RIVERTRACE

Cleaner. Smarter.

Smart Bilge+ Customer Manual

Smart Bilge+ Instruction Manual

Document Number:	**109080**
Revision:	**AP**
ECN:	**CN5000**
Date:	**02/08/2024**
Approved by:	**A. Wickenden**

Rivertrace Limited | Unit P, Kingsfield Business Centre | Philanthropic Road | Redhill Surrey | RH1 4DP England
Tel: +44 (0)1737 775500 | Fax: +44 (0)1737 775501 | email: sales@rivertrace.com | www.rivertrace.com

VAT Registration No: GB 243 5651 11 | Registered in England No: 10059284

Contents

1 Introduction

1.1 Important Notes

- All National or local codes of practice or regulations must be observed and, where applicable, are deemed to take precedence over any directive or information contained in this manual.
- This equipment must be installed and operated in strict accordance with the instructions contained in this manual. Failure to do so will impair the protection provided.
- Installation and retro fitting of parts listed in **Section 5.3** must be undertaken by a competent and suitably skilled person.
- Servicing, other than replacement of spares, must be undertaken by an RIVERTRACE approved service centre.
- The equipment must be provided with a sound electrical earth connection.
- The unit must be isolated from the electrical supply before any maintenance of the equipment is attempted.
- Hazardous voltages are present within the monitor enclosure and solenoid valve assembly.
- It is essential that maintenance is carried out as described in **Section 5**. Failure to do this will impair the functionality of the equipment and could lead to permanent damage to the monitor.
- **The SMART CELL enclosure must not be opened. If opened a cell breach error will be displayed on the screen (this error cannot be reset) and the "VOID" tamper proof labels on either side of the enclosure lid will be destroyed. Forcing the throttle to its extents will also damage the cell and if unscrewed will distort the cell lid thereby causing a cell breach error.**

1.2 SmartBilge+ Overview

The SmartBilge+ Monitor has been designed specifically for use in conjunction with 15ppm oily-water separator units. It has a specification and performance which meets the requirements of the International Maritime Organisation specifications for Bilge Alarm Units contained in Resolution MEPC 107 (49).

Analysis of the oily water sample is undertaken by a unique detector array arrangement. A narrow beam of light is emitted across a glass cell tube which the oily water sample passes through. Light scattered and transmitted is detected across the array and passed through a complex oil content calculation algorithm. The resulting oil content is then displayed on the LCD screen.

As standard the following features are available:

- Two volt free oil alarm relays are provided. Relay one will control your overboard discharge valve and relay two will control an audible warning device.
- An active 0-20mA / 4-20mA output is provided and to view / record oil content levels remotely if required.
- Onboard flash memory, capable of storing up to 3 years of data.
- Real time clock for accurate, time and date stamped data logs.
- Dual switch inputs to record the operational state of your OWS.
- Antitamper, automatic clean water / sample selection valve.

On top of all standard features, the SmartBilge+ has multiple bolt-on options that meet and exceed MEPC.107(49) requirements. The aim is to increase security, ease interactions from crew and to capture valuable data that can be utilised for both compliance and performance enhancements.

The bolt-on upgrade kits can be retrofitted to all SmartBilge+ analysers by crew, with guidance from our comprehensive online tutorial pages. This allows your fleet to expand into the new generation of bilge monitors as the benefits are realised by crew, management, owners and inspectors. Maximum performance, up time and security, Minimum burden on crew.

1.3 Upgrade bolt-on kits

SmartBilge+ Sample flow switch hardware kit – Rivertrace Part No: 113619

SmartBilge+ Discharge Flow meter hardware kit – Rivertrace Part No: 113615

SmartBilge+ GPS hardware kit – Rivertrace Part No: 113616

SmartBilge+ 24VAC Autoclean hardware kit – Rivertrace Part No: 110226

SmartBilge+ 115VAC Autoclean hardware kit – Rivertrace Part No: 110225

SmartBilge+ 230VAC Autoclean hardware kit – Rivertrace Part No: 110224

On top of the bolt-on hardware kits listed above, the software inputs can be activated by crew to allow the SmartBilge+ to utilise existing hardware that may already be onboard the vessel.

Software activation part numbers:

SmartBilge+ Sample flow switch Software activation – Rivertrace Part No: 113715

SmartBilge+ Discharge Flow meter Software activation – Rivertrace Part No: 113717

SmartBilge+ GPS Software activation – Rivertrace Part No: 113716

Figure 1 SMARTBILGE+ Overview

**Note: Image may vary slightly depending on version.*

1.4 Specification Listing

Blue items are SmartBilge+ optional features.

Measurement

Oil types:	Fuel Oil, Diesel and Mixture C (IMO defined)
Clean water calibration:	+/- 2ppm of factory set values
Oil range:	0 - 30 ppm (trend to 40) all types
Resolution:	0.1 ppm
Accuracy oil + solid's:	+/- 5ppm up to 30 ppm
Solids discrimination:	100ppm Iron Oxide in 10 ppm Diesel
Response time:	< 5 sec (oil reading)

Alarms

Alarm 1 Relay trigger(s): (Valve control)	Alarm ON when PPM exceeds Limit (1 to 15 ppm, user adjustable). Alarm ON when sample flow falls below fixed limit of 0.8 Litres per minute. When Flow Switch is activated. Alarm ON when ship Speed falls below Limit (adjustable preset limit). When GPS Input activated. Alarm ON when discharge flow exceeds Limit (adjustable preset limit). When Flow meter input activated.
Alarm 2 Relay trigger(s): (Audible alarm)	Alarm ON when PPM exceeds Limit (1 to 15 ppm, user adjustable). Alarm ON when sample flow falls below fixed limit of 0.8 Litres per minute. When Flow Switch is activated. Alarm ON when ship Speed falls below Limit (adjustable preset limit). When GPS Input activated. Alarm ON when discharge flow exceeds Limit (adjustable preset limit). When Flow meter input activated.
Alarm 1 Relay delay (Valve control):	0 – 5 seconds user adjustable

Alarm 2 Relay delay (Audible alarm):	0 – 600 seconds user adjustable in 10 sec increment.
Alarm hysteresis:	0.5 ppm when triggered by oil content.
Alarm contacts:	2 SP Alarm Relays 10A @ 250VAC (NC in alarm)

User Interface

LCD display:	4 x 16 alphanumeric back lit LCD display
Control:	3 button key-pad

Input / Output

Analogue output:	Active / powered 4-20mA / 0-20mA 24V oil content output.
Communications:	2-wire RS485 IMO data stream (Available when RS485 output is activated). Typically used for the automatic population of digital oil record book software.
GPS Input:	2-wire RS485 NMEA 0183 GPS Input. $GPRMC Sentences, 4800 baud rate. (Available when GPS Input is activated).
Analogue input:	Current loop input for passive 4-20mA flow meter. (Available when discharge flow meter Input is activated).
Cable terminals:	Accept cores of 2.5mm² (HV) and 1.5mm² (LV)
Cable glands:	4 x to accept cable diameters 10 – 14mm dia.
Inputs:	GPIO Switch input for Separator Pump Status (SW1) – IMO Requirement.
	GPIO Switch input for Separator Backflush Status (SW2)
	GPIO Switch input for sample flow switch (Available when Sample flow switch activated)

Data Storage and Retrieval

Calibration data storage:	Stored on board microcontroller in Smart Cell
IMO Data capacity:	18 months minimum. (Typically achieves >3 years before overwrite).
IMO required data:	Stored in Control enclosure (SMART CELL may be changed with data remaining on board)
IMO required data retrieval:	Via LCD display
	Via USB cable and Rivertrace IMO download software application.
	2-wire RS485 IMO data stream (Available when RS485 output is activated).

Environmental & Sample

Ambient humidity:	90%RH Max @ 55°C
Ambient temperature:	0°C - +60°C
Sample / clean water temperature:	+1°C - +60°C
Sample / clean water flow rate:	0.5 - 4.0 litres / min
Sample / clean water pressure:	0.1 bar - 6 bar
Sample / clean water select:	3-way universal solenoid valve
Sample pipe fittings:	¼ inch BSPP
Inclination	25° in any plane from normal mounting

System and Supply

Supply voltage:	115 or 230V AC, 50 – 60Hz (24VAC available)
Supply voltage Consumption:	< 50 VA including solenoid valve
Supply voltage tolerance:	+/- 15%
Other supply tolerance:	+/- 10%
Projected life:	> 50,000 hrs
Protection class:	IP 65
Approvals:	EC MED (DNVGL) + USCG to IMO MEPC 107(49)

Construction and other Criteria.

Security:	Protection of all calibration dependent items plus software lock
Auto clean (optional):	User set 1 – 360 min (if fitted)
Manual clean:	Fitted as standard
Weight:	3.2 Kg

1.5 Bolt-on upgrade kits

Bolt-on upgrade kits are available for increasing the performance, ease of use and security of your SmartBilge+ whilst aiding the crew in handling MEPC.107(49) compliant bilge water discharges. Full installation and activation instructions are supplied with each hardware kit, allowing crew to undertake these simple installations.

1.5.1 Flow switch hardware kit

Rivertrace Part number: 113619

The SmartBilge+ Flow switch ensures that adequate flow is passing through the measuring cell throughout each discharge in accordance with MEPC requirements, An alarm is indicated on the display if the monitor detects that the flow through the measuring cell has dropped below 0.8 Litres per minute. The alarm relays are also activated when the “Flow too low” message is displayed, alongside the action being recorded within the IMO date. If clow is cut to the measuring cell, the alarms will trigger within 5 seconds and the discharge is prevented.

Our Standard Flowswitch offered is a Part number 110626 as indicated below.

On specific customer request we can also offer an alternative Brass Flow switch which has an independent DNV Type Approval. The alternative DNV type approved flow switch is Rivertrace part number 113600.

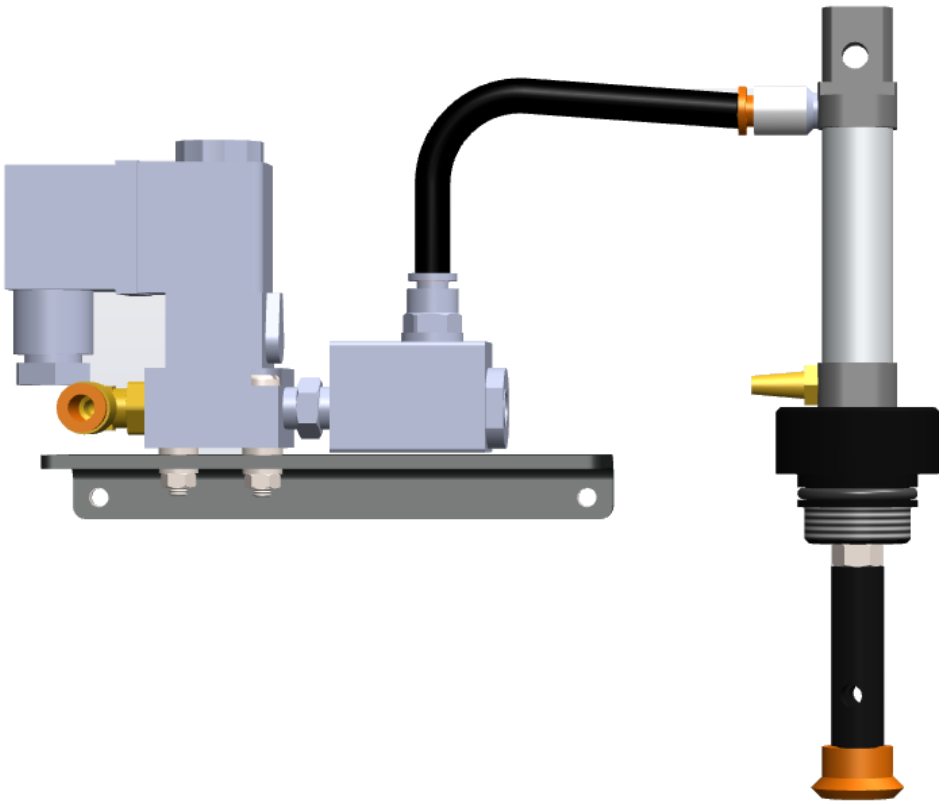
1.5.2 Autoclean hardware kit

Rivertrace part number: **110224 (230Vac)**

110225 (115Vac)

110226 (24Vac)

The Autoclean accessory is a pneumatic actuator, solenoid kit and wiper assembly, designed to ensure that the measuring cell glass tube is kept free from fouling. This greatly reduces touch time from the crew an lessens the likelihood of staining permanently damaging the measuring cell. The Autoclean is triggered by the SmartBilge+ Controller module.



Additional supplies required for the SmartBilge+ Autoclean kit:

Air: Instrument quality air @ 6 bar (this should be supplied via an air regulator).

Consumption: 47 cc per hour calculated from 3 wipe per half hour.

Voltage: Autoclean voltage is controlled and determined by the mains supply to the bilge monitor.This power is handled by the SmartBilge+. It is critical to purchase the correct voltage specific kit that matches th esupply voltage of your SmartBilge+ monitor.

Connections: Air supply to autoclean – 6 mm od push in fitting.

1.5.3 Flow Meter hardware kit

Rivertrace Part number: 113615

The flow meter hardware kit is designed to measure the discharge flow through your oily water separator. This passive 4-20mA device will function with separator capacities up to 10m/3hr and calculated flow rates using a rotating paddle wheel.

This SmartBilge will receive the mA signal on its designated flow meter input port and append the instantaneous flow rate of the discharge to each IMO data entry. The SmartBilge+ will also periodically lot whilst a flow rate is being received in adjustable periodic intervals as lot as 10 seconds. This allows the operator to download the data and accurately calculate the total volume of water discharged overboard for each discharge.

