



VOLTCRAFT[®]

MULTI-FUNCTION CHARGER
“V-CHARGE 50”

Ⓜ OPERATING INSTRUCTIONS

Item No.:
1416554

CE
VERSION 08/16

TABLE OF CONTENTS



	Page
1. Introduction	4
2. Explanation of Symbols	4
3. Intended Use	5
4. Scope of Delivery	6
5. Safety Notes	7
a) General Information	7
b) Mains Cable/Mains Voltage	8
c) Location for Installation	8
d) Operation	9
6. Rechargeable Battery Notes	11
a) General Information	11
b) Additional Information on Lithium Batteries	12
7. Usable Rechargeable Battery Types	14
8. Operating Elements	15
9. Commissioning	16
a) Connection to a Voltage/Current Supply	16
b) Connection of a Rechargeable Battery to the Charger	17
c) General Information on Operation of the Menus	19
10. Menu Structure	20
11. Lithium Batteries (LiPo, Lilon, LiFe)	21
a) General Information	21
b) Charging Rechargeable Batteries without Balancer Connection ("CHARGE")	22
c) Charging Batteries with Balancer Connection ("BALANCE")	23
d) Fast Charge ("FAST CHG")	25
e) Storing Rechargeable Batteries ("STORAGE")	25
f) Discharging Batteries ("DISCHARGE")	25
12. NiMH AND NiCd Rechargeable Batteries	26
a) General Information	26
b) Charging Rechargeable Batteries ("CHARGE")	26
c) Automatic Charge Mode ("Auto CHARGE")	27
d) Recharge Rechargeable Battery Again ("RE-PEAK")	28
e) Discharging Battery ("DISCHARGE")	29
f) Cycle Program ("CYCLE")	30

	Page
13. Lead Batteries (Pb).....	31
a) General Information.....	31
b) Charging Rechargeable Batteries ("CHARGE").....	31
c) Discharging Rechargeable Batteries ("DISCHARGE").....	32
14. Saving/Loading Rechargeable Battery Data.....	34
a) Selecting/Setting Rechargeable Battery Data.....	34
b) Saving Battery Data.....	37
c) Loading Battery Data.....	38
15. Voltage Display for Lithium Rechargeable Batteries.....	39
16. System Settings.....	40
17. Warning Messages on the Display.....	43
18. Information on the Charger.....	44
19. Maintenance and Cleaning.....	45
20. Disposal.....	45
a) General Information.....	45
b) Batteries and Rechargeable Batteries.....	45
21. Technical Data.....	46

1. INTRODUCTION

Dear Customer,

Thank you for making the excellent decision to purchase a Voltcraft® product.

Voltcraft® This name stands for above-average quality products in the areas of measuring, charging and grid technology, characterised by technical competence, extraordinary performance and permanent innovation.

Whether you are an ambitious hobby electronics or a professional user - a product of the Voltcraft® brand family will provide you with the best solution for even the most sophisticated of tasks. Special features: We offer the sophisticated technology and reliable quality of our Voltcraft® products at a near-unbeatable price/performance ratio. We lay the groundwork for long, good and successful cooperation.

Enjoy your new Voltcraft® product!

All company names and product names are trademarks of their respective owners. All rights reserved.

If there are any technical questions, please contact:

International: www.conrad.com/contact

United Kingdom: www.conrad-electronic.co.uk/contact

2. EXPLANATION OF SYMBOLS



The lightning symbol is used if there is a danger to your health, e.g. from electric shock.



The exclamation mark in a triangle indicates important notes in these operating instructions that must be observed strictly.



The "arrow" symbol indicates that special advice and notes on operation are provided.

3. INTENDED USE

The charger is used to charge and discharge rechargeable batteries of the type NiMH/NiCd (1 - 15 cells), LiPo/LiIon/LiFe (1 - 6 cells) and lead acid batteries (1 - 10 cells, 2 V - 20 V).

The charge current can be set between 0.1 A and 7.0 A (depending on the cell number/ rechargeable battery voltage). The maximum charging power is 50 W.

The discharge current can be set between 0.1 A and 2.0 A (depending on the cell number/ rechargeable battery voltage). The maximum discharging power is 5 W.

The charger is operated by four operating buttons and a two-line lit LC display.

The charger also offers a connection for an external temperature sensor (not enclosed, available as an accessory) for rechargeable battery monitoring. A balancer is integrated for multi-cell rechargeable lithium batteries; for this, the charger provides different connection sockets for 2 - 6-cell rechargeable batteries with XH-balancer plug.

The charger has an integrated mains unit to permit operation on mains voltage (100 - 240 V/AC, 50/60 Hz). The charger may, however, also be alternatively operated on a stabilised direct voltage of 11 - 18 V/DC (e.g. via an external vehicle lead battery or a suitable mains adapter).

The safety notes and all other information in these operating instructions always have to be observed!

Read the operating instructions carefully and attentively, and keep them for later reference. Only pass the product on to any third parties together with the operating instructions.

Use other than that described above can lead to damage to the product and may involve additional risks such as, for example, short circuits, fire, electrical shock etc. The entire product must not be modified or converted, and the casing must not be opened!

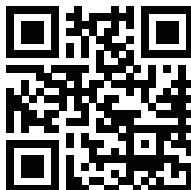
This product complies with the statutory national and European requirements.

4. SCOPE OF DELIVERY

- Multi-function charger "V-Charge 50"
- Mains cable
- Charging cable with T-plug
- Operating instructions

➔ **Current operating instructions:**

1. Open www.conrad.com/downloads in a browser or scan the QR-code shown on the right.
2. Select the document type and language, and then enter the corresponding order number in the search field. After searching starts, you can download the documents found.



5. SAFETY NOTES



Please read the operating instructions completely before commissioning the device. They contain important information for correct operation.



The guarantee/warranty will expire if damage is incurred resulting from non-compliance with the operating instructions! We do not assume any liability for consequential damage!

We do not assume any liability for property damage or personal injury caused by improper use or non-compliance with the safety instructions! In such cases the warranty/guarantee is voided.

a) General Information

- The unauthorized conversion and/or modification of the product is inadmissible for safety and approval reasons. Never dismantle the product!
- Maintenance, adjustments and repair work may only be carried out by a specialist/a specialised workshop. The device contains no parts that require servicing or adjusting by you.
- The product is not a toy and must be kept out of the reach of children! The product must only be set up, used or stored in places that are not accessible to children. The same applies for rechargeable batteries. Pay particular attention when children are present! Children may change the settings or short-circuit the rechargeable battery/batteries, which may lead to fire or explosion. Danger to life!
- In schools, training centres, hobby and self-help workshops, the use of the product must be supervised by responsible trained personnel.
- In commercial institutions, the accident prevention regulations of the Employer's Liability Insurance Association for Electrical Systems and Operating Materials are to be observed.
- Do not leave packaging material lying around carelessly. It might become a dangerous toy for children!
- Handle the product with care; impacts, shock or fall even from low heights will damage it.
- If you are not sure about the correct operation or if questions arise which are not covered by the operating instructions, please do not hesitate to contact us or another specialist.



b) Mains Cable/Mains Voltage

- Product setup corresponds to protection class I. Only a proper protective-contact mains socket must be used for connection of the charger via the mains cable.
- The mains socket to which the plug-in mains unit is connected must be easily accessible.
- Do not pull the mains plug from the mains socket by pulling the cable.
- If the mains unit or charger are damaged, do not touch it. Danger to life from electric shock!

First switch off the mains voltage for the mains socket to which the mains cable is connected (switch off the corresponding circuit breaker or take out the fuse, then switch off the fault interrupter protection switch (FI circuit breaker) so that the mains socket is separated from the mains voltage on all poles).

Only then unplug the mains unit from the mains socket.

If the charger is damaged, stop operating it. Take it to a specialised workshop or dispose of it in an environmentally friendly way.

If the mains cable is damaged, dispose of the damaged mains cable in an environmentally compatible way. Do not use it anymore. Replace it with a new mains cable of the same specifications.

c) Location for Installation

- The charger is intended for dry indoor use only. It must not become damp or wet.
If the charger is operated via the mains cable, there is danger to life from electric shock in case of moisture/wetness on the charger/mains cable!
- Avoid direct sun irradiation, strong heat or cold. Keep the charger away from dust and dirt. The same applies to any rechargeable battery that may be connected.
- Choose a solid, flat, clean and sufficiently large surface for the charger. Never place the charger on a flammable surface (e.g. carpet, tablecloth). Always use a suitable, non-flammable, heatproof surface.
- Keep the charger away from flammable or easily inflammable materials (e.g. curtains).
- Never cover the ventilation slots; danger of overheating and fire. Never push any objects into the ventilation slots of the charger; There is a danger to life from electric shock!
- Do not place the charger on any valuable furniture surfaces without using a suitable protection. Otherwise, scratches, pressure points or discolourations are possible. The same applies to the rechargeable battery.
- Do not use the charger inside a vehicle.
- The charger must only be set up, used or stored in places that are not accessible to children. Children may change the settings or short-circuit the rechargeable battery/battery pack, which can lead to an explosion. Danger to life!
- Avoid installation in direct proximity of strong magnetic or electromagnetic fields, transmitter aerials or HF generators. This can affect the control electronics.
- Ensure that the cables are not crushed or damaged by sharp edges. Never place any objects on the cables.



