AUTOMATIC CHARGER SHARK 10 V2.0

Dear Customer

Thank you for purchasing the improved version of the SHARK 10 charger. You can find a bunch of new features: backlit two line display with adjustable brightness, new safety functions - timer, max. capacity cut off, input low voltage cut off, temerature cut off and the temperature sensor port. In order to ensure you obtain the maximum from its operation, please read the following instructions carefully.

1. SPECIAL FEATURES

* Input voltage is 10~15V DC
* Capable of charging and discharging 1 - 14 NiCd or NiMH cells, 1 - 5 Lithium-Polymer cells, or 2 ~ 20V lead-acid batteries
* Adjustable charge current (0.1A - 5.0A)
* Adjustable discharge current (0.1A - 1.0A)
* "zero delta V " peak detection for NiCd and NiMH batteries
* "constant current / constant voltage" charge method for Lithium-Ion/Po batteries and Pb batteries.
* Compact & portable side
* Cycling(Charge to Discharge / Discharge to Charge)
* 2 -line, 16 character LCD can make the screen extremely clear and legible.
* Various warning messages for improper input voltage, wrong connections, unsuitable battery condition, reverse polarity on output
* Packaged in a rugged, extruded aluminium case

Specification

Input voltage	11.0-15.0V DC
Battery type & cells	1-14 Nickel-Cadmium cells
	1-14 Nickel-Metal Hydride cells
	1-5 Lithium-Polymer cells
	1 - 10 Lead-Acid cells (2V per cell)
Charge current	0.1A ~ 5A per 0.1 A step
Discharge current	0.1A ~ 1A per 0.1 A step
Charge termination	" zero delta V" peak detection for NiCd/NiMH
	" constant current / constant voltage " forLi-po and Pb
Cycling	Charge to Discharge / Discharge to Charge
Display type	2-line, 16 character LCD

2. SAFETY PRECAUTIONS

* Do NOT attempt to charge incompatible types of rechargeable batteries. This charger is designed to only charge and discharge nickel-cadmium, nickel-metal hydride, lithium-ion, and lithium-polymer batteries.
* Make sure to place the charger on a firm level surface for charging.
* Do not attempt to charge batteries at excessive fast charge currents.
* Do not use automotive type battery chargers to power the charger.
* Do not leave the charger unattended while charging.
  Disconnect the battery and remove input power from charger immediately if the charger becomes hot. Allow the charger or battery to cool down before reconnecting.
* Do not allow water, moisture or foreign objects into the charger.
* Do not place the battery or charger on or near a flammable object while in use. Keep away from carpets, cluttered workbenches, etc.
* Do not cover the air intake holes on the charger as this could cause the charger to overheat.
* Connect the input leads to a 12V power supply first, then connect the battery.
* Do not disassemble the charger.

3. PREPARING TO RUN

Input power

Connect the charger to the 12V DC power supply.

INPUT VOL ERR

Connect the charger's red alligator clip to the positive (+) terminal on the power source, and the black alligator clip to the negative (-) terminal. The charger will display "INPUT VOL ERR" error message if the input is below 10V, or above 15V. If this happens, please recheck the input power supply to make sure adequate power is present. Press „BATTERY TYPE/STOP" button to quit the alarm.