On top of performance and traceability, security is also dramatically improved as an alarm will be triggered and the discharge halted should the outlet flow of the oily water separator exceed its rated capacity, in accordance with MEPC requirements.

1.5.4 GPS hardware kit

Rivertrace Part number: 113616

The SmartBilge+ GPS Hardware kit offers the ability to record the ships speed and position alongside each IMO data entry. Alongside recording this information, the SmartBilge+ will generate an alarm and prevent all discharge if the ships speed falls below a pre-set trigger point. This ensures that no discharge can take place unless the vessel is underway, in accordance with MEPC requirements,

This kit is supplied with 100 meters of 1 pair screened cable for use between the SmartBilge monitor and the GPS Interface module and 9 meters of cable to use between the GPS Antenna and GPS Interface module.

2 Installation

These instructions are to assist with the installation of the SmartBilge+ monitor on an existing separator.

It is the responsibility of the installer/ship owner to ensure that the monitor installation is approved by CLASS before starting any work.

- ⚠ Before installation starts a risk assessment should be carried out highlighting any risks
- ⚠ All electric supplies should be isolated before making any modifications to the separator and existing bilge monitor.
- ⚠ All pipework should be isolated to ensure that there are no leaks occur and the final discharge valve should be lock shut to ensure that there is no potential for any discharges into the sea whilst carrying out modifications to the separator pipework.

2.1 Construction Details

The SmartBilge+ Monitor is split into two logical modules.

The display / control module **(2)** (left) contains the membrane keypad, LCD display and the SmartBilge+ Control PCB. Contained on this PCB are all the control and data storage associated electronics in addition to all the customer terminations which can be accessed via the cable glands **(5)**. This PCB links a 5-volt supply and RS485 communications to the Cell electronics via a 4 wire interface cable.

The measuring cell **(1)** contains the optoelectronics and mechanics used in the calculation of the sample oil content. This is the calibrated part.

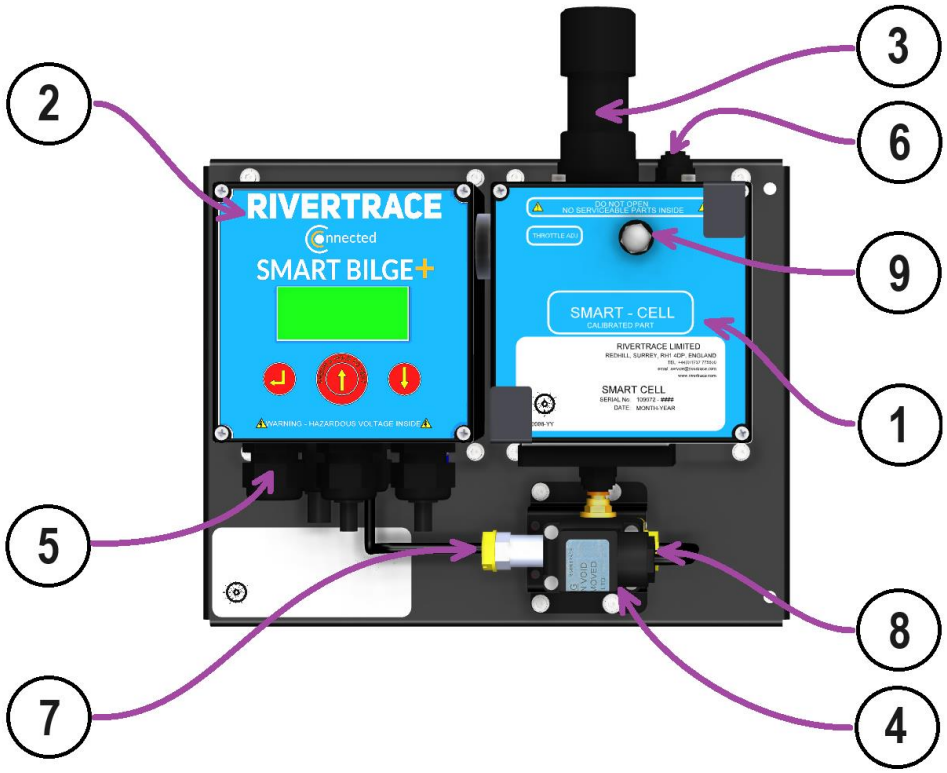
UNDER NO CIRCUMSTANCE IS THE MEASURING CELL ENCLOSURE TO BE OPENED.

Sample **(7)** and clean water **(8)** lines are connected to the solenoid valve **(4)** to allow automatic selection of clean water for clean water calibration and diagnostics.

Sample/Clean water is exhausted from the monitor via the outlet **(6)** after passing through the measuring sensor.

A manual clean unit **(3)** is provided which must be used in accordance with the maintenance requirements in **Section 5.**

The throttle **(9)** can be used to increase or decrease the back pressure in the cell. This is especially useful if air is present in the sample as increased cell pressures compress air and therefor reduce the light scattering properties of air bubbles within the sample.



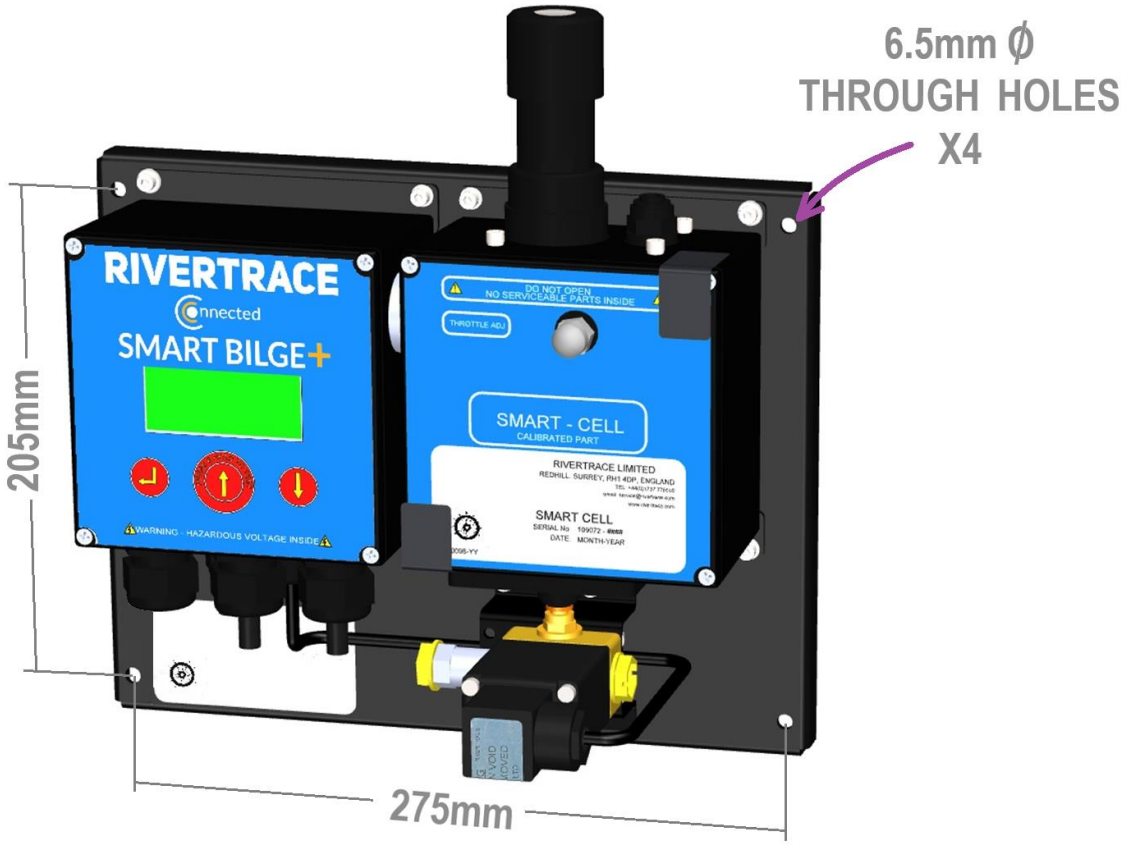
2.2 Mounting Details

The SMART CELL - BILGE monitor should be located on or in close proximity to the oily-water separator to minimise response delays. Under no circumstances should the distance between the monitor and the separator exceed a distance that would result in a response time of more than 20 seconds and breaching IMO regulations.

Mounting

Mount the SMART CELL - BILGE by means of 4 x M6 bolts on to a rigid vertical surface and preferably with the display panel of the monitor at an easy to operate level with good access.

Figure 2 Mounting Details



2.3 Pipe Work and Connections

Figure 3 Shows all pipe fittings required for Sample In, Clean Water In and Sample Out.

All fittings must be BSPP. Alternatively, Figure 4 shows the recommended piping for Japanese separators.

Figure 3 Pipe Fittings

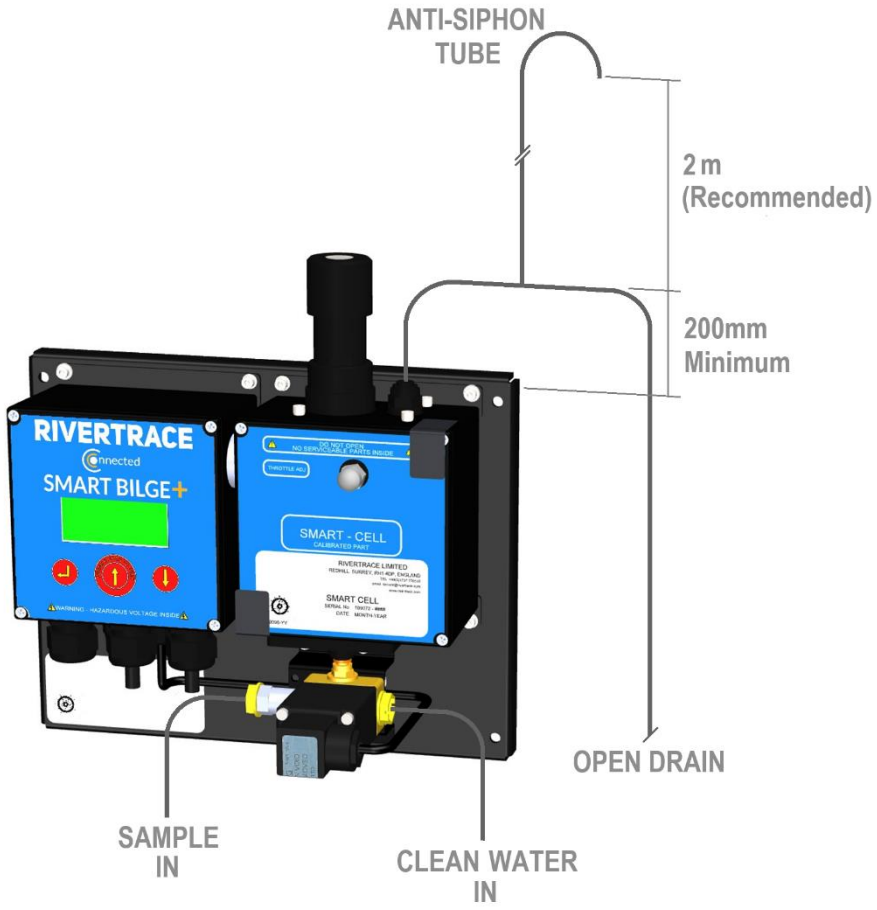
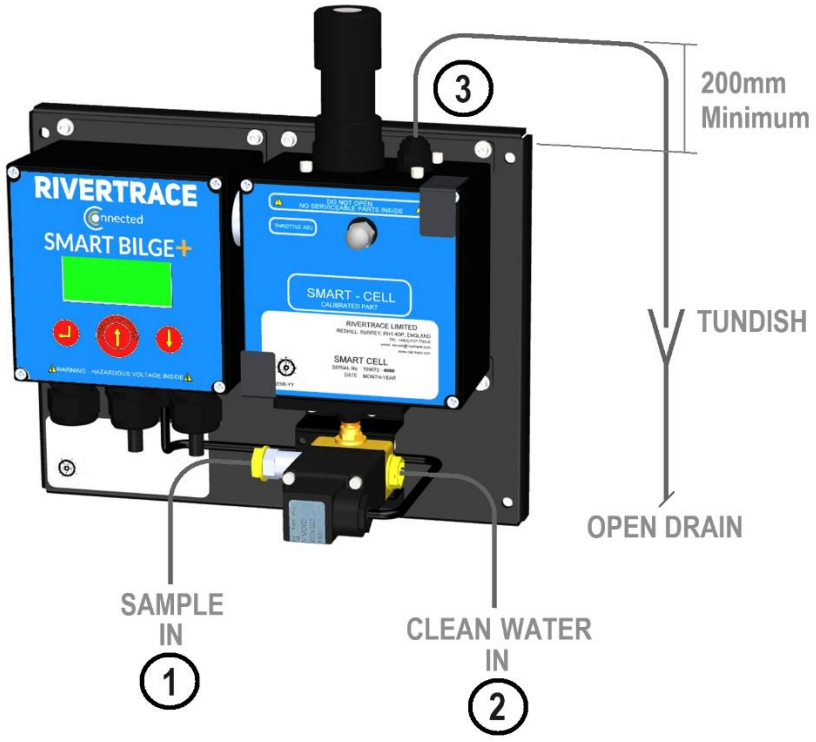


Figure 4 Alternative pipe configuration (Recommended Piping for Japanese Separators)

*1 When installing pipe “Sample Out”, be sure to install a ¼” nipple type non-return valve.

