NAVYLEC MONITOR

Fountaine Pajot ECO Cruising Version

User and configuration manual under construction
Restricted distribution - Preliminary version 0.9

NAVYLEC, an ANNECY ELECTRONIQUE S.A.S. brand

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1 INTRODUCTION

1.1 Introduction

Navylec® and NavyBus® are brands belonging to the nautical division of Annecy Electronique SAS located in France on the banks of Lake Annecy, 30 minutes from Geneva International Airport.
Annecy Electronique has been specialised in embedded systems for land vehicles, air and naval transport in harsh environments since the mid 1970's.

Navylec® and NavyBus® are revolutionising the electrical architecture on board cruise ships or operational vessels with the invention of a so-called "Multiplexed" system specially adapted to the specific constraints of ships. The integration of control/command and measurement functions also contributes to this, leading to innovative, highly practical products for the day-to-day needs of skippers and crews.

All the products have been successfully used in races on Franck CAMMAS's boats, on one-off units which have been around the world, on a large number of 35' to 102' cruise ships and passenger vessels, among others.

NavyBus : is the name of an "open" technology which is starting to be adopted by other equipment manufacturers who use the features and remarkable reliability of NavyBus for remote control/command.

NAVYBUS® MEMBER

Navylec : is ANNECY ELECTRONIQUE's "nautical" brand.

1.2 NL470-ECO1 Introduction

The NL470-ECO1 monitor is the version of the NAVYLEC MONITOR for the FOUNTAINE PAJOT shipyard. It is innovative with its modern **TOUCH graphical interface** and fits perfectly into the FOUNTAINE PAJOT ECO CRUISING programme, giving the precise status of the vessel's energy self-sufficiency and the actions to be taken to achieve this. The monitor provides:

- Full monitoring of the service battery bank;
- Surveillance and measurement of the auxiliary battery banks;
- Surveillance and measurement of the levels of all the tanks;
- Battery alarm management.

The NL470-ECO1 monitor has a configuration interface used for:

- Factory settings to fully adapt the product to the vessel in which it is fitted;
- User settings.

The NL470-ECO1 monitor is compatible with **NavyBus®.** Combined with other compatible equipment, it can be part of a more extended automation system (lighting, navigation, etc.).

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2 CHARACTERISTICS

2.1 General characteristics

Description	Values
System power supply	6.5 – 36 V
Consumption in nominal mode	420 mA @12 V // 210 mA @24 V approx.
Consumption in Standby mode 1	102 mA @12 V // 50 mA @24 V approx.
Consumption in Standby mode 2	80 mA @12 V // 40 mA @24 V approx.
Operating temperature	-20 to +70°C
Storage temperature	-30 to +80 °C
Microprocessor	RENESAS SH7269
Digital communication interface	1 x NMEA2000 1 x NavyBus
Screen	7.0 inches, 800 x 480 pixels, Resistive touchscreen
Overall size of the unit	221 mm x 160 mm x 51 mm
Earth	
Connectors	Plug-in Phoenix connectors with or without locking
Protection rating	IP60 Front – IP30 Rear
Ambient light sensor	YES
Audible signal	YES polyphonic buzzer

2.2 Normative characteristics

Description	Values
Electromagnetic emission	Conducted and radiated: IEC 60945-9
Electromagnetic immunity	Conducted, radiated, supply, ESD: IEC 60945-10
Safety precautions	IEC 60945-12
Vibrations	IEC 60945-8.7

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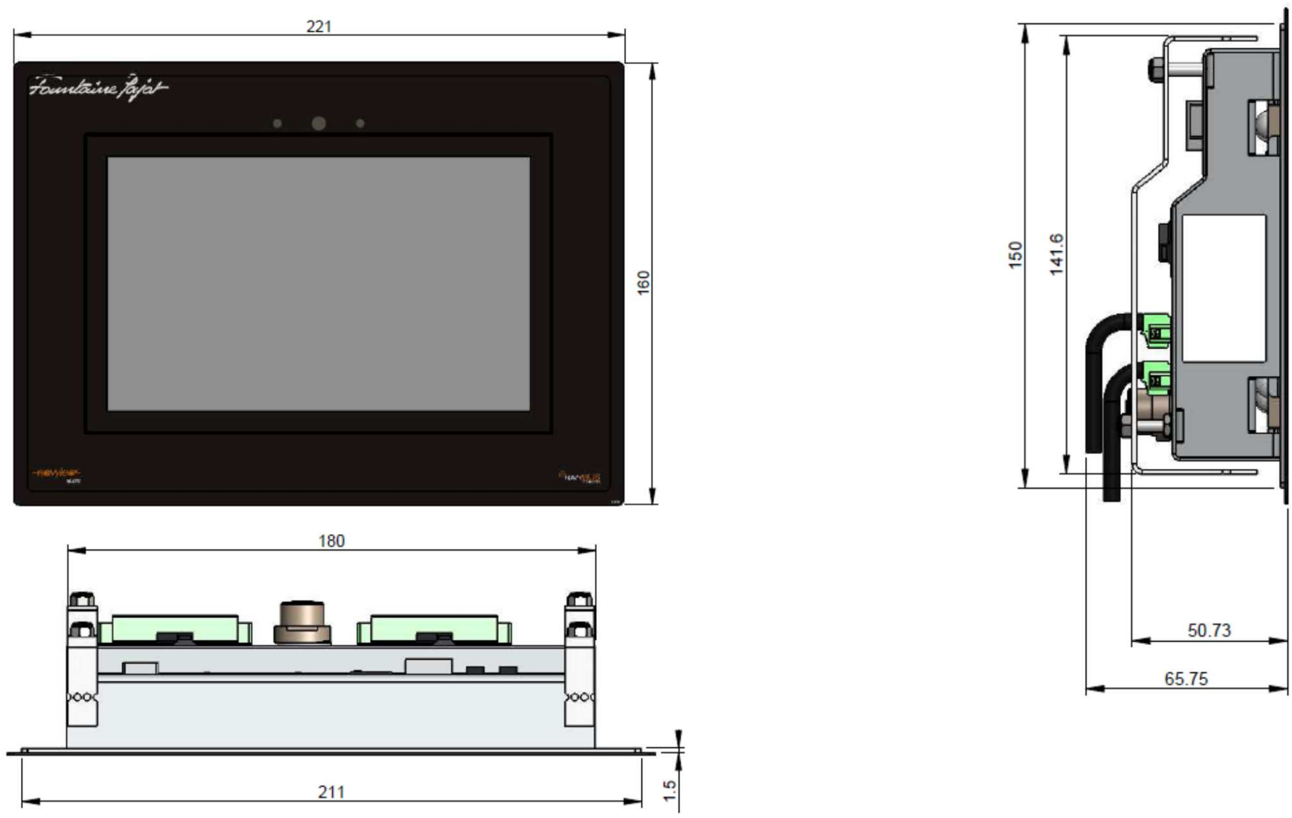
2.3 Sensor measurement characteristics

Description	Values
Voltage measurement accuracy	Measurement range 0 – 36 V Accuracy +/-10 mV (-20 to +70°C) Resolution 0.01 V
Resistance measurement accuracy	Measurement by current injection 25 mA +/- Measurement range 0 – 360 Ω accuracy +/-5 Ω
Current measurement accuracy	Measurement range 0 – 100 mV Rating 2 mV: accuracy +/- 10 µV Resolution 10 mA Rating 100 mV: accuracy +/-200 µV Resolution 0.1 mA
Temperature measurement accuracy	CTN 47K probe Measurement range -20°C to +70°C accuracy +/-2°C Resolution 1°C

2.4 Controlled output characteristics (optional)

Description	Values
Digital outputs 1	The dry contact output is limited by automatic fuse to a maximum current of 0.5 A.

2.5 Mechanical characteristics



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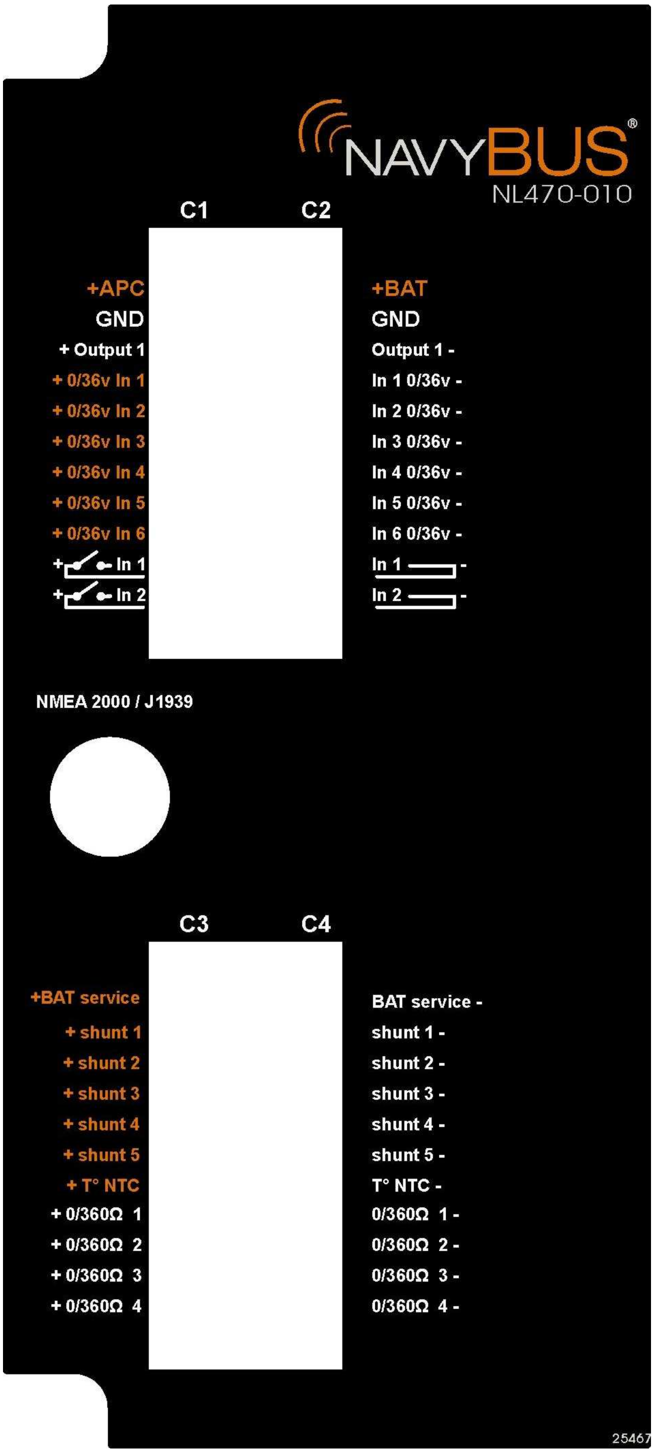
3 ELECTRICAL CONNECTIONS

3.1 Location of the electrical connections



Pin No.	CONNECTOR 1
1	+ BATT APC
2	GND
3	Digital output +
4	ANA input No.1+
5	ANA input No.2+
6	ANA input No.3+
7	ANA input No.4+
8	ANA input No.5+
9	ANA input No.6+
10	Digital input No.1+
11	Digital input No.2+

Pin No.	CONNECTOR 2
1	+ BATT perm
2	GND
3	Digital output -
4	ANA input No.1- (GND)
5	ANA input No.2- (GND)
6	ANA input No.3- (GND)
7	ANA input No.4- (GND)
8	ANA input No.5- (GND)
9	ANA input No.6- (GND)
10	Digital input No.1- (GND)
11	Digital input No.2- (GND)

Pin No.	CONNECTOR 3
1	+ Service BATT
2	Shunt 1 +
3	Shunt 2 +
4	Shunt 3 +
5	Shunt 4 +
6	Shunt 5 +
7	Service BATT. + temp.
8	Resistor No.1 +
9	Resistor No.2 +
10	Resistor No.3 +
11	Resistor No.4 +

Pin No.	CONNECTOR 4
1	- Service BATT
2	Shunt 1 -
3	Shunt 2 -
4	Shunt 3 -
5	Shunt 4 -
6	Shunt 5 -
7	Service BATT. + temp.
8	Resistor No.1 -
9	Resistor No.2 -
10	Resistor No.3 -
11	Resistor No.4 -

