



RADIOMETER PHOTOMETER

NDTM-10



INSTRUCTION MANUAL

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July 2017

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1 INSTRUMENT CHARACTERISTIC

Radiometer-Photometer NDTM-10 is two-channel, integrating meter designed for checking viewing conditions during non-destructive testing (NDT) by magnetic particle inspection (MPI) method. That kind of test is used to detecting surface and slightly subsurface discontinuities in ferromagnetic materials such as iron, nickel, cobalt and some of their alloys.

The meter has two measuring channels:

- VIS – high quality luxmeter,
- UVA – UV-A range photometer.

Technical specification of the instrument conforms to standards:

- ISO/CIE 19476 Characterization of the performance of illuminance meters and luminance meters.
- EN ISO 9934 Non-destructive testing – Magnetic particle testing – Part 1: General principles.
- EN ISO 3059 Non-destructive testing – Penetrant testing and magnetic particle testing – Viewing conditions.

1.1 Equipment

Basic equipment:

- two-channel measuring probe,
- two-channel integrating meter,
- two LR03 batteries,
- instruction manual,
- warranty card.

Extra equipment:

- photometric probe handle,
- USB cable.

1.2 Construction

1.2.1 Measuring probe

Measuring probe's input window is common to both channels, what provides the same directional characteristic and doesn't introduce additional error resulting from detectors shift for small measuring distances.

The position of reception plane, with respect to which distance between source and probe is measured, is marked on the cylindrical surface of the probe by white dash (8.3mm from the front surface).

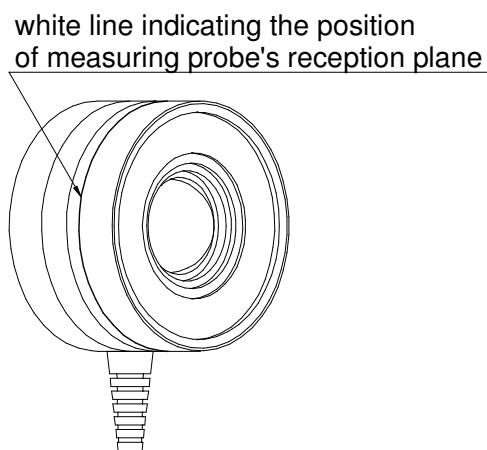


Fig.1. The position of measuring probe's reception plane.

1.2.2 Integrating meter

Keyboard and LCD screen is located on the front panel of the meter. Measuring probe socket is on the top panel, battery compartment and mini USB socket are on the bottom panel. USB socket can be used to firmware update and meter control.

1.3 Measured quantities

NDTM-10 meter allows a simultaneous measurement of:

- illuminance (VIS channel),
- UV-A irradiance (UVA channel).

The result of the single measure is 1 second average value. Measured values are displayed on LCD with resolution specified in 1.4 Technical data, reduced to 4 oldest significant digits.

1.4 Technical data

	UVA channel	VIS channel
Spectral matching	according to EN ISO 3059	$V(\lambda)$ CIE
• matching quality	$\Delta\lambda_{1/10}$ 320 – 395nm $\Delta\lambda_{1/2}$ 337 – 385nm λ_{\max} 365nm $S_{\lambda=313\text{nm}}$ < 5% $S_{\lambda=405\text{nm}}$ < 0.5%	$f_1^{2)}$ $\leq 3\%$
Direction matching	cosine	cosine
• matching quality	$f_2^{1)}$ $\leq 3\%$	$f_2^{2)}$ $\leq 3\%$
Nonlinearity	$f_3^{1)}$ $\leq 0.5\%$	$f_3^{2)}$ $\leq 0.5\%$
Measuring range ³⁾	100 W/m ² (10 mW/cm ²)	10 000 lx
Resolution	0.01 W/m ² (1 μ W/cm ²)	0.1 lx
Measurement memory	20 cells	
Power supply	2x LR03 batteries (1.5V, AAA size)	
Environmental conditions		
• temperature	-10 ÷ +50°C	
• relative humidity	90% (without condensation)	
Dimensions		
• meter	107×72×19mm (without measuring probe socket)	
• measuring probe	Ø44 x 25.5mm	
• measuring probe cable length	1.5m	
Weight with measuring probe and batteries	335g	

¹⁾ Characterizing the Performance of Integral Measuring UV-Meters. Final Report of WG1 Thematic Network for Ultraviolet Measurements. November 2000.

