

**FOTOMETER 2008 STD**  
**(Light attenuation meter users guide)**



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## Device description

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Light attenuation meter FOTOMETER 2008 consists of modulated light source, lock-in type light detector and control unit. Device measures intensity of light traveling from the light source to the light detector. It makes the device suitable for measurement changes of attenuation of light in the area between the light source and the light detector. Due to synchronization between light source modulation and the light detector the device is, to some extent, immune to ambient light and could be operated on normal day light conditions.

The readout of intensity value is in linear arbitrary units (AU) and is not directly related to any engineering units. The device is intended only for measurement of relative changes in light intensity.

Device has four decadic ranges and could be operated in two different modes. In **manual mode** the ranges must be switched manually by user. In **automatic mode** the device itself changes mode when intensity readout goes out of actual range.

The light detector is equipped with two input filters. **Fast filter** provides quick response but slightly higher noise and is intended for measurement of unstable, changing light intensity. For measurement in stable, balanced conditions might be done using **slow filter** which reduces noise but has very long settling time (up to one minute).

## Safety rules

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The control unit is powered by 230V AC which might be dangerous to life. Never remove the cover of control unit when the mains electricity is connected. Mains plug **MUST** be always removed before unscrewing the cover. Any service must be provided by a qualified electrician only.

Device may be operated only in room environment between 15 and 40 C with non condensing humidity. When moving device from cold environment to room temperature always allow the device temperature to accommodate to room environment to avoid moisture to condensate on the device before switching the device on.

## Setting up the device

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Mount control device to its place, preferably a 19 inch rack case. Connect 15 pin cable between the control unit and the detector and 25 pin cable between the control unit and the light source. Double check that cables are connected properly according to labels on control unit. Connect mains electricity and switch the device on.

The light source and light detector must be mounted in such position that light source outlet is facing the light detector inlet directly. The light beam must go through the area where the light attenuation should be measured. Make sure that axes of light source outlet and light detector inlet are perfectly parallel. Using small piece of paper make sure that the light beam is aimed directly to the center of light detector inlet.

## Display content

Display on control unit shows measured light intensity value as well as other related information like actual range, measurement mode, selected input filter and so on. The layout of the display is described in the table below.

Switching status			Mode
Overflow status			Range number
Intensity value	Reference 1	Reference 2	Diagnostic mode
Range	[dB]	[dB]	Filter

Meaning of display messages is described below.

Display field	Possible values	Description
Switching status	SWITCHING	Device is switching between ranges. Intensity value is not valid at the moment.
	<blank>	Device is not switching range.
Overflow status	OVERFLOW	Light detector is saturated by ambient light or too strong signal from light source. Intensity value is not valid at the moment.
	<blank>	Light detector is not in overflow condition.
Intensity value	<value in AU>	Actual value of intensity in AU. Selected range is already taken into account.
Range	Range 100	Selected range 0..100 AU (most sensitive)
	Range 1000	Selected range 0..1000 AU
	Range 10000	Selected range 0..10000 AU
	Range 100000	Selected range 0..100000 AU (less sensitive)
Reference 1	<value in dB>	Relative change in intensity since the reference 1 was set expressed in dB.
Reference 2	<value in dB>	Relative change in intensity since the reference 2 was set expressed in dB.
Mode	AUTO	Device is in automatic mode.
	MANUAL	Device is in manual mode.
Range number (according to codes used when operating device from remote computer)	RANGE 0	Selected range 0 (0..100 AU)
	RANGE 1	Selected range 1 (0..1000 AU)
	RANGE 2	Selected range 2 (0..10000 AU)
	RANGE 3	Selected range 3 (0..100000 AU)
Diagnostic mode	<blank>	Device is in standard measurement mode.
	DIAG ZERO	Device is in diagnostic mode ZERO.
	DIAG FULL	Device is in diagnostic mode FULL SCALE.
	DIAG NEG	Device is in diagnostic mode NEGATIVE FULL SCALE.
	DIAG CMR	Device is in diagnostic mode COMMON MODE REJECTION.
Filter	FILTER SLOW	Slow input filter selected.
	FILTER FAST	Fast input filter selected.

