

INSTRUCTION MANUAL

BilgMon488 - Version 5

15 ppm Bilge Alarm

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INSTRUCTION MANUAL

BilgMon488

15 ppm Bilge Alarm¹

¹ For special 5 ppm versions, see part 4.1 of this instruction manual.

1 TABLE OF CONTENTS

1	Table of contents.....	2
2	Document editions	4
3	Disclaimer and conditions	5
4	Introduction.....	5
4.1	Equipment	5
4.2	Installation.....	6
5	Construction	6
6	Operation	6
7	Caution	6
8	Specification	7
8.1	General.....	7
8.2	Specific 115/230 V AC model	8
8.3	Specific 24 V AC/DC model.....	8
9	Installation.....	9
9.1	Mechanical	9
9.2	Tube arrangement.....	10
9.3	Electrical	11
9.3.1	General installation	11
9.3.2	Fresh water flushing valve installation.....	12
9.3.3	Replacing older units (VERY IMPORTANT!)	12
9.3.4	115/230 VAC.....	13
9.3.5	24V AC/DC	13
10	Calibration check.....	14
10.1	Schedule	14
10.2	Calibration certificate expiry date.....	14
10.3	Calibration check requirements	14
10.4	Sensor unit replacement	14
11	Operating Instructions.....	15
11.1	Startup sequence.....	15
11.2	Main menu and indication LEDs.....	15
11.2.1	Main menu	15
11.2.2	LEDs and indications.....	16
11.3	Menu system	17
11.4	Contrast adjustment.....	18

11.5	Simulation.....	18
11.6	Force automatic stopping device activation	20
11.7	Acknowledge alert.....	20
11.8	Information menu	21
11.8.1	Master info	21
11.8.2	Sensor info.....	21
11.9	Log	22
11.9.1	Log menu	22
11.9.2	Step log.....	22
11.10	Cleaning & test	23
11.10.1	Clean cell (zero calibration).....	23
11.10.2	Check 40NTU cal (calibration check)	23
11.10.3	Test outputs.....	24
11.11	Settings	24
11.11.1	Alarm settings (automatic stopping device).....	24
11.11.2	Alert settings (bridge notification)	25
11.11.3	Start delay.....	25
11.11.4	Cleanflush	26
11.11.5	Autoflush feature (automatic freshwater cleaning).....	26
11.11.6	Set date/time.....	26
11.11.7	Output config.....	27
11.11.8	Curro 20mA cal. (Calibration of current output)	27
11.11.9	PPM display. (Select number of decimals in ppm display).....	28
11.11.10	Standby display. (Select standby notification)	28
11.12	Trend	29
11.12.1	Trend menu	29
11.12.2	Step trend	29
12	Automatic stopping device test.....	30
12.1	While separator is operating.	30
12.2	While separator is not operating.	30
13	Response test	30
13.1	Step 1.....	30
13.2	Step 2.....	30
14	Calibration check	30
15	Log entries	31
16	Maintenance	32

17	Real Time Clock (RTC)	33
17.1	Battery replacement	33
17.2	RTC malfunction	34
17.2.1	Set date/time.....	34
18	Log data download via USB	35
18.1	Running the software	35
18.2	Installing the VCP driver	35
18.3	Download procedure.....	35
19	Spare parts	38
20	Troubleshooting	40
	Appendix A Replacing old master units with newer series 5 versions.....	41
A.1	Production version	41

2 DOCUMENT EDITIONS

This document is valid for the equipment versions described in the document header.

A new edition of the document is published every time the document is improved, corrected or updated in some way. It is therefore recommended to always use the most recent edition.

3 DISCLAIMER AND CONDITIONS

All information provided by Brannstrom Sweden AB about this equipment is given in good faith and is based on the best knowledge available at the particular time. No responsibility is, however, assumed for possible inaccuracies or omissions.

The content of this manual may be copied as required for operational use on the vessel in which the equipment is installed. This Manual must not be copied, in full or in part, for disclosure to third part.

The software incorporated in the equipment is furnished on a strictly “as is” basis. The software is proprietary to Brannstrom Sweden AB. The disclosure of the software coding is not allowed. The software may not be copied in whole or part.

4 INTRODUCTION

4.1 EQUIPMENT

The type approval certificate of the 15ppm bilge alarm type BilgMon488 serves as proof that the equipment itself meets the requirements of Chapters 4 & 5 in the “Revised Guidelines and Specifications for Pollution Prevention Equipment for Machinery Spaces of Ships” adopted by IMO as per Resolution MEPC.107(49).

BilgMon488 is equipped with 2 relay outputs, one for “Alarm” as specified and required by the Guidelines, and one extra “Alert” output which may optionally be used for signaling or external signal lights/horns. Both outputs can be individually set to be triggered when the oil content exceeds a pre-set value (1 – 15 ppm, factory setting 15ppm). **Note: For special versions (master unit serial numbers 5x2x-nnnn), the pre-set value is limited to 1-5 ppm and the factory setting is 5 ppm.** The outputs are fail-safe, which means that they will be in alarm/alert state (preventing any discharge overboard or activating an external alert signal) if the power supply to the unit fails or if an internal fault occurs in the unit. The function and settings of the outputs is explained in part 11.11 of this manual.

The front panel has a display showing oil content (ppm) and status of the unit, as well as some signal lights. The detailed function of the display and signal lights is explained in part 11.2 of this manual.

The unit also has an oil content signal output which can be configured either for serial output or for analogue current output 0 ... 30ppm (factory settings 4-20mA), see part 11.11.7 in this manual.

The unit records the date, time and alarm status, and operating status of the 15 ppm Bilge Separator, as required by the Guidelines. Additionally, it also records some other events and parameter values which are useful to know. See part 15 of this manual for details. As required by the Guidelines, these events are stored in the memory for at least 18 months, and can be shown on the unit’s display for Port State Control.

Inside the unit there’s a USB port enabling extraction of a copy of these records onto a laptop computer, see part 18 of this manual for details.

4.2 INSTALLATION

Pay attention to the installation requirements in Chapter 6 of the above-mentioned Guidelines. Note that the Guidelines do not require that the installation is tamper proof. Hence it should work properly as long as nobody is intentionally tampering with the installation arrangements. Do avoid arrangements making it possible to accidentally disable it and cause pollution, for example by leaving an unlocked valve in the wrong position. However, opening drain plugs or disconnecting piping with the help of tools cannot be construed as accidental and is clearly intentional tampering and manipulation of the arrangement, no matter who is doing it and how noble the intent is. Even if someone ambitiously calls it “testing”, it still means that the installation no longer meets the requirements of Chapter 6 in the Guidelines, and the manipulation is therefore no indication of incorrect installation or equipment malfunction.

5 CONSTRUCTION

BilgMon488 consists of two main parts, MASTER unit and detachable SENSOR unit.

The MASTER unit contains all the electronics used for control and data storage of the bilge alarm. Mounted in the lid of the MASTER unit is the main memory containing the event log.

The SENSOR unit contains electronics for measuring the sample stream. The SENSOR unit also holds the measurement calibration data. Communication with the MASTER unit is done wireless hence the SENSOR unit is hermetically sealed and shall not be opened.

6 OPERATION

Optical sensors monitor the amount of light scattered and absorbed by the oil droplets in the sample stream. Sensor signals are processed by a microprocessor to produce a corresponding oil content (ppm) output. The output is communicated to the MASTER unit where it is processed. The MASTER unit takes action, such as alarm activation, logging etc., depending on the oil content and the separator signal.

Settings that affect the behaviour of the bilge alarm are described in detail in section *11 Operating Instructions*.

Zero-point calibration can be done on site whereas a calibration check as specified by IMO Resolution MEPC.107(49) may only be performed by the manufacturer or someone authorized by the manufacturer.

7 CAUTION

Do NOT open the SENSOR unit housing as this will invalidate the calibration and may also destroy it.

Do NOT open the MASTER unit when it is energized. Hazardous voltages are present inside.

8 SPECIFICATION

8.1 GENERAL

Measurement:

Oil range:	0 – 30 ppm
Resolution:	0.1 ppm
Accuracy:	According to IMO MEPC.107(49)
Response time:	< 5 sec

Alarms and alerts:

Alarm (automatic stopping device) delay:	0-10 sec user adjustable
Alert (annunciation) delay:	0-60 sec user adjustable
Alarm/alert points:	1-15 ppm user adjustable ²
Alarm/alert hysteresis:	0.5 ppm (below alarm point)

Data storage and retrieval:

Calibration storage:	Stored in sensor housing.
IMO required data:	Stored in BilgMon488 main housing (sensor housing may be replaced with data remaining on board).
	Data retrieval via display.
Optional data retrieval:	Via USB port.

User interface:

LCD display:	2 row alphanumeric display
Control:	Keypad

Environment:

Ambient temperature range:	According to IMO MEPC.107(49), (0-55°C)
Enclosure ingress protection rating:	IP65

Installation:

Sample line inlet pressure and flow:	Recommended: 1-2 bar (200 – 300 l/h) Maximum: 3 bar
Sample temperature:	Maximum: 50 °C

² For special 5 ppm versions, see part 4.1 of this instruction manual.

8.2 SPECIFIC 115/230 V AC MODEL

Input/Output:

Signal output:	0 – 20 mA or 4 – 20 mA for 0 – 30 ppm (Active output, load resistance max 300 Ω). RS422/RS485 for serial output.
Internal USB port:	For extraction of records
Alarm output (ASD control):	Relay NO/NC (max 0.4A)
Alert output (Optional use):	Relay NO/NC (max 0.4A)
FW flushing valve control output:	Supply voltage, max 0.8A
Signal inputs:	1 x switch input for separator status 1 x optional switch input for sample flow

System and supply:

Supply voltage and consumption:	115 or 230 V AC, 50 – 60 Hz, min. 1A fuse
Electronics:	10 VA
FW flushing solenoid:	18 VA

8.3 SPECIFIC 24 V AC/DC MODEL

Input/Output:

Signal output:	0 – 20 mA or 4 – 20 mA for 0 – 30 ppm (Active output, load resistance max 300 Ω). RS422/RS485 for serial output.
Internal USB port:	For extraction of records
Alarm output (ASD control):	Relays NO/NC (max 2 A)
Alert output (Optional use):	Relay NO/NC (max 1 A)
FW flushing valve control output:	Supply voltage, max 1A
Signal inputs:	1 x switch input for separator status 1 x optional switch input for sample flow

System and supply:

Supply:	24 V AC (50 – 60 Hz) or 24 V DC, min 1.5A fuse
Power consumption electronics:	10 VA
Power consumption solenoid:	18 VA

9 INSTALLATION

NOTE: If drain valve is fitted. It should always be closed while separator is operating.

