

AQUA*tracka* III

In-situ fluorimeter, nephelometer

AQUA*tracka* III is a compact, lightweight submersible fluorimeter for the determination of chlorophyll-a, dye tracing or turbidity. Two variants of the instrument are available both manufactured in titanium, and rated to 2000 metres and 6000 metres respectively.



OVERVIEW

Features of the fluorimeter include:

- excellent ambient light rejection characteristics.
- careful control of stray magnetic, electrostatic and electromagnetic field emissions.
- high data resolution.
- very high sensitivity.
- wide dynamic range (four decades).
- no range switching required.
- calibration possible in normal light (not under fluorescent lighting).
- ability to function accurately in shallow water, i.e. high ambient light situations.

High quality excitation and emission filters and careful exclusion of unwanted light rays are used to maximise the overall performance of the instrument. Minimising filter breakthrough and the effects of turbidity. The instrument uses a pulsed Xenon flashlamp light source and has an associated low consumption power supply. The output stage buffer provides a low impedance (<1 Ohm) signal source which can supply up to 5 mA without appreciable loss of performance, with 1 V or 2 V per decade logarithmic scaling depending on the option chosen. The output leads are electrically isolated from the power supply input connections and all four leads are insulated from the pressure housing.

PRINCIPLES OF OPERATION

The instrument uses a ratiometric method for measurements to eliminate variations in the flashlamp intensity due to ageing, for example. A Xenon lamp provides a light source having a high ultra violet content which is applied to two signal paths:

- an internal reference path.
- an external signal path.

The reference path measures the intensity of the light source whilst the signal path measures the intensity of the light emitted from the specimen under test. The reference signal and the emitted light signals are then applied to a ratiometric circuit. In this circuit, the ratio of returned signal to reference signal is computed and scaled logarithmically to achieve a wide dynamic range. The logarithmic conversion accuracy is maintained at better than one percent of the reading over the full output range of the instrument.

Data from the instrument is sent to the associated equipment via two wires of a twisted pair in the 4-way interconnecting cable. The source voltage for the instrument, between 9 and 18 V d.c., is applied via two wires of a second twisted pair.

SPECIFICATION

Dimensions		
Length	405mm	
Diameter	88mm	
Weight		
In Air	5.5kg	
In Water	3.5kg	
Operating Depth	2000 m (maximum) or 6000 m (maximum)	
Supply Voltage	12 V d.c(nominal) (range 9 to 18 V)	
Current Consumption	<u>10.5V</u>	<u>18V</u>
Start up	330mA	175mA
Mean running	280mA	140mA
Peak running	330mA	175mA
Output		
Standard setting	0 to +4 V (scale 1 V per decade)	
Optional setting	0 to +8 V (scale 2 V per decade)	
Operating temperature	-2 to +32°C	
Light Source		
type	Xenon lamp	
pulse rate	5.5 Hz	
life	10 ⁸ flashes	
Filter Options	Chlorophyll, Rhodamine, Fluoroscein and Turbidity	

Excitation	Chlorophyll a	Rhodamine	Fluoroscein	Turbidity
wavelength (nm)	430	500	485	* 440
bandwidth (nm)	105	70	22	* 80
Emission				
wavelength (nm)	685	590	530	* 440
bandwidth (nm)	30	45	30	* 80

*the wavelengths for the turbidity filters are a customer option but must be in the range 400 to 700 nm. Also, the same wavelength is used in both the excitation path and the emission path.

Concentration Range	
Chlorophyll a	0.01 µg/l to 100 µg/l
Rhodamine / Fluoroscein	0.01 µg/l to 100 µg/l
Turbidity	0.01-100 FTU**
Accuracy	
Chlorophyll	+/- 0.02 µg/l*
Rhodamine / Fluoroscein	+/- 0.02 µg/l*
Turbidity (0-10 FTU)	+/- 0.02 FTU*

* or +/- 3% of the reading, whichever is the greater.