- Do not place any containers filled with liquid, vases or plants, on or next to the charger/mains cable.
When these liquids get into the charger (or the plug connections of the mains cable), the charger will be destroyed and there is a most severe danger of potentially fatal electric shock or fire.
- If the charger is operated via the mains cable, first switch off the mains voltage for the mains socket to which the mains cable is connected (switch off the corresponding circuit breaker or take out the fuse, then switch off the fault interrupter protection switch (FI circuit breaker) so that the mains socket is separated from the mains voltage on all poles). Only then unplug the mains plug of the mains cable from the mains socket.
If the charger is operated via the DC input (11 - 18 V/DC), disconnect the charger from the voltage/power supply.
Then disconnect the connected rechargeable battery from the charger. Do not use the charger again - bring it to a specialist workshop.

d) Operation

- The charger may be operated either via the mains voltage (100 - 240 V/AC, 50/60 Hz) or via a stabilised direct voltage of 11 - 18 V/DC (e.g. via an external vehicle lead battery or a suitable mains adapter).
Use only one of the two connection types, but never both at once. This may damage the charger.
- Do not wear any metal or conductive materials, such as jewellery (necklaces, bracelets, rings, etc.) while you are working with the charger or batteries. A short-circuit at the rechargeable battery or charging cable poses a danger of burns and explosion.
- Never leave the product unattended while operating. Despite a considerable number of protective circuits, it is impossible to exclude the possibility of malfunctions or problems during the charging process.
- Ensure that there is sufficient ventilation during operation. Never cover up the charger. Leave enough of a distance (at least 20 cm) between charger and other objects. Overheating causes a danger of fire!
- The charger must only be used to charge (or discharge) rechargeable batteries of types NiMH, NiCd, Lilon/LiPo/LiFe and lead batteries. Never charge any other rechargeable battery types or non-rechargeable batteries. There is great danger of fire or explosion!
- Always connect the charging cable to the charger first. Only then must the rechargeable battery be connected to the charging cable.
When disconnecting, proceed in reverse order - first disconnect the rechargeable battery from the charging cable, then the charging cable from the charger.
If the order is chosen incorrectly, there may be a short-circuit of the charger plugs; there is a danger of fire and explosion!
- Only operate the product in moderate climate, never in tropical climate. For more information on acceptable environmental conditions, see the chapter "Technical Data".
- Never operate the device immediately after it was taken from a cold room to a warm room. The resulting condensation may lead to malfunctions or damage!
Let the product reach room temperature before taking it into operation again. This may take several hours!



- Avoid operation in direct proximity of strong magnetic or electromagnetic fields, transmitter aerials or HF generators. This can affect the control electronics.



- If you have reason to believe that the device can no longer be operated safely, disconnect it immediately and make sure it is not operated unintentionally.

Disconnect the charger from the voltage/current supply. Do not use the product any more after this, but take it to a specialised workshop or dispose of it in an environmentally compatible manner.

It can be assumed that operation without danger is no longer possible if the device has any visible damage, the device no longer works, after extended storage under unsuitable conditions or after difficult transport conditions.

- Keep the entire product at a dry, cool, clean site that is not accessible to children.

6. RECHARGEABLE BATTERY NOTES

Although use of rechargeable batteries in everyday life is a matter of course today, there are many dangers and problems. In particular, with LiPo/Lilon/LiFe rechargeable batteries with their high energy content (in comparison with conventional NiCd or NiMH rechargeable batteries), various regulations must be observed in order to avoid the danger of explosion and fire.

For this reason, always ensure that you have read and understood the following information and safety information when handling rechargeable batteries.

→ If the manufacturer of the rechargeable battery has provided any other information, read it carefully and observe it!



a) General Information

- Rechargeable batteries are no toys. Always keep batteries/rechargeable batteries out of the reach of children.
- Do not leave batteries/rechargeable batteries lying around openly; there is a risk of them being swallowed by children or pets. If swallowed, consult a doctor immediately!
- Rechargeable batteries must not be short-circuited, taken apart or thrown into fire. There is a risk of fire and explosion!
- Leaking or damaged batteries/rechargeable batteries can cause chemical burns to skin when touched without the use of adequate protective gloves.
- Never recharge normal (non-rechargeable) batteries. There is a risk of fire and explosion!
Non-rechargeable batteries are meant to be used once only and must be disposed of properly when empty.
Only charge rechargeable batteries intended for this purpose. Use a suitable battery charger.
- Rechargeable batteries must not get damp or wet.
- Place the charger and battery on a non-flammable, heat-resistant surface (e.g. stone tiles). Maintain enough distance from flammable objects. Leave enough distance between the charger and the rechargeable battery - never place the rechargeable battery on the charger.
- As both the charger and the rechargeable battery heat up during the charge/discharge procedure, it is necessary to ensure sufficient ventilation. Never cover the charger or the rechargeable battery!
- Never use battery packs made up of different cells.
- Never leave the charging/discharging rechargeable batteries unattended.
- Never recharge a battery directly in the model. Always remove the rechargeable battery from the model for recharging.
- Always observe correct polarity (plus/+ and minus/-) when connecting the rechargeable battery to your model or charger. Connecting the battery incorrectly will not only damage the model but also the rechargeable battery. There is a risk of fire and explosion!

This charger has a mechanism that protects against connecting the poles incorrectly. Nonetheless, it is possible that an incorrectly connected battery may lead to damage in certain situations.



- If the product is not to be used for an extended period of time (e.g. storage), disconnect any connected rechargeable battery from the charger and disconnect the charger from the voltage/current supply.

The charger has no mains switch. If you operate the charger via the mains cable, pull the mains plug from the socket when you no longer need the charger.

- Do not charge/discharge any battery that is still hot (e.g. caused by high discharging current from the model). Allow the rechargeable battery to cool down to room temperature before attempting to charge or discharge it.
- Never damage the exterior cover of a battery. There is a risk of fire and explosion!
- Never charge/discharge damaged, leaking or deformed batteries. This can result in a fire or explosion! Dispose of any unusable rechargeable batteries in an environmentally compatible fashion. Do not continue to use them.
- Remove the rechargeable battery from the charger when it is fully charged.
- Recharge the rechargeable batteries about every 3 months. Otherwise, so-called deep discharge may result, rendering the rechargeable batteries useless.
- Keep rechargeable batteries in a suitable location. Use a smoke detector in the room. The risk of fire (or the occurrence of toxic smoke) cannot be excluded. Special rechargeable batteries for the model construction area are subject to great stress (e.g. high charging and discharging currents, vibrations, etc.).

b) Additional Information on Lithium Batteries

Modern batteries with lithium technology do not only have a clearly higher capacity than NiMH or NiCd rechargeable battery packs but they also have a considerably lower weight. This makes this type of rechargeable battery very interesting for application in model construction; so-called LiPo batteries (lithium-polymer) are often used here.

Rechargeable lithium batteries require special care when charging/discharging, as well as during operation and handling.

For this reason, we would like to provide you with some information in the sections below about the dangers and how you can avoid them, thus helping such batteries to maintain their performance for an extended period of time to come.

Additionally observe chapter 6. a).

- The outer shell of many rechargeable lithium batteries is only made of a thick foil and therefore very sensitive.

Never destroy or damage the battery, never let the battery fall and do not pierce the battery with any objects! Avoid any mechanical strain on the battery; never pull the connection cables of the battery! There is a risk of fire and explosion!

These guidelines must also be observed when the battery is inserted into the model or when it is removed from the model.

- Ensure that the battery does not overheat during usage, recharging, discharging, transport or storage. Do not place the battery next to sources of heat (e.g. speed controller, motor), keep the battery away from direct sunlight. There is a risk of fire and explosion if the battery overheats!



The battery must never heat up to more than +60 °C (observe any additional information from the manufacturer!).

- If the battery is damaged (e.g. after the crash of an aircraft or helicopter model) or the exterior cover is soaked/has expanded, do not use the battery. Do not charge it anymore. There is a risk of fire and explosion!

Handle the battery with care, use suitable protective gloves. Dispose of the rechargeable battery environmentally compatibly.

Never keep such rechargeable batteries in an apartment or a house/garage anymore. Damaged or bloated lithium rechargeable batteries may catch fire suddenly.

- Only use a suitable charger to charge lithium batteries or use the correct charging procedure. Due to a risk of fire and explosion, conventional chargers for NiCd, NiMH and lead batteries must not be used!

Always choose the right charging procedure depending on rechargeable battery.

- When charging a lithium battery with more than one cell, always use a so-called balancer (one is already integrated into the supplied charger).
- Charge LiPo batteries with a max. charging current of 1C (if not indicated otherwise by the battery manufacturer!). This means that the charging current may not exceed the capacity value imprinted on the battery (e.g. battery capacity 1000 mAh, max. charging current 1000 mA = 1 A).

With LiFe and Lilon batteries, you must observe the instructions of the battery manufacturer.

- The discharging current must not exceed the value printed on the battery.

For example, if a value of "20C" is printed on a LiPo battery, the max. discharging current is 20 times the battery's capacity (e.g. battery capacity 1000 mAh, max. discharging current 20C = 20 x 1000 mA = 20 A).

Otherwise, the battery will overheat, causing deformation/bloating of the battery or explosion and fire!

The printed value (e.g. "20C") does not generally refer to the constant current, but to the maximum current that the battery is capable of producing in the short-term. The constant current therefore should not be higher than one half of the given value.

- Observe that the individual cells of a lithium rechargeable battery must not be deep-discharged. A deep discharge of a lithium rechargeable battery will lead to permanent damage/destruction of the rechargeable battery.

If the model does not provide protection against total discharge or possess a visual display indicating a low battery, remember to switch off the model in time.

7. USABLE RECHARGEABLE BATTERY TYPES

Rechargeable battery type	LiPo	Lilon	LiFe	NiCd	NiMH	Pb
Rated voltage (V/cell)	3.7	3.6	3.3	1.2	1.2	2.0
Max. charging voltage (V/cell)	4.2	4.1	3.6	1.5	1.5	2.46
Voltage for storage (V/cell)	3.8	3.7	3.3	-	-	-
Charging current for quick charge	<= 1C	<= 1C	<= 4C	1C - 2C	1C - 2C	<= 0.4C
Min. voltage after discharge (V/cell)	3.0 - 3.3	2.9 - 3.2	2.6 - 2.9	0.1 - 1.1	0.1 - 1.1	1.8

→ The voltages in the above table apply to a single cell.

The max. charging and discharging currents are indicated with the capacity value "C".

A charging current of 1C corresponds to the capacity value imprinted on the battery (e.g. indicated battery capacity 1000 mAh, max. charging current 1000 mA = 1 A).



Also observe the correct voltage setting for multi-cell battery packs. For example, the individual cells in a two-cell battery pack may be switched in parallel or in series.

