



FIBER OPTIC TECHNOLOGY
CALIBRATION LABORATORY

PM-800

Optical Power Meter

INSTRUCTION MANUAL



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s/w: 1.2 11/1/2010



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1 Introduction

The **PM-800 optical power meter** is designed to measure absolute or relative optical power in optical networks. The AWD (Auto Wavelength Detection) function facilitates the tester settings and eliminates the operator's failure. The memory capacity allows storage and uploading of up to 3000 measurements including memory position or fiber number, wavelength, absolute value or relative value and insertion loss. The SmartProtocol PC evaluation software supports memory download and test report generation.

The rechargeable battery ensures long term working with a minimum service life of 5 years. Batteries can be charged via a USB port or external AC/DC adaptor. The microprocessor controlled charging process ensures optimal battery status and extended operation time.

The PM-800H can measure a high level of optical power, up to 27 dBm.

2 Features

- Small size, light weight
- InGaAs or Si photodetector
- High input power version
- Detection of modulation 270 Hz, 1 kHz, 2 kHz
- AWD (Auto Wavelength Detection) function
- Two levels high capacity memory: Cable No., Fiber No.
- SmartProtocol PC software - memory download, reporting solution
- Firmware upgrade via USB
- S/N displayed during switch on
- Displayed units: dBm, dB, W
- Reading/writing measured data from/to tag (chip)
- High dynamic range
- Absolute and Relative optical power measurement
- Powered by 3 AA type batteries, battery charging via USB port, μ P controlled
- 10 min Auto Off, battery status indicator
- Easy to use with menu navigation
- Simple and fast calibration

3 Application

- Absolute or relative optical power measurement
- Optical network measurements
- Measurement output power of optical transmitters
- Measurement input power of optical receivers
- Measurement attenuation in fibre cabling, in conjunction with the LS-800 Optical light source
- Measurement loss in connectors, splices, adaptors, switches and other components
- Easy and rapid identification of failure points in fiber networks
- Suitable for SM and MM applications

4 Accessories

4.1 Standard

- Power meter
- SmartProtocol PC software
- Universal 2.5 mm adaptor (TE-ADP-250)
- External USB Power charging adaptor
- USB connection cable
- Rechargeable NiMH batteries – 3 pcs
- Traceable calibration certificate
- Hard carrying case (TE-HC-03)



TE-HC-03

4.2 Optional

- Master patchcords
- Master adaptors
- Universal SFF 1.25 mm adaptor (TE-ADP-125)
- SC FC, ST, ...testing adaptors
- High power probe, FC/APC connectors (TE-HP-27/NPC)



TE-ADP-250



TE-ADP-125



TE-ADP-SC



TE-ADP-FC



TE-ADP-LC



USB Power charging adaptor



TE-HP-27/NPC

*) Other types available on request:

TE-ADP-SC	SC adaptor
TE-ADP-FC	FC adaptor
TE-ADP-ST	ST adaptor

TE-ADP-SMA	SMA adaptor
TE-ADP-LC	LC adaptor
TE-ADP-MU	MU adaptor
TE-ADP-DIN	DIN adaptor

5 Specifications

Specifications:

Photo detector	1 mm InGaAs
Working wavelengths	850, 1300, 1310, 1490, 1550, 1625 nm
Dynamic range: Standard	-65 dBm to +10 dBm -57 dBm to +17 dBm
Dynamic range: High power	-40 dBm to +17 (max +20 ¹) dBm -40 dBm to +27 ² (max +30 ^{1,2}) dBm

Note:

can be customized
1300, 1310, 1490, 1550, 1625, 850 nm
1300, 1310, 1490, 1550, 1625 nm

Photo detector	3.6 mm Si
Working wavelengths	650, 850 nm
Dynamic range	-40 dBm to +10 dBm

650, 850 nm

Uncertainty	± 5%
Resolution	0.01

1310, 1550 nm @ -20 dBm

AWD /1 kHz Detection	-45 dBm -45 dBm
Dimensions	165 x 80 x 40 mm
Weight	310 g

1300 – 1625 nm
850 nm
with 2.5 mm universal adapter
with battery

Temperature operating	-10 to +50 °C
storage	-40 to +70 °C

Humidity (non condensing) 0 – 95%

Battery working time > 300 hrs

Battery life time > 5 years

backlight off
2700 mAh NiMH

Note: 1) Short term application
2) Measurement with external probe

6 Safety information

The PM-800 instrument emits no optical power itself and does not create any hazards to the user. To ensure a high level of operator safety during installation, commissioning and operating the equipment, as well as ensuring that the equipment remains undamaged, it is necessary to consider the following general warnings and recommendations.

- For high power measurement above +13 dBm is necessary to use OPTOKON external probe (see chapter 9.4 High power measurement).
- Installation, commissioning, operation and service of equipments with high power level are only allowed to be carried out by an authorised person.
- Use only the equivalent connector types to those built into the instrument in order to avoid damage to the instrument components.
- Optical connectors must be clean, in case the connectors are not perfectly clean – please clean them according to the procedure described in the technical specification for the relevant connectors.
- 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. The laser radiation can seriously damage your eyesight.

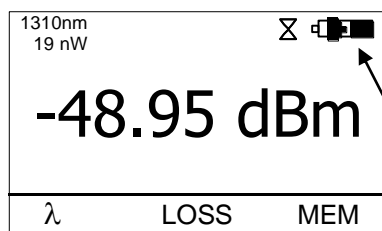
7 Maintenance

7.1 Battery care

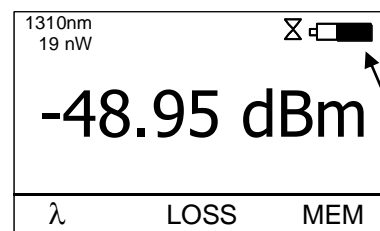
The PM-800 comes equipped with a built-in charger and is powered by three NiMH AA type batteries (standard accessories).