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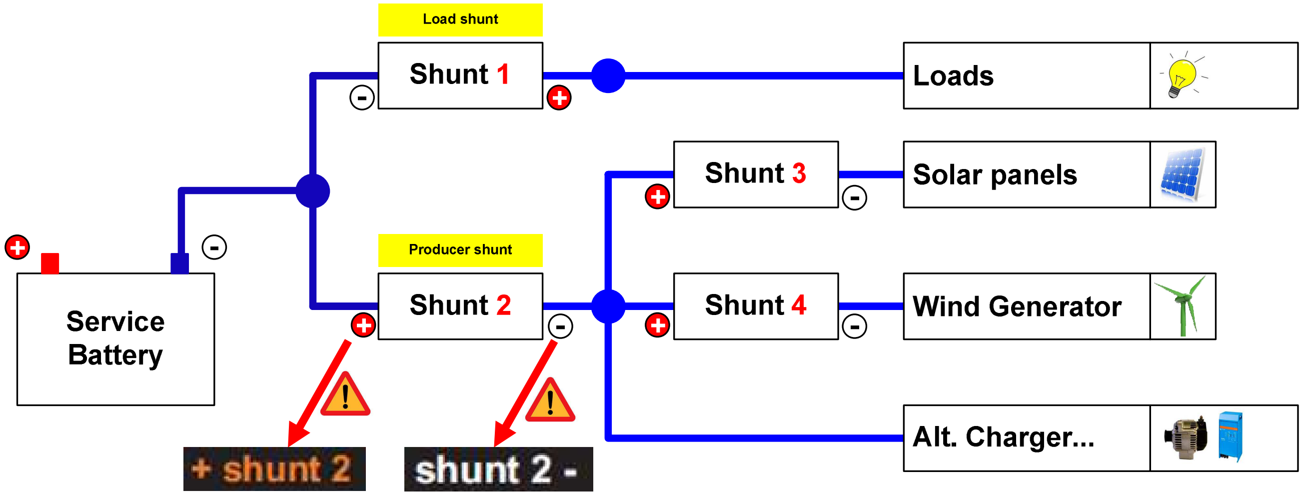
3.2 SERVICE BATTERY BANK connection

The NL470-ECO1 is connected to 2, 3 or 4 shunts which measure a current on the **NEGATIVE terminal**.

3.2.1 Shunt connection with separate DC/AC converter and charger

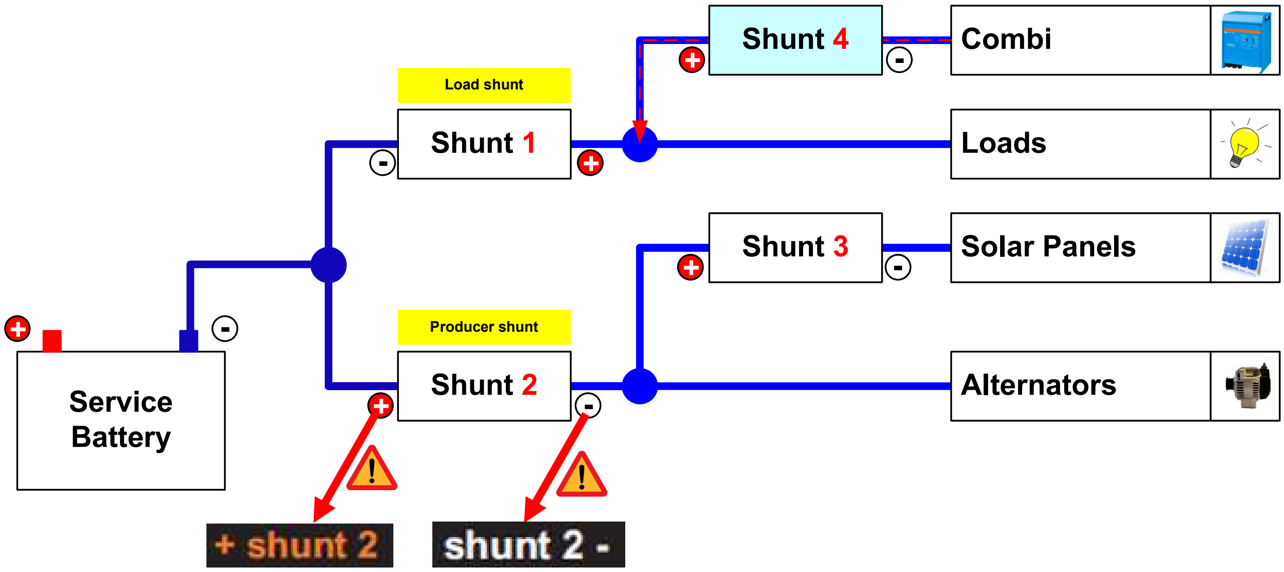


In this assembly, the loads are: converters, lighting, navigation instruments and all the other 12 V or 24 V loads.

3.2.2 Shunt connection with COMBI charger + converter with 4 shunts

The use of a combi charger + converter is possible subject to:

- It being connected after shunt 1 **"Loads"**



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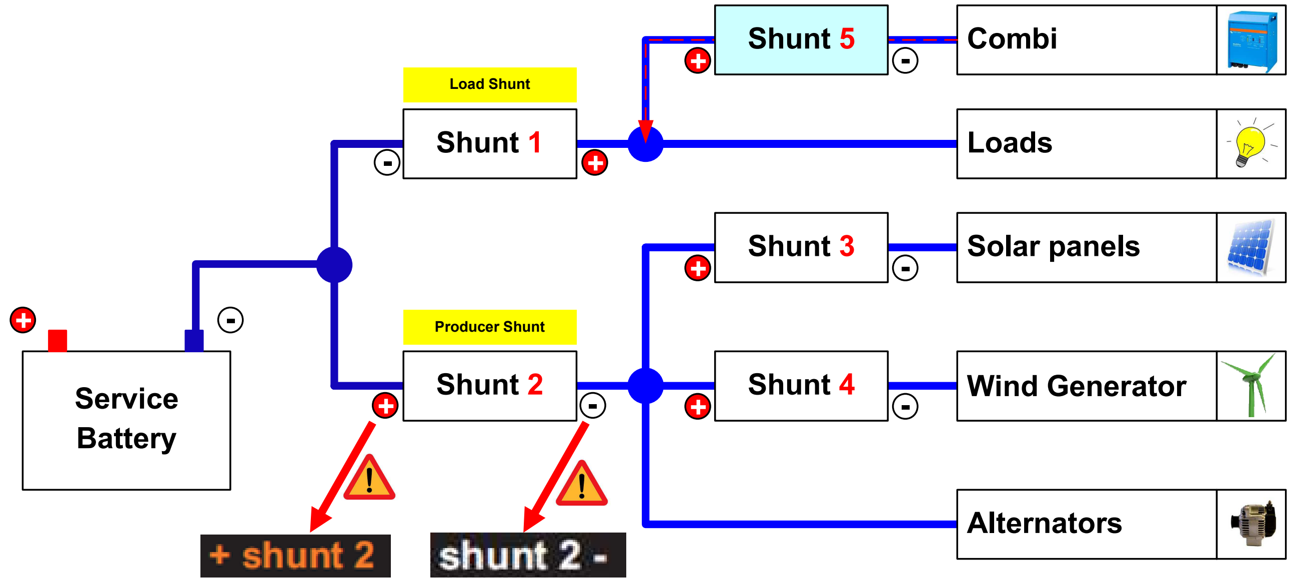
3.2.3 Shunt connection with COMBI charger + converter with 5 shunts



Explanation of the specific operation of combi chargers + converters:

Let "ShuntC" be the "Combi" shunt. Depending on the assembly, the shunt allocated to the combi will be either "shunt 4" (4-shunt assembly) or "shunt 5" in the 5-shunt assembly

In the paragraph below, "**ShuntC**" is either "**Shunt 4**" or"**Shunt 5**" depending on the assembly.

A **produced** current is read by the equipment with a **positive sign**, and a consumed current is read with a **negative sign**. The currents displayed on the monitor are generally an **absolute value.**

Calculation of **consumed currents** displayed as **AC** and **DC**:

- IF "**ShuntC**" > 0: The combi is in Charger mode
  DC current = **Shunt1 - ShuntC**
  AC current = **0**
- IF "**ShuntC**" > 0: The combi is in converter mode and produces AC
  DC current = **Shunt1 + ShuntC**
  AC current = ShuntC

In Converter mode the current consumed is totally read by shunt1.
"ShuntC" provides specific information concerning what is useful for AC production (110 or 230 V) whereas the "Shunt1 – **ShuntC**" operation gives information concerning what is specifically consumed by the 12 V or 24 V DC loads.

In Charger mode (Producer): the NL470-ECO1 monitor calculates the production and consumption currents as follows:

- Total current produced = **Shunt2 +ShuntC**
- Total current consumed = **Shunt1 -ShuntC**

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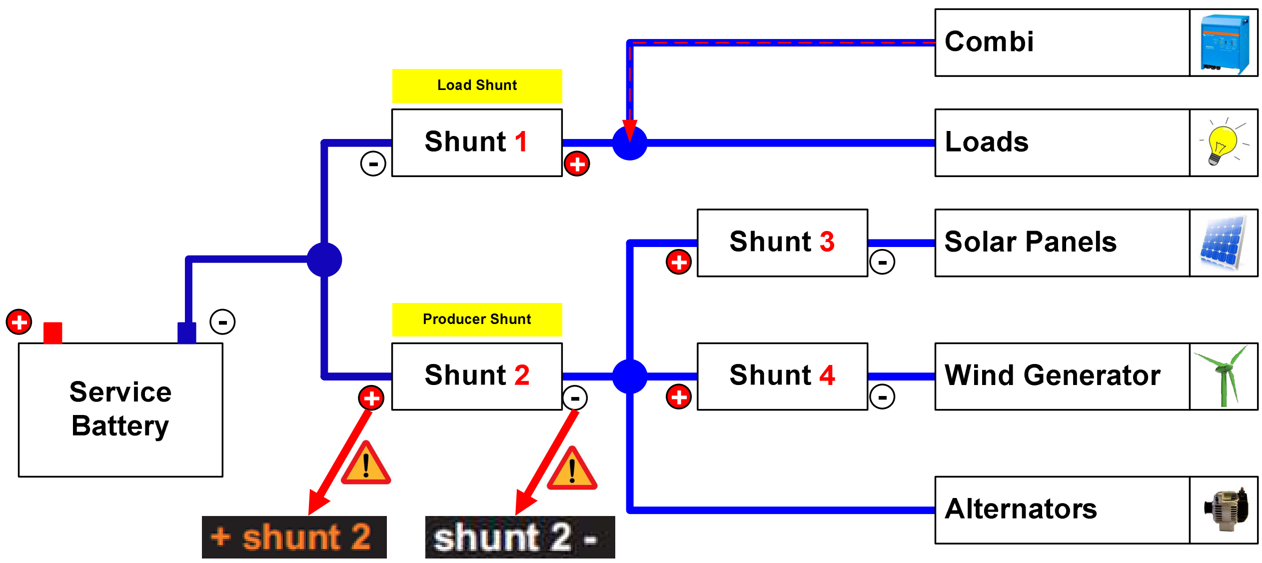
Example:

	Example 1	Example 2	Example 3	Example 4
(A) Solar panel current produced (SHUNT 3)	12.0 A	12.0 A	12.0 A	12.0 A
(B) Wind turbine current produced (SHUNT 4)	8.5 A	8.5 A	8.5 A	8.5 A
(C) Alternator current produced	86.0 A	86.0 A	86.0 A	86.0 A
Current measured on SHUNT 2: "A + B + C"	**106.5 A**	**106.5 A**	**106.5 A**	**106.5 A**
(D) Current produced if Charger (SHUNT 5)	55.0 A	10.0 A		
(D) Current produced if Converter (SHUNT 5)		0.0 A	-70.0 A	-25.0 A
(F) Current consumed by the 12/24V DC loads	-28 A	-28 A	-28 A	-28 A
Current measured on SHUNT 1: "F + D or D'"	**27 A**	**-18 A**	**-98 A**	**-53 A**
TOTAL PRODUCTION DISPLAYED on the screen	**161.5 A**	**116.5 A**	**106.5A**	**106.5 A**
TOTAL CONSUMPTION DISPLAYED on the screen	**-28 A**	**-28 A**	**-98 A**	**-53 A**
TOTAL 12/24V DC CONSUMPTION	**-28 A**	**-28 A**	**-28 A**	**-28 A**
TOTAL 110/230V AC CONSUMPTION	**0 A**	**0 A**	**-70 A**	**-25 A**

3.2.4 Shunt connection with NMEA2000-compatible COMBI charger + converter

The use of a combi charger - converter is possible subject to:

- It being connected **after shunt 1 "Loads"**
- It having a NMEA2000 interface.



