

# User Manual

## Charger for NiCd/NiMH batteries

### **EN** User Manual

Language specific user manuals are available on  
[www.mascot.no/downloads/usermanuals](http://www.mascot.no/downloads/usermanuals)



Bruksanvisning  
Käyttöohjeet  
Bedienungsanleitung  
Mode d'emploi  
Manual de instrucciones  
Istruzioni per l'uso



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## IMPORTANT SAFETY INSTRUCTIONS!



**TO REDUCE THE RISK OF FIRE AND ELECTRIC SHOCK:**

**READ THROUGH THESE INSTRUCTIONS PRIOR TO USING THE PRODUCT.**

**CAREFULLY FOLLOW THESE INSTRUCTIONS WHEN USING THE PRODUCT.**

**RETAIN THESE INSTRUCTIONS FOR FUTURE REFERENCE.**



**CAUTION! DOUBLE POLE / NEUTRAL FUSING!**



This product is designed for indoor use. (Not applicable to products marked "IP67")

### **IP41    IP44    IP67**

A version of this product marked "IP41" may be available. This version is protected against ingress of solid objects larger than 1.0 mm and the effects of vertically falling drops of water according to standard EN/IEC 60529.

A version of this product marked "IP44" may be available. This version is protected against ingress of solid objects larger than 1.0 mm and the effects of water splashed against the enclosure from any direction according to standard EN/IEC 60529.

A version of this product, marked with a symbol with two drops of water and/or "IP67", may be available. This version is filled with a potting compound and is dust-tight and protected against the effects of temporary immersion in water acco-

rding to standard EN/IEC 60529, but must not be immersed in water for longer periods of time.



Products marked with the "double square symbol" are double insulated (Insulation Class II). Products without this mark are Class I (relies on safety earth for protection).

**WARNING:** To avoid risk of electric shock, Class I products must only be connected to a supply mains with protective earth.



At the end of their service life electric and electronic equipment and their accessories shall not be discarded with the municipal waste but be disposed of using separate collection, treatment, recovery/recycling and environmentally sound disposal. This also applies to any potentially bio hazardous parts and accessories. If in doubt; contact your local authorities to determine the proper method.

Technical specifications for your product: See tables, the marking on the product or [www.mascot.no](http://www.mascot.no)

## Cautions to observe prior to use

- The intended use for this product is to charge a battery or a battery powered electrical accessory (NiCd/NiMH, Lead-Acid, Lithium-Ion or LiFePO<sub>4</sub> batteries) or to be used as a Power Supply to power an electrical accessory. Please see the marking on the product you have to verify the type of product you have and read the applicable instructions and technical specifications included with this manual.
- This product may be used by unskilled operators, under the condition that these instructions are followed.
- Unskilled operators may contact the supplier or manufacturer for assistance, if needed, in setting up, using or maintaining this product and to report unexpected operation or events.
- This appliance can be used by children aged from 8 years and above and persons with reduced physical, sensory or mental capabilities or lack of experience and knowledge if they have been given supervision or instruction concerning use of the appliance in a safe way and understand the hazards involved. Do not allow small children to handle this product while unattended as cables may represent a risk for strangulation and small parts may represent a risk for inhalation or swallowing.
- Do not allow animals to come into contact with this product. Some animals are known to cause damage to cables etc which may be a potential for risk of electric shock and excessive temperatures. Also, cables and small parts may represent a strangulation risk for the animal.
- If the product is equipped with a mains cord, please check that the cord is not damaged. If the cord is damaged, the product must not be used until the cord is replaced. Replacement should be carried out by qualified personnel.
- The mains socket outlet used should always be easily accessible to facilitate immediate removal of the products mains supply should an operational error occur during use. If the product has a detachable mains cord the appliance coupler may be used as a disconnect device.
- The product is "switched on" by inserting the mains plug into the mains socket and "switched off" by disconnecting the mains plug from the mains socket.
- The product may be connected to an IT type mains supply.
- For use in U.S.A.:
  - Be sure to use 125V 15A receptacle configuration before plugging in.
  - Use a UL817-standard compliant mains cord (plug type NEMA 1-15, cord type SJT or SVT).
- For use outside U.S.A.:  
Use a mains cord compliant with the country specific requirements.
- The time from powering this product until its full function starts may exceed 15 seconds.
- Should an operational error or unexpected change in the performance occur during use; disconnect the product from the mains immediately by disconnecting the mains plug from the mains socket and contact the supplier or manufacturer (see contact details on the front of this document).
- When not in use please think about disconnecting the product from the mains. This will reduce the risk of hazards, reduce the products environmental impact and save electricity costs.
- To avoid overheating make sure there is sufficient room for the circulation of air around the product when in use. Do not cover it up.
- Even though this product complies with relevant safety standards it should not be in contact with human skin for long periods as some people may get allergies or injuries from long-term contact with moderate temperatures and/or plastic materials.