Never use alkaline batteries !!!

- Charging – via USB port (PC) or by using external USB power charging adaptor (standard accessories)
- Before using the PM-800 for first time, charge fully the batteries.
- Use only supplied USB power charging adapter.
- Charging is not recommended until battery status indicator is 30% or less. Recommended charging time of batteries is 12 to 14 hrs.
- Charge the batteries fully before storing PM-800 for a long period. The batteries will lose its charge during storage.
- If you are not going to use the PM-800 for long period, charge the batteries once every six months.
- The batteries are a consumable. Repeated charging and discharging decreases batteries lifetime.
- To extend batteries lifetime it is recommended that batteries be completely drained before re-charging – battery refresh. Otherwise the batteries lose its ability to fully recharge.



charging



battery status
indicator

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 Recommended cleaning and mating instructions

Cleanliness will affect the performance of an optical fiber system. Perform the following procedures prior the installation. Clean all connectors, adapters, and attenuators before making any connections. The following cleaning materials are recommended and may 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.

CLEANING

Connectors/Terminators:

1. Fold a clean, new wipe into a 2" by 2" square pad.
2. Moisten, but do not saturate, the pad with alcohol making a spot approximately 1/2" in diameter.
3. Open the protective cap (E2000 only).
4. Press the ferrule and face into a wet spot on the wipe. Using force, twist the ferrule so that a hard wiping action takes place. Repeat twice, using a clean alcohol-moistened at each time.
5. Press the ferrule end face into a dry spot on the wipe. Using force, twist the ferrule so that a hard wiping action takes place
6. Close the cap (E2000 only)
7. Discard the used pad.

Attenuators:

1. For an exposed ferrule (in-line type), see connector cleaning procedure, blow the other end dry with clean compressed air.
2. Clean bulkhead attenuators only by blowing with clean compressed air.

Adapters:

1. Moisten one end of a lint-free pipe cleaner with alcohol.
2. Remove excess alcohol from the pipe cleaner with a clean wipe.
3. Insert the moisten pipe cleaner into either end of the adapter and scrub in and out so that the inside surface of the adapter is wiped by the pipe cleaner. Repeat this step for the opposite end.
4. Insert the dry end of the pipe cleaner into either end of the adapter to remove any

residual alcohol. For oversized adapters (biconic), slightly blow the middle of the pipe cleaner for better surface contact. Repeat this step for the opposite end.

5. Blow the adapter dry with clean compressed air.

MATING

SC, MT-RJ, LC:

1. Align the housing key with the slot in the adapter.
2. Push the connector into the adapter until a click is heard/felt indicating the latching system is engaged. When the SC connector is fully engaged, the white stripes on the side of the housing should be hidden inside the adapter.

FC:

1. Insert the ferrule tip into the adapter.
2. Align the key with the slot in the adapter.
3. Push the connector into the adapter until the coupling nut reaches the adapter housing.
4. Screw the coupling nut clockwise into the adapter.

E 2000:

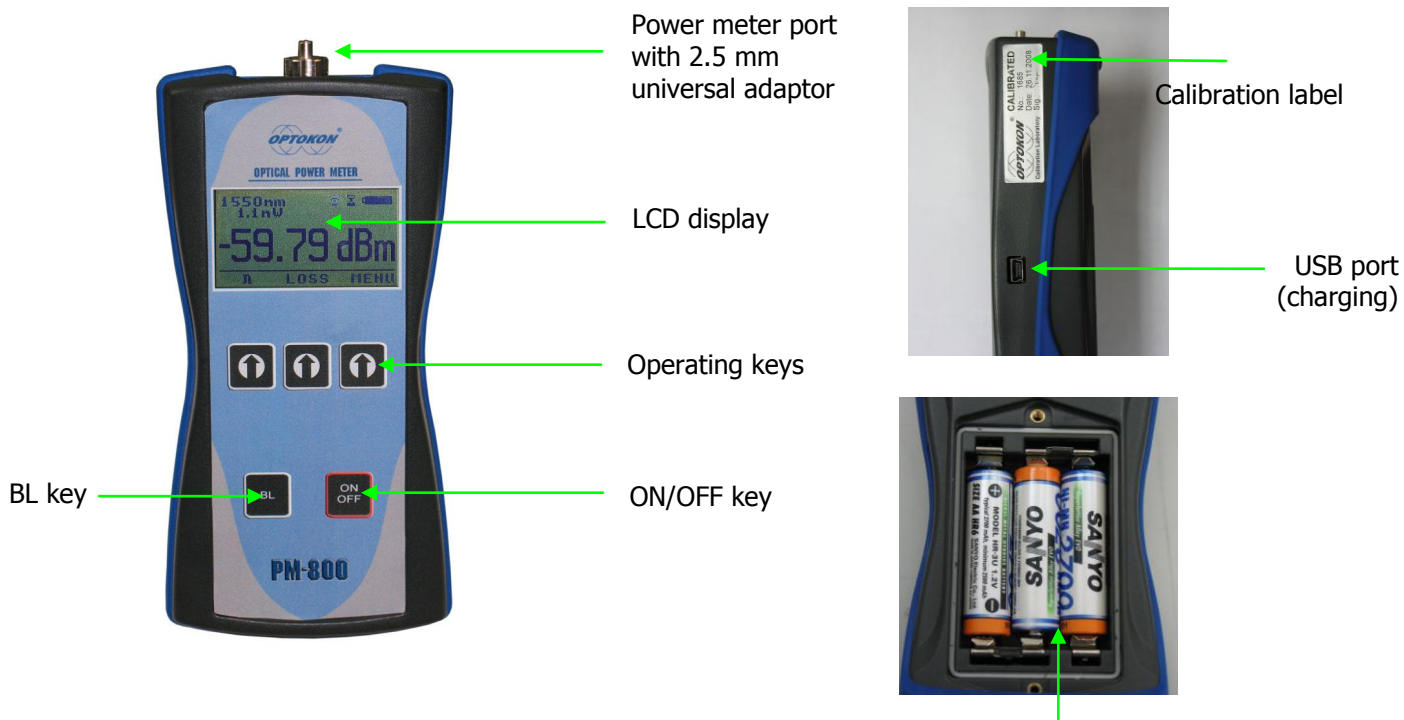
1. Align slots with key on adapter.
2. Push the connector into the adapter until it clicks.