3.2.5 General power supply to the monitor

The permanent power supply to the monitor must be connected to the service battery. This power supply is independent of the voltage reference.
Protect the power line with a 1.0 A fuse.
A switch can be installed in series on the circuit, bearing in mind that calculation of the battery capacity will no longer be effective if the general power supply is cut off.

Connect the battery (+) and (-) respectively to terminals 1 and 2 on +BAT GND connector 2.

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3.2.6 Voltage reference

Install a 0.5 A fuse on the battery voltage reference cable as close as possible to the battery to avoid any risk of fire in case of short circuit.

Connect the battery (+) and (-) respectively to terminal 1 on connector 1 and on connector 2.

+BAT service BAT service -

Ensure that no electrical loads are connected on this cable. An electrical load would lead to a voltage drop which would distort the measurements and calculations of the battery manager.

3.2.7 Temperature probe

The temperature probe (optional) must be affixed to the top of one of the batteries in your service battery bank and connected to the appropriate connector.

Connect the probe to terminal 6 on connector 3 and connector 4.

+ T° NTC T° NTC -

Comments concerning wiring:

- It is very important to comply with the polarity (+) and (-) on the SHUNTS. Wiring using clearly identified wires will avoid considerable wasted time.
- Connections between the shunts must be as short as possible.
- To avoid any measurement mistakes, ensure the charging and discharging circuits are not muddled.
- Ensure that no other devices are connected on the measurement cables.
- Protect all the cables or wires effectively to prevent any risk of overheating or short circuits.

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3.3 AUXILIARY BATTERY BANK connection

For each battery bank, install a 0.5 A2A max fuse on the battery voltage reference cable as close as possible to the battery to avoid any risk of fire in case of short circuit.

For each battery bank, connect the battery (+) and (-) respectively to:

For auxiliary battery 1: terminal **4** on connector 1 and connector 2
For auxiliary battery 2: terminal **5** on connector 1 and connector 2
For auxiliary battery 3: terminal **6** on connector 1 and connector 2
For auxiliary battery 4: terminal **7** on connector 1 and connector 2

+ 0/36v In 1	In 1 0/36v -
+ 0/36v In 2	In 2 0/36v -
+ 0/36v In 3	In 3 0/36v -
+ 0/36v In 4	In 4 0/36v -

Comments concerning wiring:

- Use a perfectly insulated 2-conductor cable without interconnections.
- Ensure no other device is connected on the measurement cables to avoid introducing a voltage drop which would distort the measurements.

3.4 TANK GAUGE connection

Connect each gauge to inputs 1 to 4 of connectors 3 and 4.
Use resistive gauges which operate in the range 0 Ω to 300 Ω.

See Chapter 7 "Factory configuration" to adjust the range settings for each gauge and the calibration according to the shape of the tank.

+ 0/360Ω 1	0/360Ω 1 -
+ 0/360Ω 2	0/360Ω 2 -
+ 0/360Ω 3	0/360Ω 3 -
+ 0/360Ω 4	0/360Ω 4 -

Comment concerning wiring:

- Use a perfectly insulated 2-conductor cable without interconnections.

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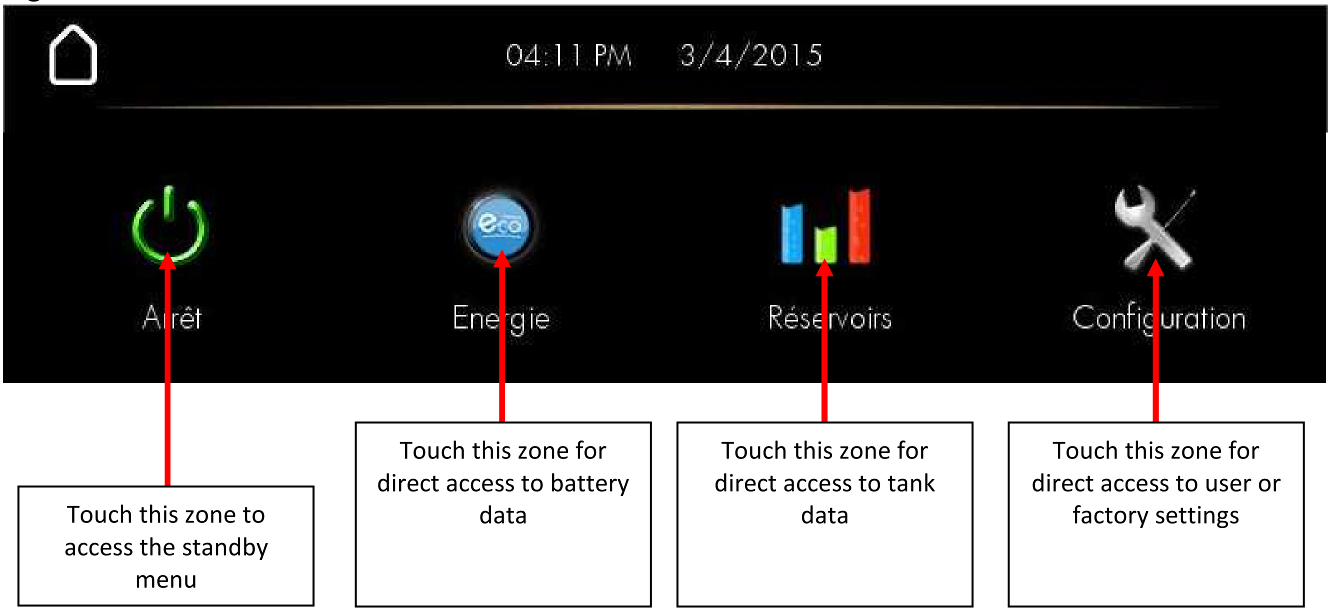
4 TOUCHSCREEN NAVIGATION AND SCREEN SEQUENCING

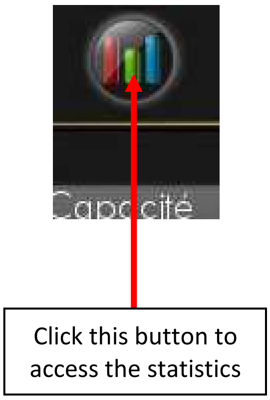
4.1 Navigation

The NAVYLEC ECO CRUISING monitor has a wide 7" resistive touchscreen. This means it can be used even with gloves or a plastic stylus.

To access a screen or function, simply click naturally on the button or zone provided for this purpose.

E.g.:





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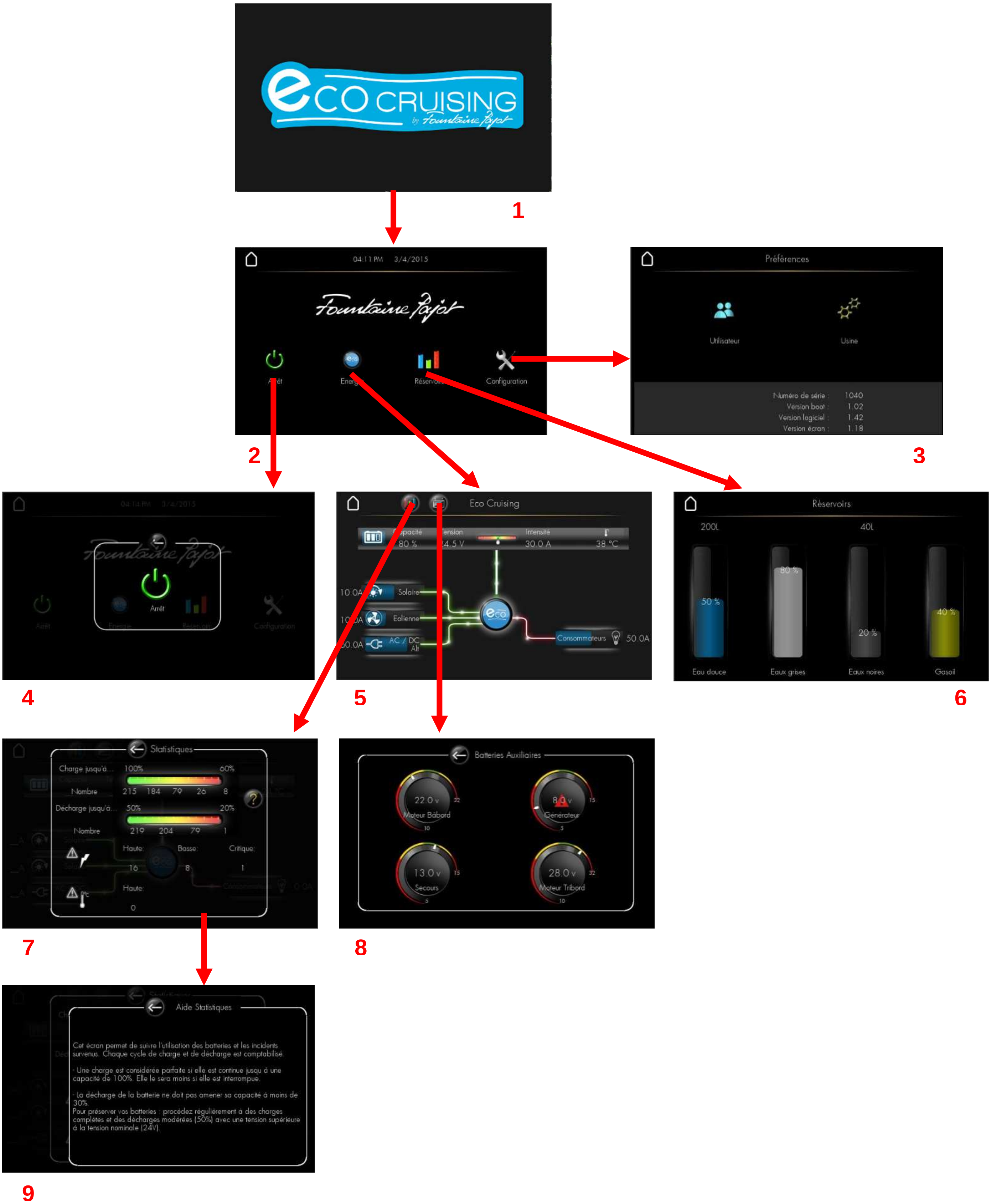
4.2 Daily use



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4.3 User configuration

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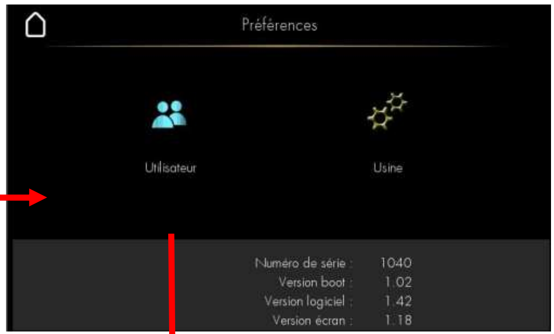

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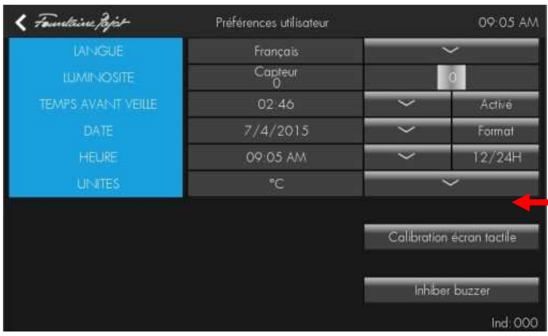

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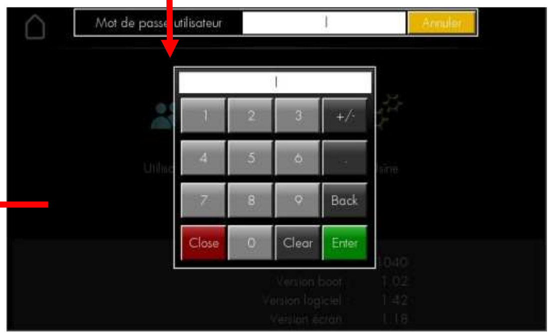

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4.4 Factory configuration

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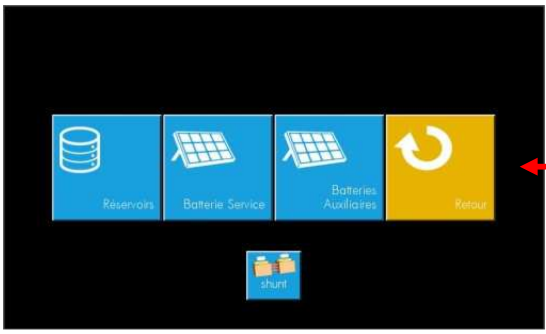

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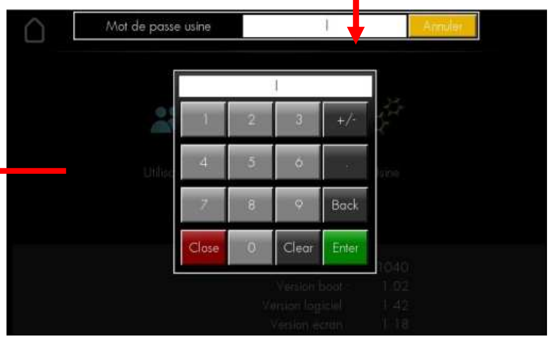

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5 DESCRIPTION OF THE INTERFACES

5.1 Service battery screens

One of the innovations of the ECO CRUISING monitor is that it measures and displays the **currents produced** separately from the **currents consumed**. Thus, the skipper can easily anticipate the reduction of his/her loads or conversely start up additional charging devices.

