

sonopan

NDTM-10

RADIOMETER PHOTOMETER



Instruction manual

PPUH SONOPAN Sp. z o.o.
ul. Ciołkowskiego 2/2, 15-950 Białystok, Poland
phone +48 85 742 36 62
sonopan@sonopan.com.pl
<https://www.sonopan.com.pl>

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1. CHARACTERISTICS OF INSTRUMENT

The NDTM-10 radiometer-photometer is a two-channel, integrating meter designed for the control of observation conditions during non-destructive tests (NDT) by the magnetic particle inspection (MPI) method. This kind of tests are used for detecting surface and slightly subsurface discontinuities in ferromagnetic materials such as iron, nickel, cobalt and some of their alloys

The meter has got two measuring channels:

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

The technical specification of the instrument conforms to the 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

The input window of the measuring probe is shared by two channels, which provides the same directional assessment of radiation and doesn't cause additional errors resulting from the shift of the detectors for small measuring distances.

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

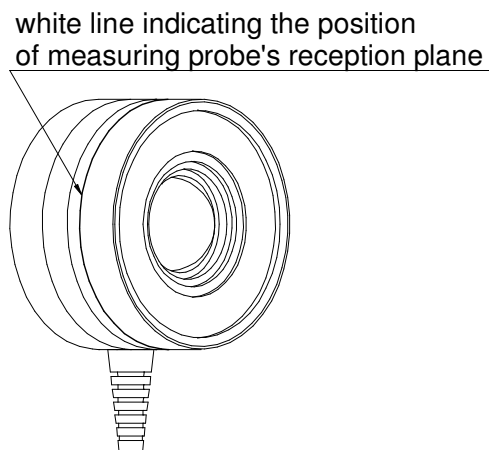


Fig.1. Position of the reception plane of the measuring probe.

1.2.2. Integrating meter

The keyboard and LCD screen are located on the front panel of the meter. The measuring probe socket is on the top panel while the battery compartment and mini USB socket are on the bottom panel. The USB socket can be used for the firmware update and meter control.

1.3. Measured quantities

The NDTM-10 meter enables a simultaneous measurement of:

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

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

1.4. Technical data

	UVA channel	VIS channel
Spectral matching	according to EN ISO 3059	V(λ) 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%	$f_1^{1) 2)}$ $\leq 3\%$
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.

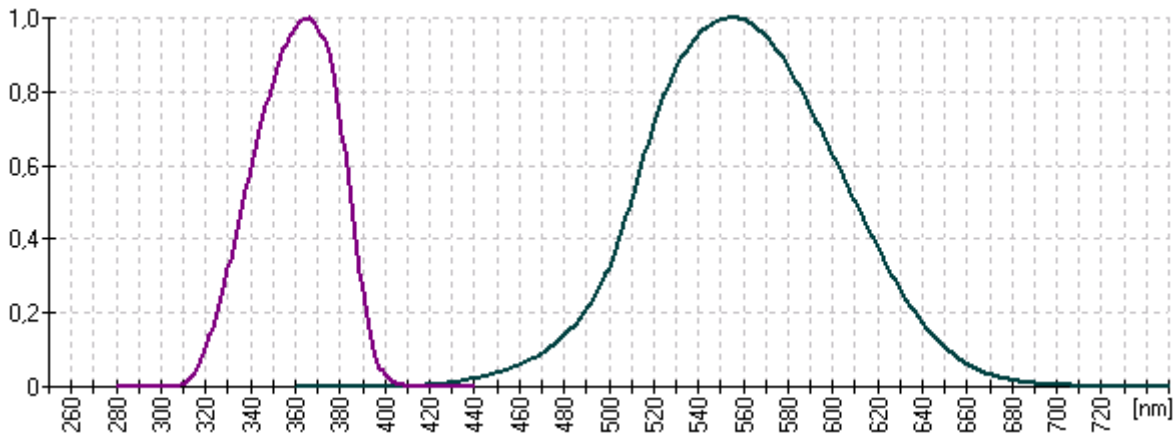


Fig.2. Relative spectral sensitivity of both VIS and UVA channels.