Output battery connections

REVERSE POLARITY

Two banana sockets are located on the right side of the charger. Connect the battery charge lead to these sockets with the positive (+) lead connected to the red socket and the negative (-) lead to the black socket. "REVERSE POLARITY" warning appears immediately after a battery is connected to the charger in reverse.
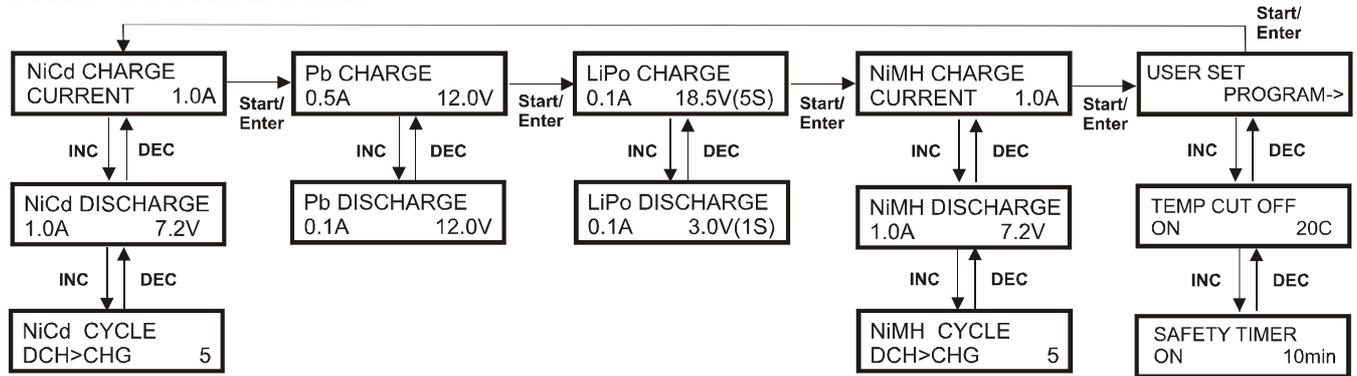
CONNECTION BREAK

"CONNECTION BREAK" error message will be displayed if trying to start charge without connecting a battery. "CONNECTION BREAK" error message will be displayed if a battery become disconnected from the charger while a function in progress. Press „BATTERY TYPE/STOP" button to quit the alarm.

4. OPERATION

RCM PELIKAN

When the charger is connected to the power supply, the charger will briefly show the initial screen „RCM PELIKAN" and then will show the battery mode that has been lastly used.

SHARK 10 PROGRAM FLOWCHART

Start/Enter

| NiCd CHARGE
CURRENT   1.0A | → Start/Enter → | Pb CHARGE
0.5A   12.0V | → Start/Enter → | LiPo CHARGE
0.1A   18.5V(5S) | → Start/Enter → | NiMH CHARGE
CURRENT   1.0A | → Start/Enter → | USER SET
              PROGRAM-> |

INC | DEC (all columns)

| NiCd DISCHARGE
1.0A   7.2V | | Pb DISCHARGE
0.1A   12.0V | | LiPo DISCHARGE
0.1A   3.0V(1S) | | NiMH DISCHARGE
1.0A   7.2V | | TEMP CUT OFF
ON   20C |

INC | DEC

| NiCd CYCLE
DCH>CHG   5 | | | | | | NiMH CYCLE
DCH>CHG   5 | | SAFETY TIMER
ON   10min |

INC | DEC

CAPACITY CUT OFF
ON   5000mAh

INC | DEC

KEY BEEP   ON
BUZZER   ON

INC | DEC

INPUT POWER LOW
CUT-OFF   10.0V

INC | DEC

BACK-LIGHT
                    100%

If the BATTERY TYPE/STOP button is briefly pressed, the present battery type (NiCd, NiMH, Lithium, or Pb) is blinking.
Every time the BATTERY TYPE/STOP button is pressed, the following modes are shown in order. NiCd→ NiMH→ Lipo→ Pb→User Set program→NiCd
If the START/ENTER button is briefly pressed, a parameter which can be adjusted, starts to blink, and if the START/ENTER button is pressed again, next parameter starts to blink.
Once the desired parameter field is activated (blinking) you can set the desired value by pressing the INC (Increase) or DEC (Decrease).
Once the START/ENTER button is pressed long, the charger starts to charge or discharge.

4.1 USER SET PROGRAMS

Temperature cut-off

Temp Cut Off
ON   20C

The Shark 10 V2.0 features the temperature sensor port allowing to measure the temperature of the battery pack being charged or discharged. The temperature sensor probe is supplied separately. The temperature cut-off program allows to monitor the temperature of the battery pack and you can set a temperature limit. Once the battery exceeds this limit, the charging or discharging proces is terminated. The adjustable values: Off, 20-80ºC. The function is applied both during charge and discharge process´. Sensible values: 35-50ºC. If the process has been terminated by the safety timer, the symbol of the battery type in the first line of the end of process display periodically changes to "TEMP".

