

# The bw-monitor for ballast water

General installation guidance  
version 04 (Dec 2017)

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### Revisions:

Version 01:	Based on preparations for installation, July 2015
Version 02:	Updates on power consumption, January 2016
Version 03:	Update of logo and minor technical details, September 2016
Version 04:	Update of connection diagrams

## About the bw-monitor In-Line and On Time

The company Ballast Water Monitoring A/S is registered in Denmark and has developed the bw-monitor to give ship-owners the option of having performance information on their Ballast Water Management System, when it is useful rather than when it is too late. The two founding companies LITEHAUZ ApS and Medico Chemical Lab ApS have developed a monitoring device that can survey the functionality and biological efficacy of a BWMS automatically, continuously, directly in the ballast line and during ballasting while the treatment is in progress. We like to think of this as 'in-line and on time'. The bw-monitor can measure and report on pre-treatment performance and the disinfection unit's efficacy in due time for a re-run, repair or re-treatment.

The bw-monitor has been tested in the lab-scale set-up and land-based full-scale facilities. The monitoring system can provide performance indications in marine, brackish and fresh water, warm and cold water, and with the typical pre-treatment (filtering) and disinfection techniques, such as electrolysis, chemical treatment and UV.

The bw-monitor is designed with accompanying software. The software's built-in algorithm automatically adjusts the monitor to the incoming water characteristics and analyses key water parameters by giving an immediate BWMS status indication for the operator of the system. The monitoring system can be also remotely accessed for software and algorithm updates. The data collected by the system is encrypted and stored in an information repository on-board the vessel and can be sent to a bw-monitor cloud storage facility for later analysis together with other data e.g. water temperature, salinity, vessel specific data, geolocation data and tidal information.

## Scope

The bw-monitor is installed in two key locations of the vessel's BWMS and compares 'before' and 'after' treatment levels.

The positions are:

- before the filter unit and
- after the treatment unit.

Both units have separate power supplies and are connected to the PLC of the vessel's BWMS to start at ballasting and deballasting. The sensors' data are stored and analysed in an accompanying PC. The bw-monitor can be fitted with a communication connection via internet to a central onshore data storage facility allowing for simple back up of data and for detailed analytical processes.

## Installation Specifications

Sensor	
Size	Approx. 150 mm Ø x 350 mm L (hereof 90 mm inside ballast pipe)
Weight	22 kg (stainless steel)
Required headspace from ballast water pipe	250 mm
Straight pipe length at sensor position	1 m (preferably 2 m) before and preferably 0.5 m after
Position and angle of sensor	Can be positioned on pipes running vertically or horizontally. If horizontally, an angle of 45 degrees is optimal (range 30-60).
Similarity	Sensors must be mounted in identical positions and flow directions
Installation	DN 150 side flanges
Sensor input	24 VDC
Power supply	
Voltage and power consumption	230 VAC and <50W
Frequency range	49-65 Hz
Position	Not specified
Weight	<0.5 kg
Data analysis and storage	
Controller (PC)	Portable rugged with touch screen (always on)
General	
Temperature	0-65 °C
Pressure	PN6 (tested to PN10)
EMC	Acceptable

## Installation specifications

- The sensor housing is currently available in stainless steel.
- The sensor comes fitted with a flange DN 150 (8 bolt holes).
- Two sensors are installed: One before the BWMS and one after.
- The ballast water pipe must be prepared by installing two DN 150 flanged branch studs.
- Branch stud height: 60 mm including flange.
- The studs are fitted with blinded flanges until sensors are mounted.
- The power required is standard 230 V to a power supply provided as part of the monitoring system.
- Data is collected by a PC.

## Interfaces with ballast water treatment system and vessel

- 2 branch studs on ballast pipe
- Power supplies for sensors and PC
- Signal for operation from PLC
- Optional: local network and internet connection

## Sensor dimensions and design

The bw-monitor is designed for installation in the ballast line in two locations (one monitor in each). The monitor fits into a 150 mm (6") branch stud welded onto the ballast pipe and fitted with a DN standard flange and blinded off in advance of the actual installation. The bw-monitor will be fitted with a similar flange for the DN standard pipe and is installed on-board.