9.1 MECHANICAL

Legend

Item	Qty	Name type dimension	Material
d1	4	M6x10 Mounting Screws	Steel
d2	3	M20 Cable Glands Cable $\varnothing$ 6-12mm	Plastic
d2	3	M16 Cable Glands Cable $\varnothing$ 4,5-10mm	Plastic

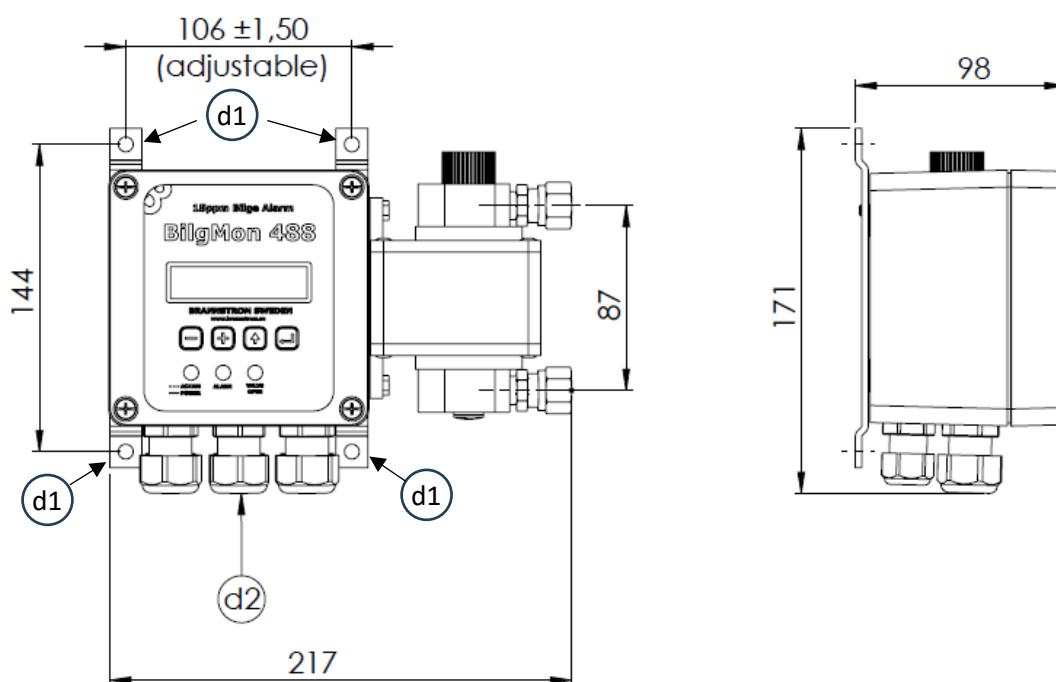


Illustration 1: Mechanical installation

9.2 TUBE ARRANGEMENT

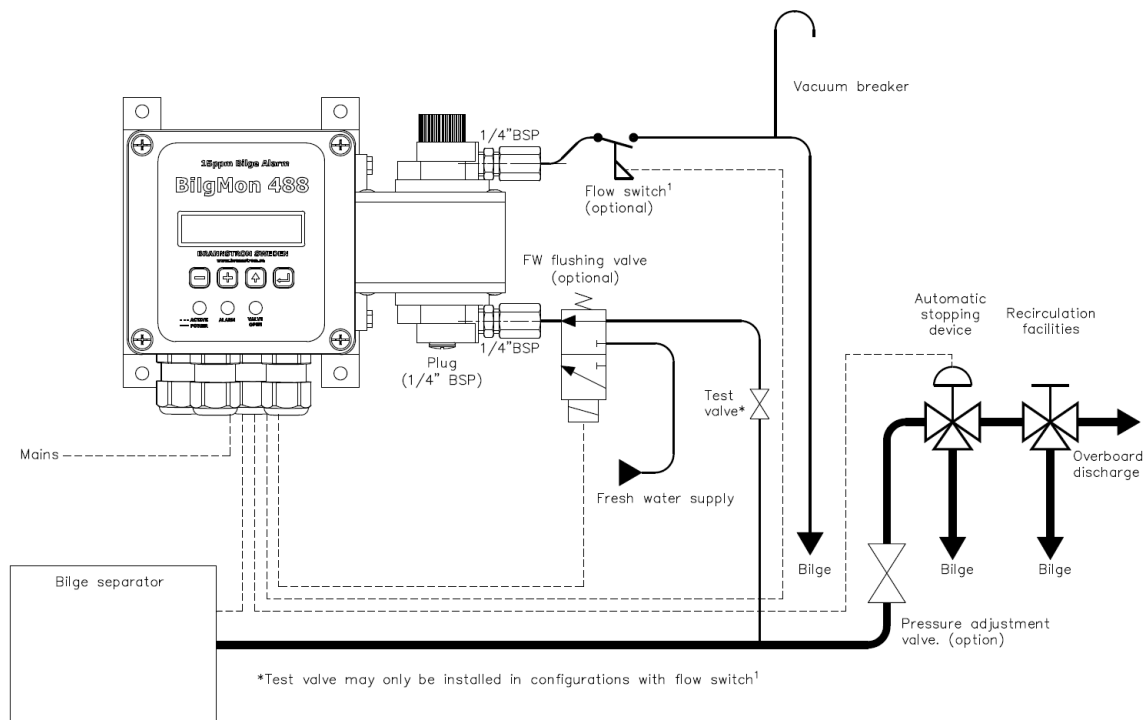


Illustration 2: Tube arrangement

9.3 ELECTRICAL

9.3.1 General installation

Bilgmon488 is manufactured in two base models, **115/230 VAC** and **24 V AC/DC**. The main difference between these two models is the base PCB of the MASTER unit.

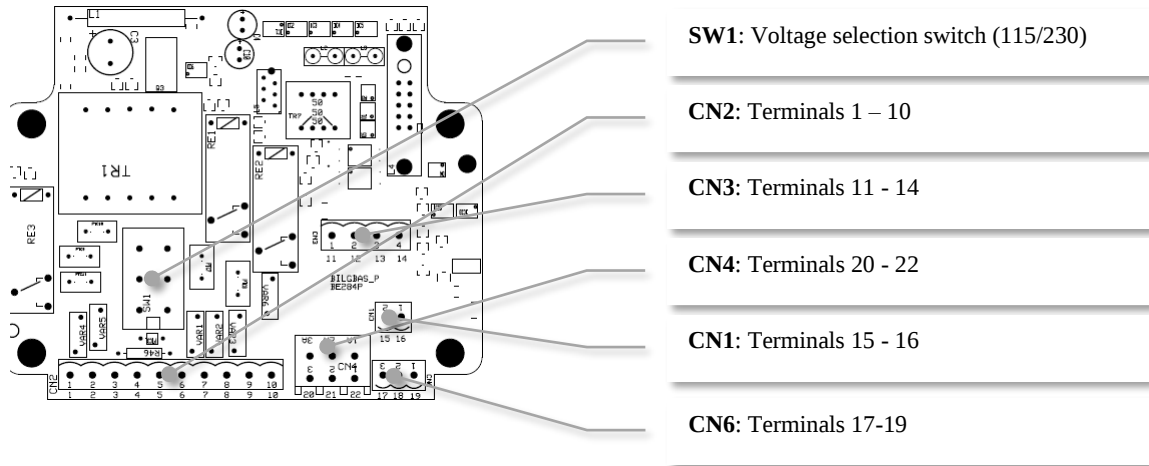


Illustration 3: Base PCB of **115/230 VAC** MASTER unit.

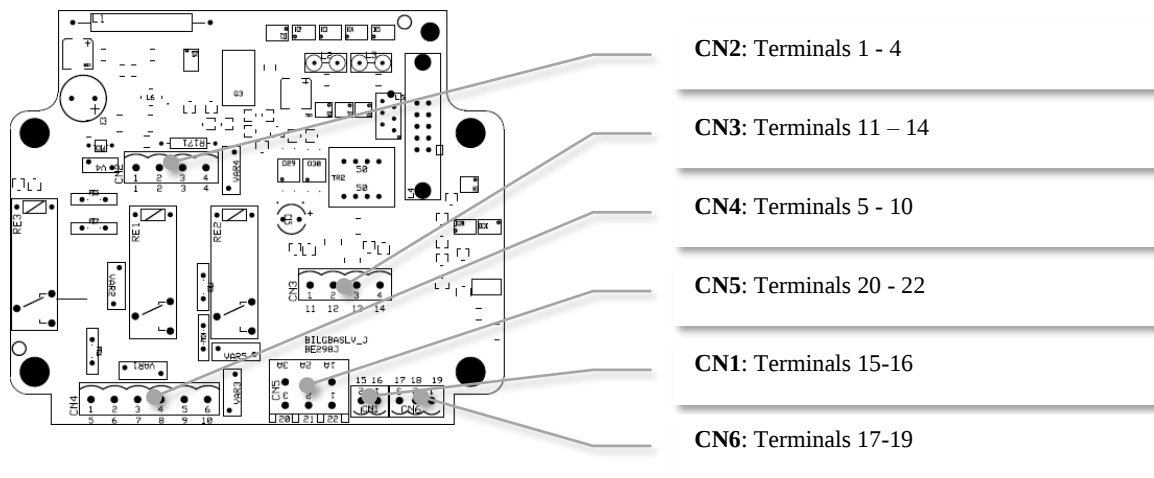


Illustration 4: Base PCB of **24 V AC/DC** MASTER unit.

When installing the **115/230 VAC model** be sure to put the voltage selection switch (**SW1**, Illustration 3) in the correct position (marked 115 resp. 230).

Terminals 10-22 (Illustration 3 and Illustration 4) are coupled and can be used for routing of external protective earth connections.

See sections 9.3.4 and 9.3.5 for detailed information of electrical connections.

NOTE: When connecting **24V DC** instead of 24V AC, the polarity of the mains connection **MUST** be correct for proper operation (positive to terminal 2 and negative to terminal 1).

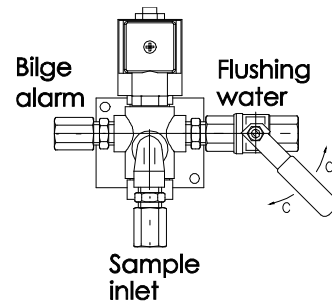
9.3.2 Fresh water flushing valve installation

This section is applicable for systems using a fresh water flushing solenoid according to Illustration 2: Tube arrangement, or for similar installation.

115/230 VAC model: There are two coils delivered with the BilgMon 488, one marked 96V to be used with 115 VAC supply voltage and one marked 205V to be used with 230 VAC supply voltage. Be sure to install the proper one for the chosen voltage.

24 V AC/DC model: Only one coil delivered with this model (marked 24 V).

NOTE: Both models are equipped with a cable having a cable connector with a built-in rectifier. The rectifier is necessary for all AC installations.



9.3.3 Replacing older units (VERY IMPORTANT!)

When replacing older master units with serial numbers different from **5xxx-nnnn** it is important to note that there are some differences in terminal numbering and electrical characteristics (fuse values etc.). It is consequently important to compare the new unit's wiring diagram and specification with those of the older unit to be replaced.

If you are uncertain regarding the replacement wiring and/or installation, please contact a service company authorized by the maker.

More detailed information can be found in "Appendix - Replacing older master units".