Safety Timer

SAFETY TIMER
ON   10min

When you start a charge process, the internal safety timer automatically starts running at the same time. This can be programmed in order to prevent overcharge of the battery if it proves to be faulty, or if the regular termination circuit cannot detect the battery is being fully charged. The value for the safety timer should be generous enough to allow the full charge of your battery. In the case of fast charge at rates above 1C it should be by 10-15% longer than the theoretical time of charge; in the case of slower charge (under 1C rate) it should be by 20-30% more. The adjustable values: Off, 10-120 minutes. The function is applied both during charge and discharge process´. If the process has been terminated by the safety timer, the symbol of the battery type in the first line of the end of process display periodically changes to "TIME".

Capacity Cut Off

CAPACITY CUT OFF
ON   5000mAh

This menu sets the maximum charge (or dischage) capacity that will be supplied to the battery during charge. If the delta-peak is not detected for any reason this feature will automatically stop the process at the selected capacity value. The adjustable values: Off, 100-9900 mAh. The function is applied both during charge and discharge process´. If the process has been terminated by the capacity cut off, the symbol of the battery type in the first line of the end of process display periodically changes to "CAPA".

Accoustic Signals

KEY BEEP   ON
BUZZER   ON

Key Beep switches ON or switches OFF the accoustic signalisation of button being pressed down.
Buzzer switches ON or switches OFF the accoustic signalisation of the various states of the charger (end of charge etc.).

Minimal Input Voltage

INPUT POWER LOW
CUT-OFF   10.0V

This program monitors the input voltage. If the voltage drops below the value you set (range 10.0 to 11.0 V), the current process is terminated in order to prevent the deep discharge of the power supply lead-acid battery.

Display Brightness

BACK-LIGHT
                    100%

You can adjust the brightness of the LCD display in the range 1-100%.
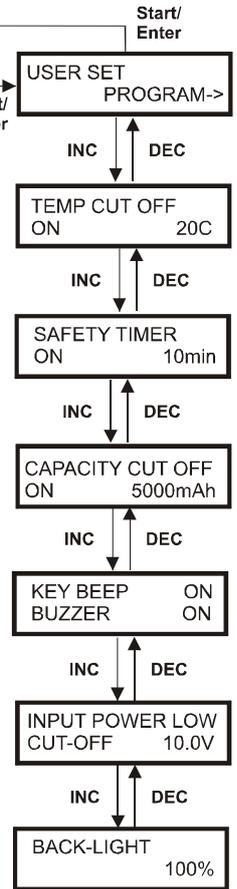
4.2 NiCd and NiMH PROGRAMS
The NiCd and NiMH battery charge/discharge programs are basically identical – the particular programs is of course being announced by the "NiCd" or "NiMH" symbol in the first line of the display. Also the factory pre-set delta peak sensitivity values (cannot be changed) are different in order to suit the particular battery type.

```
NiCd CHARGE
CURRENT    1.0A
```

Setting charge current
Adjust and find the desired charge current which ranges from 0.1A to 5.0A with INC & DEC buttons. Press the ENTER button to confirm setting.

```
NiCd DISCHARGE
1.0A        7.2V
```

Setting discharge current
Adjust and find the desired discharge current which ranges from 0.1A to 1A with INC & DEC buttons. Press the ENTER button to confirm setting. Now the end point voltage field is blinking. This is the voltage that the charger should stop discharging the battery.
Set the desired value (usually 0.8 – 1.0 V per cell). Press the ENTER button to confirm setting

```
NiCd  CYCLE
DCH>CHG        5
```

Setting cycle
This is to set cycling with two options: Charge to Discharge („CHG>DCH") and Discharge to Charge („DCH>CHG"). Set cycling with INC & DEC buttons, and press the ENTER button to confirm setting.

4.3 Li-poly MODE
This charger is capable of charging Lithium-polymer batteries up to 5 cells. This charger is using the "constant current / constant voltage" in order to fully charge Lithium-polymer batteries. Constant current is delivered during the fast charge. When the voltage of the Li-Poly battery is reached approx. 4.0V per cell, the charger starts to change its charge method from "constant current" to " constant voltage ". The " constant voltage " allows the battery to dictate how much current the charger should deliver for safe, full charges. When the current drops below approx. 0.1 A or 10% of the initial charge rate (whatever is bigger), the charger initiates the charging termination algorithm as the battery is fully charged.
The charging current is adjustable in 0.1 – 5A range; we strongly recommend you should never use more than 1C charge rate (it means e.g. 1.7 A for 1700 mAh battery) in the sake of long and safe life of your battery pack.

```
LiPo CHARGE
0.1A      18.5V(5S)
```