ST:

1. Align the ferrule hub key with the slot in the adapter.
2. Insert the connector into the adapter until the coupling nut reaches the adapter housing.
3. Align the bayonet slots on the coupling nut with the pins on the outside of the adapter.
4. Push the coupling nut into the adapter while rotating the coupler nut clockwise to lock the bayonet and secure the connection.

Infrared radiation is invisible and can seriously damage the retina of the eye. Do not look into the ends of any optical fiber.

8 Instrument and button function description

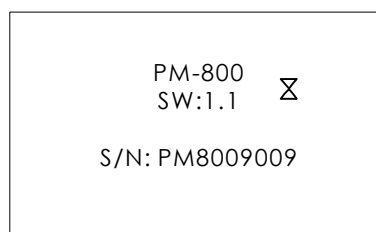
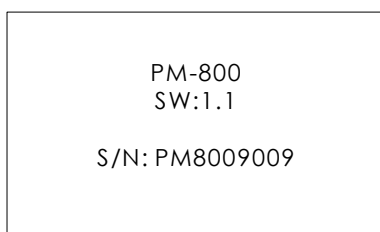


[ON/OFF]

Press to turn the unit on.

Press to turn the unit off.

After switching on, the type of device, serial number and firmware version will be displayed.



The unit will start up with "AUTO OFF" feature – symbol "⌂" will be displayed.

For disable the AUTO OFF feature press and hold the ON/OFF key until symbol "⌂" disappear.

If activated, the unit will turn off after approximately 10 minutes of no activity.

[BL]

Turns the Display Backlight On and Off.

[↑]

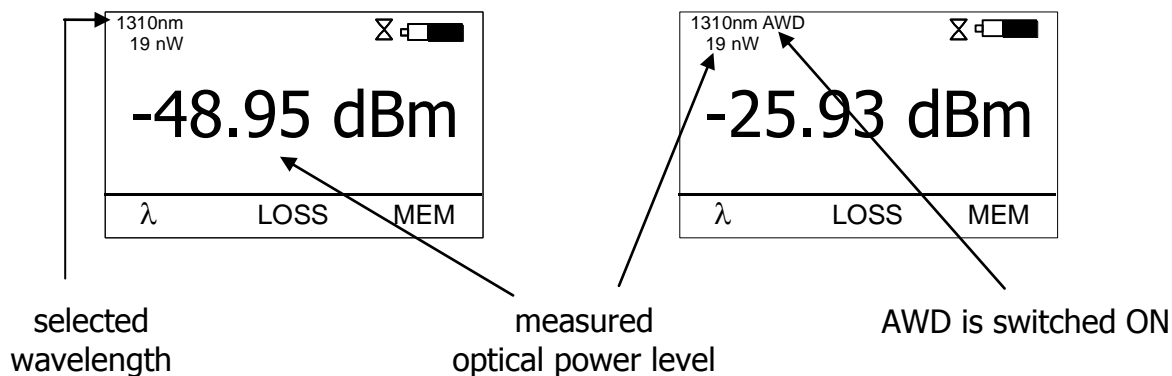
Meaning of these keys depends on current menu.

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.

Reading the display:



[λ]

Selects 850, 1300, 1310, 1490, 1550, 1625 nm wavelengths or AWD (Auto Wavelength Detection).

Auto Wavelength Detection is notified by the "AWD" on the display.

Note: LS800 with AWD modulation ON must be connected to PM-800 in order to use this feature.

[LOSS]

Activates the relative power measurement mode (unit dB).

Recalls the last set reference for a selected wavelength.

Goes to menu #2.

[MEM]

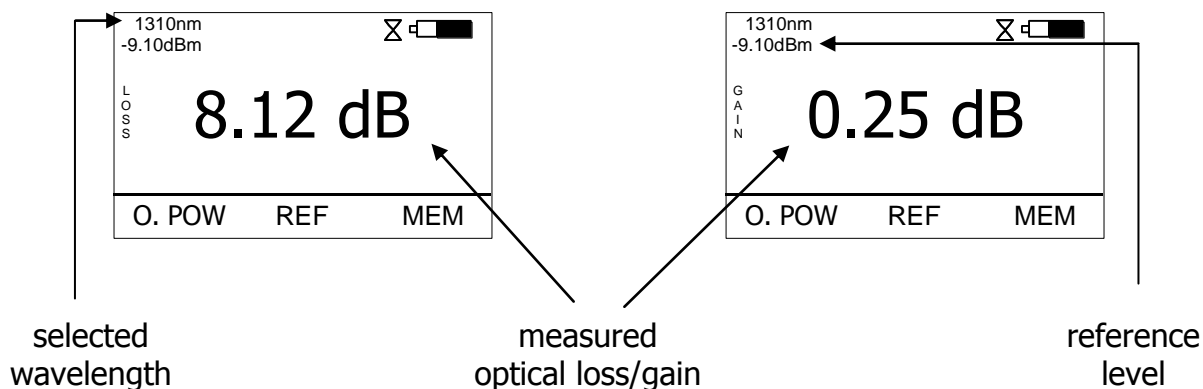
Goes to Memory menu #3.

Starts working with the internal memory.

8.2 Menu #2 – Relative power measurement mode

In the relative power measurement mode is on the value of optical insertion loss in dB units which corresponds to performed reference is shown on the display.