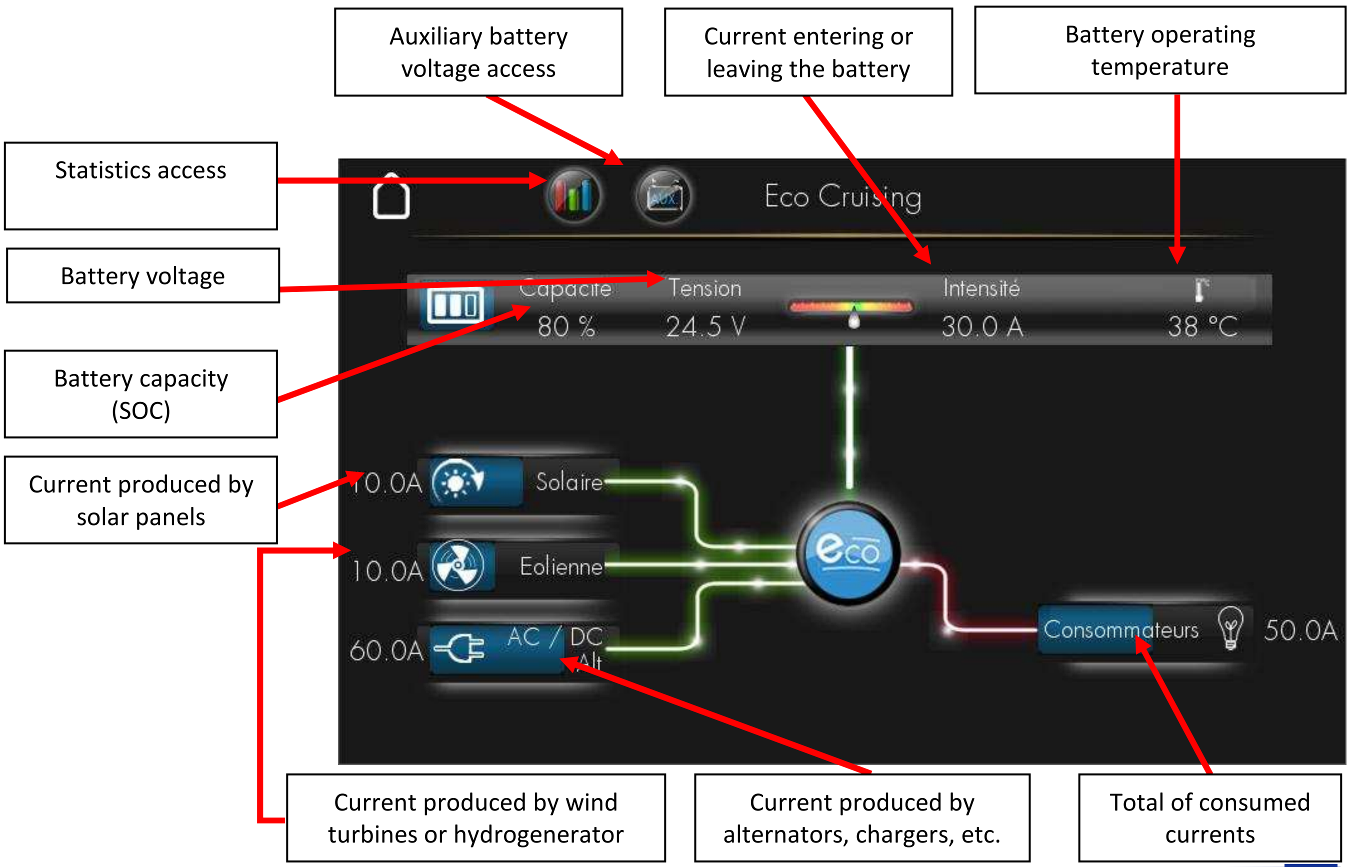
This feature is a major difference in relation to the current systems which only show the current crossing the battery!

The battery capacity expressed in %, sometimes referred to as SOC (State Of Charge) represents the % energy available in the battery at a given moment out of the total available if it was fully charged.

5.1.1 Description of the service battery screen depending on the configuration of the equipment [☞7.1]

In the following pictures, some labels (SOLAR, WIND/HYDRO, Alternator, etc.) may be named differently in another configuration, depending on the configuration of the equipment.

Mode 1: 4-shunt assembly with **separate charger and converter** [☞3.2.1]:



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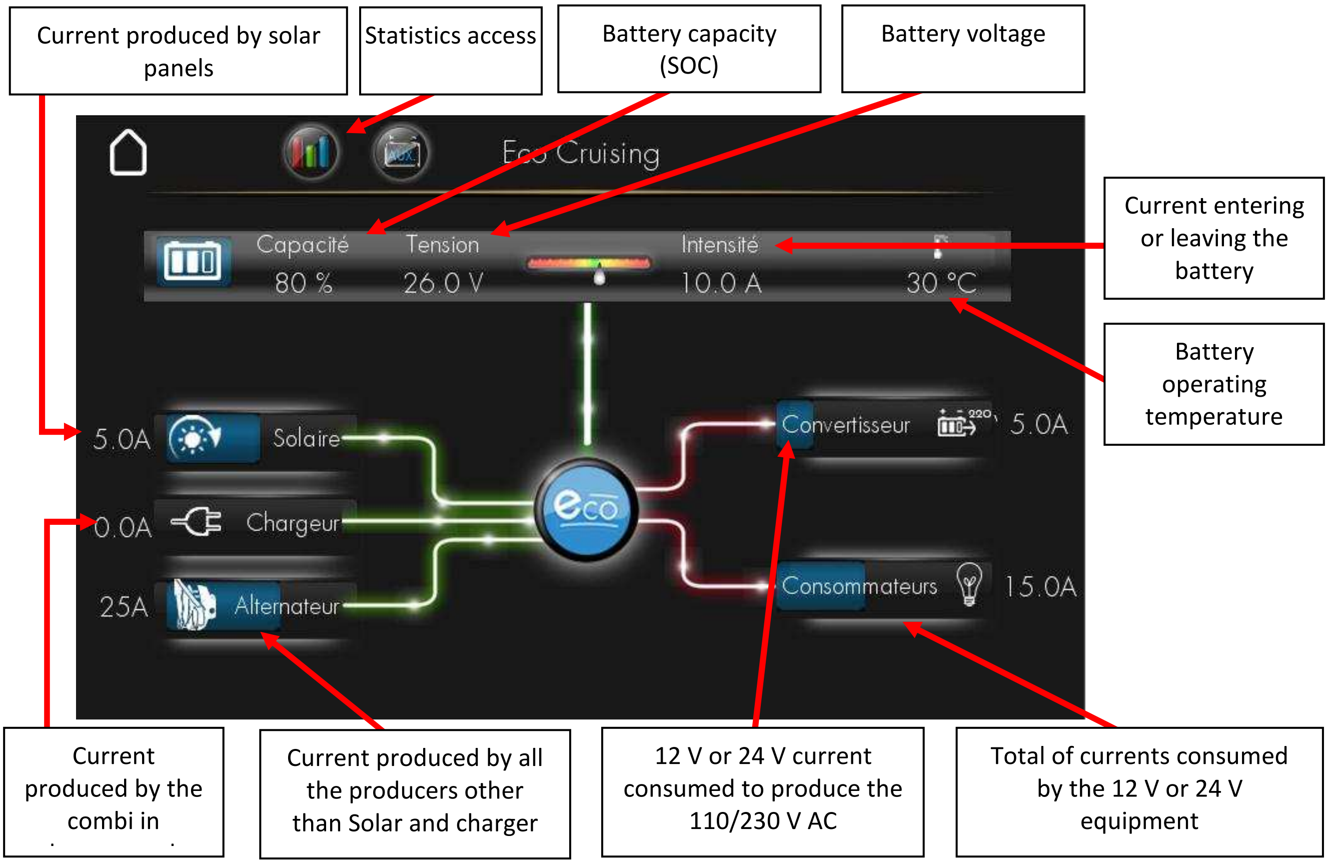
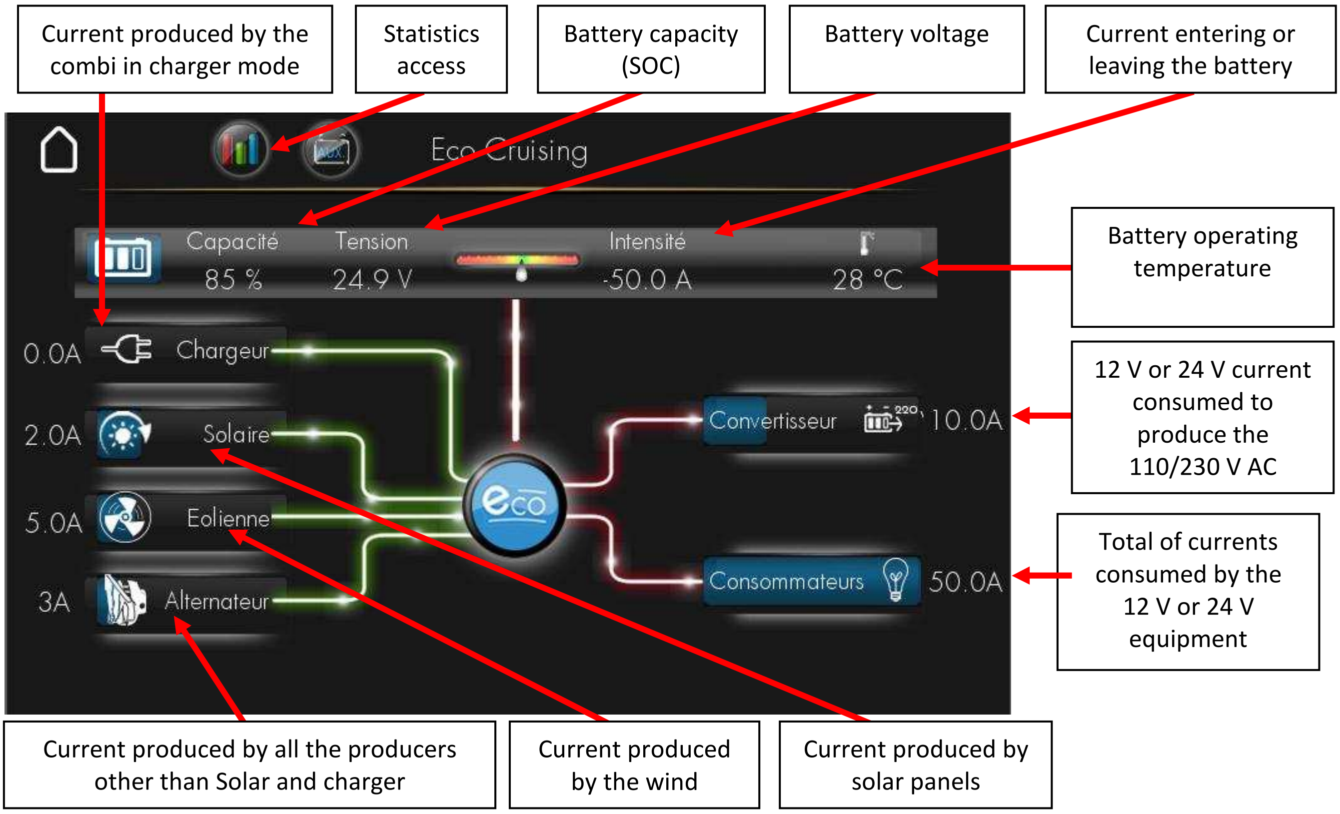
Mode 2: **4-shunt** assembly with **COMBI charger + converter** [☞3.2.2]:



Mode 3: assembly with **5 shunts** OR **NMEA2000** with **COMBI charger + converter** [☞3.2.3]&[☞3.2.4]:



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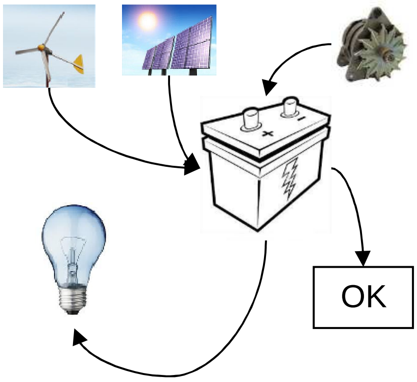
5.1.2 Role of the battery manager, calculation of remaining capacity



The NAVYLEC 470-ECO1 manager instantaneously supplies a clear vision of the state of the battery charge, displaying the currents separately to give a good understanding of the vessel's electrical situation.