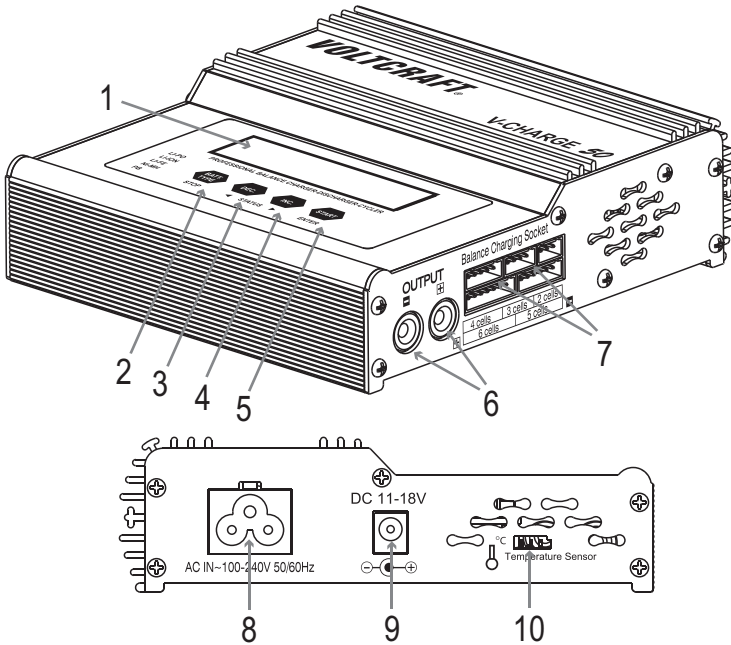
If the maximum permissible charging current for the rechargeable battery is exceeded or a wrong cell number/voltage setting is chosen, there is a danger of destroying the rechargeable battery. There also is a danger of fire and explosion from the rechargeable battery!

Further notes on the max. charging current and the cell number/voltage can be taken from the data sheets or the labels of the rechargeable batteries; these data take precedence over the information in the above table.

Important!

- Never charge battery packs made up of different cells (or cells from different manufacturers).
- Never charge non-rechargeable batteries.
- Never charge rechargeable batteries not listed in the above table.
- Never charge rechargeable batteries with integrated electronics.
- Never charge rechargeable batteries that are still connected to other devices (e.g. a speed controller).
- Never charge any damaged or bloated rechargeable batteries.

8. OPERATING ELEMENTS



- 1 Illuminated display
 - 2 Button "BATT. TYPE/STOP" for returning from a menu or stopping the charging process
 - 3 Button "DEC" for entering values (decreasing value), menu selection (backwards) and displaying various data while charging/discharging
 - 4 Button "INC" for entering values (increasing value), menu selection (forward) and displaying the voltage values of the individual cells when charging lithium batteries with a balancer connection
 - 5 Button "START/ENTER" for starting/continuing the charging process or confirming an adjustment/operating function
 - 6 Round sockets (4 mm) for rechargeable battery connection (red = plus/+, black = minus/-)
 - 7 Balancer connections (only one at a time can be used!)
 - 8 Low-voltage device socket for connecting the charger to the mains voltage
 - 9 Direct voltage input (11 - 18 V/DC, stabilised), e.g. to connect to an external vehicle lead battery
- !** Either operate the charger via the mains voltage connection (8) or the direct voltage input (9). Never use both inputs at the same time. This may damage the charger.
- 10 Socket for external temperature sensor (not enclosed, can be ordered separately)

9. COMMISSIONING

a) Connection to a Voltage/Current Supply



Attention!

Always connect the charger to the voltage/current supply first; only then must a rechargeable battery be connected to the charger.

The charger offers two different options for operation:

- Operation via the mains voltage (100 - 240 V/AC, 50/60 Hz)
- Operation via stabilised direct voltage (11 - 18 V/DC, e.g. via an external vehicle lead battery or a mains adapter)



Never use both operating modes at the same time. This may damage the charger. Loss of guarantee/warranty!

The charger has a maximum charging output of 50 W. If the charger is to be operated via the direct voltage input, the power supply strength must be chosen depending on how high the actually used charging output is (depending on the rechargeable battery type, cell number and the charging current set).

→ When fully using the maximum charging power of 50 W, the conversion loss leads to an approx. 20% - 30% higher power intake.

If the charger is not to be operated at a 12 V vehicle lead battery, but via a fixed voltage mains unit, it must be able to supply a correspondingly high current (we suggest at least 6,5 A).

When using the direct current input, observe the correct polarity when connecting (plus/+ and minus/-).

The charger will switch on automatically after connecting to the voltage/current supply. The display will light up; the start message will appear (see picture on the right) and the charger will emit a brief signal sound.



The charger then is in its main menu.

b) Connection of a Rechargeable Battery to the Charger

Please observe the following points before connecting or charging/recharging the battery:



- If you have not done so already, please read chapters 5, 6 and 7 completely and ensure that you have understood the information there.
- Do you know all of the information you need to know about your rechargeable battery? Unknown or unlabelled batteries, the necessary values of which you do not know, must not be connected/charged/discharged!
- Have you selected the correct charging/discharging program for the type of battery you are using? Incorrect settings will damage the charger and the battery; there is a danger of fire and explosion!
- Did you set the correct charging or discharging current?
- Have you selected the correct voltage (e.g. for multiple-cell LiPo batteries)? A two-cell LiPo battery may be switched in parallel (3.7 V) or series (7.4 V).
- Are all connector cables and plugs undamaged, do the plugs stay firmly in the sockets? Worn plugs and damaged cables should be replaced.
- Connect only one rechargeable battery or a single battery pack to the charger output, but never several at once.
- When connecting a rechargeable battery to the charger, always connect the charging cable to the charger first. Only then must the charging cable be connected to the rechargeable battery. When disconnecting, proceed in reverse order (first disconnect the rechargeable battery from the charging cable, then the charging cable from the charger).

Failure to do so presents the danger of a short circuit. This can result in a fire or explosion of the rechargeable batteries!

- If you wish to charge battery packs that you have manufactured yourself, the cells must be identical in their construction (same type, same capacity, same manufacturer).
The cells must also be charged to the same level (lithium batteries can be balanced out using the balancer. This is, however, not possible with other battery packs such as NiMH or NiCd).
- Before connecting a rechargeable battery/battery pack to the charger, disconnect it completely, e.g. from a flight or speed controller.

Important when charging/discharging a lithium battery pack with balancer connection:

Multi-cell lithium battery packs usually always have a balancer connection. This permits the charger to monitor the voltage of every single cell separately at all times.

The charger adjusts the voltage of all cells to each other if there are deviations. The balancer prevents that one or several cells are over-charged or other cells not sufficiently fully charged by this. The balancer therefore protects both from over-charging (which may cause fire or explosion) and from deep discharge of a single cell, and thus ensures best performance of the battery pack in your model.

Procedure when connecting a battery pack to the charger:

1. First connect the charging cable to the two 4 mm round sockets of the charging output. Ensure correct polarity (red cable = plus/+, black cable = minus/-).



The charging cable must not be connected to the rechargeable battery yet! There may be a short-circuit of the charger plugs; there is a danger of fire and explosion!

2. Connect the charging cable to the rechargeable battery now. Ensure correct polarity (red cable = plus/+, black cable = minus/-).
3. If the lithium rechargeable battery has a balancer cable, connect it to the corresponding connection of the charger (for 2 to 6-cell rechargeable batteries). Always observe the proper shape of the socket and plug on the charger and the rechargeable battery. Do not use any force for plugging in!

➔ The charger has XH-sockets. If the connection plug of the rechargeable battery has a different plug build, you need to use the corresponding adapters (not enclosed, available as accessories).

Proceed in the following steps when disconnecting a rechargeable battery:

1. If you have connected a lithium rechargeable battery with a balancer cable to the charger, disconnect it from the charger.
2. Then disconnect the charging cable from the rechargeable battery.
3. Last disconnect the charging cable from the charger.



Always proceed in this order!

The rechargeable battery must always be disconnected from the charging cable (and from the balancer connection for lithium rechargeable batteries) first. Only then must the charging cable be disconnected from the charger.

Any other order poses danger of short circuit by the two round plugs of the charging cable connected to the rechargeable battery, as well as danger of fire and explosion!

c) General Information on Operation of the Menu

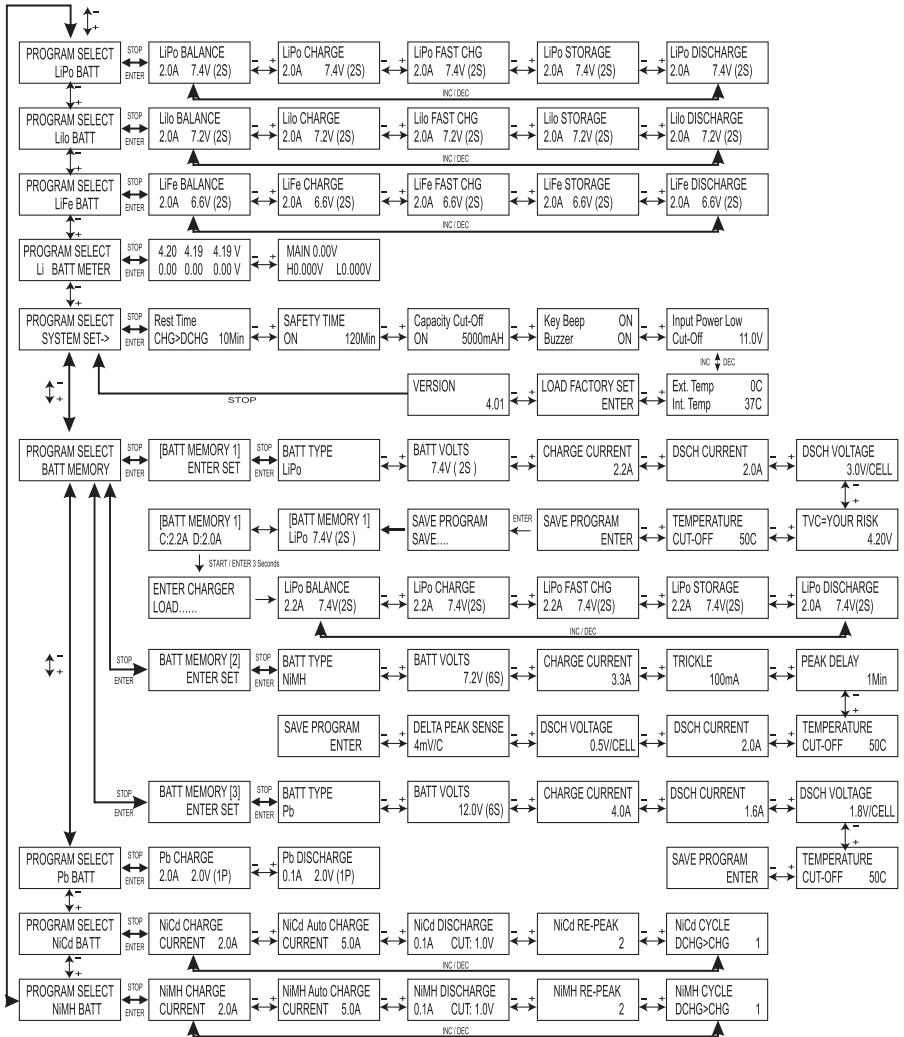
➔ For an overview of the menu structure, see the next chapter.

