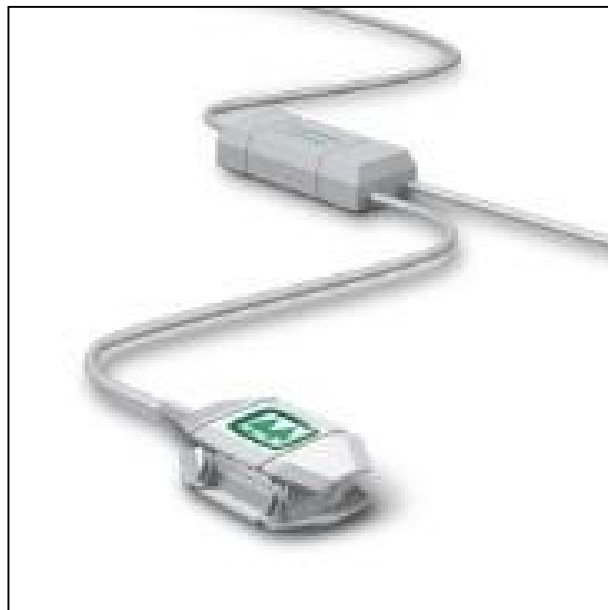


Operating Manual
Service Software
trak | soft
for
HOPPECKE Battery controller
trak | collect



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Revision	Datum	Name	Kapitel	Änderungsgrund
01	04.01.17	H.U. Hartmann	Alle	Initial
02	01.03.17	H.U. Hartmann	Alle	Correction
03	15.05.17	H.U. Hartmann	9	Adjusted
04	26.07.17	H.U. Hartmann	3	Brief instruction added
05	03.08.17	H.U. Hartmann	10	Default Parameters
06	03.08.17	H.U. Hartmann	7.1	Program start Admin
07	06.08.18	M. Strugholtz	7.4, 8.1-3	Pictures, Pictures and description

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1 General

1.1 Foreword

Dear Customer,

Thank you for buying one of our products.

Please read this documentation carefully before you start working with this Software.

It contains important information about how to unpack, store, install, start up, and operate your trak | collect battery controller software.


This service manual is intended for staff who are trained and qualified to use the battery controller for monitoring batteries correctly.


Please store this documentation in a place where it is immediately accessible for all persons who have to carry out activities in conjunction with the software.

1.2 Explanation of symbols

The following symbols and signal words are used for safety information in this operating manual in accordance with ISO 3864, ISO 7010 and ANSI Z535.4:


 DANGER
<p>DANGER! identifies a hazard which is an immediate threat. If it is not avoided, death or very serious injuries will result.</p>

 WARNING
<p>WARNING! identifies a hazard which is a possible threat. If it is not avoided, death or very serious injuries may result.</p>

 CAUTION
<p>CAUTION! identifies a hazard which is a possible threat. If it is not avoided, slight or minor injuries may result.</p>

NOTE
<p>NOTE indicates a situation which might be harmful. If it is not avoided, the system or something in its vicinity might be damaged.</p>

All safety information is structured as follows:

Safety sign	 SIGNAL WORD
	Type of hazardous situation!
	Consequence of failure to avoid the hazardous situation
	Measures for avoiding the hazardous situation

2 Safety

2.1 Correct use

trak | soft is a software for parameterizing, reading out, creating reports from the data of the HOPPECKE battery controller trak | collect.

The software is used for professional parameterizing of HOPPECKE battery controllers trak | collect.

Furthermore, it is possible to read out saved data and reset the internal memory.

trak | soft enables showing the actual state of the battery and creating meaningful reports of battery usage, operation- and failure reports.

Do only use the software for the battery controller and only for the data, that has been recorded with trak collect.

2.2 Improper use

NOTE

Use with other hardware can cause incorrect measurements and reports.

Improper use of the software can cause wrong measurements, incorrect interpretations and reports.

The software is only for use in original provided version.

Modifications or excerpts use is not permitted.

It is not allowed to copy or hand over this software or excerpts of it.

2.3 Guarantee and warranty

For guarantee claims, please see HOPPECKE GmbH & Co. KG's general terms and conditions. These can be found on the company's website.

Warranty claims are no longer valid in the following cases:

Improper use

Failure to adhere to the operating manual

Unauthorized interventions

Warranty claims for batteries, that has been used with incorrect parameterized controllers.

3 Brief instruction Commissioning

The following steps are required when setting trak | collect into operation for the first time.

3.1 Requirement for commissioning

Trak | collect has been installed according to the installing manual. The satellites LED is lightning and shows the actual battery status (Inaccuracy are possible, due to factory settings only)

The software and the Bluetooth driver are installed and a radio dongle is available. (refer to chapter 4)

If you have any further questions regarding handling, please refer to the relevant chapter of this manual for further details.

3.2 Connect

- Insert the radio dongle into the USB port, start the software (right click / as administrator)
- **update**
- select trak | collect serial number (battery name), **connect**

3.3 Basic parameterization

- Clock (setting) synchronise
(Gear wheel settings/ advanced settings/ trak collect/ time/ **synchronize**)
- Battery parameter write
(Gear wheel settings/ general/ parameter via bluetooth/ battery parameters)

system parameters		battery parameters		algorithm parameters	
no.	name	value	unit		
1	commissioning-day Trakcollect	31			
2	commissioning-Month Trakcollect	12			
3	commissioning-Year Trakcollect	2016			
4	nom. cell voltage	2.00	[1.00 V]		
5	number of cells complete	12			
6	number of cells cell ballancing tab	6			
7	nominal battery capacity [Ah]	500			
8	battery setup byte	0			
9	plate- / celltyp of battery	0			
10	batterv technologv	0			

Parameter 4 – 7 enter according battery type label

Parameter 22 enter battery-ID (costumer) , then **write**

3.4 Reset battery status / delete data memory

- Reset battery state
(Gear wheel settings/ advanced settings/ trak collect/ battery state/ reset all/ **reset**)
- Delete data memory
(Gear wheel settings/ advanced settings/ trak collect/ data memory/ all memories/ **delete memory**)

4 Requirements for using the software

4.1 Hardware Requirements

4.1.1 PC / Laptop

Processor: min. i3, 3,4 Ghz

Memory: 4 GB RAM

4.1.2 Bluetooth – Stick

Customer version: HOPPECKE Mat.-Nr. 7245240700

Service version: HOPPECKE Mat.-Nr. 7245240710

4.2 Software Requirements

Operating system : min. WIN 7 (32 / 64 Bit)

4.3 Versions and Compatibility

The software checks the current version status and releases the verified functions.

5 Software Overview

5.1 Summary

The battery controller is a complete measure,- analyses- and communication unit for lead acid traction batteries in all industrial applications.