Reading the display:

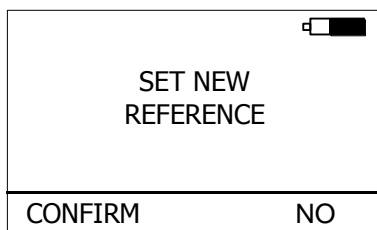


[O.POW]

Returns unit into 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:



[MEM]

Goes to Memory menu #3.
Starts working with the internal memory.

8.3 Menu #3 – Working with the internal memory

The memory of PM-800 has a structured, two-level organization. The results are stored in memory positions (FIBER) in folders called Cable (CABLE). See table below:

CABLE001	FIBER001
	FIBER002
	FIBER003
	FIBER004
	FIBER005
	FIBER006

	FIBERXXX
CABLE002	FIBER001
	FIBER002
	FIBER003
	FIBER004
	FIBER005
	FIBER006

	FIBERXXX
.....	
CABLEXXX	FIBER001
	FIBER002
	FIBER003
	FIBER004
	FIBER005
	FIBER006

	FIBERXXX

This screen will appear after pressing [MEM] key from Menu#1 or Menu#2

SAVE RESULT

→ BROWSE RESULTS

UPLOAD MEMORY

ERASE MEMORY

HOME

UP

DOWN

OK

[UP], [DOWN], [OK]

Use these buttons for selection appropriate submenu.

8.3.1 SAVE RESULT

1. By using [UP] [DOWN] select "SAVE RESULT" and press [OK].

→ CABLE 001	☐
FIBER 004	
STORED : 003	
- CABLE +	FIBER

2. Select the cable (folder) using [- CABLE +], the unit will display the number of saved results under the selected cable, then press [FIBER].

→ CABLE 001	☐
→ FIBER 004	
STORED : 003	
- FIBER +	SAVE

3. The unit will suggest the FIBER position under the selected CABLE.
Accept the suggested FIBER position and save the result by pressing [SAVE] or change the memory position using [- FIBER +], then press [SAVE] to save the result.

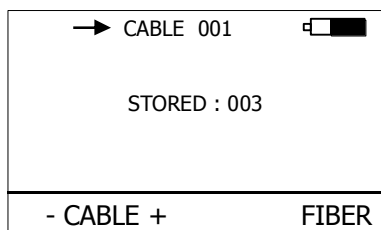
NOTE: If the selected memory position is already occupied, the "!" mark will appear on the display.

→ CABLE 001	☐
→ FIBER 001!	
STORED : 003	
- FIBER +	SAVE

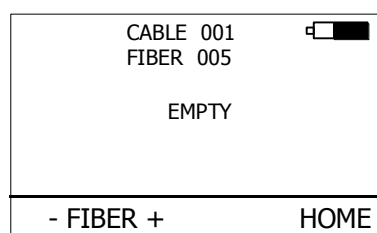
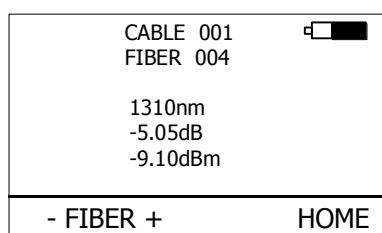
By pressing [SAVE], the new result will OVERWRITE the selected FIBER position and the old result will be discarded.

8.3.2 BROWSE RESULTS

1. By using [UP] [DOWN] select "BROWSE RESULTS" and press [OK]



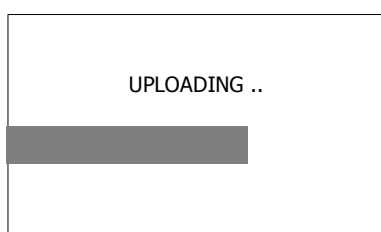
2. Select the cable (folder) using [- CABLE +], the unit will display the number of saved results under the selected cable, then press [FIBER].



3. Use [- FIBER +] to browse through the results.

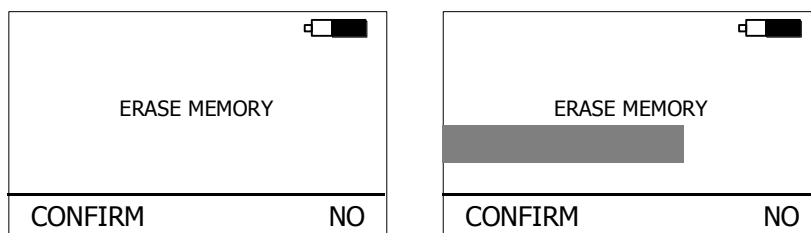
8.3.3 UPLOAD MEMORY

1. By using [UP] [DOWN] select "UPLOAD MEMORY".
2. Press [OK]. All memory content will be sent to the USB port. More information is contained in the chapter "setting up data transfer".



8.3.4 ERASE MEMORY

1. By using [UP] [DOWN] select "ERASE MEMORY" and press [OK].



2. Press [CONFIRM] to erase memory or [NO] for return to main screen.

8.3.5 HOME

1. By using [UP] [DOWN] select "HOME".
2. Press [OK] for return to main screen.

9 Measurement loss

9.1 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 of 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-800 and LS-800 are used for this test, where the light source (LS-800) acts as a transmitter and the optical power meter (PM-800) as a receiver.

