Extra Fast Chargers MGM compro AQC 3+ / AQC 3F

version 2.xx

These small and very powerful chargers are especially designed to fast and extra fast charge NiCd and NiMH batteries while being extremely gentle to the cells. Both types of chargers connect directly to lead 12V car battery or to adequate power supply. Before charging, number of cells (applies only to AQC 03) and kind of cells (NiCd/NiMH) must be set manually. Charge current is determined automatically, according to the cells´ characteristics. Three-color LED and acoustic signalization indicate the state of the charging process. ACQ 3 features voltage converter to achieve full current charging of 7-cell and 8-cell battery pack from car battery (even when the car battery is considerably exhausted).

These chargers are completely controlled by powerful processor. The high-tech algorithm of charging and evaluation enables the cells to be extra fast charged by currents ten times the amount (or even more) of the cell initial capacity without even becoming warm (NiMH cells become warmer due to their electro-chemical features which are quite different to those of NiCd). For achieving such high charging currents it is necessary to also monitor temperature of cells. Chargers constantly adapt the instantaneous charging current to the cells condition. Simultaneously, the voltage on the primary source (car battery or power supply) is monitored as well and if it drops under the given minimum value of 11V the charger refuses to continue to exhaust the accumulator and disconnects the batteries. Chargers do not feature discharging mode.

The whole charging process runs fully automatically after switching on and setting number and kind of cells. The end of charging process is indicated by optical as well as by acoustical means. Also error states (e.g. low voltage on the primary source, defective cell in the battery pack, incorrect number of cells, etc.) are indicated optically and acoustically.

The chargers are manufactured (except for coils and filtrating capacitors) using the technique of surface mounting which ensures their small size. The charger is exceptionally efficient thanks to its outstanding conception and the use of synchronous rectification. The benefits are its insignificantly low warming up and extreme security The assembly is embedded in a small plastic box. The ends of outlets to the supply accumulator 12V are furnished with standard alligator clips, the outlets to the charged accumulator lead to sockets Ø 4 mm.

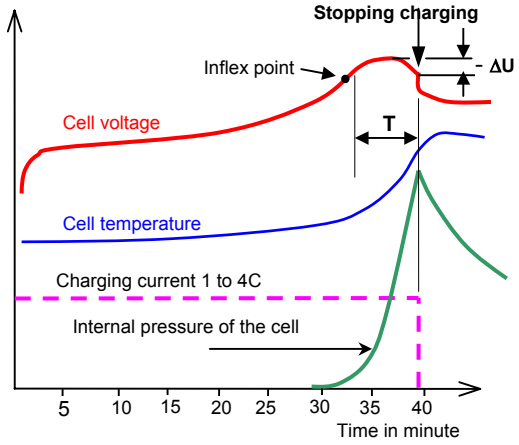
	AQC 3+	**AQC 3F**
primary feeding supply	lead (car) battery 12V/ 36 Ah min. power supply 13,8V/15 A (12 up to 15V)	lead (car) battery 12V/ 36 Ah min power supply 13,8V/15 A (12 up to 15V)
number of cells:	6 up to 8	6 up to 8
max. charge current:	5 A	**7,5 A**
battery type	NiCd/NiMH	NiCd/NiMH
capacity of cells	110 mAh up to 3000 mAh	150 mAh up to 3000 mAh
charge current setting	automatically, based on measurements of the battery	automatically, based on measurements of the battery
type and number of cells setting:	by toggle switch	by toggle switch
state of charging process :	indicated optically (3-color LED)+acoustically	indicated optically (3-color LED)+acoustically
error state indication:	indicated optically (3-color LED)+acoustically	indicated optically (3-color LED)+acoustically
dimensions:	90 × 65 × 40 mm	90 × 65 × 40 mm
weight incl. power cables	220g	240g
recommended use:	For charging R/C accumulators (not for accu with high inner resistance)	
AQC 3F:	**includes protective circuits for reversing polarity**	

The most widespread quick-charging method is probably the one using constant current for charging; and stopping the charging process at the point when drop in voltage occurs *(-ΔU, minus delta peak)*. This simple method is used by a whole range of professionally manufactured chargers. Wide range of specialized integrated circuits which make it relatively easy to build chargers (pulse or linear) based on this method, is available for both, professional and amateur constructions. The method can easily be carried out, and therefore is also cheap. However, it also has its weaker spots. The most significant weaknesses are overcharging and overheating the cells, together with rising the inner pressure in the cells. This often results in shortening the cells service life. Customary chargers also usually demand the user to set the charging current which is not optimal at all, because user cannot determine the charging current in any other way than, for example, according to the cells capacity, and not taking the different features of cells into consideration.

