OPTOKON®

FIBER OPTIC TECHNOLOGY
CALIBRATION LABORATORY

PM-212-SI3
Pocket Optical Power Meter

INSTRUCTION MANUAL

Revision 2.4

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1 Introduction

The PM 212 optical power meter is a small, pocket size low cost item. The small size does not prevent the optical meter fulfilling all the technical requirements for field equipment. The unit can be easily carried in the pocket or on a belt. It can be placed within rack mount ODF's with the display on the top or on the side. The Li-pol rechargeable battery ensures a long term working time with a minimum life time of 2 years. The unit is able to store 100 measurements which can be uploaded to a PC and managed with SmartProtocol software.

The instrument can be used separately to measure absolute or relative optical power in optical networks or with the **LS-800 Optical Light Source or OFT 820 Loss Test Set** for optical loss measurement on singlemode and multimode fiber cable at six working wavelengths.

2 Features

- Small size, light weight
- Six working wavelengths
- Absolute and Relative optical power measurement
- Internal two level memory structure
- Capacity up to 100 measurements
- SmartProtocol SW – generation of test reports
- USB port for:
      Charging the battery
      Data upload to PC
      Firmware upgrade
- Built-in NiMH rechargeable battery pack
- Auto Off
- Battery status indicator

3 Application

- Absolute or relative optical power measurement.
- Optical network testing.
- Measurement output power of optical transmitters.
- Measurement input power at optical receivers.
- Measurement attenuation in fiber cabling, in conjunction with the LS-800 Optical light source or the OFT 820 Loss Test Set.
- Measurement loss of connectors, splices, adaptors, switches and other fiber optic components.
- Easy and quick identification of failure points in fiber optic networks
- Suitable for MM applications.

4 Accessories

4.1 Standard

- Power meter
- Universal 2.5 mm adaptor (TE-APF-FC)
- Power charging adaptor
- Traceable calibration certificate
- Soft carrying case
- USB cable
- SmartProtocol SW

4.2 Optional

- Master patchcords
- Master adaptors
- Universal SFF 1.25 mm adaptor (TE-ADP-125)
- Hard carry case (TE-HC-01)

TE-APF-FC	TE-APF-SC	TE-APF-ST	TE-APF250	TE-APF-HFBR	TE-APF-LC	TE-APF-220

TE-HC-01   Power charging adaptor

5 Specifications

Power meter			Note:
Photodetector	3.6 mm Si		
Working wavelengths	650 nm, 850 nm, 980nm		can be customized
Uncerntainty	± 5%		
Resolution	0.1		
Dynamic range	-65 dBm to +10 dBm		650 nm, 850 nm
Dimensions		24 x 47 x 71 mm	with universal adapter
Weight		90 g	with battery
Temperature operating		-10 to +50 °C	
storage		-40 to +70 °C	
Humidity (non condensing)		0 – 95%	
Battery working time		> 35 hrs	backlight off
Battery life time		> 2 years	

6 Safety information

The PM 212 instrument emits no optical power itself and does not create any hazards to the user.

<p align="center">**WARNING!**</p>

- Never use magnifying devices to inspect optical fiber ends unless you are sure that no optical power is being emitted.
- Use only magnifying devices with a built-in infra-red filter to ensure safety.
- During operation, testing or maintenance of a fiber optic system, never look into an active fiber optic cable. Infrared radiation may be present and permanent eye damage can result.
- Avoid direct exposure to the beam.
- Do not activate the laser when there is no fiber attached to the optical output connector

Under no circumstances should you look into the end of an optical cable attached to the optical output when the device is operational. Laser radiation can seriously damage your eyesight.

7 Maintenance

7.1 Battery care

The PM 212 comes equipped with a built-in charger and internal battery pack.

- Before using the PM 212 for first time, charge fully battery pack.
- Use the USB charger, cable and USB port for charging.
- Charging is not recommended until battery status is 30% or less. Recommended charging time of battery pack is 4 to 7 hrs.
- We don't recommended charge the battery pack fully before storing PM 212 (optimal value is about 70 %).

- If you are not going to use the PM 212 for long period, charge the battery pack once every six months.
- The battery pack is a consumable. Repeated charging and discharging degreases battery pack life. Please contact OPTOKON for battery pack replacement.
- Battery status informs about current energy of battery. In case PM-212 has fully battery charged, is displayed this char „ ✔ "(figure 2).


Figure 1: Battery status

Battery status

Figure 2: Status of fully chargered battery

Identification status of fully charged battery

7.2 Instrument care

- During storage and transport keep the instrument in its carry case to protect against crushing, vibration, dust and moisture.
- Where possible keep the instrument away from strong sunlight.
- Clean the instrument housing using alcohol or other cleaning agents. Acetone or other active solvents may damage the case.
- The instrument is resistant to normal dust and moisture, however it is not waterproof. If moisture does get into instrument, dry it out carefully before using it again.

