnected end of the patch cable should be connected to the 575L. Connect the analog output of the 575L to a Voltmeter. Set the Voltmeter to the 2V range. Referring to 10-4 adjust the attenuation setting of the 1975XQ to get the desired power readings on the 575L display.

NOTE:
To set the 575L amplifier ranges to the values shown in 4 use the secondary function #11 (Range Hold Configuration, see section 0)
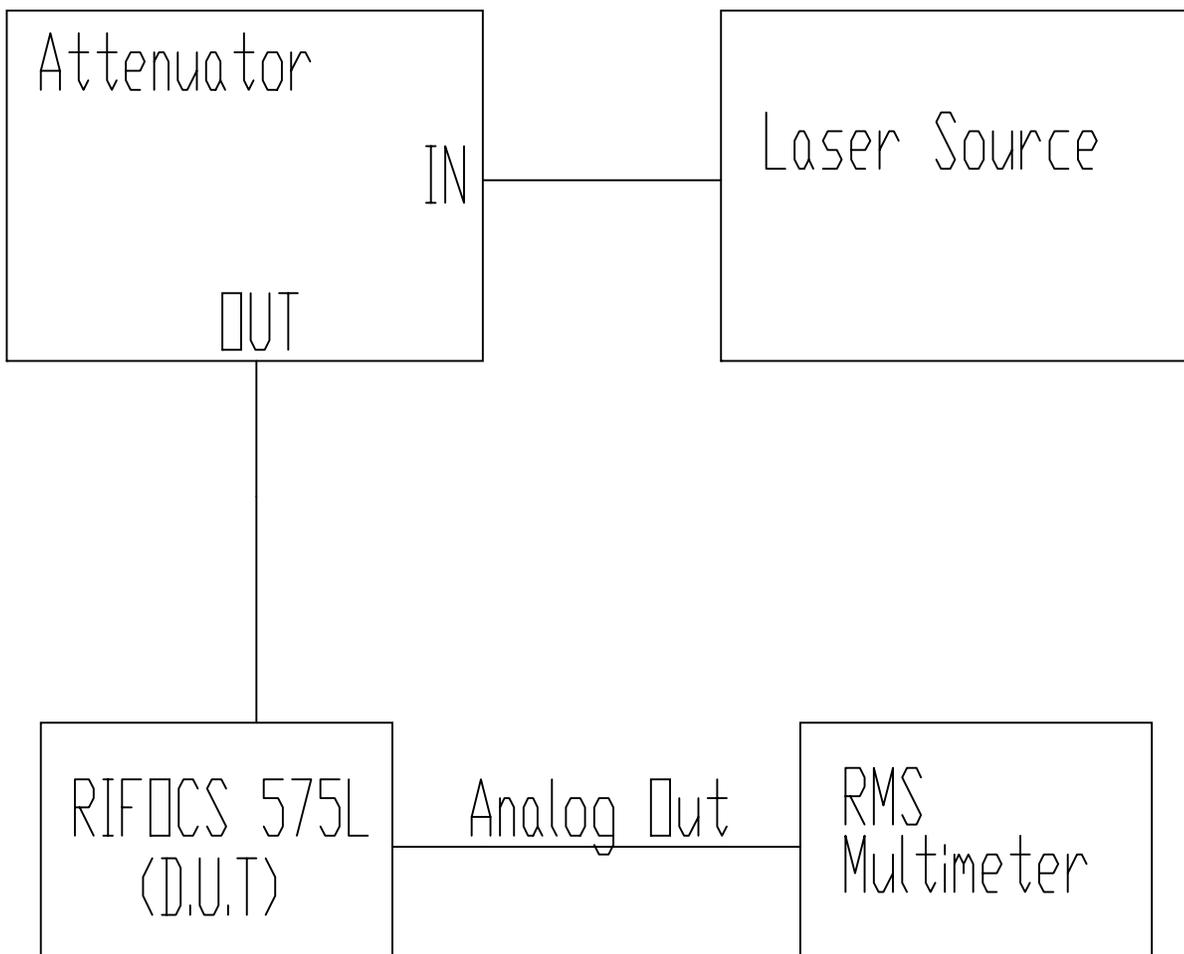
Figure 10-2   Equipment set-up for analog output verification.

Table 10-4   Analog Output Accuracy Verification Chart.