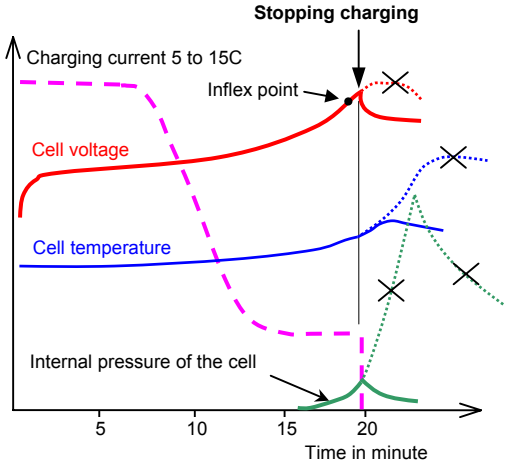
In the time between the inflex point is passed and until switching off at -ΔU (marked as “T” in the graph shown below) is reached, the accumulator does not receive any more charge (or if it does, only a very little charge). Most of the received energy is only converted to heat and the inner pressure rises as well. If a charger ends charging process using this method (-ΔU) and if it displays the amount of supplied charge in mAh (or in Ah) it is important to say that the data are a bit incorrect because they include energy which is uselessly transformed into heat and pressure at the stage mentioned above.

AQC (**A**dvanced **Q**uick **C**harging) **method of the MGM compro company is different**. At the beginning of the charging process, the charger tests the cells and according to their condition, type and quality, automatically sets the optimal initial charging current. The current is usually about 10C (but varies - for bad cells it may be only 5C, for excellent cells 15C), that means for good cells (e.g. 330 mAh) the initial charging current will be 3.3 A. Using large currents for charging has its significant advantages –on one hand it is shorter charging period and on the other the better ability of cells to supply loads with bigger currents. The cells condition and their temperature, is monitored throughout the whole charging process, as well as cells ability to receive charge is analyzed. Instantaneous charging current adjusts to this ability. The charging process is finished when the cells voltage reaches the inflex point (see graph). This results in not overcharging the cells, not overheating them and not rising inner pressure, which is a great advantage. Also the charging period is shortened, apart from shortening the period by using big charging currents, of time “T”.

For NiMH cells the similar applies, only the drop in voltage -ΔU is smaller or none so that the usual method of evaluation fails sometimes and therefore it is better to evaluate a zero voltage increase. However, The AQC method evaluates the end of charging in the area of inflex point reliably also for NiMH cells. The temperature of NiMH cells rises faster and more than that of NiCd cells and is higher for the whole charging period, concerning usual methods, and the AQC method as well.



Standard quick charging: constant current, + stopping charging on minus delta peak



AQC charging method of the MGM compro company, + stopping charging on the inflex point

The AQC chargers (Automatic quick charger) of course are based on the AQC charging method. When using this extremely quick charging method it is necessary to know the temperature of cells throughout the whole charging process and therefore are chargers equipped with temperature sensor. It is advised to connect the temperature sensor to the cells every time you charge them, because then you can even charge NiCd cells which are warmed up through operation, without cooling them before. (Generally, it is recommended to cool NiMH cells before charging). In an error case, charger will stop the charging process at the point when the cells temperature reaches above ca 45°C. This condition does not occur when using good cells. The charging period can be slightly shortened by cooling (using ventilator). Chargers work in pulse mode.

Instruction for use:

Make suitable counterpieces (adapters) between outlets from the charger and your accumulators. Use as short wires as possible, aprox 10cm. Wires should be very flexible. Their radius of wires used must be chosen accordingly to the current (the same as on your accu), Use only quality, golden plated connectors.

If in special cases you need to lower the charging current (for example: for charging a „9V" accu – usual instead of 9V battery), extend the wires leading to the charged accu or put a suitable resistor (in tens or hundreds of milliohms) in serial to the charged accu, so that the starting charging current would be according to your criteria and the possibilities of accu.

Use bus-bar ampermeter to measure charging current to the accu or measure the voltage drop on shunt of 1milliohm which would be placed in the circuit. Common ampermeters may due to their inner resistance significantly influenced the correct determination of charging current! Not each meter is suitable to measure pulse currents correctly and the measured value may therefore differ from the reality in tens of percents!!!!

Accumulators must be discharged to ca 0.8 V / cell (applies mainly to NiCd types, for NiMH there is no necessity to discharge) prior charging.

