OPERATING INSTRUCTIONS

Battery/Tank Monitor BTM2

Thank you for purchasing the Battery / Tank Monitor BTM2.
This gives you one of the most advanced and accurate battery / tank monitors available on the market.

Battery monitor:

You can see at a glance:

- the current state of charge
- charge and discharge currents
- the battery voltage
- the remaining operating time until the adjustable capacity alarm of the main battery
- the voltage of up to 2 additional batteries
- the currents of a solar system and the charger (optional)

and have the possibility

- connect a second shunt SHP to measure e.g. the current of the solar system.
- connect a philippi charger ACE to monitor the charging process.
- set an alarm when the capacity of the main battery falls below a threshold
- set an alarm when the voltage falls below or exceeds a threshold.
- connect the monitor to an NMEA 2000 network and display the battery and tank levels on the plotter.

Tank monitor:

You can see at a glance

- the current fill levels of up to 4 tanks

and have the possibility to

- set an alarm threshold for each tank (full or empty alarm)

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1 General information

1.1 V purpose of use

The battery/tank monitor BTM can only be operated in conjunction with the shunt SHE-348 on extra-low voltage DC 8-32V. It is designed for use on yachts and may only be operated in enclosed spaces protected from rain, moisture, dust and condensation. Never use the battery/tank monitor in locations where there is a risk of explosion from gas or dust. The battery/tank monitor is not suitable for outdoor installation.

1.2 L Scope of delivery

- Battery/Tank Monitor BTM2
- 3 Plug-in terminals (2x MVSTB 2.5- 3 and 1x 9-pole)
- 2 fuse holder ASH1 with fuse FSS 1A
- These operating instructions

Optional accessories (not included in the scope of delivery):

- SHUNT SHE 348 for battery capacity detection Order no.: 0 7003 0348
- SHUNT SHP 348 for solar power measurement Order no.: 0 7003 0351
- Temperature sensor Temp-BT Order no.: 0 5900 3480
- Battery charger interface ACE-LIN Order no.: 0 8000 4975
- N2K cable for NMEA 2000 connection Order no.: 5 0411 1140

1.3 RECOMMENDED FUEL SENSORS (not included)

To measure the fill level, we recommend the immersion tube sensor of the TGT or TGW series for fuel and fresh water as well as the ultrasonic sensor UTV for faeces tanks and the flow rate sensor DFS (fresh water only). For deep tanks up to 200 cm and a very precise measurement, the pressure sensor TDS200 (water/diesel/faeces) or TDW200 (water/faeces).
However, these sensors are not included in the scope of delivery.
Sensors from other manufacturers can also be connected. The display is configured to the connected sensors in SETUP. Furthermore, an adjustment to the tank geometry is possible in order to correctly display the actual tank content.

Please note: only with the DFS
flow sensors is the litre display accurate, as litres are also measured here. With all other sensors, this is only a conversion of the measured fill level and, depending on the sensor accuracy, can never be accurate to the litre!

Fresh water:

-Flow sensor (1x)	DFS	Order no.: 7 0003 0304
-immersion tube sensor	TGW 200-800	Order no.: 6 6011 7xxx
-Pressure sensor	TDN 200 / TDT 250	Order no.: 6 6025 1208

Petrol:

-immersion tube sensor	TGT 200-800	Order no.: 6 6011 7xxx
Diesel:		
-immersion tube sensor	TGT 200-800	Order no.: 6 6011 7xxx
-Pressure sensor	TDS 200 / TDT 250	Order no.: 6 6026 1206
Grey water/ black water:		
-Pressure sensor	TDN 200	Order no.: 6 6025 1208
-Ultrasonic tank sensor	UTV 20-80	Order no.: 7 0219 35xx
recommended accessories for ultrasonic sensor:		
-Sound guide tube	UFT 40 (40cm long)	Order no.: 7 0219 9400
-Sound guide tube	UFT 80 (80cm long)	Order no.: 7 0219 9800
-spacer ring	UTS 25 (25mm high)	Order no.: 7 0219 9025
-Fuse holder incl. fuse 1A for measuring leads	ASH1A	Order no.: 6 0030 3411

1.3 Warranty

Warranty is granted for a period of two years from the date of purchase. Defects due to incorrect connection liquids leaking into the unit or oxidation due to condensation liquids leaking into the unit or oxidation due to condensation
lightning strike excluded

Subsequent costs and natural wear and tear are not covered by the warranty.
When asserting claims under guarantee and warranty, a detailed description of the defect is essential. Detailed information facilitates and accelerates processing. Please understand that we cannot accept shipments that are sent to us freight collect.

1.4 Disclaimer

Compliance with the operating instructions as well as the conditions and methods during installation, operation, use and maintenance of the battery/tank monitor BTM cannot be monitored by philippi elektrische systeme gmbh. Therefore, we do not accept any responsibility or liability for losses, damages or costs resulting from incorrect installation and improper operation.

1.5 Quality assurance

During production and assembly, the units undergo several checks and tests. Fabrication, inspections and tests are carried out according to established protocols. Each unit has its own serial number. Therefore, never remove the type plate. The assembly and testing of all units is carried out entirely in our factory.

2 S ich safety instructions

- No modifications may be made to the unit, otherwise the CE mark
- The battery/tank monitor may only be connected by qualified electricians. -
Before connecting the battery/tank monitor, disconnect the battery leads.
- Ensure that the polarity of the batteries is correct!

- The power supply line to the monitor and shunt must be fused.
- This appliance is not intended for use by children.

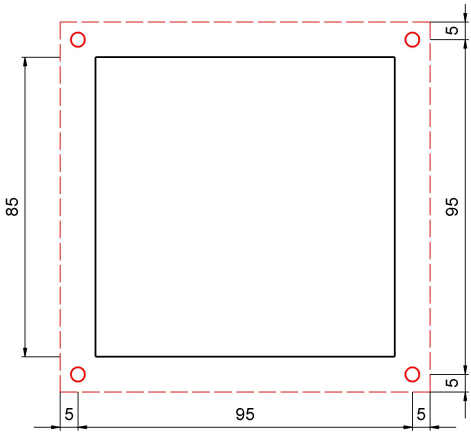
These installation and operating instructions are part of the component delivery. They must be kept in a safe place - important for later maintenance work - and passed on to any subsequent owners of the unit.