*2 Do not open “Manual Clean” when monitor is powered on as this will cause a malfunction.



Item no:	Description
1	Sample Inlet 1/4 inch BSPP fitting
2	Clean Water Inlet 1/4 inch BSPP fitting
3	Sample Outlet 1/4 inch BSPP fitting

For retrofits, the pipework between the existing monitor and the separator will have to be removed and refitted to the new monitor, **if there are any isolation valves in the line then these will have to be removed. For good practice the pipework between the separator sample point and the Smart bilge monitor input should be a continuous piece of pipework. There should not be any means for clean water to be introduced into the sample pipework via a three way valve.**

2.4 Electrical Connections

WARNING: Hazardous voltages are present In the control enclosure – Ensure equipment is isolated before proceeding.

Please read the following points before attempting any electrical work.

- ⚠ Ensure all cabling is volt free and isolated.
- ⚠ This unit must be connected to the mains supply via a suitably rated double pole (3mm contact gap), 2 Amp fused, isolator unless such fusing/isolation is provided by associated equipment. Isolator should be clearly marked as to function.
- ⚠ Cable gland entries can accept cables from 10 to 14 mm diameter and terminal blocks will accept cable cores of 2.5mm^2 (mains / Alarm contacts) and 1.5 mm^2 (terminals less than 48 V) . Cables carrying hazardous voltages must be at least 0.5 mm^2 csa.
- ⚠ When terminating mains cabling at monitor and electrical source, the earth conductor must be made longer than the live and neutral conductors.

The Smart Bilge monitor has been designed to meet the requirements of MEPC 107(49). For it to successfully record all data it requires to have an output from the separator (separator status) to the SW1 input on the monitor.

The wiring between the separator and the bilge monitor for this connection should be a screened cable. Separators built to previous MEPC specifications will not have the required output and will have to be modified.

Typically the separator motor contactor circuit will have to be modified so that an additional relay is linked across the contactor supply so that it is activated at the same time as when the contactor is activated. The selected relay will have to the same operating voltage as the contactor voltage. If the separator has a backflush function then this will also have to be fitted to SW2 input on the monitor.

User terminations are located by removing the lid from the SMART Display/Control module via the four screws. A protection plate is situated above the terminals which must be removed via 4 M3 screws.

Figure 5 User Terminations

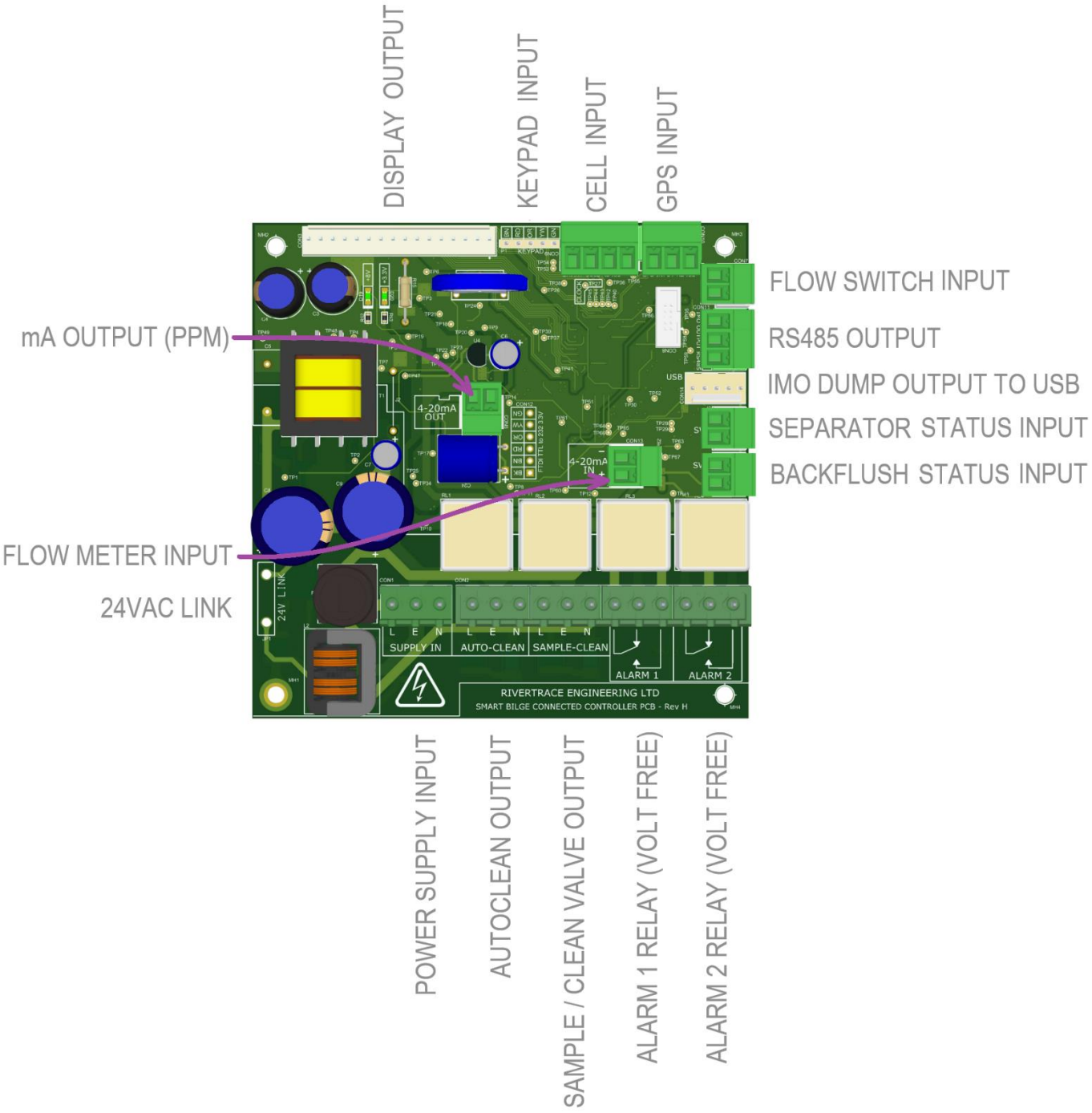


Table 1 User Terminal Connections

SUPPLY IN - L	Live in 24/115/230 VAC	Customer Supply Mains input from suitably rated Isolator (24V Link must be installed for 24V monitors – cannot be changed after purchase due to solenoid valve).	250V AC, 40 VA max.
SUPPLY IN - E	Earth		
SUPPLY IN - N	Neutral in 24/115/230 VAC		
AUTOCLEAN - L	Live 24/115/230 VAC	Auto clean control. Note: wiring (if present) to this terminal is not to be altered.	250V AC , 500mA.
AUTOCLEAN - E	Earth		
AUTOCLEAN - N	Neutral 24/115/230 VAC		
SAMPLE/CLEAN - L	Live 24/115/230 VAC	Sample clean control. Note: wiring to this terminal is not to be altered.	250V AC, 500mA.
SAMPLE/CLEAN - E	Earth		
SAMPLE/CLEAN - N	Neutral 24/115/230 VAC		
ALARM 1 - 1	Common	Alarm 1 relay contacts, normally closed in power down and alarm active states. **(Overboard Valve Control)**	VOLT FREE – RATED TO 250V AC/DC, 10A.
ALARM 1 - 2	Normally closed contact		
ALARM 1 - 3	Normally open contact		
ALARM 2 - 1	Common	Alarm 2 relay contacts, normally closed in power down and alarm active states. **(Alarm Annunciation Only)**	VOLT FREE – RATED TO 250V AC/DC, 10A.
ALARM 2 - 2	Normally closed contact		
ALARM 2 - 3	Normally open contact		
SW2	5V DC from PCB	Back-flush Switch Input	5V DC 20mA
SW2	Switch In		
4-20 mA OUT - +	+24V DC	mA Output Connection to share PPM value to remote equipment.	24V DC 20mA
4-20 mA OUT - -	0V		
4-20 mA INPUT - +	+24V DC	mA input for passive mA discharge flow meters (SmartBilge+ Supplies the power).	24V DC 20mA
4-20 mA INPUT - -	0V		
SW1	5V DC from PCB	Separator Status Switch Input	5V DC 20mA
SW1	Switch In		
USB	USB	IMO Data dump terminal	5VDC 10mA
RS485 OUTPUT - A	A	IMO DATA STREAM OUTPUT	-
RS485 OUTPUT - B	B		
RS485 OUTPUT - GND	GND		
FLOW SWITCH INPUT	5V DC from PCB	Sample flow switch input (for volt free switches)	5V DC 20mA
FLOW SWITCH INPUT	Switch In		
GPS INPUT - A	A – RS485	2-Wire RS485 NMEA 0183 GPS input. 4800 baud rate, $GPRMC Sentences,	-
GPS INPUT - B	B – RS485		
GPS INPUT - GND	GND – RS485		

Smart Bilge Electrical Connections

(provided supply voltage is the same for both Smart Bilge and Overboard Discharge valve)

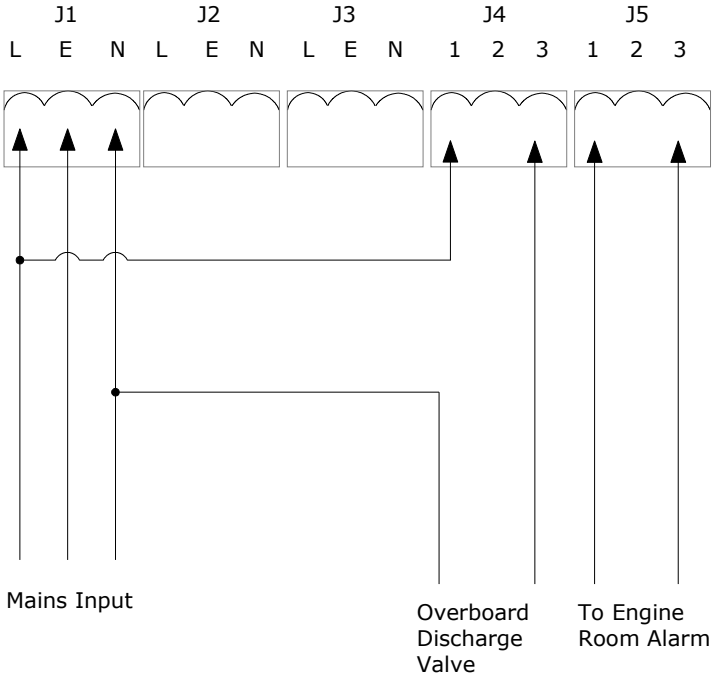
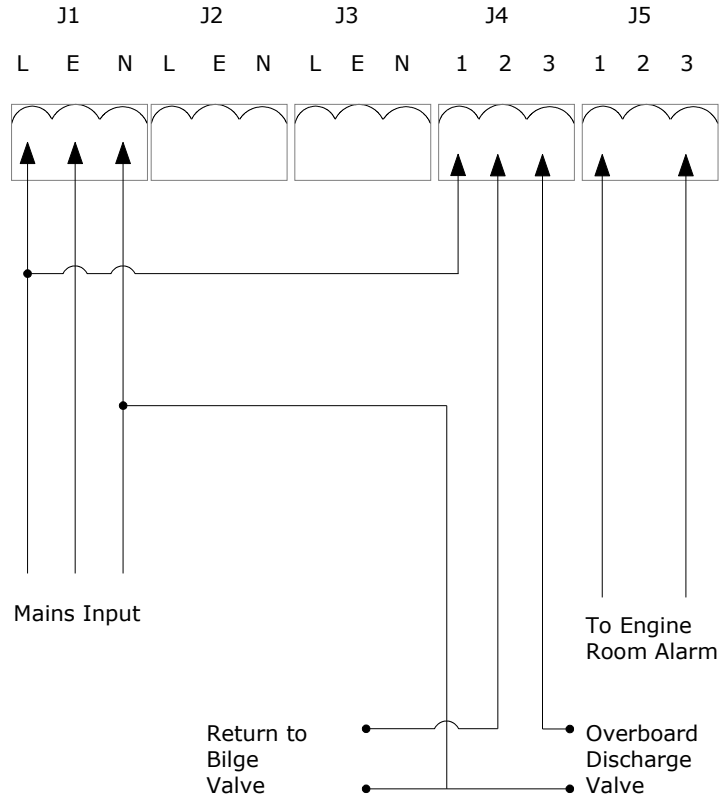


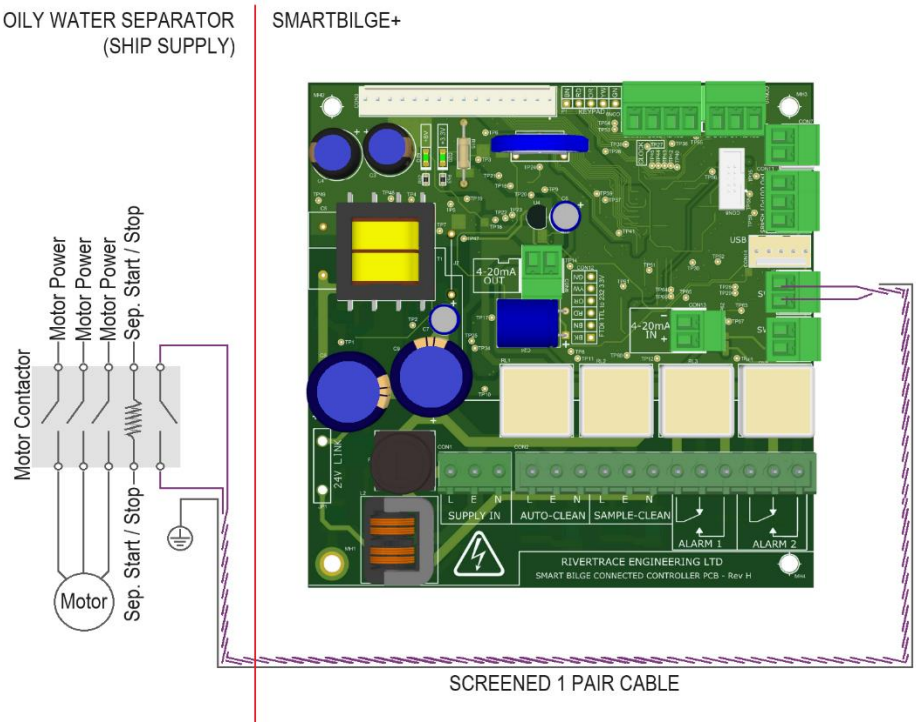
Figure 6 User Wiring Connections

It should be noted that the alarm contacts on the Smart Bilge monitor are volt-free. Alarm 1 should be used to control the overboard discharge valve or if the separator does not have this the pump stop contact.