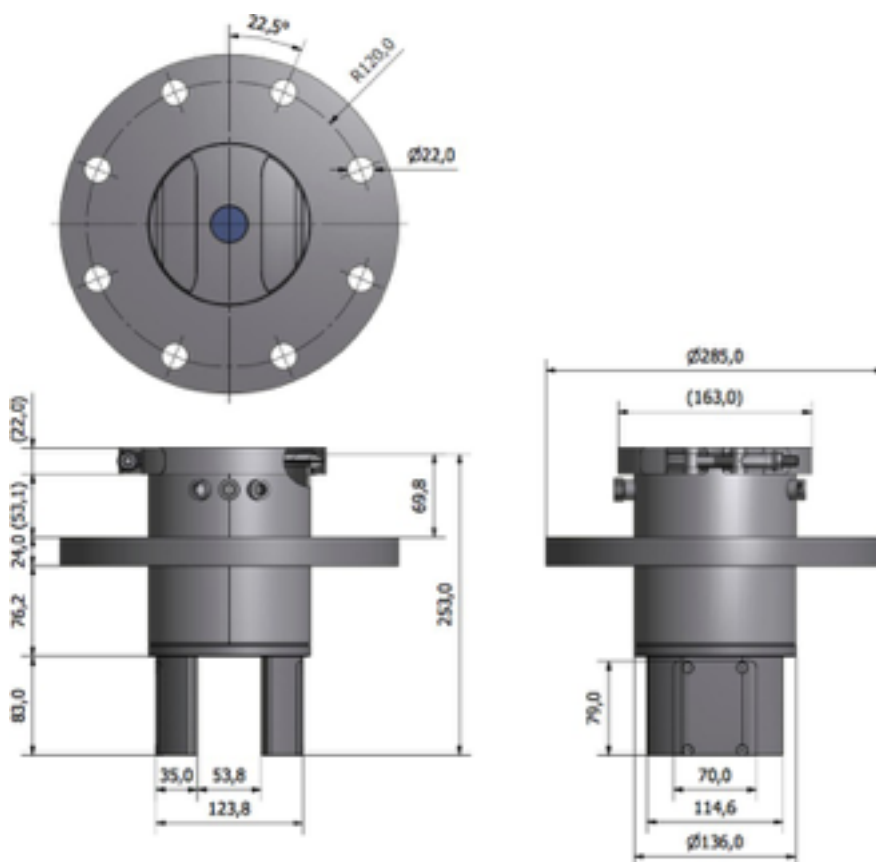


Figure 1 BW monitor with housing

## Branch studs

- Length of DN150 pipe welded to ballast water main pipe
- DN150 flange welded to DN150 pipe
- DN150 gasket
- DN150 blind flange (lid until installation of bw-monitor)

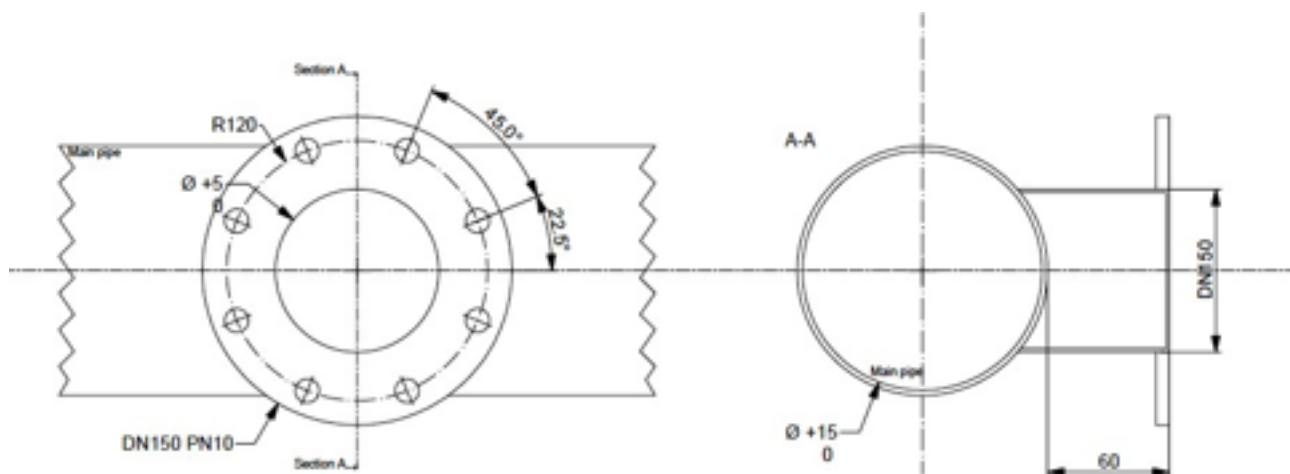


Figure 2 Technical drawing of DN150 pipe and DN150 flange welded to main pipe (main pipe not to scale). All distances in [mm]