Accumulators plugs leading to the primary source should not be replaced by „cigarette lighter" connectors for cars – many of these connectors are not suitable for such big currents for longer periods which the charger is able to draw from the primary source.

NiMH accumulators get warmer during charging from their principal significantly more than NiCd. **It is recommended to cool accumulators, preferably NiMH, during charging process** (a small fan for 12V is more than enough). Please, take into consideration that in summer when the temperature is higher, even cold accus will get warmer just from the outside temperature, that is quite often from the temperature of 30°C and the difference to 45°C is not that big.

If you wish to use mains supply for feeding the charger, it is necessary that it is able to supply 15A in pulses without a significant drop in voltage or a switch off of the current fuse.

Charging:

1) check the main switch position, it has to be in the "**switched off**" position
2) connect the charger to the 12V primary source – **Be careful not to reverse poles !!!** *(except for types „F")*
   Connection to the primary source and readiness for use is signaled by green LED on the charger (short blinks repeated every 3 sec.)
3) connect the batteries you want to charge to the charger - **Be careful not to reverse poles !!!** *(except for types „F")*
4) fasten the thermal sensor to the batteries that will be charged
5) select the type of the batteries (NiMH/ NiCd) that are going to be charged using the toggle switch on the front panel of the charger
6) select the number of cells in the battery pack that are going to be charged using the toggle switch on the front panel of the charger
7) turn on the main switch on the front panel (to "START" position), charger will start automatic charging process
8) after the charging process is finished, turn off the main switch
9) If you do not wish to charge any more batteries, disconnect the charger from its primary source

Notice: The position of the toggle switches is evaluated immediately after the charger is switched on. Later manipulation (also not intended manipulation) with the switches has no impact on the setting. Therefore, if you switch on charger with incorrect setting, it is necessary to first turn it off, change the setting using the toggle switches and then turn the charger on again.

Notice: Immediately after main switch on, charger indicate position of the toggle switches:
NiCd – red LED **/ NiMH** – green LED
6 cells – 1 beep **/ 7 cells** – 2 beeps **/ 8 cells** – 3 beeps

Safety Notice:

- if the charger is connected to the primary source (power supply), the output conductors must not be shortcut **!!!**
- do not use for charging of different types of batteries and different number of cells than specified
- do not leave the charger unattended when charging
- do not cover the charger (especially its cooler on the back side) and the batteries while charging **!** do not expose to direct sunlight **!**
- do not connect more accu packs at a time
- each battery pack you charge must contain only the same types of cells
- do not charge damaged or fault cells or accu assembled of cells of different capacity, different types or different manufacturers **!**
- do not charge NiMH batteries when warm – let them cool down first
- always fasten (using elastic band,…) the thermal sensor to the batteries you will charge
- if the charger informs of any error states, please check the manual for errors and correct the error if possible

Notice and recommendations:

Please make sure the safety diode (in most transmitters) is not connected. If the diode is connected it is needed to shortcut it with coupler (if transmitter allows to do so), otherwise you should disconnect the batteries and charge them outside the transmitter.

New cells do not have full capacity. It is necessary to form them at first by charging – discharging cycle a few times. It is not incorrect if few first charging processes ends with error message. Discharge the batteries using real load with which you would like to use the batteries for (it is better to us larger load than smaller). Most of dischargers (expect for bulb ones) are not able to discharge by using high enough currents.

It is recommended to cool the accu while charging by small fan, preferably the NiMh cells. This will help to prevent possible overheating of cells and at the same time shorten the charging time.

Do not charge the batteries from lead (car) battery when the car motor is running – voltage peaks may damage the charger.

Charging times for selected batteries: (informational, aged from several cycles up to several years)

Battery	Type	charging time	Battery	Type	charging time AQC 3+ / 3F
SANYO N-110 AA	NiCd	13 min.	SANYO N-1700 SCR	NiCd	20 min.
SANYO N-270 AA	NiCd	15 min.	SANYO RC 2000	NiCd	23 / 15 min.
SANYO N-500 AR	NiCd	22 min.	SANYO RC 2400	NiCd	26 / 20 min.
SANYO N-600 AA	NiCd	23 min.	SANYO HR-AAAU 650	NiMH	44 min.
SANYO N-800 AR	NiCd	14 min.	SANYO 3000	NiMH	45 / 35 min.