5.2 Overview

Figure 1 provides an overview of the individual components and their functions. The software accesses via the Bluetooth interface to the satellite. The satellite exchanges all data via a RS 485 bus with the basis. Therefore, the software enables access to the flash storage, RTC and NFC devices.

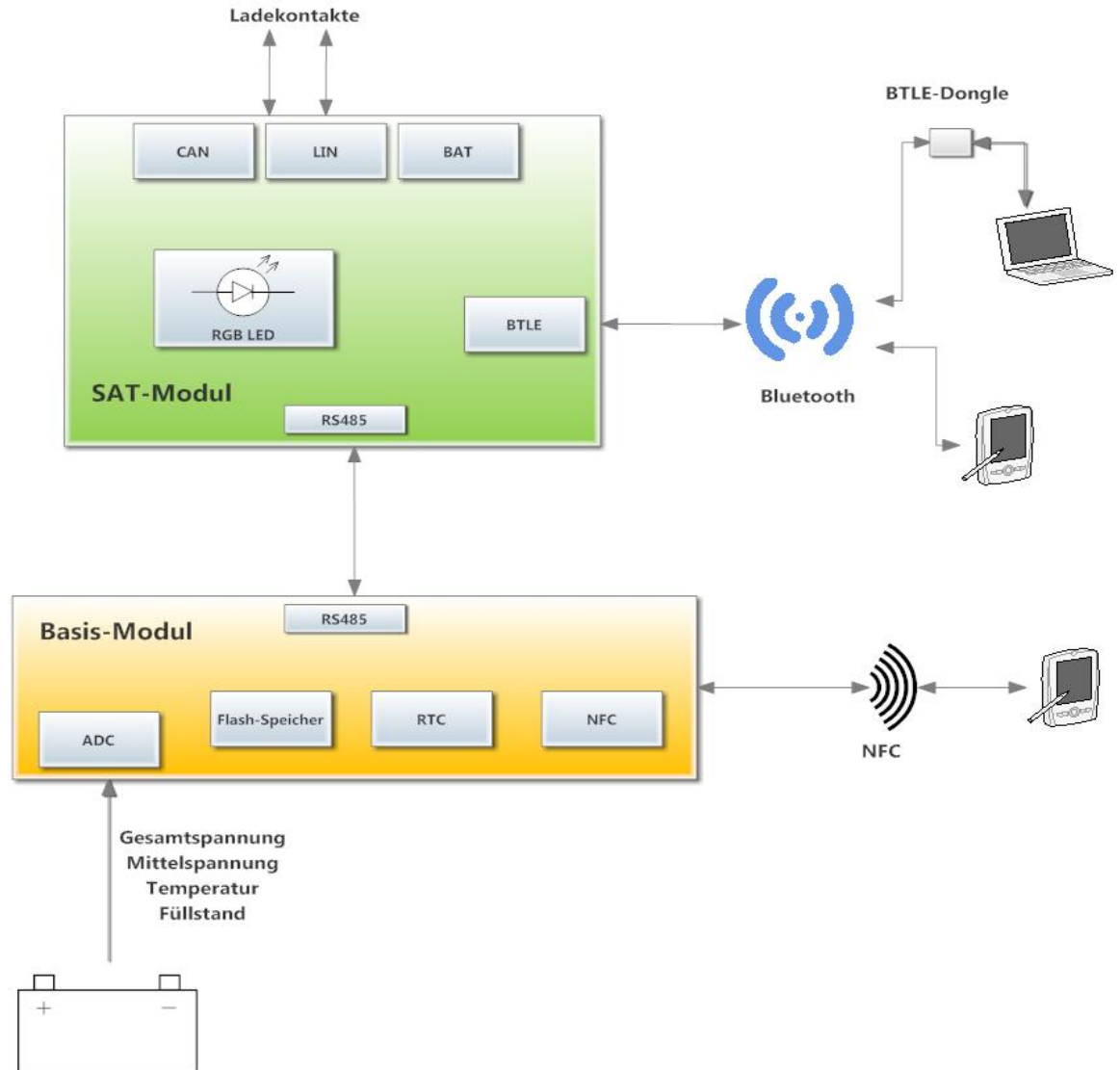


Figure 1: Construction and communication trak | collect

5.3 Features

Construction	Basis und Satellite housing
Operating voltage	15 VDC ... 150 VDC
Current measurement	max. 500 A permanent
Current meas. method	Shunt measurement
Temperature range	- 30 C° ... 80 C°, PT1000 sensor
Real time clock	power reserve 30 days

Display	Multi-Color LED
Interfaces	NFC, Bluetooth 4.0 LE, CAN Bus, LIN Bus, Batt-Bus
Data storage	Logging-Data (I,U,θ), 30 days @ 10 sec. storage interval Cumulative Cycle Data 20.000 Cycles

6 Installation

This chapter describes the installation of the software trak | soft and the USB driver on your computer. Follow this manual step by step to install the software without failure and to guaranty proper function.

6.1 Software Installation

1. Download the software installation file from HOPPECKE homepage and save it locally on your computer.
2. Start the installation by opening the installation file and follow the instruction.

6.2 USB driver installation

1. Download the USB driver installation file from HOPPECKE homepage and save it locally on your computer.
2. Start the installation by opening the installation file and follow the instruction.

Connect the USB stick to your computer and wait for the system to allocate and connect the USB driver correctly.

7 Program handling

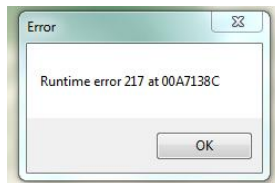
7.1 Program start

Connect the USB wireless dongle in a free USB port to your computer.



Start the program with a double click on the trak | soft symbol on your desktop. (The shortcut symbol has been automatically created while installing the software.)

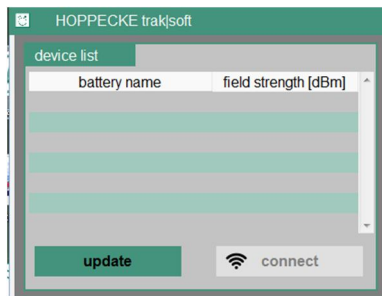
In case of Error message



Right Click and *Run as Administrator*.

7.2 Starting wireless connection

The program communicates wireless with the battery controller.

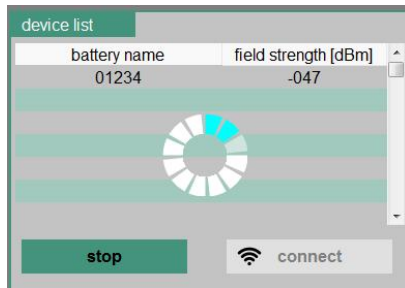


Click on **update** to start the wireless communication and the software starts searching for all available controllers in the environment.