- Prior to using this product with accessories and/or interconnected equipment please carefully read its respective User Manuals.
- If the product is supplied with exchangeable output plugs, please see separate page for assembly.
- Output cables having a modular plug ( similar to a telephone connector) must never be connected to a telephone outlet.
- Products with a welded plastic housing or rated IP 67 are not repairable. For such products the supply cord cannot be replaced. If the cord is damaged the appliance should be scrapped. Please contact your supplier for replacement part.
- This product contains hazardous voltages and there are no user replaceable parts inside the product. Never attempt to remove the cover.
- **WARNING:** No modification of this equipment is allowed. Any repair/service should be carried out by qualified personnel who may get assistance by contacting the manufacturer or the manufacturer's agent.
- Products specified to have automatic polarity protection must be switched off if a battery is connected with reverse polarity. The protection will be automatically reset when the polarity has been corrected.
- In chargers specified to have a replaceable fuse as polarity protection the fuse must be replaced if the battery has been connected with reverse polarity. When replacing the fuse; a fuse of the same type and rating must be used.
- If the product is specified to comply with the standard for Medical Electrical Equipment (standards based on IEC60601-1) it complies with some of the requirements for medical electrical equipment and may be used in medical applications and hospital environments.
- The product must be kept away from sources of heat and may not be used in the vicinity of flammable anesthetic gases or in other environments with flammable or explosive atmosphere.
- If the product is specified to comply with the standard for Medical Electrical Equipment for Home Healthcare Environment (standard IEC60601-1-11) it may be used in medical applications used in a home healthcare environment.
 

NOTE: Products relying on safety earth for protection (Class I) may not be used in home healthcare environment unless they are permanently wired to the building installation: Installation must only be carried out by qualified service personnel, following the below instructions:

  - The protective earth conductor must be min. 0.75 mm<sup>2</sup>.
  - Connect the protective earth conductor to the external protective earthing system.
  - Verify that the protective earth terminal used is connected to the external protective earthing system.
  - Verify the integrity of the external protective earthing system.
- This product converts the mains voltage to a safety extra low voltage. Some products may be treated as Applied Part (Type BF) according to standard EN/IEC 60601-1 and may come in physical contact with a patient.
- This product must be operated in an environment within temperature range +5 to +40°C, humidity 15 - 93 % RH and atmospheric pressure 70 - 106 kPa (700 - 1060 hPa).
- Expected service life of this product and accessories delivered with this product is three (3) years, if operated as indicated above. However; the guarantee times indicated in document "TERMS OF SALES AND DELIVERY FOR MASCOT AS" apply (available at [www.mascot.com](http://www.mascot.com)).
- Environmental parameters during transport and storage between uses: temperature range -25 to +85 °C, humidity 15 - 93% RH NC and at-

atmospheric pressure 70 - 106 kPa (700 - 1060 hPa). If the product has recently been stored or transported at conditions outside this range; please wait for 30 minutes before operating the product.

- If stored for longer periods of time the environmental parameters should be within the temperature range +5 to +35°C, humidity range 10 - 75% RH NC and atmospheric pressure 70 - 106 kPa (700 - 1060 hPa) to maintain the products expected service life.
- Expected shelf life of this product is one (1) year, if stored as indicated above.
- This product complies with the requirements to electromagnetic compatibility for medical electric equipment and for use in residential, office or light industrial environment but all electric products imply a potential for electromagnetic or other interference between the product and other devices. If such interference is suspected please disconnect the product from the mains and consult a qualified technician, your supplier or the manufacturer.
- No special maintenance procedure is required but if the product gets dusty or dirty it should be wiped clean using a dry cloth while the product is disconnected from the mains. No other maintenance should be necessary.
- For products having a plastic casing, please avoid any contact with lotions, oils, grease and solvents as most types of plastic may be degraded by such chemicals. Also make sure to position, operate and store such products away from UV-light and direct sunlight.
- Position, operate and store this product only under reasonable foreseeable environmental conditions with respect to magnetic fields, EM-fields, electrostatic discharges, pressure or variations in pressure, acceleration etc.
- If this product is used with or mounted in a vehicle it may only be used when the vehicle is not in use.
- When in use, position this product so that the label can be read – within 40 cm of the operator.