3. Assembly and installation

3.1 Monitor

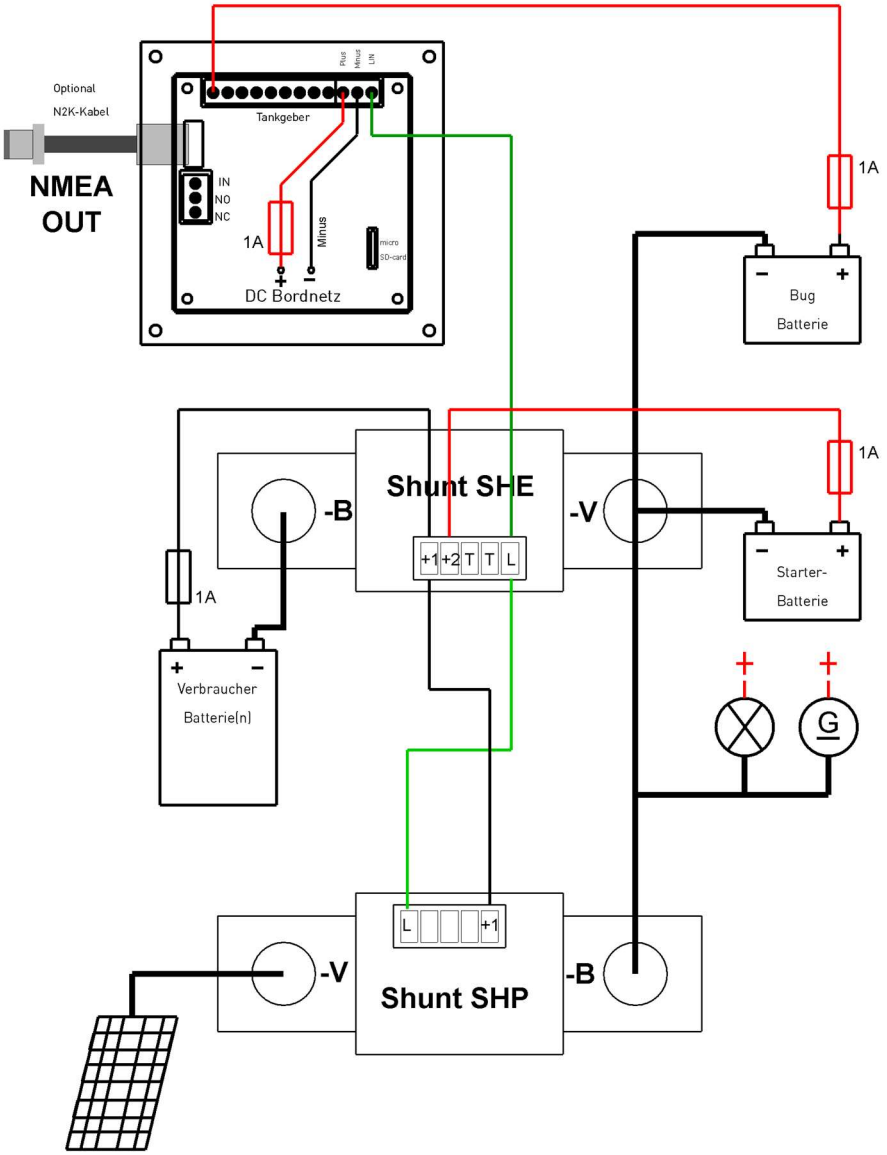
Mount the battery monitor in a protected, dry and clearly visible place so that it can be read at any time. The required mounting cut-out is 85x85 mm, the required minimum depth is 35mm. On the rear side there is a 3-pole terminal for the power supply of the monitor and the communication line to the shunt SHE and SHP. The tank sensors are connected via the 9-pole terminal. A potential-free relay contact is available via the 2-pole terminal.

A software update can be loaded onto the monitor via a micro-SD card on the back.



The power supply to the monitor can be interrupted at any time without losing battery status data, as this is stored in the SHE 348 shunt.

Therefore, the shunt SHE 348 should be permanently connected to the battery. If the monitor is switched off, the shunt SHE goes into sleep mode and the current consumption of the shunt drops to 2 mA. This is not a particular load on the battery. However, if the battery system remains without charge for more than 3 months, the shunt should also be disconnected from the battery.
The following figure gives an overview of the connection of the monitor and the shunt SHE 348.



The LIN bus connection between the monitor and the shunt is made via a 1-wire cable. This can also be any or an existing cable. For mechanical reasons, the cable cross-section should be min. 1mm² and max. 1.5 mm².

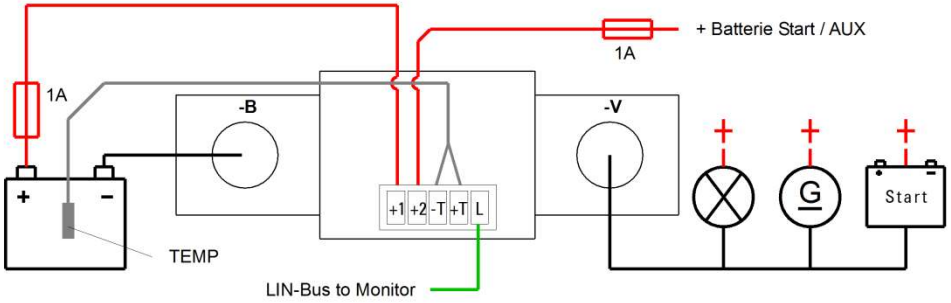
3.2 Shunt SHE for battery monitoring

Mount the shunt SHE 348 in a protected, dry place as close as possible to the battery. The shunt must be connected in the **MINUS path of** the battery.

Install the active shunt SHE 348 as close as possible to the service battery. However, avoid the shunt making contact with the positive - terminal of the batteries. Connect the side of the shunt marked B- to the negative terminal of the main battery using a short, thick cable (35-70 mm²). Connect the negative terminal of up to two starter batteries to the side of the shunt marked V-.

Note: If the main battery consists of several batteries connected in parallel, their common negative terminal must be connected to the side of the shunt marked B-. The negative cables of the starter batteries are connected to the other side (V-) of the shunt. We recommend that all negative connections of the consumers, charging devices and the negative terminals of the starter batteries are combined on a ground busbar and that a short cable is laid from there to the V- connection of the shunt.- Connect the measuring lead of the shunt to the positive terminal of the main battery via an inline fuse holder (1A). This line measures the voltage of the main battery and simultaneously supplies the shunt with current.