The "end to end" test has two steps:

1. Setting the reference
2. Measurement the loss

Important

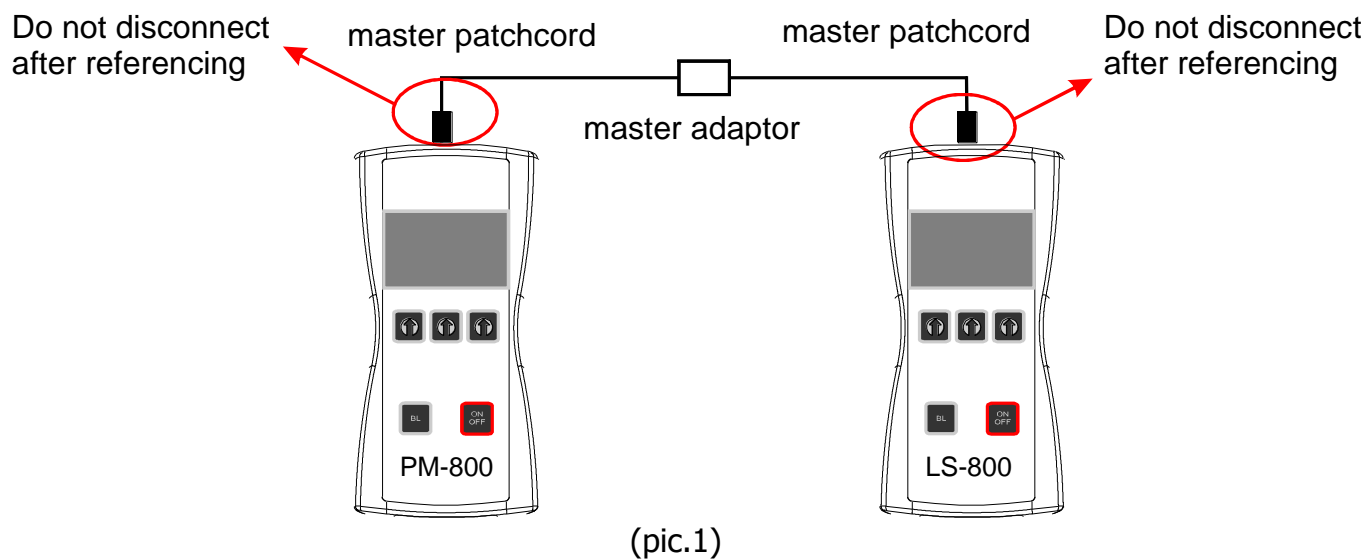
- All connectors and fiber end faces should be cleaned prior to testing (see chapter 7.3).
- The master cord used to set the reference should be the same type as the patchcords (cables) to be tested (MM:50/125, 62.5/125 or SM).
- It is very important that the connections are not disturbed after the reference value is established.

9.2 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.

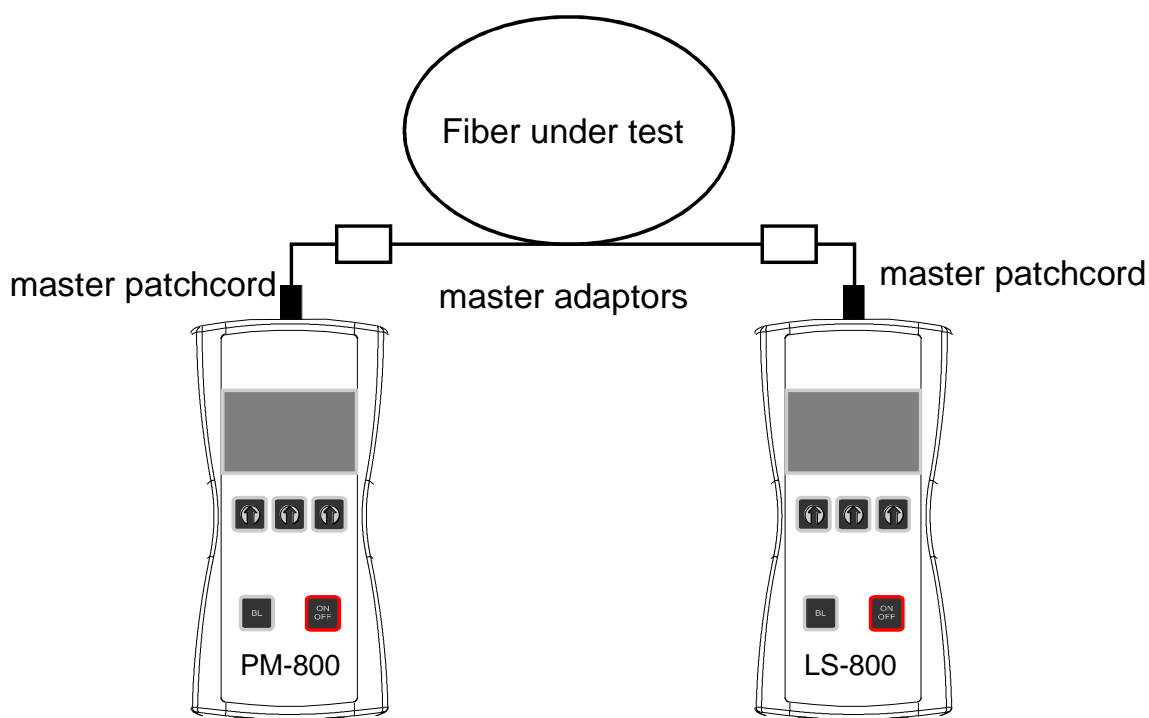
9.2.1 Setting the reference

1. Connect the first master cord to the power meter (PM-800).
2. Connect the second master cord to light source (LS-800).
3. Use the master adaptor to connect the two fiber ends (pic.1).
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 **[LOSS]**.
7. Set and store the new reference for the selected wavelength - by pushing **[REF]** and then **[CONFIRM]**.



9.2.2 Measurement Loss

1. Do not disconnect the master cords from the light source and power meter.
2. Disconnect second master cord from the adaptor.
3. Connect the trace to be measured between the master cords. An extra master adaptor is required (pic.2).
4. The power meter display will simultaneously report the value with the message "LOSS" or "GAIN" in dB.
5. This value represents a difference between the reference and the performed measurement.
6. If the value will be displayed with the "LOSS" message, the trace to be measured has just this loss.
7. If the value will be displayed with the "GAIN" message, this means that the trace to be measured has been compared with the reference for this gain.
8. Value of loss (or gain) can be stored in the internal memory (see "SAVE RESULT" chapter).