## Operating device in automatic mode

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In automatic mode the device switch to more sensitive range, when intensity value decrease below 8 percent of current range. When intensity rise over 100 percent of current range, device automatically switches to less sensitive range.

During switching device displays SWITCHING message on the display. During this period the intensity readout is not valid. On some conditions (slow filter selected, large sudden change in intensity) the intensity might not be settled when SWITCHING message disappear and additional waiting for valid value might be necessary.

### **Switching to automatic mode**

While in manual mode, press **AUTO/MANUAL** button to switch to automatic mode.

### **Switching back to manual mode**

While in automatic mode you can press **AUTO/MANUAL** button to switch back to manual mode. By pressing **RANGE+**, **RANGE-** or **DIAG** while in automatic mode you switch back to manual mode as well.

## Operating device in manual mode

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In manual mode, ranges must be switched manually by the user. When range is manually switched, device displays SWITCHING message and goes through the switching procedure in same manner as in automatic mode.

### **Switching to manual mode**

While in automatic mode you can press **AUTO/MANUAL** button to switch to manual mode. By pressing **RANGE+**, **RANGE-** or **DIAG** while in automatic mode you switch to manual mode as well.

### **Switching back to automatic mode**

While in manual mode, press **AUTO/MANUAL** button to switch to automatic mode.

### **Switching to less sensitive range**

To switch to less sensitive range press **RANGE-** button.

### **Switching to more sensitive range**

To switch to more sensitive range press **RANGE+** button.

## Using references

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To compute light attenuation directly during measurement there are two user references available. When reference is set it displays the ratio between reference value and current value in a logarithmic scale in dB. The value in logarithmic scale is computed using following formula:

$$\text{Log value [dB]} = 10 \cdot \log \left( \frac{\text{Intensity value [AU]}}{\text{Reference value [AU]}} \right)$$

## Setting reference

To set reference press SET button bellow the reference you want to set. Current intensity value is stored as reference value.

## Using input filter

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Light detector has two input filters. Fast filter is intended for measurement of values changeable in time. It provides fast response with slightly increased noise level. Slow filter suppress noise but has rather slow response time. Thus it is suitable for measurement of in stable conditions when light intensity does not change fast.

### Setting input filter

To adjust input filter press the **FILTER** button. The filter will toggle from slow to fast and vice versa with every pres of the button.

## Diagnostic modes

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The device provides four diagnostic modes which are useful for troubleshooting. The diagnostic modes are: zero offset, full scale, negative full scale, common mode rejection.

Mode	Description
Zero offset	Both differential inputs of A/D converter are switched to ground.
Full scale	Negative input of A/D converter is grounded. Positive is switched to the voltage reference.
Negative full scale	Positive input of A/D converter is grounded. Negative is switched to the voltage reference.
Common mode rejection	Both differential inputs of A/D converter are switched to voltage reference.

### Switching to diagnostic mode

To switch to diagnostic mode press **DIAG** button. First diagnostic mode is selected. With every consecutive press of **DIAG** button device will switch to next diagnostic mode. After last diagnostic mode the device switch back to normal measurement mode.

While in diagnostic mode you can switch to normal measurement mode anytime by pressing **RANGE+**, **RANGE-** or **AUTO/MANUAL** buttons.

## Basic maintenance tasks

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### Replacing bulb in the light source

To replace the bulb in the light source follow the steps described bellow.

- Switch off the device.
- Disconnect cable between control unit and the light source.
- Remove four screws on the back cover of the light source using Philips screwdriver.
- Carefully remove the back cover together with cylindrical side cover.
- Disconnect internal connector so you can completely remove back and side cover.
- Remove four screws which hold the bulb assembly and remove bulb assembly.
- Loosen screws holding the bulb in place and remove old bulb.
- Install new bulb in the same position as the original and tighten screws.
- Put bulb assembly back to its place and fasten it by four screws.

- Attach connectors back to its place. Be careful not to swap two same size connectors. One marked as MOTOR connect to the chopper motor. Other connectors can not be swapped.
- Slide the cylindrical side cover and the back cover to its place and fasten it using four screws.