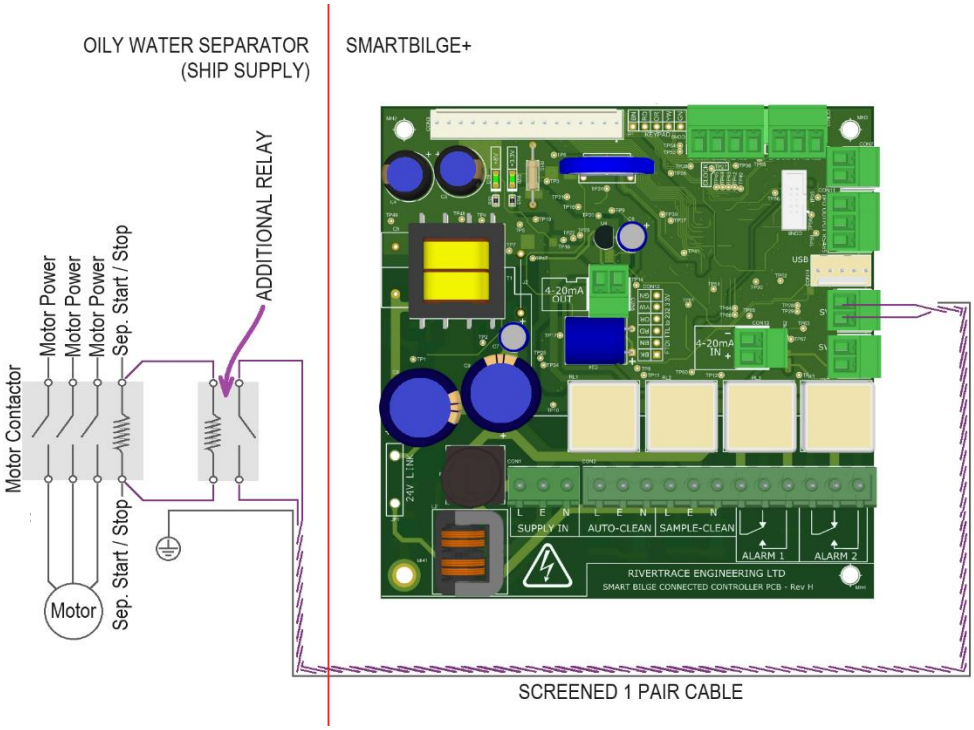
Smart Bilge Electrical Connections
(if there is a separate discharge and return to Bilge valve)



Separator input status wiring for separators with spare volt free N/O contacts that close when the OWS is running:



Separator input status wiring for separators without spare volt free N/O contacts that close when the OWS is running:



3 Commissioning

3.1 Piping

Check all piping for leaks and rectify where appropriate

Ensure all piping and fittings conform to specifications set in **Section 2.3.**

3.2 Electrical

Check that correctly rated isolator is connected to the mains input **(see Section 2.4.).**

Check the SmartBilge+ is correctly earthed.

Check all cabling conforms to specifications set out in "Table 1 User terminal connections", where applicable.

Table 1 User Terminal Connections

3.3 Functional testing

Follow **section 4** to start up and run clean water calibration.

Follow **section 6** for trouble shooting should any errors/spurious readings result.

3.4 Throttle

The throttle is used to regulate the flow through the measuring cell and to provide backpressure to decrease any aeration in the sample flowing from the separator.

The throttle should not be forced beyond its end stops – if rotated clockwise beyond its stop it is possible to strip its thread thereby causing the cell to leak. If the throttle is rotated anticlockwise beyond its stop then it is possible to distort the cell case lid which in turn will activate a cell breach error. This will require intervention by RIVERTRACE

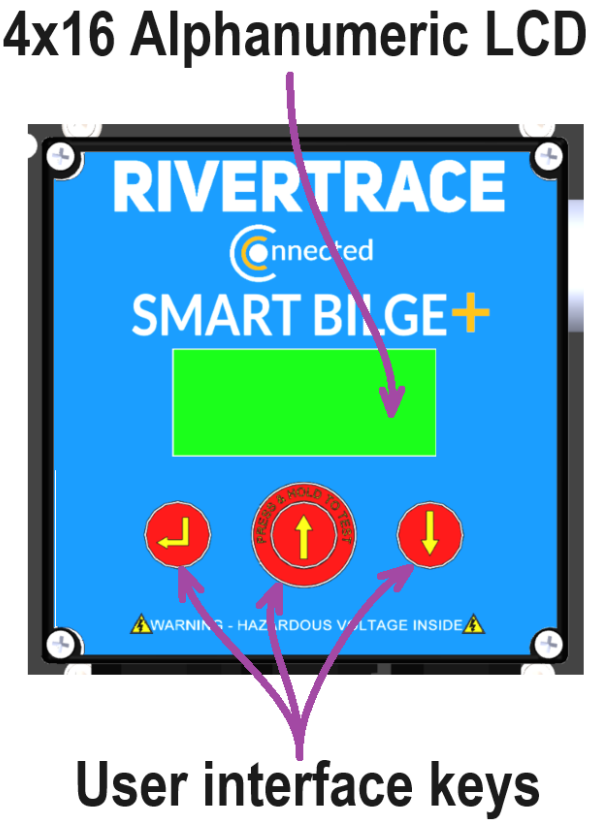
IF you experience fluctuating ppm readings then firstly try rotating the throttle clockwise to increase the backpressure. Monitor the flow from the cell. You should ensure that at the flow rate does not fall below 0.5 litres/min.

4 Operating Instructions

4.1 Getting Started

The SmartBilge+ is controlled and set up by the user interface on the Display/Control Module. Use the diagram below to become familiar with the controls.

User interface



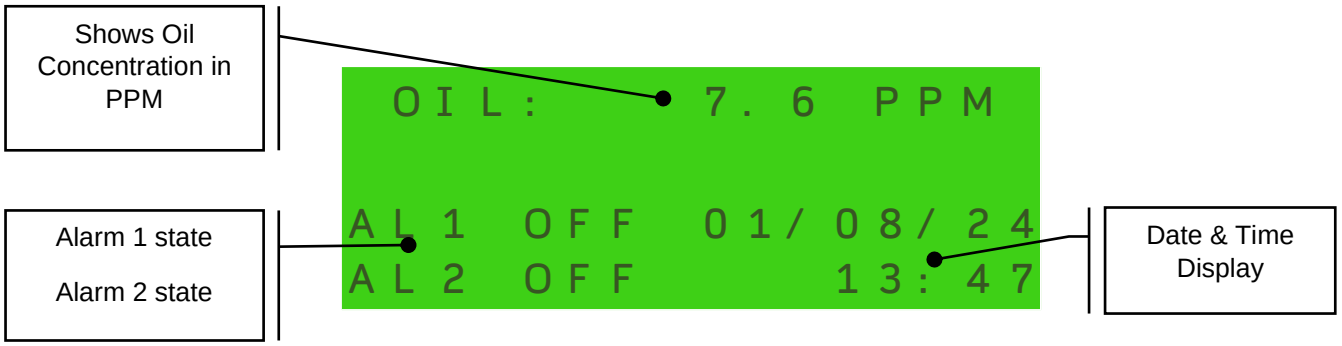
Screen Shot – Start Screen

On power up the user will be presented with a screen as shown in **Error! Reference source not found.**which shows that the monitor is in its startup sequence. The screen will show “Initialising” and will show a counter that will decrement from 20 seconds to 0 seconds before changing to the Main Information screen. During this period the alarms will be activated.

After initialisation the user will be presented with a screen as shown below.

- At the top of the display the user will see the oil concentration in Parts Per Million (PPM).
- The status of the two oil alarms will be displayed.
- The date and time is displayed. (time is set to UTC / GMT).
- If either of the alarm set points are passed, the LCD backlight will flash.

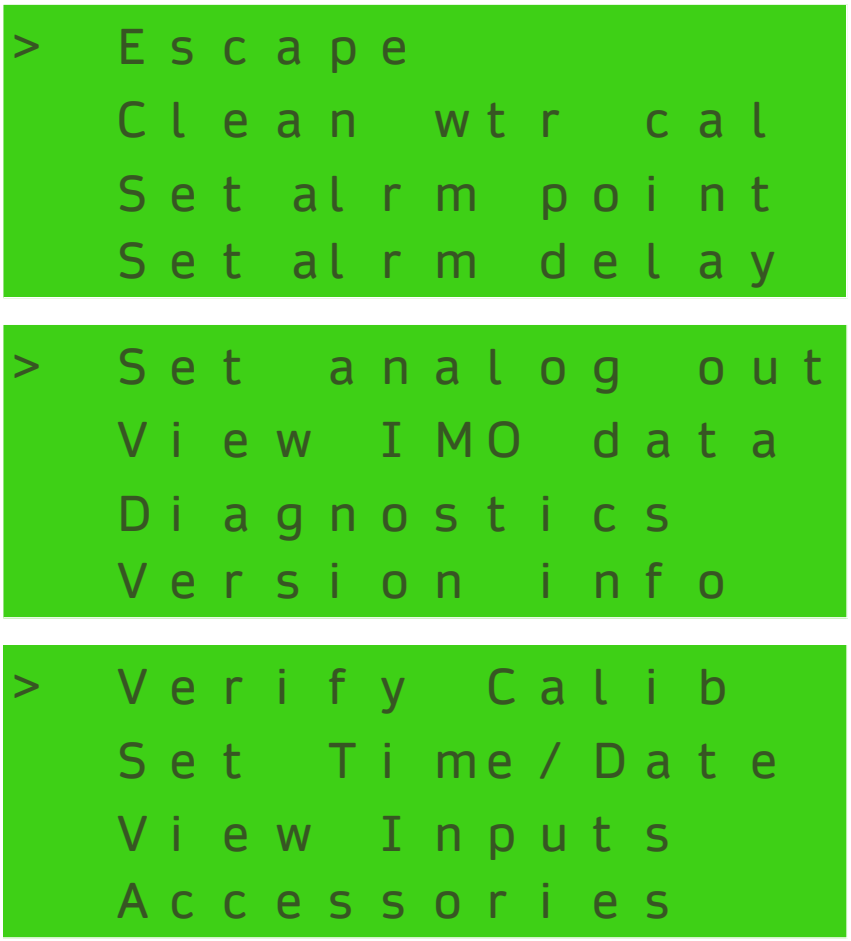
Main Information Screen



To interrogate the SMART CELL - BILGE Monitor settings the user can press the enter or down keys to bring up the Menu Options Screen as shown next.

Menu Screen Options

Use the **DOWN** and **UP** Keys to view all the Menu options. Press **ENTER** on any option to select or on Escape to return to main information screen

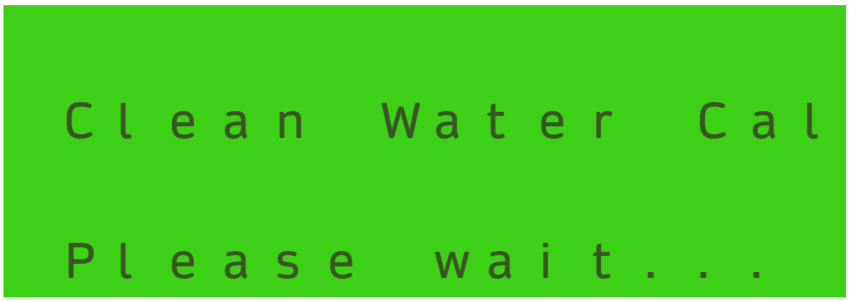


4.2 Clean Water Calibration

A clean water calibration can be performed to account for differences in clean water between the factory calibrated clean water and the ships own clean water supply.

On activation of the clean water calibration the clean water / sample solenoid will select clean water and both alarms will turn ON. The SmartBilge+ will then average the clean water reading over the period of 30 seconds after which a further 10 seconds will lapse for the user to verify the calibration in monitor mode before the solenoid selects sample once more.

Screen Shot – Clean Water Cal Screen



To set the clean water calibration enter the Menu screen and scroll using the up / down keys until the cursor reaches "**Clean wtr cal"** then press the **ENTER** key. The screen will change as shown here.

The screen will display for **30 seconds** after which, it will return to the menu screen. The solenoid will select clean water for a further 10 seconds so that the clean water reading can be verified by the operator. The alarms will return to the correct state for the displayed PPM.