Available devices are shown in the list with name and field strength.

The program sorts the controllers by field strength, so that the strongest – and therefore the nearest controller - is on top.

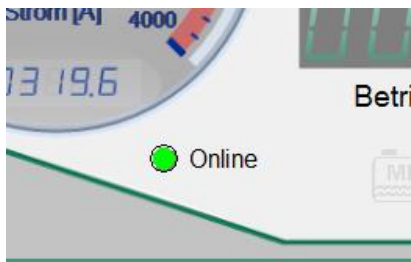
Stop searching, when your wanted battery appears in the list by pressing **stop**. The complete



search process takes approximate
lately one minute.

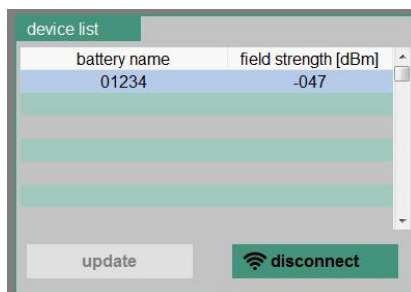
Choose the wanted battery with a click on its line from the list and click **connect**. The link connection starts up.

The battery controller is connected, when the green LED Symbol is flashing.



7.3 Wireless disconnecting

Click on **disconnect** if you want to end the connection.

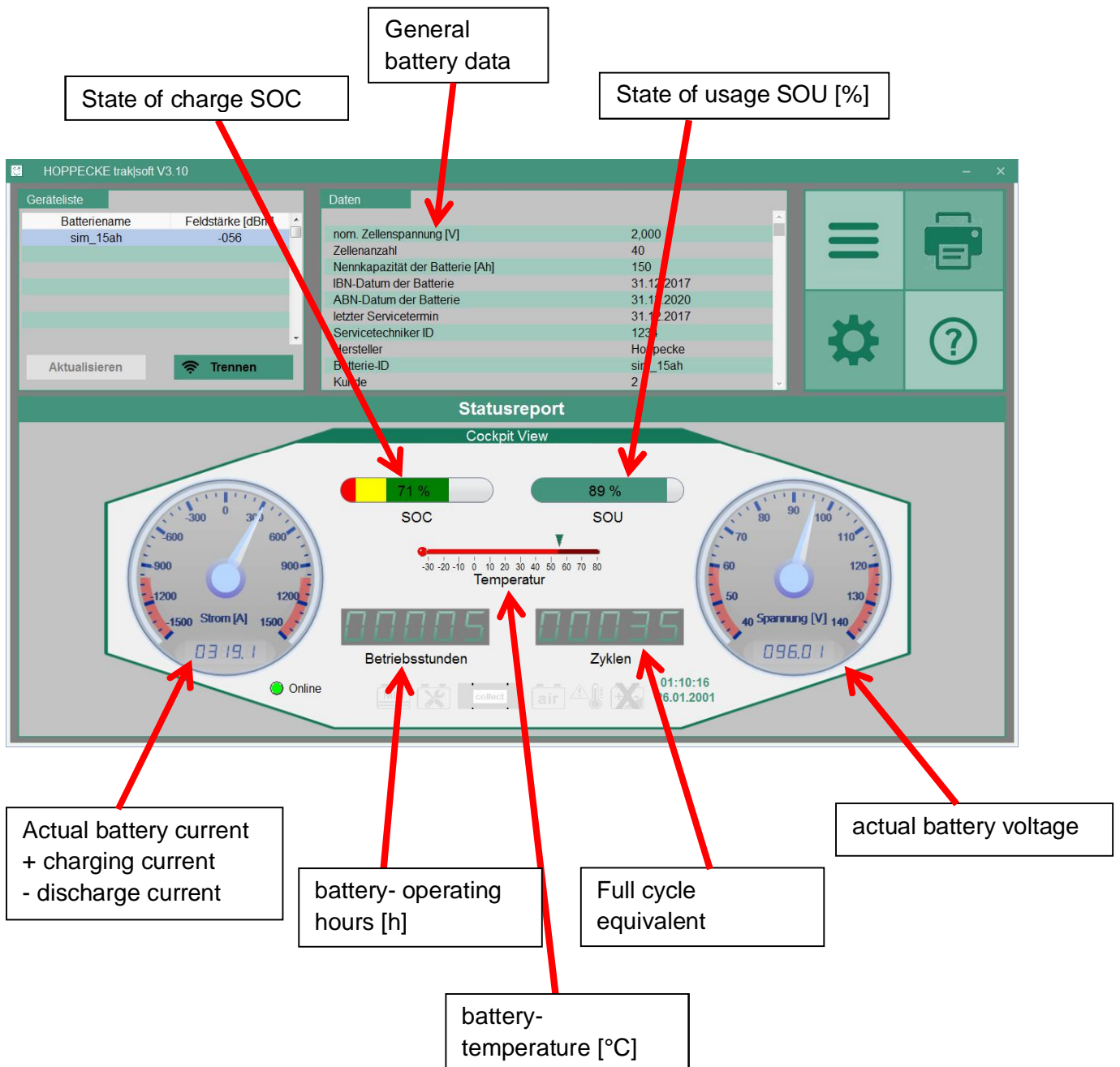


The red LED symbol “Offline” confirms the disconnection. You can select another battery from the list now.



7.4 Explanation – Cockpit View

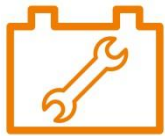
The first view after a connection is established is the cockpit view. This view gives a quick overview over actual condition state of the battery. In der Abbildung xxx sind die einzelnen Elemente beschrieben.



Warning symbols are shown in light grey color on the bottom of the window.









The symbols are lighting up in red color according to the failure.

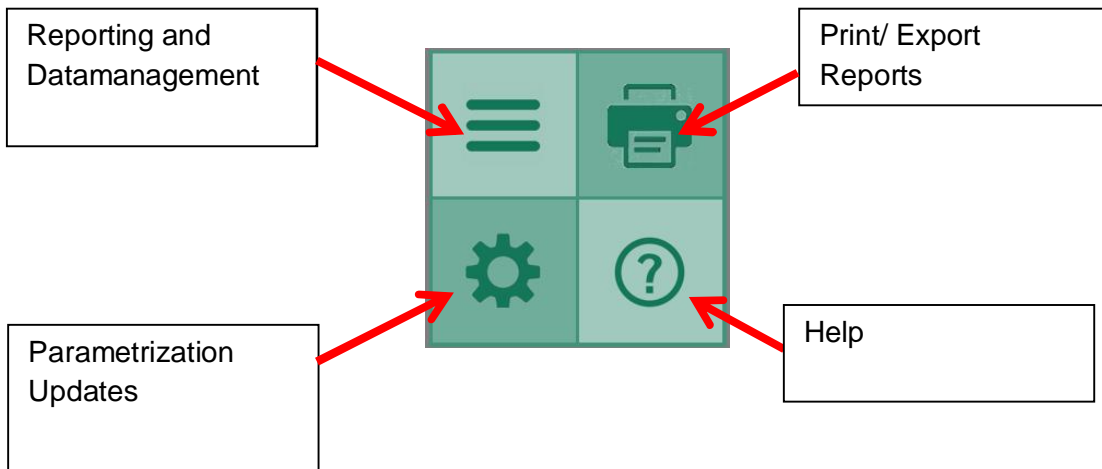


Example: call for service!