9.3.4 115/230 VAC

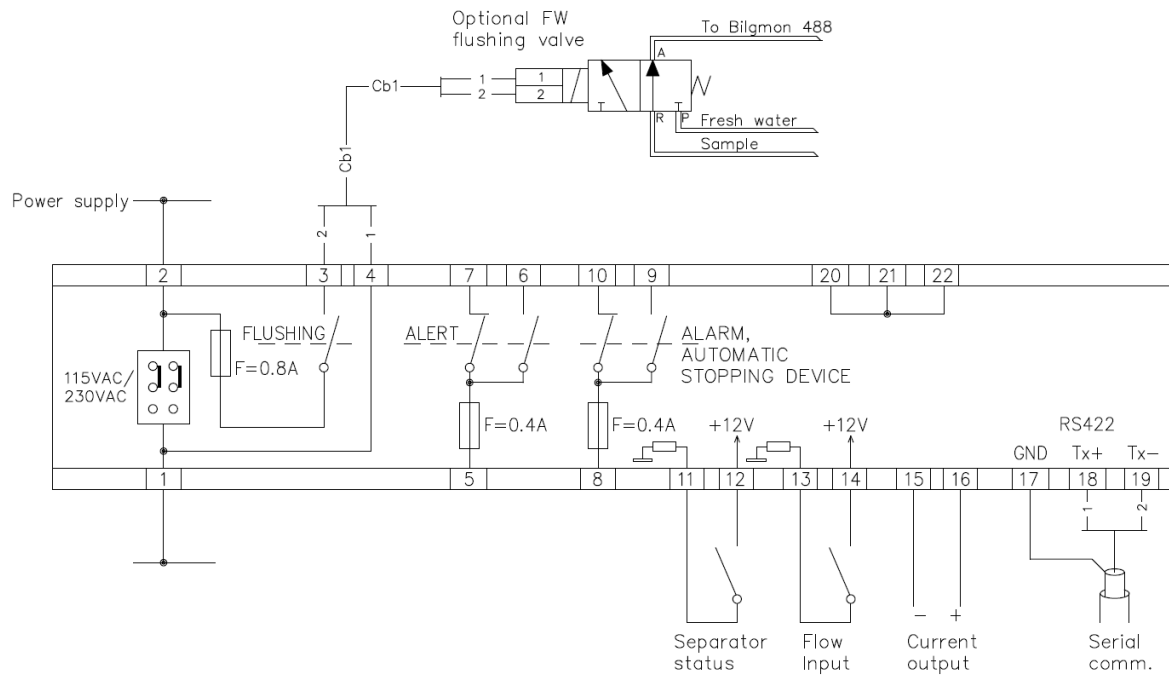


Illustration 5: 115/230 VAC electrical connections (Valid only for master unit serial numbers 5xxx-nnnn)

9.3.5 24V AC/DC

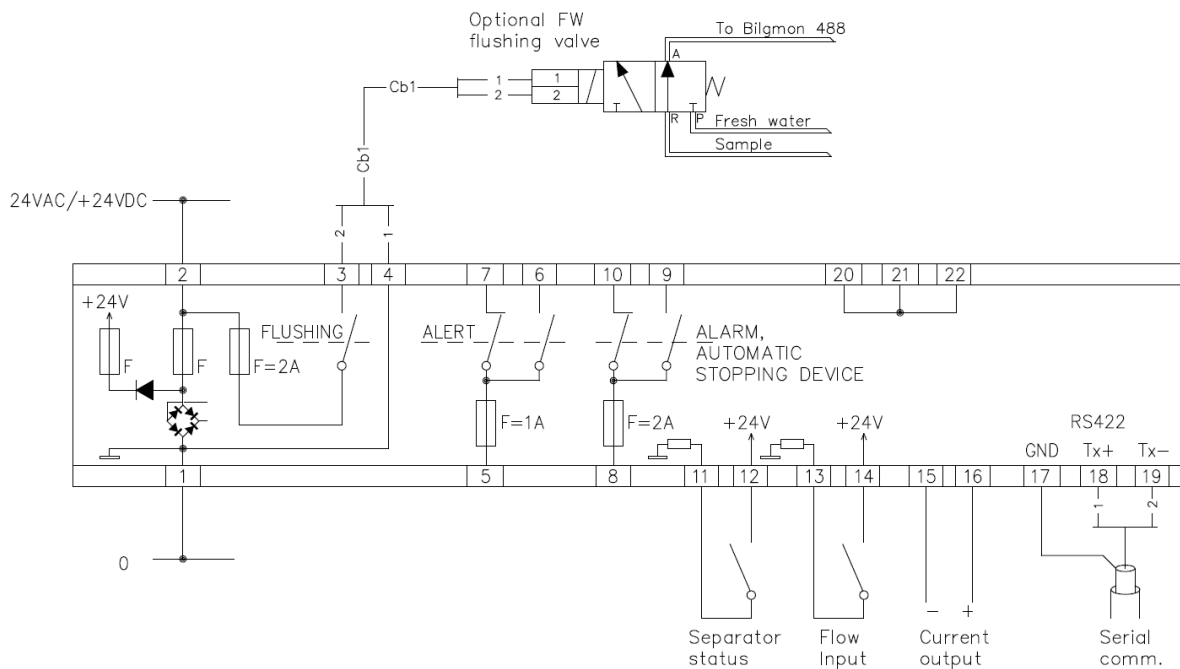


Illustration 6: 24V AC/DC electrical connections (Valid only for master unit serial numbers 5xxx-nnnn)

10 CALIBRATION CHECK

10.1 SCHEDULE

Two items need to be addressed when setting up the maintenance schedule for the BilgMon488:

- Expiry date of the factory issued calibration certificate.
- Occasionally a calibration check is required within the validity period of the factory issued calibration certificate.

The following two subchapters explain how to resolve these two items.

10.2 CALIBRATION CERTIFICATE EXPIRY DATE

When the factory issued calibration certificate expires, the SENSOR unit must be replaced, or the calibration must be checked and certified by someone who is authorized by the maker, with a new expiry date not exceeding the maximum sensor life-time specified by the maker.

The SENSOR unit of BilgMon488 is designed to be easily replaced by the crew, see *10.4 Sensor unit replacement*. Replacement does not require any adjustments of the MASTER unit setup.

Each new SENSOR unit is delivered with a factory issued calibration certificate.

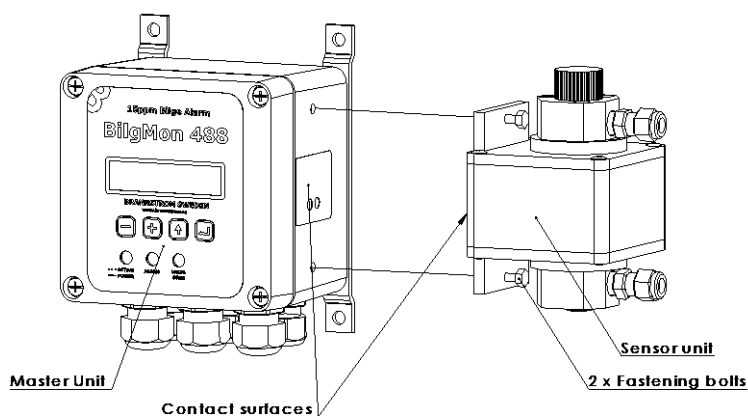
10.3 CALIBRATION CHECK REQUIREMENTS

Occasionally ships may be required to have a “calibration check” of the SENSOR unit even if the original factory issued calibration certificate is still valid.

A new calibration certificate can be obtained in the following ways:

- A successful calibration check with a “Calibration Check Kit” performed by someone who is authorized by the maker.
- Replacement of the existing sensor unit (the new one comes with a factory issued calibration certificate)

10.4 SENSOR UNIT REPLACEMENT



Removing Sensor Unit:

1. Loosen fastening bolts.
2. Gently pull Sensor Unit away from Master Unit.

Mounting Sensor Unit:

1. Clean contact surfaces using water and mild detergent.
2. Hold together Sensor Unit and Master Unit.
3. Tighten fastening bolts.

Master Unit preparations:

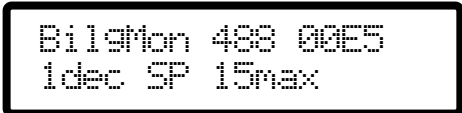
No preparations necessary.
Sensor Unit contains all calibration data.
System updates automatically.

Illustration 7: Sensor unit replacement procedure.

11 OPERATING INSTRUCTIONS

11.1 STARTUP SEQUENCE

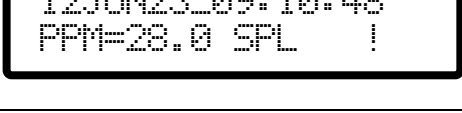
When BilgMon488 is powered up the LCD display will show an initialization sequence.

Sequence: 1. Internal time reference (Real Time Clock, RTC) is checked. 2. Information about unit setup is shown. Explanation of example shown in 2.: BilgMon 488 - Product name. 00E5 - Software version of master unit. 1dec - PPM value display precision. SP – Serial Port and Current Output facility enabled. 15max - Maximum PPM level for alert and alarm (automatic stopping device) settings. ³	1.  2. 
--	---

11.2 MAIN MENU AND INDICATION LEDs

11.2.1 Main menu

After the initialization sequence is done the unit is ready for operation and the main menu will be shown:

The main menu shows <i>date</i> and <i>time</i> followed by <i>PPM measurement</i> , <i>optional fresh water valve output status</i> and <i>optional flow switch input status</i> .	
If the <i>optional flow switch input</i> is open the PPM indication will be replaced by "No flow!".	
If "start delay" is used, a countdown in seconds will be shown to the right of <i>optional fresh water valve output status</i> .	
Alert output is indicated by an exclamation mark in the bottom right: - Flashing "!" : Alert - Steady "!" : Acknowledged alert	

Date and *time* are set at factory to UTC time (Coordinated Universal Time) and is displayed in the format:

DDMMYY hh:mm:ss

(DD – day, MM – month, YY – year, hh – hour, mm – minutes, ss – seconds)

PPM measurement shows the latest measurement of oil content in parts per million as reported by the sensor unit.

³ For special 5 ppm versions, see part 4.1 of this instruction manual.

Optional freshwater valve output status:

SPL – fresh water flushing valve in SamPLe position

WTR – fresh water flushing valve in WaTeR position

If the internal clock battery backup voltage is too low the display will display a warning (see right) every 2 seconds. See 17 Real Time Clock (RTC) for further information.	
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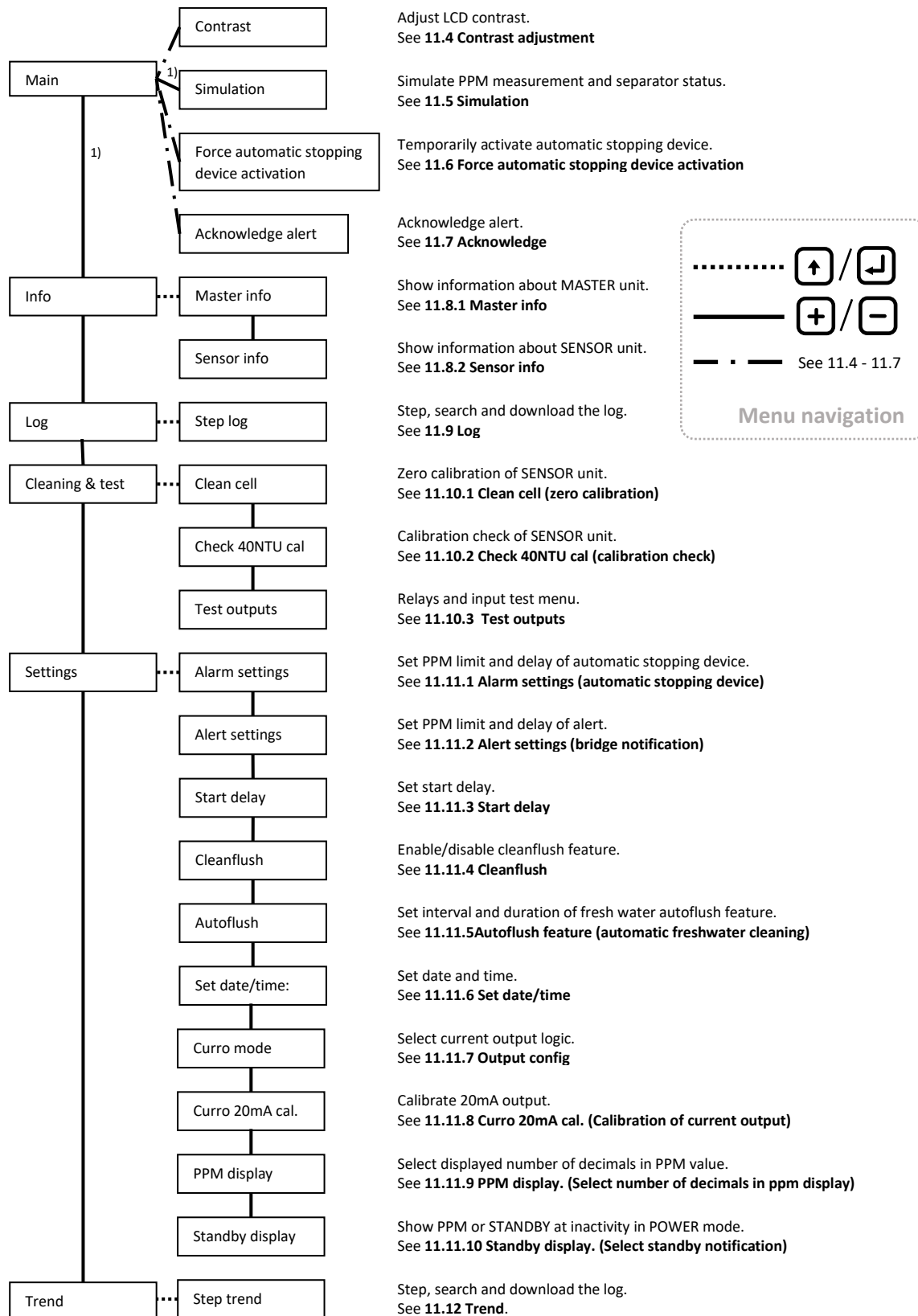
11.2.2 LEDs and indications