- Select the desired submenu from the main menu using the "INC" or the "DEC" button as described and confirm your selection with the button "START/ENTER".
- Using the buttons "INC" and "DEC", the various configuration options are called up.
- To modify a value, push the "START/ENTER" button - the display then flashes. Modify the value flashing in the display using the "INC" and "DEC" buttons. For quick adjustment of a value (e.g. the charging current), keep the respective button pushed for a longer time.
- Save the (modified) value with the "START/ENTER" button.
- Exit each setting menu using the "BATT. TYPE/STOP" button. The charger then returns to the main menu.

➔ Various information is indicated on the display during a charge/discharge process by repeatedly pressing the button "DEC" (see chapter 18). If you do not push any button for a few seconds, the charger will return to the normal display.

If a lithium rechargeable battery with balancer plug is connected to the charger, you can switch to the display of the individual cell voltages during charging/discharging by pushing the button "INC". Briefly push the button "START/ENTER" for the charger to return to the normal display.

10. MENU STRUCTURE



11. LITHIUM BATTERIES (LIPO, LIION, LIFE)

a) General Information

The rechargeable battery programmes for LiPo, Lilon and LiFe rechargeable batteries generally differ only in the voltages and the permitted charging current, see table in chapter 7.

When charging a lithium battery, there are two different phases. First, the rechargeable battery is charged with a consistent current. When the rechargeable battery reaches its maximum voltage (at a LiPo rechargeable battery, e.g., 4.2 V), charging continues at constant voltage (the charging current drops). When the charging current drops below a certain threshold, charging is ended and the rechargeable battery is fully charged.



If the rechargeable battery has a balancer connection (usually this is the case in almost every lithium battery with more than one cell), the balancer connection must be connected to the charger as well as the rechargeable battery's cable for charging/discharging.

There are different types of balancer plug. Therefore, do not apply any force when the plug does not fit in the charger! The matching adapters for the balancer plugs are available as accessories.

There are also rare rechargeable batteries with more than one cell where the cell connections are separately routed out and that strictly speaking are not a "multiple-cell battery pack". Therefore, always observe the information of the rechargeable battery manufacturer on the build and rated voltage.

When using a balancer (integrated in the charger), all cells of a multi-cell battery pack have the same voltage after the charge process, which prevents the overcharging of individual cells (danger of fire and explosion) or a deep discharge of one of the cells (damage to the rechargeable battery).

The charging current to be set depends on the battery capacity and build (see chapter 7). Always observe the battery manufacturer's instructions.

The charger must be in the main menu.

Select the rechargeable battery type matching the rechargeable battery used with the button "INC" or "DEC" (LiPo, Lilon or LiFe), see figures on the right.

Confirm the selection by pressing the "START/ENTER" button.

Then use the button "INC" or "DEC" to select the different rechargeable battery programmes:

- "BALANCE": Charge lithium battery with balancer connection
- "CHARGE": Charge lithium battery without balancer connection
- "FAST CHG": Quick charge for lithium rechargeable battery
- "STORAGE": Charging/discharging batteries at a set voltage value (e.g. for storage)
- "DISCHARGE": Discharging the rechargeable battery

```
PROGRAM SELECT
LiPo BATT
```

```
PROGRAM SELECT
LiIo BATT
```

```
PROGRAM SELECT
LiFe BATT
```

b) Charging Rechargeable Batteries without Balancer Connection ("CHARGE")



Of course, you can also charge multiple-cell lithium rechargeable batteries with a balancer connection with the rechargeable battery programme "CHARGE".

However, the individual cell voltages are not reconciled here, so that one or several cells may be overcharged. There is a risk of fire and explosion!

Therefore, always charge multiple-cell lithium rechargeable batteries with balancer connection with the rechargeable battery programme "BALANCE", but never with the rechargeable battery programme "CHARGE"!

- First, choose the rechargeable battery type with the button "INC" or "DEC" as described in chapter 11. a) (LiPo, Lilon or LiFe) and push the button "START/ENTER".

- Select the rechargeable battery programme "CHARGE" with the button "INC" or "DEC".

```
LiPo CHARGE
2.0A 11.1V(3S)
```

The previously selected rechargeable battery type is written in the upper left.

The value at the lower left indicates the currently set charging current ("2.0A"), the lower right shows the rechargeable battery nominal voltage ("11.1V") and the associated cell number ("3S" = 3cell rechargeable battery).

- ➔ Use the button "INC" or "DEC" to select a different rechargeable battery programme; use the button "BATT. TYPE/STOP" to return to the main menu.

- If the values need to be changed, push the "START/ENTER" button.

The charging current at the lower left of the display flashes. Change the charging current using the button "INC" or "DEC". Keep the respective button pressed for quick adjustment.

- ➔ The maximum possible charging current depends on the battery type and number of cells. The max. charge output is 50 W, which may reduce the actual charge current later.

- Confirm the charging current with the "START/ENTER" button.

The number of cells at the lower right of the display is flashing. Set the number of the cells with the buttons "INC" and "DEC". Keep the respective button pressed for quick adjustment. The associated rechargeable battery nominal voltage is automatically calculated and displayed to the left of the cell number.

Confirm the number of the cells by pressing the "START/ENTER" button.

- When no display is flashing anymore, start charging by keeping the "START/ENTER" button pushed (approx. 3 seconds).

- The charger now examines the connected rechargeable battery. In case of an error, a warning signal is output and the corresponding information is displayed. You can stop the warning signal by pressing the "BATT. TYPE/STOP" button. You then return to the previous configuration menu.

```
BATTERY CHECK
WAIT...
```

If no error is found, e.g. the display shown on the right will appear.

The "R:" value indicates the cell number that the charger has recognised (in the example a 3-cell rechargeable battery).

```
R: 3SER S: 3SER
CANCEL(STOP)
```

The "S:" value indicates the cell number that you have set in the menu (in the example also a 3-cell rechargeable battery).

```
R: 3SER S: 3SER
CONFIRM(ENTER)
```



If these two numbers do not match, please check the settings on the charger and the battery itself. It may be that the rechargeable battery has been completely discharged, or a cell may be faulty. In this case, the battery should not be charged, as there is a risk of fire and explosion!

You can return to the previous configuration menu using the "BATT. TYPE/STOP" button.

- If the two cell numbers match, briefly push the "START/ENTER" button.
- Charging process starts. The display will show various information on the current charging progress.

```
LP3s 1.2A 12.32V
CHG 022: 43 00682
```

Example:

At the upper left, the rechargeable battery type and the cell number are displayed (e.g. "LP3s" = LiPo rechargeable battery with 3 cells); the charging current is shown in the upper middle and the current rechargeable battery voltage at the upper right.

The lower left shows the current rechargeable battery programme ("CHG" = "CHARGE"), in the middle the elapsed charging time and the charged capacity in mAh are displayed to the right of this.

- ➔ Various information is indicated on the display during a charge/discharge process by repeatedly pressing the button "DEC" (see chapter 18). If you do not push any button for a few seconds, the charger will return to the normal display.
- After completion of charging, an audio signal is emitted (if it has not been turned off).
- ➔ If you wish to cancel the charging process, push the "BATT. TYPE/STOP" button.

c) Charging Batteries with Balancer Connection ("BALANCE")

In contrast to the simple rechargeable battery programme "CHARGE" (see chapter 11. b), the rechargeable battery programme "BALANCE" monitors the voltage of every single cell of a multiple-cell lithium rechargeable battery and corrects it accordingly if there are any deviations.

```
LiPo BALANCE
2.0A 7.4V(2S)
```

Besides the two normal rechargeable battery connections (plus/+ and minus/-), the balancer connector for the battery must also be connected to the charger.

Observe correct polarity when connecting the balancer plug of the rechargeable battery to the charger. Usually, the minus pole of the balancer connection is applied with a black cable or is specifically marked. This side of the balancer plug must point in the direction "-" of the charger's balancer socket and of course also be pushed onto this connection pin.

- ➔ If you use self-customised rechargeable batteries, the balancer plug must be correctly assigned.

The black/marked cable is the minus pole of the first cell. The next connection pin is the plus pole of the first cell; the respective next connection pin is the plus pole of the second, third, fourth, fifth and sixth cell (depending on cell number).

The last connection pin of the balancer plug of the rechargeable battery therefore is the plus pole of the last cell. Therefore, the same voltage can be measured between the two outer pins of the balancer plug as at the two rechargeable battery connections directly.

The remaining procedure for charging is described in chapter 11. b).

→ If a lithium rechargeable battery with balancer plug is connected to the charger, you can switch to the display of the individual cell voltages by pushing the button "INC", see figure on the right.

3.90	3.92	3.89	V
0.00	0.00	0.00	V

Briefly push the button "START/ENTER" for the charger to return to the normal display.



Important!

Only a battery pack with exactly the same voltage for each cell provides the maximum performance and service life for a model airplane/vehicle.

Variations in the quality of the materials used and the internal structure of multiple-cell lithium battery packs mean that the cells may have different voltages once discharged.

Charging such a rechargeable lithium battery without balancer will quickly cause large differences of cell voltage. This not only shortens the operating life (as one cell may have a very low voltage), but also damages the rechargeable battery as a result of a total discharge.