The meanings of the symbols are

Symbol	Meaning	Recommended action
	Electrolyte level low	Top up demineralized water
	SOC lower than 20 %	Do not use the battery any longer, but charge immediately!
	Max battery temperature exceeded	Do not use the battery any longer, but let battery cool down!
	Battery failure in trak air system	Check trak air hosing and plugs, and repair if necessary. Call for service, if no defect can be found!
	Battery failure, defective cell	Call service!
	trak collect failure (sensors, storage, etc.)	Call service!

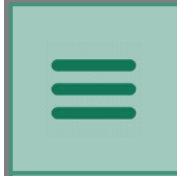
In the upper right corner is shown the short cut menu, which allows access to further functions.



8 Software Functions

8.1 commands

All functions for reading out data and creating reports are combined behind the list-symbol.



The list symbol opens the further menu.

8.1.1 Reports

The menu item *reports* enables creating and displaying of usage relating reports based on the stored data.

There are two ways of creating reports.

- a) Download of data from actual connected trak | collect and after that creating reports
=> USB wireless stick required!
- b) Creating reports of already available data
=> No USB wireless stick or connection required!

Batteries with available data can be selected from the list. The interesting time period can be chosen in a second option.

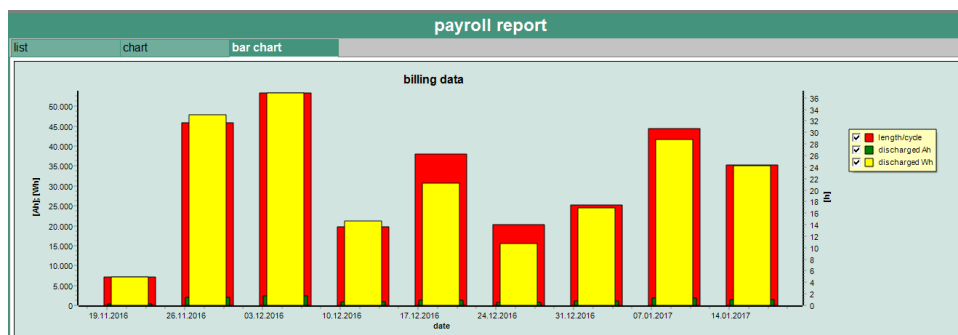
Most reports consists of list, chart or bar chart view.

8.1.1.1 Status report

The status report is equal to the start window of the software and is shown as a cockpit view. It displays the overview over the actual contacted battery. (see Cap. 6.4)

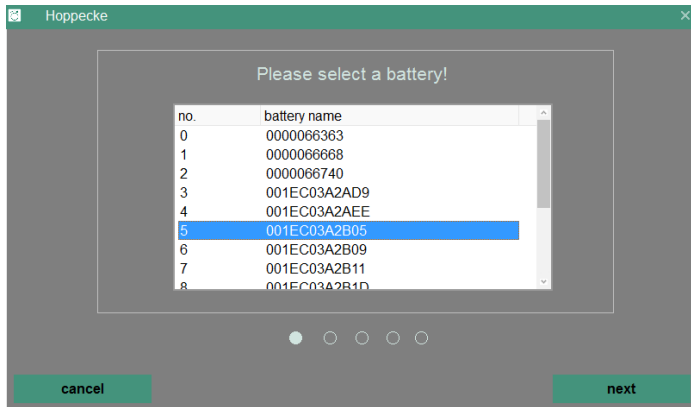
8.1.1.2 Billing report

The billing report is shown with the defined units for billing the usage of the battery, according to the selected time intervals. The billing period has to be defined and split in days, weeks or month and is than shown in a relating diagram.

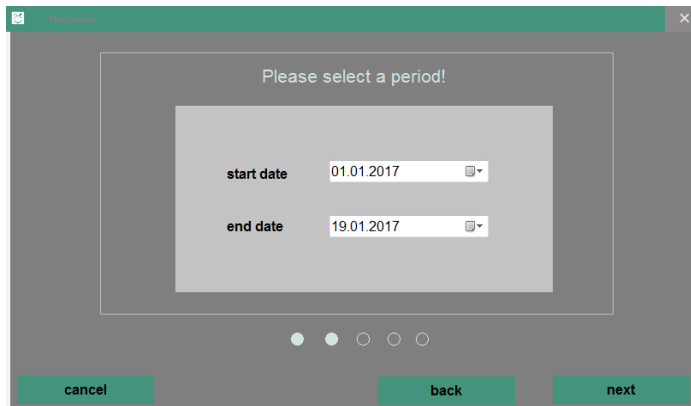


Screenshot billig report

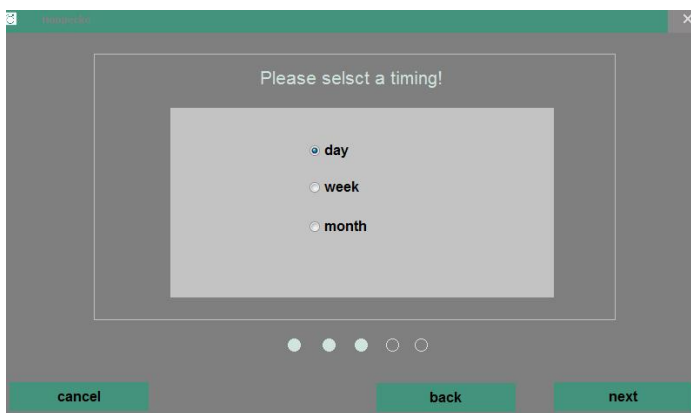
Following steps lead to this report:



Select a battery from the list (If battery can't be found, the laptop wasn't connect with that battery before)