The LED lamps on the front panel indicate the status of the equipment. The straight/dashed lines indicate if the lamps are lit continuously/flashing.

(green)  ACTIVE POWER	(not lit)  	Power supply failure. Bilgmon488 is in ACTIVE mode (separator operating). BilgMon488 is in POWER mode (menu subsystem is active).
(red)  ALARM	(not lit) 	No alarm. Alarm, Automatic Stopping Device activated (overboard valve closed).
(yellow)  VALVE OPEN	(not lit) 	Automatic Stopping Device activated (overboard valve closed). Automatic Stopping Device not activated (overboard valve open).

The LED lamps on the front panel indicate the status of the equipment. The straight/dashed lines indicate if the lamps are lit continuously/flashing.

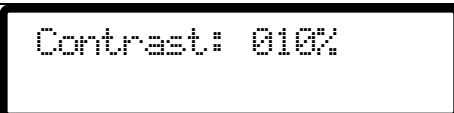
11.3 MENU SYSTEM



1) **NOTE:** Transition only possible when BilgMon488 is in POWER mode (see 11.2).

Illustration 8: Menu layout

11.4 CONTRAST ADJUSTMENT

While in <i>main menu</i> press and hold . With  held press  /  to increment/decrement contrast setting by 10%.	
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11.5 SIMULATION

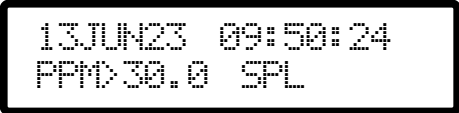
The simulation menu lets user simulate the PPM input from the sensor unit as well as the separator status input state to verify that the installation of the unit is correct and that it responds as expected to different oil content measurements.

Simulated events will be stored in the log starting with a SIM_ON event and ended with a SIM_OFF event.

To enter this menu the BilgMon488 needs to be in POWER mode. POWER mode is when the unit is powered but separator is not operating (separator status input is open, see 9.3 *Electrical*).

Enter <i>simulation menu</i>: From <i>main menu</i> press and hold . The LCD will now show something similar to the picture on the right. Keep holding  to stay in the <i>simulation menu</i>. Leave <i>simulation menu</i>: Release . Toggle the simulated separator status input: While still holding , press  to toggle between separator on/off (SEP_ON/SEP_OFF shown in LCD). Increment/decrement simulated PPM value: While holding , press  /  to increment/decrement the simulated PPM value in steps of 1.0.	
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Example of simulation with explanations (if the alarm limit is set to 15 .0 ppm)⁴:

1) Start in <i>main menu</i> with separator off (separator status input open).	 ALARM LED – ON VALVE LED – OFF (no discharge)
2) Hold  (do not release until step #7 in this example). <i>Automatic stopping device (ASD) is now active⁵ since the separator is not operating.</i>	 ALARM LED – ON VALVE LED – OFF (no discharge)
3) Press  to simulate that the separator starts operating (toggle to SEP_ON). <i>ASD is now NOT active since the PPM value is below 15.0 ppm and the separator is operating.</i>	 ALARM LED – OFF VALVE LED – ON (discharge)
4) Press  repeatedly until PPM value is above 15.0 ppm (15.1 or higher value shown). <i>ASD is now active since the PPM value is above 15 PPM and the separator is operating.</i>	 ALARM LED – ON VALVE LED – OFF (no discharge)
5) Press  repeatedly until PPM value is below 14.6 PPM (14.5 or lower value shown). <i>ASD is now NOT active since the PPM value is below 15.0 ppm and the separator is operating.</i>	 ALARM LED – OFF VALVE LED – ON (discharge)
6) Press  to simulate that the separator stops operating (toggle to SEP_OFF). <i>ASD is now active since the separator is not operating.</i>	 ALARM LED – ON VALVE LED – OFF (no discharge)
7) Release  to return to <i>main menu</i> and end simulation.	 ALARM LED – ON VALVE LED – OFF (no discharge)

⁴ For special 5 ppm versions, see part 4.1 of this instruction manual.

⁵ The VALVE LED and the automatic stopping device output has reversed logic. Hence when VALVE LED is lit the automatic stopping device is NOT active (overboard valve in discharge position) and vice versa.

11.6 FORCE AUTOMATIC STOPPING DEVICE ACTIVATION

When the separator is operating and the PPM value is below 15.0 ppm⁶ (or set alarm value) the automatic stopping device can be temporarily activated by pressing and holding  for approx. 2 sec.

After 10 seconds or on a press of  BilgMon488 returns to normal operation.



Force valve
close: 10s EXIT

11.7 ACKNOWLEDGE ALERT

If separator is operating (separator status input is closed, BilgMon488 in ACTIVE mode) and the PPM value goes above 15.0 ppm⁶ (or set alert value) the unit will generate an alert (alert output terminal and flashing “!” on the LCD). The alert can be acknowledged⁷ by pressing ,  or . This means that the alert output terminal will be put in no alarm position and the “!” on the LCD will stop flashing.

⁶ For special 5 ppm versions, see part 4.1 of this instruction manual.

⁷ Automatic stopping device output cannot be acknowledged (only alert output).

11.8 INFORMATION MENU

To enter this menu the BilgMon488 needs to be in POWER mode. POWER mode is when the unit is powered but separator is not operating (separator status input is open, see 9.3 *Electrical*).

The information submenus will display⁸ information about the MASTER and the SENSOR unit of BilgMon488 according to examples below:

11.8.1 Master info

Cycle 0: Menu name.	Master info
Cycle 1: Serial number.	Master ID: 511A-4567
Cycle 2: Software version.	Master SW ver: 00E5
Cycle 3: Master unit lid power supply voltage. Should be approx. 5V.	Master voltage: 5V supply=5.3V
Cycle 4: RTC backup battery voltage. Should be approx. 3V. If lower than 2.5V, replace battery ().	Master voltage: RTC battery=3.0V

11.8.2 Sensor info

Cycle 0: Menu name.	Sensor info
Cycle 1: Serial number.	Sensor ID: 001B-4325
Cycle 2: Software version.	Sensor SW ver: 00D2
Cycle 3: Factory calibration date.	Sensor date: 01JUN23 10:23:10
Cycle 4: Calibration check date.	Cal. checked: 01JUN23 13:43:12
Cycle 5: SENSOR internal measurements (temperature, moisture, voltage etc.).	T:25.3 Dry:60 U3:3.20 U03: .312

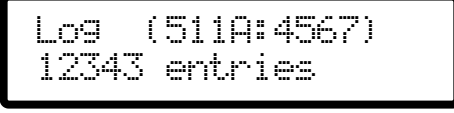
⁸ Information is continuously cycling (cycle 0, cycle 1, ... , cycle n, cycle 0, ...).

11.9 LOG

To enter this menu the BilgMon488 needs to be in POWER mode. POWER mode is when the unit is powered but separator is not operating (separator status input is open, see 9.3 *Electrical*).

The log menu enables the user to search and step the IMO-regulated log of the BilgMon488 as well as download parts of or the entire log to file using the "BilgMon488 log download kit" (purchased separately).

11.9.1 Log menu

The log menu shows the serial number stored in the log memory (normally same as the serial number of the master unit) and the number of log items currently stored in log. Press  to enter the <i>step log</i> submenu.	
--	--

11.9.2 Step log

First row of <i>step log menu</i> shows type of event and second row shows date and time of occurrence. If log entry has additional information, this will be alternated with time and date on the second row. Stepping: Navigate the log by pressing  resp.  to step forwards resp. backwards in the log.	 Alt. 
Searching: Press  and a small cursor will appear in under the first entry in the date field. Press  again to move the cursor cyclically through the date/time fields. Use  and  to increase/decrease the digit marked by the cursor. Finish by holding  for approx. 3 seconds. The display will now show the event that is closest in time to the date/time you entered.	
Sending log via USB (download kit required): When leaving the <i>step log</i> menu () user is asked to send log. If user answers no () the unit returns to <i>log menu</i>. If user answers yes () a follow up question is asked of how many items from the current and forward (in time) is to be sent 100, 500 or all. Select with  /  and finalize by holding  for approx. 3 seconds. LCD will show "sending log" while sending the log followed by "sent xxxx" when download is complete.	  

	Sending log! Sent 100!
--	---

11.10 CLEANING & TEST

To enter this menu the BilgMon488 needs to be in POWER mode. POWER mode is when the unit is powered but separator is not operating (separator status input is open, see 9.3 *Electrical*).

11.10.1 Clean cell (zero calibration)

The *clean cell menu* provides the facility to zero calibrate the BilgMon488. It is also a useful tool for checking on dirt, layering and scratches on the sample tube inside the SENSOR unit.

Values shown range from 0% (clean, same values as factory calibration) to 100% (dirty) where 50% or below is required to perform zero calibration.

Press  to start zero calibration process.	Clean cell: START
Toggle fresh water flushing valve to position UTR by pressing . Make sure the fresh water supply line is closed to prevent the liquid poured in to the SENSOR is not flushed out “backwards”. Unscrew the top cap of the SENSOR, clean thoroughly with mild detergent and soft brush, rinse and then pour in some clean air free water. When/if zero value goes below 50%, ZERO is shown. Press  enter to send zero calibration command to SENSOR unit.	Zero value: 045% UTR ZERO

If zero value does not go below 50% see **20 Troubleshooting**.

11.10.2 Check 40NTU cal (calibration check)

The *check 40NTU cal* lets the user perform a calibration check⁹ of the equipment. The calibration check makes sure that the units sensors are still in good condition and that the measurements of the oily water is still accurate.

Values range from 0% to 100% where 80% or above is considered acceptable (using calibration check kit mixture).

Press  to start calibration check process.	Check 40NTU cal:
Toggle fresh water flushing valve to position UTR by pressing . Make sure the fresh water supply line is	Cal. value: 093% UTR OK

⁹ Doing a calibration check requires the “Bilgmon488 calibration check kit” (bought separately).

closed to prevent the liquid poured in to the SENSOR is not flushed out “backwards”.
Unscrew the top cap of the SENSOR and fill with the calibration check kit mixture.
When/if cal. value goes above 80%, OK is shown.
Press  enter to set the calibration check date of the SENSOR unit.