It is important that no other cables are connected between the B- terminal and the battery MINUS terminal, otherwise not all currents will be detected and the battery management system will not work. All cables of the vehicle electrical system including the connection cable to the starter battery must be connected to the V side of the shunt SHE 348.



Monitored battery group

Consumers, charging sources, starter batteries

After applying the operating voltage to pin +1, the shunt goes into operation and indicates the operating status via the integrated **LED:**

- Rapid flashing during firmware update of the shunt SHX
- Flashing every 1 sec. Normal operation
- Flashing every 5 sec. Sleep mode (power saving mode) when monitor off

The following connections are available on the shunt at the 5-pin connector:

1: Battery voltage measuring lead (+1) and at the same time power supply for shunt
This line is absolutely necessary for the function of the shunt and should only be disconnected during winter storage to enable a complete recording of the battery capacity. Due to the very low current consumption in sleep mode, the shunt does not place any additional load on the battery.
2: Voltage (+2) second battery group
Optional connection of a voltage measurement of a second battery group (starter battery), this is then displayed as a second battery group on the monitor.
3: T-: Minus temperature sensor (brown wire) T+: Plus temperature sensor (blue wire)
Optional temperature sensor (Temp-BT) for recording the battery temperature. The temperature sensor should be fixed to the outside of the battery housing. The temperature sensor has no active influence on the capacity calculation or charging, but is only used for information.
4: LIN bus communication with display
The BLS monitor communicates with the SHE 348 shunt and the ACE charger via this line.

3.3 Shunt SHP for current measurement

Mount the optional shunt SHP for measuring the solar current or similar in a protected, dry location as close as possible to the battery. The shunt must be connected in the **MINUS path of** the solar system.

Connect the negative pole of the solar system to the side of the shunt marked V-.

The following connections are available on the shunt at the 5-pin connector:

1: Battery voltage measuring lead (+1) and at the same time power supply for shunt
This line is absolutely necessary for the function of the shunt and can be disconnected at any time when the monitor is switched off.

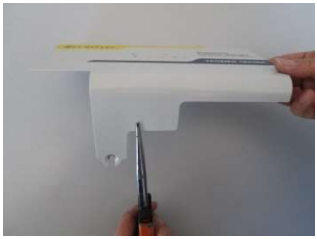
4: LIN bus communication with display
The BTM2 monitor communicates with the SHP shunt via this line. This line can be realised with any cable, preferably with 1 mm² cross-section.

3.4 Interface ACE-LIN (optional accessory)

To communicate the BTM2 monitor with an ACE series charger, an ACE-LIN interface must be inserted into the ACE charger. For the models ACE 12/60 and ACE 24/30, the integrated monitor must be removed and replaced with the interface ACE-LIN.

Removing the front charger cover and preparing the cable gland

Remove the cover



Break out the metal tongue with flat-nose pliers

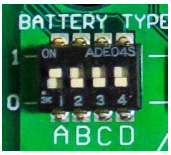
Inserting the rubber cable grommet

Inserting the cover and the cable.

Inserting the interface board ACE-LIN

Make sure that the ACE charger is disconnected from the AC mains before starting work.

After removing the front cover, the setting of the DIP switches must be adjusted for operation with the CAE-LIN interface.



The ACE chargers are equipped with DIP switches to adjust the charging characteristic individually to the batteries. Only if the DIP switches of the charger are set to ABCD = "1111", the charging characteristic can be adjusted from the monitor BLS. Then it is also possible to set a user-defined characteristic curve. Otherwise, the characteristic curve set via the DIP switches applies.

For the electrical connection of the interface board, the 16-pin connector of the ribbon cable must be plugged into the matching red connector on the main board of the charger ACE.

The interface board is held in place by three plastic clips on the housing.

Wiring LIN line to monitor BLS / shunt SHE

The communication connection "LIN" of the interface ACE-LIN is connected to the connection "LIN" of the shunt SHE 348 and the monitor BLS via a 1-wire connection cable. This can be decided according to the local installation conditions. The order of the units on the "LIN" line is irrelevant. Since the "LIN" connection on the ACE-LIN interface is duplicated, it is advisable to lay one LIN line from the monitor to the charger and the other from the charger to the shunt. The ideal conductor cross-section for the "LIN" cable is 1mm².

IMPORTANT: The monitor, the shunt and the charger must have the same negative potential, i.e. be connected to a common negative point (battery negative).

3.5 Electrical connection tank sensor

Up to four tanks can be monitored simultaneously.
However, if fewer tanks are monitored, the first tank sensor is connected starting at connection TG 1 (e.g. with 2 tank sensors, only connections TG 1 and TG 2 are used).

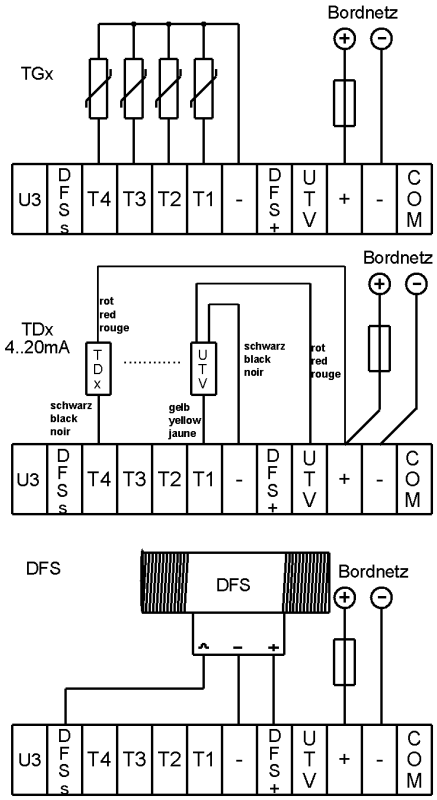
Resistance sensor (e.g. TGT/TGW) and active tank sensor (e.g. pressure probe TDS) can be connected in mixed form.

The connection is made according to the adjacent diagram

A flow sensor DFS can only be connected to DFS (DFS + /Minus/DFS S)!

ATTENTION: If
the power supply (red line) of the ultrasonic tank sensor is not via the BTM, but directly via the DC on-board power supply, the supply line must be protected with a 1A fuse!

The minus lines of the tank sensor must be connected to the minus (-) terminal to avoid incorrect measurements.