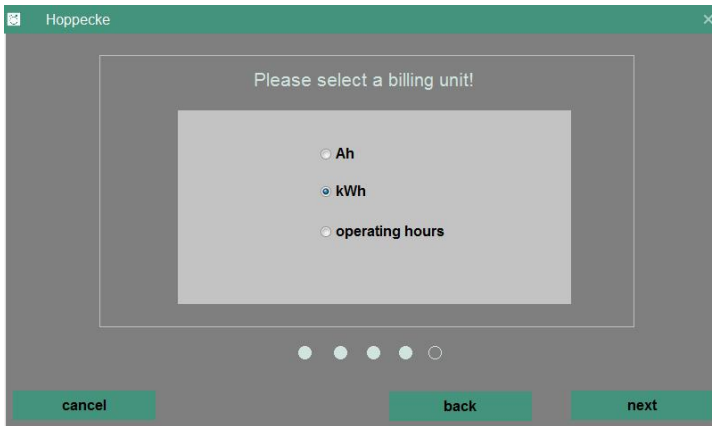


Select a time period for the report

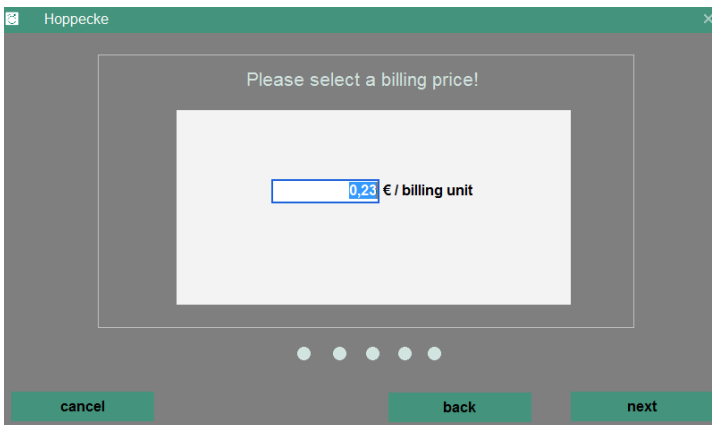


Select the time division for summarizing the data

Select the unit for billing



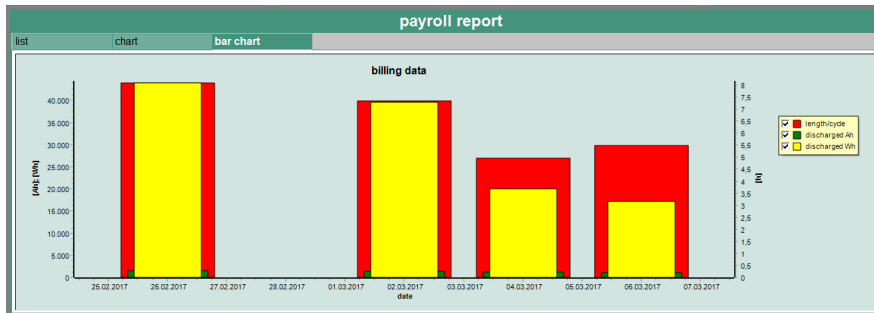
Put in the cost per billing unit according to valid contract



Leads to a report in table form

payroll report					
list	chart	bar chart			
no.	period	operating hours	discharged capacity	discharged energy	price
		[h]	[Ah]	[Wh]	[€]
1	06.03.2017	5,48	1126	17199	3,96
2	04.03.2017	4,95	1155	20065	4,61
3	02.03.2017	7,33	1420	39607	9,11
4	26.02.2017	8,08	1480	43962	10,11
				total	27,79

Or a bar graph over the selected time period



8.1.1.3 Driver's log

The driver's log breaks down the usage of the battery over a selected time period. All relevant values are ordered chronologically and displayed in cycles. The data are separated in discharge and charge operation.

driver's log														
list	chart	bar chart												
cycle no.	start discharge	discharged capacity	discharged energy	end point SOC	break after discharge	mean temperature	mean discharge current	min. discharge voltage	max. discharge current	open circuit volt. after discharge	start charge	charged capacity	charged energy	SOC end of charge
		[Ah]	[Wh]	[%]	[hh:mm]	[°C]	[A]	[V/cell]	[A]	[V/cell]		[Ah]	[Wh]	[%]
1	19.01.2017 17:24	392	9023	0	00:00	35,5	22,6	0,70	292,7	1,06	20.01.2017 10:13	432	12008	87
2	18.01.2017 16:34	380	8766	3	00:00	35,2	22,4	0,69	328,7	1,06	19.01.2017 09:04	427	11942	84
3	17.01.2017 16:48	383	8800	5	00:00	35,4	23,1	0,60	372,7	1,05	18.01.2017 08:55	421	11693	86
4	16.01.2017 17:59	372	8520	9	00:00	34,9	23,4	0,63	342,1	1,05	17.01.2017 09:25	408	11351	88
5	13.01.2017 09:56	364	8322	9	00:00	30,4	4,8	0,61	191,8	1,07	16.01.2017 11:43	379	10513	89
6	12.01.2017 06:54	376	8570	13	00:00	33,2	47,9	0,64	274,0	1,06	12.01.2017 14:31	410	11340	90
7	11.01.2017 08:51	378	8579	15	00:00	35,5	60,2	0,63	287,3	1,06	11.01.2017 14:54	424	11763	92
8	10.01.2017 09:55	364	8334	18	00:00	34,2	49,4	0,65	307,2	1,06	10.01.2017 17:04	406	11295	94
9	09.01.2017 08:52	346	7854	21	00:00	30,3	48,6	0,61	284,7	1,07	09.01.2017 15:49	380	10584	95
10	06.01.2017 11:12	364	8288	21	00:00	22,8	58,0	0,61	343,7	1,06	06.01.2017 17:17	419	11695	97
11	05.01.2017 12:54	323	7372	31	00:00	32,4	56,5	0,70	312,4	1,06	05.01.2017 18:24	362	10118	98
12	03.01.2017 10:10	377	8740	0	00:00	28,0	15,6	0,71	279,4	1,06	04.01.2017 09:47	423	11835	100
13	30.12.2016 09:41	329	7610	0	00:00	28,4	4,2	0,61	202,0	1,08	02.01.2017 14:27	387	10982	62