When charging a rechargeable lithium battery with different cell voltages without a balancer, there is the risk of overcharging one cell.

Example:

A dual-cell LiPo battery pack charged without the use of a balancer appears to have a voltage of 8.4 V and thus appears to be fully charged. The individual cells, however, have a voltage of 4.5 V and 3.9 V (one cell is dangerously overcharged, the other half discharged).

A cell overcharged in this way may leak, expand or, in a worst case scenario, catch fire or explode!

When this LiPo rechargeable battery is, e.g., used in a model airplane, the flight time will be very short because the voltage of the half-discharged cell will break down quickly and the rechargeable battery will stop supplying power.



If your lithium battery has a balancer connection, it must always be connected to the charger via the balancer plug in addition to the two regular rechargeable battery connections (plus/+ and minus/-); always use the charge programme "BALANCE" then instead of the charge programme "CHARGE".

d) Fast Charge ("FAST CHG")

When charging a lithium rechargeable battery, the charging current reduces continually due to the charging method used, the fuller the rechargeable battery becomes (when the rechargeable battery has reached its maximum charging current and the charger switches from continuous current to continuous voltage charging). This will, of course, also extend the charging time.

Quick charging reaches a higher charging current. However, this reduces the capacity, because the charge process is terminated earlier due to the safety cut-off in the charger.

This means, a LiPo battery, for example, cannot be fully charged using the fast charge function. Only approx. 90% of the capacity achievable with the normal charge process is available.

→ Therefore, fast charging is only wise if the battery has to be used again as quickly as possible.

The procedure when setting the charging current and voltage/cell number must be performed as for the rechargeable battery programme "CHARGE"; see chapter 11. b).

e) Storing Rechargeable Batteries ("STORAGE")

This rechargeable battery programme can be used if you want to store the rechargeable battery for an extended period. Depending on the rechargeable battery type set, the rechargeable battery is charged or discharged to a specific voltage.

→ Depending on the cell voltage, the battery is either charged or discharged. Of course, with a multi-cell battery pack, this is only wise if a balancer connection is available and connected to the charger.

At extended storage of a lithium rechargeable battery (e.g. when storing a flight battery over winter), the rechargeable battery should in any case be checked every 3 months and treated with the rechargeable battery programme "STORAGE" again to prevent harmful deep discharge.

The procedure when setting the charging current and voltage/cell number must be performed as for the rechargeable battery programme "CHARGE"; see chapter 11. b).

f) Discharging Batteries ("DISCHARGE")

Normally, it is not necessary to discharge lithium batteries (contrary to NiCd batteries) before charging. The battery can be charged immediately, independent of its current status. If you want to discharge a rechargeable lithium battery anyway, you can set the discharge current.

→ The maximum possible discharging current depends on the battery type, battery capacity and number of cells. The max. discharge output of the charger is 5 W. This limits the max. possible discharge current of rechargeable batteries with multiple cells.

Discharge a lithium rechargeable battery only to the minimum permitted discharge end voltage per cell (see table in chapter 7 or observe information of the rechargeable battery manufacturer). If the rechargeable battery is discharged any further, this deep discharge will permanently damage it and render it useless!

The procedure when setting the discharging current and voltage/cell number must be performed the same as when charging, see chapter 11. b), except that the rechargeable battery is not charged, but discharged after starting the rechargeable battery programme.

12. NIMH AND NiCd RECHARGEABLE BATTERIES

a) General Information

The rechargeable battery programmes for NiMH and NiCd rechargeable batteries generally differ only in the internally used charging procedures. The settings in the menus are the same.

The charger must be in the main menu.

Select the rechargeable battery type matching the rechargeable battery used here with the button "INC" or "DEC", see figures on the right.

```
PROGRAM SELECT
NIMH BATT
```

Confirm the selection by pressing the "START/ENTER" button.

Then use the button "INC" or "DEC" to select the different rechargeable battery programmes:

```
PROGRAM SELECT
NiCd BATT
```

- "CHARGE": Charge rechargeable battery
- "Auto CHARGE": Select the charge current according to the rechargeable battery
- "DISCHARGE": Discharging the rechargeable battery
- "RE-PEAK": Repeat the charge end recognition
- "CYCLE": Perform multiple discharge/charge cycles

```
NiMH CHARGE
CURRENT 2.0A
```

➔ You can return to the main menu using the "BATT. TYPE/STOP" button.

b) Charging Rechargeable Batteries ("CHARGE")

The charging current to be set depends on the rechargeable battery's capacity and is usually 1C (also see chapter 7). High-quality rechargeable batteries also can stand a charging current up to 2C. However, you should always observe the battery manufacturer's instructions.

➔ The value "1C" means that the charging current is equivalent to the battery's capacity. A charging current of 3 A therefore is required for a 3000 mAh-NiMH battery at 1C.

A value of 0.5C means that the charging current corresponds to half the capacity value. At a NiMH rechargeable battery with a capacity of 3000 mAh, 0.5C means that a charging current of 1.5 A must be set.

In general: The smaller the rechargeable battery (the individual cell), the lower the maximum charging current.

For example, conventional NiMH-mignon/AA-cells with a capacity of 2000 mAh permit a charging current of 1C (this corresponds to a charging current of 2 A). For quick charging of such cells (contained, e.g., in receiver batteries), never set more than 0.5C.

Charge a NiMH or NiCd battery as follows:

- First, choose the rechargeable battery type with the button "INC" or "DEC" as described in chapter 12. a) (NiMH or NiCd) and push the button "START/ENTER".
- Select the rechargeable battery programme "CHARGE" with the button "INC" or "DEC".

```
NiMH CHARGE
CURRENT 2.0A
```

The value at the lower right represents the currently set charging current.

➔ Use the button "INC" or "DEC" to select a different rechargeable battery programme; use the button "BATT. TYPE/STOP" to return to the main menu.

- If the value for the charging current must be changed, push the "START/ENTER" button. The charging current flashes. Change the charging current using the button "INC" or "DEC". Keep the respective button pressed for quick adjustment.

➔ The maximum possible charging current depends on the battery type and number of cells. The max. charge output is 50 W, which may reduce the actual charge current later.

Confirm the set charging current with the "START/ENTER" button.

- When no display is flashing anymore, start charging by keeping the "START/ENTER" button pushed (approx. 3 seconds).
- The charger now examines the connected rechargeable battery. In case of an error, a warning signal is output and the corresponding information is displayed. You can stop the warning signal by pressing the "BATT. TYPE/STOP" button. You then return to the previous configuration menu.

```
BATTERY CHECK
.....
```

If no error is found, e.g. the display shown on the right will appear.

```
NiMH 1.2A 7.63V
CHG 022:48 00682
```

The rechargeable battery type is shown in the upper left ("NiMH" = NiMH rechargeable battery), the upper middle shows the charging current and the upper right the current rechargeable battery voltage.

The lower left shows the current rechargeable battery programme ("CHG" = "CHARGE"), in the middle the elapsed charging time and the charged capacity in mAh are displayed to the right of this.

- After completion of charging, an audio signal is emitted (if it has not been turned off).

➔ If you wish to cancel the charging process, push the "BATT. TYPE/STOP" button.

c) Automatic Charge Mode ("Auto CHARGE")

In automatic charge mode, the charger checks the condition of the connected rechargeable battery (e.g. the inner resistance) and calculates the charging current from this. You need to set an upper limit for the charging current so that the rechargeable battery is not damaged by a too-high charging current.

```
NiMH Auto CHARGE
CURRENT 5.0A
```

Depending on the rechargeable battery and its inner resistance, shorter charging times may be achieved in the rechargeable battery programme "Auto CHARGE" than in the rechargeable battery programme "CHARGE" (chapter 12. b).

➔ Proceed as in the rechargeable battery programme "CHARGE" for setting and operation (chapter 12. b).

The only difference is that you do not set the actual charging current, but the limit for the maximum charging current that the charger must not exceed for reasons of safety.

d) Recharge Rechargeable Battery Again ("RE-PEAK")

The charger automatically ends charging of NiMH and NiCd rechargeable batteries when the rechargeable battery is fully charged. Recognition of when the rechargeable battery is fully charged is according to the delta-U procedure.

The rechargeable battery programme "RE-PEAK" performs this recognition again. This way, you can not only ensure that the rechargeable battery is truly fully charged, you can also check how well the rechargeable battery can take quick charging.

First, charge the rechargeable battery completely (see chapter 12. b) or chapter 12. c). Then start the rechargeable battery programme "RE-PEAK".

Proceed as follows:

- Set the rechargeable battery type as described in chapter 12. a) (NiMH or NiCd) and select the rechargeable battery programme "RE-PEAK".



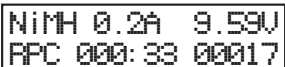
NiMH RE-PEAK 2

The value in the lower right means the number of the recognition processes.

- ➔ Use the buttons "INC" and "DEC" to select a different rechargeable battery programme; use the button "BATT. TYPE/STOP" to return to the main menu.
- When the number of recognition processes for the delta-U charging procedure is to be changed, briefly push the button "START/ENTER". The number flashes.
- Use the buttons "INC" and "DEC" to set the number of recognition process.
- Briefly push the "START/ENTER" button to confirm the setting. The display stops flashing.
- Start the rechargeable battery programme "RE-PEAK" by pushing the button "START/ENTER" for 3 seconds.
- ➔ If the settings are wrong, or if the charger detects a problem, a warning signal is emitted and the appropriate information is shown in the display. You can stop the warning signal by pressing the "BATT. TYPE/STOP" button. The charger then returns to the previous configuration menu.

The display shows, e.g., the following data while charging:

The rechargeable battery type is shown in the upper left ("NiMH" = NiMH rechargeable battery), the upper middle shows the charging current and the upper right the current rechargeable battery voltage.



NiMH 0.2A 9.59V
RPC 000:33 00017

The lower left shows the current rechargeable battery programme ("RPC" = "RE-PEAK"), the middle the elapsed charging time and the charged capacity in mAh is displayed to the right of this.

- Once the charging process has been completed, an audio signal is emitted (if it was not turned off).
- ➔ If you wish to cancel the charging process, push the "BATT. TYPE/STOP" button.

e) Discharging Battery ("DISCHARGE")

This rechargeable battery program can be used to put partially charged NiMH/NiCd rechargeable batteries into a defined starting condition or to perform a measurement of the rechargeable battery capacity.

