robbe

OPERATING MANUAL

PROFI - HOME - CHARGER

No. 8194

Dear Customer,
Thank you for choosing the Automatic Charging Station Profi Homecharger from the robbe range.

You now own an efficient, microprocessor controlled home charging device with battery management.

In spite of the fact that this charging station is easy to use, operating such a high quality automated charging device such as the Profi Homecharger requires a certain amount of knowledge from the user.
This operating manual will help you get to know the device quickly.

In order to achieve this goal, you should read the operating manual carefully, in particular the chapter “Brief information about batteries” and the safety notes, before operating your new automatic charging station.
We wish you much success and enjoyment with your new charging station!

Safety note
Extensive safety notes are listed at the end of the operating manual regarding the handling of charging devices and the different battery types.
Furthermore, there are other informative, general notes regarding individual battery types summarized in the chapter BRIEF INFORMATION ABOUT BATTERIES.

You MUST read these instructions and safety notes BEFORE starting to operate the equipment.

Incorrect handling of batteries and charging devices can lead to battery explosion or fire.

Liability clause
This charging device is exclusively designed and permitted for charging the batteries stated in the introduction. robbe Modellsport assumes no liability for any other use.

Neither the compliance with the operating instructions nor the conditions and methods of operation, use and maintenance of the charging station can be monitored by robbe-Modellsport. For this reason, we assume no liability for losses, damage or costs which result from, or are connected in any way with, incorrect use and operation.

In as far as it is legally permissible and for whatever legal reasons, liability to compensate is limited to the invoice value of the robbe products which have been directly affected by the damaging event.

This does not apply if liability must be unlimited in accordance with compulsory legal guidelines because of intent or gross negligence.

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1. SCOPE OF DELIVERY

The scope of delivery consists of the Profi Homecharger with plug-in supply cable.

1.1 RECOMMENDED ACCESSORIES

Transmitter battery charge cable No. F 1415

Receiver battery charge cable No. F 1416

2. GENERAL DESCRIPTION

The Profi Homecharger is an intelligent home charging station with easy battery management for charging and discharging of NC, NiMH, lead and lithium batteries.
The reflex charge procedure already prevents undesirable memory and lazy battery effects with NC and NiMH batteries during the charging process.

The mains-powered device has four programmable charging outputs which are independent of each other and which are executed one after the other. This means that both the same as well as different battery types and charge programs can be selected. The Profi Homecharger is equipped with an automatic start function; when a battery is plugged in charging starts automatically.
If a process is finished or a battery is removed, then the software ensures that the next charge Output with connected battery is executed.

The menu is controlled via the large background lit 2 x 16 character dot-matrix LC display. Once it has started, you will be informed about all necessary parameters of the current charging procedure in the “working” display. The charge current, charge voltage, charged or discharged capacity and the charged or discharged time elapsed are displayed.

The charge and discharge current are automatically detected in automatic mode for NC and NiMH batteries and set to the optimum value by the software.
This ensures that the batteries are charged carefully and quickly. The end of the charge program is signalled optically and acoustically.

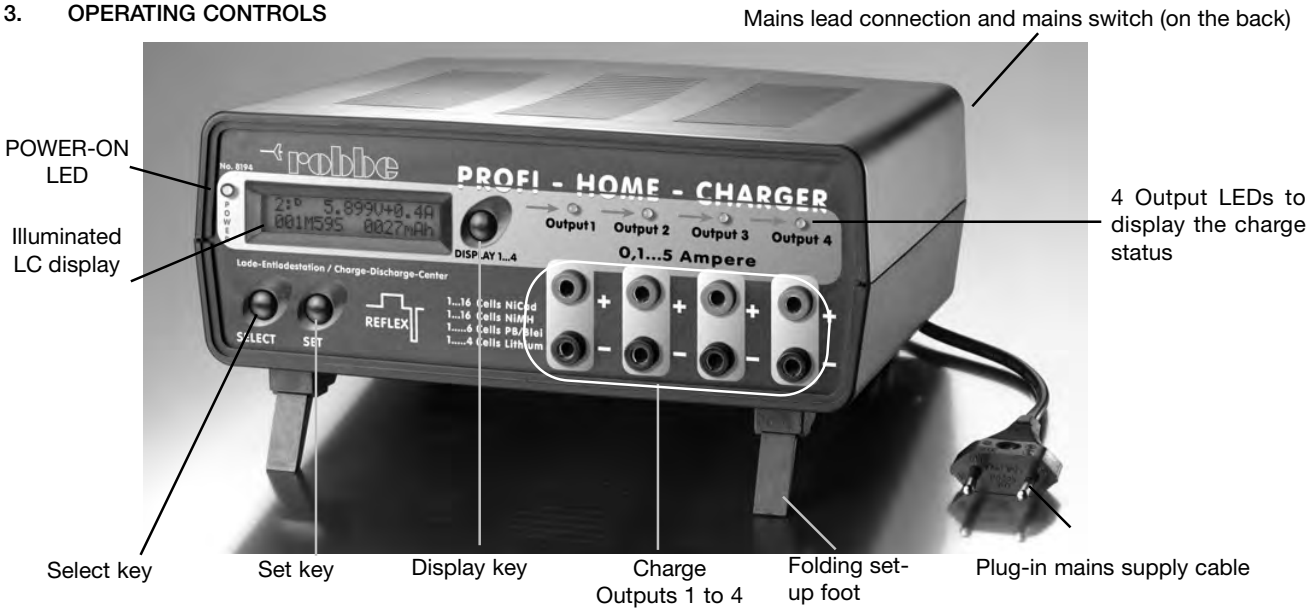
The Profi Homecharger is one of the first home stations which can safely charge or discharge not only conventional and modern batteries but also high capacity batteries such as lithium-ion and lithium polymer batteries.
Different charging and discharging programs are ready to optimally supply the different lithium battery types.
Particular attention was paid to the disconnect voltage with regard to this; both charging/discharging are determined very precisely so that the charge/discharge currents are disconnected at exactly the right moment.

The Profi Homecharger software has seven different charging programs, depending on the type of battery.

NC + NIMH	Lead + Lithium	Charge program
●	-	Charging in automatic mode
●	●	Charging in manual mode
●	-	Discharge-charge in automatic mode
●	●	Discharge-charge in manual mode
●	-	Discharge-charge in auto. mode with 3 cycles
●	-	Discharge-charge in man. mode with 3 cycles
●	●	Regeneration program, with discharging and subsequent C/5-charging, depending on the pre-selected battery capacity

This means that nearly all charge types that occur in practice are covered.