If cal. value does not go above 80% see **20 Troubleshooting**.

11.10.3 Test outputs

The *test outputs menu* is used for testing the function of the separator status input as well as the alarm2, automatic stopping device and fresh water flushing valve outputs (see 9.3 *Electrical*).

Press  to enter <i>test outputs</i> menu.	Test outputs: START
ALT: Press  to toggle the alert output.¹⁰ VLV: Press  to toggle the alarm (automatic stopping device) output.¹⁰ WTR: Press  to toggle the fresh water flushing valve output. Input status (top right): O/C: Separator status input state (O = Open, C = Closed). O/C: Optional flow switch input state (O = Open, C = Closed) Note: If the MASTER unit is not equipped with the optional flow switch input (not present on the base PCB), the optional flow switch input state will always be displayed as O.	ALT VLV WTR O C OFF 00 OFF EXIT

11.11 SETTINGS

To enter this menu the BilgMon488 needs to be in POWER mode. POWER mode is when the unit is powered but separator is not operating (separator status input is open, see 9.3 *Electrical*).

11.11.1 Alarm settings (automatic stopping device)

This menu allows the user to lower the detection level for alarm output (automatic stopping device output). This might be useful in cases where lower limits than 15 ppm oil content is requested. There is also an adjustable delay (max 10 seconds) of the alarm output. Factory defaults are 15 ppm limit, 0 sec delay¹¹.

Press  to display the cursor (under leftmost digit).	Alarm settings ppm:15.0 t:000s
---	-----------------------------------

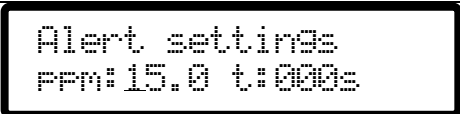
¹⁰ Fresh water flushing and alarm output can only be activated 15 resp. 10 seconds at a time. Seconds countdown is shown on LCD.

¹¹ For special 5 ppm versions, see part 4.1 of this instruction manual.

Press / to increase/decrease digit. Press  to move cursor right one digit (cursor moves cyclically from left to right, one step per ). Save setting by holding  until cursor disappears. Abort input at any time by pressing  (cursor disappears, previous values are filled in).	
---	--

11.11.2 Alert settings (bridge notification)

This menu lets the user set the parameters for the alert output.¹²

Press  to display the cursor (under leftmost digit). Press / to increase/decrease digit. Press  to move cursor right one digit (cursor moves cyclically from left to right, one step per ). Save setting by holding  until cursor disappears. Abort input at any time by pressing  (cursor disappears, previous values are filled in).	
---	--

11.11.3 Start delay

When separator goes active there sometimes is a delay before the sample reaches the SENSOR. This delay causes the alarm to be active during that time regardless of oil content measurement.

This menu lets the user set the parameters for the start delay.

Press  to display the cursor (under leftmost digit). Press / to increase/decrease digit. Press  to move cursor right one digit (cursor moves cyclically from left to right, one step per ). Save setting by holding  until cursor disappears. Abort input at any time by pressing  (cursor disappears, previous values are filled in).	
--	--

¹² For special 5 ppm versions, see part 4.1 of this instruction manual.

11.11.4 Cleanflush

When separator is operating (ACTIVE mode) and oil content exceeds 15.0 ppm¹³ will try to rinse the SENSOR by flushing with fresh water 15 sec every 90 sec.

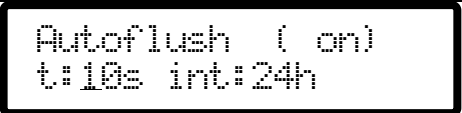
This menu lets the user enable/disable the cleanflush feature.

Press  to display the cursor (under leftmost digit). Press / to toggle value. Press  to move cursor right one digit (cursor moves cyclically from left to right, one step per . Save setting by holding  until cursor disappears. Abort input at any time by pressing  (cursor disappears, previous values are filled in).	
--	--

11.11.5 Autoflush feature (automatic freshwater cleaning)

If system is fitted with a freshwater flushing valve it is possible to let the unit clean itself at set intervals with fresh water if the separator is not operating. This menu lets the user set the interval at which the cleaning should be performed (in hours) and the duration of the cleaning/flushing (in seconds). If a duration of 0 seconds is chosen the feature is disabled (off).

Note: The autoflush feature is disabled when the separator is operating (separator status input is closed).

Press  to display the cursor (under leftmost digit). Press / to increase/decrease digit. Press  to move cursor right one digit (cursor moves cyclically from left to right, one step per . Save setting by holding  until cursor disappears. Abort input at any time by pressing  (cursor disappears, previous values are filled in).	
---	--

11.11.6 Set date/time

The BilgMon488 has an internal timekeeping mechanism with a battery backup. This mechanism is referred to as RTC (Real Time Clock). The RTC is set at production to UTC time (Coordinated Universal Time).

Time and date format used is:

¹³ For special 5 ppm versions, see part 4.1 of this instruction manual.

DDMMYY hh:mm:ss

(YY – year, MM – month, DD – day, hh – hour, mm – minutes, ss – seconds)

Press  to display the cursor (under leftmost digit). Press / to increase/decrease digit. Press  to move cursor right one digit (cursor moves cyclically from left to right, one step per ). Save setting by holding  until cursor disappears. Abort input at any time by pressing  (cursor disappears, previous values are filled in).	
--	--

11.11.7 Output config

Select output mode on terminals 15-19 (current output or serial output) according to the following table:

Mode	Comment
0 to 20 mA	0-30 ppm oil content output as 0-20 mA on terminals 15-16
4 to 20 mA	0-30 ppm oil content output as 4-20 mA on terminals 15-16
serial 2400 8N1	Serial output on terminals 17-19, for use with compatible device.
serial 4800 8N1	Serial output on terminals 17-19, for use with compatible device.
RS422 4800 v01	Serial output on terminals 17-19, for use with compatible device.

In current output mode, terminals 15-16 can be used for external printing/logging of the momentary oil content measurement.

In serial output mode, terminals 17-19 is used for communicating data to compatible device (see reference manual for connected device).

Press  to display the cursor. Press / to alter mode. Save setting by holding  until cursor disappears. Abort input at any time by pressing  (cursor disappears, previous values are filled in).	
--	--

11.11.8 Curro 20mA cal. (Calibration of current output)

If current output corresponds badly to the displayed oil content the current output can be calibrated in this menu (one point calibration).

When entering this menu, the BilgMon488 will try to output 20 mA (corresponding to 30 ppm). Measure the output with ampere meter. If reading is not correct adjust the output according to below instruction.

If a “serial output” mode is selected in 11.11.7 Output config, this menu will show “N/A” (Not Applicable).

Press  to display the cursor. Press / to increase/decrease the current output signal (adjust to 20 mA output). Save setting by holding  until cursor disappears. Abort input at any time by pressing  (cursor disappears, previous values are filled in).	
--	--

11.11.9 PPM display. (Select number of decimals in ppm display)

Select between one decimal (default) and no decimal when displaying the PPM value.

Press  to display the cursor. Press / to toggle between “ONE DECIMAL” and “NO DECIMAL”. Save setting by holding  until cursor disappears. Abort input at any time by pressing  (cursor disappears, previous values are filled in).	
--	--

11.11.10 Standby display. (Select standby notification)

Select between showing current PPM value (default) and showing “STANDBY” in main menu when unit is in “POWER” mode.

If selected the unit will show “STANDBY” after 5 seconds of inactivity when in “POWER” mode.

Press  to display the cursor. Press / to toggle between “Show PPM” and “Show STANDBY”. Save setting by holding  until cursor disappears. Abort input at any time by pressing  (cursor disappears, previous values are filled in).	
--	--

11.12 TREND

The trend feature monitors the sensor ppm value and input change (separator status or optional flow switch) during the last 24 hours (approximately).

A 1-minute moving average of the sensor oil content value is calculated along with a maximum oil content value for that minute.

Trend entries are stored every minute or on input change.

The trend menu enables the user to step the stored trend data as well as download data to file using the “BilgMon488 log download kit” (purchased separately).

To enter this menu the BilgMon488 needs to be in POWER mode. POWER mode is when the unit is powered but separator is not operating (separator status input is open, see 9.3 *Electrical*).

11.12.1 Trend menu

The trend menu shows the number of trend entries currently stored. Press  to enter the <i>step trend</i> submenu.	
--	--

11.12.2 Step trend

First row of <i>step trend menu</i> shows the trend data and second row shows date and time of occurrence. Switching displayed data: By holding  while pressing  or  the user can select which data to inspect from the following list: • AVG : 1 min moving average of oil content • MAX : max oil content during 1 min • SEP : separator status input (1-closed, 0-open) • FLOW : optional flow switch input (1-flow, 0-no flow) • FWV : output signal to fresh water flushing valve Stepping: Navigate the trend history by pressing  or . Press and hold buttons for repeated/quicker stepping.	
Sending trend via USB or clearing trend: When leaving the <i>step trend</i> menu () user is asked to send trend. Downloading the trend data to file follows the same procedure as 35 Log data download via USB except for selecting the <i>trend menu</i> in place of the <i>log menu</i> where applicable.	

12 AUTOMATIC STOPPING DEVICE TEST

12.1 WHILE SEPARATOR IS OPERATING.

If the separator is operating and the automatic stopping device is not activated (overboard valve open) it is possible to force the activation of the stopping device for a short period of time (10 s) by holding  in the *main menu*. This allows testing that the automatic is correctly connected.

12.2 WHILE SEPARATOR IS NOT OPERATING.

To check that the automatic stopping device is correctly connected see *13.2 Step 2*.

13 RESPONSE TEST

13.1 STEP 1

To check that the sensor responds to objects in the measuring path unscrew the cleaning cap (top of SENSOR housing) and insert a long plastic rod or something similar into the measuring path. **Do not** use anything that might scratch or in other ways damage the glass tube inside the SENSOR housing (as for example screwdrivers). If the sensor is working properly the display should read “PPM>30.0” (main menu). Note that the air-detection feature of the SENSOR requires the glass tube to be filled with water during this test for it to work.

13.2 STEP 2

Testing alarms and valves are done in simulation mode (see *11.5 Simulation*) or in the *test outputs* submenu of the *cleaning & test* menu (see *11.10.3 Test outputs*) since this doesn't require opening the MASTER housing.

14 CALIBRATION CHECK

Doing a *calibration check* requires the “Bilgmon488 calibration check kit”. This kit also contain detailed information on procedures and mixtures used in the calibration check procedure. Please note that a calibration check has no official status unless performed and certified by someone who is authorized by the maker (IMO requirement).

See sections *11.10.1 Clean cell (zero calibration)* and *11.10.2 Check 40NTU cal (calibration check)*.

Note: Complete calibration can only be performed by factory. Calibration check will perform a zero calibration and a check of the units calibration values compared to those set at production.

