

# MGM Compro Chargers AQC 4 / AQC 4F version 2.0

These small efficient, comfortable chargers are intended for quick and extra quick charging of NiCd, NiMH and Li-Ion / Li-Pol cells. The required function, number and type of cells is easily set using keypad in clearly organized menu on display.

The charging current is automatically set according to the features of the accumulator that is being charged. However, you may limit the charging current by setting its maximal value (e.g. for charging cells in transmitter). For quick set-up you may use one of the 10 user-defined modes (memories). The end of the charging process and error messages (informing about error states – too low voltage of primary accu, poor cell in the charged accu pack, wrong number of cells, etc.) are indicated not only on display but by beeping as well.

These chargers are completely processor-controlled. Thanks to a very modern charging algorithm and evaluation of charging conditions the cells are very quickly charged by currents that reaches up to  $10 \times C$  (ten times the amount of nominal capacity) without warming up. Charging with the use of such heavy currents is also conditioned (except for the method) by measurement of the cell temperature. Chargers also monitor the condition of the primary accumulator and once its voltage drops under the stated minimum, the chargers stop further exhaustion of the accumulator. Chargers do not have a built-in discharger. The whole charging process is fully automatic and after switch on, there is no need of other service.

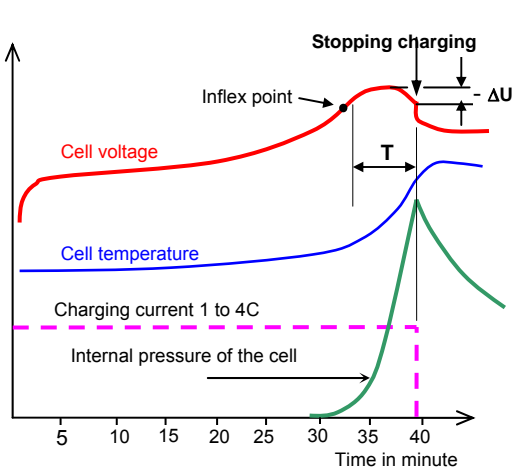
The chargers are manufactured (except for coils and filtrating capacitors) using the technique of surface mounting which ensures their small size. The assembly is embedded in a small plastic box. The ends of outlets to the supply accumulator 12V are furnished with standard alligator clips, the outlets to the charged accumulator lead to sockets  $\varnothing 4$  mm.

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 ( $-\Delta U$ , 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.

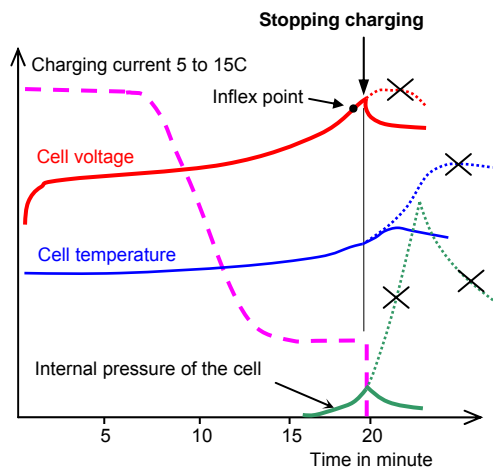
In the time between the inflex point is passed and until switching off at  $-\Delta U$  (marked as "T" in the graph shown below) is reached, the accumulator does not receive any more charge (or if it does, only a very little charge). Most of the received energy is only converted to heat and the inner pressure rises as well. If a charger ends charging process using this method ( $-\Delta U$ ) 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 (Advanced Quick Charging) 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  $-\Delta U$  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.