3. OPERATING CONTROLS



3.1 FUNCTION OF THE OPERATING CONTROLS

POWER LED
- Lights up if the charger is switched on.

DISPLAY key
- By repeatedly pressing this key you can switch between the output working displays for Outputs 1...4.
- From Output 4 you get back to the Output 1, the displays are arranged in an endless loop.

SELECT key
- This key changes from the “working” display to the “setting” display where the preset positions are carried out for the charge program of the appropriate Output.

- If the Output has been selected, then SELECT also serves to navigate the cursor to the individual menu points in the “setting” display. These menu points are also arranged in an endless loop.

SET key
- This key changes the values in the “setting” display.
  The values are also arranged in an endless loop and increase by one step each time the key is pressed.
  Once the highest value has been reached the loop begins again with the smallest value.

All keys have an auto-repeat function; holding the key down causes the same effect as repeatedly pressing.

INTEGRATED ACOUSTIC SENSOR
- The internal piezo buzzer acknowledges each time a key is pressed and signals the end of charging or discharging, as well as any errors occurring.

LEDs (OUTPUT 1...4)
- Each charger Output (Output 1...4) has a status LED, which clearly shows the status of the appropriate Output.

Explanation of the LED Status

LED	Anzeige	Bedeutung
Red	Steady light	Charging process running
Red	Flashing	Ready for start
Red	Flashing + warning noise	Error, process not correct
Green	Steady light	Discharging process running
Green	Flashing	Process finished

4. START-UP OF CHARGING STATION

Connect the supply cable on the back of the Profi Homecharger and link with a 230 V/50-60Hz mains supply socket.
Afterwards, turn the equipment on with the switch on the back.

4.1 DISPLAYS AFTER SWITCHING ON

The blue ‘POWER’ LED and a short sound signalize that it is switched on and the following appears in the illuminated display:

The software version is displayed next to the company symbol and the device name. A short self-test will be carried out as is usual with microcomputer controlled devices. If no battery is connected then the device will continue showing this display.
Now there are two navigation alternatives:
1. Without changing the language go directly to the “working” display -> then press the DISPLAY key.
2. Select the language in which for example the error message should be displayed, then:
- Press ‘SELECT’ key; the set language will be displayed.

- The ‘Set’ key can call up the following languages one after the other.
- **Deutsch (German)**
- **Französisch (French)**
- **Spanisch (Spanish)**
- **Italienisch (Italian)**
- **Englisch (English)**

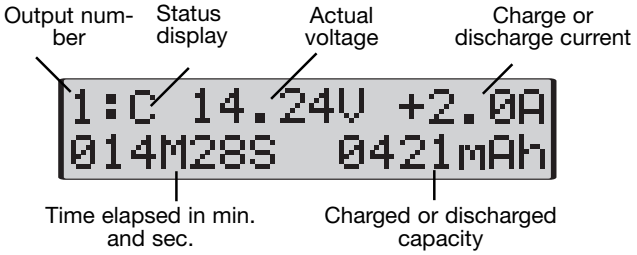
- Select the desired language and press the ‘DISPLAY’ key.

This will display the “working” display of the first charge Output.

4.2 WORKING DISPLAY

The display will make all necessary information available to the user during a discharging or charging procedure.

Example of a “working” display



4.3 STATUS DISPLAY AND EXPLANATION		
N	**N**o battery	No battery connected
C	**C**harge	Charging procedure
D	**D**ischarge	Discharging procedure
D/C	**D**ischarge/**C**harge	Discharge/charge cycle
F	**F**inish	Process completed
R	**R**eady	Charger ready
-	Negative value	Discharge value (current or capacity)
+	Positive value	Charge value (current or capacity)

4.4 SETTING THE CHARGE/DISCHARGE PARAMETERS

To set the parameters for a new procedure, press the SELECT key.

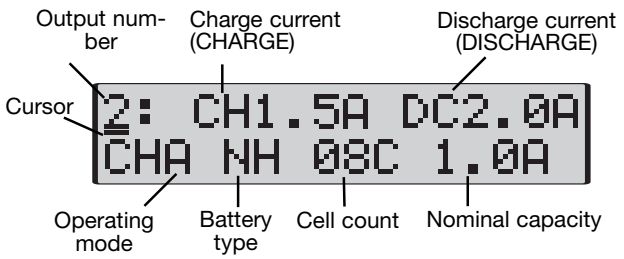
- The display changes to the “setting“ display

- Select a charge Output (1…4) with the SET key.

- Navigate through the “setting” display by repeatedly pressing the SELECT key. A cursor marks the adjustable value.

- The values are changed by pressing the SET key.

Example for the “setting” display of charge Output 2



Explanation:
The individual parameters can be set in the following ranges or limits:

Output number: **1 to 4**

CH:	**Battery voltage**	**Charge current**
	0 - 8 V:	0.1...5 A
	8 -10 V:	0.1...4 A
	10 -13 V:	0.1...3 A
	13 -20 V:	0.1…2 A
	over 20 V:	0.1…1 A

DC:	**Battery voltage**	**Discharge current**
	0 - 6 V:	0.1...5 A
	6 - 8 V:	0.1...4 A
	8 -10 V:	0.1...3 A
	10 -16 V:	0.1...2 A
	over 16 V:	0.1...1 A

Charge and discharge currents are dependent on the battery voltage and are automatically limited to the preceding values by the device.

Operating modes: (Programs)
- CHA: Charging in automatic mode
- CHM: Charging in manual mode
- DCA: Discharge-charge in automatic mode
- DCM: Discharge-charge in manual mode
- REA: 3 cycles discharge-charge in automatic mode
- REM: 3 cycles discharge-charge in manual mode
- D/C: Regeneration program, with discharging and subsequent C/5-charging

Battery types:
NC: Nickel cadmium batteries (NC)
NH: Nickel metal hydride batteries (NiMH)
Pb: Lead batteries
LI: Lithium-ion batteries (Li) 3.6V/cells
LP: Lithium-ion polymer batteries (Lp) 3.7V/cells

C Cell count

NC batteries:	1 to 16 cells (nominal voltage 1.2...19.2V)
NH batteries:	1 to 16 cells (nominal voltage 1.2...19.2V)
Pb batteries:	1 to 6 cells (nominal voltage 2...12V)
LI batteries:	1 to 4 cells (nominal voltage 3.6…14.4V)
LP batteries:	1 to 4 cells (nominal voltage 3.7...14.8V)

Ah: Battery capacity
0.1 to 20 Ah with different increments:

0.1...1.0 Ah	= increment 0.1 Ah
1.0...5.0 Ah	= increment 0.5 Ah
6.0...20 Ah	= increment 1.0 A

With intermediate values, set the next higher value.