** other wavelengths are available on request.

TECHNICAL DESCRIPTION

Mechanical Description

The general assembly of AQUA^{tracka} III is shown in Figure 1. The instrument comprises four major sub-assemblies:

- a) A Turret Assembly that houses the optical components and makes the front cap for the Pressure Housing.
- b) An Electronics Chassis that contains:
 - the signal circuits of the instrument.
 - the light source and its power supply.
- c) A Pressure Housing that encloses the Electronics Chassis.
- d) A Rear End Cap that is used to seal the Pressure Housing.

The turret has two plain bores machined into it, one bore houses the excitation optics, the other the emission optics. The optical components consist of a series of lenses and filters and, on the detection side only, a photo-diode. Each bore runs parallel with the length of the instrument and is optically linked by a prism mounted separately in the top section of the turret. The lenses, filters and photo-diode are held in their correct axial positions by a set of spacers. The optical layout is shown in Figure 2.

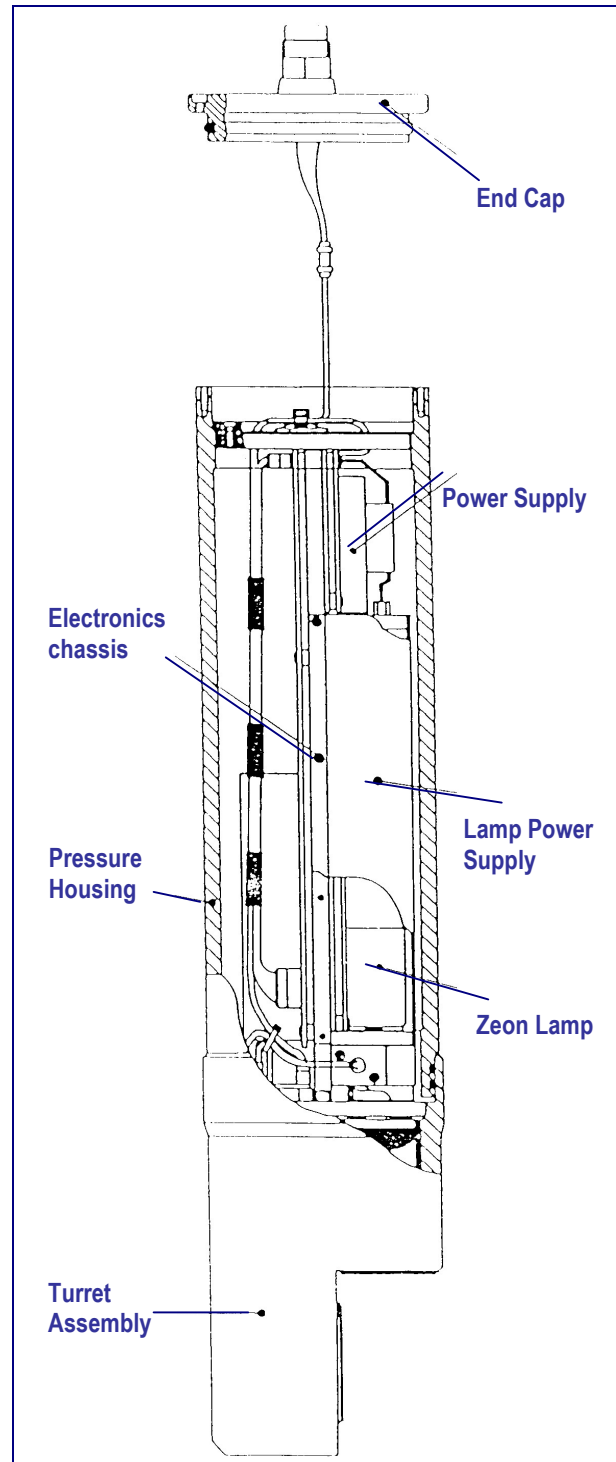


Figure 1 – AQUA^{tracka} Assembly

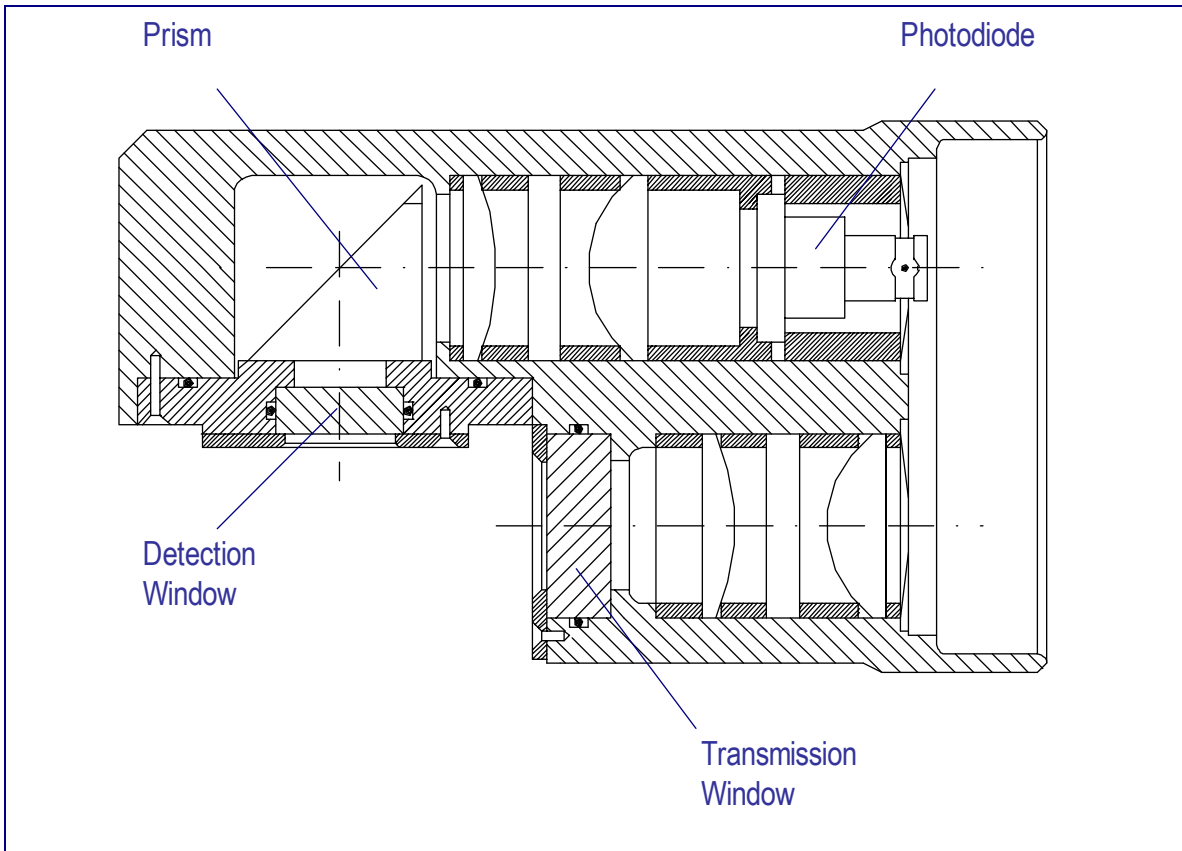


Figure 2 - Optical Layout

Mechanical Description (continued)

The Electronics Chassis Assembly is fitted with front and rear bulkheads. The front bulkhead provides the Chassis to Turret mounting point and when secured to the Turret, retains the optical components by pre-loading two wave-form washers.

The Pressure Housing is fitted with two O-rings at the front, and slides over the Electronics Chassis to engage with the rear of the Turret. A clamp ring sits on a shoulder inside the rear of the Pressure Housing, this ring draws the Pressure Housing firmly onto the Turret. The Rear End Cap is sealed by a single, large cross-section O-ring. The 4-way underwater connector is mounted on the Rear End Cap.

Electrical Description

The electrical components of the circuits of AQUA^{tracka} III are mounted on three p.c.bs. These p.c.bs. are:

- a) An analogue p.c.b., which contains all the analogue processing components.
- b) A power supply p.c.b., which contains the components that convert the incoming 9 to 18 V d.c. supply from the Sea Cable to +12 V and -12 V supplies for the various electronic circuits.
- c) A lamp supply p.c.b., which provides the high voltage (700 to 750 V d.c.) required by the Xenon lamp.



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