Measuring the battery charge status involves permanently monitoring the current entering and leaving the battery. To measure this current accurately, 2 shunts are used to measure the **currents PRODUCED** and the **currents CONSUMED** separately.

This remarkable feature is a NAVYLEC innovation. By dissociating the currents produced from the currents consumed, it is possible to interpret specific operating situations and allow skippers to anticipate decisions which were previously hidden when all the measurements were combined. (Impossible to assess the current produced directly absorbed by the loads).

The manager has a complex algorithm which precisely records and monitors changes in:

- the currents produced (battery charge) and consumed (battery discharge),
- the voltage of the battery in all its operating modes,
- the basic characteristics of the battery (capacity, technology, etc.),
- battery usage history,
- temperature,
- etc.

A voltage measurement provides information concerning correct functioning of the recharging devices and the battery's state of health. It also allows end of battery charge conditions to be detected and calculation of the state of charge to be refined when fully charged status is neared.

The battery temperature is measured optionally for operating security reasons, as above 50 °C, recharging a battery can cause accelerated ageing, or even thermal runaway and lead to damage in the battery room which may end in fire.

When the battery is discharging, **an autonomy indicator**☞5.3 gives an estimate of the remaining operating time for the equipment before the capacity falls below a reserve value (25%). This indication should lead the user to take the necessary measures to conserve battery power, either by triggering a generator or limiting the consumption of certain non-necessary equipment.

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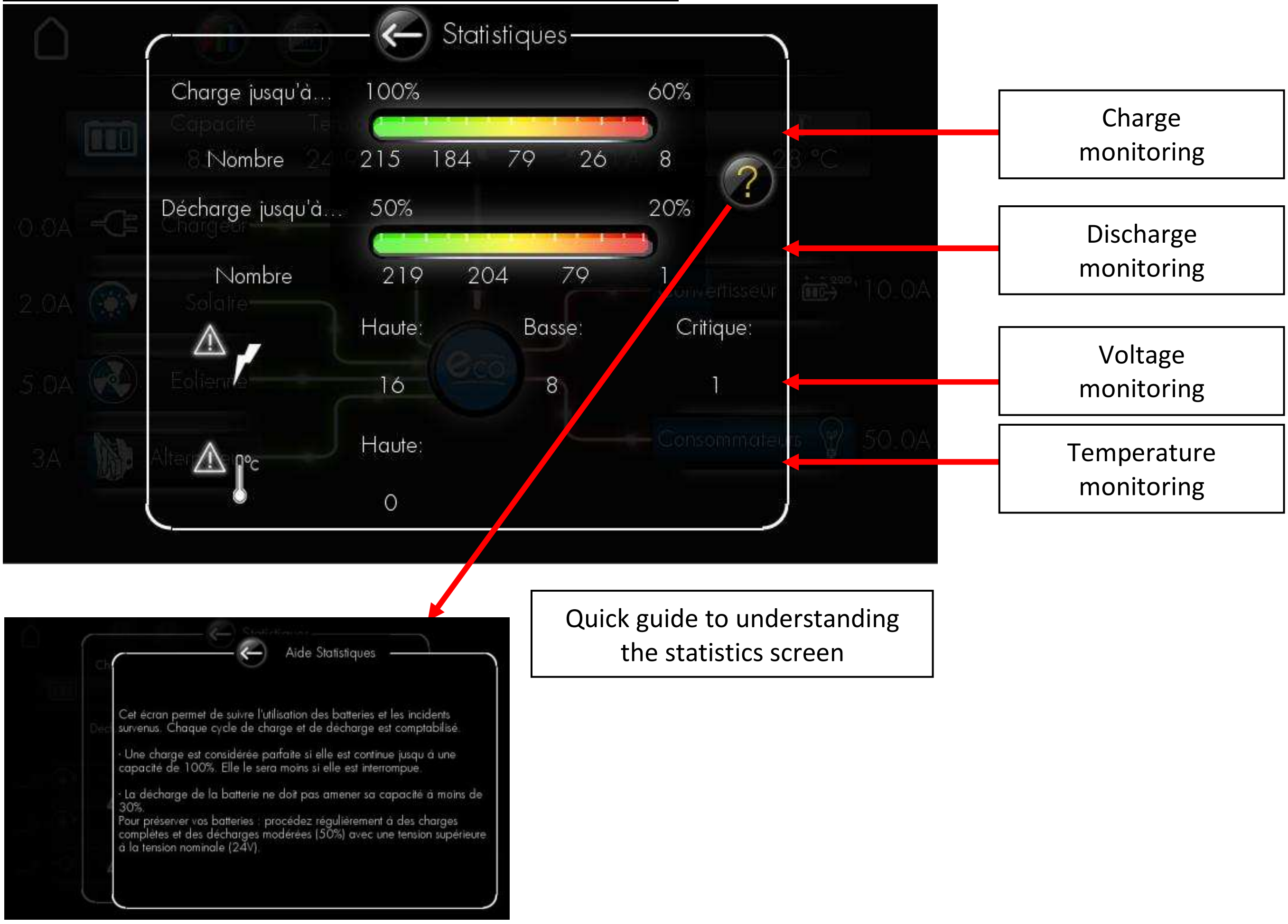
5.2 Service battery statistics screens

Access the statistics window by pressing the [button icon] service battery screen button.

The statistics screen allows the battery history to be taken into account and possibly to understand the causes of any malfunction.

3 types of statistics are managed by the device related to:
- **the state of charge,**
- **the voltage,**
- **the temperature.**

Statistics screen related to use of the service batteries:



The statistics linked to the charge status allow understanding of the cycling imposed on the battery:
- **An ideal charge** consists in charging the battery to 100 % capacity in one go.
- **Discharge** should not bring the capacity to less than 45 %.

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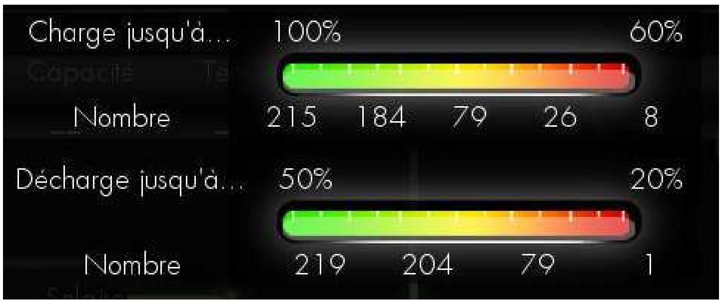
A] Statistics indicators concerning battery charge and discharge status



These 2 innovative indicators allow good and bad usage of your batteries to be monitored.

If necessary, they will help you better manage your charging and discharging cycles, management of your loads, use of your charging resources (wind turbine, hydrogenerator, generator, chargers, alternators, etc.)

To avoid recording insignificant events, the Navylec monitor adopts a few simple rules:

Battery discharge: Levels indicated are considered to be reached as soon as you move into the extended threshold zone. For example "40% capacity" corresponds to the zone between 35 and 44% inclusive. Thus, when the charge status descends to 44%, the 40% threshold is considered to be reached.

Battery recharging: conversely, the thresholds when recharging must be exceeded to be recorded. Thus, to record a threshold of 90%, this value must be reached. At 89%, the 80% threshold would be taken into account.

Situations with plateaus and small changes: To avoid recording non-representative thresholds, if discharging moves capacity successively into the 50% zone, then 40, then 30, and stops at 30%, the NAVYLEC monitor will only record the lowest threshold (30% in this example).
The NAVYLEC monitor only memorises the lowest charge value obtained. If the charge status rises above this value by 10%, the lower threshold is recorded. The same procedure applies to upward thresholds.

2 exceptions to this method of operation:

- When the threshold reaches 20% (i.e. under 24% inclusive), critical threshold level is immediately taken into account. If the installation were to suddenly shut down, the monitor would have already memorised the incident.
- The monitor will record a successful 100% charge if this charge is maintained for at least 10 minutes. If not, the threshold of 90% will be adopted.

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B] Statistics indicators concerning battery voltage

The voltage statistics concern 3 values: a critical voltage, a low voltage and a high voltage.

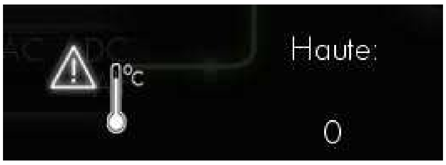
- **Critique** (*Critical voltage*) may be due to a very high current peak when the battery charge is low or with a deeply discharged battery. This situation should be strictly avoided as it is very destructive.

- **Basse** (*Low voltage*) often indicates a lack of battery recharging. It therefore means the batteries should be recharged more often or better daily energy management.

- **Haute** (*High voltage*) generally indicates
    - A malfunction or incorrect adjustment of the charger;
    - Batteries in poor condition or an damaged element;
    - A connection problem between the charger reference and the battery bank.

  High voltages are often synonymous with battery overheating.

C] Statistics indicators concerning battery temperature



The temperature statistic records the number of times the temperature exceeds the programmed alarm value, generally 45°C.

This value should be equal to "0".

If not:
- Check that the battery has not been excessively used at a capacity of less than 30% (SOC).
- Disconnect all the batteries and check the voltage of each battery independently. Isolate and possibly replace the faulty batteries.
- Check the status and setting of the battery charger in relation to the battery characteristics.
- Check all the connections between the batteries and the production sources.