5. CONNECTING THE BATTERIES

Important!!!
Check the set charge parameters again (especially the battery type and the cell count) before connecting a battery!
If the setting is wrong the battery can be damaged, explode or start to burn.

Up to four batteries can be connected simultaneously to the four Outputs via an appropriate charge cable.
E.g. use charge cable for transmitter batteries (No. F1415) and receiver batteries (No. F1416).
To avoid a short circuit with the banana plugs first connect the charge cable to the charge device and then to the battery.
When disconnecting, proceed in reverse order.

Important:
A reverse battery protection diode is installed in the transmitter on most remote control systems.
These types of transmitters can not be charged or discharged via the charge box with the reflex charge program used for NC and NiMH batteries, with an automatic charge program or a discharge program.
For this purpose, the reverse battery protection diode should be by-passed or the battery should be charged outside the transmitter with a direct charging cable.

Pay attention to the correct polarity when connecting; the Outputs are clearly marked.
If you do not use any prefabricated, mass-produced charge cables, check that the battery is correctly connected. The device is not damaged if a battery is connected with the wrong polarity.
Each Output is protected against reverse battery polarity. A loud warning sound and a corresponding error message on the display screen indicate the status (see Chapter 9).

6. STARTING THE CHARGE PROCESS

The Profi Homecharger is equipped with an automatic start function. When the battery is plugged in, the programmed charge process starts automatically; the relevant status LED is illuminated red or green and the charge or discharge process begins.

The “setting” display will appear for a short time directly after the battery has been plugged in, so that the programmed parameters can be checked. Afterwards, the device will switch automatically to “working” display.
If the “setting” display is still active when a battery is plugged in, then the display will change automatically to “working” display.

If, when you plug in a battery, the setting display shows another Output, then the display will jump immediately to “setting” display and then to “working” display.

The connected batteries are executed one after the other with the preset parameters.
If the charging program has finished then the program will jump to the next charger Output with connected battery.

If the connection to a battery is interrupted at an active output, then the error message “Output interruption“ will appear and a steady warning sound will be heard (see Chapter 9).
In spite of the error message on the display, the device switches to the next charge Output and executes this charge program.
After the charge program has been executed, the device switches the charge process off.
- An acoustic signal sounds for a short period at the end of the charging process.
- The status LED changes from a red steady light to a green flashing light.
- The process is signalled as properly finished by showing the letter ‘F’ (Finish) on the display.

Apart from this, the current battery voltage, the process time in min. and sec. as well as the charged or discharged capacity are alternately displayed (negative value = discharged capacity, positive value = charged capacity).
0.0A is displayed as there is no current flowing.

7. COMPENSATION CHARGING - PERMANENT CHARGING

The individual charge programs are designed in such a way that there is generally no compensation charging.
If the charged batteries remain in the charge device then the device will automatically re-start the execution of Outputs 1...4 after 22 days.
This means that the batteries always remain charged and ready for use even over long periods of time.

8. CHARGE PROGRAMS

Depending on the battery type, there are up to 7 different charge programs available.
In the general course of events, these programs are the same for all battery types, but the charge procedure and the automatic disconnect are different and dependent on the set battery type.

NICKEL CADMIUM BATTERIES (NC)

These batteries are charged with the special reflex charge procedure which already prevents the undesirable memory and lazy battery effect during the charging process.
The great advantage of the reflex charge procedure is that no different charge structures occur between the compensated charge and new charge during recharging.
A homogenous charge structure is created in the battery during the charge process as a result of a powerful discharge pulse.
The precise, digital delta peak disconnection switches off the charge process exactly at the right time.
In addition to this, a safety disconnect works in the background which finishes the charge process when it has reached 125% of the set capacity.

NICKEL METAL HYDRIDE BATTERIES (NH)

These batteries are also charged with the reflex charge procedure.
Since these types of batteries react very sensitively to overcharging and therefore require a more sensitive disconnection, the automatic disconnect works according to a special ZERO-DELTA volt procedure.
Note: The prerequisite for this very careful charge procedure is that the battery is in a well formed condition.
Older or badly formed NiMH batteries can lead to early disconnection.

Remedial action: Regenerate the battery with a regeneration program or charge in NC mode.
In addition to this, a safety disconnect works in the background which finishes the charge process when it has reached 125% of the set capacity.

LEAD BATTERIES (Pb)
These types of batteries are charged with a constant voltage (2.30 volt / cell). At the start of charging, the current is kept constant at the preset value.
The charge current reduces continuously after reaching the charge end voltage.
The charging is finished if approx. 10% of the set charge current is achieved.

Lithium-ion batteries (Li)
These types of batteries are also charged with a constant voltage (4.10 volt / cell). At the start of charging, the current is kept constant at the preset value.
A charge current of 1C is recommended. The charge current reduces continuously after reaching the charge end voltage.
Charging is finished if approx. 10% of the set charge current is achieved.

LITHIUM-ION POLYMER BATTERIES (LP)
These types of batteries are also charged with a constant voltage (4.20 volt / cell). At the start of charging, the current is kept constant at the preset value.
A charge current of 1C is recommended. The charge current reduces continuously after reaching the charge end voltage.
Charging is finished if approx. 10% of the set charge current is achieved.

It is particularly important that the charge targets of the battery manufacturer and the remote control manufacturer charge targets for the installed transmitter batteries are not exceeded.

8.1 CHARGING IN AUTOMATIC MODE - CHARGE AUTOMATIC (CHA).

The charge currents are automatically detected in automatic mode and set to the optimal value. The limits set by the charge device (see Chp. 4.4) are taken into consideration. The currents specified in the “setting” display do not influence the values established by the processor.

There is initially a small current at the start of the charge process, when measuring the battery. The optimal charge current is then set after a short operating period.
The batteries are charged at an optimal charge rate with particularly careful handling in this operating mode.

For reasons of safety, this operating mode is not available for lithium-ion batteries (LI), lithium polymer batteries (LP) and lead batteries (Pb).