7.3 Optical connector care

- Cleanliness will affect the performance of an optical fiber system.
- All connectors and fiber end faces need to be clean prior to testing.
- Clean all connectors, adapters, and attenuators before making any connections.
- Use appropriate optical cleaning supplies to keep connectors and adaptors free from contamination.
- The following cleaning materials are recommended and can form part of your cleaning kit:
  - Lint-free laboratory wipes.
  - Isopropyl alcohol in pressurised dispenser
  - Lint free pipe cleaners
  - Clean, dry, oil-free compressed air

7.4 Power Meter Adapter exchange

The adapter set includes adapters specified in order according following ordering codes:

Optional adapters:

| TE-APF-FC | TE-APF-SC | TE-APF-ST | TE-APF250 | TE-APF-HFBR | TE-APF-220 |

	adapters mounted • power meter port
	For exchange adapter loosen two screws • avoid loosing screws • carefully remove adapter out to prevent scratching of port covering glass • after removing adapters you can also make cleaning of power meter covering glass
	adapter removed • try to avoid any contact with covering glass of ports • scratching, dirt or moisture can badly affect instrument certainty • insert is always black side up • LC adapter insert has smaller hole!!
	IMPORTANT NOTE: NEVER LOOSEN SCREWS UNDER ADAPTERS – it may cause INSTRUMENT DAMAGE!

8 Instrument and button function description
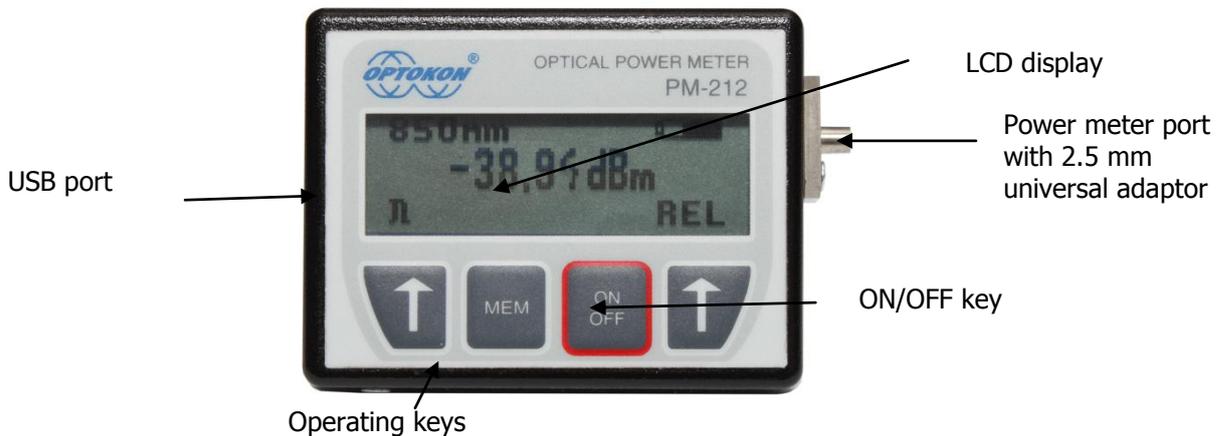
[ON/OFF]

Press ON/OFF key to turn the unit on.
Press ON/OFF key to turn the unit off.
After switching on, the type of device, serial number and firmware version will be displayed.

The unit always starts up with displaying the settings when it was switched off. For example, if absolute mode measurement, wavelength 1550 nm and Auto Off is selected and the unit is switched off, after pressing the ON button, the unit will start up with the same settings.


[AUTO OFF]

Activation and deactivation function Auto Off: Press button ON/OFF (displayed picture 3.), you can using the button [+] enable / disable Auto Off. The unit will display this symbol " ⧖" (function is activated figure 4).
If Auto Off is enabled, the unit will switch off after 10 minutes of no activity.

Figure 3: Auto off function

```
┌─────────────────────────────────────────────┐
│  1310 nm                          ⧖ ▭▬▬▬     │
│              +19.56 dB                        │
│  ABS                                    REF   │
└─────────────────────────────────────────────┘
```
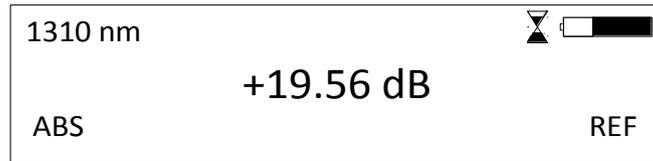
Figure 4: Auto Off status

8.1 Menu #1 – Absolute power measurement mode

In the absolute power measurement mode the absolute value of the optical signal in dBm units is shown on the display.
This screen will appear after the instrument is switched on and information regarding the type of device, serial number and firmware version will appear
(if the unit was switched off in the "absolute power measurement mode").

```
┌─────────────────────────────────────────────┐
│  1310 nm                           ▭▬▬        │
│                                     60%       │
│              -53.52 dBm                       │
│   λ                                    REL    │
└─────────────────────────────────────────────┘
```
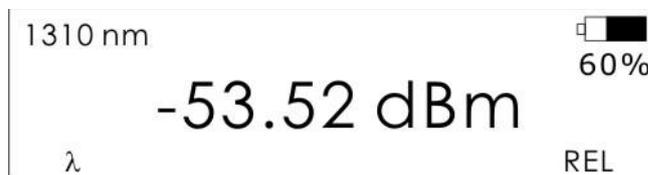
[λ]
Selects 650, 850, 980 nm wavelengths.