Amplifier Range (Select the amplifier range using secondary function #11, see section 4.12.12)	575L Power Reading (575L is in Watt mode)	Voltmeter reading (Voltmeter is on 2V scale)
Range 1	+4.000mW	+0.4V ±0.02V
Range 2	+400.0μW	+0.4V ±0.02V
Range 3	+40.00μW	+0.4V ±0.02V
Range 4	+4.000μW	+0.4V ±0.02V
Range 5	+400.0nW	+0.4V ±0.02V
Range 6	+40.00nW	+0.4V ±0.02V
Range 7	+4.000nW	+0.4V ±0.02V

11   OPTICAL CALIBRATION

This section contains information necessary to perform the optical calibration of the 575L. A one point calibration is sufficient.

11.1   Calibration

Calibration should be performed every 15 months, or sooner if the performance verification procedures in section 0 show that the 575L is out of specification.

11.2   Recommended Calibration Equipment

The 575L can only be calibrated over the RS232 interface. The calibration set-up requires a system consisting of a computer, and stable sources. The source may be either an LED or Laser as long as a fiber optic pigtail with a reliable termination is available. Selection of the sources depends upon the spectral bandwidth requirements of the user. For example, the user should be aware that an LED source has a wider spectral half-bandwidth (typically 50nm) than a corresponding laser (typically 2nm) with the same peak wavelength. Thus, calibrations with an LED source should be only applied to LED-based systems. The same is true for laser systems.

The recommended test equipment listed in 11-1 is for performing 1550nm, 1300nm, 850nm and 780nm spectral calibrations.

Table 11-1   Recommended Calibration Equipment.

EQUIPMENT	SPECIFICATIONS
Computer with an RS232 interface and calibration software	RS232 Interface must conform to RS232-C specifications
N.I.S.T. Secondary Transfer Standard for Optical Fiber Power Measurements (STSOFPM)	Accuracy: ±2% at 1550nm, 1300nm, 850nm and 780nm
RIFOCS Model 666R 1550nm Laser Source	Single-mode laser source, pigtailed with SMF-28 fiber Peak wavelength: 1550nm
RIFOCS Model 665R 1300nm Laser Source	Single-mode laser source, pigtailed with SMF-28 fiber Peak wavelength: 1300nm
RIFOCS Model 667R 850nm Laser Source	Multi-mode laser source, pigtailed with SMF-28 fiber Peak wavelength: 850nm
RIFOCS Model 664R 780nm Laser Source	Multi-mode laser source, pigtailed with SMF-28 fiber Peak wavelength: 780nm
RIFOCS single-mode fiber optic cable assembly P/N 2020-101-05 Qty. 2	Single-mode cable assembly terminated with FC-PC connectors on both ends. Core/Cladding dia: 9/125μm
RIFOCS Snap-On series adapter	FC-PC Adapter for the 575L
Photodyne Model 1975XQ-010J SM Optical Attenuator or equivalent	Single-mode optical attenuator with FC-PC connectors on the optical ports. Accuracy: Greater of ±0.20dB or ±2% Max. Insertion loss: Less than 5dB
Keithly Model 175 Digital Multimeter	2V Range: ±(0.03% + 1 count)

11.3   Environmental Conditions

Calibration should be performed under laboratory conditions having an ambient temperature range of 18 to 25°C and relative humidity of approximately 70%. With the instrument on, allow it to warm up for 10 minutes. If the instrument has been subjected to temperatures outside of this range, or to higher humidity, allow additional time for the instrument to stabilize before beginning the calibration procedure.

11.4   Equipment Set-Up

11-1 shows how the equipment should be hooked together for performing the 1300nm spectral calibration. Initially connect the output of the Model 665 Laser Source to the input of the Transfer Standard. Adjust 665 Laser Source for an output power of 1.00µW (-30.00dBm).