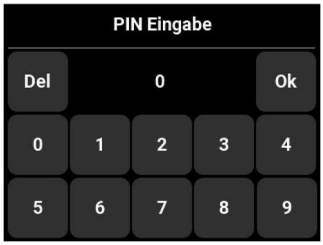
4. settings on the monitor

To access the settings, press the cogwheel symbol in the main screen at the bottom centre.

4.1 Password protection (PIN) of the Setup menu

Afterwards, you will be asked to enter the PIN, which is "1234" by default.

After successful entry with subsequent confirmation "OK" takes you to the settings menu.



The following settings can be made by pressing the respective symbol:

1. Display
2. Battery
3. Charger
4. Energy source
5. Tanks
6. Alarms

4.2 Display

After pressing the "Display" symbol, the adjacent picture appears. The following settings can now be made or information read off:

- Language DE/FR/GB...
- Brightness max. 20 - 100%
- Brightness AutoON/OFF
- Threshold night mode 3.. 30
- Auto Stand by OFF/x [s/min]
- Change PIN
- Number of tanks1-4
- Tank capacity Unit Litres / Gallons (L/g)
- Home page Battery/Tank
- Raymarine mode (only relevant for NMEA 2000)
- Load factory settings
- Save configuration to SD card (all settings are exported)
- Load configuration from SD card (all settings are imported)
- Display of software and hardware status

The setting "Threshold night mode" is used to calibrate the light sensor in automatic mode. For calibration, the light sensor (left centre of the display) must be covered with the finger and the value in brackets must be read. Add two to this value and enter it by pressing briefly. If the measured value falls below the set value, the display is dimmed. If the measured value exceeds the set threshold +10, the display is illuminated normally again.

4.3 Battery management

For proper function, the following data must be set during commissioning:

If the battery was not fully charged at that time, it is mandatory to fully charge it in order to synchronise the display with the battery charge level.

- Name
- Nominal capacity of the battery (Chap. 5.3)
- Rated voltage of the battery group (Chap. 5.4)
- Battery type (chap. 5.6)
- Ah Efficiency factor (CEF) (Chap. 5.9)
- Peukert exponent (Chap. 5.10)
- Cycle depth (chap. 5.11)
- Shunt Info
- Name Battery 2 / 3

4.3.1 Name

This name is shown in the battery symbol of the display and is used for easier assignment.

4.3.2 Nominal capacity

The nominal capacity of the battery (1-9999Ah) is set here. To obtain a meaningful accuracy of the remaining time function as well as the percentage charge display, the capacity of the battery to be monitored must be set.
Please note that the battery capacity should only be adjusted when the batteries are 100% charged, as this procedure sets the capacity indicator to 100% and all internal counters to 0.
If the battery was not fully charged at that time, this is mandatory to synchronise the display with the battery charge level.

4.3.3 Rated voltage

Please set the nominal voltage 12 or 24V / 36V / 48V of the battery group so that the capacity calculation can be done properly.

4.3.4 Battery type

To adjust the "battery empty" and "battery full" detection, the type of battery used [GEL, NASS, AGM, Lithium, INDIV] must be entered.

4.3.5 Ah Efficiency (CEF)

Every battery has an Ah efficiency. This means that more ampere-hours must be loaded into the battery than can be removed. The efficiencies of lead batteries are between 80% and 95%. If the CEF deteriorates below 70% during operation, this basically means that the battery has reached the end of its life and needs to be replaced. The factory default setting is 95%. The CEF is automatically adjusted during operation by means of a sliding average over the last 4 cycles.

4.3.6 Cycle depth

The cycle depth indicates the % value by which a battery must be discharged and charged for a charge cycle to be counted. For starter batteries a value between 10-20% should be set and for GEL batteries up to 50% can be set. The value represents the cycle stability of the battery, i.e. how much the battery can be discharged without reducing its life.

4.3.7 Peukert Factor

The capacity of lead-acid batteries is usually specified for a 20-hour discharge. This means, for example, that a 100 ampere-hour battery can deliver 5 amps for 20 hours before the battery is empty. If the discharge current is higher, for example 10 amps, the battery is not able to deliver the full 100 ampere hours. In this case, the battery voltage drops below the lower limit of 10.8 V for 12V batteries before the battery has delivered its rated capacity.
This relationship can be captured mathematically with the Peukert equation.
In the residual time function, this equation is used to adjust the residual time at high discharge rates. Under normal circumstances, the Peukert exponent does not need to be changed.

Usually, the Peukert exponent is set to 1.27 for lead batteries, if no deviating values are available, and to 1.02 for lithium systems.

4.3.8 Name2

This name is displayed in the battery symbol of the additional battery and is used for clear assignment.

4.3.9 Name3

This name is displayed in the battery symbol of the additional battery and is used for clear assignment.

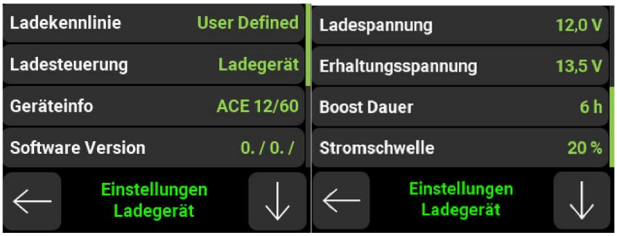
4.3.10 Shunt type / software version / update

The type of the connected shunt and its software version are displayed. A firmware update can be uploaded to the shunt via the item "Update software" if a corresponding file (PB99R1) is available on the SD card. To do this, the shunt must be de-energised (disconnect the green plug on the shunt) and then press the START button. Within 30 seconds, the shunt must be supplied with power again (plug in the green connector on the shunt) so that the update process is started. The successful process is then displayed on the screen.

4.4 Charger

The following settings can be made:

- Charging characteristic
- Charge Control (control of the charging process by the charger or the battery monitor)
- Info on which charger is connected (ACExx) and its software version
- Software version of the ACE-LIN interface



The current charging parameters of the set characteristic curve can be read in the 4 following fields. If the individual charging characteristic is selected, these settings can be edited:

- Maximum charging voltage (boost)
- Max. Boost duration
- Float charge voltage (float)
- Current threshold in % of the maximum power for switching to trickle charge

If no philippi ACE series charger is connected or the charger is not supplied with mains voltage, no settings can be made.