## **Instructions for charging NiCd and NiMH batteries**

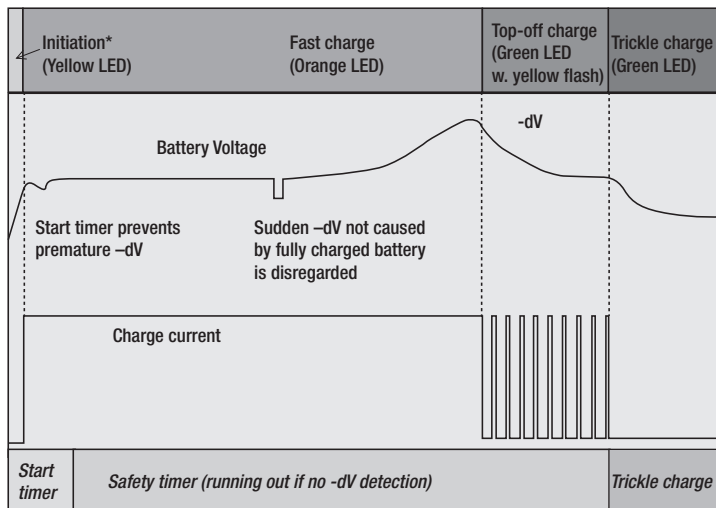
### **Charger functionality**

This charger is a fast charger for NiCd/NiMH batteries. The standard version utilizes a method called -dV detection for charge termination when the batteries are fully charged. This method is based on the fact that the voltage drops over the NiCd/NiMH cells when the batteries are fully charged. This voltage drop is detected when the voltage has dropped a certain percentage from the highest value (typically 0.5%). If this drop does not occur, the charger has a safety timer which will terminate charging after a given time period to avoid overcharging the batteries. A few

cells may have a voltage drop in the first part of the charge cycle. This is especially true for battery cells which have been idle for a longer period of time. Because of this, a start-timer is built into the charger which prevents -dV detection the first minutes of the charge cycle.

As the charger is programmable, it is possible that the standard parameters, which this user manual is based on, have been changed. See separate user manual or contact supplier for additional information.

## Mascot CPM charge diagram



A new charge cycle starts by reconnecting battery at output or connecting/reconnecting mains

## Cautions before charging NiCd and NiMH batteries

- NiCd/NiMH chargers are designed for charging NiCd and NiMH batteries only.
- Make sure you have the correct battery charger for the battery you wish to charge. The number of cells must correspond to the output indicated on the charger. **Never charge more battery cells than the charger is made for.**
- When charging separate battery cells, avoid charging cells with different rest capacities at the same time.

- Do not attempt to charge batteries that are not rechargeable.
- Please check that the specification for your battery allows for the maximum charge current indicated on the charger. If in doubt; contact the battery manufacturer for details.
- Please check that the specification for your battery allows for the environmental conditions present during charging.  
**Do not charge batteries at too high or too low temperatures.**
- Please ensure correct polarity when connecting to the battery terminals. Reverse polarity connection may, in some chargers (see the charger's specification), result in a fuse blowing, leaving the charger useless.
- The charge cycle starts when the charger is connected to the mains.
- If the charger is disconnected from the mains voltage during a charge cycle the charger will start a new charge cycle when it is reconnected to the mains.
- When charging is complete, disconnect the charger from the mains before removing battery connections.

## Safety features

### The embedded microprocessor & charge program has numerous features for safe battery charging

- The -dV level will adapt to the number of cells and will be approximately equally sensitive for all number of cells.
- The safety timer will protect the batteries if a -dV signal fails to appear during charging. It is normal to have a safety timer that is longer than the max. charge time.
- Some battery cells may give a voltage drop during the initial part of the charge cycle. To avoid interruption of the charge cycle the charger has a start-timer that prevents -dV detection during the first minutes of the charge cycle.
- The charger is programmed to disregard large voltage fluctuations due to connection of external loads etc. Such false -dV signals will be detected by the software and will be disregarded.
- Top-off charge following -dV detection ensures that all cells in a battery pack reaches full capacity (are balanced) prior to trickle charge.
- The charger output is protected against reverse polarity, in most cases by an automatically resettable fuse.
- The charger is designed for the lowest possible leakage current from the battery when mains is disconnected (<1mA). Even so, it is recommended that the batteries are disconnected from the charger when mains is not connected.
- On request the charger may be supplied with battery temperature monitoring. A built-in temperature change control (+dT/dt) secures optimal charge with a built-in NTC resistor in the battery pack.
- Other functions such as OdV detection and timer only charge is available upon request. Most charge parameters may be altered using an external programming tool. Contact Mascot for details.

