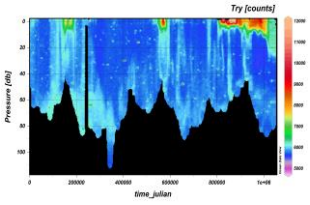
ALSEAMAR

ALCEN

MiniFluo UV

User Manual



COMMERCIAL IN CONFIDENCE

Document reference	Rev	Page
MFL01-070-MUM-UserManual MiniFluo-UV	C	1 / 16

Document Revisions

Revision	Release Time	Object
A	10/2015	First release
B	04/2016	Modification of optical path channels.
C	08/2017	Introduction of Scaled Values in seapaylaod.cfg file

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1 INTRODUCTION

1.1 Disclaimer

This user manual is specifically intended for ALSEAMAR customers and users of the Minifluo-UV sensor with a SeaExplorer glider. It shall not be transmitted, distributed or disclosed in any case. The sole purpose of this manual is to give ALSEAMAR customers a better understanding of the MiniFluo-UV sensor for more complete use.

The information contained in this manual is subject to modifications that would be specifically mentioned in the customer data sheet for said glider. ALSEAMAR may update this manual at any time to reflect any modifications to the vehicle. ALSEAMAR cannot accept any responsibility for errors, loss, omission or damage directly or indirectly caused by the information contained in this manual. ALSEMAR is not responsible for any loss, break or damage caused directly or indirectly by the SeaExplorer (piloting, operation, use, handling, etc.).
The Warranty for the MiniFluo-UV sensor will be included in the shipping package: a 1-year warranty applies starting on the date of delivery of goods. Any return of the sensor shall be performed on ALSEAMAR premises at the customer's expense.

1.2 Restrictions

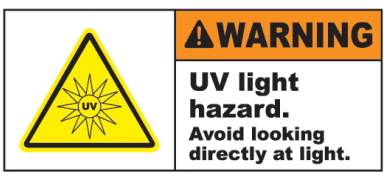
The MiniFluo-UV fluorometer is specifically designed for use on a SeaExplorer glider. ALSEAMAR will not take any responsibility for damages caused to the sensor by use with a platform other than the SeaExplorer glider.

1.3 Warning

The MiniFluo-UV is a fluorometer with LEDs (Light Emitting Diode) emitting in the UVC region (100 – 280 nm).

DO NOT LOOK DIRECTLY AT A UV LED WHEN IT IS ON.
YOU MAY EXPOSE YOUR EYES TO IRREVERSIBLE DAMAGES.

Use UV-resistant safety glasses when a UV Led is on.
The following symbol is sticked on the sensor housing:



1.4 Contact

For further information or technical support, please contact ALSEAMAR technical support:
ALSEAMAR Technical support
9 Europarc
13590 Meyreuil - France
Tel. +33 (0)4 42 58 54 52
seaexplorer@alseamar-alcen.com
Customer support via e-mail and telephone is provided during French office hours (9:00 a.m. to 5:30 p.m.).

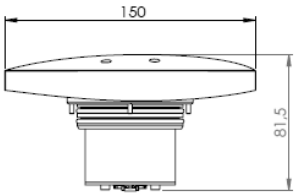
2 SPECIFICATIONS

2.1 Mechanical

- **Dimensions (Puck Only):**

Diameter: 75.5 mm

Height: 60 mm

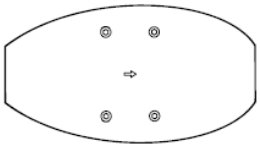


- **Dimensions (with optical "hat"):**

Length: 150 mm

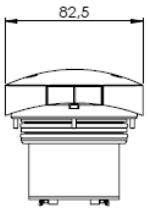
Width: 82.5 mm

Height: 81.5 mm



- **Weight (in air):**

300 grams

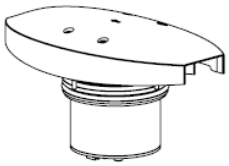


- **Material (housing):**

Hard-coated Anodized aluminium.