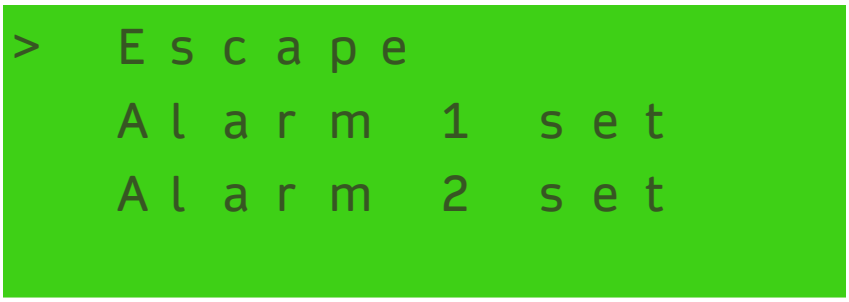
4.3 Set Alarm Points

The SmartBilge+ Monitor has two independent oil alarm contacts for user termination. These can be set by the user to operate when the displayed Oil content reaches the required Parts per Million (PPM) settings.

Note: The alarms have a 0.5 ppm hysteresis included to prevent relay chatter. e.g. if an alarm is set at 15 ppm and the oil concentration exceeds 15 ppm, the alarm will be activated. The alarm will not deactivate until the oil concentration drops below 14.5 ppm.

To set the required Alarm points enter the Menu screen and scroll down until the cursor reaches "**Set alarm point"** then press the **ENTER** key.

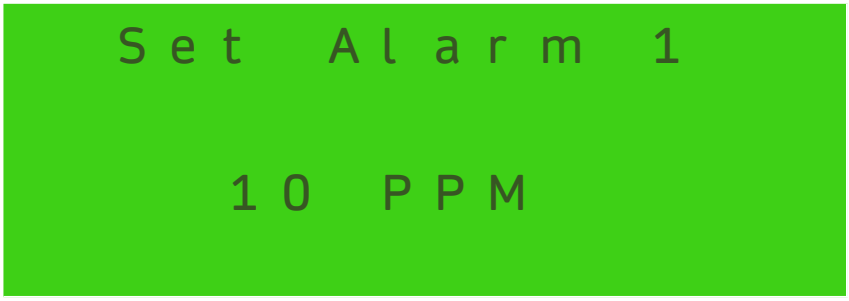
Screen Shot - Alarm Set Options



Move the cursor to Alarm 1 set by pressing the **DOWN** key and then press **ENTER.** This will bring up the screen the alarm menu screen,

Note: Alarm 1 MUST be used for control of the overboard discharge valve.

Screen Shot - Alarm PPM Value



The PPM value can now be set. The range is between **1 & 15**. Use the **UP** or **DOWN** key to select the required value. Once the required value has been selected press the **ENTER** key. This will bring the screen back to the alarm menu screen. Repeat this operation to set the value for alarm 2. Press the **ENTER** key 3 times to return to the main information screen.

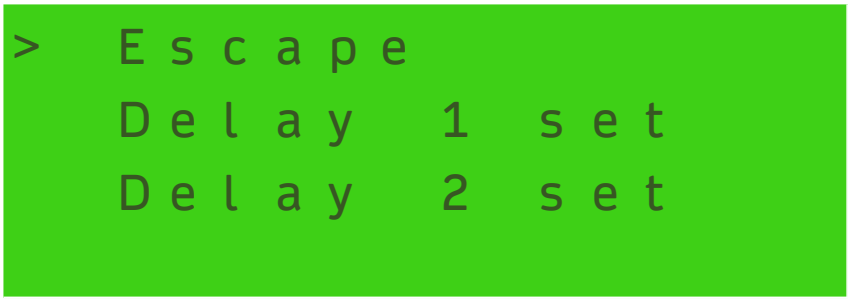
4.4 Set Alarm Delays

Once the alarm points have been set as described in **Section 4.3**, the alarm delay values can be entered. The alarm delay can be used so that if the oil concentration rises above the oil alarm set point for a period exceeding the alarm delay value the alarm relay will activate and only de-activate once the Oil Concentration has fallen below the Alarm Set Point.

Note: The main information display screen will show if an oil alarm is less or more than the current oil reading regardless of the alarm delay.

To set the required alarm delays go the menu screen and scroll down until the "**Set alarm delay"** then press the **ENTER** key.

Screen Shot - Alarm Delay Options

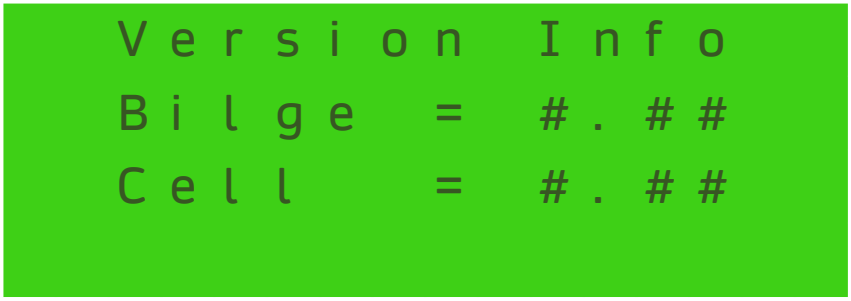


Move the cursor to delay 1 Set by pressing the **DOWN** key and then press **ENTER.** This will bring up the delay adjuster menu.

Screen Shot - Alarm Set Delay Value

Alarm delay 1 value can now be set between **0 & 5 Seconds**. Use the **UP** or **DOWN** key to select the required value. Once the required value has been selected press the **ENTER** key, this will bring the screen back to the display adjust menu. Repeat this operation to set the value for delay 2 (range between **0 & 600 Seconds** in **10 second increments**). Press the **ENTER** key 3 times to return to the main information screen.

Screen Shot – Version Info

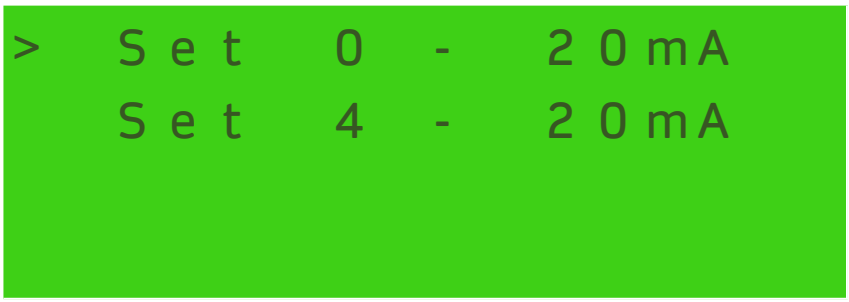


The Version Info can be used to view the software version fitted to the Smart Bilge monitor, it will show both the software version for the microcontroller module and the measuring cell module.

4.5 Set Analogue Out

The analogue signal output can be set to either **0 – 20 mA or 4 - 20 mA** and is scaled from 0 to 30 ppm calculated oil concentration. To set the required analogue signal output go to the menu screen and scroll down until the "**Set analogue out"** then press the **ENTER** key.

Screen Shot - Analogue Output Options



Move the cursor using the **UP** or **DOWN** key to select required option. Press the **ENTER** key twice to return to the main information screen.

4.6 View IMO Data

It is required that the date, time, bilge alarm status and separator status is to be recorded for any change in alarm status or separator status and stored for a minimum of 18 months.

This data is recorded within the Smart Control / Display enclosure, allowing replacement of the SMART CELL - BILGE whilst ensuring the data remains on board.

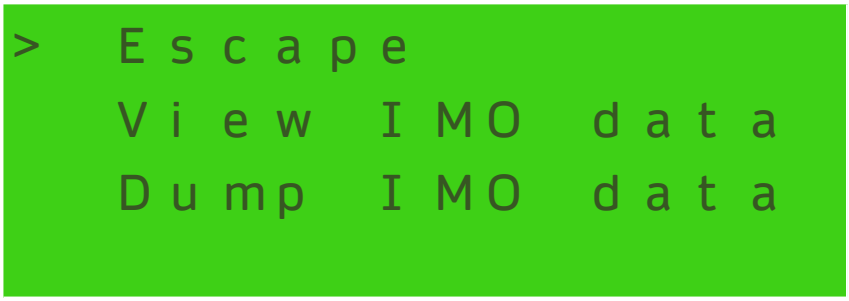
The separator status is recorded via the SW1 and SW2 inputs. The following configuration is used.

- **SW1** Separator ON/OFF status.
- **SW2** Separator Back-flush (If fitted)

Note. SW2 will select clean water and activate alarms permanently when closed. To be connected to Separator backflush control circuit via a potential free contact.

To view or download the IMO required data go to the Menu screen and move the cursor down until "**View IMO data"** then press the **ENTER** key. The screen will change as shown in

Screen Shot - View IMO Data



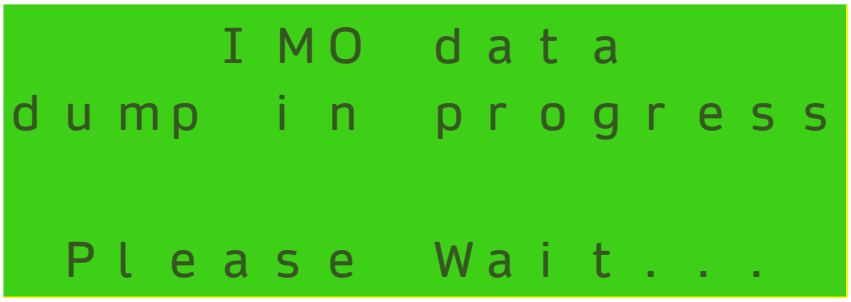
Move the cursor to either View IMO data or Dump IMO data by pressing the **DOWN** key and then press **ENTER.** This will bring up the IMO data menu.

Figure 7 Screen Shot - IMO Data

This screen displays one IMO record at a time. Each record shows the oil content, Alarm status, switch input status and time/date of the record. The users can scroll through the records by pressing the **UP and DOWN** keys. When inspection is complete the **ENTER** key will exit the user

AL1 ON – this shows that the alarm 1 was activated at the time the event was recorded.
AL2 ON – this shows that the alarm 2 was activated at the time the event was recorded.
SW1 OFF – this shows that the separator status input was not active at the time the event was recorded.
SW2 OFF – this shows that the separator backflush input was not active at the time the event was recorded.
40 PPM – this shows the what the oil content was at the time the event was recorded

Screen Shot - Dump IMO Data



By selecting the dump IMO data command, the complete IMO required data history is copied and downloaded to the USB port. This can be captured by purchasing a Smart Bilge download cable with instructions from Rivertrace Eng, see **Section 5.3.**

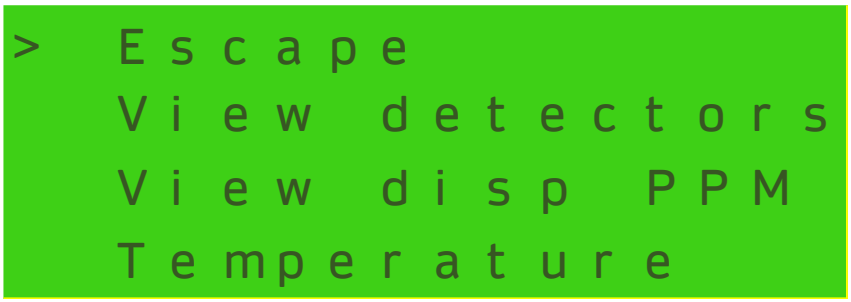
The download data screen will remain displayed until download is complete. This may take up to 30 minutes. Cycle the power to abort.

NOTE: Dump IMO data command is copy only and will NOT erase any data

4.7 Diagnostics & Clean Water Flushing

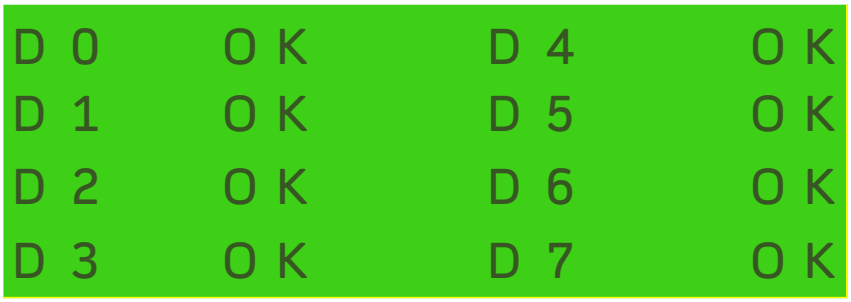
*To view the diagnostics go to the menu screen and scroll down until the "**Diagnostics"** then press the **ENTER** key.*

Screen Shot – Diagnostics



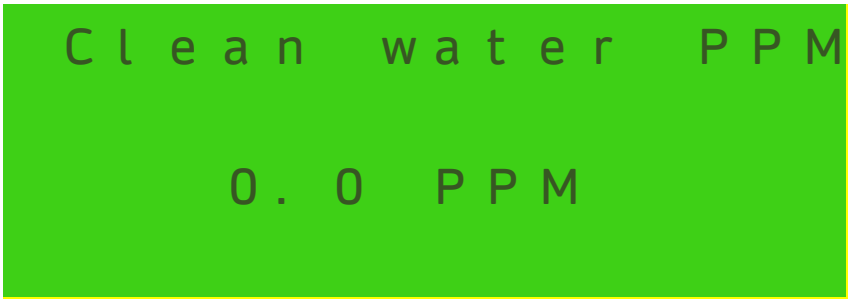
*Move the cursor to either View detectors, temperature or View disp PPM by pressing the **DOWN** key and then press **ENTER.***

Screen Shot – View detectors



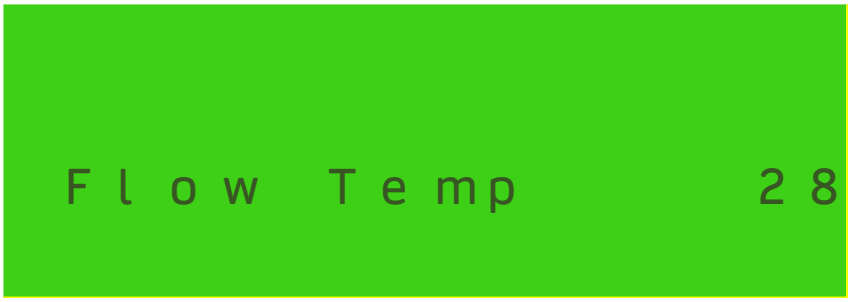
Once in view detectors, the solenoid valve will select clean water and the screen will display the current signals present for clean water. The alarm relays will activate when view detectors is selected. Pressing the **ENTER** key will leave the diagnostics screen and set the valve back to sample.