Specifically NiCd rechargeable batteries should not be recharged from a partially discharged condition, since the capacity may reduce by this (memory effect).

- ➔ The maximum possible discharging current depends on the battery type, battery capacity and number of cells. The max. discharge output of the charger is 5 W. This limits the max. possible discharge current of rechargeable batteries with multiple cells.

Discharge a NiMH or NiCd battery as follows:

- Set the rechargeable battery type as described in chapter 12. a) (NiMH or NiCd) and select the rechargeable battery programme "DISCHARGE".



NiMH DISCHARGE
0.1A CUT: 1.0V

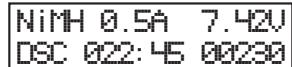
The set rechargeable battery type (NiMH or NiCd) is shown in the upper left of the display, and the rechargeable battery programme next to it.

The value in the lower left indicates the currently set discharging current; the value on the lower right represents the deactivation voltage at the end of the discharge process.

- ➔ Use the buttons "INC" and "DEC" to select a different rechargeable battery programme; use the button "BATT. TYPE/STOP" to return to the main menu.
- To change the value for the discharging current and the deactivation voltage, briefly push the "START/ENTER" button. The discharging current flashes.
- Set the discharging current with the buttons "INC" and "DEC". Keep the respective button pressed for quick adjustment.
- Briefly push the "START/ENTER" button; the deactivation voltage flashes.
- Set the deactivation voltage with the buttons "INC" and "DEC". Keep the respective button pressed for quick adjustment.
- Briefly push the "START/ENTER" button to confirm the setting.
- ➔ Proceed as described above to change the discharging current or the discharging voltage again if desired.
- When no display is flashing anymore, keep the "START/ENTER" button pushed (approx. 3 seconds), to start discharging.
- ➔ If the settings are wrong, or if the charger detects a problem, a warning signal is emitted and the appropriate information is shown in the display. You can stop the warning signal by pressing the "BATT. TYPE/STOP" button. The charger then returns to the previous configuration menu.

The display shows, e.g., the following data while discharging:

The rechargeable battery type is shown in the upper left of the display ("NiMH" = NiMH rechargeable battery), the upper middle shows the discharging current and the upper right the current rechargeable battery voltage.



NiMH 0.5A 7.42V
DSC 022:45 00230

The lower left shows the current rechargeable battery programme ("DSC" = "DISCHARGE"), in the middle the elapsed charging time and the charged capacity in mAh are displayed to the right of this.

- Once the discharging process has been completed, an audio signal is emitted (if it was not turned off).
- ➔ If you wish to cancel the discharging process, push the "BATT. TYPE/STOP" button.

f) Cycle Program ("CYCLE")

To test rechargeable batteries, form new rechargeable batteries or refresh older rechargeable batteries, you can perform up to 5 cycles in sequence automatically. The two possible combinations are "Charge/Discharge" ("CHG>DCHG") and "Discharge/Charge" ("DCHG>CHG").

- ➔ The values that you have set in the charging programme ("CHARGE") or discharging programme ("DISCHARGE") are used as charging or discharging current.

Proceed as follows:

- Set the rechargeable battery type as described in chapter 12. a) (NiMH or NiCd) and select the rechargeable battery programme "CYCLE".

NiMH CYCLE	
DCHG>CHG	1

The set rechargeable battery type is shown in the upper left of the display, and the rechargeable battery programme next to it.

The display in the lower left represents the corresponding combination "Charging/discharging" ("CHG>DCHG") or "Discharging/charging" ("DCHG>CHG"), the lower right shows the number of currently set cycles.

- ➔ Use the buttons "INC" and "DEC" to select a different rechargeable battery programme; use the button "BATT. TYPE/STOP" to return to the main menu.
- If any other cycle mode is to be selected or if you would like to set the number of cycles, briefly push the button "START/ENTER". The display "CHG>DCHG" or "DCHG>CHG" flashes.
- With the buttons "INC" or "DEC", select the desired order in cycle operation:
 "CHG>DCHG" = Charge + then discharge
 "DCHG>CHG" = Discharge + then charge
- Briefly push the button "START/ENTER"; the number of cycles flashes (how often the currently set sequence of charging/discharging or discharging/charging is performed).
- Set the cycle number with the buttons "INC" and "DEC" (1 - 5 cycles are possible).
- Briefly push the "START/ENTER" button to confirm the setting. The display stops flashing.
- To start cycle operation, keep the "START/ENTER" button pressed for longer (approx. 3 seconds).
- ➔ If the settings are wrong, or if the charger detects a problem, an audio signal is emitted and the appropriate information is shown in the display. You can stop the warning signal by pressing the "BATT. TYPE/STOP" button. The charger then returns to the previous configuration menu.

The display shows, e.g., the following data while charging or discharging:

The rechargeable battery type is shown in the upper left ("NiMH" = NiMH rechargeable battery), the upper middle shows the charging or discharging current and the upper right the current rechargeable battery voltage.

NiMH	2.0A	7.42V
C>D	022:45	00090

The lower left shows the selected cycle operation ("C>D" = Charge/discharge, "D>C" = Discharge/charge), the middle shows the elapsed charging or discharging duration and the right next to it the charged or discharged capacity in mAh.

- Once cycle operation has been completed, an audio signal is emitted (if it has not been turned off).
- ➔ To interrupt cycle operation, push the button "BATT. TYPE/STOP".

13. LEAD BATTERIES (PB)

a) General Information

Lead batteries are completely different from lithium, NiMH or NiCd batteries. Despite their high capacity they can only provide low currents. The charging process is also different.

The charging current for modern lead batteries must not exceed 0.4C; 1/10C is perfect for lead batteries.

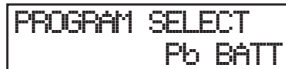


A higher charging current is not permitted; it would overload the rechargeable battery! This not only causes danger of explosion and fire, but also danger of injury from the contained acid.

Also always observe the information printed on the battery or the information provided by the battery manufacturer on the permitted charging current.

The charger must be in the main menu.

Select the rechargeable battery type "Pb BATT" with the "INC" or "DEC" button here, see figure on the right.



Confirm the selection by pressing the "START/ENTER" button.

Then use the button "INC" or "DEC" to select the different rechargeable battery programmes:

- "CHARGE": Charge rechargeable battery
- "DISCHARGE": Discharging the rechargeable battery

b) Charging Rechargeable Batteries ("CHARGE")

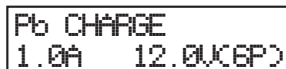
The charging current to be set depends on the battery capacity and is usually 0.1C (also see chapter 7). High-quality lead batteries also can stand a charging current up to 0.4C. However, you should always observe the battery manufacturer's instructions.

➔ The value "0.1C" means that the charging current is equivalent to one-tenth of the rechargeable battery's capacity. For a lead battery with a capacity of 5000 mAh (= 5 Ah) the charging current at 0.1C must be set to 0.5 A.

Proceed as follows to charge a lead battery:

- First, choose the rechargeable battery type "Pb BATT" with the buttons "INC" and "DEC" as described in chapter 13. a) and push the button "START/ENTER".

- Select the rechargeable battery programme "CHARGE" with the buttons "INC" or "DEC".



The set rechargeable battery type is shown in the upper left of the display, and the rechargeable battery programme next to it.

The value on the lower left shows the currently set charging current, the value at the lower right shows the voltage or number of cells of the lead battery (in this example, a 6-cell lead battery (6 x 2.40 V = 14.40 V)).

➔ Use the buttons "INC" and "DEC" to select a different rechargeable battery programme; use the button "BATT. TYPE/STOP" to return to the main menu.

- If the value for the charging current must be changed, push the "START/ENTER" button. The charging current flashes. Change the charging current using the buttons "INC" and "DEC". Keep the respective button pressed for quick adjustment.

- ➔ The maximum possible charging current depends on the battery type and number of cells. The max. charge output is 50 W, which may reduce the actual charge current later.
- Confirm the set charging current with the "START/ENTER" button.
- The number of the cells in the lower right of the display flashes. Set the number of the cells with the buttons "INC" and "DEC". Keep the respective button pressed for quick adjustment.
- Confirm the number of the cells by pressing the "START/ENTER" button.
- When no display is flashing anymore, start charging by keeping the "START/ENTER" button pushed (approx. 3 seconds).
- ➔ If the settings are wrong, or if the charger detects a problem, an audio signal is emitted and the appropriate information is shown on the display. You can stop the warning signal by pressing the "BATT. TYPE/STOP" button. The charger then returns to the previous configuration menu.

The display shows, e.g., the following data while charging:

The rechargeable battery type is shown in the upper left ("P" = lead battery), as well as the cell number; the upper middle shows the charging current and the upper right the current rechargeable battery voltage.

P-6	1.0A	12.32V
CHG	022:45	00690

The lower left shows the current rechargeable battery programme ("CHG" = "CHARGE"), in the middle the elapsed charging time and the charged capacity in mAh are displayed to the right of this.

- Once the charging process has been completed, an audio signal is emitted (if it was not turned off).
- ➔ If you wish to cancel the charging process, push the "BATT. TYPE/STOP" button.

c) Discharging Rechargeable Batteries ("DISCHARGE")

This rechargeable battery program can be used to put partially charged lead batteries into a defined starting condition or to perform a measurement of the rechargeable battery capacity.

- ➔ The maximum possible discharging current depends on the battery type, battery capacity and number of cells. The max. discharge output of the charger is 5 W. This limits the max. possible discharge current of rechargeable batteries with multiple cells.

Proceed as follows to discharge a lead battery:

- First, choose the rechargeable battery type "Pb Battery" with the button "INC" or "DEC" as described in chapter 13. a), then briefly push the button "START/ENTER".
- Select the rechargeable battery programme "DISCHARGE" with the button "INC" or "DEC".

The set rechargeable battery type is shown in the upper left of the display, and the rechargeable battery programme next to it.

Pb	DISCHARGE
0.2A	12.0V(6P)

The value on the lower left shows the currently set discharging current, the value on the right shows the voltage or number of cells of the lead battery (in this example, a 2-cell lead battery (6 x 2.0 V = 12.0 V)).