D.U.T. =   Device Under Test.
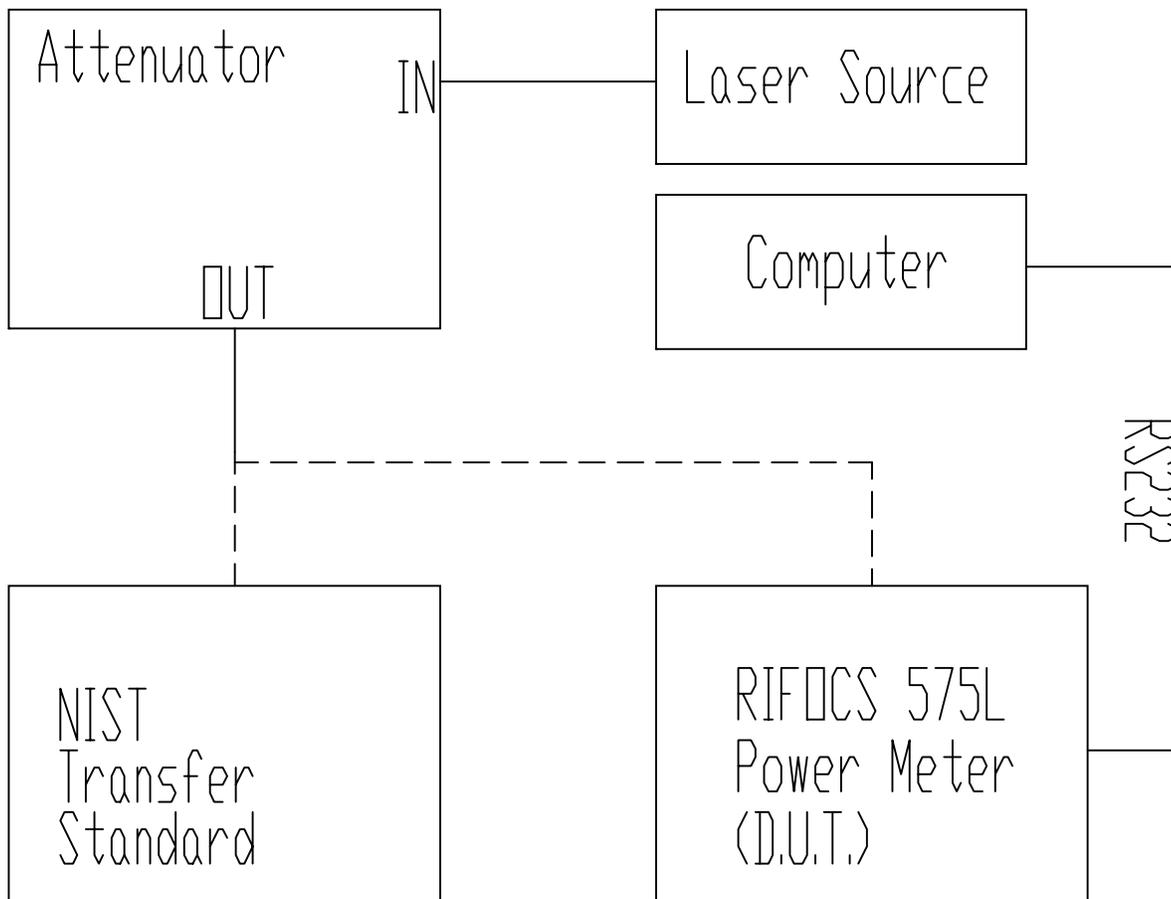
Figure 11-1   Diagram of equipment setup for calibration.

11.5   Calibration Procedure

1. Connect the output of the 665 Laser Source to the input of the Transfer Standard and adjust the Laser Source for an output power of 1.00μW. The calibration can be performed at any power level between 0.50μW and 100μW but for our example we will calibrate at 1.00μW.

2. Put the CAL/RUN toggle switch located on the 575L rear panel into the CAL position.
3. Select the desired cal wavelength of the 575L (in our example 1300nm).
4. Zero detector of the 575L (see section 0).
5. Put the 575L into the WATT mode.
6. Disconnect the patch cord from the Transfer Standard and connect it to the 575L.
7. From the computer send the "RECAL,2,1300,1.00" command (see section 0 for an explanation of the RECAL command).
8. The 575L will take approximately 5 seconds, once the calibration is complete the 575L will display 1.00μW. If the 575L does not display 1.00μW the calibration did not complete successfully. If the calibration did not complete successfully:
8.1 Make sure the CAL/RUN switch is in the CAL position.
8.2 Make sure that the parameters sent with the RECAL command are correct.
8.3 Make sure that the Laser Source is connected to the 575L.
8.4 Make sure there is a cable connecting the 575L to the computer.
8.5 Make sure that the computer and the 575L are set to the same BAUD rate.
9. When the calibration has been completed put the CAL/RUN switch into the RUN position.