4.5 Alarm

A tank alarm is always indicated by the associated tank symbol flashing. A battery alarm is always displayed in the battery symbol. In addition, the alarm can be issued/configured as follows:

- optical Display illumination flashes
- Audible internal buzzer
- Relay contact potential-free relay (max. 1A)

The optical and acoustic alarm can always be acknowledged in advance by touching the screen or can switch off automatically after a definable time.

Alarm options:

Tank alarms:

An alarm threshold can be set individually for each of the 4 tanks. The following settings are possible:

0 %Alarm off1

..50 %. Empty alarm: if the fill level falls below the set value, alarm is triggered. The alarm triggering is delayed by 15s.

51... 99 % Full alarm: if the fill level rises above the set value, the alarm is triggered. The alarm is delayed by 15s.

The alarm is automatically cancelled as soon as the value has changed by 5%.

By briefly pressing the respective line, the acoustic alarm can be switched on or off. By pressing and holding (> 2s), the respective threshold value can be edited.

Battery capacity alarms
A message appears on the monitor to charge the battery (battery appears red) if the battery falls below the set capacity threshold.
The alarm for the alarm capacity is preset to 50%. For an average application, this value is usually fine; however, the alarm can be adjusted according to the application's requirements.
If the state of charge drops further, 2 different thresholds take effect: Battery reserve (20%) and battery deep discharge (0%). An alarm is triggered here depending on the configuration.

Battery voltage alarms
If there is a voltage >1V at the shunt on the terminal (+2) for the 2nd battery voltage, this is reported as another battery. If the battery voltage drops or exceeds the set threshold value for 30 s, an alarm can be generated.

The following settings are possible in the alarm menu:

- Visual alarmLighting flickers (on / off)
- Alarm auto off0-255 sec **(Attention 0 = always on)**
- Relay auto off 0-255 sec **(Attention 0 = always on)**

The potential-free relay and the buzzer can be configured for individual alarms. Depending on the configuration, the alarm switches on for the following alarm states and remains on until all pending alarms have been cancelled. If an alarm has been acknowledged and a new alarm is added, the buzzer is activated again.

Battery 1	Capacity alarm	Adjustable (10 - 80 %)
	Battery Empty (20%)	determined by battery management
	Battery deep discharge (0%)	determined by battery management
	Overvoltage adjustable	(14 - 32 V)
	(Over)-temperature	adjustable (40 - 60 °C)
Battery 2	Undervoltage	adjustable (9-24V)
	Overvoltage	adjustable (14-32V)
Battery 3	Undervoltage	adjustable (9-24V)
	Overvoltage	adjustable (14-32V)

The voltage alarms must be adjusted for 24V batteries!

Tank	Tank 1 Level	adjustable, empty or full alarm
	Tank 2 Level adjustable	, empty or full alarm
	Tank 3 Level	adjustable, empty or full alarm
	Tank 4 Level adjustable	, empty or full alarm

4.6 SETTINGS IN THE TANK MENU:

The respective tank menu for the tanks shown is accessed by pressing the button (arrow on the right):

In the tank menu, the volume, the tank type, the sensor type can be entered and an adjustment to the tank geometry can be made.
With the free setting of the resistance range (User R), the ohm values for 0%, 25%, 50%, 75% and 100% are entered in this menu or the tank monitor can adopt the resistance values for these fill levels at the push of a button.

The same applies to tank sensor with a voltage output (sensor type: User U).
For the sensor type UTV 40/80, the tank depth is entered in this menu.

These settings are saved in the event of a power failure and are available again when the unit is switched back on.

4.6.1 TANK TYPE E

There are 5 different tank symbols to choose from for each tank:
Water / Diesel / Petrol / Faecal matter (black water) / Grey water

4.6.2 VOLUME

Enter the tank volume. The content is displayed in litres.

4.6.3 SENSOR

Sensor type	Tank sensor	Measuring range	Geometry adjustment	
TGX 10-180 (Ohm)	philippi TGT / TGW	10.. 180 Ohm	optional	240
- 33 (Ohm)	240...33 Ohm	UTR not possible!	optional	
User R	1 - 1000 Ohm	1 - 1000 Ohm	necessary	
User V (0-10V)	philippi UTV (0,5-2,5V)	0.. 10V	necessary	
UTV 40/80	philippi UTV 40/UTV 80	0,5.. 2,5 Voptional		
TDx	TDS / TDN / TDT	(4 - 20mA)	necessary	
DFS - (down)	philippi DFS	Flow sensor not possible	DFS + (up)	
	philippi DFS flow sensor	not possible		
TRS / RSW / DSW	philippi TRS / RSW / DSW	Float switch	not possible	

TIL5	Rod Tuft sensorAdditional hardware TILnot		possible
Gobius4	Gobius 4 (1-4V)	4 steps for from MJ 16	not possible

If the tank type does not match the tank sensor type used, either "---" is displayed as the value or an incorrect value may be displayed.

4.6.3.2 SENSOR TYPE TGX 10 - 180 (OHM)

For this setting you need a tank sensor TGW (fresh water) or TGT (fuel) with a resistance range of 10 - 180 Ohm (10 Ohm = empty / 180 Ohm = full). In the TRIM menu, the characteristic curve of the tank sensor can be adapted to the tank geometry.

4.6.3.3 SENSOR TYPE 240 - 33 (OHM)

For this setting you need a tank sensor with a resistance range of 240 - 33 Ohm (240 Ohm = empty / 33 Ohm = full). In the TRIM menu, the characteristic curve of the tank sensor can be adapted to the tank geometry.

4.6.3.4 SENSORTYP User R

For this setting you need a passive tank sensor with any resistance range between 1 - 1000 Ohm. For the levels 0, 25, 50, 75 and 100%, the corresponding resistance values must now be entered in the TRIM menu.
Tank sensor: This setting option only works with passive resistance tank sensors, not with capacitive tank sensors or active resistance sensors (e.g. philippi UTR) !

4.6.3.5 SENSOR TYPE USER V (UTV)

With this setting, tank sensors can be displayed with a voltage signal in the range of max. 0 - 10 volts. For the filling levels 0, 25, 50, 75 and 100%, the
corresponding voltage values can be entered in the TRIM menu item.
The default setting ex works
is pre-assigned to the ultrasonic tank transmitter UTV with an output signal 0.5-2.5V.

4.6.3.6 SENSOR TYPE UTV 40 / 80

For this setting you need the following ultrasonic tank sensors:

Tank depth (plus optional distance ring UTS 25) up to 40 cm: **UTV 40Tank depth**
(plus optional distance ring UTS 25) 40 -80 cm: **UTV** 80

The tank depth can then be entered in the SETUP menu with centimetre precision for each tank.