15 LOG ENTRIES

Type	Example	Explanation
POWER ON	POWER ON 02JAN23 11:36:32	Power was turned on at given date and time (yyymmdd hh:mm:ss).
POWER OFF	POWER OFF 02JAN23 14:06:10	Power was turned off.
SEP ON	SEP ON 02JAN23 12:10:12	Separator signal input turned from not activated to activated.
SEP OFF	SEP OFF 02JAN23 12:23:34	Separator signal input turned from activated to not activated.
DISCH. DISABLED	DISCH. DISABLED 02JAN23 12:15:13 Second row alternating with cause: • > XX.X PPM • NO FLOW • SEP OFF • DELAY	Automatic stopping device activated (discharge disabled).
DISCH. ENABLED	DISCH. ENABLED 02JAN23 12:17:42	Automatic stopping device deactivated (dsicharge enabled).
ALARM SET	ALARM SET 02JAN23 13:10:07 Second row alternating with set values: • XX.X PPM, XXsec	Alarm ppm level and/or delay setting was changed to indicated values.
SIM ON	SIM ON 02JAN23 12:09:50	Simulation was turned on.
SIM OFF	SIM OFF 02JAN23 12:24:19	Simulation was turned off.
RTC ADJ	RTC ADJ 21OCT23 08:32:02	Time before adjustment of RTC clock.

RTC NEW	RTC NEW 21OCT22 09:47:29	Time after adjustment of RTC clock. (Normally preceded by "RTC ADJ" entry)
NEW SENSOR	Log: NEW SENSOR 02JAN23 12:47:29 Second row alternating with new sensor serial: ID = 001B-1234	A new sensor was attached.
BATTERY LOW	BATTERY LOW 21OCT23 09:47:29	Internal clock battery backup voltage low (first occurrence).
BATTERY #.#V	BATTERY 3.0V 21OCT23 09:47:29	Internal clock battery backup voltage at power on (only logged if preceded by "BATTERY LOW" event).
START DELAY SET	START DELAY SET 02JAN23 12:49:32 Second row alternating with new start delay value: 10sec	Start delay setting was changed.

16 MAINTENANCE

The BilgMon488 can be set to autoflush (see 11.11.5 Autoflush feature (automatic freshwater cleaning)). This means that the sensor tube is flushed with clean water at durations and intervals as set in the settings menu. Autoflush is only active when in main menu and BilgeMon488 is not active.

Cleaning the SENSOR unit should be done using a soft bottle-brush and mild detergent. Unscrew the cleaning cap on top of the SENSOR unit and use the correct bottle-brush to clean. Note that there is a glass tube inside the SENSOR unit so don't use anything that might scratch or damage the glass (i.e. metal objects). If the glass tube is layered with rust or similar try using low concentrated acid (for example hydrochloric acid). Rinse well and make sure you protect your eyes, skin and airways if using acidic substances.

Check the expiry date of the factory issued calibration certificate (10.2 Calibration certificate expiry date).

17 REAL TIME CLOCK (RTC)

The timekeeping mechanism in Bilgmon488 is referred to as the Real Time Clock (RTC). The RTC is essentially a crystal oscillator backed up by a battery and a capacitor. The RTC keeps track of the time and date and is essential for keeping the log of Bilgemon488 correct.

17.1 BATTERY REPLACEMENT

The RTC backup battery is coupled in parallel with a backup capacitor. This means that the Bilgemon488 can keep its RTC running for a couple of hours without the battery present.

The RTC battery (type CR1225) is located on the backside of the master unit lid (see illustration).

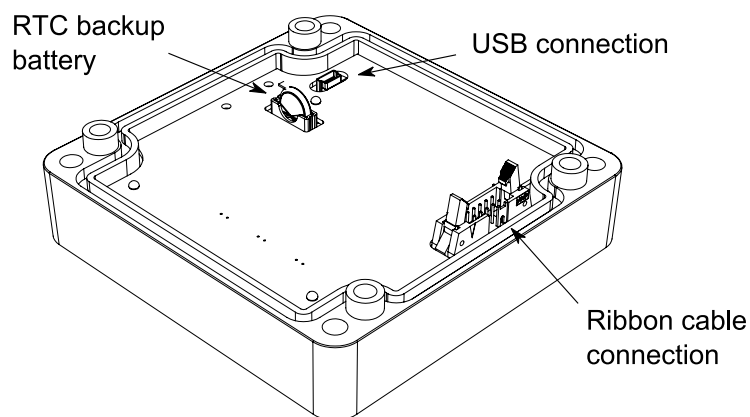


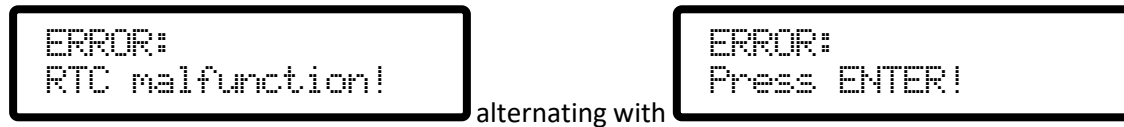
Illustration 9: Master unit lid backside

Battery replacement procedure:

1. Disconnect the power supply.
2. Open the lid of the master unit (loosen 4 screws in the corners of the lid).
3. Push on the metal clip (holding the battery) and pull the battery out of the socket.
4. Replace with new battery of type CR1225 as soon as possible (within a couple of hours).

17.2 RTC MALFUNCTION

In the event of the RTC stopping the following message will appear:



When pressing  the user enters the *RTC recovery menu* (see Illustration 10: RTC recovery menu layout).

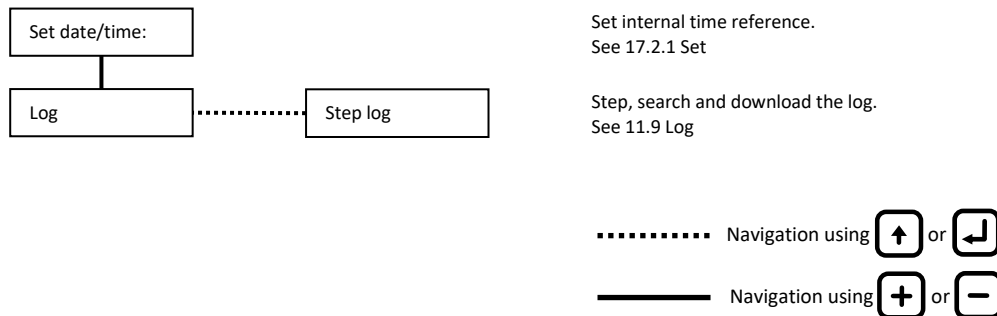
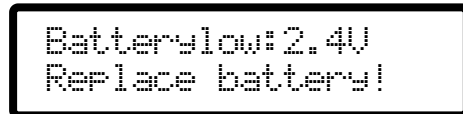


Illustration 10: RTC recovery menu layout

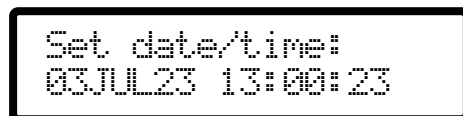
17.2.1 Set date/time

If the battery voltage is too low (< 2.5 V) the following warning will be shown:



Follow the battery replacement procedure (17.1 Battery replacement).

When the battery is replaced and the voltage has increased to above 2.5V (might take a couple of minutes if the backup capacitor is exhausted) the following menu will appear:



Enter correct date and time using same method as described in 11.11.6 Set date/time.

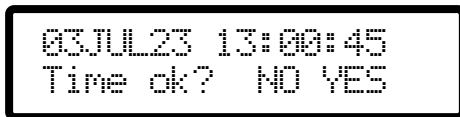
After setting date and time, the following will be displayed,



Followed by,



Followed by,



Verify that display is showing the correct date and time.

Press  if date and time is correct or  to go back to *Set date/time* menu.

NOTE: After pressing  the RTC recovery menu is left and user is returned to main menu. **Make sure that the date and time is correct before pressing .**

18 LOG DATA DOWNLOAD VIA USB

Apart from inspecting the log via the LCD (see 11.9 Log) there is a possibility to download the log via a USB-connection to a personal computer running Windows operating system.

NOTE: This procedure requires the “BilgMon488 log extraction software” and a USB cable (Male USB A to Male USB Mini B).

18.1 RUNNING THE SOFTWARE

Run the “BM488_log_receiver.exe” in the “dist” directory to start the log receiver.

18.2 INSTALLING THE VCP DRIVER

If your operating system reports “unrecognized device” (or similar) when connect your bilge alarm to your PC using the supplied USB-cable you must install a hardware (VCP) driver. For most recent operating systems this part will not be necessary since required drivers are preinstalled.

For the most recent versions of the driver, visit <https://ftdichip.com/drivers/vcp-drivers/>.

An older version of the drivers can be found in the “drivers” directory.

The VCP (Virtual Com Port) – driver has to be installed for the connected bilge alarm to show up in the log receiver software.

18.3 DOWNLOAD PROCEDURE

The following steps will guide you through the process of downloading data from the log of your bilge alarm.