For these batteries, the parameters must be set directly by the user in manual mode (CHM) while strictly observing the charge targets of the battery manufacturer. The settings are locked off from each other by the software. This means that, if the automatic mode is specified, only nickel cadmium (NC) or nickel metal hydride batteries (NH) can be selected.
If one of the lithium battery types or a lead battery is specified then you will not be able to set the automatic mode.

8.2 CHARGING IN MANUAL MODE - CHARGE MANUAL (CHM).

This operating mode is suitable for charging all battery types. The charge current must be programmed in the “setting” display while observing the limits which are specified by the Profi Homecharger (see Chp. 4.4).

8.3 DISCHARGE-CHARGE AUTOMATIC MODE (DCA)

The discharge and charge currents, as well as the discharge end voltage, are automatically detected in automatic mode and set to the optimal value. The limits set by the charge device (see Chp. 4.4) are taken into consideration. The currents specified in the “setting” display do not influence the values established by the processor.

There is initially a small current at the start of the discharge-charge process, when measuring the battery. The optimal current is then set after a short operating period. In this operating mode, the batteries are charged at a perfect charge rate with particularly careful handling.

For reasons of safety, this operating mode is not available for lithium-ion batteries (LI), lithium polymer batteries (LP) and lead batteries (Pb).

For these batteries, the parameters must be set directly by the user in manual mode (DCM) while strictly observing the targets of the battery manufacturer. The settings are locked off from each other by the software. This means that, if the automatic mode is specified, only nickel cadmium (NC) or nickel metal hydride batteries (NH) can be selected.

If one of the lithium battery types or a lead battery is specified then you will not be able to set the automatic mode.

8.4 DISCHARGE-CHARGE IN MANUAL MODE (DCM)

This operating mode is suitable for discharging-charging all battery types. The discharge and charge current must be set corresponding to the targets of the battery manufacturer. Guide values for each battery type are stated in the chapter “Brief information about batteries” (from Page 10).
The discharge end voltage is automatically determined.

8.5 DISCHARGE-CHARGE IN AUTOMATIC MODE 3 CYCLES REGENERATION AUTOMATIC (REA)

Three discharge-charge cycles are run through in this operating mode. This means that the charge and the discharge current, as well as the discharge end voltage are automatically determined by the Profi Homecharger. The process begins with discharging the battery. This is followed by recharging. This cycle is run through three times. At the end, a charged battery is available.

This procedure is applied to improve the condition of NiCd or NiMH batteries. There is more capacity available subsequent to this.
There are no improvements from this procedure with lithium-ion batteries (LI), lithium polymer batteries (LP) and lead batteries (Pb). The software therefore does not supply for these types.

8.6 DISCHARGE-CHARGE IN MANUAL MODE REGE NERATION MANUAL (REM)

Three discharge-/charge cycles are run through in this operating mode. This means that both the charge and discharge current must be programmed manually in the “setting” display; the discharge end voltage is automatically determined. The process begins with discharging the battery. This is followed by recharging. This cycle is run through three times. At the end, a charged battery is available.

This procedure is applied to improve the condition of NiCd or NiMH batteries. There is more capacity available subsequent to this.
There are no improvements from this procedure with lithium-ion batteries (LI), lithium polymer batteries (LP) and lead batteries (Pb). The software therefore does not supply for these types.

8.7 REGENERATION PROGRAM (D/C)

A regeneration program is made available for all battery types with this program.
In this operating mode, the battery is discharged first.
Subsequently, the battery is recharged depending on the preset battery capacity with a charge current C/5.
The discharge current, the capacity and the cell count must be set manually.

Important:
The following settings are to be carried out depending on the selected battery type to achieve correct disconnection during a charging process:

Lead battery:
Additional entry of the charge current.

Explanation: The disconnection criterion for lead batteries is coupled to the charge current on the Profi Homecharger. The charge process is stopped if the charge current reaches 10% of the set value.
However, this would lead to an unnecessarily long 2nd charge phase as lead batteries have a very high leakage current. We recommend you set the charge current to the maximal value (5A).

Lithium-ion / lithium polymer batteries:
Additional entry of the charge current.

Explanation: The disconnection criterion for lithium batteries is coupled to the charge current on the Profi Homecharger. The charge process is stopped if the charge current reaches 10% of the set value.
We recommend you set the charge current to 1C.
The duration of the 2nd charge phase can be determined within certain limits by an experienced user consciously setting a higher or lower charge current than 1C with lithium cells.

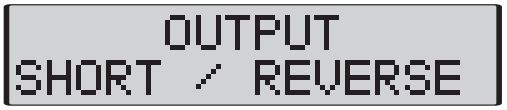
Examples:
- **Charge current smaller** = about 0.5 C -> The 2nd charge phase lasts longer because is it disconnected with a smaller residual current.
- **Charge current larger** = about 2 C -> The 2nd charge phase is shorter because is it disconnected with a higher residual current. The battery is therefore not completely charged.

9. ERROR MESSAGES

The Profi Homecharger is equipped with safety features to guarantee safe charging or discharging processes. As soon as an error occurs, a corresponding message appears in the display and a piezo buzzer sounds a shrill warning tone.

9.1 REVERSE BATTERY / SHORT-CIRCUIT OF AN OUTPUT

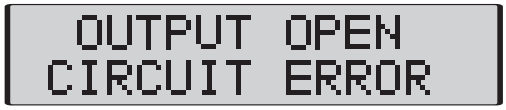
All Outputs of the Profi Homecharger are protected against reverse polarity of connected batteries. If a battery is connected to an Output with the wrong polarity, then a loud constant tone will sound as a warning, the Output LED lights up red and the error is shown in the display.
The same applies if a short circuit occurs on one of the Outputs.
The following display shows the error display.



For reasons of safety, a charge or discharge current does not flow in this condition.
As soon as the battery is unplugged or the short circuit has been removed, the LED will go out, the warning tone will stop and the previous display will appear again.

9.2 INTERRUPTION

If the charge cable or the battery have a loose contact and it leads to an interruption in the charge or discharge current, there will appear a corresponding error message in the display and the buzzer will sound.
The corresponding Output is marked by a red, steady Output LED.



The same warning signs are displayed optically and acoustically if the battery is removed from the charge device without it being fully charged.

One of the three keys must be pressed to delete these warning signals.

NOTE:
The charge process will be restarted after re-establishing the power supply if there is an interruption of the charge process at the input point of the charge device, for example as a result of power failure, or unintentionally pulling the mains supply plug etc.