After selecting the tank type UTV 40/80, the UTV type, any spacer ring UTS and the tank depth of

the tank are entered in the submenu.

For tank depths incl. distance ring less than or equal to 40 cm, a UTV 40 is required; above this, a UTV 80. When using a UTV 40, the adjustable range is always less than 40cm. Only UTV40 or UTV80 ultrasonic tank sensors may be used!

4.6.3.7 SENSORTYP TDx:

For this setting you need a tank sensor with a current output of 4-20mA (e.g. TDS200, TDN200, TDT 250). The calibration is carried out in the TRIM menu, where the corresponding current measurement values can now be entered or determined for the levels 0, 25, 50, 75 and 100%.

4.6.3.8 SENSOR TYPE DFS -

For this setting you need a philippi DFS flow sensor. The connection is only possible to DFS S. The following symbol appears under the respective tank in the main menu:

Since this sensor cannot detect whether the tank is being filled, you must enter the fill level manually. Pressing the assigned button takes you directly to the tank menu where you can set the fill level accordingly. If water
flows through the flow sensor DFS, this is indicated by the rotating symbol. The DFS with arrow pointing downwards empties the corresponding tank in the display.

4.6.3.9 SENSOR TYPE DFS +

See 4.6.3.8 - Differently, this setting fills the associated tank. This is useful to record the amount of fresh water produced when using a watermaker.

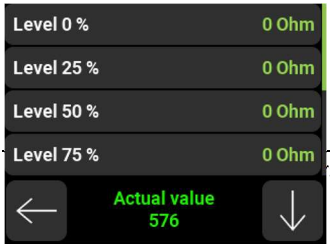
A maximum of one (1!) DFS can be connected to the BTM!

4.6.3.10 SENSOR TYPE TRS/RSW/DSW:

For this setting you need a philippi TRS float switch (mounted on top of the tank) or philippi RSW/DSW (mounted on the side). The tank display remains at 0% until the float switch switches through - the display then goes to 100%. No series resistor is necessary!

4.6.3.11 SENSOR TYPE GOBIUS4

The voltage output of the Gobius control unit must be connected to a tank input. The level is displayed in 4 steps. The internal settings of the Gobius system cannot be changed from the BTM. They must be adjusted via the Gobius display.



4.6.4 Adaptation

To adapt the level indicator to a non-rectangular tank geometry, you have the option of adjusting the characteristic curve. The

respective default settings from the selected sensor type can be adapted to the individual conditions. This is mandatory for the tank types User R, User U, TDS:

Method 1 (tank is filled step by step):
the probe is in the empty tank. In the Setup menu, go to the setting value for 0% and read the measured value in the middle at the bottom and enter it in the Level 0% field. Then fill the tank to 25% and enter it in the Level 25% field. Proceed in the same way with the values 50%, 75%, 100%.
This method has the advantage that even with an unusual tank shape, the content is reproduced correctly.

Method 2 (installation e.g. TDS200 with full fuel tank):
the probe is outside the tank. In the setup, go to the setting value for 0% and read the measured value in the middle at the bottom and enter it in the Level 0% field.
Then install the probe and read the reading in the middle at the bottom and enter it in the Level 100% field. To get the values for 25%, 50% and 75%, you must first divide the difference between the values 0% and 100% by 4. Add this value to the value at 0% - this way you get the input value for 25%. By adding correspondingly more, you get the values for 50% and 75%.
You can enter these values at the setting values for 25%, 50% and 75%.

Method 3:
You know the values for 0%, 25%, 50%, 75% and 100%? Then enter these values directly in the corresponding settings.

4.7 Energy source

The current and the landed capacity are displayed in the lower left part of the main screen. The following settings are available.

4.7.1 Name

This battery symbol is displayed on the main screen and is used for clear assignment.

4.7.2 Reset counter

The capacity counter can be set to zero again.

4.7.3 Shunt type / software version / update

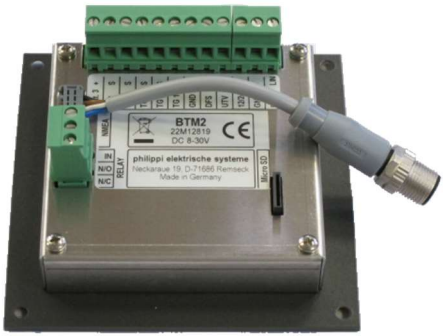
The software version of the SHP shunt is displayed. A firmware update can be uploaded to the shunt via the item "Update software" if a corresponding file (PB99R1) is available on the SD card. To do this, the shunt must be de-energised (disconnect the green plug on the shunt) and then press the START button. The shunt must then be restarted within 30 seconds (plug in the green connector at the shunt) so that the update process is started. The successful process is then displayed on the screen.

4.8 Integration into the NMEA 2000 network

The BTM2 monitor is equipped with an additional NMEA2000 interface.

For the connection to the NMEA 2000 network, the cable (N2K cable) available as an accessory is required. This is then plugged into the 4-pin connector and the Mirco-C (M12) connector is connected to the NMEA network via a corresponding T-piece. The monitor requires its own power supply and is not supplied via the network.

The NMEA data are automatically sent cyclically every 2.5 seconds after connection.



This enables the tank levels to be displayed via PGN 127505 (Fluid Level).
and the battery voltages via the PGNs 127751 (DC Voltage Current)
and PGN 127506 (DC Detailed Status) are sent to the NMEA2000 network as soon as the monitor goes into operation.

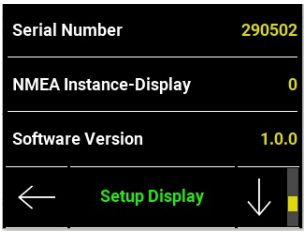
The NMEA 2000 instances must be adapted according to your network requirements.
Depending on the chartplotter and multifunction display used (Raymarine, BG, Garmin, Furuno, etc), it may be necessary to change the existing transducer instance (tank, battery), especially if there are other transducers with similar data in the network.

Instance 0 is usually selected by default. However, if the data on your chart plotter is not displayed or is on the wrong page, you should select a different instance for the Philippi unit. If there are 2 Philippi units on the network, different unit instances must be set on each unit (see Setup Monitor Display).