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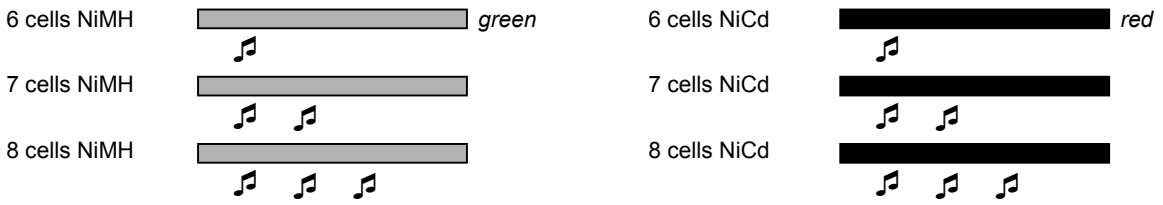
CHARGERS AQC 3+ / AQC 3F INDICATED STATUS

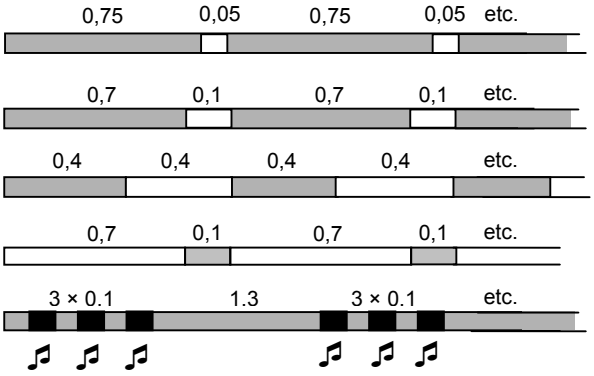
red yellow-orange green beep

OPERATING Statuses:

- confirmation of chosen number of cells and type of cells after switch on:

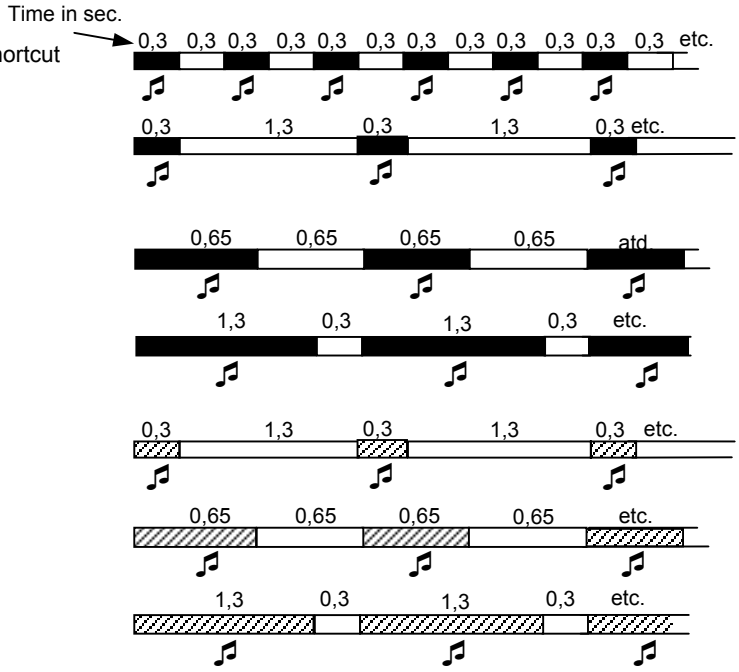


- Initial batteries testing and rise of current and charging with the max. current suitable for used batteries
- Charging with the max. current suitable for used batteries (limited by the max. current of the charger)
- Current lowering zone
- Final phase of charging
- Batteries are charged to 100% of their capacity, charging is stopped



ERROR Statuses:

- Defective thermal sensor, sensor is disconnected or shortcut
- Temperature of batteries exceeded the allowed boundary of ≈45°C
- Charge current out of allowed boundaries, capacity of batteries out of toleration, defective cell, shortcut or batteries not connected
- Defective cell, incorrect number of cells connected, batteries with very high capacity
- Defective cell, incorrect number of cells connected, or cell already charged connected
- Voltage on primary source is smaller than 11V
- Defective cell, incorrect number of cells connected, or cell already charged connected



WARNING:

Possibility of charger damage or destroy or accu charges and loss of warranty may happen while:

- connecting different type of cell than is specified in technical data
- reversing polarity of feeding accu or accu that is being charged (except for types „F“)
- feeding from different source than specified (e.g. from 12V car socket when motor running)
- connecting accu with more cells than specified
- charging Lithium cells with installed inner protections
- shortcut wires to the accu being charged
- shortcutting the wires of charger, taking the charged apart
- operating the charger in small sealed place or covering the charged while charging
- dropping into water or if water gets inside
- mechanical damage, damage caused by chemical substances

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