This means that the Profi Homecharger starts with the first charge Output at which a battery is connected. All occupied Outputs are executed one after each other.
Since the batteries at the already executed Outputs are full, the charger will quickly get back to the Output which was active at the time of power interruption and resume the charge process.

10. TECHNICAL SPECIFICATIONS

Input: 230V ~, 50/60 Hz

Outputs 1 to 4

Cell count

NC batteries:	1 to 16 cells (nominal voltage 1.2...19.2V)
NH batteries:	1 to 16 cells (nominal voltage 1.2...19.2V)
Pb batteries:	1 to 6 cells (nominal voltage 2...12V)
LI batteries:	1 to 4 cells (nominal voltage 3.6…14.4V)
LP batteries:	1 to 4 cells (nominal voltage 3.7…14.8V)

Charge current:

0 - 8 V:	0.1...5 A
8 -10 V:	0.1…4 A
10 -13 V:	0.1…3 A
13 -20 V:	0.1…2 A
over 20 V:	0.1…1 A

Discharge current:

0 -6 V:	0.1…5 A
6 - 8 V:	0.1…4 A
8 -10 V:	0.1…3 A
10 -16 V:	0.1…2 A
over 16 V:	0.1…1 A

Battery capacity: 0.1 to 20 Ah
Dimensions: 200x230x87 mm
Weight: approx. 2 kg
Protective functions: Protection against reverse battery polarity and short circuit, safety disconnect with capacity x 125%

11. WARRANTY

The warranty period for this charging device is 24 months. The receipt from your specialist model dealer, which you will have received on purchasing the system, serves as proof for the start and finish of this warranty. Any repairs made do not extend the warranty period.

During this period, we will remedy any functional defects, as well as manufacturing and material faults, free of charge. Further claims, e.g. resulting from consequential damage, are excluded.

Transportation of goods to us must be paid for by the customer, return transport to the customer will then be free of charge.
Any consignments incurring costs will not be accepted.

We assume no liability for damages during transport or for the loss of your consignment. We recommend you take out a corresponding insurance. Please send your equipment to the appropriate service centre in the respective country.

The following prerequisites must be fulfilled to process your warranty claims:
- Include your proof of purchase (till receipt) with your consignment.
- The equipment was operated in accordance with the operating instructions.
- Only the recommended electricity sources and original robbe accessories were used.
- There was no damage due to moisture, no external interventions, over-voltages, overloading or mechanical damage.
- Include pertinent information for locating the fault or defect.

12. GENERAL SAFETY NOTES

- The Profi Homecharger is only suitable for charging rechargeable NC / NiMH / lead and lithium batteries.
- Do not charge dry batteries; there is a risk of explosion.
- The charge device is only designed for use with 230 V ~ AC; never operate it with another voltage.
- You must protect the charge device against dust, dirt and moisture.
- Do not subject the device to excessive cold, heat or direct sunlight.
- Avoid shock or pressure loads and do not subject the Profi Homecharger to any strong vibrations.
- **Never place charge device or connected batteries on inflammable surfaces. Never use near combustible materials or gases.**
- **Do not** leave the device unattended during use.
- The device can heat up a lot during normal use.
- Pay attention to cooling openings for air circulation when setting up (never place on a carpet or felt base), always unfold the stand bracket.
- If the device is not used for long periods, disconnect it from the power source and possibly remove connected batteries.
- Do not charge batteries again shortly after the first charging.
- Do not charge batteries that are really warm. Let batteries cool to the surrounding temperature.
- Only cells of the same capacity and the same manufacture can be charged in compound.
- Do not charge any two NC or NiMH battery packs parallel on one Output, only connect one battery pack.
- Pay attention to the correct polarity of the battery and avoid short circuits.
- Strictly observe the details from the battery manufacturer.
- **Always check the settings on the Profi Homecharger exactly. Batteries can be destroyed by unsuitable settings.**
- Check for damages to the casing and cables.
- Take care when dealing with mains supply voltage as there is a risk of electric shock.
- Take care when dealing with battery packs with high cell counts. Check for good insulation otherwise there is a risk of electric shock.

13. BRIEF INFORMATION ABOUT BATTERIES
13.1 NICKEL CADMIUM BATTERIES (NC)

In the field of model construction, nickel cadmium batteries (in model building jargon "NC batteries") have a secure position as drive batteries and for supplying power to remote control units. These power sources are efficient, easy to maintain and reliable. Nevertheless, some principles should be observed when dealing with the batteries. They will thank you for it with longer service life and the highest degree of available capacity.

Charge rate
The term “charge rate” (C) has established itself for the size of the charge and discharge currents. It creates the connectivity between charge current and battery capacity.

If, for example, a battery with a capacity of 600 mAh is to be charged with a rate of '1 C', then there must be a current of 600 mA flowing.

Forming
A new battery, or one that has not been used for a long period of time, must be formed before use. An exhaustively discharged battery, which can lead to some of the cells having their polarity reversed, must also be formed again first. The battery is formed over 20-24 hours with a charge rate of 0.1C. The Profi Homecharger has the regeneration mode (D/C) available for this purpose.

Charging
A charge rate of up to 0.1 - 0.2 C is called **normal charging.** Since you always have to charge the battery more than you can discharge, the charge time for normal charging with 0.1 C is not 10 hours but 14 hours. That means that the overcharge factor is 40 % for normal charging.

Longer charging of this type will only cause damage with overcharging of more than approx. 100 hours; however, this should be avoided as the electrical energy introduced is no longer saved, but chemical processes are released which reduce the service life of the battery.

There is an **accelerated charging** if a charge current flows at a level of 0.3 - 0.5 C.

Quick charging is when you charge the battery with rates of more than 1C.
With larger charge rates than 0.1 C, the charge current must be interrupted as soon as the battery is fully charged. The digital delta peak process, for example, is suitable as disconnect criterion. This evaluates the undervoltage which occurs when the battery is completely charged up.

Depending on the level of the charge rate, a battery builds up different crystal structures. For this reason, with high current discharging of drive batteries there must be a quick charge.
The higher the charge current selected, the lower the voltage collapse during discharging.

We recommend the following charge rates for NC batteries:
High energy batteries, 1-2 C, please also observe the details from the battery manufacturer.

High current batteries, 2 -3 C, extreme up to 5 C. Observe any maximum charge current details from the battery manufacturer. Check whether the plug-in connection and/or the charge cables are suitable for the selected charge current.