- ➔ Use the button "INC" or "DEC" to select a different rechargeable battery programme; use the button "BATT. TYPE/STOP" to return to the main menu.
- If the value for the discharging current must be changed, briefly push the "START/ENTER" button. The discharging current flashes.

- Change the discharging current using the button "INC" or "DEC". Keep the respective button pressed for quick adjustment.

Briefly push the "START/ENTER" button to confirm the set discharging current.

- When no display is flashing anymore, keep the "START/ENTER" button pushed (approx. 3 seconds), to start discharging.

➔ If the settings are wrong, or if the charger detects a problem, an audio signal is emitted and the appropriate information is shown on the display. You can stop the warning signal by pressing the "BATT. TYPE/STOP" button. The charger then returns to the previous configuration menu.

The display shows, e.g., the following data while discharging:

The rechargeable battery type is shown in the upper left ("P" = lead battery), the upper middle shows the discharging current and the upper right the current rechargeable battery voltage.

P-B	1.0A	12.32V
DSC	022:45	00630

The lower left shows the current rechargeable battery programme ("DSC" = "DISCHARGE"), in the middle the elapsed charging time and the charged capacity in mAh are displayed to the right of this.

- Once the discharging process has been completed, an audio signal is emitted (if it was not turned off).

➔ If you wish to cancel the discharging process, push the "BATT. TYPE/STOP" button.

14. SAVING/LOADING RECHARGEABLE BATTERY DATA

→ The charger has a total of 10 memories in which you can save rechargeable battery data/settings. They can be loaded again on demand.

a) Selecting/Setting Rechargeable Battery Data

- Select the function "BATT MEMORY" in the main menu of the charger with the button "INC" or "DEC".
- Confirm the selection by pressing the "START/ENTER" button. The memory number flashes.
- Select one of the 10 memories with the buttons "INC" or "DEC".



PROGRAM SELECT
BATT MEMORY



[BATT MEMORY 1]
ENTER SET->

→ If there already are data in the memory, the display will alternate, e.g., between the rechargeable battery type and the cell number, as well as the charging and discharging current.

When the memory is empty, only "ENTER SET ->" is displayed.

- Confirm the selection of the memory number by pressing the "START/ENTER" button.



BATT TYPE
LiPo

The rechargeable battery type is displayed first; see figure on the right.

→ The buttons "INC" and "DEC" select the desired setting function (e.g. battery type, cell number, charge current, etc.). A description of the respective setting functions shown is included on the following pages.

If a setting is to be changed, briefly push the button "START/ENTER". The respectively adjustable value flashes.

Change the flashing value with the buttons "INC" and "DEC". Keep the respective button pressed for quick adjustment.

Complete the setting by briefly pushing the "START/ENTER" button. The respective adjustable value stops flashing. Then you can select another setting function, see above.

If you want to save all previous settings in the memory selected at first, call the setting function "SAVE PROGRAM" at the end with the buttons "INC" and "DEC" and briefly push the button "START/ENTER".



SAVE PROGRAM
ENTER

Otherwise, all settings are lost! Then the display shows the indication with the flashing memory number again.

To discard previous settings and cancel setting mode, push the button "BATT. TYPE/STOP" repeatedly until you are back in the main menu.

The following functions are available:

➔ Depending on the set battery type (LiPo, Lilo, LiFe, NiMH, NiCd, Pb), different setting functions are available. For example, the setting function for the charge end voltage per cell is only available for lithium rechargeable batteries.

Therefore, always set the rechargeable battery type first and only then the other data, so that the charger can offer the setting functions matching the rechargeable battery type.

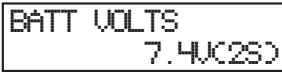
Rechargeable battery type



For this, select the rechargeable battery type "LiPo", "Lilo", "LiFe", "NiMH", "NiCd" or "Pb".

➔ As described above, this selection must be made first, since the right setting functions matching the rechargeable battery type are only displayed then.

Battery Voltage



Depending on the set rechargeable battery type, the rechargeable battery voltage can be set here.

➔ However, it is not possible to set any voltage, but the steps depend on the rated voltage of an individual cell of the respective rechargeable battery type; see chapter 7.

For example, the rated voltage of a cell in LiPo rechargeable batteries is 3.7 V; the rechargeable battery voltage can thus only be set in steps of 3.7 V (3.7 V, 7.4 V, 11.1 V, etc.).

Charging current



Set the desired charging current here (0.1 - 7.0 A). It must be selected according to the rechargeable battery used.

➔ Observe that the charging output of the charger is up to 50 W. Depending on the cell number, the maximum charging current may therefore not be available.

Discharging current



Set the desired discharging current here (0.1 - 2.0 A). It must be selected according to the rechargeable battery used.

➔ Observe that the discharging output of the charger is max. 5 W. Depending on the cell number, the maximum discharging current will therefore not be available.

Discharging end voltage per cell

DSCH VOLTAGE 3.0V/CELL

Here, the voltage per cell at which discharging ends can be set.



Attention!

Never set the voltage too low. For lithium rechargeable batteries, this may cause deep discharge and permanent damage to the rechargeable battery!

Observe the table in chapter 7 and any special information of the rechargeable battery manufacturer.

Charging end voltage per cell

TVC=YOUR RISK! 4.20V

Here, the voltage per cell at which discharging ends in lithium rechargeable batteries can be set.



Attention!

Never set the voltage too high. This can result in a fire or explosion with lithium rechargeable batteries!

Observe the table in chapter 7 and any special information of the rechargeable battery manufacturer.

Deactivation at overtemperature

TEMPERATURE CUT-OFF 50C

The charger can automatically cancel charging/discharging if the rechargeable battery exceeds the temperature set here.

→ To use this function, an external temperature sensor is required (not enclosed). It must be connected to the respective socket of the charger.

Maintenance charging current (for NiMH and NiCd only)

TRICKLE 100mA

Set the maintenance charging current here. When a NiMH or NiCd rechargeable battery is fully charged, it will lose part of its capacity again by self-discharge. The maintenance charging current (short charging impulses, no continuous charging current!) ensures that the rechargeable battery remains fully charged. Thus also prevents crystal formation in the rechargeable battery.

Delay time for delta-U recognition (for NiMH and NiCd only)

```
PEAK DELAY
1Min
```

The charger ends charging of NiMH or NiCd rechargeable batteries according to the delta-U method.

Set for how long the charger is to continue charging after this recognition here.

Voltage for delta-U recognition (for NiMH only)

```
DELTA PEAK SENSE
4mV/C
```

Set the voltage here where the delta-U charging procedure recognises a fully charged rechargeable battery.

→ If the value is set too high, the charger may not recognise that the rechargeable battery is fully charged. The protection circuit for the charge duration or the maximum capacity usually trips here (if set correctly).

If the value is set too low, the charge will switch off too early and the rechargeable battery will not be fully charged.

Change the voltage in steps and check the charging process. Due to the many different rechargeable batteries, it is not possible to suggest a perfect value.

Save settings

```
SAVE PROGRAM
ENTER
```

For this purpose, see chapter 14. b).

b) Saving Battery Data

To save the set values, select the setting function "SAVE PROGRAM" and then briefly push the button "START/ENTER". Otherwise, all settings are lost.

The charger will show the corresponding display message when saving ("SAVE....") and emit a sound signal.

```
SAVE PROGRAM
ENTER
```

```
SAVE PROGRAM
SAVE....
```

When selecting the function "BATT MEMORY" in the main menu of the charger and then an already-occupied memory, the charger alternatingly shows the most important information, see example in the figure on the right (rechargeable battery type LiPo, 2 cells, charging current 2.2 A, discharging current 0.4 A).

```
[ BATT MEMORY 1 ]
LiPo 7.4V(2S)
```



```
[ BATT MEMORY 1 ]
C: 2.2A D: 0.4A
```

This shows you which rechargeable battery or data are stored in the memory at first glance.

→ When the memory is empty, the bottom line shows only the information "ENTER SET->".

```
[ BATT MEMORY 1 ]
ENTER SET->
```

c) Loading Battery Data

- Select the function "BATT MEMORY" in the main menu of the charger with the button "INC" or "DEC".
- Confirm the selection by pressing the "START/ENTER" button. The memory number flashes.
- Select one of the 10 memories with the buttons "INC" or "DEC".

➔ If there are data in the memory, the display will show in the bottom line alternately, e.g., the rechargeable battery type and the cell number, as well as the charging and discharging current.

When the memory is empty, the bottom line shows only the information "ENTER SET ->".

- Load the battery data from the selected memory by pushing the button "START/ENTER" for 3 seconds.

The display shows the message "ENTER CHARGE LOAD....."; the data are then loaded and the desired charging/discharging programme can then be started (push the button "START/ENTER" again for 3 seconds).

➔ If you keep the button "START/ENTER" pushed for 3 seconds in an empty memory, the charger will start selection/setting mode, see chapter 14. a).

```
PROGRAM SELECT  
BATT MEMORY
```

```
[ BATT MEMORY 1 ]  
LiPo 7.4V(2S)
```

```
[ BATT MEMORY 2 ]  
ENTER SET->
```

```
ENTER CHARGE  
LOAD...
```

15. VOLTAGE DISPLAY FOR LITHIUM RECHARGEABLE BATTERIES

The charger can also display the current voltages of the cells of a lithium rechargeable battery.

➔ For this, the rechargeable lithium battery must have a balancer connection that must be connected to the charger.

Proceed as follows:

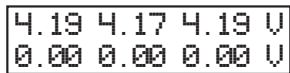
- Select the function "LI BATT METER" in the main menu of the charger with the button "INC" or "DEC".
- Confirm the selection by pressing the "START/ENTER" button.



PROGRAM SELECT
LI BATT METER

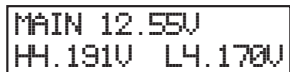
Then the voltage display appears.

- Use the buttons "INC" or "DEC" to switch between:
 - individual voltages of cells 1 - 6
 - overall voltage ("MAIN"), maximum cell voltage ("H") and minimum cell voltage ("L")



4.19 4.17 4.19 U
0.00 0.00 0.00 U

The individual voltage displays depending on the cell number, of course. The example figure on the right may be a 3-cell LiPo rechargeable battery (or a multiple-cell LiPo rechargeable battery with defective cells or defective balancer connections).