- **Depth rating:**

0 – 750 meters



- **Temperature Range**

0 – 30 °C

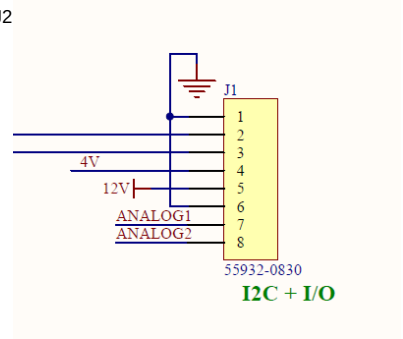
2.2 Connector

The MiniFluo-UV sensors has two Molex Microclasp connectors, J1 and J2, as shown below:

J2 is advanced user only and should not be used by customer.

J1 pin configuration is shown below:

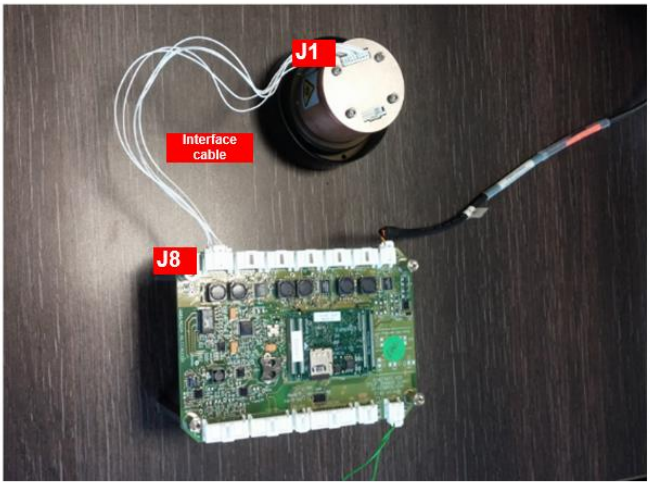
Pin	J1	I2C Input / Output
1	Gnd	
2	SDA	
3	SCL	
4	Reserved	
5	12 V In	
6	Gnd	
7	Analog1	
8	Analog2	



2.2.1 Connection to Sea Explorer payload board

MiniFluo-UV should be connected to the J8 connector of the payload board. Refer to the SeaExplorer user Manual for Payload Board pin description.

The interface cable is delivered with sensor.



2.2.2 Consumption

Sensor typical consumption is given in table below. Note that consumption depends of the sensor configuration defined by the user (see section 3.2)

Input	**Current draw**	**Power (typical)**
10 – 15 VDC	31 mA @ 12V	380 mW

2.3 Communication

The MiniFluo-UV is an autonomous sensor which acts as a slave I2C module controlled by an I2C master (the Payload Board).
It comprises two fluorescence measurements and two light monitoring measurements, with one additional temperature measurements with the following addresses:

I2C peripheral	Address on the I2C bus	
	MiniFluo-UV1	MiniFluo-UV2
Fluorescence – V1, V2, V3, V4	0x70	0x74
Internal temperature	0x48	0x49

Sensor sample rate, range and mode can be modified by the user. See section 3.2.

2.4 Optical

2.4.1 MiniFluo-UV1

MiniFluo-UV1 measures Tryptophan/Naphthalen and Phenanthren fluorescence:

Parameters	Wavelength Em/Ex	Range	Detection Limit (standards)
Tryptophan	270 nm / 340 nm	0 – 800 µg/L	0.15 µg/L
Naphthalen (HAPs)	270 nm / 340 nm	0 – 600 µg/L	0.15 µg/L
Phenanthren (HAPs)	255 nm / 360 nm	0 – 250 µg/L	0,2 µg/L

2.4.2 MiniFluo-UV2

MiniFluo-UV1 measures Fluoren and Pyrene (HAPs) fluorescence:

Parameters	Wavelength Em/Ex	Range	Detection Limit (standards)
Fluoren	260 nm / 315 nm	0 – 300 µg/L	0,05 µg/L
Pyrene	270 nm / 376 nm	0 – 500 µg/L	0,05 µg/L

3 OPERATION

3.1 Interfacing MiniFluo on SeaExplorer Payload bay

The Minifluo can be installed in one of the four “Puck” holes of the science bay (generally, the downward looking puck hole is reserved for the altimeter). Refer to section 2.2.1 for electrical connection to the SeaExplorer payload board.