Self-discharging
Self-discharging of NC cells is approx. 0.5...1% per day (20°C). That means that after approx. 100...200 days, a previously fully charged battery is completely discharged without being strained at all. Batteries must therefore be recharged before use.

Storage
If a NiCd battery is not used for a foreseeable period of time it is better to discharge it beforehand and then store it in a cool and dry place. Then, after one forming, the battery will gain nearly its full capacity. If the battery is not discharged beforehand then the first charging will only result in about 90 - 95 % of the voltage and capacity and it will only achieve full capacity after 2-3 charge cycles.

Service life
Depending on the application and use of the charge procedure, NC batteries have a service live of approx. 500...1000 cycles. After this, the battery is used up and must be disposed of in an appropriate manner.

Temperature
The NiCd battery heats up very markedly during a high current discharge. The cells must therefore be cooled down before charging. A warm or even a hot cell absorbs less charge and can accordingly release less energy.

Discharge end voltage, exhaustive discharge
Measured under load, the permissible discharge end voltage is approx. 0.85 volt per cell (this is automatically set by the Profi Homecharger).
Exhaustive discharge occurs during further discharging. This can lead to pole reversal of one or several cells. Pole reversed cells change their polarity. There is minus potential at the plus pole and plus potential at the minus pole (if there is low loading check with the voltmeter).
Cell defects can be prevented by immediate 14 hour normal charging.
NC batteries are not as sensitive to exhaustive discharge as NIMH batteries.
Storage over a long period of time in an exhaustive discharge condition can however also lead to cell defects with NC batteries.

When handling NC cells, some safety precautions must be observed to prevent bodily injury or material damage. You assume responsibility when using these batteries.

- Never allow NC cells to come into contact with open flames as there is a risk of explosion.
- Never open NC cells with force as there is a risk of acid burn.
- Never short-circuit NC cells as there is a risk of burning and explosion.
- Never allow secreted electrolyte to come into contact with skin or eyes. If this should happen by accident, rinse generously with water and find a doctor. Never put batteries in your mouth as there is a risk of poisoning.
- Never solder with the solder iron on the cell casing.
- The minus side of the cell is particularly sensitive.
- A charged NC battery is not a toy. Batteries should be kept out of the reach of children.
- Observe the information from the corresponding battery manufacturer when charging and discharging.

13.2 NICKEL METAL HYDRIDE BATTERIES (NIMH).

In the last few years, modern nickel metal hydride batteries (NiMH) have developed as a real alternative to NC batteries. They are now capable of bearing high currents and can therefore be used as batteries for remote control systems as well as drive batteries. As a rule, they offer 1.5 times the capacity than NC batteries with the same weight and are also environmentally friendly.

Charge rate

The term “charge rate” (C) has established itself for the size of the charge and discharge currents. It creates the connection between the charge current and the battery capacity.
If, for example, a battery with a capacity of 600 mAh is to be charged with a rate of '1 C', then there must be a current of 600 mA flowing.

Forming

A new battery, or one that has not been used for a long period of time, must be formed before use. A battery which was exhaustively discharged, which can lead to some of the cells having their polarity reversed, must also be formed again first. The battery is formed over 24-26 hours with a charge rate of 0.1C. The Profi Homecharger has the regeneration mode (D/C) available for this purpose.

Charging

A charge rate of up to 0.1 - 0.2 C is called **normal charging.** Since you can always charge the battery more than you can discharge, the charge time for normal charging with 0.1 C is not 10 hours but 16 hours. That means that the overcharge factor is 60% for normal charging. Longer charging of this type damages the battery and should therefore be avoided as the electrical energy introduced is not longer saved, but chemical processes are released which reduce the service life of the battery.

There is an **accelerated charging** if a charge current flows at a level of 0.3 - 0.5 C.
Quick charging is when you charge the NiMH batteries with rates of more than 0.5 C.
With larger charge rates than 0.1 C, the charge current must be interrupted as soon as the battery is fully charged. The digital delta peak process, for example, is suitable as disconnect criterion. This evaluates the undervoltage which occurs when the battery is completely charged up.

Depending on the level of the charge rate, a battery builds up different crystal structures. For this reason, with high current discharging of drive batteries there must be a quick charge. The higher the charge current selected, the lower the voltage collapse during discharging.

We recommend the following charge rates for NiMH batteries:
High energy batteries, 0.5...1 C, please also observe the battery manufacturer information.

High current batteries, usually 1C, some battery types can be charged with 1.5...2C. Observe the maximum charge current details of the battery manufacturer.

Self-discharging

NiMH batteries lose about 1.5% (at 20°C) of their charge per day. After approx. 75 days the full battery is completely discharged. Batteries must therefore be recharged before use.

Storage

If a NiMH battery is not to be used for a foreseeable amount of time, store it in a cool and dry place (10 to 30°C); the battery should have a capacity of at least 30…100% before storing.
Then, after one forming, the battery will gain nearly its full capacity.

Service life

Depending on the application and use of the charge procedure, NC batteries have a service live of approx. 500 to a maximum of 1000 cycles. After this the battery is used up and must be disposed of in an appropriate manner.

Temperature

The NiMH battery heats up very markedly during high current discharge. The cells must therefore be cooled down before charging. A warm or even a hot cell absorbs less charge and can accordingly release less energy.

Discharge end voltage, exhaustive discharge

Measured under load, the permissible discharge end voltage is approx. 1 volt per cell (this is automatically set by the Profi Homecharger).

Exhaustive discharge will occur during further discharging. This can lead to pole reversal of one or several cells. Pole reversed cells change their polarity.

There is minus potential at the plus pole and plus potential at the minus pole (if there is low loading check with the voltmeter). If at all, cell defects can be prevented only by immediate 14 - 16 hour normal charge.

Avoid exhaustive discharges with NiMH batteries; exhaustive discharges can lead to irreparable cell defects.

When handling NiMH cells, some safety precautions must be observed to prevent bodily injury or material damage. You assume responsibility when using these batteries.

- Never allow NiMH cells to come into contact with open flames as there is a risk of explosion.
- Never open NiMH cells with force as there is a risk of acid burn.
- Never short-circuit NiMH cells as there is a risk of burning and explosion.
- Never allow secreted electrolyte to come into contact with skin or eyes. If this should happen by accident, rinse generously with water and find a doctor. Never put batteries in your mouth as there is a risk of poisoning.
- Never solder with the solder iron on the cell casing.
- The minus side of the cell is particularly sensitive.
- A charged NiMH battery is not a toy. Batteries should be kept out of the reach of children.
- Observe the information from the corresponding battery manufacturer when charging and discharging.

