

## General Information PULSAR I V1.21



PULSAR is a rapid, microcontroller-based charger suitable for use with various types of batteries. Special design of hardware and software makes it possible to charge batteries with high currents without risk of damage and in some cases even improve their durability. During charging process all important parameters are displayed on LCD and transmitted via serial port (RS232) to a desktop computer. Additional software allows visualization of changes in voltage, current, voltage time derivative and temperature during whole charging process which allows user to determine precisely status of batteries and decide whether they need conditioning or not.

Technical specification	
Battery types supported	Ni-Cd, Ni-Mh, Pb-bat, Li-Ion/Pol (3,6V), Li-Taditan (3V)
Supply voltage	10 – 16V DC (car battery min 30Ah or power supply 14V/15A)
Low voltage alarm level (alarm)	min 10 – 12V adjustable in <i>Setup</i> max 16V
Charging voltage	0.5-30V; from 1 up to 16 Ni-Cd cells
Charging current	100mA – 8A (150W)
Discharging current	100mA – 8A (150W) with energy return 100mA – 8A (30W) with heat dissipation
Temperature measurement	0 - 99°C with 0.1°C accuracy
Voltage measurement	0,1 – 30V (averaging 16-bit processing)
Current measurement	0,1 – 10A (averaging 10-bit processing)
Time measurement	up to 14 hours
Max voltage on supply battery	<i>Reverse mode ON</i> – 15.1V

# Before You start

PULSAR charger is designed to work with car battery, but it is possible to use it with DC power supply with output voltage 12-14V and output current at least 5A (15-20A recommended).

Red cable +12V  
 Blue cable -12V, ground

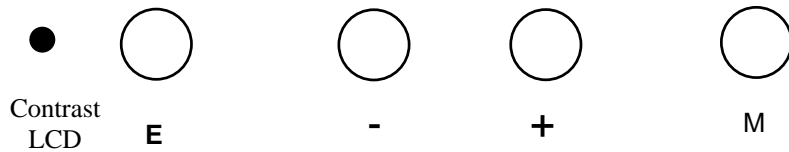
There are three connectors on the left side of the device:

- temperature sensor connector
- fan connector (max. 1.2A) – for cooling battery pack
- serial port connector (RS232 – DB9)

After turning the charger on you can enter *Setup* by pressing ‘M’ key and switch on/off sound signal and adjust minimum input voltage level, which protects supply battery from discharging - if supply voltage fall below desired level charger is stopped and alarm is on.

Pressing *Start* (‘E’ key) takes you to the main menu.

-	P	U	L	S	A	R	-			V	1	.	1	2	
S	t	a	r	t						S	e	t	u	p	



Mode	Keys	Action
Start	E	Main menu <i>Disch.; Simple; Reflex; PB-bat; Lith.; Format; Regen.</i>
Setup	M	Global parameters: 1. Bip <i>ON/OFF</i> – sound signal (+,-); E 2. Voff from 10V to 12V - min supply voltage (+,-); E

(+,-); E – choose a parameter with ‘+’ or ‘-’ keys and confirm that with ‘E’ key.

After connecting battery to the charger there is a 5-second connectivity test and after that appropriate action starts depending on a set mode. It is very important to take note of quality and reliability of all connections.

**Stop of the charging process should be done by pressing the E key for 1s and not by disconnecting the battery.**

**Info box** (battery disconnected)

T	c	=	2	3	,	7	°		1	,	9	7	5	A	h
V	b	=	1	2	,	5	V		2	,	1	3	1	A	h

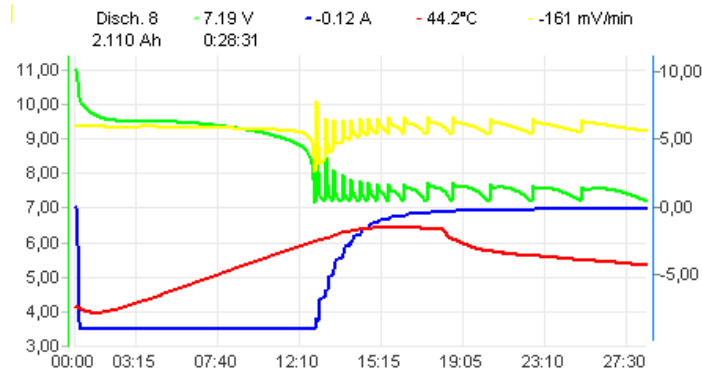
- Tc=23,7° - Battery pack temperature (--,- - sensor not connected)
- 1,975Ah - Energy in previous process
- 2,131Ah - Energy in last process
- Vb=12,5V - Supply voltage

# Discharging - Disch. (0,1 – 8A, Revers, Auto)

D	i	s	c	h	.			8	,	0	A			r	A
c	o	n	n	e	c	t		a	c	c	u				

r - Reverse function is on

A - Auto function is on



Discharging lasts until battery voltage reaches 0.9V per cell. In *Auto* mode current is decreased by ¼ each time the threshold voltage is reached. Discharging process ends when discharging current is less than 100mA. When *Reverse* mode is set energy from discharging battery is transferred back to the supply accumulator.