12   MAINTENANCE

12.1   Fuse Installation/Replacement

The 575L is powered from the AC line (100-250VAC, 50-60Hz). The fuse holder is integrated with the AC line receptacle. To replace the fuse, remove the AC power cable from the AC line receptacle and use a small screw driver to open the fuse holder door. Replace the fuse with a 5mm X 20mm 0.5 amp slow blow fuse.
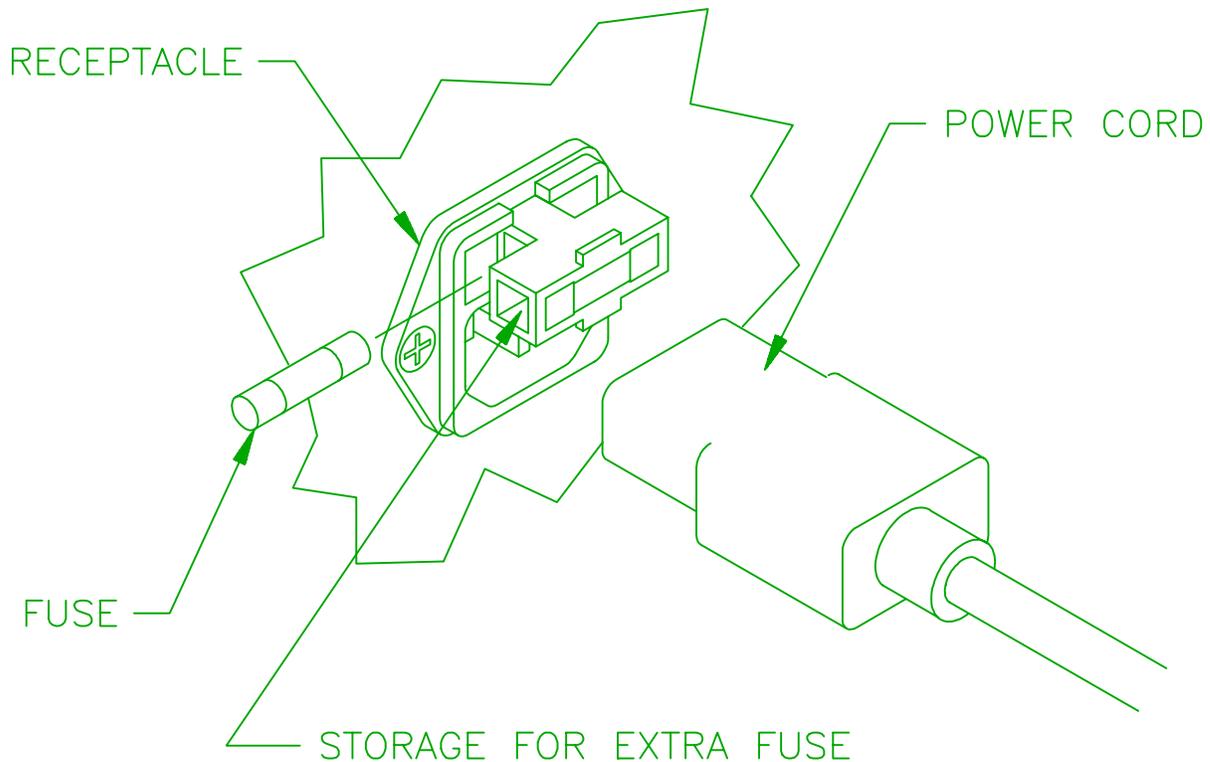
Figure 12-1   Fuse Installation.

12.2   Troubleshooting

1 describes the causes and possible solutions for many common problems. All other problems should be referred directly to the factory.

NOTE:

Error codes E10 - E23 are not displayed on the LCD, they are reported in the data return string only.

Table 12-1   Troubleshooting Chart

ERROR CODE	CAUSE OF ERROR CONDITION	CHECK(s)
E1	EEPROM error. This indicates that the EEPROM chip has lost some or all of its data.	This error is non-recoverable, contact the factory for repair.
E2	Zeroing error. This indicates that the 575L's zero offset is excessive.	Place a cap over the detector, it is important that absolutely no light makes it's way to the detector. Press the ZERO button. The "E2" error should now go away, if the error persists contact the factory for repair.
E3	ROM error. This indicates that the ROM chip has lost some of its data.	This error is non-recoverable, contact the factory for repair.
E4	A relative REL+RATIO unit has stopped receiving a signal from the reference REF unit.	Make sure that the I^2C bus cable is connected between the REL+RATIO unit and the REF unit. Make sure that the I^2C bus cable is wired correctly, see Figure 5-5 for the cable connections. Make sure that the REF unit is actually configured as the REF unit, see Section 4.13.11 Selecting REF/REL+RATIO
E5	More than one unit configured as a reference REF unit while trying to take multi-channel dB ratio measurements.	Only one 575L is allowed to be configured as a REF unit while connected to the I^2C bus. See Section 4.13.11 Selecting REF/REL+RATIO