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5.3 Remaining battery capacity

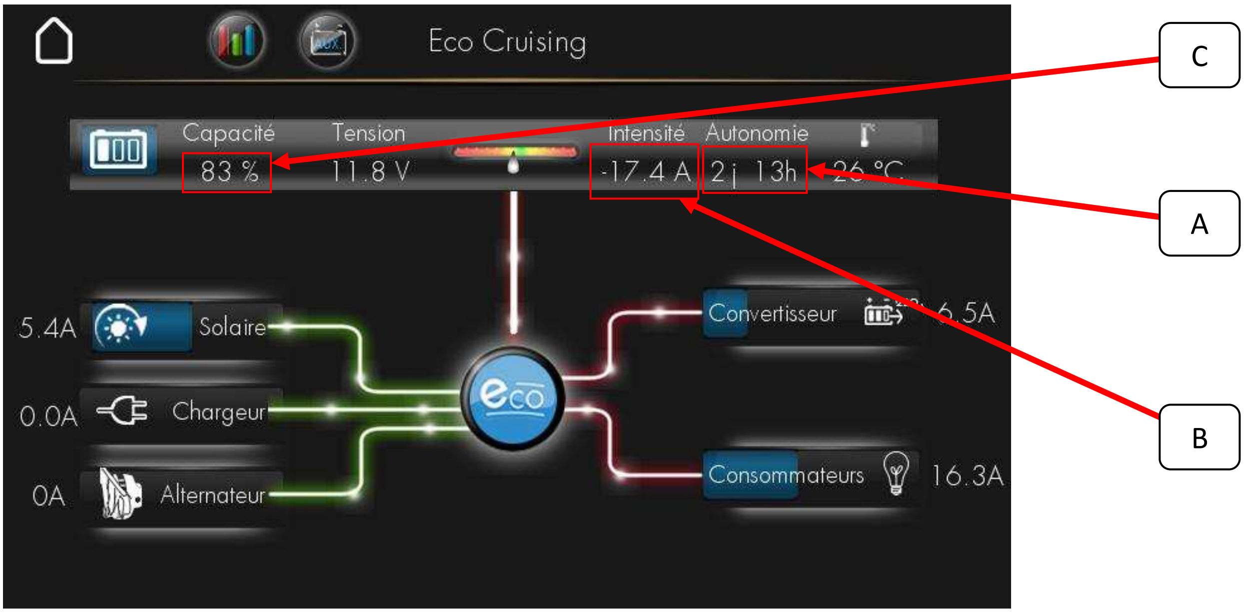
As soon as the battery is discharging, i.e.:

- When all the charging devices are stopped;
- When the charging devices are no longer sufficient to compensate for the electrical loads and the battery is supplying the energy.

The remaining capacity [A] at stable current will be displayed in the battery capacity bar graph.

Notes:

- This display will only appear for capacity less than 3 days.
- The time shown corresponds to battery capacity [A] in Days(*j*) /hours(*h*) for the constant current indicated [B] to reduce battery capacity [C] to 25%.



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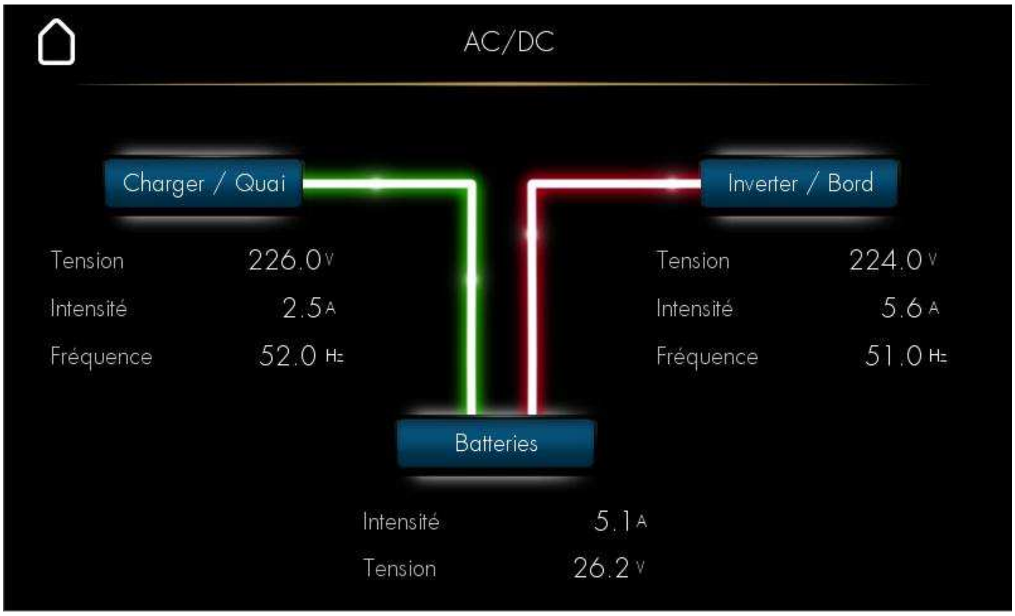
5.4 Combi DC/AC converter + charger screens in NMEA2000 mode



If your installation uses a **COMBI Charger + Converter** configured in **NMEA2000** ☞7.1.2you have a screen where you can view the parameters and operating status of your equipment.

Note:
On a boat which is not connected to the quayside, integrated equipment (COMBI) can consume over 2A @12 V with no load in converter mode without any 230 V loads being connected.

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5.5 Auxiliary battery screens

The monitor can display the voltage of 1 to 4 separate batteries. The example above corresponds to a configuration of 3 auxiliary batteries.

Depending on the configuration of the auxiliary batteries paragraph [☞7.2], the screen automatically displays the values measured in the appropriate voltage range.

Key:

	Severe fault zone with risk of damage to the batteries or overheating which may lead to an outbreak of fire.
	Correct operating zone with low current or normal voltage zone without current. Battery in floating charge mode (maintains a 100% capacity)
	Operating zone with a moderate or high discharge voltage and current (consumption) Presence of a battery recharging source (alternator, charger, etc.)
	The voltage of the battery in question is abnormal. This indicator follows the triggering of an audible alarm.

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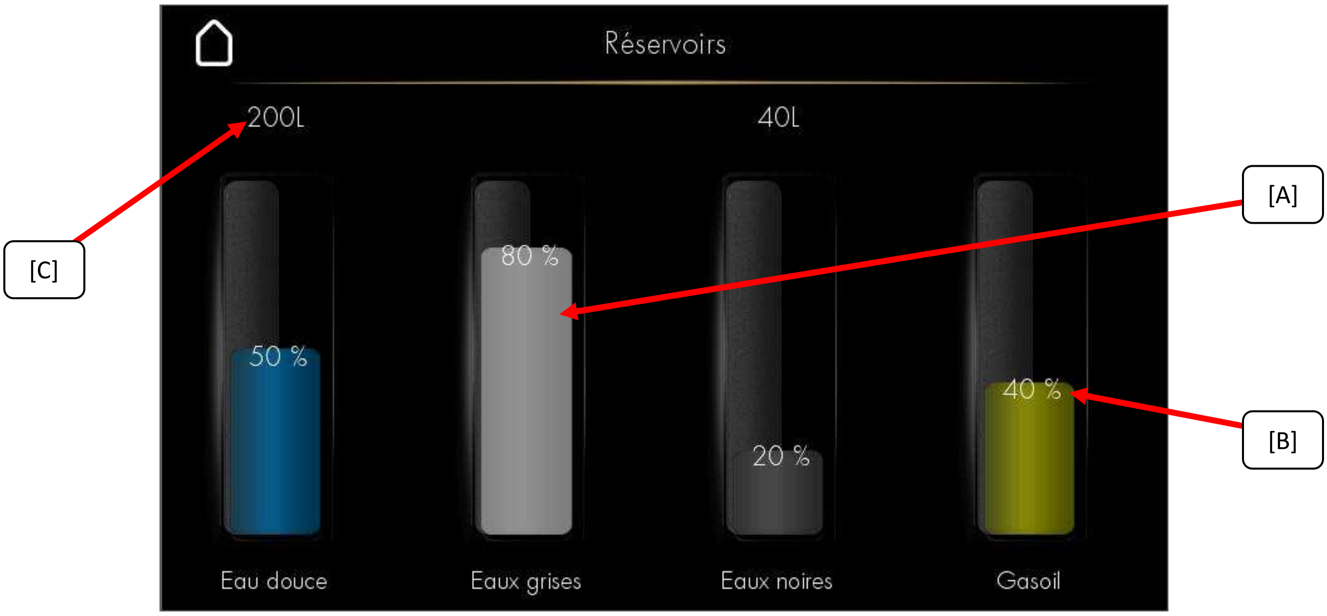
5.6 Tank gauge screens



Depending on the configuration of the tanks [☞7.3], the screen automatically displays:

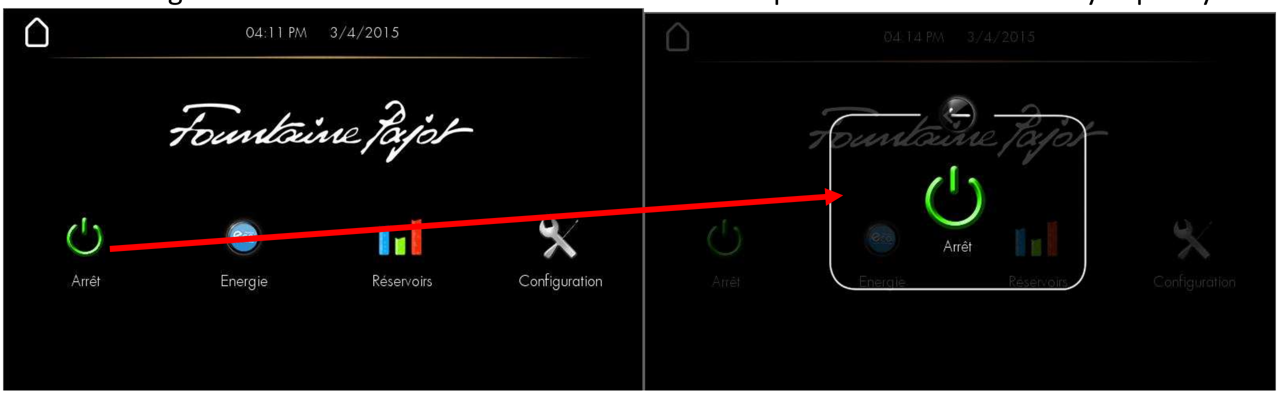
- The tank level between 0 and 100% in the form of a bar graph [A];
- The tank level between 0 and 100% in numerical form [B];
- Depending on the configuration, the volume of liquid in the tank [C].

5.7 Shutdown & Standby

From the main screen, click on the standby button and confirm in the window according to your choice.

The monitor will switch off all unnecessary systems to allow only:

- The monitor to be reactivated by touching the screen or coming close to the screen (if your monitor is fitted with optional radar);
- Voltages and currents to be monitored in order to update the service battery capacity.



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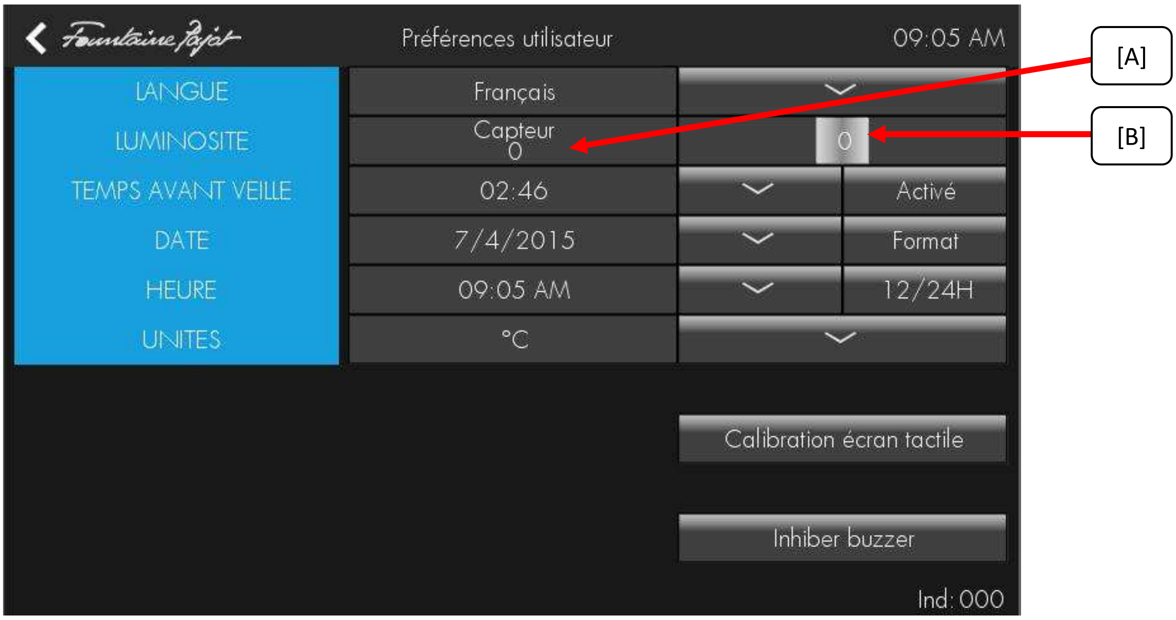
6 USER CONFIGURATION



6.1 "Langue" (*Language*) setting

Select the desired language directly from the list available by clicking the corresponding  button.