## Technical parameters of AQC 4 / 4F:

Primary power supply:	lead (car) accumulator 12V / 35 Ah min, proper mains adapter 12 up to 13,8V / 15 A	
Type of charged cells:	NiCd / NiMH / Li-Ion / Li-Pol	
Number of charging cells:	<b>NiCd / NiMH:</b> 1 to 10	<b>Li-Ion / Li-Pol:</b> 1 to 3
Nominal capacity of charging cells:	<b>AQC 4:</b> 110 mAh to 3 Ah	<b>AQC 4F:</b> 150 mAh to 3 Ah
Max. charging current:	<b>AQC 4:</b> 5 A	<b>AQC 4F:</b> 7,5A
Adjust of charging current:	fully automatic based on measurements of accu (it is possible to limit the charging current)	
Charging termination:	automatic / manually at any time	
Displayed data:	charging current / supplied charge / voltage of the charging accumulators / cell's temperature / operating and error messages	
Setting parameters:	keypad + display	
User settings memory:	10x	
Dimensions:	90 × 65 × 40 mm	
Weight:	240 g	
Temperature of the environment:	0 to 40°C	
Recommended use:	For charging R/C accumulators (not for accu with high inner resistance). <b>(Not suitable for accu with installed protections, for example some types of Li-Ion, Li-Pol !!!)</b> includes protective circuits for reversing polarity	
<b>AQC 4F:</b>		

## How to begin:

Charger is switched on by connecting the accu clips to the 12V lead (car) accumulator of the minimal capacity of 35 Ah or a proper mains adapter (stabilized dc power supply 12 up to 13,8V / 15A). „AQC 4“ or „AQC4F“ sign is lit on depending on type you purchased. Now, the charger is ready for setting the basic parameters of cells you wish to charge. After the end of charging process always disconnect the charger from the primary supply.

For connecting the accu, make a wire of suitable radius in length of 10 up to 15 cm **with quality banana plug** (recommended are golden-plated G4) on one end and a counter piece of the connector you are using on your accumulators on their end. It is necessary to use only quality connectors! Low-quality connectors considerably rise the possibility of model crash. **Recommended type of connectors: golden plated G2 / G3,5 Schulze / G4 / MP JET 1,8 / MP JET 2,5 / MP JET 3,5.**

## Parameters setting and operation

To roll in the main menu use the „F“ button (you will move only one direction) or in submenu by using „+“ and „-“ buttons in both directions. Use the „ENTER“ button to choose, confirm or save. Hitting button is acoustically signaled. The „START / STOP“ starts or ends the charging process, or puts you back into the main menu after the charging is finished.

## Memory selection – opening of the saved settings

Hit the „F“ button and sign „SET 0“ up to „SET 9“, is lit on depending on which memory was used last time. **To confirm this selection just press the „ENTER“.** If you wish to choose a different preset memory move up and down by using „+“ and „-“ buttons and confirm the requested memory by hitting „ENTER“. If you wish to change a parameter in the chosen memory you will reach the parameter by pressing „F“. The same applies, if you wish to only look at setting of any memory.

## Setting of parameters

If set parameters in none of the memories do not suit you it is possible to change parameters as follows: In any chosen memory („SET 0“ up to „SET 9“) pressing the „F“ button will get you to the parameter you wish to change. By pressing „+“ and „-“ change the parameter as you wish. Then hit „ENTER“ to save. Use „F“ to go to the next parameter. You may change the parameter by pressing „+“ and „-“ or go directly to the next parameter. When, by pressing „F“ you reach back to the memory selection (SET x), you may choose (by „+“ and „-“) in which memory you will save the new parameters. Save by hitting „ENTER“ (1). Now, you can charge – after the end of charging process are the parameters set by this procedure not available anymore – they were not saved into the permanent memory. This is great when for example all your memories are full and you do not wish to change them but you need to charge a cell pack with different parameters..

**(1) If you wish to save the set parameters into the chosen memory permanently** (that means until the next possible reprogramming) **press „ENTER“ and hold it until the beeper stops and „=“ is lit on** (for example SET\_6 → SET=6).