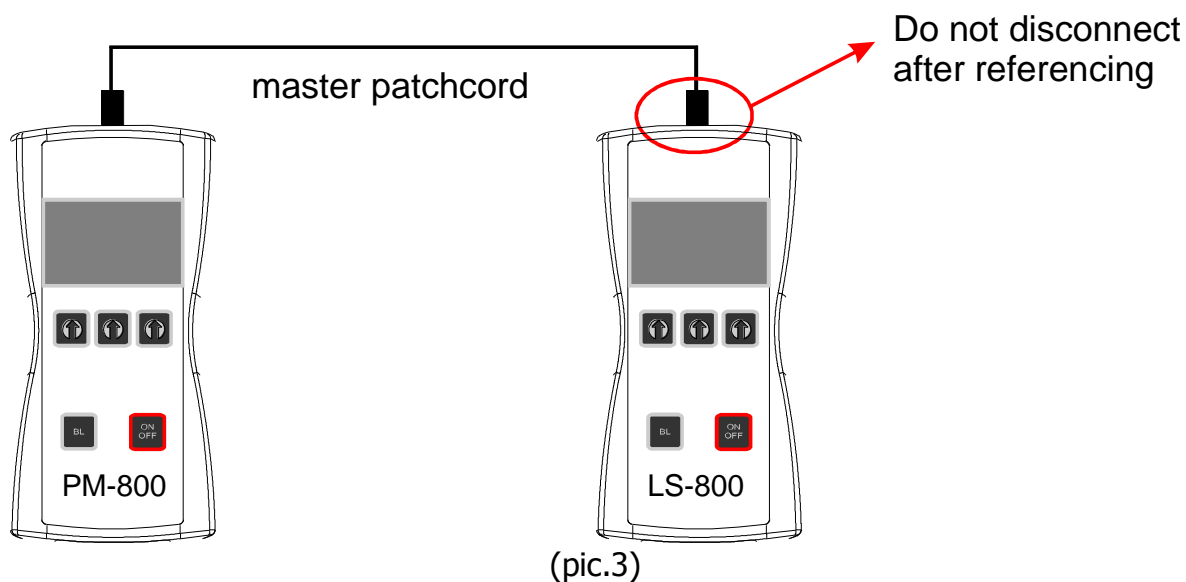
(pic.2)

9.3 Method 7

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

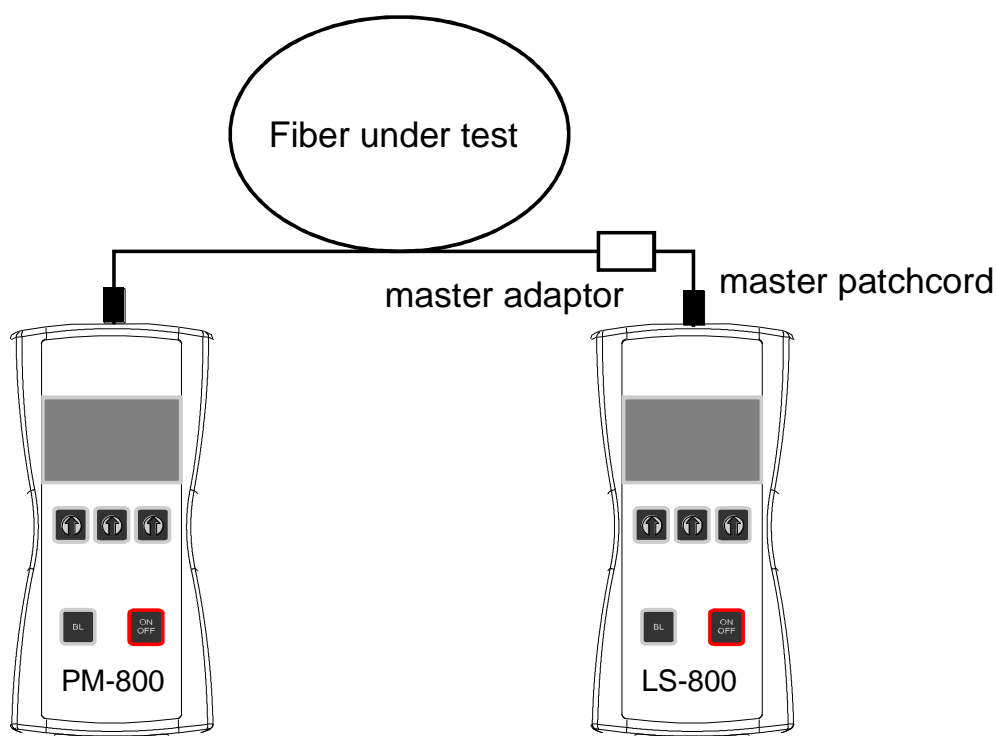
9.3.1 Setting the reference

1. Connect the master cord to the power meter (PM-800).
2. Connect the second end of the master cord to the light source (LS-800, pic.3).
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 [LOSS].
6. Set and store the new reference for the selected wavelength - by pushing [REF] and then [CONFIRM].



9.3.2 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 (pic.4)
4. The power meter display will report the value simultaneously with the message "LOSS" or "GAIN" in dB.
5. This value represents the difference between the reference and the performed measurement.
6. If the value will be displayed with the message "LOSS", the trace to be measured has just this loss.
7. If the value will be displayed with the message "GAIN", this means that the trace to be measured has been compared with the reference for this gain.
8. The value of the loss can be stored in the internal memory (see "SAVE RESULT" chapter).



