

The ultimate system

FastBallast provides an ultra-sensitive solution for **continually** monitoring large volumes of inlet and outlet water of a ballast water treatment system at the D2 regulatory limit. High sampling rates, made possible by incorporating a Single Turnover One Pulse (STOP) detection method, makes FastBallast better suited to analysing low densities of phytoplankton cells at the D2 threshold than more common (Multiple Turnover) PAM methods.

When analysing flowing water, FastBallast first is performing a level 1 indicative test in near real-time. If this generates a clear PASS or FAIL (i.e. <4% or >4000% of the PASS/FAIL threshold, respectively), the system stops the water flow and performs a level 2 detailed analysis and the result is reported. If the initial result falls between these limits, FastBallast automatically extends the test to level 2, which is completed in less than 8 minutes.

In contrast to other bulk sample fluorescence methods, the distribution-based FastBallast level 2 test does not require assumptions to be made about the amount of fluorescence per cell and estimates cell densities within the margin of error for microscope-based testing between zero and 100 cells/mL.

With FastBallast's level 2 test, false negatives are extremely unlikely and false positives are virtually impossible. In contrast, estimates of cell density from alternative bulk sample tests can be orders of magnitude away from the true cell density. Consequently, false positive results can only be minimised by setting the threshold for a PASS so low that false negatives become more likely, even at high cell densities.

To allow for potential changes to the regulations, FastBallast also incorporates four excitation wavelengths to provide greater flexibility for interrogating cyanobacteria.



Specifications

User interface	Ethernet to ship control and display system
Sample volume	20 mL minimum
Interrogated volume	0.5 mL
Excitation	Four channels (Royal Blue, Blue, Green and Orange/Red)
Sensitivity	<1 cell/mL
Dynamic range	0 – 4000 cells/mL
Time to result	Continuous for level 1 <10 minutes for level 2 with isolated sample volume
Power	Ship ac mains
Connectivity	USB, Bluetooth or Ethernet
External dimensions	800 (H) x 600 (W) x 300 (D) mm
Mass	40 kg
IP rating	IP65 (with electronics door closed)
Service interval	Greater than two years

FastBallast

Integrated Compliance Monitor



www.chelsea.co.uk

Integrated system for continuous compliance monitoring of ballast water to the IMO D2 (10 to 50 µm) standard



Users:

- Manufacturers of Ballast Water Treatment Systems (BWTS)
- Ship operators
- Analytical Laboratories

Clarity in Water

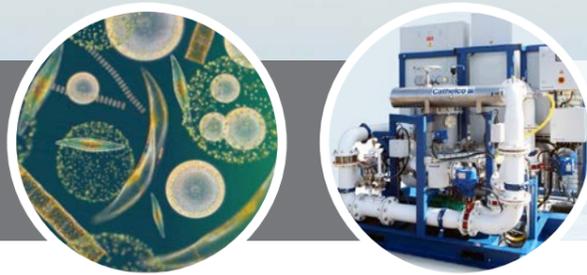
Contact us today to see how we can help you



Chelsea Technologies Group Ltd

55 Central Avenue West Molesey Surrey KT8 2QZ United Kingdom
Tel: +44 (0)20 8481 9000 Fax: +44 (0)20 8941 9319
sales@chelsea.co.uk www.chelsea.co.uk

What can the FastBallast system do for you?



★ Advantages

- Provides continuous compliance testing to the D2 limit (10 - 50 µm in the smallest dimension)
- Detection limit of < 1 cell/mL
- Size-independent measurement of cell density
- Sampling issues associated with analysing small static volumes at close to the D2 threshold are overcome by analysing enough water to gain a representative sample in a contained system
- Very low level of false negatives and negligible possibility of false positives
- Wide dynamic range provides a high tolerance of background fluorescence (from dead cells, CDOM and other sources)
- High level of turbidity rejection
- Can be installed with any ballast water treatment system
- Long service intervals (greater than two years)

Ballast Water Monitoring

It has long been accepted that ballast water functions as a vector for the transfer of harmful organisms. The IMO 'Ballast Water Management Convention, 2004' was established to tackle the problem of invasive species and is being adopted around the world.