Screen Shot – View disp PPM



Once in "**view disp PPM**", the solenoid valve will select clean water and the screen will display the current calculated ppm for clean water. The alarm relays will activate when view detectors is selected. Pressing the **ENTER** key will leave the diagnostics screen and set the valve back to sample.

Screen Shot – Temperature



Once in view Temperature, the temperatures shown is the flow temperature in deg Celsius. Pressing the **ENTER** key will leave the diagnostics screen and set the valve back to sample.

Clean Water Flushing

During "**View disp PPM**", the clean water valve is activated and clean water is allowed to flow through the monitor. The calculated PPM for clean water will be displayed. This reading should be less than 2 ppm. The manual clean plunger should be used at this time to clean the glass cell tube. It can sometimes take up to 30 minutes of flushing to thoroughly clean the fresh water line due to its irregular usage.

4.8 Test Procedure

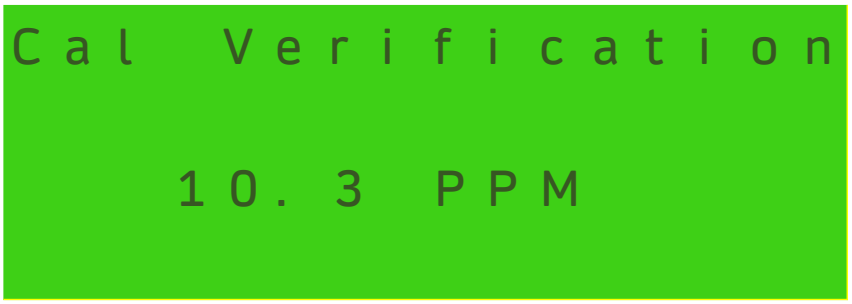
The smart Bilge monitor has two alarm relays that can be set anywhere between 1 and 15ppm. These are normally set at 15ppm.

The following steps can be followed to demonstrate that the alarm relays change state at the correct PPM.

1. Press and hold UP button for 5 seconds to initiate alarm test.
2. Smart bilge will count to 40ppm from its original true PPM reading in 1ppm / second intervals.
3. Alarms will trip at their pre-set alarm points to ON.
4. When the display reached 40ppm, it will then begin to count back down in the same timing of 1ppm / second to settle at its true PPM once more.
5. On the way counting down, when the PPM drops below the pre-set alarm points, the alarms will turn OFF.
6. At the end of the test, the operator will be given the option to; "View IMO Data" or "Done". The UP / DOWN keypad can be used to highlight an option and then ENTER to select.
    a. If "View IMO Data" is selected this will put display the IMO Data. The customer can scroll up and down from here. Pressing enter will return back to the menu as usual.
    b. If "DONE" is selected, the monitor return back to the home screen.

4.9 Monitor Calibration Check

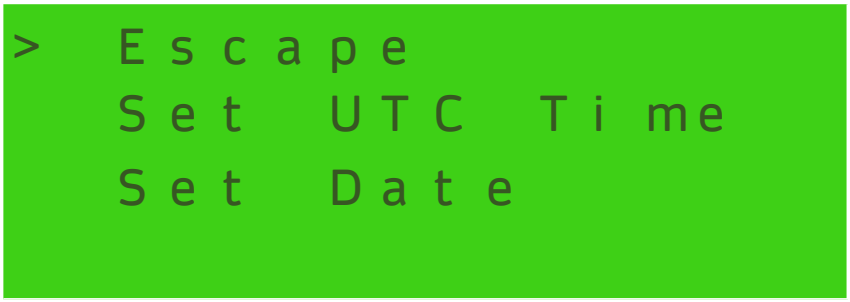
The monitor's calibration can be checked by using the Monitor Calibration Check Water Sample Kit. This kit contains two bottles of fluid, one marked 10 ppm and the other 20 ppm. The user menu contains a sub menu – Verify Calib. Entering this menu allows the user to view the ppm value of the fluid being poured into the cell.



Procedure 109993 refers to the above.

4.10 Time, Date Adjustment

Screen Shot – Set Time/Date Adjustment Selection



The Time and Date must be set to UTC (GMT) time

Move the cursor to the Set Time/Date and press ENTER.

Now select either the ‘Set UTC Time’ or ‘Set Date’ using the UP or DOWN and ENTER keys.

Using the UP or DOWN keys allows the minutes/days to be incremented/decremented. If the ENTER key is pressed, the time/date is updated and theses menus exited. If no key is pressed for 90 seconds these adjustment menus are automatically exited and any adjustments lost.

A menu showing the set time and date is then displayed. Press ENTER to exits this display, if no key is pressed for 90 seconds this display is automatically exited. The current time is now the set time. Changes to the time and date will be recorded in the IMO data log.

4.11 Separator operation

The bilge monitor will detect the oil content from the discharge from the bilge separator.

The bilge monitor will close the overboard discharge valve if the oil content is above 15 ppm.

You should ensure that any valves that control the flow from the separator to the bilge monitor are open and also ensure that any valve that controls the flow of the clean water valve is open.

Please refer to the separator instruction manual for operation of the separator.

5 Maintenance and Spares

5.1 Weekly Maintenance

- Manual clean must be plunged and released 10 times.
- Carry out “Clean Water Calibration” as per **Section 4.2**
- Confirm Unit reads 0 ppm by following **Section 4.7**

5.2 Yearly Maintenance

At yearly intervals (or where necessary) the wiper ring on the manual clean assembly should be replaced. This can be ordered from RIVERTRACE directly as part no. 109039.

To remove wiper assembly, electrically isolate the monitor. Have some rags available to wipe up any spills.

Ensure that the separator is switched off and there is no flow through the monitor cell.

Isolate clean water supply and remove manual clean by using the knurled cap to unscrew it.

Pull the manual clean from the cell in a vertical motion and wipe with a rag. Locate the wiper and prise off with a small flat bladed screwdriver. Fit the new wiper by pushing it against a flat surface and rotating the manual clean at the same time.

Refit the manual clean into the cell and de-isolate power and water supplies.

It is also a possible to verify or check the accuracy of the SMART BILGE by purchasing a Calibration Check Kits. This can be purchased directly from Rivertrace or from one of our agents.

If the Calibration check is carried out by Rivertrace or one of our approved Service Agents a Calibration Check Certificate can be issued on behalf of Rivertrace. This will only be VALID if the original FACTORY CALIBRATION CERTIFICATE for the Calibrated SMART CELL is within its 5 year validity.

If you have an autoclean installed – it is recommneded the wiper is replaced every 6 months. The autoclean actuator can be removed from the measuring cell and the wiper replaced.

5.3 5 Yearly Maintenance

On the SmartBilge+ the Calibrated SmartBilge+ Cell has a validity of 5 years on the Factory Calibration Certificate. After 5 years the SmartBilge+ Cell should be replaced with a replacement cell. Contact Rivertrace or one of our Agents for further details.

5.4 Spares

When ordering spares, it is important to supply details of the type of monitor, serial number of monitors, part number of each spare required, its description and any other relevant information.

ANNUAL RECOMMENDED ON-BOARD SPARES

Item	Qty	Part Number
Cell wiper ring	1	109039
Fuse 1.25A	1	109167
Calibration Check Kit	1	109996
Spare Smart Cell Assembly	1	109171
Smart Bilge Cleaning kit	1	110707
Smart Bilge IMO data download Kit	1	110958

OTHER SPARES

Item	Qty	Part Number
Spare 24/110/240VAC Programmed Smart Bilge PCB Assy	1	113333
Membrane overlay	1	113343
LCD display module	1	109068
Solenoid valve 3mm orifice (230V ~ 50/60Hz)	1	109059
Solenoid valve 3mm orifice (115V ~ 50/60Hz)	1	109060
Solenoid valve 3mm orifice (24V ~ 50/60Hz)	1	109061
Cell Wiper ring	1	109039
Solenoid valve 3mm orifice (24V ~ 50Hz)	1	112109

SmartBilge+ Upgrades and bolt-on kits.

Item	Qty	Part Number
SmartBilge+ 230vac AutoClean Kit	1	110224
SmartBilge+ 115vac AutoClean Kit	1	110225
SmartBilge+ 24vac AutoClean Kit	1	110226
SmartBilge+ Sample Flow switch hardware kit	1	113619
SmartBilge+ Sample Flow switch software activation	1	113715
SmartBilge+ Flow Switch with DNV Cert - *Alternative	1	113600
SmartBilge+ GPS Hardware kit	1	113616
SmartBilge+ GPS Software activation	1	113716
SmartBilge+ Discharge Flow Meter hardware kit	1	113615
SmartBilge+ Discharge flow meter software activation	1	113717

5.5 Sales Support and bolt-on activation PINs

For sales support, spares enquires or information on upgrades, contact Sales@rivertrace.com.

If you wish to upgrade your SmartBilge+, all bolt-on upgrade kits can simply be installed by competent crew. The kits are designed to be simple and very clearly explained, by engineers, for operators.

This agile approach allows your fleet to organically grow with the ever-tightening regulations and drive for compliance, adapting as benefits are realised through operation.

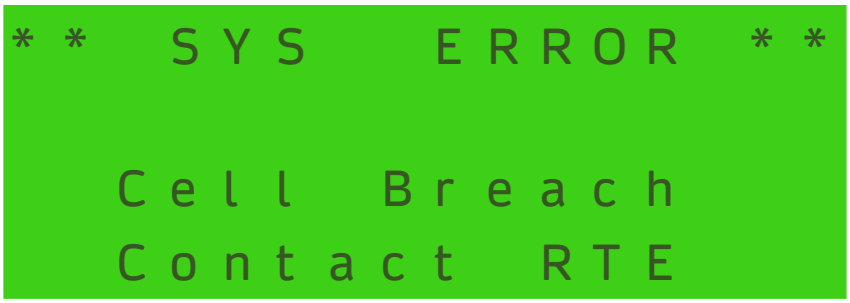
6 Troubleshooting Guide

Table 2 Trouble shooting guide

Symptoms	Possible Cause	Corrective Action
Monitor is switched on and the LCD screen is blank	Power is Isolated. Failure of mains fuse. Loose ribbon cable connection. LCD display Module is damaged.	• Check Isolator • Check fuse (F1). See Figure 5. • Check all ribbon cable connectors are firmly inserted. • Contact RIVERTRACE for a replacement LCD module **(Section 5.3)**
Monitor stays in alarm or reading is inaccurate. **Or** Display shows **SYS ERROR**, **Detector 0 – 7 Is under / over range.** **Or** Display shows **SYS ERROR**, **Oil content Is under / over range.**	Dirty measuring cell. Excessive Contaminates present in sample e.g. rust bacteria, emulsified oils, detergents, discoloration of water. Measuring Cell is empty. Air bubbles are present in the Sample. Manual Clean has become stuck in the down position.	• Clean cell and perform Clean water calibration. **Section 4.2** • Correct cause of contaminants and run clean water calibration. • Check water flowrate through measuring cell is >0.5l/min. • Turn throttle clockwise until air is removed from sample (taking care not to exceed the maximum operating pressure. • Remove Manual clean unit and clean with a detergent. Check Wiper ring on the end of the piston and replace if necessary. • If problems persist Contact RIVERTRACE for a replacement • Solenoid valve **(Section 5.4).**
Monitor ppm remains high and does not change	Measuring Cell is empty.	• Check water flowrate through measuring cell is >0.5l/min.
Display shows **Warning, flow Error detected** **Only If flow switch fitted**	Flow through measuring cell not sufficient.	• Increase flow through monitor cell, Remove pipework from sample inlet to solenoid and check that there is no debris blocking the port.
Display shows **SYS ERROR**, **Temperature Is under / over range.**	Current Ambient temperature inside the Cell is not within **0 - 60°C**.	• Move equipment to an area with ambient temp between **0 - 60°C.**
Display shows **SYS ERROR**, **Communications failure**	RS 485 communications cable is loose / not connected Cell Electronics Fault.	• Ensure 4-pin plug from the measuring cell in secure withing the controller PCB.
Display shows **SYS ERROR**, **RTC – I2C failure**	Smart Bilge electronics failure.	• Contact RIVERTRACE for a replacement • Smart Bilge PCB **(Section 5.4).**
Display shows **SYS ERROR**, **Cell breach contact RIVERTRACE**	Measuring Cell has been opened or overuse of the throttle has damaged the cell.	• Contact RIVERTRACE for a replacement measuring cell **(Section 5.4).**
"Speed too low" Warning.	Vessel is moving < minimum discharge speed set by company. Resume discharge when speed has increased.	• Resume discharge when speed has increased.
"Discharge flow too high"	Flow meter has detected that the separator is operating outside of its rated capacity.	• Restrict outlet flow of OWS until error clears.
"Flow too low"	Sample flow is not sufficient to operate in accordance with MEPC requirements.	• Increase sample flow to SmartBilge+. This is typically achieved by restricting the OWS outlet after the SmartBilge+ Sample point.