(pic.4)

9.4 High power measurement

For measurement up to +13 dBm is intended PM-800:
-70 dBm to +13 dBm for 1300, 1310, 1490, 1550, 1625 nm
(standard measurement methods 6 or 7 described above)

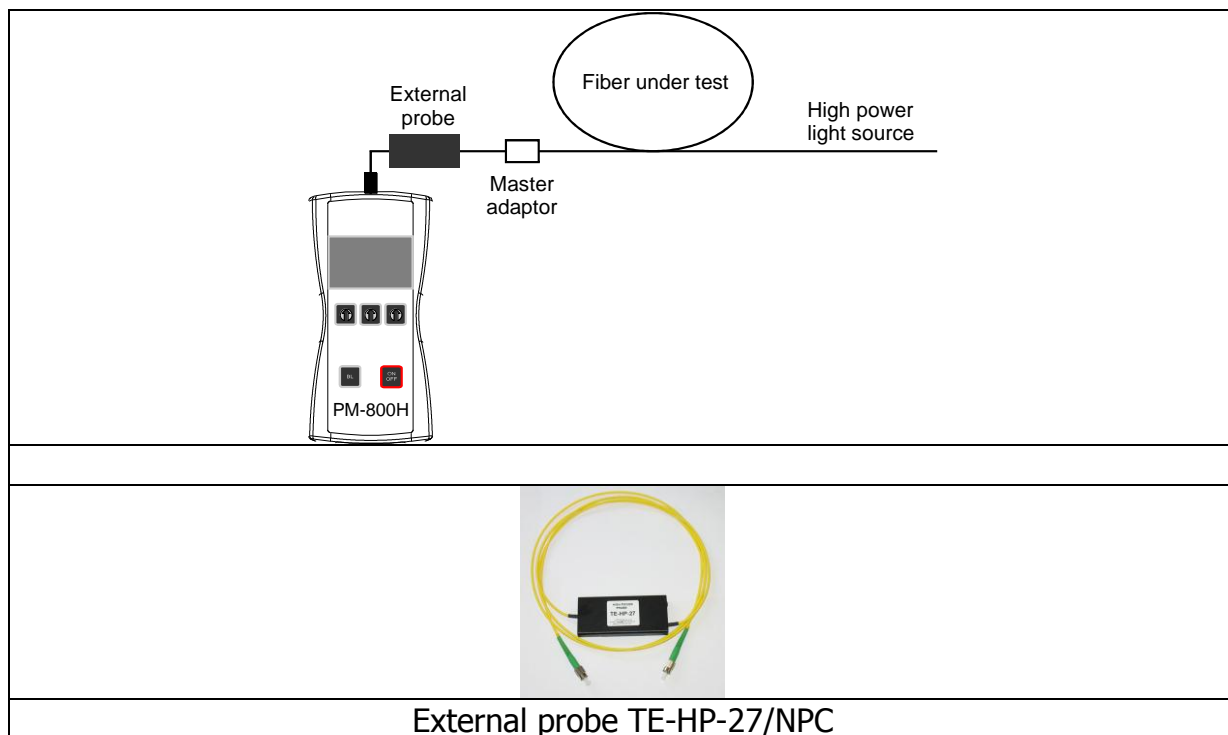
For high power measurement is intended PM-800H:
-40 dBm to +17 (max +20¹) dBm for 1300, 1310, 1490, 1550, 1625 nm
or PM-800H with external probe:
-40 dBm až +27² (max +30^{1,2}) dBm pro 1300, 1310, 1490, 1550, 1625 nm

Note: 1) Short term application
2) Measurement with external probe

Warning !!!

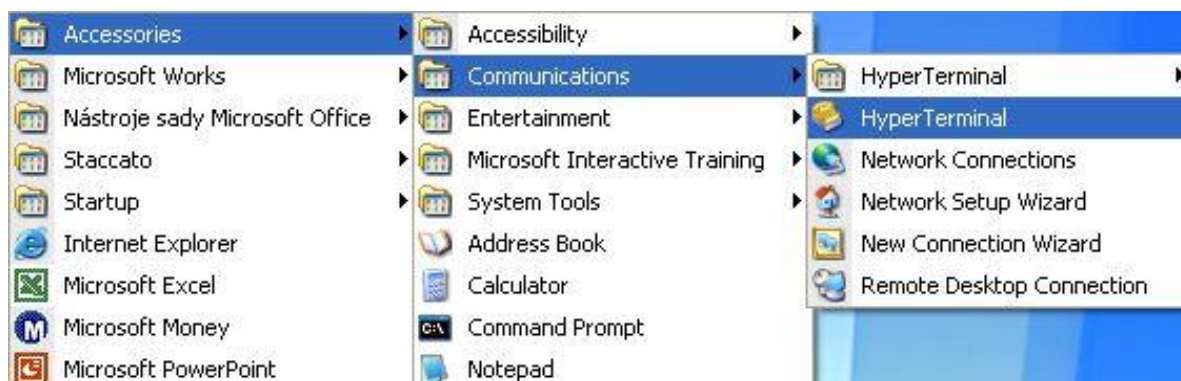
Never use PM-800 for high power measurement above +13 dBm. The high power can destroy optical interface and damage instrument. For high power measurement above +13 dBm use only PM-800H and PM-800H with external probe for measurement above +17 dBm.