Before installing the sensor, be sure that the sealings are properly greased.

The orientation of the sensor must be respected. The two LEDs holes in the middle of the sensor must be in the alignment of the glider (Figure 1 – top)

The orientation of the optical hat must be respected. The arrow must point towards the front of the glider (Figure 1 – bottom)

Please screw the CHC gently and not too hard, as you may damage the prisms inside the optical hat.

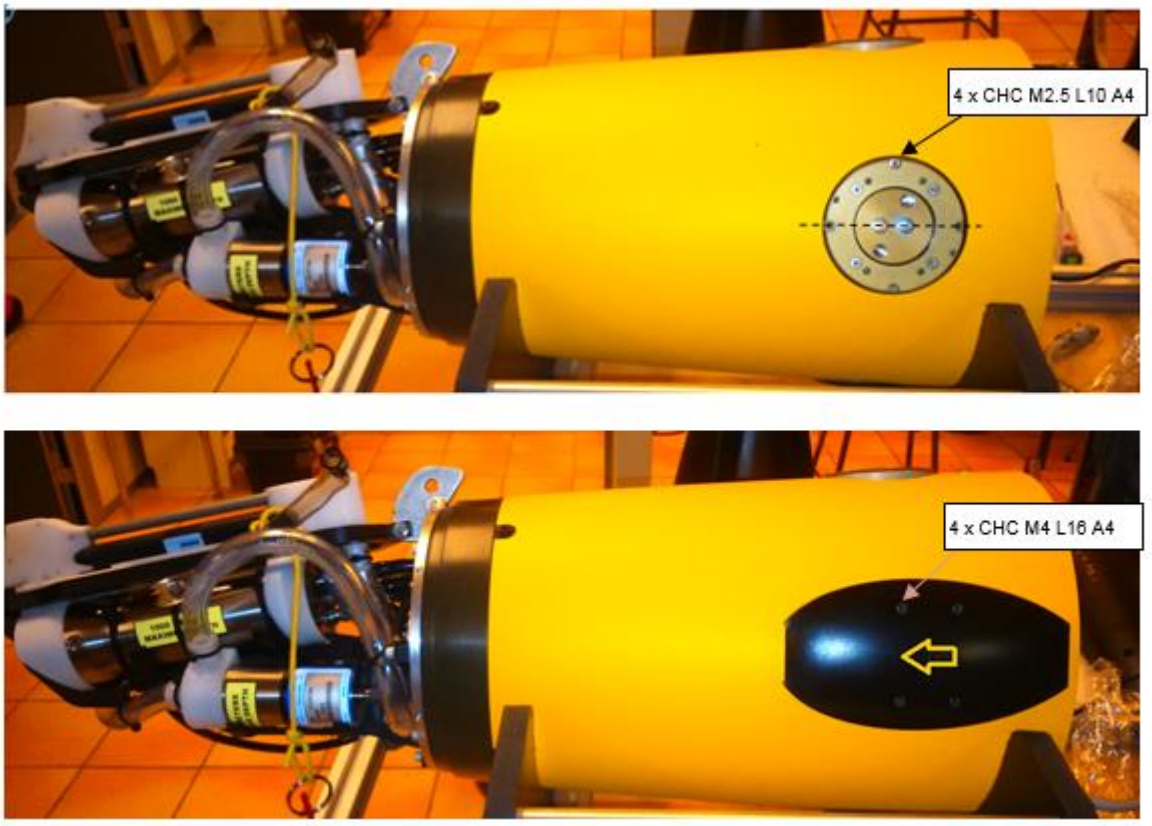


Figure 1 – Orientation of the MiniFluo puck (top), orientation of the optical hat (bottom).