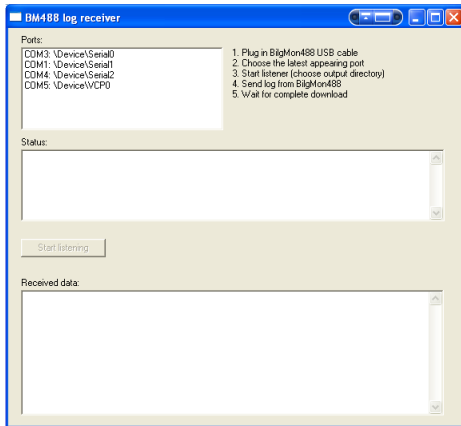


Illustration 11: Initial screen, waiting for connection

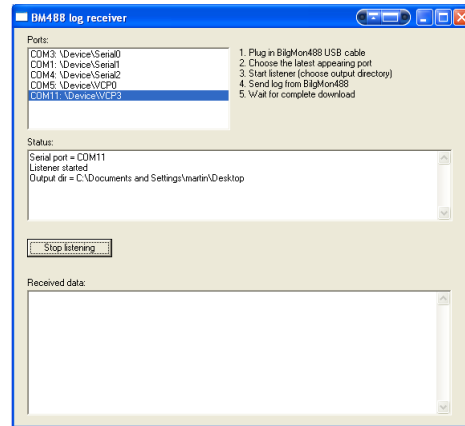


Illustration 12: Connected (VCP3) and listening

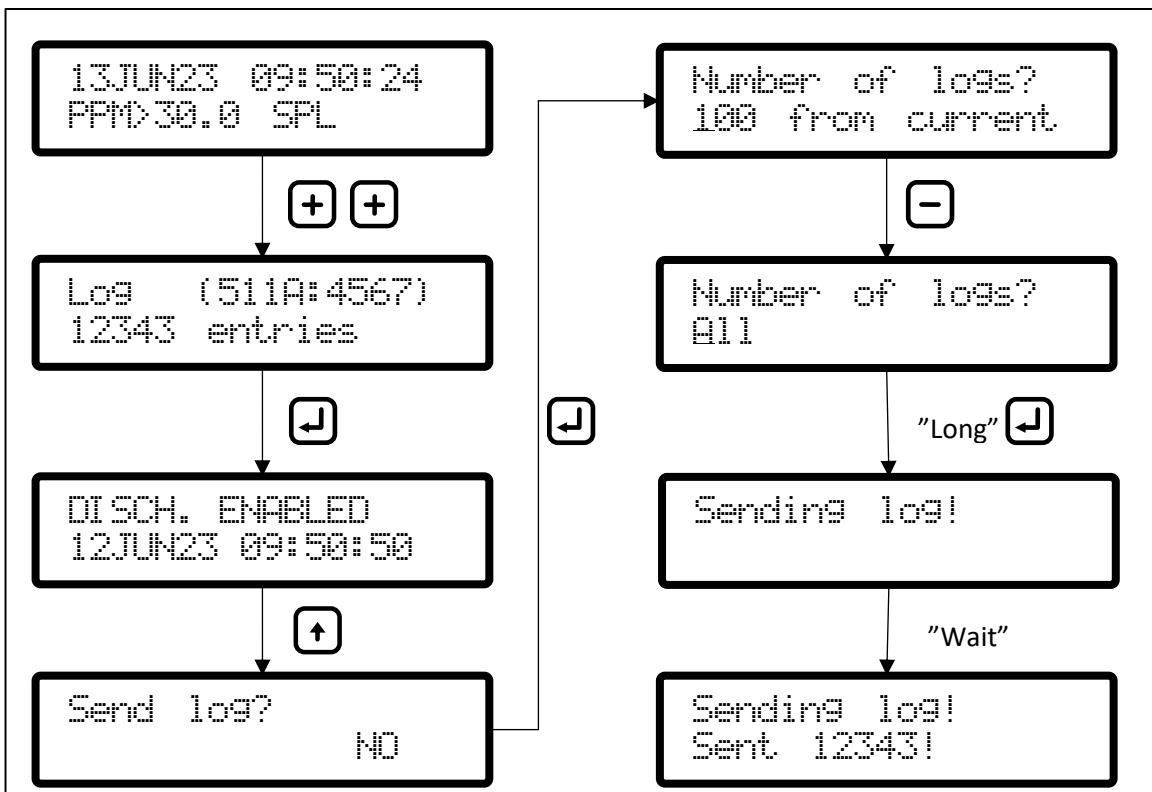


Illustration 13: Send log data from Bilgmon488

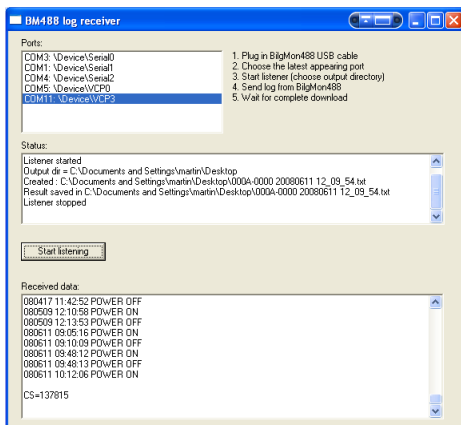


Illustration 14: Log data download completed

Steps:

1. Initial screen is shown (see Illustration 11: Initial screen, waiting for connection). The program is now waiting for a USB-connection.
2. Connect the BilgMon488 to your PC using the USB-cable. Note that the bilge alarm does not need to be connected to a power supply since it gets power from the USB-cable. The connected bilge alarm will show up last in the "Ports:" list.
3. Choose the latest appearing port from the list.
4. Click the "Start listening"-button. A dialogue will appear where you can choose an output folder for the downloaded result.
5. The software is now listening for data from BilgMon488 (see Illustration 12: Connected (VCP3) and listening).
6. On your BilgMon488 navigate to the log-menu and step in to the log. When exiting the log, you will be asked if you want to send the log. Answer yes and choose the amount of data to download (see Illustration 13: Send log data from Bilgmon488). While the data is sent it will show up in the "Received data" section of the log receiver.
7. When the download is finished the filename and position of the result can be found in the "Status:" list (see Illustration 14: Log data download completed).
8. Close the application.

19 SPARE PARTS

New equipment and spares can be obtained from the maker's appointed distributors. The maker does not supply equipment or spares directly to end users or trading companies.

<i>Pos¹</i>	<i>Description</i>	<i>Order information</i>
1, 2, 3	Complete equipment, for replacing old BilgMon 488.	Refer to old master unit serial number.
1, 2, 3	Complete equipment, new installation (Master, Sensor and Freshwater valve).	Indicate supply voltage (24V or 115/230V).
1	Sensor unit only.	Refer to master unit serial number or old sensor unit serial number
2	Master unit only.	Refer to old master unit serial number.
3	Fresh water flushing valve assembly only.	Indicate supply voltage (24V, 115V, or 230V).
4	Calibration check kit, comprising: • Cleaning brush • Syringe • Bottle 500 ml with lid • Bottle 50 ml, calibration check liquid. • Instructions • Cleaning cap	BilgMon 488 Calibration Check Kit.

¹ See Illustration 15: General assembly/Spares parts.

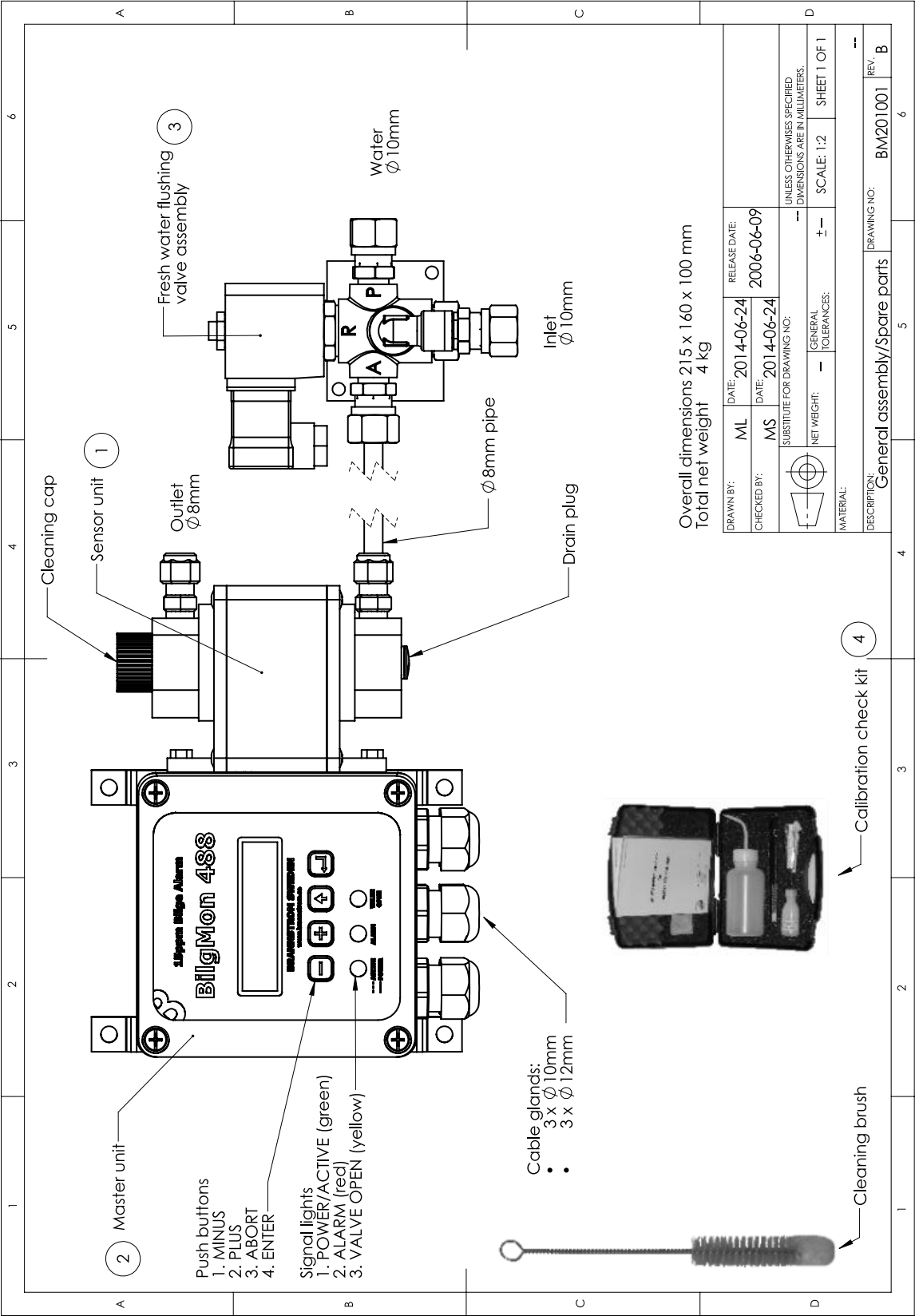


Illustration 15: General assembly/Spare parts

20 TROUBLESHOOTING

Symptom	Possible reason(s)	Servicing
BilgMon488 is switched on but LCD remains blank or the green POWER/ACTIVE led is not lit.	Power supply is erroneous.	Check connections internally, externally and power supply voltages.
	LCD monitor is broken.	Order replacement part.
	Automatic fuses blown.	Disconnect externals that might have caused the short-circuit (e.g. fresh water flushing valve). Wait until fuses have cooled down power up the unit again.
Oil content measurement (ppm value) remains high.	Dirty sensor tube.	Clean the sensor tube and perform zero calibration (see <i>11.10.1 Clean cell (zero calibration)</i>)
	Air is present in sample.	Correct cause of air presence. Clean the sensor tube and perform zero calibration (see <i>11.10.1 Clean cell (zero calibration)</i>)
	Excessive contaminants present in sample (rust, bacteria etc. ...)	Correct cause of contamination. Clean the sensor tube and perform zero calibration (see <i>11.10.1 Clean cell (zero calibration)</i>)
LCD display indication: MEMORY ERROR, MEMORY WRITE ERROR, ERASE ERROR	Memory malfunction.	Order replacement part.
	Memory chip not present.	Order replacement part.
LCD display indication: Lost sensor com!	Dirty or damaged MASTER-SENSOR contact area.	Part MASTER and SENSOR units. Clean contact surface with mild detergent.
LCD display indication: RTC malfunction!	Internal time reference stopped/malfunctioning.	Replace backup battery, then enter correct date and time (see <i>17.2 RTC malfunction</i>).

For equipment, spares, service, installation, commissioning, documentation, pricing, or technical advice/troubleshooting, please contact one of the distributors or service companies appointed or authorized by the maker (see the list on the maker's website www.brannstrom.se). These services are not available directly from the maker.

Appendix A

REPLACING OLD MASTER UNITS WITH NEWER SERIES 5 VERSIONS

BilgMon488

15 ppm Bilge Alarm

A.1 PRODUCTION VERSION

There are some differences between BilgMon 488 master units of newer series 5 and older production series. The serial number of the BilgMon 488 master unit will reveal which version it is.

The newest version of the BilgMon 488 master unit has a serial number starting with "5". For 115/230V supply voltage versions the serial number will be in the format 51xx-nnnn, and for 24V supply voltage versions it will be in the format 52xx-nnnn.

In case the BilgMon 488 master unit to be replaced is of an older version, its serial number will start with "A", "AE", "EDA", "BFA", "4A", "4AE", "4AC", "4EDA", or "4BFA". For these older versions the numbering of the terminals for the electrical wiring is different compared to the presently produced units, and you must therefore compare the wiring diagram of the old unit to the wiring diagram of the new unit before you connect the wires to the new unit. Below a simple table showing the terminal numbering and function of the old version vs that of the newer present series 5 version. However, the special BilgMon 488 used in Bilge Guard, MasterTrack 588, and MasterTrack 588B has a special communication standard and can for now only be replaced with a similar special version BilgMon 488 of series 4. For the MasterTrack 588C, only the new BilgMon488 series 5 can be used

Terminal numbers of the BilgMon 488 master unit.