D	0	8	-	8	,	0	A			7	,	2	V	↓	E	
0	0	:	1	2	:	3	4			1	,	9	1	5	A	h

every 5 seconds – the other line

V	b	=	1	3	,	5	V			4	4	,	7	°	C
---	---	---	---	---	---	---	---	--	--	---	---	---	---	---	---

**Important notice**

A bold 'A' after a value of current indicates that charger has limited current due to maximum power.

- D 08 - discharging, 8 cells
- 8,0A - last measured current
- 7,2V - last measured voltage
- 00:12:34 - time elapsed
- 1,915Ah - energy returned
- E - current limit indicator

Disch.	Keys	Action
Battery Disconnected	+ lub -	Changing mode
	E	Setting value of current (+,-); E
	<b>E</b> (1 s)	Setting other parameters: 1. Reverse ON/OFF (+,-); E 2. Auto ON/OFF (+,-); E
	M	Info box
Battery Connected	+ lub -	Number of cells correction
	E	After discharging turn on charging: 1. Simple (S blinks alternatively with D) 2. Reflex (S blinks alternatively with D) 1. do not charge.
	<b>E</b> (1 s)	Stop discharging

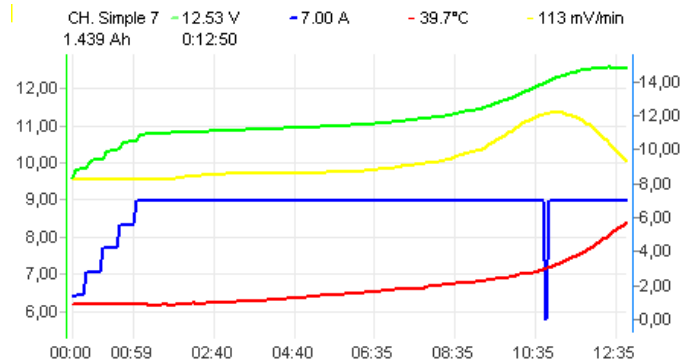
### Important Notices

- You must NOT use *Reverse* function if you are using external DC power supply unit.
- Maximal duration of this process – 5 hours.

# Charging Ni-Cd/Ni-Mh batteries *Simple* mode (0,1 – 8A, delta peak, inflex)

S	i	m	p	l	e			8	,	0	A				i	d
c	o	n	n	e	c	t		N	i	-	C	d				

- I - *Inflex* function is on
- d -  $\Delta$  low function is on
- D -  $\Delta$  high function is on



Charging ends when voltage drop ( $-\Delta v$ ) or inflexion point is detected. *Inflex* mode allows finishing charging process before unnecessary heating of charged battery starts (inflexion point marker – vertical line on the current graph).

S	0	8		8	,	0	A		1	2	,	9	V	↑	i
0	0	:	1	6	:	0	0		2	,	3	2	6	A	h
every 5 seconds – the other line															
V	b	=	1	2	,	1	V		4	0	,	0	°	C	

**Important notice**  
A bold 'A' after a value of current indicates that charger has limited current due to maximum power.

- S 08 - charging, 8 cells
- 8,0A - last measured current
- 12,9V - last measured voltage
- 00:16:00 - time elapsed
- 2,326Ah - energy consumed
- ↑ - increase of voltage
- i - inflexion point indicator
- S - slow start function indicator

Simple	Keys	Action
Battery Disconnected	'+' or '-'	Changing mode
	E	Setting value of current (+,-); E
	E (1 s)	Setting other parameters: 1. <i>Delta low/high</i> - $-\Delta v$ value (+,-); E 2. Accumulator type <i>NiCd/NiMh</i> (+,-); E 1. <i>Inflex ON/OFF</i> – charging ends when inflexion point is detected (+,-); E
	'+' and '-'	Forced start – battery voltage < 0.5V
	M	Info box
Battery Connected	'+' or '-'	Number of cells correction
	E	Slow start function OFF (S blinking)
	E (1 s)	Stop charging

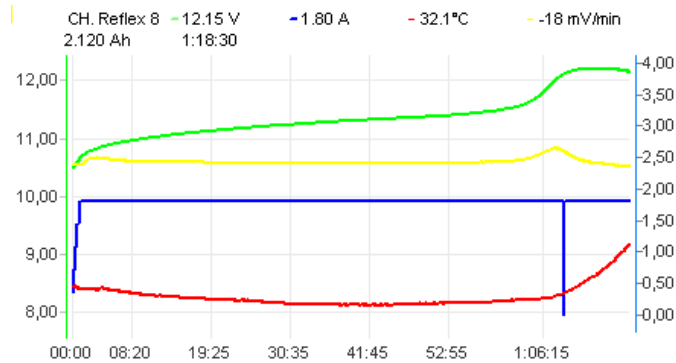
## Important Notices

- Maximal duration of this process – 5 hours.
- Charging current for Ni-Cd batteries – up to 4C; for Ni-Mh batteries – up to 2C.
- *Delta high* – for currents lower than 1C for Ni-Cd and 0.5C for Ni-Mh batteries.
- *Inflex* – turned on for currents over 1C and for more than 4 cells.
- Forced start – designed for batteries with diode protection (RC transmitter).