[REL]
Activates the relative power measurement mode (unit dB).
Recalls the last set reference for a selected wavelength.
Goes to menu #2.

8.2 Menu #2 – Relative power measurement mode

If the relative power measurement mode is on, the value of the optical insertion loss in dB units which corresponds to the performed reference is shown on the display.
This screen is displayed after the instrument is switched on and information regarding the type of device, serial number and firmware version is described
(if the unit was switched off in the "relative power measurement mode").

```
┌─────────────────────────────────────────────┐
│  1310 nm                         ⧖  ▭▬▬       │
│                                      60%      │
│              +19.56 dB                        │
│   ABS                                  REF    │
└─────────────────────────────────────────────┘
```
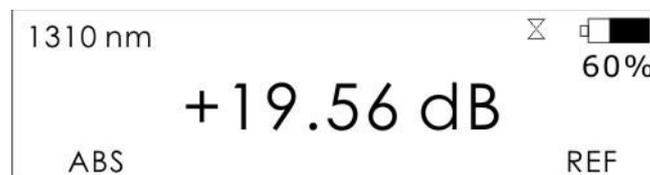
[ABS]
Returns unit to the absolute power measurement mode (unit dBm).
Goes to menu #1.

[REF]
Sets and stores the new reference for the selected wavelength.
Note: The new reference must be confirmed by the following screen:

```
              SET NEW
              REFERENCE

CONFIRM                          NO
```

9 Working with the internal memory

The PM 212 memory has a structured, two-level organization. The results are stored in memory positions (MEM) in folders called Cable (CAB). See the table below:

```
CAB1     MEM1
         MEM2
         MEM3

         ....
         MEM X

CAB2     MEM1
         MEM2
         MEM3

         ....
         MEM Y

.....    MEM1
         MEM2

         ....
         MEM Z

CAB N    MEM1
         MEM2
         MEM3

         .....
         MEM Q
```

A maximum of 100 results can be stored in the memory, although the maximum number of CAB and MEM is 100. This means, if 50 CAB folders are used, each CAB folder can contain a maximum of two memory positions (MEM), and vice versa; if only two CAB folders are used, each folder can contain up to 50 memory positions (MEM).

[MEM]
To access the memory, press the MEM key.

Use **[↑]** or **[↓]** keys for selecting the appropriate function.

9.1 SAVE RESULT

1. Press [MEM].

2. Use [+] or [-] keys for selecting "SAVE RESULT" and press [MEM].
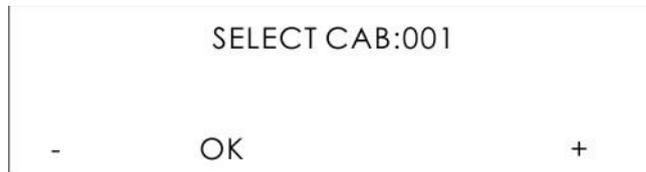
3. Use [+] or [-] keys for selecting the appropriate CAB and press [OK].
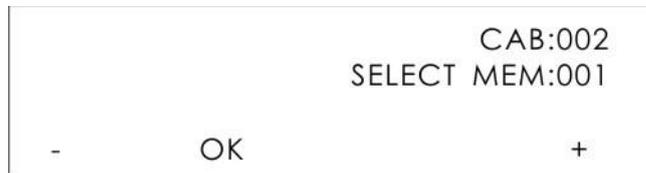
4. Use [+] or [-] keys for selecting the appropriate MEM and press [OK].
5. The measurement value will be saved into the selected memory position.

9.2 BROWSE RESULT

1. Press [MEM].
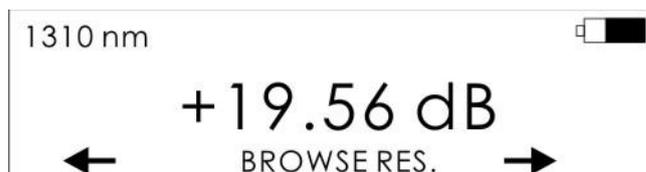
2. Use [+] or [-] keys for selecting " BROWSE RES." and press [MEM].

```
                              SELECT CAB:001
                                  STORED:001

      -          OK                         +
```

3. Use [+] or [-] keys for selecting the appropriate CAB and press [OK].

```
1310 nm                       SELECT CAB:001
-21.36 dBm                         MEM:001
+16.74 dB
      -          OK                         +
```
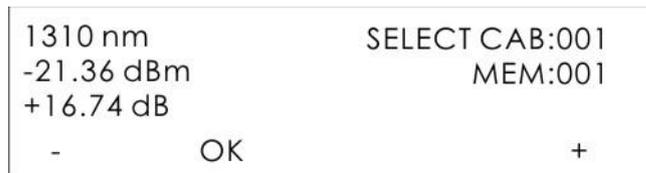
4. Use [+] or [-] keys for selecting the appropriate MEM.