8.1.1.4 Event Report

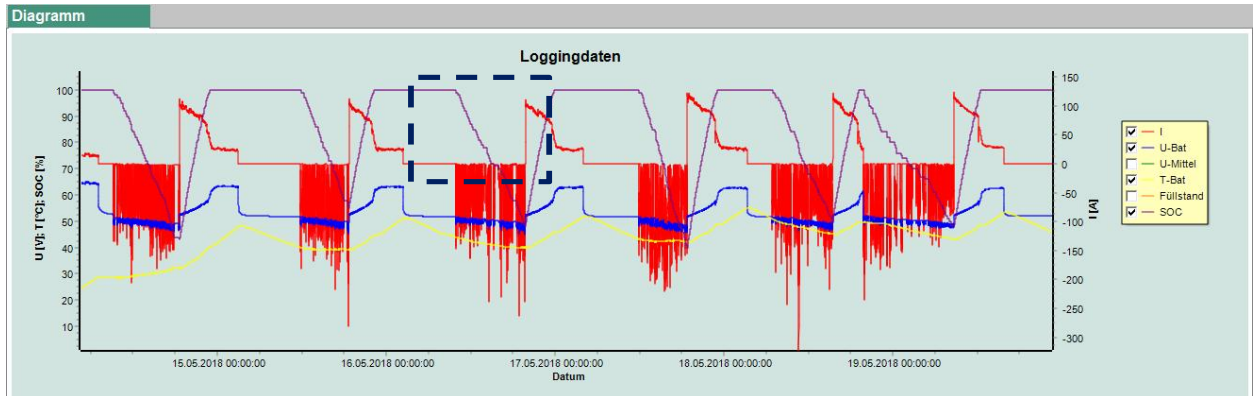
The event report highlights every moment, that the battery was used out of the specific range, like low electrolyte level, over temperature, over discharge etc.

event report																				
list	no.	date	time	state	event	current	battery voltage	middle voltage	battery temperature	SOC	SOR	SOU	recharge current	fill level	trak air	minimal temperature	maximal temperature	voltage imbalance	minimal charge voltage	minimal circuit v
						[A]	[V]	[V]	[°C]	[%]	[%]	[%]								
1	20.01.2017	11:31:38	✓	minimal SOC	88,6	26,9	4,5	32,8	31	100	97	✓	✓	✓	✓	✓	✓	✓	✓	✓
2	20.01.2017	07:53:32	✗	minimal SOC	-5,3	24,3	4,1	30,4	20	0	97	✓	✓	✓	✓	✓	✓	✓	✓	✓
3	19.01.2017	10:11:09	✓	minimal SOC	94,3	26,8	4,5	31,8	31	100	97	✓	✓	✓	✓	✓	✓	✓	✓	✓
4	19.01.2017	07:15:48	✗	minimal SOC	-36,3	23,7	4,0	29,5	19	0	97	✓	✓	✓	✓	✓	✓	✓	✓	✓
5	18.01.2017	09:58:52	✓	minimal SOC	88,9	26,8	4,5	32,2	31	100	97	✓	✓	✓	✓	✓	✓	✓	✓	✓
6	18.01.2017	08:47:40	✗	minimal SOC	-199,1	21,7	3,6	31,0	6	0	97	✓	✓	✓	✓	✓	✓	✓	✓	✓
7	18.01.2017	08:42:40	✓	power on	-534,0	16,7	2,8	30,8	7	100	97	✓	✓	✓	✓	✓	✓	✓	✓	✓
8	18.01.2017	08:42:39	✓	power off	-713,9	14,4	2,5	30,8	7	0	97	✓	✓	✓	✓	✓	✓	✓	✓	✓
9	18.01.2017	07:28:35	✗	minimal SOC	-5,3	24,2	4,1	29,8	19	0	97	✓	✓	✓	✓	✓	✓	✓	✓	✓
10	17.01.2017	10:16:52	✓	minimal SOC	91,7	26,6	4,5	31,4	31	100	97	✓	✓	✓	✓	✓	✓	✓	✓	✓
11	17.01.2017	08:42:43	✗	minimal SOC	-5,6	24,0	4,0	29,4	19	0	97	✓	✓	✓	✓	✓	✓	✓	✓	✓
12	16.01.2017	12:33:39	✓	minimal SOC	90,6	26,8	4,5	26,5	31	100	97	✓	✓	✓	✓	✓	✓	✓	✓	✓
13	16.01.2017	11:36:48	✗	minimal SOC	-5,0	23,5	3,9	24,7	9	0	97	✓	✓	✓	✓	✓	✓	✓	✓	✓
14	16.01.2017	11:31:48	✓	power on	-349,7	18,5	3,1	24,3	11	100	97	✓	✓	✓	✓	✓	✓	✓	✓	✓

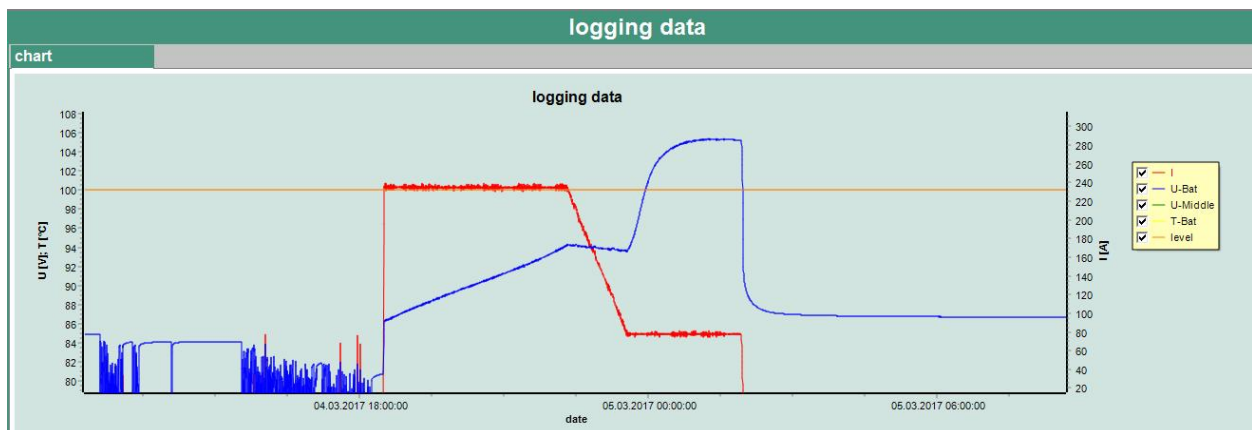
8.1.1.5 Logging-Data

The menu item logging data leads to a graphical presentation of the measuring values current, battery voltage, battery middle voltage, battery temperature within a selected time period.

The diagram enables the analyzation of usage conditions of the battery.



You can activate a zoom function by click and drop from left to right over a small detail in the diagram.



Click and drop from right to left deactivate the zoom function and goes back to the complete diagram.

8.1.2 Download

The battery controller records permanently measuring values of the battery and analyses state of charge (SOC), state of readiness (SOR) and state of usage (SOU). All data are organized in separate sections and can be read out with the download functions.

A special function compares already existing downloaded and locally on your PC stored data and prevents double download.

Therefore, only the latest data are read out from trak | collect.

8.1.2.1 Download measuring data

The logging function of trak | collect saves battery current, voltage and temperature in define able intervals. (Preset from factory is every 10 seconds)

You can start the download by click on the menu item.