²⁾ ISO/CIE 19476 Characterization of the performance of illuminance meters and luminance meters.

³⁾ Minimum value guaranteed by manufacturer. Real value depends on sensitivity of used detector.

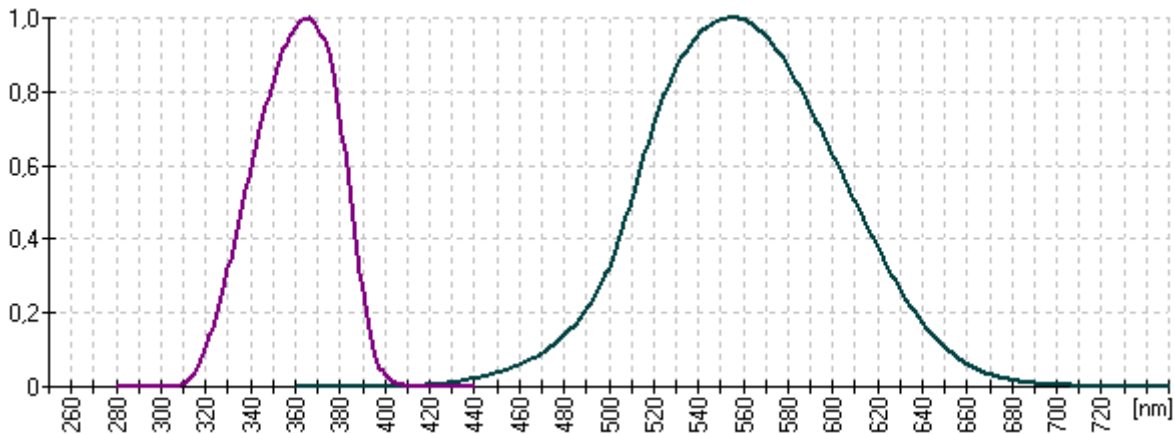


Fig.2. Relative spectral sensitivity of both VIS and UVA channels.

1.5 Firmware update


NDTM-10 firmware can be updated by user. Update procedure is as follows:



- Download SonBoot application from the manufacturer's website.
- Download NDTM-10 firmware from the manufacturer's website.
- Connect the meter to PC by USB cable.
- Wait for proper drivers installation.
- Run SonBoot application.
- Select NDTM-10 from the "Device type" list
- Select connected meter from "USB Device" list
- Open firmware file.
- Turn on the meter.
- Push "Program" button.

2 OPERATION

2.1 Powering the instrument

Before turning on the instrument, two AAA size batteries should be placed in the battery compartment according to the polarity marked on the back panel of the meter. High capacity alkaline batteries should be used, i.e. LR03 type. The meter turns on by pushing and hold

for a while button . After turning on, meter name and firmware version is displayed on the LCD screen. That screen will disappear after about 15 seconds or after pushing any



key. On welcome screen pushing buttons   enters set contrast menu (look at: 2.4.4.1 Contrast).




After welcome screen disappears results screen is displayed. Result screen contains:

- VIS channel measured value, expressed in lux,
- UVA channel measured value, expressed in W/m^2 or W/cm^2 depends on user setting (look at: 2.4.4.4 UVA unit),
- battery indicator,
- RUN / PAUSE indicator.


2.2 Battery indicator



Battery indicator is displayed in the top right corner of the results screen:

-  battery full,
-  battery partially discharged,

-  battery discharged,
-  battery discharged to critical level – meter can automatically power off in any time,
-  meter power supplied from USB port (look at: 3 COMMUNICATION WITH PC).


2.3 Measure

The measurement starts and pause using button . RUN / PAUSE indicator is displayed in the bottom right corner of the results screen::

-  measure paused, last measured values are presented,
-  measure is running, current measured values are presented.