6.2 "Luminosité" (*Brightness*) setting

The NAVYLEC monitor has an ambient light sensor to automatically adjust the brightness of the screen. This value is displayed in [A] for checking purposes.
The brightness of the screen can be increased or decreased in proportion to the ambient light:

- Move the cursor [B] to the right for the screen to be brighter;
- Move the cursor [B] to the left for the screen to be dimmer.

6.3 "Temps avant veille" (*Standby time*) setting

To reduce the monitor's electricity consumption, it is possible to program an automatic standby time. After a period of inactivity corresponding to the selected time, the Monitor will switch off as though you had put it into standby mode yourself [5.7]. Simply pressing on the screen will wake up the monitor.

This function can also be deactivated (pressing the 

button switches from one mode to the other).

6.4 "Date/Heure" (*Date and time)*" setting

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Select the desired date and time directly using the drop-down menus by clicking on the corresponding button.

6.5 Touchscreen calibration

The NAVYLEC monitor uses a resistive touchscreen. This screen can sometimes require recalibrating. To do so,

- take a suitable stylus which will not damage your screen,
- click on the "Calibration écran tactile" (*Touchscreen calibration*) button and follow the instructions which will be displayed on the screen.

6.6 Inhiber buzzer (*Disabling the buzzer*)

The monitor's internal buzzer can be deliberately disabled to avoid any audible alarm caused by an identified problem at night for example.

It is important to re-enable this buzzer to be warned of any anomaly which may seriously damage your batteries.

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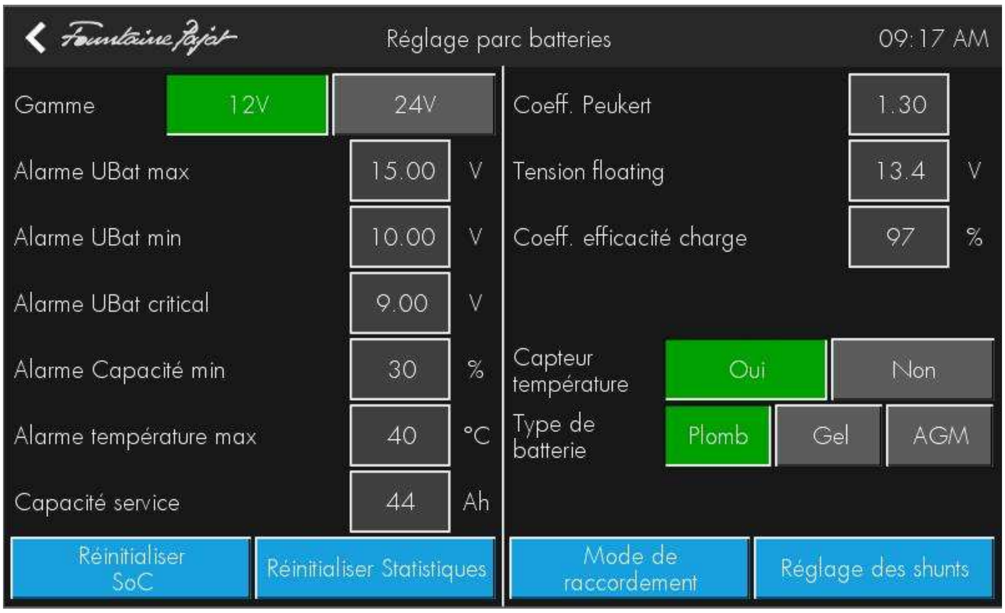
7 FACTORY CONFIGURATION

7.1 Service batteries



Gamme 12V ou 24V (***12V or 24V range***)	Select the voltage of your service bank
Alarme UBat Max (***Max Batt V Alarm***)	Upper red zone on the voltage indicator. Value taken into account for the "High voltage alarm" statistic threshold Exceeding this setpoint triggers an audible signal and a warning light
Alarme UBat Min (***Min Batt V Alarm***)	Lower red zone on the voltage indicator. Value taken into account for the "Low voltage alarm" statistic threshold Exceeding this setpoint triggers an audible signal and a warning light
Alarme UBat Critical (***Critical Batt V Alarm***)	Value taken into account for the "Critical voltage alarm" statistic threshold
Alarme Capacité min (***Min Capacity Alarm***)	Lower red zone on the voltage indicator. Exceeding this setpoint triggers an audible signal and a warning light
Alarme température max (***Max Temperature Alarm***)	Red zone on the battery temperature indicator Exceeding this setpoint triggers an audible signal and a warning light
Capacité service (***Service Capacity***)	Set the capacity for a discharge coefficient C/20h [☞7.1.3]
Coeff. Peukert (***Peukert Coeff.***)	Adjust the coefficient corresponding to the batteries used [☞7.1.4]
Tension floating (***Floating Voltage***)	Adjust the voltage corresponding to the batteries used [☞7.1.5]
Coef. Efficacité charge (***Charge Efficiency Coeff.***)	Adjust the coefficient corresponding to the batteries used [☞7.1.6]
Capteur temperature (***Temperature Sensor***)	Select *OUI* (YES) if a temperature probe is connected to the monitor or to the combi charger + converter if the latter is connected via the NMEA2000 interface
Type batterie (***Battery type***)	Select the battery technology used

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Réinitialiser le SOC (*Reset the SOC*)	Reset the capacity %. (Memorised when starting up if an incorrect value was indicated during shipyard tests for example)
Réinitialiser Statistiques (*Reset Statistics*)	Reset the statistics before delivering the ship or after replacing a battery bank
Mode de raccordement (*Connection mode*)	To access the screen to configure the type of charger / converter installed Used to modify the labels and logos on shunts 3 and 4
Réglage des Shunts (*Shunts setting*)	To access the shunt configuration screen
Fountaine Pajot	Click on the "Fountaine Pajot" logo to memorise and return to the previous page

7.1.1 "Shunts" setting

Intensité (*Current*)	Rating in amperes of the shunt connected to the input. Generally from 10 A to 600 A or 1000 A
V	Sensitivity in mV of the shunt connected to the input in question (generally 50 mV or 100 mV)
Intensité Max. (*Max.Current*)	Enter the maximum normal current for the input in question. This value is only used by the graphical interface so that 100 % of the bar graph corresponds to the value entered. If a higher value were to be measured, the bar graph would remain at the maximum position.

Fountaine Pajot	Click on the "Fountaine Pajot" logo to return to the previous page

Notes:

The shunt 2 zone [A] is used to measure the sum of the currents produced. This value is not represented in the form of a bar graph. Therefore there is no need to enter the "Intensité Max." (*Max. Current*)

The "AC/DC - Alt" zone [B] is a calculation between the sum of the currents produced and the production recorded by shunts 3 and 4.

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7.1.2 Assembly

Adjustment of the type of Charger - Converter:

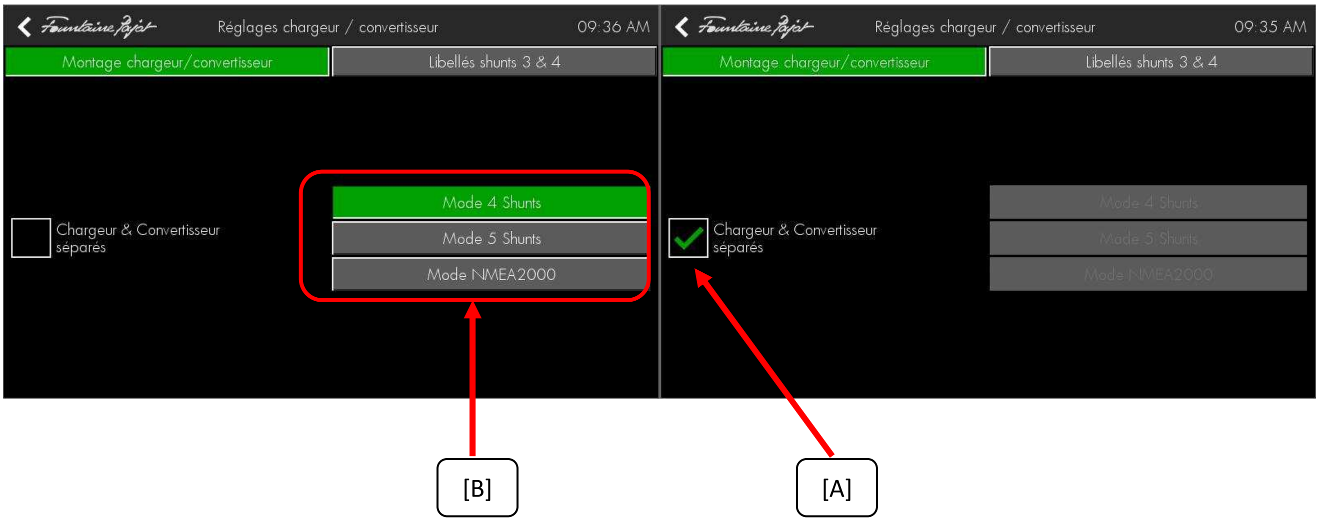
Select the type of Charger - Converter installed as described in chapter [☞3.2]:

☑ You do not have a 12/24 V DC to 110/230 V AC converter or your charger and converter are independent:

- check selector [A]

☑ You have an integrated Charger + Converter (COMBI):

- do not check selector [A]
- Using selector [B] select the type of assembly / wiring realised according to the diagrams described in paragraph [☞3.2]



Adjustment of the type of Charger - Converter:

Select the type of production source you have connected for shunt 3 and shunt 4. This information will automatically be taken into account in the graphical interface.

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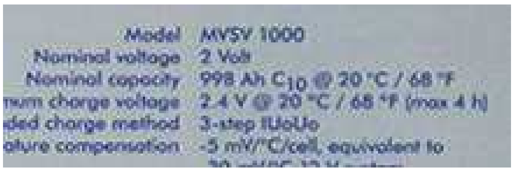
7.1.3 "Service capacity" setting

The NAVYLEC monitor uses a capacity termed C20 which corresponds to the capacity for a discharge rate in 20 hours (C20).

This value C20 is generally indicated on the battery. If this is the case, enter it directly in the configuration screen.

If the capacity is given for a different discharge rate (e.g. 10), the value of the capacity given by the manufacturer must be corrected using the indicated discharge rate and the Peukert exponent.



The general equation is as follows: $C20 = [(20 / R)^{((n-1)/n)}] \times CR$

Where R is the rate expressed on the battery (e.g. 10 for 10 hours), CR is the value read (e.g. 100 A.h) and n is the Peukert exponent.

We provide you with a chart which calculates the value between the square brackets directly for different values of n and R.

Multiply the value read in the table by the capacity read on the battery to obtain the C20 capacity to enter in the manager.

C20 = C10 x R

		N (peukert)										
Rp	**20**	**1**	**1.05**	**1.1**	**1.15**	**1.2**	**1.25**	**1.3**	**1.35**	**1.4**	**1.45**	**1.5**
R	**5**	1	1.068	1.134	1.198	1.26	1.32	1.377	1.432	1.486	1.538	1.587
	10	1	1.034	1.065	1.095	1.122	1.149	1.173	1.197	1.219	1.24	1.26
	20	1	1	1	1	1	1	1	1	1	1	1
	25	1	0.989	0.98	0.971	0.963	0.956	0.95	0.944	0.938	0.933	0.928
	50	1	0.957	0.92	0.887	0.858	0.833	0.809	0.789	0.77	0.752	0.737
	100	1	0.926	0.864	0.811	0.765	0.725	0.69	0.659	0.631	0.607	0.585

E.g. for a battery capacity C10 = 100 A.h and a Peukert exponent of 1.25, the factor to apply is 1.149, or a capacity C20 = 100 x 1.149 = 115 A.h.

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7.1.4 "Peukert coefficient" setting

As far as possible, enter the value indicated on the data sheet for the battery used.

If this value is not given or if you do not have a data sheet, use the generic values given opposite:

Battery technology	Generic Peukert coefficient
Lead-acid	1.30
Gel & AGM	1.20
Li-Ion & Ni-MH	1.05
Ni-Cd	1.15

More details

The Peukert exponent reflects the fact that the capacity of a battery depends on its discharge rate: the higher the current, the lower the capacity.

The general relationship between the battery capacity, the current and the time is in the form:
$Cr = Td \times I^n$
Where
- Cr is the battery capacity in A.h,
- Td is the discharge time in hours
- I, the corresponding current
- n, the Peukert exponent.