13.3 LEAD BATTERIES (PB)

In the field of model construction, lead batteries as drive batteries are being superseded more and more by quick-charge and lighter NC batteries. However, they are indispensable as a starter battery, a power source for mobile 12 volt charge devices, and for high start winds as well as in the field of model ship construction.

The charge procedure for lead batteries is completely different than for NC/NiMH batteries, they are charged with the constant voltage procedure. This charge procedure is very similar to the Li-ion batteries (see Chp. 12.4).

Charge rate

A charge current limit is only rarely necessary as normally the lead batteries have a high capacity and a high internal resistance. In most cases, the maximum available charge current can be set. When the target voltage has been reached, the charge current sinks; it should be interrupted at about 0.01-0.02 C to prevent the battery gassing (it is automatically interrupted with the Profi Homecharger at about 10% of the charge current).

Charging

Quick charging of lead batteries is critical as the charge voltage is increased to 2.4 volts per cell for this which simultaneously represents the gassing limit and which is very dependent on the surrounding temperature.

Charge voltage

In cycle operation, the charge end voltage can be set to 2.35 volts per cell at a surrounding temperature of 20°C (this is automatically calculated by the Profi Homecharger via the cell count).

Charge dependency

Lead batteries with gel-formed electrolyte are mostly charged independent of position; in contrast, lead batteries with liquid electrolytes must be charged in a standing position.

Self-discharging

Self-discharging of lead batteries is in the lower range with approx. 0.2...05 % per day (at 20°C). After approx. 300 days the battery is exhausted without even being used. Charge up lead batteries every 10-12 months.

Storage

Storage of lead batteries in not critical and can be carried out at - 15...+40 °C. You must make sure that lead batteries are charged up before storage. Storage of uncharged lead batteries leads to the destruction of the battery.

Service life

Depending on the application and use of the charge procedure, lead batteries have a service live of approx. 500-1000 cycles. After this the battery is used up and must be disposed of in an appropriate manner.

Discharge end voltage, exhaustive discharge

Lead batteries are very sensitive to exhaustive charging, which leads to loss of capacity and shortening of the service life and **they must be fully recharged immediately after use to avoid long-term damage.**

The discharge end voltage should not fall short of 1.75 volts per cell (at 20°C) (this is automatically calculated by the Profi Homecharger via the cell count).

When handling lead batteries, some safety precautions must be observed to prevent bodily injury or material damage. You assume responsibility when using these batteries.

- The gel-lead batteries most common in model construction are mostly gas-tight and are therefore less dangerous.
- In contrast, car batteries with liquid sulphuric acid as electrolyte are very dangerous because of the corrosive sulphuric acid and the quick gas formation if they are overcharged.
- Never allow lead batteries to come into contact with open flames as there is a risk of explosion.
- Never open lead batteries with force as there is a risk of acid burn.
- Never short-circuit lead batteries as there is a risk of burning and explosion.
- Never allow secreted electrolyte to come into contact with skin or eyes. If this should happen by accident, rinse generously with water and find a doctor. Never put batteries in your mouth as there is a risk of poisoning.
- A charged lead battery is not a toy. Batteries should be kept out of the reach of children.
- Observe the information from the corresponding battery manufacturer when charging and discharging.
- Gassing of lead batteries can occur during the charge process. **For this reason, make sure there is sufficient ventilation. Overcharging creates a “detonating gas” (oxyhydrogen gas) from a mixture of water and oxygen.**
  There is a risk of explosion.

13.4 LITHIUM BATTERIES (LI AND LP)

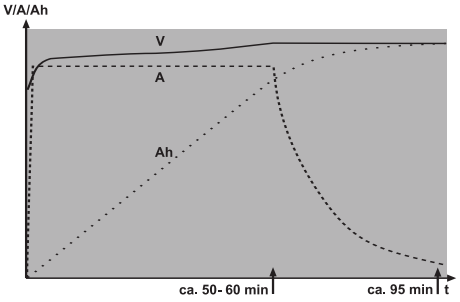
General

There are different lithium battery types:

1. Lithium-ion batteries with liquid electrolyte and 3.6 volt nominal voltage, which are the first generation of lithium batteries, are not common in model construction.
2. Lithium-ion batteries with liquid electrolyte and 3.7 volt nominal voltage, which are the second generation of lithium batteries, with metal cup.
3. Lithium-ion polymer batteries with gel-formed electrolyte and 3.7 volt nominal voltage which are the current generation of lithium batteries and are also called LiPoly. There is less pressure in the cell during charging and discharging as a result of the gel-type electrolyte which means that a foil casing is sufficient. It has become common very quickly in model construction because of its low weight and high energy density.

Charge procedure

Lithium-ion batteries are charged with the constant voltage procedure. The charge procedure is the same for all lithium battery types, however the disconnect voltage is different depending on the nominal voltage.
For this reason, the cell count is pre-selected on the charge device from which the Profi Homecharger calculates the correct disconnect voltage.
During the first charge phase, the battery voltage increases slowly to a maximum value of 4.1 / 4.2 V / cell.
In this phase, the charger ensures that the charge current remains constant at the set value.
This first phase lasts about 50-60 minutes with a charge current of 1C and a discharged battery. A battery capacity of about 80-90 % is thereby charged.



In the second phase, the charge current sinks as the voltage difference between the charger and the battery gets smaller and smaller.

Another 35-40 minutes are required for charging the residual capacity. Once the lower current limit of about 10 % of the specified charge current is reached then the charge device will turn the charge process off.

With the currently permissible charge rates of 1C this means that the entire charge process takes at least 90 minutes with a discharged battery.

In general LiPoly batteries have the following specifications:

Charge rate

1C, means capacity value = charge current

- **Example: LiPoly cells with 1500 mAh; 1C = 1500 mA (=1.5A) charge current**

Discharge current

3-5 C, short-term also up to 10 C

Charge end voltage

Cells with nominal voltage 3.6 V = 4.1 volt
Cells with nominal voltage 3.7 V = 4.2 volt
This is automatically determined by the Profi Homecharger by setting the battery type and the cell count.