3.2 Modifying parameters in seapayload.cfg

Minifluo parameters can be changed in configuration file seapayload.cfg. Please refer to the glider manual to edit the seapayload.cfg file.

The following parameters are user-configurable:

Table 1 - Configurations parameters (common to MiniFluoUV1 and MiniFluoUV2)

Parameters	Values	Description
cfg.mode	[0 ; 1 ; 3]	Defines the LED flashing mode. Default Value is 3: - 0 : LED OFF (dark measurement only) - 1 : LED ON (no dark measurement correction) - 3 : LED ON-OFF (dark measurement correction)
cfg.range	[0 ; 1 ; 2 ; 3 ; 4 ; 5 ; 6 ; 7]	Defines the sensibility of the detection. [0] is highest sensibility and [7] lowest sensibility. Default value is 0.
cfg.dacq	[Min ; Max] = [50ms; 1200 ms]	Defines the acquisition time in milliseconds, time during which the LED is flashing. Default value is 600.
cfg.d2acq	[Min; Max] = [50 ms; 10 000 ms]	Defines the time interval in milliseconds between two measurements. Default value is 4000. Note: d2acq must be at least 2 times dacq value.

The scaled values are computed using the scaled factor and blank values specified in the seapaylaod.cfg file (Table 2 and Table 3 below). These fields are optional: if missing the scaled values in the data files will be 0.

Refer to calibration sheet of the sensor to enter the good coefficients. The blank value can also be adjusted from in-situ measurement.

Table 2 - Calibration Coefficients for MiniFluoUV1

Parameter	Values	Description
cfg.phe_sf	See Calibration Sheet	Phenantrene scale factor (optional)
cfg.phe_bk	See Calibration Sheet	Phenantrene blank value (optional)
cfg.naph_sf	See Calibration Sheet	Naphtalene scale factor (optional)
cfg.naph_bk	See Calibration Sheet	Naphtalene blank value (optional)
cfg.try_sf	See Calibration Sheet	Tryptophan scale factor (optional)
cfg.try_bk	See Calibration Sheet	Tryptophan blank value (optional)

Table 3 - Calibration Coefficients for MiniFluoUV1

Parameters	Values	Description
cfg.flu_sf	See Calibration Sheet	Fluorene scale factor (optional)
cfg.flu_bk	See Calibration Sheet	Fluorene blank value (optional)
cfg.pyr_sf	See Calibration Sheet	Pyrene scale factor (optional)
cfg.pyr_bk	See Calibration Sheet	Pyrene blank value (optional)

```
#-------------------------------------------------------------------------------
[MFLUV1]
#serial number = MFL12
#date of calibration =26/06/2017
cfg.WarmUpPeriod = 10
cfg.phaseswitch = 1

cfg.mode  = 3
cfg.range = 0
cfg.dacq  = 600
cfg.d2acq = 4000

cfg.phe_SF  = 2.0056
cfg.phe_bk  = 0.0602
cfg.naph_SF = 0.0391
cfg.naph_bk = 0.0222
cfg.try_SF  = 0.0091
cfg.try_bk  = 0.0068

acq.1.depth = 750
acq.1.period = 0
acq.1.phase = 111
acq.1.yo = 1
#-------------------------------------------------------------------------------
[MFLUV2]
#serial number = MFL19
#date of calibration =29/06/2017
cfg.WarmUpPeriod = 10
cfg.phaseswitch = 1

cfg.mode  = 3
cfg.range = 0
cfg.dacq  = 600
cfg.d2acq = 4000

cfg.flu_SF = 2.1393
cfg.flu_bk = 0.2428
cfg.pyr_SF = 0.0140
cfg.pyr_bk = 0.0317

acq.1.depth = 750
acq.1.period = 0
acq.1.phase = 111
acq.1.yo = 1
#-------------------------------------------------------------------------------
```

Figure 2 - Example of SeaPayload.cfg files for MFLUV1 and MFLUV2 sensors

3.3 Data output

Minifluo data frames are written in “pld1.sub” and “pld1.raw” files along with other sensors data. Please refer to the SeaExplorer Manual for further information on data files.