Ballast water discharge must not contain more than 10 cells/mL of 10 - 50 µm in the smallest dimension. Because this size range is dominated by phytoplankton, active chlorophyll fluorometry is widely viewed as the ideal test method.

The FastBallast active chlorophyll fluorometer provides **continual compliance-level testing**, where other systems provide indicative static sample results.

Step	Standard Procedure	FastBallast Procedure
1	Inspection of documents and BWMS	
2	Detailed inspection and check against plan	
3	On board indicative test	On board compliance test
4	Samples taken for shore-based compliance test	

Table 1: FastBallast provides an **on board compliance-level test**.

Integrated Solution

Ballast water continually flows through the FastBallast System to monitor the efficiency and efficacy of a ballast water treatment system to the D2 level.

This is the **only solution available** that analyses enough ballast water to provide truly representative sampling.

The test result comprises Pass/Fail, confidence level and cell density (cells/mL).

Size Matters!

Standard parameter	<i>Thalassiosira punctigera</i>	<i>Dunaliella salina</i>
Fv/Fm	0.111	0.940
Fv	0.254	0.263
Cells/mL		
Level 1	111 (FAIL)	94 (FAIL)
Level 2	8.8 (PASS)	360 (FAIL)
Microscope	7.0 (PASS)	427 (FAIL)

Table 2: Data demonstrating FastBallast analysis is independent of cell size

Table 2 illustrates how cells of different sizes and species can dramatically affect the results of an indicative test.

With *T. punctigera* (a large diatom), the level 1 (indicative) test generates a false positive (a FAIL result that should have been a PASS). The level 2 (compliance) test correctly assesses the sample as a PASS.

With *D. salina* (a small chlorophyte), the level 1 test indicates a cell density below 25% of the microscope-based result. The level 2 test is much closer, at 85% of the microscope-based result.

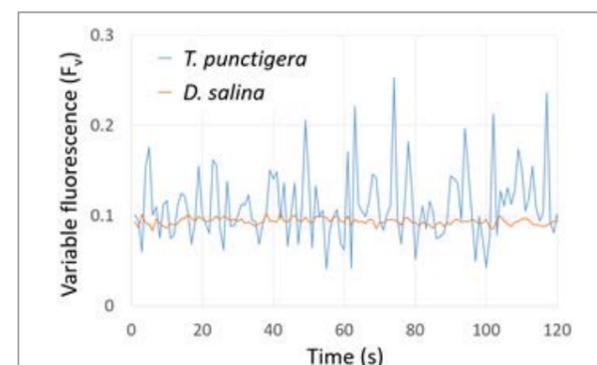


Figure 1: Distribution based analysis

Figure 1 shows selections from the distribution data (variable fluorescence, F_v) used to generate the level 2 test values in table 2. While both samples report the same F_v , the range of values for *T. punctigera*, as a proportion of the mean value, is clearly many times larger than for *D. salina*. This difference arises from the Poisson distribution within the sample and provides the basis of the size-independent distribution method used for level 2 testing by FastBallast.

FastBallast vs. Indicative Testing

Indicative test	Confident PASS	PASS could be 100x the D2 threshold	Confident FAIL
FastBallast level 1 test	Confident PASS	Go to level 2 test	Confident FAIL
FastBallast level 2 test	Confident PASS		Confident FAIL

Table 3: FastBallast's measurement approach

Indicative tests (level 1) performed with other fluorescence-based systems must assume the amount of fluorescence per cell, which can produce a large error as the fluorescence emitted from cells of different sizes and species varies enormously.

The FastBallast level 1 (indicative) test provides a **continuous** indication of whether a sample is grossly compliant or non-compliant. If the level 1 test produces a result between 4% and 4000% of the D2 threshold for a PASS/FAIL, it automatically triggers a level 2 (compliance) test. The FastBallast level 2 test is as accurate as shore based analysis and will always generate a high confidence result.