Setting charging current
Adjust and set the desired battery charging current from 0.1 to 5.0 A (0.1 A per step) with INC & DEC buttons. Press the ENTER button to confirm setting. The nominal voltage field is now blinking. Be sure to set the correct nominal voltage (number of cells in series) with INC & DEC buttons. Press the START button again to confirm the nominal voltage.

```
LiPo DISCHARGE
0.1A       3.0V(1S)
```

Setting discharging current
Adjust and set the desired battery discharging current from 0.1 to 1.0 A (0.1 A per step) with INC & DEC buttons. Press the ENTER button to confirm setting. The end point voltage field is now blinking. Be sure to set the correct end point voltage (number of cells in series) with INC & DEC buttons. Press the START button again to confirm the value.

CAUTION!
Please be sure you are setting correct charge/discharge ratio and - even more important – the correct number of cells in series. Although Shark 10 features highly sophisticated safety circuitry that eliminates almost any risk associated with charging of Li-poly batteries your constant attention to correct operation and set up of the charger is essential.

4.4 Pb MODE

```
Pb CHARGE
0.5A        12.0V
```

Setting charging current
Adjust and set the desired battery charging current from 0.1 to 5.0 A (0.1 A per step) with INC & DEC buttons. Press the ENTER button to confirm setting. The nominal voltage field is now blinking. Be sure to set the correct value with INC & DEC buttons. Press the START button again to confirm the nominal voltage.

```
Pb DISCHARGE
0.1A        12.0V
```
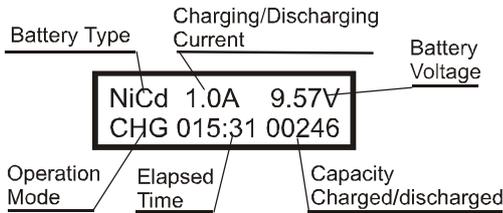
Setting discharging current
Adjust and set the desired battery discharging current from 0.1 to 1.0 A (0.1 A per step) with INC & DEC buttons. Press the ENTER button to confirm setting. The nominal voltage field is now blinking. Be sure to set the correct value with INC & DEC buttons. Press the START button again to confirm the nominal voltage.

4.5 CHARGE/DISCHARGE OPERATION DISPLAY

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

Once the desired charge/discharge parameters have been correctly set you can start the operation. The charging starts from the particular charge menu, discharging starts from the particular discharge menu and the cycle charge/discharge (NiCd and NiMH only) from the cycling menu. Long press (more than 3 sec) START/ENTER button. While the charger is performing the pre-run check of the battery pack the „BATTERY CHECK. WAIT..." message is being displayed. Once the charger control unit is „satisfied", the selected process begins.

The display switches to the operation mode: the first line displays the chosen type of batteries, charging or discharging current and the battery voltage. The second line: operation mode (charge, discharge, cycle), elapsed time and the charged or discharged capacity.

```
          Charging/Discharging
Battery Type  Current
                              Battery
                              Voltage
    NiCd  1.0A   9.57V
    CHG 015:31 00246

Operation   Elapsed      Capacity
Mode        Time         Charged/discharged
```

Battery Type	Operation Mode
NiCd: NiCd batteries	**CHG**: charging
NiMH: NiMH batteries	**DCH**: discharging
LixS: Li-poly batteries (x -number of cells in series)	**C>D**: charge/discharge cycle
Pb: lead-acid batteries	**D>C**: discharge/charge cycle

```
R: 3Ser      S: 3Ser
Confirm (ENTER)
```

There is one more safety querry when the Li-poly batteries are being charged. After the initial battery check period the charger asks to confirm the number of cells in series (in our example: "R: 3ser" - number of cell found by the charger, "S: 3ser" - number of cell set by the user). "Confirm (ENTER)/Cancel(STOP)" blinks in the second line.