5. Measurement value (reference) will be displayed.

6. Press [OK] to return to Menu#1 or #2.

9.3 UPLOAD DATA

1. Press [MEM].

```
1310 nm                    ▭▮

      +19.56 dB
   ←      UPLOAD DATA    →
```

```
         UPLOADING ..
         ▮▮▮▮▮▮▮▮
```

2. Use [+] or [-] keys for selecting " UPLOAD DATA" and press [MEM].

3. Saved data will be uploaded through the USB port into a PC.

4. For creating measurement protocol use "SmartProtocol" PC software.

9.4 ERASE MEMORY

1. Press [MEM].

```
1310 nm                    ▭▮

      +19.56 dB
   ←      ERASE MEMORY    →
```

2. Use [+] or [-] keys for selecting " ERASE MEMORY" and press [MEM].

3. Press [CONFIRM] or [NO].
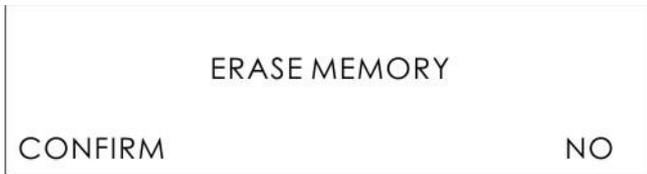
4. After confirmation all memory contents will be erased.

9.5 EXIT MEMORY

1. Use [+] or [-] keys for selecting " EXIT MEMORY" and press [MEM].

2. Press [MEM].

3. Display will return to Menu#1 or #2.

10 Insertion Loss Measurement

10.1 Basic theory

Loss measures the signal degradation in a fiber optic cable. A light source injects an optical signal of the appropriate wavelength into the fiber and a power meter measures the received signal at the same wavelength.
There are two different measurement methods:
- Method 6
- Method 7

according to IEC 874-1 4.4.7.4.

Power measurement is the basis of optical testing and determines the power budget of the fiber optic link by comparing the power of the transmitter and the sensitivity of the receiver. This difference is the maximum acceptable loss. Power loss is caused by different phenomena such as attenuation of the fiber, dirty connector mating faces, connector misalignment, loss of splices and other issues such as sharp fiber bends.
The "end to end" loss test is the most commonly used acceptance test for power loss in fiber optic links. The test is based on measurement the power difference at the input and output of the link.
The PM 212 and LS-800 are used for this test, where the light source (LS-800) acts as a transmitter and the optical power meter (PM 212) as a receiver.
he "end to end" test includes two steps:
1. Setting the reference
2. Measurement the loss

10.2 Method 6

For method 6 two master cords are used to set the reference. Method 6 cancels the effects of the master cords and one adaptor for all subsequent measurements.

10.2.1   Setting the reference

1. Connect the first master cord to the power meter (PM-212).
2. Connect the second master cord to the light source (LS-800).
3. Use the master adaptor to connect the two fiber ends (figure 5).
4. Power on the light source and by pushing **[λ]**.select the appropriate wavelength.
5. Power on the power meter and by pushing **[λ]** select the appropriate wavelength range.
6. On the power meter activate the relative power measurement mode - by pushing **[REL]**.
7. Set and store the new reference for the selected wavelength - push **[REF], [CONFIRM].**
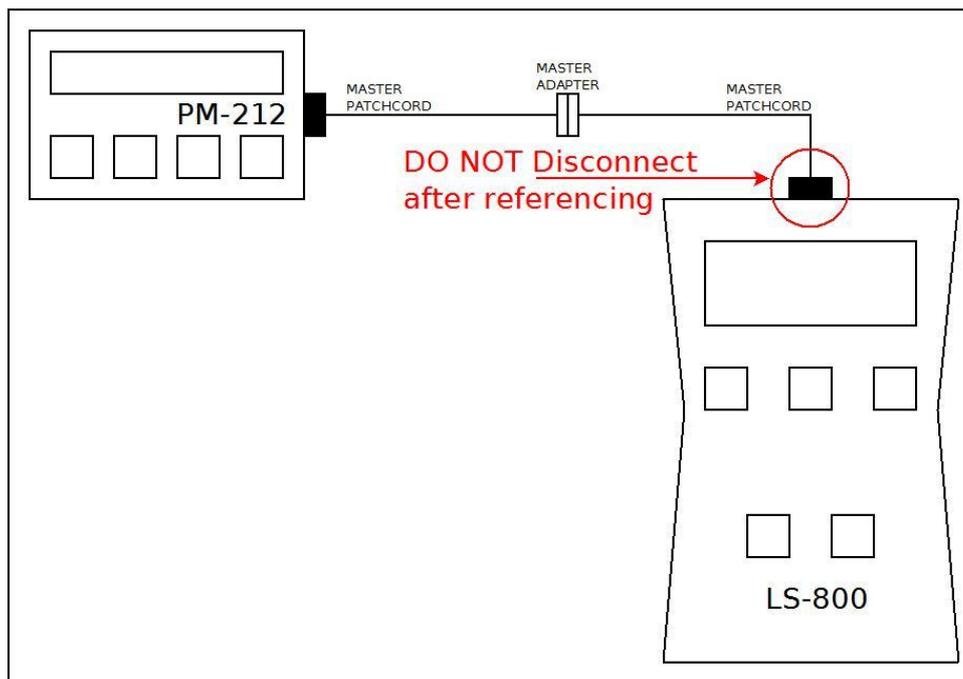
Figure 5: Setting reference by method 6