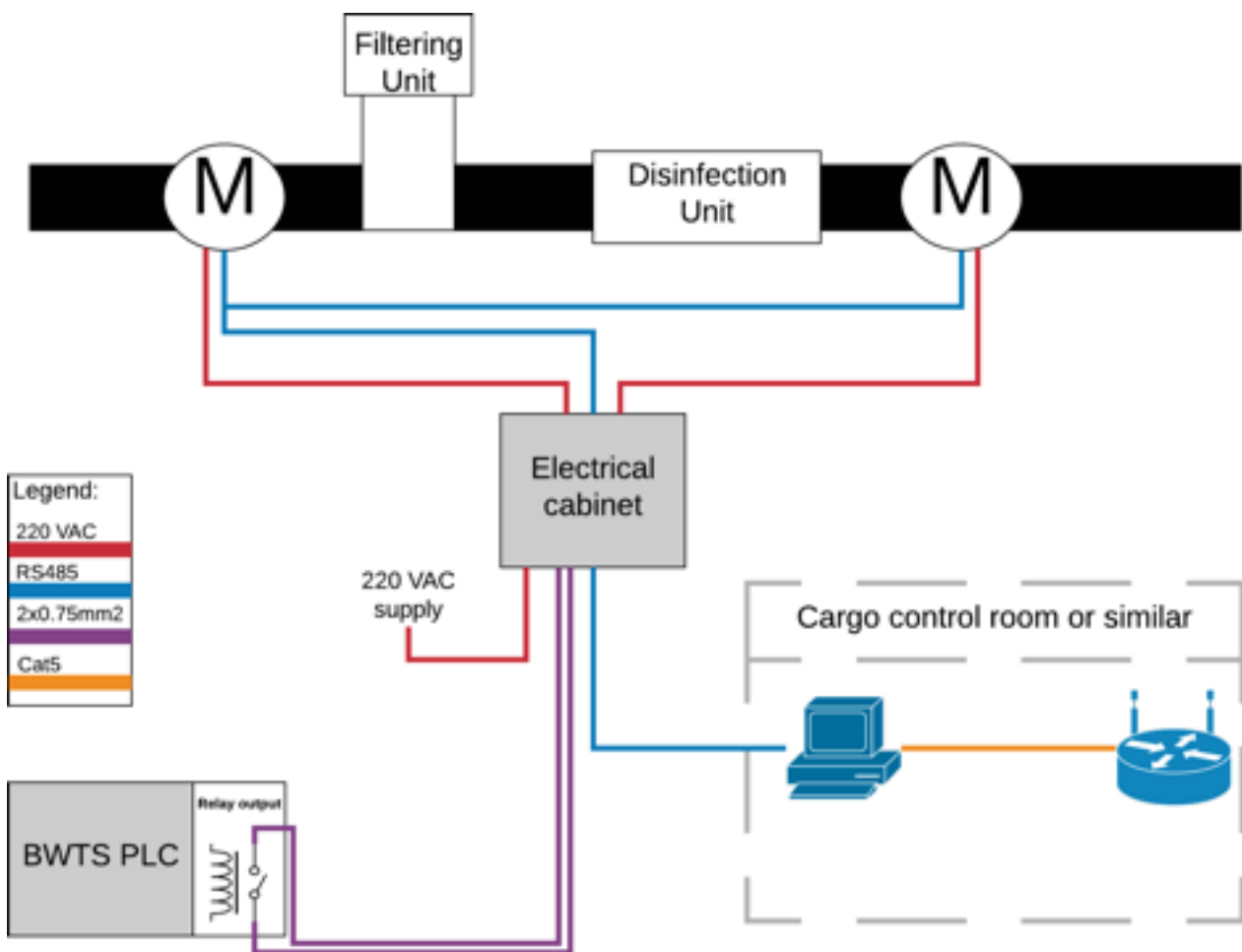
In order to get accurate measurements from the monitor, the branch stud must be welded perpendicularly to the ballast water pipe. Furthermore measurements from the top of the flange to the outer perimeter of the ballast water pipe should be 60 mm +/- 2 mm, as shown in figure 2. Cutting and welding residuals are to be removed.

## Power supply and wiring

The bw-monitor system should be connected to a power supply, a data hub and optionally an internet connection. Control of the bw-monitor is performed via the ballast water PLC or the ballast water system (pump), as appropriate. The following diagram depicts the general schematic installation principles.

Figure 3 Wiring scheme

Each sensor has a 230 VAC power supply. The sensors are connected to the BWMS' PLC to be switched on automatically and simultaneously when BWMS process is started. In ballasting mode the sensors are switched on by the BWMS' PLC. In deballasting mode the sensors can automatically be switched on from the ballast pump PLC, if treatment is not performed during deballasting.





Cables for power supply and service of the bw-monitor system originate from the ship's switchboard room. In this room a cabinet of grade IP65 needs to be implemented, with the wiring depicted in the below diagram.