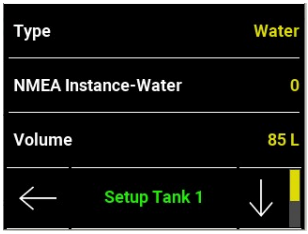
Basically, each tank or battery must have a unique instance so that they can be identified in the network. The distinction between diesel, water, etc. is made automatically via the tank type. This is set in the menu.

The setting of the instances is done in the setup under the corresponding submenus:

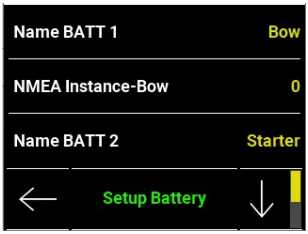
For the monitor itself in the setup displayin the



the tanks 1-3the batteries 1 + 2 setup tanks 1-3in the



setup battery



The tank instance is a combination of tank type (4bit) and the set tank number (4bit) on the NMEA2000 side. The recognition of the tank type (diesel, water, ...) is usually correctly evaluated by the plotters so that only the tank number is decisive. Is.

Attention: With Raymarine plotters it is important that the instances start with the number 0.

5. operation

On the main page, you can switch between the 3 main screens using the lower buttons:
Tank / battery and charger, if a philippi charger ACE with interface ACE-LIN is installed. Otherwise, only the battery/tank screen is available.

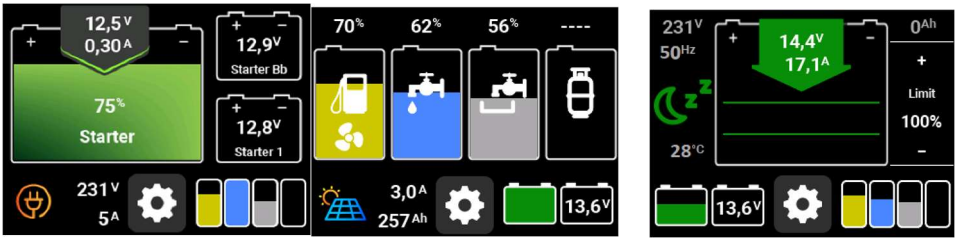
The lower buttons have the following functions:

Batteries: If a shunt SHE 348 is connected, the state of charge of the battery system can be read. Pressing this button switches to the battery screen.

Energy: If a shunt SHP 348 is connected, the current and the energy charged so far are displayed. This information is displayed alternately with the charger information if this is connected.

Tanks: If tank sensors are connected, the fill levels can be read. Pressing this button switches to the tank screen.

Charger: If an ACE charger is connected, the current mains voltage and the DC charging current are displayed. If no mains voltage is present at the charger, this is displayed accordingly.
Pressing this button switches to the loading screen.



SETUP: The settings for the battery system can be made here. See chapter 4.

The **tank screen** shows the individual tank levels. The measurement takes place automatically after the monitor is switched on and is interrogated every 5s. The measured values are displayed in the form of a bar chart. By pressing the tank symbol, you can switch between the display in %, in litres or without further display. If "----" appears above the associated tank, the measured value of the associated tank sensor is outside the expected value or no sensor is connected.

The **battery screen** shows the main battery measured via the shunt on the left. The arrow shows the current and the battery voltage. If the arrow is green, the battery is charged, a red arrow indicates the current discharge.

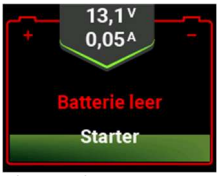
Up to two battery voltages of the additional batteries appear in the right area of the battery screen. The names and associated voltage alarm thresholds can be adjusted in the settings.

The bar height of the battery indicates the level of the battery.
The lower grey portion of the battery is the unusable portion of the battery's nominal capacity that was determined at the last complete discharge. This portion provides information about the battery's state of life.

With a short press on the battery symbol, you can switch between the displays
- Capacity in % - Capacity in AH - Remaining time - Battery temperature -
must be changed. Alternatively, the following error messages appear:

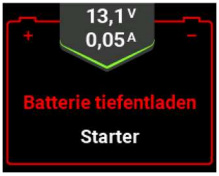
"Out of sync"
The shunt has been restarted and the displayed capacity value does not yet correspond to the true capacity level. Then the battery group connected to the shunt must be fully charged with a charger so that the capacity display can synchronise with the battery's state of charge. The message then goes out automatically.

"Charge battery"
the battery capacity has fallen below the set warning threshold. In order to achieve a long battery life, the charging process should be initiated at the next opportunity.



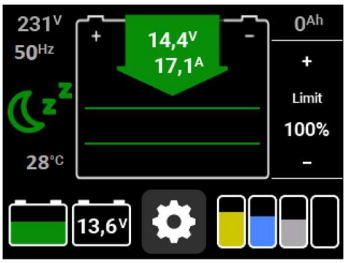
"Battery empty"
The battery capacity has fallen below a maximum of 20% residual capacity and must be recharged immediately to prevent harmful deep discharge.

The battery is switched off and further damage to



"Battery deep discharged"
completely discharged and all consumers must be charging must be initiated immediately to prevent the battery.

"Temperature"
the battery temperature is outside the permissible range



The **charging screen** shows the operating status of the active philippi charger ACE. If the ACE charger is disconnected from the mains or if no charger is connected, the screen is not active and cannot be selected.

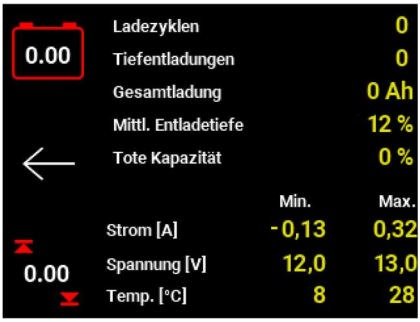
The green arrow shows the current charging current and the charging voltage. The battery symbol shows the current charging phase (strong charge / full charge / maintenance) and the battery temperature. To the right of the battery, the mains voltage measured by the charger and its frequency are displayed.

The side buttons have the following function:
LIMIT +/-: To adapt the charging current to the battery system or a weakly fused shore connection, the charging current can be adjusted in 10%. The minimum value is 40%.

Night mode: On units with an active fan, the fan can be switched off to enable silent operation. The max. charging current is limited to the thermal conditions of the charger. This function is automatically deactivated after 8 hours.