If the number of cells that has been set by the user and the number found by the charger is identical, press START/ENTER to launch the charging process. If not, press the BATT TYPE/STOP button to cancel the charge. After 3 minutes the charger checks once more if the battery voltage is corresponding to the number of cells that has been set by the user. If not, the charging process is being terminated imediately and "VOL SELECT ERR" warning is displayed.

```
DRY  1.0A  9.48V
C>D 020:42 00606
```

The corresponding letter in the operation mode display will blink to indicate the current phase of the cycle in the cycle mode (C – charging, D – discharging). During the cooling intermission (3 minutes) between the cycle phases „DRY" is blinking in the first line instead of the battery type.

- You can stop the operation of the charger by pressing the BATTERY TYPE/STOP button anytime.

4.6 THE END OF CHARGE/DISCHARGE PROGRAM

```
END  0.1A  9.48V
CHG 040:50 01725
```

The end of charge/discharge program is indicated by an acoustic signal and in the first line of display the word „END" flashes. The trickle charge current is being displayed instead of the charging/discharging current in the second line.

```
CHG       1650mAh
DCH        125mAh
```

If the cycle charge/discharge program was selected the display shows the charged capacity (CHG) in the first line and the discharged capacity in the second line (DCH) in miliamperhours (mAh).
Press the BATTERY TYPE/STOP button to return to the program menu.

5. THE ERROR MESSAGES AND WARNINGS

The charger incorporates extensive protective and monitoring system programmed to verify function and to monitor the state of its electronics. In any case of occurring error, the screen displays a self explanatory error message and audible alarm sound is being generated.

```
REVERSE POLARITY
```

The battery pack has been connected with reversed polarity.

```
INPUT  VOL  ERR
```

The input voltage is lower than 10 V or higher than 15 V.

```
CONNECTION
BREAK
```

The charge/discharge program has been started but there is no battery connected to the output or the battery is faulty,
OR: the charging leads were disconnected during the operation of the charger,

```
SHORT ERR
```

There is a short connection of the output terminals (charge leads or battery are faulty).

```
IN VOLTAGE ERR
```

The input voltage is being lower than the value set in the USER SET Programs (refer to 4.1).

```
BREAK DOWN
```

The charger is out of order due to an internal failure.

```
BATTERY CHECK
LOW VOLTAGE
```

Li-poly and Pb charging: The nominal voltage of the Li-poly or Pb battery has been set higher than is corresponding to the actual number of cells in series – it protects from the dangerous overcharge.

```
BATERY CHECK
OVER VOLTAGE
```

Li-poly and Pb charging: The nominal voltage of the Li-poly or Pb battery has been set lower than is corresponding to the actual number of cells in series – the charger would not be able to 100% charge the pack,
OR: Li-poly and Pb discharging: The end point voltage of the Li-poly or Pb battery has been set lower than is corresponding to the actual number of cells in series – it protects from the dangerous deep discharge

```
VOL SELECT ERR
```

After 3 minutes after the charging proces had been started, the charger checks once more if the battery voltage is corresponding to the number of cells that has been set by the user. If not, the charging process is being terminated imediately and "VOL SELECT ERR" warning is displayed.

Please note: Li-poly and PB discharging: if you set higher end point voltage than is corresponding to the actual number of cells in series the charger will finish the operation after a couple of seconds (or it will discharge the pack to the value you have set). It is not a dangerous error.

Press the BATERY TYPE/STOP button to switch off the alarm sound. Before you try to restart the operation of your charger, find and solve the problem that caused the alarm first.

Charge/discharge rate limits
Since the amount of heat that a small pocket size charger is able to dissipate is limited by natural laws the charger automatically maintains the charge and/or discharge rate within the safe operation area. It means the more the charged and/or discharged pack contains cells the more will be the charge/discharge rate limited. Please refer to the table below for detailed info. Please note similar limits are applied to any charger of this size even if the particular manufacturer does not write it in his manual.

NiCd/NiMH Batteries			
Number of Cells	**Nominal Voltage (V)**	**Max. Charging Current (A)**	**Max. Discharging Current (A)**
1-4	1,2	5,0	1,00
6	7,2	5,0	0,69
7	8,4	4,9	0,60
8	9,6	4,3	0,52
10	12	3,6	0,42
12	14,4	3,2	0,35
14	16,8	2,6	0,30
Li-poly Batteries			
1	3,7	5,0	1,00
2	7,4	5,0	0,68
3	11,1	4,5	0,45
4	14,8	3,5	0,34
5	18,5	2,6	0,27