10.2.2   Measurement Loss

1. Do not disconnect the master cords from the light source and the power meter.
2. Disconnect one master cord from the adaptor.
3. Connect the trace to be measured between the master cords. An extra master adaptor is required (figure 6).
4. The power meter display will report the loss in dB.
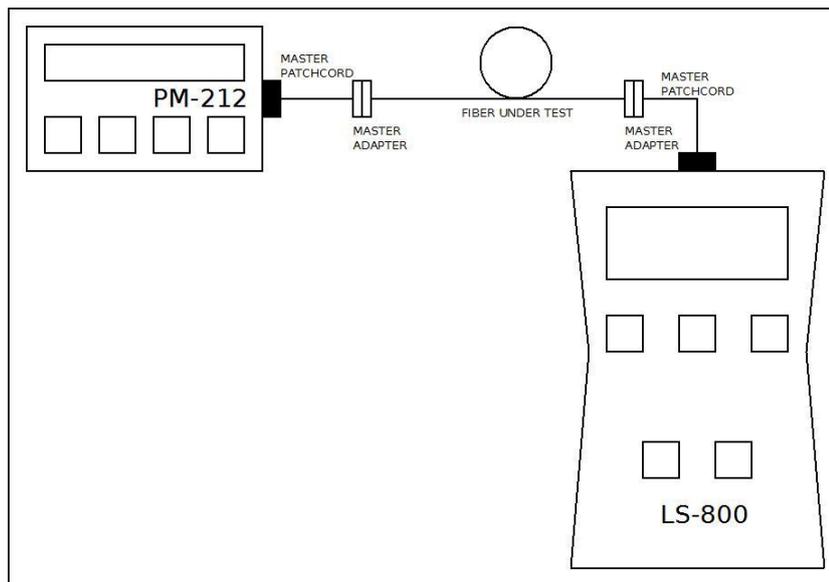
Figure 6: Measurement Loss by method 6

10.3 Method 7

For method 7, one master cord is used to set the reference. The master cord will be cancelled for all subsequent measurements.

10.3.1   Setting the reference

1. Connect the master cord to the power meter (PM 212).
2. Connect the second end of the master cord to the light source (LS-800, figure 7).
3. Power on the light source and select the appropriate wavelength - by pushing **[λ]**.
4. Power on the power meter and select the appropriate wavelength range - by pushing **[λ].**
5. On the power meter activate the relative power measurement mode - by pushing **[REL]**.
6. Set and store the new reference for the selected wavelength - push **[REF], [CONFIRM].**
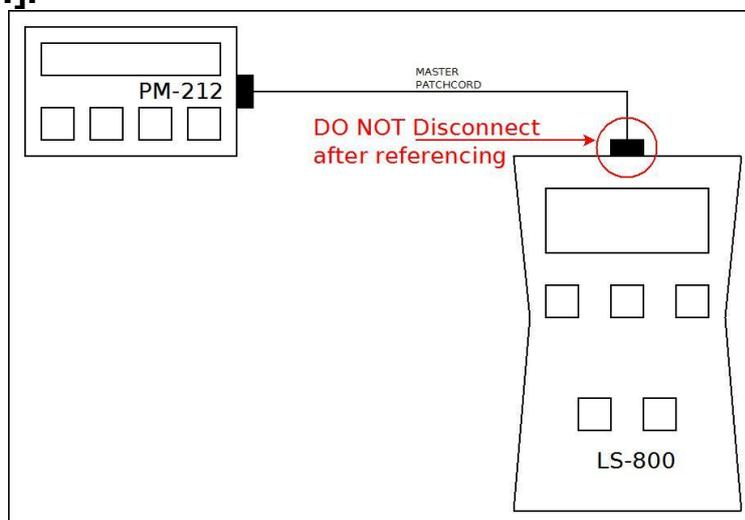
Figure 7:Setting reference by method 7