## How to use the charger

The charger is started by connecting the battery pack to the charger and then connecting the charger to the mains.

The LED (light emitting diode) will be yellow before the fast charge starts and the LED changes to orange. When the batteries are fully charged and the voltage drops because of the -dV signal from the batteries, the charger will go into a top-off charge mode before it goes over to trickle charge mode. During top-off charge the LED will be green with a short intermittent yellow light. When the top-off charge is completed, the charger will go into trickle charge mode and the LED will be green. The charge current is now reduced to a safe level, which allows the charger to stay connected to the NiCd batteries without damaging the batteries. NiMH batteries are not as well suited for trickle charge, and some battery manufacturers recommend that trickle charge

does not exceed 24 hours. If in doubt; contact the battery manufacturer for details.

If the safety timer runs out before -dV is detected, the charger will go directly to trickle charge mode (no top-off charge) and LED will be continuously green. If the battery voltage is far below normal, the charger will cut the fast charge current and go to trickle charge mode. The LED will then indicate "error" by flickering green and orange light.

If the mains input voltage is turned off, the charger will reset. When the mains input voltage is turned on again a new charge cycle will start.

If new batteries are to be connected, the charger must idle for approx 15 sec. to make sure all parameters in the microprocessor have been reset. When the charger has been reset the LED changes to yellow, and a new charge cycle can begin.

## Charge cycle and LED indications

LED	MODE
YELLOW	Battery not connected
YELLOW	Battery initialisation and analysis
ORANGE	Fast charge
GREEN with intermittent YELLOW flash	Top-Off Charge
GREEN	Trickle Charge
Alternating ORANGE-GREEN	ERROR

When the mains is connected the LED will be orange for the first seconds and then turn to yellow when the initialisation and analysis starts. If a battery is connected, the actual charging will start a few seconds later when the LED changes to orange. After the start-timer period has run out (the first few minutes of the charge cycle when

the -dV detection is disabled), the LED will be green for approx. 8 seconds. This is a signal for testing and service only. When -dV has been detected, the start of the top-off charge is indicated with a green LED with intermittent yellow flashes. The LED is green during trickle charge.



## Temperature control (optional feature)

If the charger is used with a temperature sensor (NTC-resistor in the battery) it is possible to add control to the battery charging process. If the battery temperature is too low ( $< 0^{\circ}\text{C}$ ) at the start of the charge cycle, the charger will charge with trickle charge current until the temperature level is safe. This is indicated by an intermittent orange flash while the LED is green. The same will take place if the battery temperature exceeds  $40^{\circ}\text{C}$ .

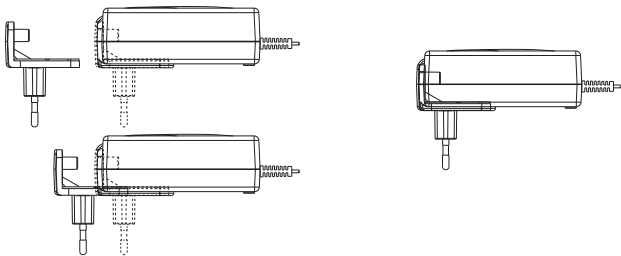
NOTE. The charger may be programmed for other temperature parameters. See a separate user manual or contact supplier for additional information.

The current will then remain low until the temperature is at a level where fast charge can start. If the temperature is too high for safe charging ( $> 60^{\circ}\text{C}$ ), the LED will show "error" by intermittently flashing orange and green. By using the temperature increase control ( $+dT/dt$ ), the charger will switch to top-off charge and later to trickle charge the same way as charging with  $-dV$  control.