Minifluo data frame contains the following values:

Table 4 - Data Output for MiniFluoUV1

Field _Name	Format	Units	Description
MFLUV1_V1	Float	counts	Minifluo raw path 1 (LED TRY/NAPH)
MFLUV1_V2	Float	counts	Minifluo raw path 2 (LED PHE)
MFLUV1_V3	Float	counts	Minifluo raw path 3 (Monitoring LED1)
MFLUV1_V4	Float	counts	Minifluo raw path 4 (Monitoring LED2)
MFLUV1_TMP	Float	°C	Minifluo internal temperature
MFLUV1_TRY_SCALED	Float	ug/L	Tryptophan scaled value
MFLUV1_NAPH_SCALED	Float	ug/L	Naphthalene scaled value
MFLUV1_PHE_SCALED	Float	ug/L	Phenantrene scaled value

Table 5 - Data Output for MiniFluoUV2

Field _Name	Format	Units	Description
MFLUV1_V1	Float	counts	Minifluo raw path 1 (LED PYR)
MFLUV1_V2	Float	counts	Minifluo raw path 2 (LED FLUOREN)
MFLUV1_V3	Float	counts	Minifluo raw path 3 (Monitoring LED1)
MFLUV1_V4	Float	counts	Minifluo raw path 4 (Monitoring LED2)
MFLUV1_TMP	Float	°C	Minifluo internal temperature
MFLUV2_FLU_SCALED	Float	ug/L	Tryptophan scaled value
MFLUV2_PYR_SCALED	Float	ug/L	Naphthalene scaled value

Notes:

- V1 to V4 are integer values comprised in [0; 1048575].
- V3 and V4 are used for controlling the amount of light emitted from the ultraviolet LED.
- TMP is temperature in °C inside the sensor.
- Scaled values are calculated from the calibration parameters entered in seapayload.cfg (§ 3.4).

3.4 Calculating Scaled Values

Concentration in [µg/L] are calculated using the following formulae:

$$[C] = \frac{(u - blank)}{SF}$$

where:

- [C] is concentration of chemical in [µg/L].
- $\boldsymbol{u1 = \frac{V1-4096}{V3-4096}}$
- $\boldsymbol{u2 = \frac{V2-4096}{V4-4096}}$
- Blank (or Y-Intercept) and Scaled Factor (SF) values are given in the Calibration Sheet.

For example, to compute Phenantrene-Like concentrations in ug/L:

$$[PHE] = \frac{(V2 - 4096)/(V4 - 4096) - blank\_phe)}{SF\_phe}$$

Important Note:

Calibration is performed in a chemical laboratory with a special cover cap for intercomparison purposes.

Changing the cap will modify the blank value so you may have to calculate your own blank from in-situ measurement.

The tables below list the correspondence with V1, V2, with chemical compounds for MiniFluoUV1 and MiniFluoUV2 sensor.

4 MAINTENANCE

Always turn power off before any manipulation of the sensor.

4.1 Cleaning Optical Hat

You can clean the sensor without unmounting the optical hat using milli-Q water flushed through the sensor.

If you unmount the hat, handle gently or you may risk to damage the hat and/or the optical prisms inside.

4.2 Cleaning sealings

We recommend to clean the sealings each time the sensor is unmounted/remounted from the dry science bay. Apply grease before remounting the sealings. Molicote 55 is recommended for O-rings.

4.3 Cleaning Optics

Cleaning quartz silica window or prisms can be realized with optical soft paper and ethanol.

Use gloves during operation to avoid any fingerprints and grease to be deposited on the optical surface and inside the hat.

Don’t unmount the four countersunk head screws maintaining the quartz window, waterproofness of the sensor will not be guaranteed anymore.