10.3.2   Measurement Loss

1. Do not disconnect the master cord from the light source.
2. Disconnect the master cord from the power meter port.
3. Connect the trace to be measured between the power meter port and the master cord that is attached to the light source. An extra master adaptor is required (figure 8).
4. The power meter display will report the loss in dB.
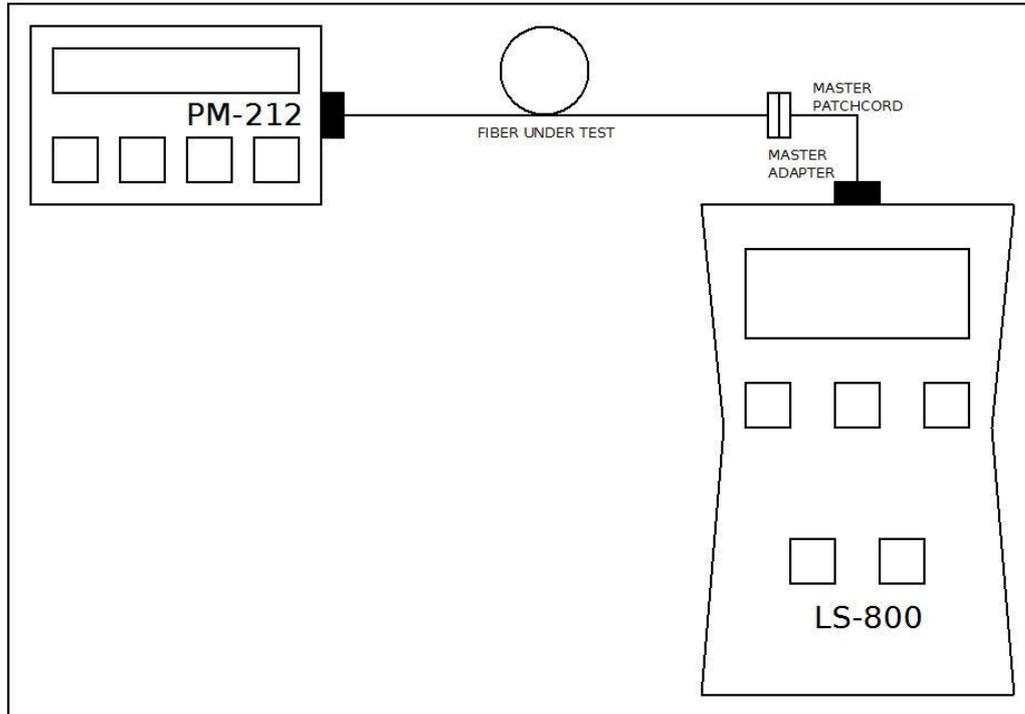
Figure 8: Mesurement Loss by method 7

11 Setting up data transfer

For connection to PC we can use those options:
1. Network client (Hyper terminal, Tera term and putty)
2. Smart protocol and Data exporter.

1) Hyper terminal
   a) Connect the PM 212 to a PC using the USB cable provided and turn the PM 212 on. The Pc will automatic install drivers or prompt you to install the drivers for new hardware. Drivers and software can download from this page: http://www.optokon.cz/testers-manuals. These drivers will create a virtual serial com port.
   b) Start the Hyper Terminal.
   c) Start >> Programs >> Accessories >> Communication >> Hyper Terminal.
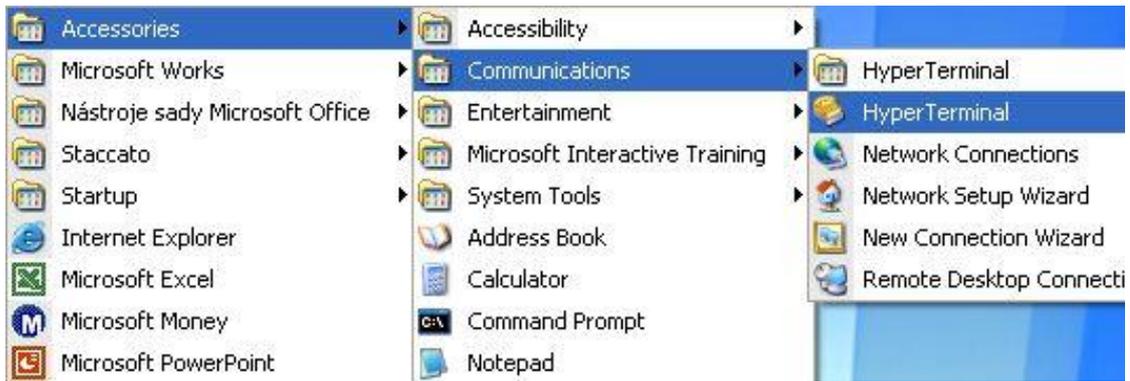
d) Enter the name of a connection and click on OK.