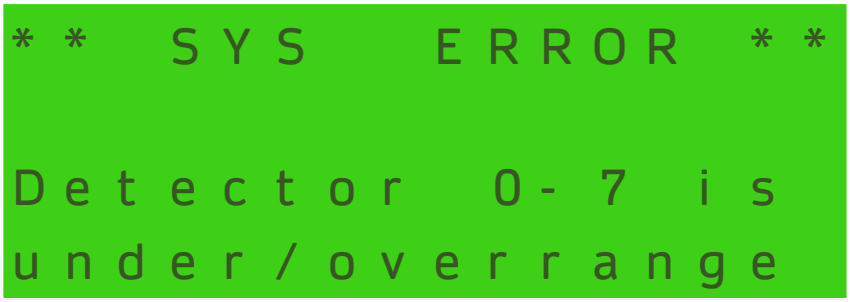
6.1 Fault-finding

Plunger down error is caused by the light path across the glass measuring cell being obscured. This can occur if the manual clean plunger is left in the down position or if the measuring cell is contaminated with oil, stained with rust deposits, or if there is an electrical fault with the cell PCB. The manual clean can be removed and cleaned with a rag, the cell can be drained and filled with a weak acid such as orange juice or vinegar and left to soak overnight before being flushed through with clean water.

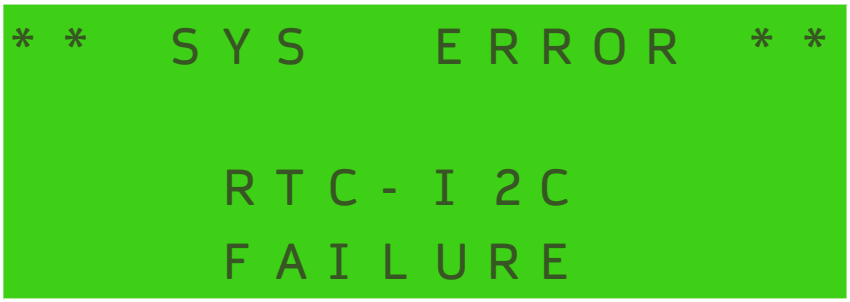


Cell Breach error is caused by damage to the measuring cell cover or removing the cover. The breach can only be reset at the factory.

Communication failure is caused by the loss of the RS485 signal between the measuring cell and the microcontroller module. Check that the cable from the measuring cell that is connected to the SmartBilge+ controller PCB is fully secure.



Excessive Contaminates present in sample e.g. rust bacteria, emulsified oils, detergents, discoloration of water. This could also indicate measuring cell failure.



Real Time Clock Failure – Unit will not display or record the correct time and date. This indicates that the controller PCB has failed and will need replacing.

Air Bubbles present in sample water. Increase back pressure using the Throttle Screw. Check sample pipework for leaks.

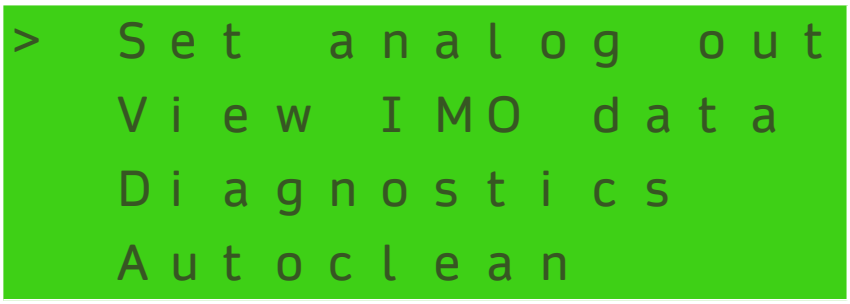
7 Additional Features and Functions

There are additional features that can be added to the SmartBilge+ monitor which increases security and lessens maintenance. They are the flow switch module and the AutoClean module.

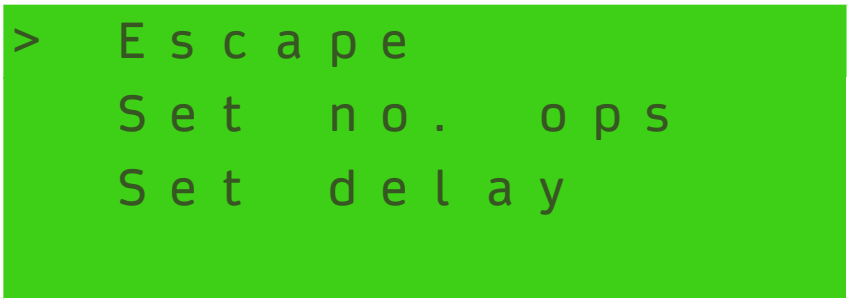
7.1.1 Flow Switch

The display will indicate an error if insufficient flow is detected through the measuring cell. Increase the flowrate through the measuring cell to above 0.8 l/min (Note: this is an option and not available on the standard monitor).

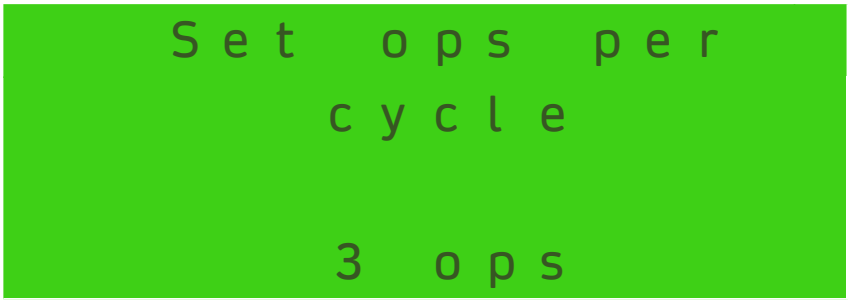
7.1.2 Autoclean



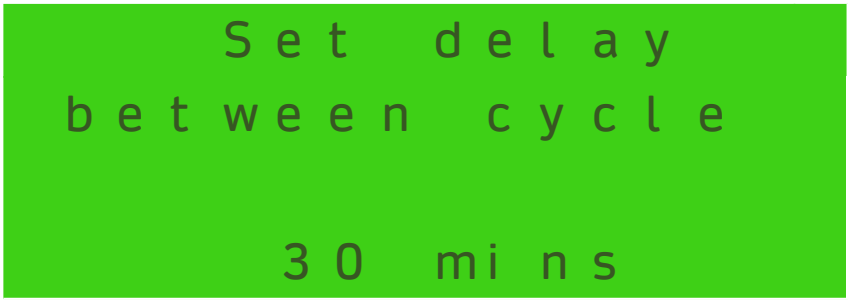
If Autoclean has been invoked in the software, then the user menu will include “Autoclean” as a sub menu. (Note: this is an option and not available on the standard monitor).



The screen will show two sub menus; the number of strokes the wiper will make and the delay between each AutoClean action.

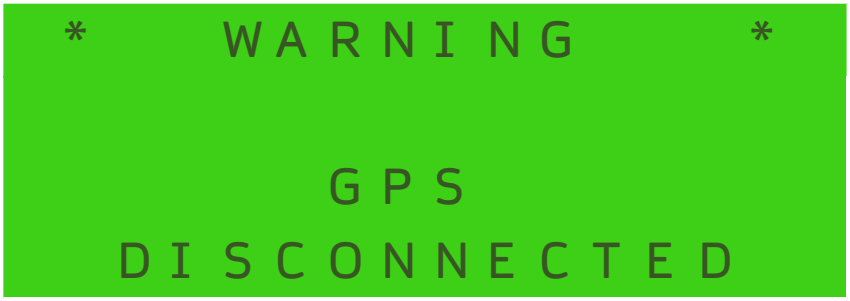


Selecting ops per cycle and using the up or down arrow will increase or decrease the figure show on the screen. Press Enter to return to previous menu.



Selecting delay between cycles and using the up or down arrow will increase or decrease the time shown on the sC

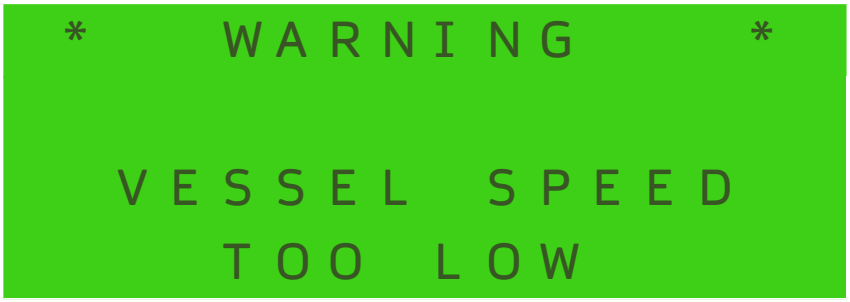
7.1.3 Vessel Speed / GPS messages



When the GPS Bolt-on is utilised, the SmartBilge+ has the ability to accept NMEA 0183 GPS over 2-wire RS485. The Baud rate must be 4800 and $GPRMC sentences must be used. This signal can either come from the ships own GPS system or the Rivertrace supplied stand along set-up for additional security. This allows the ships speed and position to be stored within the IMO data and also to check that the vessel is “Underway”, in accordance to MEPC requirements whilst the discharge takes place. When the data is recalled, this can be cross checked against manually recorded discharge logs, which are prone to human error and ensures that the oil record book is always accurate.

If the GPS signal is not received by the SmartBilge+ due to incorrect data or an electrical / mechanical wiring issue, the GPS disconnected message will be displayed and discharge prevented. The alarm relays will be in a fault state whilst this message is displayed.

To overcome this issue, double check that the correct GPS data is being sent to the SmartBilge+ and that the wiring is correct and secure. When the GPS connection resumes, the alarms will no longer be forced on by this fault and the display will return to normal.



Alongside recording critical GPS data within the IMO data, the SmartBilge+ will generate an alarm if the vessels speed falls below 7 knots and prevent discharge until the vessel is underway once more. This limit can be adjusted with support from Rivertrace, however although there is no specified speed which relates to “Underway”, a parallel regulation in MARPOL requirements states that 7 knots is underway. This relieves the burden of manual checks by crew, eliminating the possibility of human error.

To overcome this message, resume discharge once the vessel is sailing at a speed that satisfies the minimum discharge limits (>7 knots).

7.1.4 Separator Flow messages

When the Discharge flow meter bolt-on utilised, the SmartBilge+ has the ability to police the outlet flow of the oily water separator discharges, preventing the oily water separator from discharging more water than its rated capacity. This relieves the burden of manual checks by crew. The instantaneous flow rate is recorded at adjustable time intervals (As low as 10 seconds), throughout each discharge. When the data is recalled, this allows the operator to determine the volume of discharge and extremely useful when used in conjunction with the GPS input.

7.1.5 Sample Flow too low messages

If your SmartBilge+ has a sample flow switch installed, the sample flow rate through your measuring cell is continuously monitored to help check that the sample is a true and accurate representation of the discharge water, passing overboard. This prevents clean water from being trapped inside the measuring cell and non-compliant discharges taking place as a result.

If the sample through the measuring cell falls below 0.8 litres per minute, a 5 second delay will automatically start. Once the delay has expired, the alarms will instantly be forced ON and the overboard valve closed.

This leaves a response time of 5 seconds, plus valve closure time (Which varies from ship to ship). Valves are typical spring return and close within one or two seconds. This would equate to a time of ~6 or ~7 seconds between statis sample being detected and the overboard valve being fully closed and all discharge prevented. This information is also stored within the IMO Data.

To overcome the “sample flow too low error”, the flow to the SmartBilge+ must be increased. This is usually possible by restricting a valve or inserting a restriction on the discharge line, after the SmartBilge+ sample take-off point.

7.2 Technical Support

For Technical Support on this product, please visit www.rivertrace.com and click the “SUPPORT” tab or scan here

Over 90% of remote support cases are explained and resolved here.

If you are unable to find what you need, then feel free to submit a Remote Support Request to our experts, through our website for our most efficient response time or email remotesupport@rivertrace.com

8 Annexes

8.1 Type Approval Certifications

MED – EC type Examination Certificate – Module B – DNVGL MEDB0000629

MED – EC Certificate of Conformity – Module D – DNVGL MEDD0000113

Transport Canada – Certificate of Type Test for 5ppm Bilge Alarms – CBA-018

EC-TYPE EXAMINATION CERTIFICATE (MODULE B)

Certificate no.:
MEDB0000629
Revision no.:
2

Application of: Directive 2014/90/EU of 23 July 2014 on marine equipment (MED). This Certificate is issued by DNV SE based on the notification of the Federal Maritime and Hydrographic Agency of Germany.

This is to certify:

that the **Oil-content meters**

with type designation(s)
SMART CELL - BILGE

issued to
Rivertrace Limited
Redhill, **United Kingdom**

is found to comply with the Implementing Regulation **(EU) 2024/1975** for
Item no. **MED/2.3** (Row **1 of 1**)
according to the following requirements:
MARPOL 73/78 Annex I, Reg. 14, IMO MEPC.1/Circ. 643

Further details of the equipment and conditions for certification are given overleaf.