8.1.2.2 Download event data

Data sets that has been recorded while the battery was operating out of the specified range are stored in this area. Criteria's are exceeded temperature range, over discharge, differing middle voltage and others.

You can start the download by click on the menu item.

8.1.2.3 Download cycle data

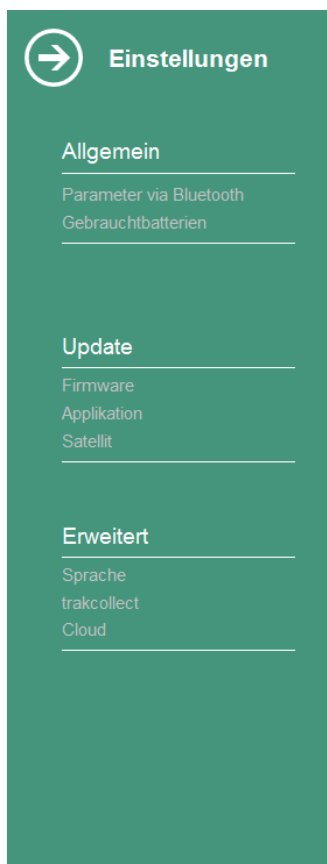
At those time points, when trak | collect detects a change of operation between driving or charging, all relevant data like Ah, kWh, average- and maximum values of current, voltage and temperature are stored with a time stamp.

8.2 Einstellungen

Below the menu item settings you find the access to trak | collect parameters, Update function, change of language, and Configuration of the battery controller.



The gear wheel leads to the setting menu.



8.2.1 General

Access to the parameters is possible via Bluetooth Interface and implements reading and writing. You can select between the tabs system parameters, battery parameters and algorithm parameters. The complete menu can be closed with *close*.

System parameters

parameters

system parameters		battery parameters	algorithm parameters
no.	name	value	unit
1	time interval of saving the battery state	6000	in 10 ms
2	time interval of saving the measurement values	20	in 10 ms

write

read

close

Battery parameters

parameters

system parameters		battery parameters	algorithm parameters
no.	name	value	unit
1	commissioning-day Trakcollect	31	
2	commissioning-Month Trakcollect	11	
3	commissioning-Year Trakcollect	2016	
4	nom. cell voltage	2.00	[1.00 V]
5	number of cells complete /	12	
6	number of cells cell ballancing tab	6	
7	nominal battery capacity [Ah]	775	
8	battery setup byte	10	
9	plate- / celltyp of battery	0	
10	battery technology	0	
11	profile	xyz	
12	production day battery	1	
13	production month battery	12	
14	production year battery	2015	
15	commissioning day battery	1	
16	commissioning month battery	11	
17	commissioning year battery	2015	
18	puttung out of service day battery	31	
19	puttung out of service month battery	12	
20	puttung out of service year battery	2020	

write

read

close

Algorithm parameters

parameters

system parameters		battery parameters		algorithm parameters	
no.	name	value	unit		
1	usable capacity	100	%		
2	minimal charge amount to full cycle detection	20	[%]		
3	Break current (Threshold for charge counter)	1.0	[1.0 A]		
4	Start voltage @discharge current after complete charge	0.00	[1.00 V/C]		
5	final discharge voltage @ discharge current	0.00	[1.00 V/C]		
6	time delay to discharge mode (time below threshold voltage)	0	[sec]		
7	reset voltage (reset SOC = 100 @ charge)	0.00	[1.00 V/C]		
8	max. temperature for operational	50	[°C]		
9	delay max. temperatur	5	[sec]		
10	Reset-delay max. temperature	5	[sec]		
11	temperature for reset	30	[°C]		
12	min. temperature for operational	0	[°C]		
13	delay for minimum temperature	5	[sec]		
14	Reset-delay minimum temperature	5	[sec]		
15	min. temperature for reset	2	[°C]		
16	max. voltage differenz for operationl	0.50	[1.00 V/C]		
17	delay for max. voltage differenz	30	[sec]		
18	reset-delay for max. voltage differenz	5	[sec]		
19	max. voltage differenz for reset	0.30	[1.00 V/C]		
20	min. voltage for operational @ I = 0	1.97	[1.00 V/C]		

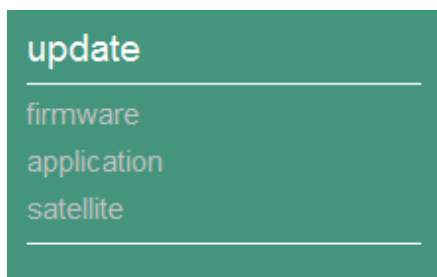
write

read

close

8.2.2 Update

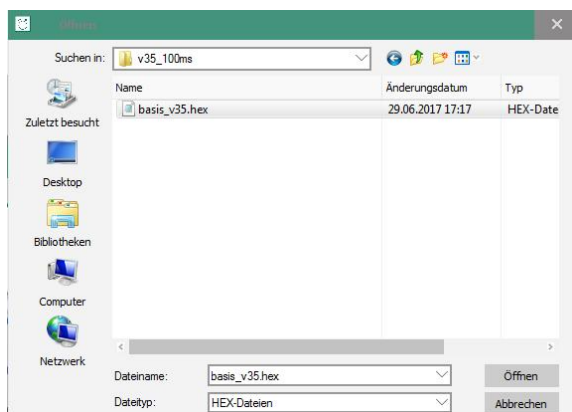
The update function enables to flash the controller with new developed releases or operation and customer optimized algorithms.



The update is split into a firmware (basis) version, a satellite version and an application which includes the algorithm for determining the battery state.

The procedure of updates is equal and is explained with an example in updating the basis firmware.

After selecting an item, a windows opens for selecting the update file.

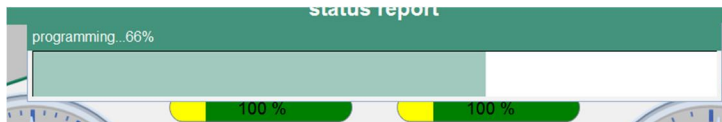


Select the version of the firmware file that you want to update.

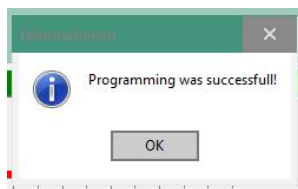
Hint: The software checks the version of the selected file. If a wrong version has been selected accidentally, the software will block and give a failure message, for example if you try to update the satellite with a firmware (basis) version.

Correct your selection in that case.

The update starts with a progress bar after confirming your selection.