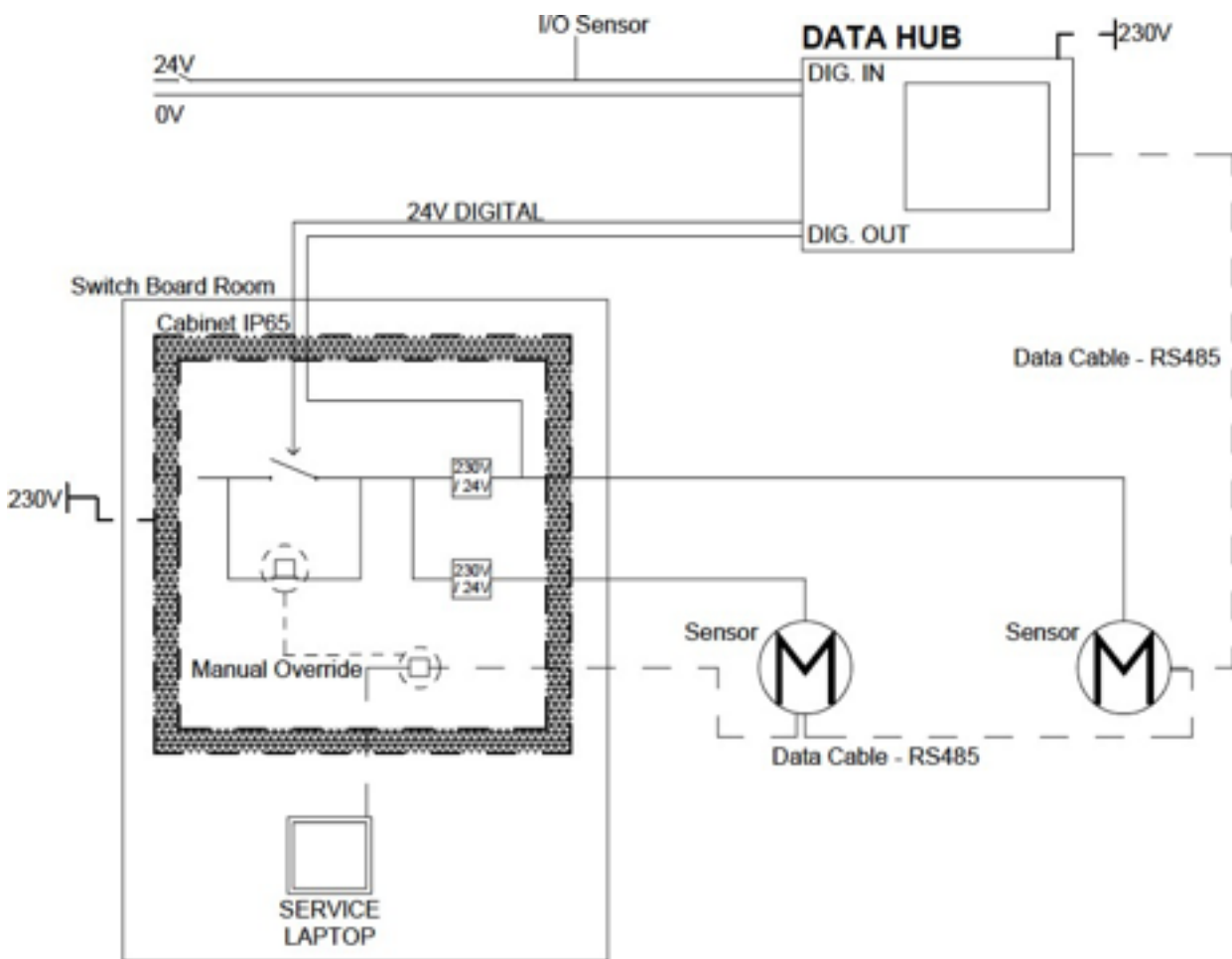


Figure 4 Wiring plan for the bw-monitor system

## Data collection

Software installed on a PC - Data HUB collects and analyses data incoming from two connected monitoring devices. Data HUB will be a rugged laptop or a touch-display all-in-one PC (see example below). The Data HUB is always started when bw-monitor is started via PLC or ballast pump.

The installed software can also as optionally connect to the internet and send un-tampered and encrypted logged data to the specially designed server for analysis and storage. If possible, this is preferred also during prototype testing, but need only be activated in port or near shore situations.



Figure 5 Example of all in one touch display PC

The Data HUB is always started when bw-monitor is started via PLC or ballast pump.

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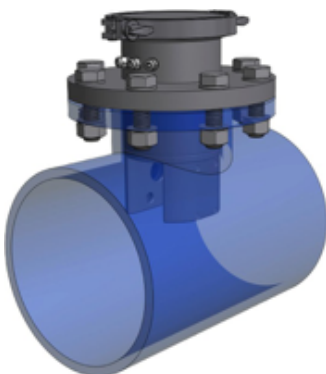
## Pictures



Bw-monitor in stainless steel



The bw-monitor installed in a 150 mm (6") pipe, which is the minimum pipe diameter, with Victaulic fitting



The bw-monitor in a 250 mm (10") pipe