## Parameters that are set:

- type of cells: **NiCD – NiMH – 4,1V – 4,2V** (Li-Ion / Li-Pol)
- number of cells: **CL = 1** up to **10** for NiCd / NiMH, **1** up to **3** for Li-Ion / Li-Pol
- displayed data: **Curr ...** (current in A)  
**Ah .....** (supplied charged in Ah)  
**Uout ..** (the voltage of accu being charged in V)  
**°C .....** (temperature in °C)
- limiting the max charging current: **= 0.0 A** up to **=5.0 A**, resp. **=7.5 A**  
(depending on the type of charger, mostly is this value higher – up to 5,2 / 7,8 A)

**Limit the maximal charging current in necessary cases only !** For example for charging transmitter batteries directly in the charger, when there is a danger of damaging the thin wires in some transmitters by high currents. **If possible always leave the setting of optimal charging current on the charger, that means in parameter „limiting the max charging current“ use the maximal value (=5,0A or =7,5A) !** it is much better for the accu. (From value „0.0A“ to the max value you can easily get by pushing the „-“, once) If you decide to limit the maximal charging current do not set too low maximal current (regarding the capacity of charged accu), the charged may incorrectly evaluate the end of charging. If you extend wires to the charged accu the charging current will lower (this is unwanted !!!)

## Charging:

Connect the accu you wish to charge to the charger. Fasten the thermal sensor to the accu. After setting the suitable parameters (see instructions above) **you will get from choosing memory (SET x) to the automatic charging process by pressing „START / STOP“.** (It is not possible to get to the charging process from different menu than the memory selection.) The charger starts to display the chosen value after few seconds (current, charge, etc.) If you wish to display any other measure value press „F“. The name of value will be shortly displayed then the measured value will be visible.

If you need to stop the charging from any reason, press „START / STOP“. Use „F“ to display any of the measured values. Press „START / STOP“ again to get into the main menu (now, you lost the chance to display the values measured, e.g. the supplied charge).

The proper finish of charging process is signaled by the – **End** – sign on screen and by acoustic signal. It is possible to display the measured values by „F“ button. Press „START / STOP“ again to get into the menu. Where parameters are set.

If a situation that is evaluated as error situation by the charger occurs the charging process is stopped and sign „ERRxx“ is displayed. „xx“ stands for the number of error. (Use „F“ to display any of the measured values). The problems under the „xx“ are stated in this manual. Try to correct the error (if possible, e.g. incorrect number of cells) then by pressing „START / STOP“ get to the menu for parameter setting and from there standardly get back to charging. If the error signals failure of the charger, contact the service.

## 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
- regarding **Li-xxx batteries** always make sure with your supplier what the charging voltage is, (wether 4.1V or 4.2V) – **DO NOT INTERCHANGE ! – DO NOT REVERSE POLARITY !!!**
- **do not charge Li-xxx cells with installed protections - you may damage or destroy such cells !!!**
- 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 (except 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.

