

biomed

Photometer-module

Absorbance –Photometer
Specifications

General description

The photometer-module is a complete photometer for the measurement of optical density of liquids at one or two wavelengths, depending on version.

In detail, the photometer module consists of a compact unit comprising the entire mechanism, the optical system (including the LED light sources and narrow band optical interference filter), the electronics and the operating firmware.

The circuit is built next to the preamp and A / D converter from the microchip, the driver for the serial communications and the preparation of the operating voltages for the amplifiers and LEDs.

- The photometer module needs supply power from an external source, as well as a wired connection to the controller. Typically, the module is controlled by a host processor with a TTL level.
- The unit is controlled via RS232 asynchronous serial protocol.
- For testing purposes, you can directly control the module, either the PC has a RS232 interface or you can use a USB/RS232 - converter.
- LED - Light sources for the photometric measurements are used. The spectrum of the light source is also cut with a narrow-band interference filter.
- A part of the light flux is deflected to a reference-channel to compensate temperature drifts.
- The power consumption of a single LED light source is max. 100 mW, so no additional cooling or ventilation is required.
- The module can be used in normal daylight without additional optical shielding.

Physical basis

The module's firmware calculates and returns the optical density:

$$OD = \log\left(\frac{1}{\text{Transmission}}\right)$$

whereas:

$$\text{Transmission} = \frac{\text{optical intensity light} - \text{optical intensity dark}}{\text{optical intensity measurement} - \text{optical intensity dark}}$$

Optical intensity light: Measurement with a neutral object to be measured (solvent)

Optical intensity dark: Measurement with LED off

Optical intensity: Measurement with reagent etc.

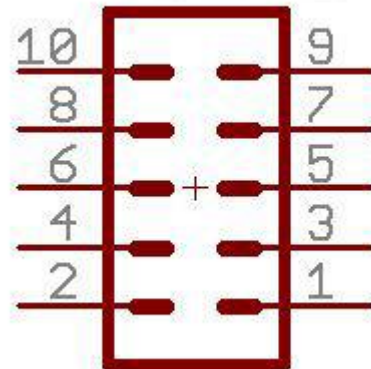
Through oversampling in the A/D-conversion a high resolution (16-bit) is achieved - as well as a good signal to noise ratio compared to the 50Hz interference (mains frequency).

Technical information

Principle	1 or 2-channel filter photometer with reference channel, μ -controller and serial interface
Light source	1 or 2 LEDs and narrow-band interference filter
Range	0 to 2,7OD
Display range	max. 4,8 OD
Resolution	0,0001 OD (0,1mOD)
Linearity	1% between 0,2 OD and 2,5OD
Wavelengths	standard between 400nm and 900nm, (other wavelength on request)
Interface	Asynchronous serial data transmission RS-232 (TTL level)
Voltage Power consumption	$\geq 8,5 \text{ V}$, $\leq 15\text{V}$ Max. 200 mA

Hardware Interface

cable connector	
serial in	2
serial out	4
Reset (L)	5
GND	7,8
+UB	9,10
Not to be connected!	1,3,6



Settings

9600 Baud
8 Databit
No parity
1 Stopbit
No Handshake

Commands description

- Command **X** (for channel 1) and Command **Y** (for channel 2 if available):

Same as **M** and **N** – measurement values will not be outputted, but stored as blanks.
Do this before first measure.

- Command **M** (for channel 1) and Command **N** (for channel 2 if available):

First measurement:

LEDs off

System-offset calibration

Measurement of the dark value

LED on

Reference channel measure and storing

Measurement cuvette

Output measured value

Time required: ~1073 msec

Each additional measurement:

LED on

Measure the reference channel

Actual measurement cuvette

Correct drift

Output measured value

LED off

Time required: 240 msec

- Command **m** (for channel 1) and Command **n** (for channel 2 if available):

Same as **M** and **N** but the respective LED will not be turned off for fast kinetics measurements.
Time required from the second measurement ~55 msec.

The answers will be responded after complete execution of the commands.

Macro Commands

Command	Action	Answer	msec
X	Measure Channel 1 and store as blank	X	240
Y	Measure Channel 2 and store as blank	Y	240
M	Measure Channel 1, put out value (minus blank value)	5 digits	240
N	Measure Channel 2, put out value (minus blank value)	5 digits	240
m	Measure Channel 1, put out value	5 digits	55
n	Measure Channel 2, put out value	5 digits	55

Single Commands

Command	Action	Answer	msec
R	Firmware Reset	R	15
S	Output serial number (XXXX) if defined	4 digits	2

10. Service Commands

Command	Action	Answer	msec
a	LED off	a	15
c	EEPROM-check	5 digits	32
d	Measure dark value and store	d	27
e	Channel 1 LED on	e	15
f	Channel 2 LED on	f	15
g	„R“ + „m“	g	80
h	„R“ + „n“	h	80
k	Measure reference channel and store	k	20
o	Offset A/D-Converter calibration	o	15
p	Photometer Init	p	15
v	Output version number	3.x	15
w	Output of the last measurement value	5 digits	15

Not defined commands will not give an answer.