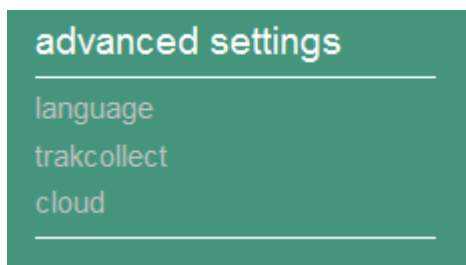
A successful update is confirmed with a message. After clicking OK, trak | collect starts with a new version.



Start the update again, if you get a failure message.

8.2.3 Advanced settings

The advanced settings item leads to selecting languages for the software and reports, the reset of status values as well as deleting the measurements of trak | collect.



Select your preferred language. The software adapts the new setting directly without starting new again.

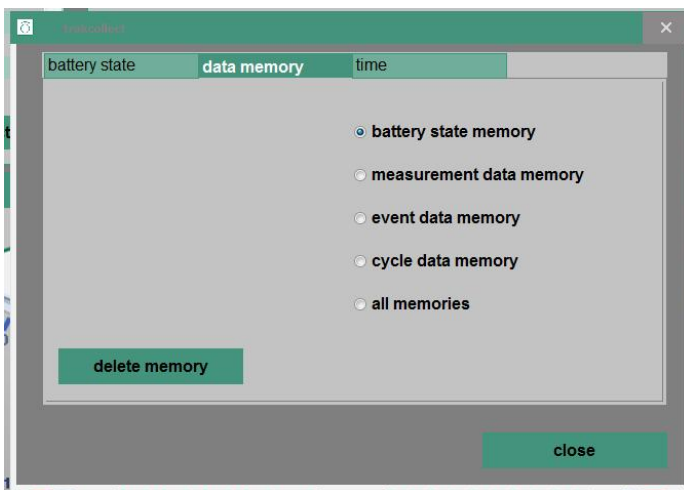


The menu item *trakcollect* leads to the reset options of status values.



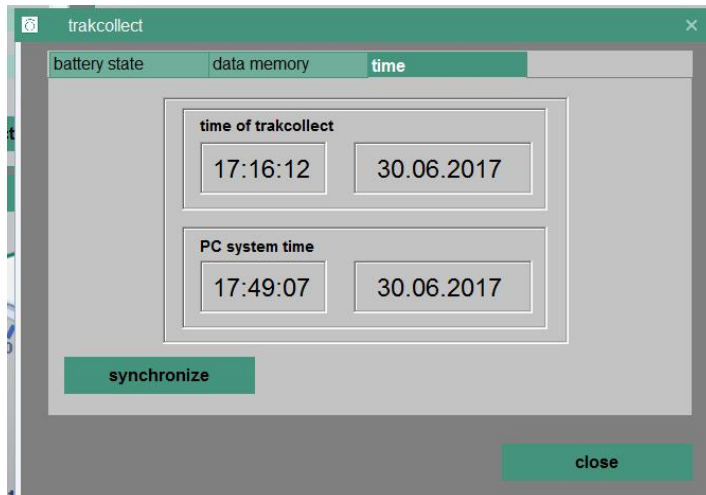
Hint: Process a reset only, if the calculated status are wrong due to false parametrization or an update.

A complete reset and memory delete is necessary, if a primly used trak | collect is mounted on a new battery.



This can also be reasonable, if a new time period needs to be controlled. You have the option to delete the complete memory or just single sections.

An important function is the setting of the real time clock by adjusting the trak | collect clock with connected PC / Laptop clock. Ensure, that your Laptop is set correctly!



Click on button *synchronize* sets the trak | collect clock to the system time of the connected PC / Laptop.

8.3 Export

The menu item *export* consists all functions to use data and reports extern from trak | soft.

It is only possible to export the actual opened report.



The printer symbol opens the according menu.



8.4 Help

Here you can find information to single software functions as well as hints for troubleshooting.



9 Glossary

Name	Meaning	Description
Ah	Ampere-hours	value for electrical capacity of batteries
SOC	State of Charge	Value of Battery in %
SOR	State of readiness	Estimation of actual measurements if battery is ready to use
SOU	State of usage	Estimated remaining usage of the battery in %
LVL	Level-Sensor	Electrolyte sensor
CAN	Controller Area Network	Data bus for truck or charger communication
LIN	Local Interconnect	Data bus for truck or charger communication

	Network	
Batt.Bus	Battery Bus	Hoppecke specific data bus for charger communication

10 Attachment

10.1 Battery- und Operation parameters

Name	Value range	Default	comment
Set to operation-Date trak collect day		31	
Set to operation-Date trak collect month		12	
Set to operation-Date trak collect year		2016	
nom. Cellvoltage [V]	0,01 ÷ 4,00 V	23	
Number of cells	1 - 256	30	
number of cells cell ballancing tab	1 - 256	12	from B- Minus
nominal battery capacity [Ah]	0 - 9999	500	
history storage rate [0.1 sec]	1 - 600	10	Logging memory
battery setup byte: Bit 0: - CAN-Bus termination on/off Bit 1: - Levle sensor enable / disable Bit 2: - Rental usage yes/ no		0	
plate- / celltyp of battery		0	Typ (Seperator, alloy, Pole,...)
battery technology		0	Battery typ (1 = PzS, 2 = AGM, 3 = GEL, 4 = FNC, 5 = NMC, 6 = GM2)
Charge profile Batt.-Bus - HTC		0	VVAABBBCCCCDEEFFG VV: Version AA: charge characteristic (0 = Hopp1, ... 5 = Hopp6) BBB: charge time with one digit (085 = 8,5h) CCCC: main charge current with 2 digts (01256 = 12,56A/100Ah) D: Trak Air (1 = An, 0 = Aus) EE: Battery typ (1 = PzS, 2 = AGM, 3 = GEL, 4 = FNC, 5 = NMC, 6 = GM2) FF: Application (0 = Normal, 1 = fresh, 2 = deep cold) G: Water Refill (1 = on, 0 =off)
production day battery		31	
production month battery		12	
production year battery		2015	
commissioning day battery		31	commissioning
commissioning month battery		12	
commissioning year battery		2015	
putting out of service day battery		31	Out of service
putting out of service month battery		12	
putting out of service year battery		2020	
manufacture name (ASCII)		Hoppecke	
battery-ID costumer (ASCII)		123	
costumer name (ASCII)		K 12	
last service day		31	
last service month		12	
last service year		2015	
service technician ID		1234	

Parameter for Installation on used batteries

SOC [%]	0 ÷ 100	0	
Operation hours [h]	0 - 65000	0	
Discharged AH per cycle [Ah]	0 ÷ 6500	0	
Average temperature	0 to 80	0	
Number of cycles	0 - 10000	0	

Tabel 1: Battery – and operation parameters