e) Choose the virtual serial port that the PM 212 is connected, click on OK.
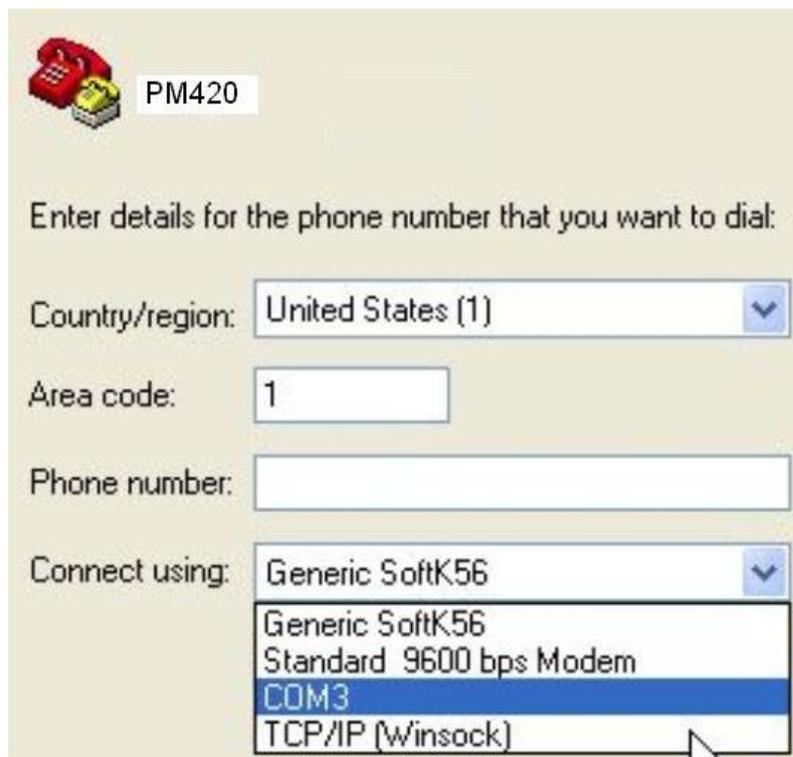
f) Set "Bits per second" to 19200 and click on OK.
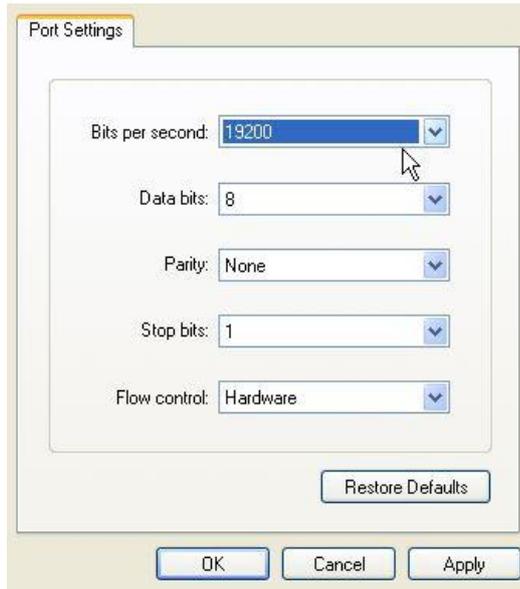
g) Go to the menu in PM 212 and push [MEM], use **[↑]** or **[↓]** keys for selecting "UPLOAD DATA", push [MEM].

h) The stored data will be transferred to the PC in this format:
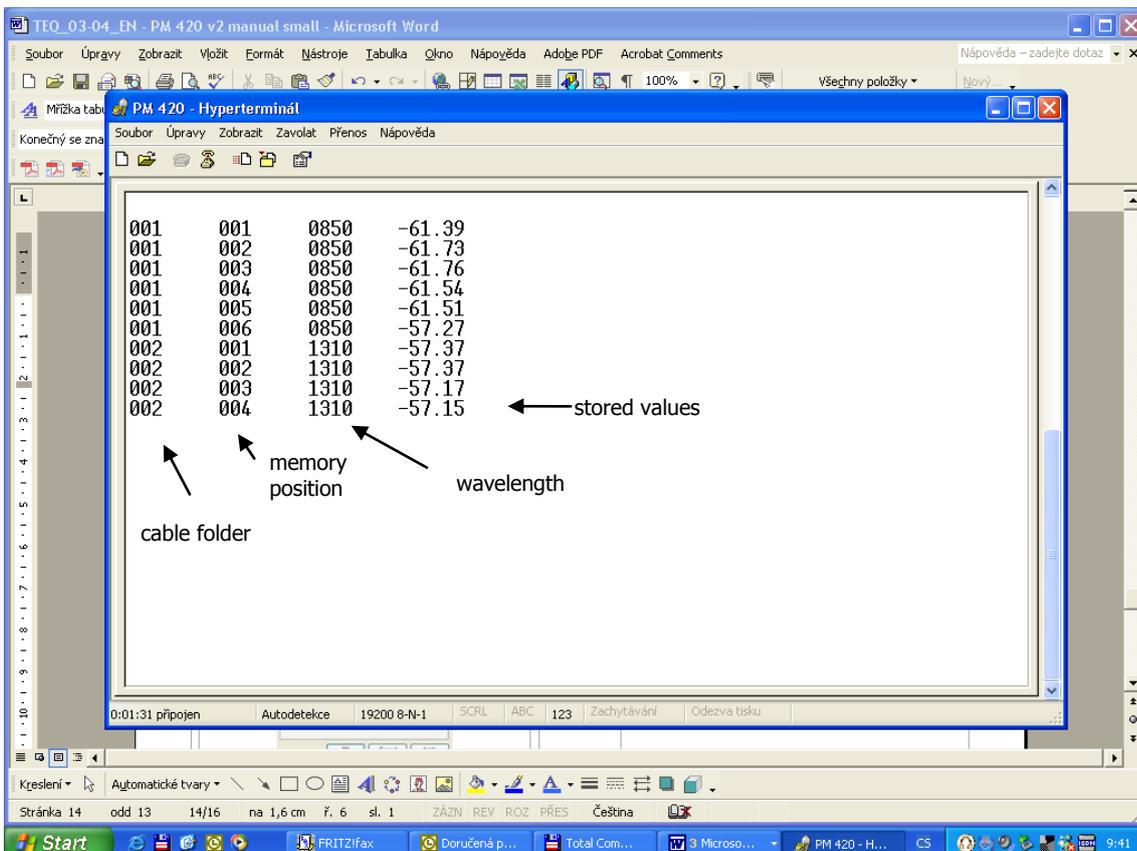
The data from this window can be easily copied to any other application. Similar process can use for another network clients.