1.5. Firmware update


The NDTM-10 firmware can be updated by the user. The update procedure is as follows:



- Download the SonBoot application from the manufacturer’s website.
- Download the NDTM-10 firmware from the manufacturer’s website.
- Connect the meter to a PC with the use of the USB cable.
- Wait for the installation of the drivers.
- Run the SonBoot application.
- Select the NDTM-10 from the “Device type” list
- Select the connected meter from the “USB Device” list
- Open the firmware file.
- Turn on the meter.
- Press the “Program” button.

2. OPERATION

2.1. Powering the instrument

Before the instrument is turned on, 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 is turned on

with the use of the  button being pressed and held for a while. The welcome screen with the name of the meter and firmware version are displayed after the instrument is turned on. The screen will be turned off in about 15 seconds or after any key is pressed.




While the welcome screen is on, with the use of the   buttons, the contrast set menu is selected (see: 2.4.4.1 Contrast).



After the welcome screen is off, the results screen is displayed. It contains:

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


2.2. Battery indicator



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

-  full battery,
-  partially discharged battery,
-  battery discharged,

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


2.3. Measurement

The measurement is started and paused with the use of the button . The RUN / PAUSE indicator is displayed in the bottom right corner of the results screen::

-  measurement is paused, last measured values are displayed,
-  measurement is running, current measured values are displayed.

The measurement results from both channels are displayed with the units of the measured quantities. The prefixes of multiplies and sub-multiplies of the units are used and they are the following ones:








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

In the case of the measuring range overload, the overload indicator  is displayed in front of the measured value. The overload is signalled when at least one current value of the one second average is higher than the measurement range. In that case, the average value can be much lower than the maximum value of the measurement range, but it is affected by a significant error.

2.4. Menu

In order to change the parameters and settings of the meter the hierarchical menu system is used. The menu structure 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

The menu is invoked with the use of the  button. The   buttons are used for menu navigation. The  button is used to confirm the choice, the  button is used to move back to the previous level of the menu or cancel the edited value. If the number of menu items don't all fit on the screen, the following indicators   are displayed to inform about these invisible positions.





2.4.1. Zeroing

The option is used for compensation of the dark current of the detectors and measurement channel offset voltage in order for the meter to indicate “zero” in both channels when there is no signal in the input window of the probe.

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






2.4.2. Memory

The instrument is equipped with the memory of measurements. Using the memory is possible from the menu level with the help of the submenus: save, load or erase. Once you have selected one of the three available options, you can see a list of memory cells. The list contains the illuminance and irradiance values in the cell, or "none" if the cell is empty.

The following keys   are used to select an active memory cell. The  button is used to save, load or erase a memory cell. When an empty cell is selected, pressing the  button in the menu “erase” results in deleting the whole memory of the measurements (this operation requires additional confirmation in the dialogue box displayed on the screen).





2.4.3. Calibration

This menu enables to check calibration factors and adjust the indicated value by changing these calibration factors in both channels. After the menu is entered, the calibration factors for both channels are displayed. The measuring channel should be selected. On the next screen the current measured value is displayed. This number should be edited to





obtain the proper measured value, using the following buttons   to change the digit value or unit prefix and the  button to select the active digit and unit prefix. After the button is pressed, the old and new calibration factors are displayed. When the  button is pressed once again, the changed calibration factor value is accepted. When the  key is pressed at any time, the adjustment is cancelled and the main adjustment menu is displayed again.



2.4.4. Setup

2.4.4.1. Contrast

In this menu the LCD contrast can be adjusted. The change of contrast is made with the use of the following buttons   . The  button is used to turn backlight on and off during contrast adjustment. The new contrast setting can be accepted with the help of the  button.

2.4.4.2. Autooff function





This setting enables to save the battery life. When the option is turned on, the instrument is switched off after the time is set starting from the recent pressing of any button. The following buttons   are used to turn the function on or off. The auto-off time can be set with the use of the   buttons to change the value of the

digit and  button to change the active digit when the function is ON. The time is set in the format: hh:mm:ss (hours, minutes, seconds). The minimal time is 30s. The new setting can be accepted with the use of the  button.