## Zero dV feature (optional feature)

If zero dV has been activated, the charger will stop the fast charge when the voltage has not increased the last 5 minutes. This feature may be the only sensor, or it may be used in combination with  $-dV$  and/or  $+dT/dt$

## How to connect exchangeable AC-plugs

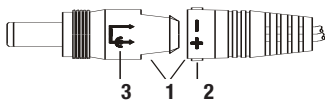


### The following exchangeable AC plugs are available:

Type 018110 - "EURO"	250V 2.5A (EN50075/IEC83 C5 II)
Type 018111 - "US"	125V 2.5A (NEMA 1-15 / CSA-C22.2 No.42)
Type 018112 - "UK"	250V 13A (BS 1363)
Type 018114 - "AUS"	250V 10A (AS/NZS 3112)

Mains Cord Set is available on request if you wish your product to be "DeskTop"

## How to connect exchangeable DC-output plugs



1. To connect for desired polarity, both plug ends are clearly marked.
2. When connected, the female plug is also marked on each side to identify plug polarity.
3. Shows the center polarity of the plug.

## Common technical data

NiCd/NiMH versions: (cells in series):	3-6 cell	4-8 cell	5-10 cell	6-12 cell	10-20 cell	12-25 cell	15-30 cell
No-Load Voltage	12.8 V ± 0.7 V	16.5 V ± 1.0 V	21.0 V ± 1.2 V	24.7 V ± 1.5 V	41.0 V ± 2.0 V	51 V ± 2 V	55 V ± 3 V
Min. output voltage for -ΔV detection	3.7 V	5.0 V	6.2 V	7.5 V	12.5 V	15 V	19 V
Max. output voltage for -ΔV detection	10.8 V	14.4 V	18.0 V	21.6 V	36.0 V	45 V	49.5 V

## Specific technical data

	<b>2115/2116</b>	<b>2015</b>	<b>2215/2216</b>	<b>2415</b>	<b>2515</b>	<b>3015</b>
<b>Input voltage : current : frequency:</b>	100 - 240VAC max.0.35A 50 - 60 Hz	230 - 240VAC max.0.5 A 50 - 60 Hz	100 - 240 VAC max.0.9A 50 - 60 Hz	100 - 240VAC max. 1.3A 50 - 60 Hz	10 - 30 VDC max 4A	10-30 VDC max 8A
<b>Max. Output Power</b>	16 W	40 W	35 W	67 W	32 W	67 W
<b>Protection at input</b>	Fuse:T1.0 AH 250 V, 5 x 20 mm	Fusible resistor	Fuse: T1.6 AH 250 V, 5 x 20 mm	Fuse: T2.5 AH 250 V, 5 x 20 mm	5 A fuse on input cable.	10A fuse on input cable
<b>Protection against ingress of water (IEC 60529)</b>	IP4X (IP67 available)	IP3X	IP4X (IP67 available)	IP4X (IP67 available)	IP4X (IP67 available)	IP4X (IP67 available)
<b>Insulation Class</b>	Class II	Class II	Class II	Class II	Class II, common minus	Class II, common minus
<b>Dimensions (LxWxH)</b>	90x45x32mm (2115) 103,5x46,8x38,7mm (2116)	100x63x47mm	107x67x36,5mm (2215) 117x75x44mm (2216)	135x80x44mm	107x67x36,5mm	135x80x44mm
<b>Weight</b>	125g / 150g	220g	250g	350g	250g	350g
<b>Input terminals</b>	- Non-detachable mains cord or 2-pin connector (IEC 60320/C7) for detachable mains cord set (2115, 2215 and 2415 only) - Exchangeable AC adapters (model 2116 and 2216 only). 2015 has fixed plug-in connector. - DC/DC chargers 2515 and 3015 has cable in and out.					

## Specific technical data

	<b>3546</b>	<b>3743</b>
<b>Input voltage :</b> <b>current :</b> <b>frequency:</b>	100 - 240 VAC max.0.7 A 50 - 60 Hz	100 - 240 VAC max.0.5 A 50 - 60 Hz
<b>Max. Output Power</b>	30 W	16 W
<b>Protection at input</b>	Fuse: T1.6 AH 250 V, 5 x 20 mm	Fuse: T1.0 AH 250 V, 5 x 20 mm
<b>Protection against ingress of water (IEC 60529)</b>	IP4X	IP4X
<b>Insulation Class</b>	Class II	Class II
<b>Dimensions (LxWxH)</b>	123x49.5x37mm	108.5x49x29.3mm
<b>Weight</b>	220g	150g
<b>Input terminals</b>	2-pins IEC320 connector for exchangeable mains plug (EU, US, UK and AUS)	