The formula I^n indicates that the current is raised to the power n.
The higher the exponent, the higher the effect of the current on the battery, the Peukert exponent being 1 at best for a battery which will not have a Peukert effect and 1.6 at worst.

The battery manufacturers indicate a capacity value in A.h for a duration which is generally 20 hours. For example, a C20 battery of capacity 100 A.h indicates that its capacity is 100 A.h for a discharge of 20 hours with a current of 5 A.

Due to the Peukert effect, this battery subject to a 10 A current (therefore twice as high) will discharge in less than 10 hours (half of 20: e.g. 9 h). Its apparent capacity would therefore be 90 A.h for a 9A current.

Some manufacturers indicate the Peukert exponent in the documentation for their batteries but most of the time the exponent is not available.

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7.1.5 "Floating voltage" setting

The **floating voltage** is the voltage at which a battery can be permanently on charge to combat self-discharging and avoid it drying out by electrolysis.

At the end of the absorption phase, the battery is considered to be full. However, the adsorption voltage is sufficiently high to create a recharge current in the battery and this phase must not exceed a few hours. It is programmed in the charger logic and often combines current measurement and an operating time t (e.g. 4 hours absorption maximum).

Thus, at the end of charging, either the charger stops, or it moves to maintenance charge (or floating charge) i.e. with a reduced voltage to avoid evaporation of the battery's electrolyte. In this phase, the charger can instantaneously exit the maintenance phase to cope with a sudden demand from the network (a load starting up).

The floating voltage values are normally available on the battery manufacturers' website, and can also be given in the charger manual.

Values commonly encountered:

Battery technology	Floating voltage
Lead	13.2 to 13.5 V
Gel	13.8 V
AGM	13.4 V

7.1.6 "Charging coefficient" setting

This is the ratio of the incoming current to the outgoing current in order for a battery to be restored to its initial status. A battery requires more current to be restored in order to return to its initial status.

More scientifically, this coefficient concerns battery recharging. It corresponds to an efficiency to be compared to the Faraday efficiency of the battery.

This efficiency value depends on the battery technology.

The coefficient indicated by the battery manufacturer can be used if it is available.

Values commonly encountered:

Battery technology	Charging coefficient
Lead-acid	90 %
AGM	> 95 %
Li-Ion & Ni-MH	> 98 %

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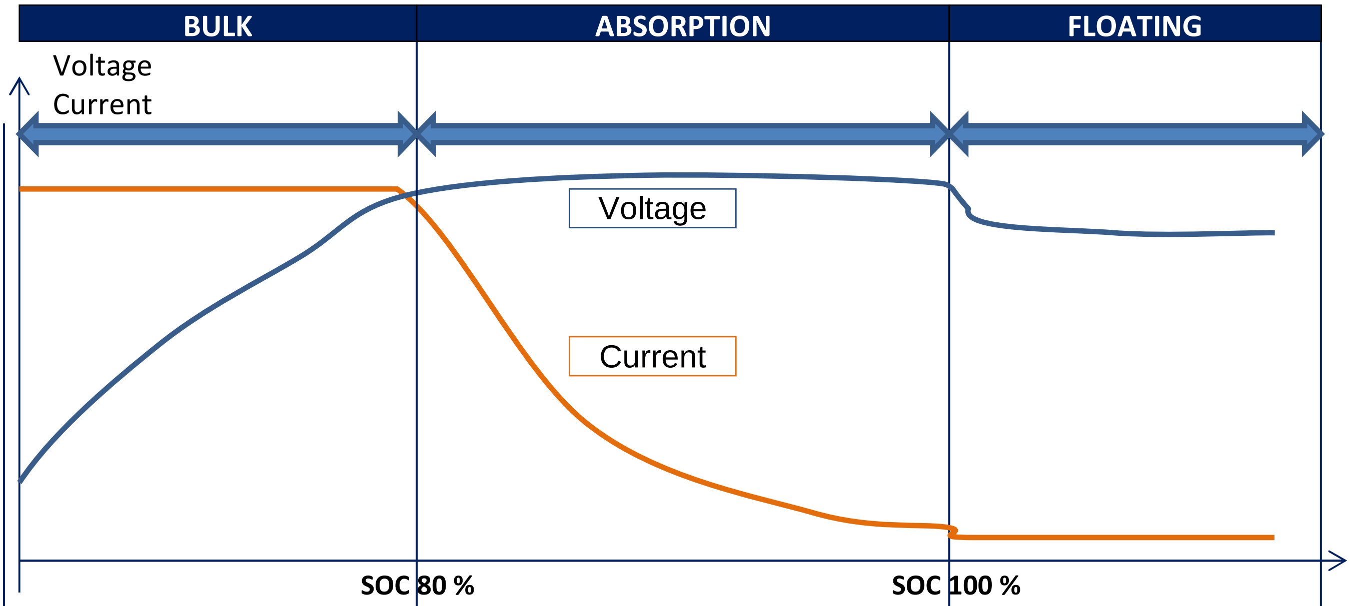
7.1.7 Reminder of the charging cycles of a battery



The current is maximum. It is limited by the charger. Its value must remain under C20/4. The voltage continually rises. At the end of this phase, the battery is approximately at 80% charge	The battery accepts less and less current. The charger must regulate its voltage to a value compatible with the battery (absorption voltage). This voltage is to be adjusted on the charger by choosing the correct type of battery. At the end of this phase, the battery is at 100 % charge.	The voltage is regulated by the charger so that there is no evaporation of the electrolyte (degassing). The current is very low. It maintains the battery without charging it. The charge remains at 100%.

Remember to reset the statistics and SOC before delivery of the boat.
This reset must be done after fully charging the batteries.

This operation will need to be renewed if battery replacement occurs. In this case, the parameters of the batteries must be adjusted accordingly.

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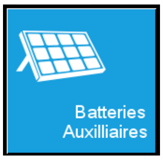
Auxiliary batteries

From the Factory Configuration menu,
Click on the button:



Auxiliaire 1 (*Auxiliary 1*)	Tab for configuration of the first auxiliary battery
Auxiliaire 2 (*Auxiliary 2*)	Tab for configuration of the second auxiliary battery
Auxiliaire 3 (*Auxiliary 3*)	Tab for configuration of the third auxiliary battery
Auxiliaire 4 (*Auxiliary 4*)	Tab for configuration of the fourth auxiliary battery

According to the number of batteries you wish to monitor, check or uncheck the activation box [A] in each tab.

Adjust the parameters for each battery:

Tension 12V ou 24V (*12V or 24V Voltage*)	Select the voltage of your service bank
Alarme tension minimale (*Minimum voltage alarm*)	Lower red zone on the voltage indicator. Value taken into account for the "Low voltage alarm" statistic threshold Exceeding this setpoint triggers an audible signal and a warning light
Alarme tension maximale (*Maximum voltage alarm*)	Upper red zone on the voltage indicator. Value taken into account for the "High voltage alarm" statistic threshold Exceeding this setpoint triggers an audible signal and a warning light
Nom parc batterie (*Battery bank name*)	From the 7 possible choices, select the name you wish to see in the "Batteries auxiliaires" (Auxiliary Batteries) screen [☞5.5]

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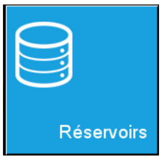
7.2 Tanks

From the Factory Configuration menu,
Click on the button:



[A]

Réservoir 1 (*Tank 1*)	Tab for configuration of the first tank
Réservoir 2 (*Tank 2*)	Tab for configuration of the second tank
Réservoir 3 (*Tank 3*)	Tab for configuration of the third tank
Réservoir 4 (*Tank 4*)	Tab for configuration of the fourth tank

According to the number of tanks you wish to monitor, check or uncheck the activation box [A] in each tab.

Adjust the parameters for each tank:

Capacité (*Capacity*)	Enter 0 if you do not wish the tank level indicator to give an indication in litres (just in %) Enter the total volume of your tank if you wish the volume to remain displayed on the tank screen [☞5.6]
Nom du réservoir (*Tank name*)	From the 4 possible choices, select the name you wish to see in the "*Réservoirs*" (Tanks) screen [☞5.6]
Points d'étalonnage (*Calibration points*)	Adjust the curve for each tank as indicated in the paragraph [☞7.3.1]

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7.2.1 Tank calibration points setting

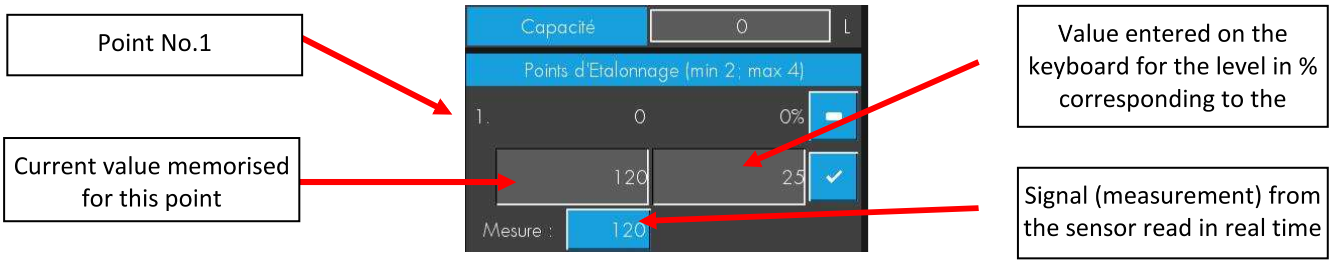
Each tank can be calibrated in advance or when the tank is filled for the first time. You can enter a calibration curve composed of up to 3 lines (4 points).

If it is not possible to calculate the volume of complex tanks with complete accuracy, this 4-point calibration will come close to the actual value with a high degree of efficiency.

 Click here to add a new point (up to a maximum of 4)

 Click to delete the last point added

 Click to validate a point



Each calibration point is composed of:

- The value from the sensor read in real time
- Value entered on the keyboard for the level in % corresponding to the position of the sensor.

☞ Input of the calibration points must be performed from **the minimum <u>signal</u> to the maximum <u>signal</u>**.

☞The lower level can be different to "0 %" and the upper level can be different to "100 %".

☞Choose your points carefully according to the shape of your tank.

<u>Method:</u>

Click the "+" buttons to add the first calibration point.	

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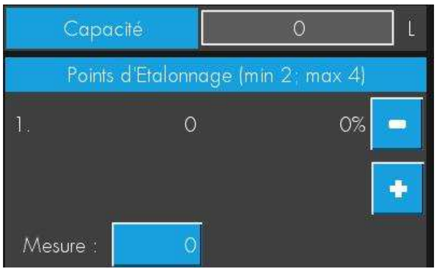
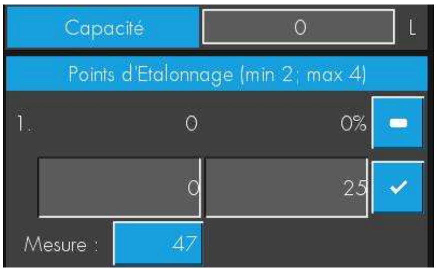
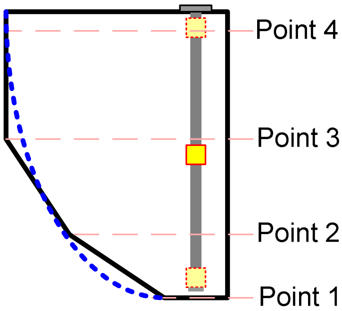
Enter the % corresponding to the level of the liquid. Here, 0% corresponds to the empty tank.
☺ Check that the value read by the monitor seems correct.
Memorise the value by touching the blue measurement zone (*Mesure*): the value appears in the box on the left (here 0).
Confirm your point by clicking on the buttons "✓".



Click on the "+" button to add the second point and so on.

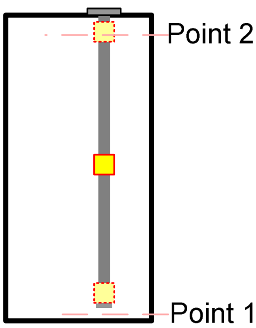


<u>Example with a complex tank with a WEMA type gauge:</u>



Point	Gauge value Ω	Capacity %
1	0	0 %
2	80	13 %
3	201	46 %
4	363	100 %

<u>Simple example with a WEMA type gauge:</u>



Point	Gauge value Ω	Capacity %
1	0	0 %
2	363	100 %

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