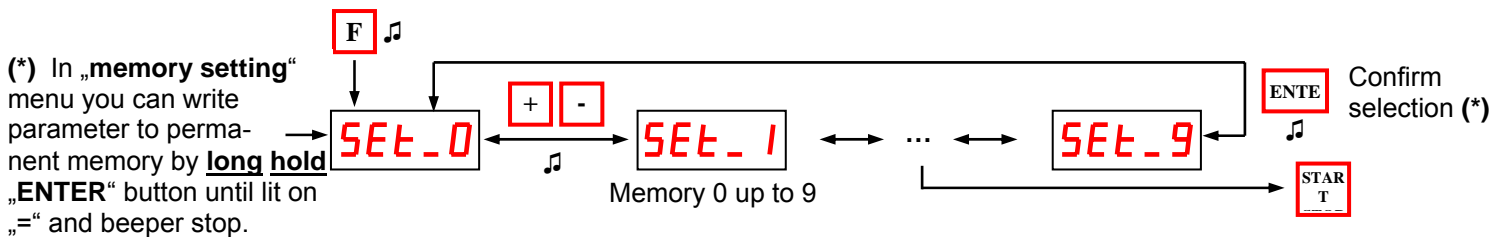
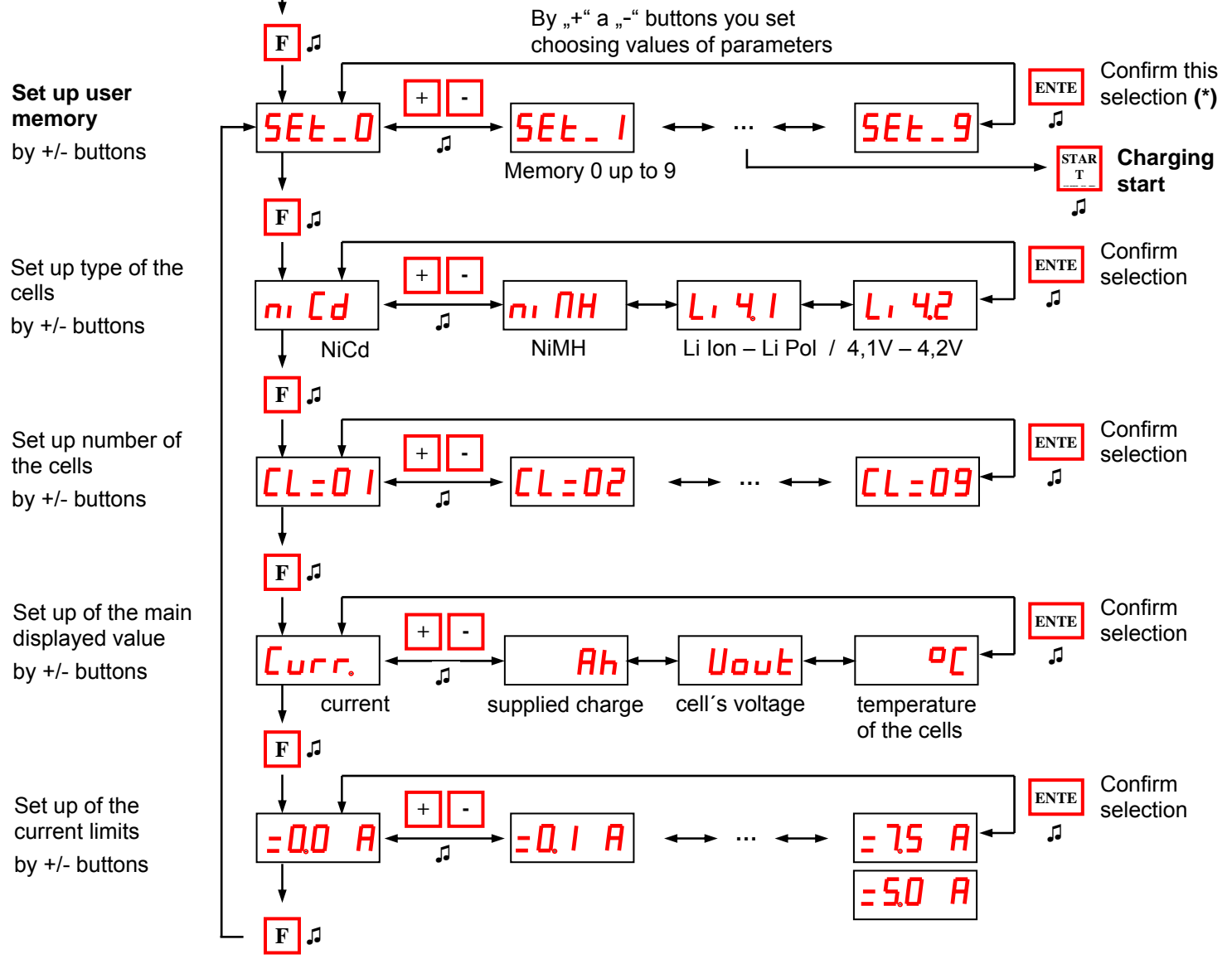
**Do not charge the batteries from lead (car) battery when the car motor is running – voltage peaks may damage the charger.**

## Setting of parameters menu

(Main menu / submenu)

Connecting to supply 12V:

**AQC4** or **AQC4F**

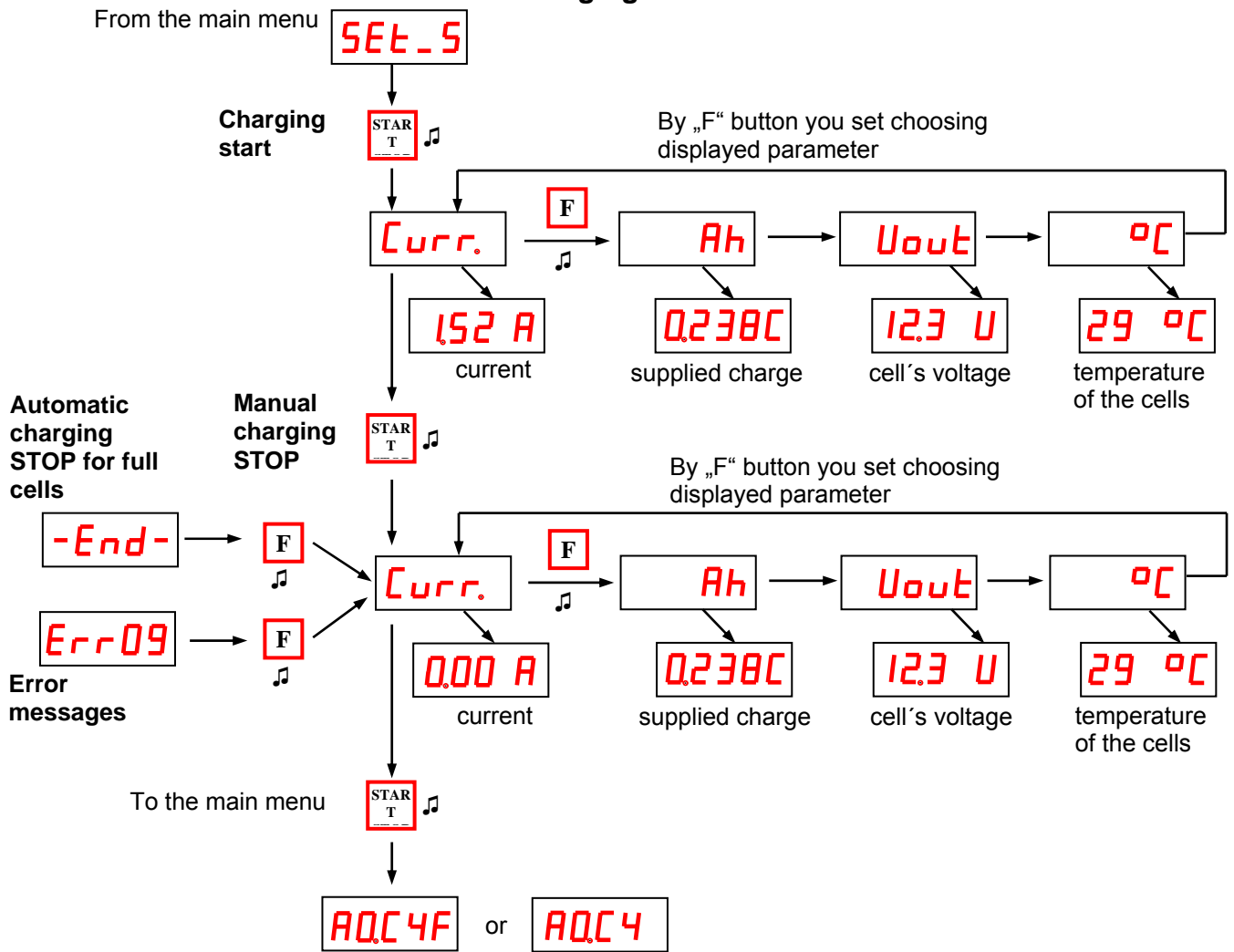


**From this submenu only** you can start charging by press „START“ button

**SEt\_5** Long push **ENTE** Permanent memory writing → **SEt=S**



## Charging menu



### Error messages:

ERR 01	too low voltage U2 on cells .....	incorrect number of cells or fault cells
ERR 02	voltage U2 outside the 0,5V up to 20V boundary .....	incorrect number of cells, not connected or disconnected cells
ERR 03	to high U2 voltage on cells .....	inner resistance of cells is too high, cells are charged or incorrect number of cells
ERR 04	too low voltage U2 on cells .....	incorrect number of cells or capacity of cells is too high
ERR 05	U1 < 11V .....	primary source is discharged
ERR 06	U2 voltage to big in the beginning of charging .....	incorrect number of cells or fault cells
ERR 07	capacity of cells is too high or fault cells	
ERR 08	too small current, not possible to increase .....	fault accu, not connected accu or fault lead-in wires
ERR 09	too high current, not possible to lower .....	fault accu, incorrect number of cells or shortcut
ERR 10	temperature of accu > 45°C .....	necessary to cool by fan or fault cells
ERR 11	temperature sensor tore, shortcut or damaged .....	contact service
ERR 12	U2 > than allowed, without current .....	fault or disconnected cells
ERR 13	current exceeded allowed boundary .....	fault accu, incorrect number of cells or shortcut
ERR 14	current failed to reach the needed value in time .....	cells eith too high inner resistance or fault cells
ERR 15	inner resistance of cells too low regarding wires .....	shorten wires, increase wire radius, fault connectors, too high capacity of cells
ERR 41	incorrect recording to do EEPROM .....	contact service

### WARNING:

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

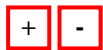
- connecting different type of cell than is specified in technical data
- reversing polarity of feeding accu or accu that is being charged (except for types „F“)