5.1 Battery history

By pressing the battery symbol for a long time (2 seconds), more information about the use of the battery appears:



- Number of charging cycles
- Number of deep discharges
- Average depth of discharge
- Dead (unusable) capacity
- Battery use
- maximum charging current*
- Maximum discharge current*
- Minimum voltage*
- Maximum voltage*
- Lowest temperature*
- Highest temperature*

* Values determined from a 45 s interval)
Pressing the return arrow takes you back to the main page.

5.1.1 Charging cycles

A cycle is counted when the battery has been discharged by the capacity set in the cycle depth and then recharged.
With the number of cycles, you will be able to estimate the life of your battery. Standard starter batteries have a life span of 30-50 cycles, whereas cycle batteries can be expected to last up to 348 cycles if a modern charger is used. These values can only be achieved with proper care and deteriorate rapidly if not handled properly.

5.1.2 Deep discharges

Any complete discharge to the lower voltage limit (9-11.5 V depending on the load) is considered a deep discharge. Deep discharges should be avoided at all costs, as they damage the battery and premature loss of capacity and reduction of service life can be expected with most battery types. Should a deep discharge nevertheless occur, the battery must be recharged immediately to avoid further damage.

5.1.3 Average depth of discharge

The average depth of discharge indicates by how much the battery group was discharged on average in the past 10 cycles. From this, the cycle load of the battery can be read and a conclusion drawn about the battery life.

5.1.4 Reset the counters

If a new battery set is inserted, the number of cycles, the number of deep discharges and the total capacity counter must be set to zero. To do this, the upper battery "000" key must be pressed and subsequently confirmed by entering the PIN (PIN default 1234). The min/max counters can be reset by pressing the lower "000" key and then entering the PIN (PIN default 1234).

5.2 Function of the battery capacity calculation

Below are some notes on the function of the battery capacity calculation.

5.2.1 Full charge detection

A battery is classified as fully charged (100%) when the following conditions are met depending on the battery type [GEL, NASS, AGM, Lithium, INDIV].

e.g. for lead acid batteries:
1) the charging voltage is maintained (13.4 V) **and**
2) the charging current has dropped below 2% of the set battery capacity **and**
3) the charged capacity is greater than the previous withdrawn capacity.
or
1) the charging voltage is maintained (14.0 V) and
2) the charging current has dropped below 1% of the set battery capacity.

If the parameters are met for 3 minutes, the value for the current capacity is reset to 100%. For the other battery types, values adapted to the battery chemistry apply.

5.2.2 Detection of the non-usable part of the battery capacity

If the battery voltage drops below certain voltage thresholds prematurely depending on the load, the state of charge is automatically set to 20 % or to 0% if the battery is completely discharged.

If possible, the unavailable capacity (difference between nominal capacity and withdrawn capacity) is determined and shown as a grey area.
This grey area can be used as an indicator of battery ageing for normal discharges smaller than C10 (current smaller than nominal capacity/10).
In the case of high current loads in the range greater than C5 (e.g. electric boats (current greater than nominal capacity/5)), this is to be taken as an indicator of the usual reduced capacity at high loads.

The detection of the unavailable capacity is only possible if the battery is discharged up to the first discharge limit (depending on battery type & load, below approx. battery voltage < 11.5 V).
If the battery is never discharged to this first discharge limit, this detection cannot take place and a 100% intact battery is assumed.
We therefore recommend that this is done once a year at the start of the season to determine the performance of the battery system.

5.2.3 Residual time calculation

The remaining time is the time that the main battery can still be used with the current power consumption until the capacity alarm is reached.
During charging, the expected charging time is displayed until the batteries are charged to approx. 95 %. The maximum value during a discharge process is 99.9 hours (> 4 days). The remaining time is automatically corrected taking into account the Peukert function.

5.2.4 Calculating the current state of charge

During charging, the Ah efficiency of the battery (C.E.F.) is automatically taken into account in the capacity calculation. In doing so, the charging current is evaluated with the C.E.F. value (in %).

6. tips and tricks

a) If the message "not synchronised" does not go out despite 100% full charge (U > 14.0V and I < 2% of the nominal capacity) of the battery, this can be achieved manually by changing the nominal battery capacity by 1 Ah.
Please check that each charging source is correctly recognised. Charging currents are always positive if all consumers are switched off at the same time.

b) Battery full detection does not work. Please check the charging voltage of your battery charger / solar system and set the battery type to WET to work with the lowest possible values.
Please check whether each charging source is detected with the correct current, charging currents are always positive if all consumers are switched off at the same time. This must be checked individually for each charging source. Only the shunt with the B- connection may be connected to the negative pole of the battery, nothing else!

Software update

A micro SD card is required to update the software of the battery tank monitor. After receiving the software, the file must be copied to the previously empty micro SD card (FAT32) (without folder, top level).
To update, insert the SD card into the SD card slot on the back of the monitor and disconnect the power supply from the battery monitor. The power supply is then switched on and the screen shows that new software has been detected and is being installed automatically. During the

update process, the progress is displayed. If the monitor starts normally after inserting the SD card, no SD card has been detected or the software is up to date.

8. Technical data

Supply voltage	DC 8-60 V
Monitor power consumption	60 mA at max. display brightness, 5 mA in sleep mode
Current consumption shunt	20 mA , 2 mA in sleep mode
Shunt 3480	.1 m Ω
Measuring range U10-60V, resolution	30mV, accuracy 0,25%
Measuring range U20-35V, resolution	30mV, accuracy 0.25%
Current carrying capacity shunt	300A, 600A 1 min, 1500A 0,5 s
Current carrying capacity relay	1A
Measuring range I, shunt-600 - +600A,	resolution 10mV, accuracy 0.5%.
Measuring range T (ext. probe)	-15 - 60°C, resolution 1K, accuracy 1K
Dimensions monitor	L 105 x W 105 x D 40 mm
Dimensions shunt	L 118 x W 40 x H 65 mm
Shunt bolt connections	M8

9. c onfirmation of conformity

This device fulfils the requirements of the EU directives:
2014/30/EG "Elektromagnetische Verträglichkeit"
Interference immunity EN 61000-6-1
Emitted interference EN 61000-6-3

The conformity of the device with the above directive is confirmed by the CE mark.

10. e ntention for disposal

When disposing of this appliance, observe the applicable local regulations and use the collection services/places for waste electrical/electronic equipment.

11. NMEA 2000 PGNs

PGN 127505 Fluid Level
PGN 127508 Battery Status
PGN 127506 DC Status