Measured results from both channels are displayed with measured units. Also, unit prefixes are used::

- μ "micro" $\times 10^{-6}$,
- m "milli" $\times 10^{-3}$,
- k "kilo" $\times 10^3$,
- M "mega" $\times 10^6$.





In the case of measuring range overload, overload indicator  is displayed in front of measured value. Overload is signaled when at least one actual value of the one second average is higher than measurement range. In that case, average value can be much less than high limit of measured range but it is saddled with significant error.

2.4 Menu

To change parameters and settings of the meter hierarchical menu system was developed. Menu is organized as follows:

- Zeroing
- Memory
 - Save
 - Load
 - Results
 - Erase
- Calibration
 - VIS
 - UVA
- Setup
 - Contrast
 - Autooff
 - Backlight
 - UVA unit
 - W/m^2
 - W/cm^2
 - Language
 - Polish
 - English
- Measuring ranges

Menu is called by pushing button . Buttons   are used to menu navigation.

Button  confirms the choice, button  is used to back to previous level of menu or cancel. If the number of menu items don't fit the on the screen, indicators   appear to inform about invisible positions.

2.4.1 Zeroing




That option is used to detectors' dark current and measurement channel offset voltage compensation to set indication to zero when there is no input signal in both channels.


CAUTION: Zeroing can be started only when measuring probe is covered. Otherwise, measured results will be inaccurate.

2.4.2 Memory

The instrument is equipped with a measurement memory. Using the memory is possible from menu system level, by submenus: save, load, erase. Once you have selected one of the three available options, you will see a list of memory cells.





The list shows the illuminance and irradiance values in the cell, or "none" if the cell is empty.



Use the keys   to select an active memory cell.  performs a save, load or

erase operation. In erase submenu, using button  when empty cell is selected erase all measurement memory (this operation requires additional confirmation in the dialog box shown).

2.4.3 Calibration

This menu allows to check calibration factors and to adjust indicated value by changing that calibration factors in both channels. After entering the menu, calibration factors for both channels are displayed. Measuring channel should be selected. On the next screen current measured value is displayed. This number should be edited to obtain proper measured





value, using buttons   to change digit value or unit prefix and button  to select active digit and unit prefix. After pushing  button, old and new calibration factors are

displayed. Another pushing of  button accept changed calibration factor value. Pushing key  in any time cancels adjustment and back to the main adjustment menu.

2.4.4 Setup



2.4.4.1 Contrast



In this menu LCD contrast can be adjusted. Changing of contrast is made using buttons


 . Button  turns backlight on and off during regulation. New contrast setting can be accepted using button .


2.4.4.2 Autooff function

This setting allows to save battery life. When the option is turned on, instrument will be

switched off after set time from last pushing of any button. Buttons   are used to

turn the function on or off. Autooff time can be set using   buttons to change

value of the digit and  button to change active digit when the function is ON. Time is set in format: hh:mm:ss (hours, minutes, seconds). The minimal time is 30s. New setting

can be accepted using button .





2.4.4.3 Backlight

This menu allows to manage meters' backlight. There are three options, which can be

changed using   buttons:

- On – backlight always on (shortest battery life),
- Off – backlight always off (maximum battery life),




- Auto – backlight on during set time after button pushing (compromise between user's comfort and battery life).

After choosing position "Auto", time can be set using   buttons to change value of the digit and  button to change active digit. Time is set in format: hh:mm:ss (hours, minutes, seconds). New setting can be accepted using button .

2.4.4.4 UVA unit

In this menu irradiance units can be changed. Available possibilities:




- W/m²,
- W/cm².

The choice is performed using   buttons and new setting can be accepted using button .

2.4.4.5 Language

In this menu language of the menu can be changed. Available possibilities:


- Polish,
- English.

The choice is performed using   buttons and new setting can be accepted using button . Language is changed “on the fly”, just after selecting a new one.

2.4.5 Measuring ranges

This menu allows to check of real measuring ranges for both VIS and UVA channels. These measuring ranges are strictly connected with calibration factors and are result of varied sensitivity of used detectors (look at: note ³⁾ in section 1.4 Technical data).