MAIN 12.55V
H4.191V L4.170V

The display of the maximum cell voltage ("H") and the minimum cell voltage ("L") of all cells of the connected battery pack shows the difference of the voltage situation of the cells at a glance.

- You can return to the main menu as usual via the "BATT. TYPE/STOP" button.

16. SYSTEM SETTINGS

The system settings of the charger summarise various basic settings. They are pre-applied with the most common values in the delivery condition.

Depending on the rechargeable batteries you want to charge or discharge, however, certain changes to the values are sensible.

Proceed as follows:

- Select the function "SYSTEM SET ->" in the main menu of the charger with the button "INC" or "DEC".
- Confirm the selection by pressing the "START/ENTER" button.

```
PROGRAM SELECT
SYSTEM SET->
```

First, the break time between a charging/discharging process (e.g. in cycle operation) is displayed; see figure on the right.

```
Rest Time
CHG>DCHG 10Min
```

➔ Use the buttons "INC" or "DEC" to select the desired setting functions.

If a setting is to be changed, briefly push the button "START/ENTER". The respectively adjustable value flashes.

Change the flashing value with the buttons "INC" and "DEC". Keep the respective button pressed for quick adjustment.

Complete the setting by briefly pushing the "START/ENTER" button. The respective adjustable value stops flashing. Then you can select another setting function, see above.

To return to the main menu, push the button "BATT. TYPE/STOP".

Observe the following information for description of the possible setting functions.

Pause duration between charging/discharging processes

```
Rest Time
CHG>DCHG 10Min
```

When charging a rechargeable battery, it heats up (depending on the charging current). In cycle operation, the charger may make a break between charging and discharging so that the rechargeable battery cools off before discharging starts.

Safety timer

```
SAFETY TIMER
ON 120Min
```

If charging starts, the internal safety timer starts as well. If the charger cannot detect whether the battery is fully charged for whatever reason (e.g. with delta-U detection), the charge process is terminated automatically after a set time if the safety timer is on. This protects the battery from overloading.

The safety timer can be switched on ("ON") or off ("OFF"); the time for the safety timer can also be changed.

➔ Do not set the time too short, since the rechargeable battery cannot be fully charged then because the safety timer will cancel charging.

Calculate the time for the safety timer as follows:

Examples:

Battery capacity	Charging current	Timer time
2000 mAh	2.0 A	$2000 / 2.0 = 1000 / 11.9 = 84$ minutes
3300 mAh	3.0 A	$3300 / 3.0 = 1100 / 11.9 = 92$ minutes
1000 mAh	1.2 A	$1000 / 1.2 = 833 / 11.9 = 70$ minutes

➔ The factor 11.9 is used to permit charging 140% of the rechargeable battery capacity (the rechargeable battery is guaranteed to be fully charged then), before the safety timer trips.

Automatic deactivation at specific charging capacity

```
Capacity Cut-Off
ON      5000mAh
```

This safety function of the charger terminates charging automatically when a certain capacity has been "loaded" into the battery.

The safety function can be switched on ("ON") or off ("OFF") and the capacity can be set.

➔ However, do not set a capacity which is too low; otherwise the rechargeable battery cannot be fully charged.

Switching the key confirmation/warning sounds on/off

```
Key Beep      ON
Buzzer        ON
```

With the option "Key Beep", confirmation beep for each push of a button is switched on ("ON") or off ("OFF").

The function "Buzzer" switches the signal sound for various functions/warning messages on ("ON") or off ("OFF").

Monitoring of the input voltage

```
Input Power Low
Cut-Off      11.0V
```

This function monitors the voltage at the charger input. This is sensible when a 12 V car lead battery is used for power supply.

If the voltage drops below the set value, charging is terminated to prevent deep discharge of the car lead battery.

Display of the rechargeable battery and charger temperatures

Ext. Temp	00
Int. Temp	270

This function shows the external rechargeable battery temperature and the internal temperature of the charger.

- The external temperature can only be displayed if an external temperature sensor is connected to the charger (not enclosed, but available as an accessory).

Loading factory settings (reset)

LOAD FACTORY SET
ENTER

This recovers the factory settings (reset).

Keep the button "START/ENTER" pressed for 3 seconds. The lower display line shows "COMPLETED"; the charger restarts and then is in the main menu again.

- Observe that all values set by you are then reset to factory settings; the 10 rechargeable battery memories (see chapter 14) are also deleted.

Display firmware version

VERSION	4.01
---------	------

The current firmware of the charger is displayed at the lower right of the display.

17. WARNING MESSAGES ON THE DISPLAY

REVERSE POLARITY

The polarity of the rechargeable battery connections has been switched.

CONNECTION BREAK

The connection to the rechargeable battery has been disrupted, e.g. if the battery has been disconnected during the charging process.

CONNECT ERROR
CHK MAIN PORT

The rechargeable battery was connected with reversed polarity.

BALANCE CONNECT
ERROR

The balancer connection of the rechargeable battery has been connected incorrectly or with reversed polarity.

DC IN TOO LOW

The input voltage (at the direct voltage input) for the charger is too low (< 11 V).

DC IN TOO HIGH

The input voltage (at the direct voltage input) for the charger is too high (> 18 V).

CELL ERROR
LOW VOLTAGE

The voltage of a cell of a connected lithium rechargeable battery is too low.

CELL ERROR
HIGH VOLTAGE

The voltage of a cell of a connected lithium rechargeable battery is too high.

CELL ERROR
VOLTAGE-INVALID

The voltage of a cell of a connected lithium rechargeable battery cannot be measured correctly.

CELL NUMBER
INCORRECT

The set cell number is wrong.

INT. TEMP. TOO HI

The inner temperature of the charger is too high.

EXT. TEMP. TOO HI

The temperature measured at the rechargeable battery via the external temperature sensor (not enclosed, can be ordered separately) is too high.

OVER CHARGE
CAPACITY LIMIT

The set capacity limit (see chapter 16) has been exceeded.

OVER TIME LIMIT

The set time limit for charging (see chapter 16) has been exceeded.

BATTERY WAS FULL

The connected rechargeable battery is fully charged. If required, check the cell number settings.

18. INFORMATION ON THE CHARGER

Various information is indicated on the display during a charge/discharge process by repeatedly pressing the button "DEC". If you do not push any button for a few seconds, the charger will return to the normal display.

→ The information that can be displayed depends on the connected rechargeable battery type.

Voltage of the battery at the end of charging/discharging

End Voltage
12.6V(3S)

Input voltage

IN Power Voltage
14.93V

Display of the temperature at the external temperature sensor

Ext.Temp	0C
Int.Temp	27C

→ If no external temperature sensor is connected (not enclosed, can be ordered separately), "Ext.Temp" will display "0C".

Duration for safety timer

Safety timer
ON 200min

Battery capacity for safety cut-off

Capacity Cut-off
ON 5000mAh

19. MAINTENANCE AND CLEANING

The product does not require any maintenance. You should never take it apart.

The product should only be repaired by a specialist or specialist workshop or it may be damaged. Furthermore, the CE approval and the guarantee/warranty will expire.

➔ Any rechargeable battery connected must be disconnected from the charger before cleaning. Then disconnect the charger from the voltage/current supply.

Clean the product only with a soft, clean, dry and fuzz-free cloth. Do not use cleaning agents as they may corrode the casing and wear off the labelling.

Dust can be removed using a clean, soft brush and a vacuum cleaner.

20. DISPOSAL

a) General Information



The product does not belong in the household waste.

Dispose of the product according to the applicable statutory provisions at the end of its service life once it has become useless.

b) Batteries and Rechargeable Batteries

You as the end user are required by law (Battery Ordinance) to return all used batteries/rechargeable batteries. Disposing of them in the household waste is prohibited!



Batteries/rechargeable batteries containing harmful substances are marked with the following symbols, which point out that they are not allowed to be disposed of in the domestic refuse. The descriptions for the respective heavy metals are: Cd=cadmium, Hg=mercury, Pb=lead (the names are indicated on the battery/rechargeable battery, e.g. below the dust bin icons shown to the left).

You may return used batteries/rechargeable batteries free of charge at the official collection points in your community, in our stores, or wherever batteries/rechargeable batteries are sold.

You thus fulfil your statutory obligations and contribute to the protection of the environment.

21. TECHNICAL DATA

Operating voltage Mains voltage input: 100 - 240 V/AC, 50/60 Hz (max. 1,0 A)

Direct voltage input: 11 - 18 V/DC (max. 6,5 A)



Never use both inputs at the same time. This may damage the charger. Loss of guarantee/warranty!

Output voltage max. 25.2 V (at the charge sockets)

Charging/discharging channels 1

Charge current 0.1 - 7.0 A (depending on the cell number and rechargeable battery type)

Charging output max. 50 W

Discharge current 0.1 - 2.0 A (depending on the cell number and rechargeable battery type)

Discharging power max. 5 W

Suitable rechargeable batteries NiMH/NiCd, 1 - 15 cells

LiPo/LiIon/LiFe, 1 - 6 cells

Pb, 1 - 10 cells (rated voltage 2 - 20 V)

Discharging current for balancer LiPo/LiIon/LiFe: 300 mA per cell

Delta-U detection NiMH/NiCd: 3 - 15 mV/cell (adjustable)

Safety timer 10 - 720 minutes, can be switched off

Ambient conditions Temperature +10 °C to +40 °C; humidity 0% to 90% relative, non-condensing

Weight Approx. 600 g

Dimensions Approx. 137 x 147.5 x 45 mm (W x D x H)

© Legal Notice

This is a publication by Conrad Electronic SE, Klaus-Conrad-Str. 1, D-92240 Hirschau (www.conrad.com).

All rights including translation reserved. Reproduction by any method, e.g. photocopy, microfilming, or the capture in electronic data processing systems require the prior written approval by the editor. Reprinting, also in part, is prohibited. This publication represent the technical status at the time of printing.

© Copyright 2016 by Conrad Electronic SE.

*1416554_V5_0816_02_VTP_m_en