Date of issue: **2025-04-01**

Expiry date: **2030-03-31**

DNV local unit:
UK & Ireland CMC & VMC

Approval Engineer:
Hagen Markus

Notified Body
no.: **0098**

for **DNV SE**

Digitally Signed By:
Christine Mydlak-Röder

Christine Mydlak-Röder
Head of Notified Body

The mark of conformity may only be affixed to the above type approved equipment and a Manufacturer's Declaration of Conformity issued when the production-surveillance module (D, E or F) of Annex B of the MED is fully complied with and controlled by a written inspection agreement with a Notified Body. The product liability rests with the manufacturer or his representative in accordance with Directive 2014/90/EU.
This certificate is valid for equipment, which is conform to the approved type. The manufacturer shall inform DNV SE of any changes to the approved equipment. This certificate remains valid unless suspended, withdrawn, recalled or cancelled.
Should the specified regulations or standards be amended during the validity of this certificate, the product is to be re-approved before being placed on board a vessel to which the amended regulations or standards apply.

Product description

The SMART Cell - Bilge Oil Monitor is split into two logical modules.
Module 1
SMART - Display / CONTROL MODULE contains the membrane keypad, LCD display and the Smart Bilge Control PCB.

Module 2
SMART – MEASURING CELL contains the opto electronics and mechanics used in the calculation of the sample oil content. Measuring principle by the Smart Cell Detector Array Technology (scattered light), developed by Rivertrace Limited.

The SMART CELL analyses all three oil types (HFO, Diesel and Emulsions) simultaneously without the need for re-calibration.

The 15ppm Bilge Alarm is designed and tested to meet the requirements of IMO Resolution MEPC.107(49).

Application/Limitation

The SMART CELL - BILGE Alarm is intended for installation on-board ships for monitoring the oil content of bilge water. The unit monitors the effluent from an approved Bilge Water Separator and sends an alarm signal that facilitates the activation of discharge control devices that divert bilge water from overboard to bilge tank(s) or bilge when the oil content exceeds 15ppm.
A copy of the RIVERTRACE “Smart Bilge+ Customer Manual, Document Number 109080” shall always be delivered with the content meter and available on-board vessel.

Limitation
The equipment is not permitted to be installed in spaces subject to explosion hazards.

Installation
The onboard arrangement of the 15ppm Oil-content Meter (Bilge Alarm) in co-operation with the 15ppm Bilge Separator and the discharge control device (automatic stopping device) shall function automatically.

The following shall be verified during installation:

1) The alarm is always activated whenever clean water is used for cleaning or zeroing purposes.
2) The alarm is always activated whenever no flow of sample through the 5 ppm bilge alarm is detected by the flow sensor (optional).
3) Any alarm signal from the 5 ppm bilge alarm will activate the automatic stopping device and lead to re-circulation.
4) The overall response time (including the response time of the alarm) between the effluent discharge exceeding 5 ppm oil and to the automatic stopping device preventing the overboard discharge is less than 20 s.
5) By-passing the 5 ppm bilge alarm during normal operation shall by no means be possible.
6) Every access of the 5 ppm bilge alarm (beyond check on instrument drift, repeatability of the instrument reading, and the ability to re-zero the instrument) requires the breaking of a seal.

Type Examination documentation

Document No.	Rev.	Title
109072	J	SMART CELL Assembly - Page 1-3
109069-RC	E	SMART BILGE Module Assembly 24/115/230 VAC
109275	R	SMART BILGE - Calibration Procedure

Tests carried out

See Appendix "Tests carried out"

Please see Appendix: Tests carried out

Marking of product

See Appendix "Marking"

Please see Appendix: Marking of product

APPENDIX
Marking of product

Certificate no.:
MEDB0000629
Revision no.:
2

For traceability to this EC Type-Examination, each unit to be marked with;

Scope	Example
Manufacturer name	Rivertrace Limited
Separator type	SMART CELL - BILGE
MED Mark of conformity[1] Wheel mark / notified body / Year built	0098 /2025
Serial number	xxxxxxxxxxxxxxxxx

Notes
[1] may only be affixed to the type approved equipment, if the associated production-surveillance module (D, E or F) is valid.

APPENDIX
Tests carried out

Certificate no.:
MEDB0000629
Revision no.:
2

Test Data and Results of Tests conducted on a 15 ppm Bilge Alarm in accordance with Part 2 of the Annex to the Guidelines and Specifications contained in IMO Resolution MEPC.107(49)

Test location	Rivertrace Limited, Unit P, Kingsfield Business Centre, Philanthropic Road, Redhill, RH1 4DP, England
Organization conducting the test	Rivertrace Limited
Witnessing of tests	Hagen Markus, Germanischer Lloyd, Hamburg

Test specimen	
15 ppm Bilge Alarm (Oil Content Monitor) Model SMART CELL-BILGE manufactured by Rivertrace Limited	
Analyzing unit	Smart Cell Assembly - Dwg.No.:109072, 2004-07-14
Electronic section	Smart Bilge Assembly - Dwg.No.: 109069, 2004-07-14
Test rig according to drawing	Smart Cell – Bilge Calibration procedure, 109275 rev. H, 2018-07-13

Sample analyzing	
Samples analyzed by	Tei-Testing Services – Analytical Laboratory, Mr Mathew Mac Gregor Test report: TEI Summation Certificate TS-P00372
Method of sample analysis	ISO 9377-2:2000

Environmental testing	
Environmental testing of the electronic section of the 15 ppm Bilge Alarm has been carried out in accordance with part 3 of the annex to the guidelines and specifications contained in IMO Resolution MEPC.107(49). The equipment functioned satisfactorily on completion of each test specified on the environmental test protocol.	
Testing laboratory	Intertek Testing Services, Guilford, U.K.
Test report	No. 04014866, September 2004

Calibration Test and Response Time

	Test Fluid					
	A		**B**		**C**	
	Measured	**Grab sample**	**Measured**	**Grab sample**	**Measured**	**Grab sample**
0 ppm	0	0	0	0	0	0
15 ppm	16.2	19.5	14.8	16.9	16.4	18.8
Full scale [ppm]	29.5	28.6	29.2	34.0	28.3	32.1
Water Temperature	26.5°C		27.2 °C		24.0 °C	
Re-zero	No		No		No	
Re-calibrate	No		No		No	
Response Time	1.5 sec.		1.7sec.		1.5 sec.	

Contaminant(s) and Colour Test

Non-oil particulate matter
Meter reading shift with ppm non-oil particulate contaminants and with very salt water.

Test condition		Expected Reading ppm	Oil Content Meter Reading ppm
Clean water and 10 ppm Test Fluid "B"		10.0	9.9
Very salt water (6% common salt with clean water)		10.0	7.1
Fluid B and Iron Oxide in a concentration of	10 ppm	10.0	9.9
	50 ppm	10.0	8.5
	100 ppm	10.0	8.5

Sample Pressure of Flow Test

Test condition	Oil Content Meter Reading ppm
15 ppm Bilge Alarm reading shift at normal	12.9
15 ppm Bilge Alarm reading shift at 50 % of normal	13.2
15 ppm Bilge Alarm reading shift at 200 % of normal	12.9

Shut-Off Test

Test condition	Measured oil content ppm	Oil Content Meter Reading ppm
15 ppm Bilge Alarm before shut-off	14.0	17.5
15 ppm Bilge Alarm reading after start-up (minimum dry period 8 hours)	15.3	19.5

Damage to meter as follows: None

Utilities Supply Variation Test

Test condition		Effect on the measured ppm
110 %	voltage effects	There was no change in the Oil Content Meter Reading when the voltage was varied.
90 %	voltage effects	
110 %	air pressure effects	Not applicable
90 %	air pressure effects	
110 %	hydraulic pressure effects	
90 %	hydraulic pressure effects	

Other Comments

None

Calibration and Zero Drift Test

Calibration drift	-1.18 ppm
Zero drift	0.0 ppm

End of Appendix

QS - CERTIFICATE OF ASSESSMENT - EC (MODULE D)

Certificate No:
MEDD0000113
Revision No:
5

Application of: Directive 2014/90/EU of 23 July 2014 on marine equipment (MED). This Certificate is issued by DNV SE based on the notification of the Federal Maritime and Hydrographic Agency of Germany.

This is to certify:

That the Quality System for the products

with type designation(s) as specified in the Appendix to this Certificate

Issued to
Rivertrace Limited
Redhill, **United Kingdom**

is found to comply with the applicable requirements.
The quality system has been assessed with respect to the procedure of conformity assessment described in Annex II, Module D in the directive 2014/90/EU and regulation (EU) 2021/1158.

This Certificate is valid until **2027-07-06**.

Issued at **Hamburg** on **2022-07-07**

DNV local station:
UK & Ireland CMC & VMC

Approval Engineer:
Hagen Markus

Notified Body
No.: **0098**

for **DNV SE**

Christine Mydlak-Roeder
Head of Notified Body

0098/yyyy

0098: Notified Body number undertaking quality surveillance
yyyy: The year in which the mark is affixed

The product liability rests with the manufacturer or his representative in accordance with Directive 2014/90/EU.
This certificate authorizes the manufacturer in conjunction with the valid EC Type Examination (Module B) Certificate(s) of the equipment listed before to affix the Mark of Conformity (wheelmark) to the product described herein.
This certificate loses its validity if the manufacturer makes any changes to the approved quality system, which have not been notified to, and agreed with the notified body named on this certificate. This certificate remains valid unless suspended, withdrawn, recalled or cancelled.
The Manufacturer has to apply for periodical audits to verify the maintenance and application of the quality system every 12 months.

APPENDIX

Item no. MED/2.3 Oil-content meters

Type designation	EC Type-Examination Certificate No.	Expiry date	Notified Body No.	USCG approval number
SMART - PFM 107[1]	MEDB00000YW Rev.4	2027-07-06	0098	N/A
SMART CELL - BILGE[1]	MEDB0000629 Rev.1	2025-01-05	0098	N/A

Item no. MED/2.5 Oil discharge monitoring and control system for an oil tanker

Type designation	EC Type-Examination Certificate No.	Expiry date	Notified Body No.	USCG approval number
SMART ODME[1]	MEDB00006DD Rev.1	2025-06-28	0098	N/A

Places of production

1.Rivertrace Limited, Unit P, Kingsfield Business Centre, Philanthropic Road, Redhill, United Kingdom

CANADA

Certificate number **CBA-018**
Certificat numéro

CERTIFICATE OF TYPE TEST FOR BILGE ALARMS
CERTIFICAT D'AGRÉMENT PAR TYPE DES ALARMES POUR EAUX DE CALE
5 - 15 ppm alarm **5 - 15** *ppm alarme*

This is to certify that the equipment listed below has been examined and tested in accordance with the requirements of the Specifications contained in Part II of the Annex to the Guidelines and Specifications contained in IMO resolution MEPC 107(49). This Certificate is valid only Bilge Alarm referred to below.
Il est certifié que l'alarme pour eaux de cale comprenant les éléments ci-après a été examiné et soumis à des essais conformément aux dispositions des spécifications qui font l'objet de la Partie II de l'annexe aux Directives et spécifications contenue dans la résolution 107(49) de l'OMI. Le présent certificat est valable que pour une alarme pour eaux de cale du type décrit ci-dessous:.

Bilge Alarm supplied by *Alarme pour eaux de cale fourni par*	Rivertrace Engineering Ltd., Redhill, RH1 4DP, Surrey United Kingdom
under type and model designation *type et désignation du modèle:*	Smart–Cell Bilge Alarm
and incorporating: *comprenant:*	
Bilge Alarm analysing unit manufactured by *Dispositif d'analyse de l'alarme pour eaux de cale fabriqué par*	Rivertrace Engineering Ltd.
to specification/drawing numbers *conformément à la spécification/au schéma n°*	109072 date: 2004/07/14
Electronic section of Bilge Alarm manufactured by *Éléments électronique de l'alarme pour eaux de cale fabriqué par*	Rivertrace Engineering Ltd.
to specification/drawing numbers *conformément à la spécification/au schéma n°*	109069 date: 2004/07/14

THE SYSTEM IS ACCEPTABLE FOR THE FOLLOWING APPLICATION:
LE DISPOSITIF EST CONÇU POUR LES UTILISATIONS SUIVANTES :

This Bilge Alarm is acceptable for use in accordance with regulation 14.7
Cette alarme pour eaux de cale est acceptable et peut être utilisé conformément à la règle 14.7

This Bilge Alarm meets the specification for a **5 ppm** unit, as contained in the "Standard For 5 ppm Bilge Alarms For Canadian Inland Waters," in accordance with the *Regulations for the Prevention of Pollution from Ships and for Dangerous Chemicals.*
*Cette alarme pour eaux de cale satisfait aux spécifications pour une unité à **5 ppm**, selon la "* Norme Relative aux Alarmes À 5 ppm pour Eaux de Cale (Eaux Internes du Canada) *", conformément au Règlement sur la prévention de la pollution par les navires et sur les produits chimiques dangereux.*

Test date and results: 15 ppm tests: as per Tei test report Nr. TS-P00372 dated October 25th, 2004
Les données et résultats des essais Environmental testing of electronic section as per Intertek Testing report nr. 04014866 dated September 2004

A COPY OF THIS TEST CERTIFICATE SHOULD BE CARRIED ABOARD A VESSEL FITTED WITH THIS EQUIPMENT AT ALL TIMES
UN EXEMPLAIRE DU PRÉSENT CERTIFICAT D'ESSAIS DEVRAIT SE TROUVER EN PERMANENCE A BORD D'UN NAVIRE ÉQUIPÉ DE CE MATÉRIEL

Matt Cook, Senior Marine Inspector, Environmental Protection
DATED THIS **6th** DAY OF **April** **2009**
DATE CE *JOUR DE*

Canada

AMSE - C030(06-94)