2.5 Turning off the instrument

To turn off the instrument push and hold  button for at least 2 seconds.

2.6 Calibration procedure

Calibration is the process of finding a relationship between two quantities, one of which is standard value and second one which is unit under test. After calibration adjustment can be made, to adjust the indication of the instrument to the applied standard value. Calibration (including adjustment) should be conducted not less than once a year.

Calibration procedure:

- Place proper standard on photometric bench (illuminant A for VIS channel or 365nm monochromatic source for UVA channel).
- Place measuring probe in the axis of the radiation source.
- Calculate proper value of illuminance or irradiance, using standard value and measured distance between probe's reception plane (look at: 1.2.1 Measuring probe) and the source, or measure that value using reference meter.
- Using NDTM-10 meter, measure illuminance / irradiance.

Adjustment procedure:

- Enter to meter's menu and select option Calibration.
- Select proper channel.
- Enter previously calculated or measured proper value of measured quantity and accept a new calibration factor (look at: 2.4.3 Calibration).

3 COMMUNICATION WITH PC

NDTM-10 is equipped with mini USB socket for PC connection. After first connection, proper drivers should be installed by system. This communication interface can be used to firmware update (look at: 1.5 Firmware update) or unit control using dedicated software.

After connection of USB cable, meter turns on automatically and is powered from USB port. Then meter cannot be turned off using keyboard. Meter turns off after USB cable disconnecting.

4 SAFETY DURING MEASURES

NDTM-10 instrument is designed to ultraviolet radiation measurement which is dangerous for human health. Special care should be taken during measurement, eyes and skin protections should be used to reduce ultraviolet radiation dose.

During using NDTM-10 meter to non-destructive testing it is essential to follow the recommendations contained in section 5 of EN ISO 9934-1 standard.

5 RECOMENDATIONS FOR INSTRUMENT USE

- It is not recommended to expose instrument on falls, shakes neither on any other factors that might cause mechanical damages.
- Protect instrument from excessive moisture and aggressive chemical agents that may damage the meter.
- The measuring probe cover should be removed only at the time of the measurement.
- In the case of dirty measuring probe dome, unscrew the stepped ring, as shown on the picture below, and clean it with a soft cloth dampened with clean alcohol

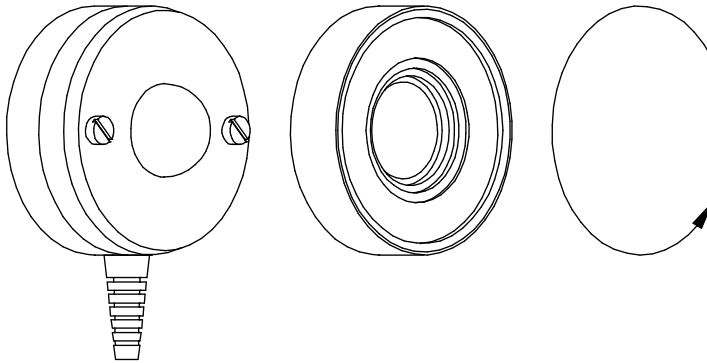


Fig.3. Access to the measurement probe dome.

- In the case of overload of any channel, remove measuring head from the measuring field or cover the probe. Prolonged exposure with strong radiation can damage detectors.
- The instrument should be stored and transported in factory case.
- In the case of longer storage, remove batteries from the instrument.

6 MAINTENANCE AND REPAIRS

Radiometer-photometer NDTM-10 requires no special maintenance treatments.

Any repairs have to be performed by the manufacturer of the instrument.

7 CE MARKING AND CONFORMANCE TO EU COUNCIL DIRECTIVES

The product described in this instruction conforms to following EU Council Directives: 2004/108/EC Electromagnetic compatibility.



The conformance to above-mentioned requirements is confirmed by CE mark.



This product cannot be thrown away with household waste. Deposit the product in an authorized electrical and electronic waste collection area for recycling. Contact local Municipal Bureau or nearest waste disposal company to get more detailed information.