Charging battery packs

Integrated charge protection

Each cell usually has a voltage control module to protect the LiPoly cells from overcharging, exhaustive discharging or too high current.

Since mostly high load currents are discharged in the field of model construction, this control module would very frequently switch off to protect the cells. For this reason, it is not integrated into most battery packs.
This fact causes problems when charging LiPoly cells switched in a row. As mentioned previously, the individual cells have slightly different charge conditions and voltage positions.

The applied total charge end voltage distributes itself unevenly over the individual cells, whereby cells with higher voltage position can be overcharged.

To prevent this, the individual cells must be brought up to a charge end voltage of 4.1 or 4.2 volt.
Charging of parallel switched individual cells is unproblematic as the total current distributes itself to the individual cells depending on the voltage position.

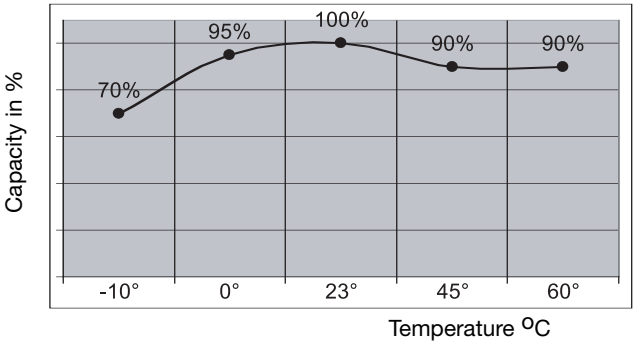
We would like to explicitly point out to you that, for reasons of safety, LiPoly batteries can only be charged with the Profi Homecharger if the individual cells are provided with a voltage control module.
We assume no liability for damages resulting from improper handling of the cells.

Battery temperature range

Charging -> 0°...+45°C
Discharging -> -20°...+60°C

Temperature behaviour

Lithium cells have a distinct temperature index whereby the nominal capacity is not available with very low and high temperatures.



Both when charging (45°C) and when discharging (60°C), the max. external cell temperature may not be exceeded as otherwise the cell will be damaged permanently in the form of capacity loss.

If it is exceeded for a longer period it is destroyed, can explode or start to burn.

Self-discharging
LiPoly cells have an extremely low self-charging rate (approx. 0.2% per day) and can therefore be stored over long periods of time without any problems.

Storage
However, before long periods of storage they should be charge to about 50-80 %. They should be recharged again after approx. 4-6 months.

Service life
With low discharge currents, the theoretical service life of a cell is about 500 charge/discharge cycles. With higher discharge currents of approx. 3-5 C, the service life is lower at only approx. 300 cycles. With even higher discharge currents the cycle number is reduced even more noticeably.
After this the battery is used up and must be disposed of in an appropriate manner.

Different capacity
If several cells are processed into a battery pack and discharged with a higher current, then the cells will heat to differing temperatures as the inner cell cannot release heat easily.
This changes the internal resistance and the release capacity is lower. This cell is then discharged earlier and there is a risk that this cell is discharged with a charge end voltage of 2.5 volt.

Strong capacity differences occur in particular with very low external temperatures. For example, if LiPoly batteries are flown in an electro-helicopter, then the front cell is cooled greatly by the drive wind while the internal cells are considerably warmer. As a result of this, the cold cell has a lower capacity and there is a risk that the colder cell is discharged under the charge end voltage.

For this reason, we recommend you discharge the LiPoly cells only to about a 3 volt discharge end voltage to avoid any permanent damage to the cells.

Memory effect, cell capacity
Since LiPoly cells have no memory or lazy battery effect, the discharge-charge (cycles, matches) necessary for NC and NiMH batteries is not necessary here.
Discharging before charging is also avoided.
Since the capacity of the LiPoly battery is slightly reduced with each charging, this would cause the cell to lose capacity unnecessarily.

Interconnecting battery packs
Interconnection of LiPoly cells in a row or parallel, to increase voltage or capacity is problematic because of the charge voltage and capacity differences.
Only selected cells can be interconnected into a battery pack.

Discharge end voltage
Cells with nominal voltage 3.6 V = 2.4 volt
Cells with nominal voltage 3.7 V = 2.5 volt

This is automatically determined by the Profi Homecharger by setting the battery type and the cell count.

Important note:
If the charge or discharge end voltages are exceeded or fall short, the cells will be damaged in the form of permanent capacity loss. If the boundary value is exceeded the cell is destroyed, can explode or start to burn.

Safety notes for lithium-ion polymer batteries
This charge device operating manual can only give a general overview of charging and handling of rechargeable LiPoly batteries; individual instructions from the corresponding battery manufacturer cannot be replaced by this.

For this reason, you must also observe the notes provided by the battery manufacturer.
- You must place the battery on an inflammable surface when charging or discharging, and do not leave unattended.

- Do not submerge the battery in water or any other liquid as the control module can be damaged in this way and the battery will be charged with abnormal currents or voltage.
- Do not heat the battery, throw it into fire or place in a microwave.
- Do not charge it when it is short-circuited or if the poles are reversed
- Do not subject the battery to any pressure, deform or throw it
- Do not solder directly on the battery
- Do not alter or open the battery
- Do not charge batteries over 4.1 or 4.2 volt per cell
- Do not discharge batteries below 2.4 or 2.5 volt per cell
- Only charge batteries with charge devices suitable for them, never connect directly to a power supply unit
- Never charge or discharge the battery in open sunlight of in proximity to heating or fire as the control module can be damaged in this way
- Do not use the battery in places which are subject to high static discharge.
- **All this can lead to the battery being damage by exploding or catching fire.**
- Keep the battery out of the reach of children.
- Do not allow contact between secreted electrolyte and fire; it is easily combustible and can ignite.
- The electrolyte fluid should not come into contact with eyes; if it does, rinse immediately with lots of water. Then find a doctor.
- The electrolyte fluid can also be rinsed off or out of clothes and other objects with plenty of water.

14. DISPOSAL OF BATTERIES

On no account should you throw batteries into household rubbish. Take defective or used batteries only in a discharged state to the corresponding collection site in order to protect the environment. These are all sales outlets where batteries are sold or communal hazardous waste collection sites.

If necessary, apply sticky strips to the blank contacts to avoid short-circuits.

The costs for recycling the batteries and their disposal are already included in the purchase price. All sites are obligated to accept batteries whether they were bought there or not.

The batteries are recycled. In this way, the material enters the production cycle again.
Help to protect and maintain the environment!

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