12-2

Table 12-1   Troubleshooting Chart (continued)

ERROR CODE	CAUSE OF ERROR CONDITION	CHECK(s)
E6	The attempted recalibration did not complete successfully. Too much light present at the optical input port.	Make sure that the power level being specified with the "recal" command is correct.
E7	The attempted recalibration did not complete successfully. Not enough light present at the optical input port.	Make sure that the power level being specified with the "recal" command is correct. Make sure that the calibration source is connected to the 575L.
E8	The attempted recalibration did not complete successfully. The CAL/RUN switch is not in the CAL position.	The CAL/RUN switch located on the rear panel of the 575L must be in the CAL position during recalibration. When the calibration procedure is finished, put the CAL/RUN switch into the RUN position.
E9	EEPROM error. Some of the data in EEPROM memory was lost.	This error is recoverable. Press any key to continue operation of the power meter. The factory default EEPROM values will be loaded into the EEPROM.
E10	The dB command was executed when the 575L was displaying HI or LO.	Adjust the optical power input of the 575L.
E11	Power level too high to measure.	If the optical power input to the 575L is within the dynamic range specification, then check that the range hold is not enabled.

Table 12-1   Troubleshooting Chart (continued)

ERROR CODE	CAUSE OF ERROR CONDITION	CHECK(s)
E12	Power level is too low to measure.	If the optical power input to the 575L is within the dynamic range specification, check that the range hold is not enabled.
E13	Tried to change wavelengths while the 575L is in the dB mode.	When the 575L is in the dB mode, wavelength changes are not allowed.
E14	Invalid wavelength sent with the "cal" command.	The 575L has not been calibrated at the wavelength specified with the "cal" command.
E15	An unrecognized command was received by the 575L.	Check that the command string being sent to the 575L is correct.
E16	Illegal number format received.	Check that the number format of each command parameter is correct.
E17	A command parameter is outside of its accepted range.	One or more of the parameters sent with a command is outside of its accepted range.
E18	Too few parameters sent with a command.	One or more of the parameters associated with a command is not be sent.
E19	Too many parameters were sent with a command.	One or more too many parameters are being sent with a command.
E20	The command string is not terminated correctly.	Command strings are terminated with a CR,LF

12-4

Table 12-1   Troubleshooting Chart (continued)

ERROR CODE	CAUSE OF ERROR CONDITION	CHECK(s)
E21	Parameter string is too long.	Check that the parameters being sent with a command are valid.
E22	Improper character was encountered in a string parameter.	Check that the parameters being sent with a command are valid.
E23	Invalid I^2C address.	The device specified with the "ch" command is not responding. Check if there is a device connected to the I^2C bus with the specified I^2C address.
E24	Not used	
E25	Not used	
E26	This error occurs when the 575L is being operated with a 588RL. It indicates that the 588RL is not set to an I^2C address of 1, or the I^2C cable is not connected between the 575L and 588RL.	Make sure that the I^2C cable is connected between the 575L and the 588RL. Set the I^2C address of the 575L to 2. Set the I^2C address of the 588RL to 1.
E27	This error occurs when a 588RL is being operated with a 575L, but the 575L is not configured with the correct dB mode. This error will also occur if the user pressed the [IL] button of the 588RL but has not yet taken a dB reference with the 575L.	Configure the dB mode of the 575L to operate with the 588RL, this is done by accessing secondary function #13 of the 575L. Then take the dB reference with the 575L.

Table 12-1   Troubleshooting Chart (continued)

ERROR CODE	CAUSE OF ERROR CONDITION	CHECK(s)
E28	This error occurs when a 588RL is being operated with a 575L, but the 575L is not configured with the correct dB mode.	Access secondary function #13 and check the dB mode configuration of the 575L. Selecting dB mode 4 should correct this problem.
E29	This error occurs when a 588RL is being operated with a 575L, but the 575L is not calibrated at 1300nm or 1550nm.	Make sure that the 575L is calibrated at 1300nm and 1550nm.

INDEX