2.4.4.3. Backlight

This menu enables to manage the backlight of the meter. There are three options which can be changed with the help of the   buttons:




- On – backlight always “on” (shortest battery life),
- Off – backlight always “off” (maximum battery life),
- Auto– backlight “on” during the set time after the button is pressed (a compromise between the user’s comfort and battery life).

After the position "Auto" is chosen, the time can be set, using the   buttons to change the value of the digit and the  button to change the active digit. The time is set in the format: hh:mm:ss (hours, minutes, seconds). The new setting can be accepted with the use of the  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 with the use of the   buttons while the new setting can be accepted with the aid of the  button.

2.4.4.5. Language

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


- Polish,
- English.

The choice is made with the use of the   buttons and the new setting can be accepted with the  button. The language is changed “on the fly”, just after selecting a new one.

2.4.5. Measuring ranges

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

2.5. Turning off the instrument

To turn off the instrument, the  button should be pressed and held for at least 2 seconds.

2.6. Calibration procedure

The procedure of calibration is the comparison of the measured values with those of a calibration standard of known accuracy. After calibration is conducted, adjustment can be made in order to adjust the indication of the instrument to the applied standard value. Calibration (including adjustment) should be conducted at least once a year.

The procedure of calibration:

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

The procedure of adjustment:

- Enter the menu of the meter and select the "Calibration" option.
- Select the proper channel.
- Enter the previously calculated or measured proper value of the measured quantity and accept a new calibration factor (see:2.4.3 Calibration).

3. COMMUNICATION WITH PC

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

After the USB cable is connected, the meter is turned on automatically and is powered from the USB port. The meter cannot be turned off with the use of keyboard. The meter is turned off after the USB cable is disconnected.

4. SAFETY DURING MEASUREMENT

The NDTM-10 meter is designed for ultraviolet radiation measurement which is dangerous for human health. Special care should be taken during measurements, eye and skin protection should be used to reduce the dose of ultraviolet radiation.

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

5. USAGE RECOMMENDATIONS

- It is not recommended for the meter to be exposed to falls, shakes or any other factors that might cause mechanical damages.
- The meter should be protected from excessive moisture and aggressive chemical agents that might damage the meter.
- The measuring probe cover should be removed only at the time of the measurement.
- In the case of the dirty measuring probe dome, unscrew the stepped ring, as shown in the picture below, and clean it with a soft cloth moistened with pure alcohol.

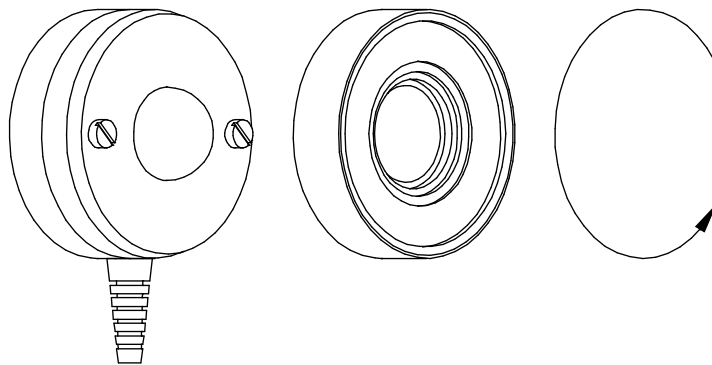


Fig.3. Access to the measurement probe dome.

- In the case of re-control in any channel, the probe should be removed from the measuring field or it should be covered with a cap. The detectors will be damaged if they are exposed to strong radiation for too long.
- The instrument should be stored and transported in the original package.
- In the case of the instrument not being used for a long time, the batteries should be removed from the instrument.

6. MAINTENANCE AND REPAIRS

The NDTM-10 radiometer-photometer does not require any special maintenance jobs. **All repairs of the instrument must be performed by the manufacturer.**

7. CE MARKING AND CONFORMANCE TO EU COUNCIL DIRECTIVES

The product described in this instruction conforms to the 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.