For high power measurement is necessary to use following measurement configuration:



10 Setting up data transfer

1. Connect the PM-800 to a PC using the USB cable provided and turn the PM-800 on. The PC will prompt you to install the drivers for new hardware. Use the drivers provided by OPTOKON. These drivers will create a virtual serial com port.
2. Start the Hyper Terminal
Start >> Programs >> Accessories >> Communication >> Hyper Terminal



3. Enter the name of a connection, then click on OK.



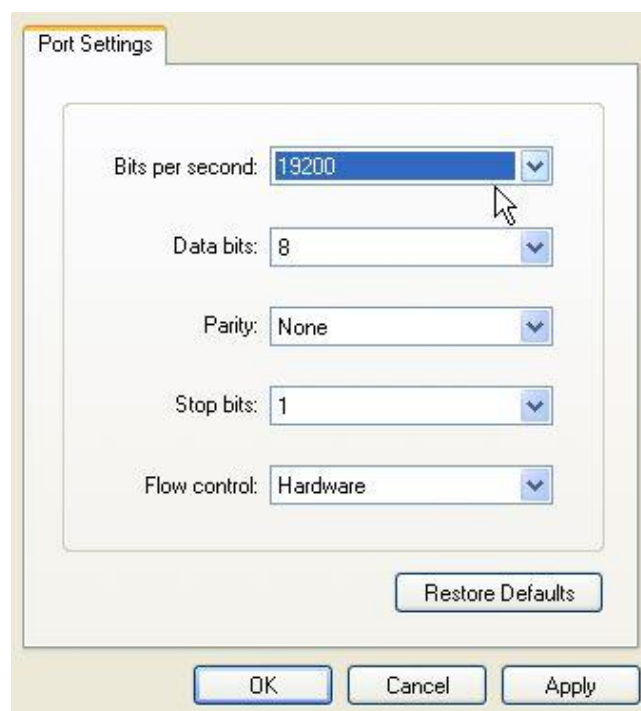
4. Choose the virtual serial port the PM-800 is connected to, then click on OK



The screenshot shows a configuration window for the PM-800. At the top left is a red telephone icon and the text 'PM-800'. Below this is the instruction 'Enter details for the phone number that you want to dial:'. The form contains the following fields:

- Country/region:** A dropdown menu showing 'United States (1)'.
- Area code:** A text box containing the number '1'.
- Phone number:** An empty text box.
- Connect using:** A dropdown menu with the following options: 'Generic SoftK56', 'Generic SoftK56 Standard 9600 bps Modem', 'COM3' (which is highlighted in blue), and 'TCP/IP (Winsock)'.

5. Set "Bits per second" to 19200, then click on OK



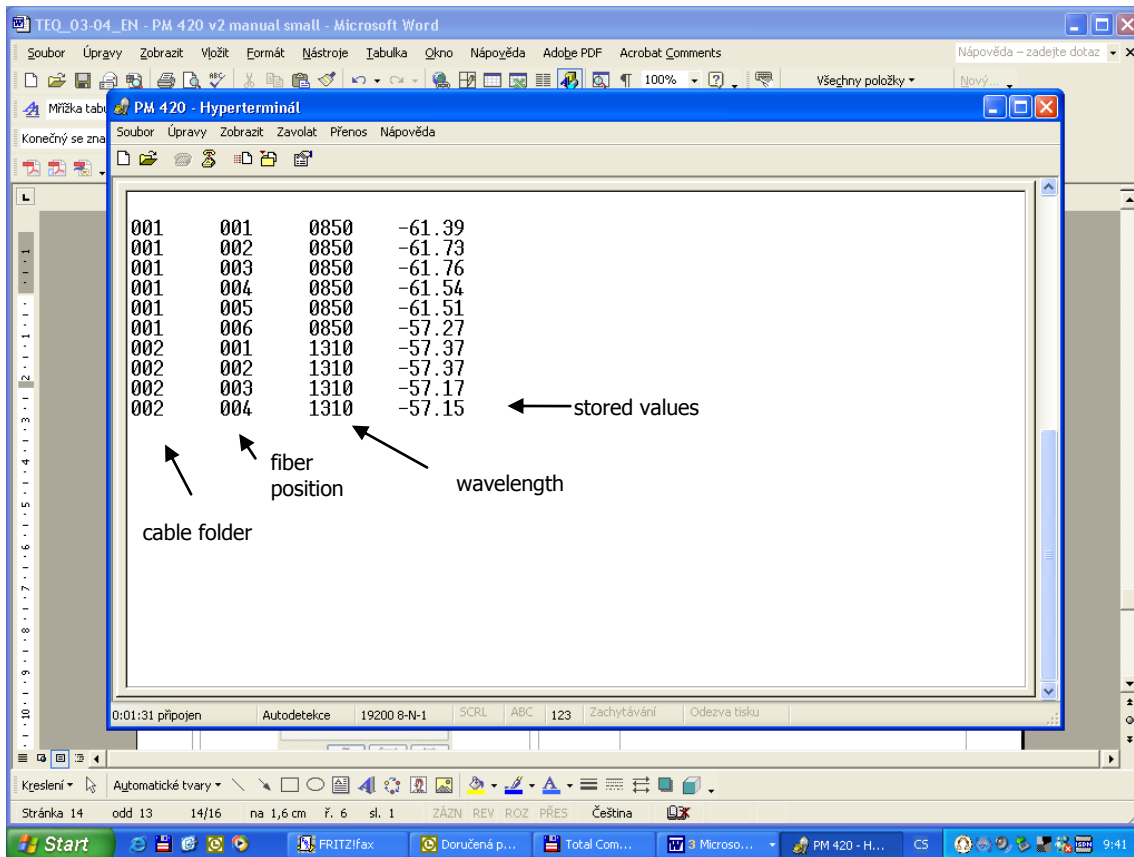
The screenshot shows a 'Port Settings' dialog box. It contains the following settings:

- Bits per second:** A dropdown menu set to '19200'.
- Data bits:** A dropdown menu set to '8'.
- Parity:** A dropdown menu set to 'None'.
- Stop bits:** A dropdown menu set to '1'.
- Flow control:** A dropdown menu set to 'Hardware'.

At the bottom of the dialog box are three buttons: 'OK', 'Cancel', and 'Apply'. A 'Restore Defaults' button is also present above the 'OK' button.

6. Go to the menu in PM-800 and push [MEM], select [UPLOAD MEMORY], [OK].

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.

11 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

12 Notes

[illegible]

13 Calibration, service center

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