## Fast charge current/ Top-off current/ Trickle current, std models\*

	2015	2015	2215/2216	2415	2515	3015
<b>2 cell</b>	Fast charge: Top-off charge: Trickle charge:	1.3 A ± 100 mA 160 mA ± 30 mA 30 mA ± 15 mA				
<b>3-6 cell</b>	Fast charge: Top-off charge: Trickle charge:	3.5 A ± 250 mA 480 mA ± 100 mA 150 mA ± 50 mA	3.0 A ± 250 mA 390 mA ± 80 mA 100 mA ± 50 mA	4.5 A ± 350 mA 630 mA ± 100 mA 150 mA ± 50 mA	2.5 A ± 250 mA 390 mA ± 80 mA 100 mA ± 50 mA	
<b>4-8 cell</b>	Fast charge: Top-off charge: Trickle charge:	2.8 A ± 200 mA 400 mA ± 80 mA 150 mA ± 50 mA	2.2 A ± 150 mA 310 mA ± 80 mA 100 mA ± 50 mA	4.0 A ± 300 mA 560 mA ± 100 mA 130 mA ± 50 mA	2.2 A ± 150 mA 310 mA ± 80 mA 100 mA ± 50 mA	
<b>5-10 cell</b>	Fast charge: Top-off charge: Trickle charge:	0.8 A ± 100 mA 110 mA ± 30 mA 30 mA ± 15 mA	1.8 A ± 150 mA 270 mA ± 70 mA 100 mA ± 50 mA	3.5 A ± 300 mA 480 mA ± 70 mA 100 mA ± 50 mA	1.8 A ± 150 mA 270 mA ± 70 mA 100 mA ± 50 mA	
<b>6-12 cell</b>	Fast charge: Top-off charge: Trickle charge:	0.7 A ± 100 mA 100 mA ± 30 mA 30 mA ± 15 mA	1.5 A ± 100 mA 240 mA ± 60 mA 100 mA ± 50 mA	3.0 A ± 200 mA 420 mA ± 60 mA 100 mA ± 50 mA	1.5 A ± 100 mA 240 mA ± 60 mA 100 mA ± 50 mA	
<b>10-20 cell</b>	Fast charge: Top-off charge: Trickle charge:	0.4 A ± 50 mA 65 mA ± 20 mA 25 mA ± 10 mA	0.9 A ± 150 mA 130 mA ± 40 mA 50 mA ± 25 mA	1.8 A ± 150 mA 250 mA ± 50 mA 60 mA ± 30 mA	0.9 A ± 150 mA 130 mA ± 40 mA 50 mA ± 25 mA	
<b>12-25 cell</b>	Fast charge: Top-off charge: Trickle charge:					
<b>15-30 cell</b>	Fast charge: Top-off charge: Trickle charge:					
<b>40 cell</b>	Fast charge: Top-off charge: Trickle charge:					1.0 A ± 100 mA 150 mA ± 30 mA 60 mA ± 25 mA

\* For custom versions see marking on product.

The max. battery capacities given in the tables above are for guidance only.

For import to the U.S.A.: see the U.S. DOE Compliance Certification Database for maximum battery capacity allowed.

## Fast charge current/ Top-off current/ Trickle current, std models\*

	<b>3546</b>	<b>3743</b>
<b>2 cell</b>	Fast charge: Top-off charge: Trickle charge:	1,3 A ± 100 mA 160 mA ± 30 mA 30 mA ± 15 mA
<b>3-6 cell</b>	Fast charge: Top-off charge: Trickle charge:	1,3 A ± 100 mA 160 mA ± 30 mA 30 mA ± 15 mA
<b>4-8 cell</b>	Fast charge: Top-off charge: Trickle charge:	1,0 A ± 100 mA 130 mA ± 30 mA 30 mA ± 15 mA
<b>5-10 cell</b>	Fast charge: Top-off charge: Trickle charge:	0,8 A ± 100 mA 110 mA ± 30 mA 30 mA ± 15 mA
<b>6-12 cell</b>	Fast charge: Top-off charge: Trickle charge:	0,7 A ± 100 mA 100 mA ± 30 mA 30 mA ± 15 mA
<b>10-20 cell</b>	Fast charge: Top-off charge: Trickle charge:	0,4 A ± 50 mA 65 mA ± 20 mA 25 mA ± 10 mA

\* For custom versions see marking on product.

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