Ser. 5 vers. All voltages	Older vers. 24V	Older vers. 115/230V	Function	
1	1	1	Power supply 0V	
2	2	2	Power supply 24VAC or +24VDC or 115/230VAC	
3	3	3	Flushing valve output 24VAC or +24VDC or 115/230VAC (fused)	
4	4	4	Flushing valve output 0V	
5	5	5	Alert relay common terminal (fused)	
6	6	6	Alert relay NO terminal	
7	7	7	Alert relay NC terminal	
8	8	8	Alarm relay (ASD control) common terminal (fused)	
9	9	9	Alarm relay (ASD control) NO terminal	
10	10	18	Alarm relay NC terminal	
11	11	10	Separator status signal input	closed when OWS operating
12	12	11	Separator status signal +12V	
13	NA	NA	Optional flow switch signal input	closed when flow ok ¹⁴
14	NA	NA	Optional flow switch signal +12V	
15	16	16	Oil content signal current output (-)	
16	17	17	Oil content signal current output (+)	
17	NA	NA	Oil cont. signal RS422 output GND	(galv. isol.)
18	NA	NA	Oil cont. signal RS422 output Tx+	
19	NA	NA	Oil cont. signal RS422 output Tx-	
20-21-22	13-14-15	12-13-14	External protective earth connections (galv. isol.)	

¹⁴ A flow switch is optional, so if no flow switch is connected, terminals 13 & 14 should be shorted with a jumper.

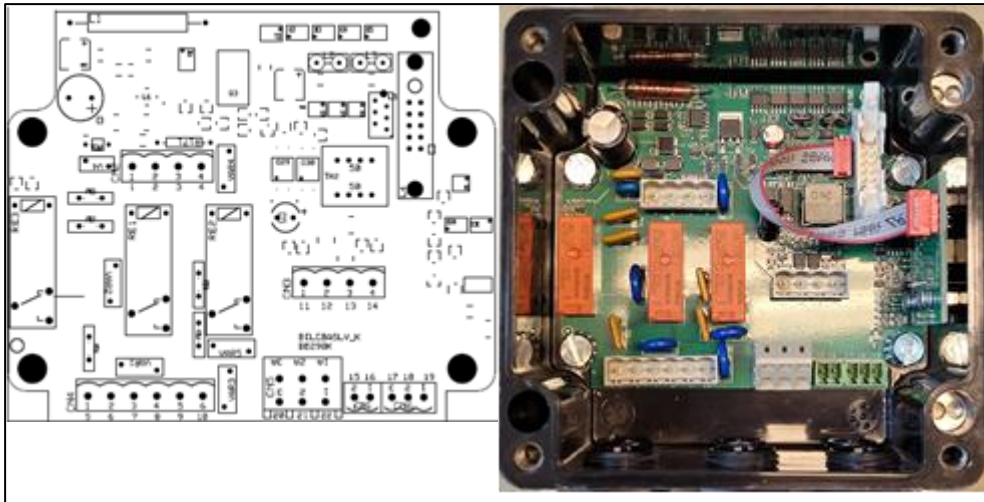


Figure A- 1. Series 5 version base PCB 24V

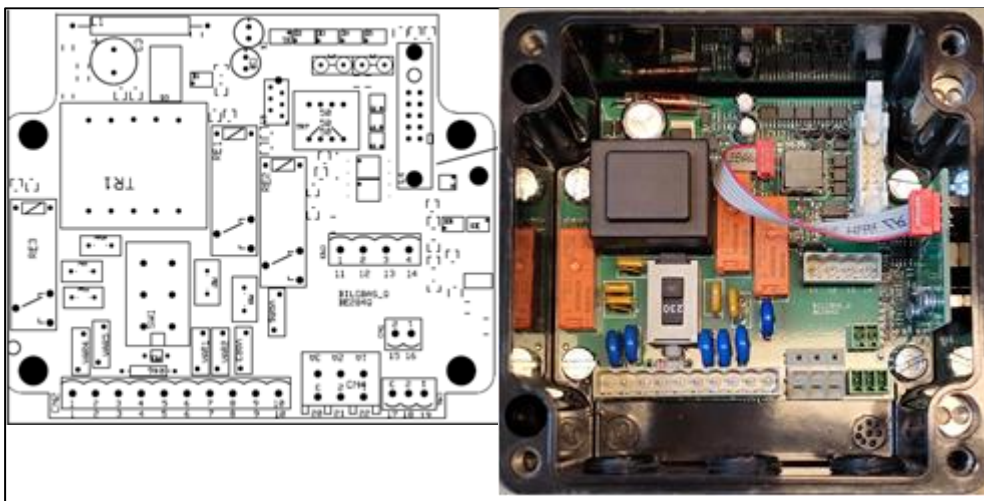


Figure A- 2. Series 5 version base PCB 115/230V

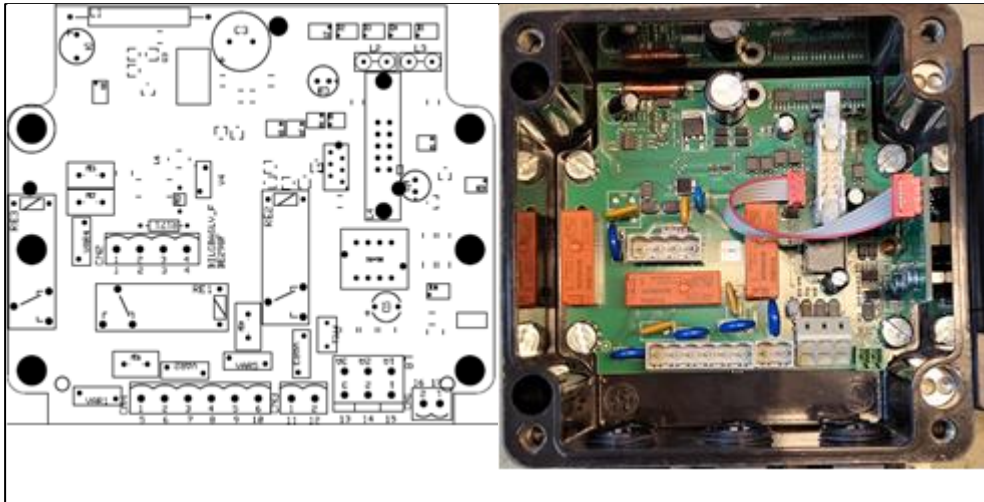


Figure A-3. Older series 4A version base PCB 24V

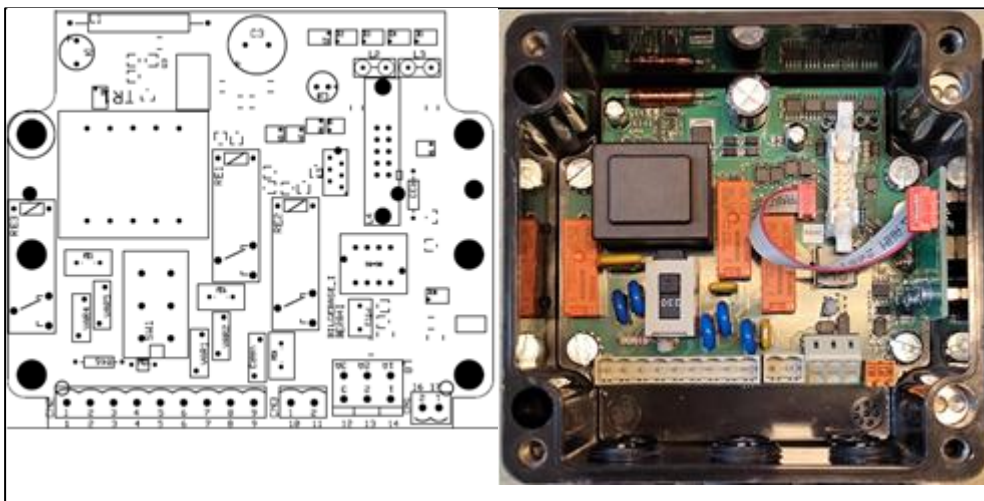


Figure A-4. Older series 4A version base PCB 115/230V

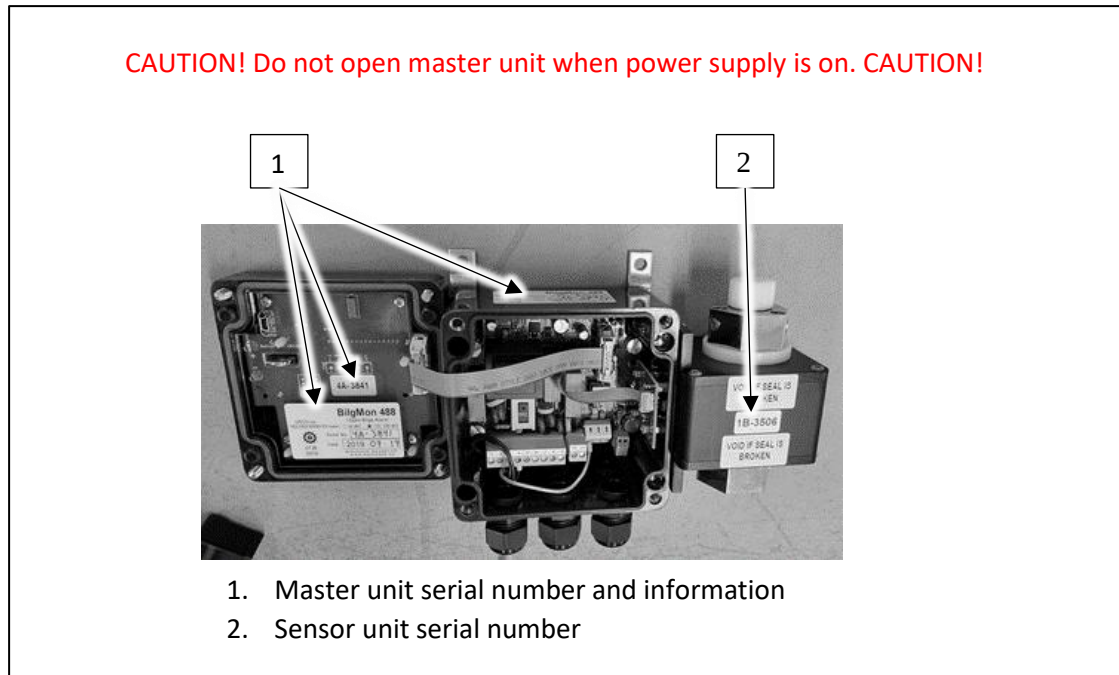


Figure A- 5. Unit identification.

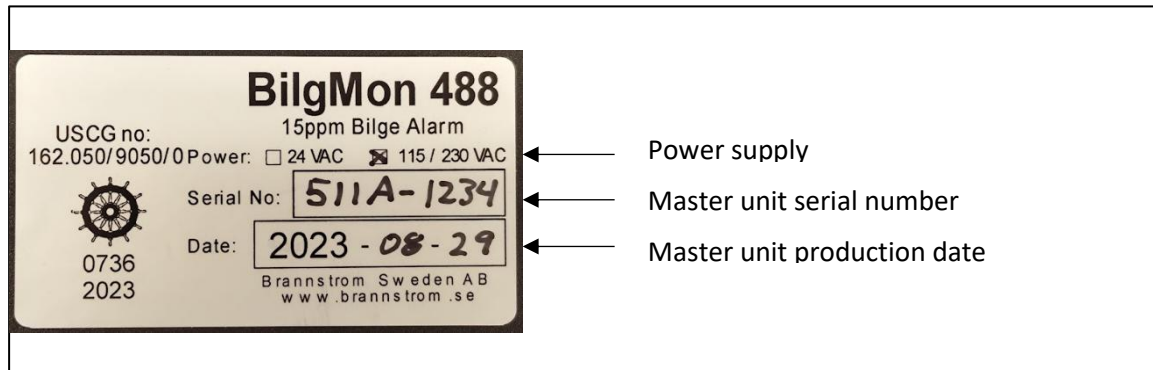


Figure A- 6. Master unit label