- feeding from different source than specified (e.g. from 12V car socket when motor running)
- connecting accu with more cells than specified
- 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

Approximate charging periods of chosen batteries, aged from several cycles up to several years:

Accumulator	Type	charging period
SANYO N-110 AA	NiCd	13 min.
SANYO N-270 AA	NiCd	15 min.
SANYO N-500 AR	NiCd	22 min.
SANYO N-600 AA	NiCd	23 min.
SANYO N-800 AR	NiCd	14 min.

Accumulator	Type	charging p. AQC 4 / 4F
SANYO N-1700 SCR	NiCd	20 min.
SANYO RC 2000	NiCd	23 / 15 min.
SANYO RC 2400	NiCd	26 / 20 min.
SANYO HR-AAAU 650	NiMH	44 min.
SANYO 3000	NiMH	45 / 35 min

#### Functions of the buttons:



Main menu: setup requested parameters. When you setup new values by this buttons, **YOU MUST** confirm it by short pressing of the button „ENTER“ !!!



Both menu: moving between parameters (one way).

Chosen memory „SET 0“ up to „SET 9“ **YOU MUST** confirm by short pressing of the button „ENTER“ !!!



You confirm chosen memory by short pressing this button (after pressing „F“ button).

You confirm new values by short pressing this button (after using buttons „+“ a „-“).

You store new values to chosen memory by long pressing this button, **ONLY** for set „SET 0“ up to „SET 9“ !!!



Main menu: (from „SET 0“ to „SET 9“ position **ONLY**) start automatic charging.

Charging menu: Stop charging immediately.

#### Default memory setup:

Set	Number of cells	Type of cells	Displayed parameter	Maximal (limit) current
Set_0	10	NiCd	Current	5,2 / 7,8 A
Set_1	1	NiCd	Current	5,2 / 7,8 A
Set_2	2	NiCd	Current	5,2 / 7,8 A
Set_3	3	NiCd	Current	5,2 / 7,8 A
Set_4	4	NiCd	Current	5,2 / 7,8 A
Set_5	5	NiCd	Current	5,2 / 7,8 A
Set_6	6	NiCd	Current	5,2 / 7,8 A
Set_7	7	NiCd	Current	5,2 / 7,8 A
Set_8	8	NiCd	Current	5,2 / 7,8 A
Set_9	9	NiCd	Current	5,2 / 7,8 A

#### Memory setup:

Set	Number of cells	Type of cells	Displayed parameter	Maximal (limit) current
Set_0				
Set_1				
Set_2				
Set_3				
Set_4				
Set_5				
Set_6				
Set_7				
Set_8				
Set_9				