2) Smart protocol
Smart Protocol software is a flexible solution for data capture, analysis and reporting to fiber optic loss. The Data Exporter is a software utility for easy import measured data from OPTOKON measuring devices to PC. Those programs with manuals can download at this page: http://www.optokon.cz/testers-manuals

6. Control via Hyperterminal

Control is performed by entering commands that are written to the window of HyperTerminal.
Note: Commands for PM-212 are the same as for OFT-820

Command	Significance	Notes
v	Actual value of display	This commands are shown in the window of HyperTerminal
r	Reference	
l	Actual wavelength	
n	Type and serial number	
1	Simulation of pushing first button	This commands are shown on the display of device
2	Simulation of pushing second button	
3	Simulation of pushing third button	
0	Reset device	

Basic commands for HyperTerminal.
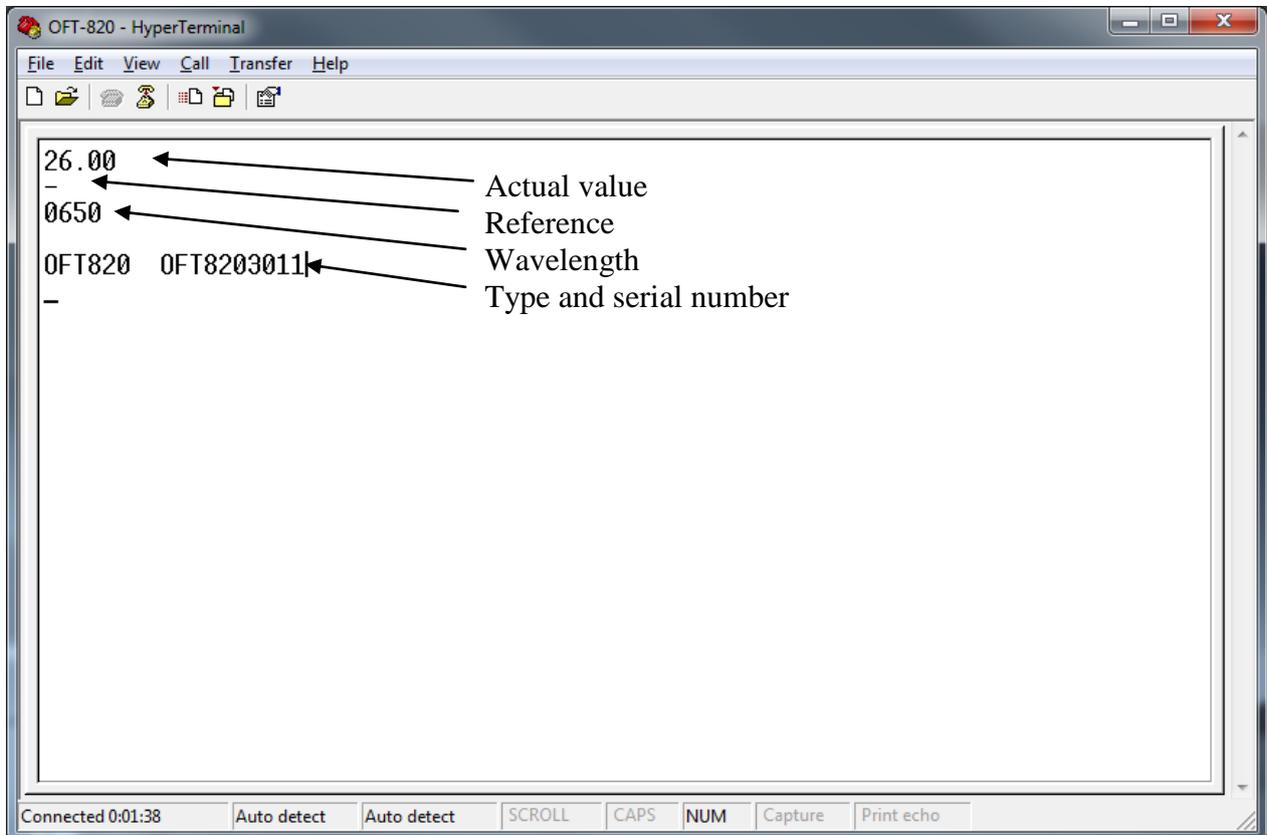
Window of HyperTerminal with basic command.

12   Power loss and decibels

Loss (dB)	% Loss	dBm	Power (mW)
0	0,0	-50	0,00001
0,1	2,3	-40	0,0001
0,2	4,5	-30	0,001
0,3	6,7	-20	0,01
0,4	8,8	-10	0,10
0,5	10,9	-9	0,13
0,6	12,9	-8	0,16
0,7	14,9	-7	0,20
0,8	16,8	-6	0,25
0,9	18,7	-5	0,32
1	20,6	-4	0,40
2	36,9	-3	0,50
3	49,9	-2	0,63
4	60,2	-1	0,79
5	68,4	0	1,00
6	74,9	1	1,26
7	80,0	3	2,00
8	84,2	5	3,16
9	87,7	7	5,01
10	90,0	10	10,00
12	93,7	12	15,84
15	96,8	15	31,62
20	99,0	17	50,12
30	99,9	20	100,00

13   Calibration, service center

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