# Charging Ni-Cd/Ni-Mh batteries *Reflex mode* (0,1 – 8A, delta peak, inflex)

R	e	f	l	e	x			8	,	0	A			i	d
c	o	n	n	e	c	t		N	i	-	C	d			

- i - *Inflex* function is ON
- d - *Δ low* function is ON
- D - *Δ high* function is ON



*Reflex mode* makes it possible to recharge batteries and avoid *memory effect*. Charging ends when voltage drop ( $-\Delta v$ ) or inflexion point is detected. *Inflex* mode allows finishing charging process before unnecessary heating of charged battery starts (inflexion point marker – vertical line on the current graph).

R	0	8		1	,	8	A		1	2	,	2	V	↑	i
0	1	:	1	8	:	3	0		2	,	1	2	0	A	h

every 5 seconds – the other line

V	b	=	1	2	,	1	V		3	2	,	2	°	C
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**Important notice**  
A bold 'A' after a value of current indicates that charger has limited current due to maximum power.

- R 08 - charging, 8 cells
- 1,8A - last measured current
- 12,2V - last measured voltage
- 01:18:30 - time elapsed
- 1,120Ah - energy consumed
- ↑ - increase of voltage
- i - inflexion point indicator
- S - slow start function indicator

Reflex	Keys	Action
Battery Disconnected	'+' or '-'	Changing mode
	E	Setting value of current (+,-); E
	E (1 s)	Setting other parameters: 1. Delta <i>low/high</i> - $-\Delta v$ value (+,-); E 2. Accumulator type <i>NiCd/NiMh</i> (+,-); E 1. <i>Inflex ON/OFF</i> – charging ends when inflexion point is detected (+,-); E
	M	Info box
Battery Connected	'+' or '-'	Number of cells correction
	E	Slow start function OFF (S blinking)
	E (1 s)	Stop charging

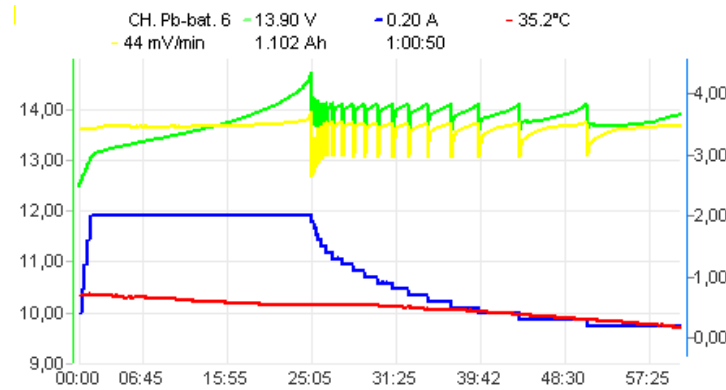
### Important Notices

- Maximal duration of this process – 5 hours.
- Charging current for Ni-Cd batteries – up to 4C; for Ni-Mh batteries – up to 2C.
- *Delta high* – for currents lower than 1C for Ni-Cd and 0.5C for Ni-Mh batteries.
- *Inflex* – turned on for currents over 1C and for more than 4 cells.

# Charging gel batteries - *PB-bat.* (0,1 – 3A, Lit-ion 3,6V, Lit-tad 3V, fast)

P	B	-	b	a	t				1	,	8	A				F
c	o	n	n	e	c	t			a	c	c	u				

F – Fast function is on



Charging ends when threshold voltage is detected and simultaneously charging current is decreased. When *Fast* function is on charging current is controlled with pulses, which makes it possible to reduce charging time more than two times.

P	0	6		2	,	0	A		1	3	,	3	V		E
0	0	:	0	7	:	3	4		0	,	2	2	7	A	h

every 5 seconds – the other line

V	b	=	1	2	,	5	V		2	3	,	7	°	C
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**Important notice**  
A bold 'A' after a value of current indicates that charger has limited current due to maximum power.

- P 06 - charging, 6 cells
- 2,0A - last measured current
- 13,3V - last measured voltage
- 00:07:34 - time elapsed
- 0,227Ah - energy consumed
- E - current limit indicator
- S - slow start function indicator

Pb - bat	Keys	Action
Battery Disconnected	'+' or '-'	Changing mode
	E	Setting value of current (+,-); E
	E (1 s)	Setting other parameters: 1. <i>Fast ON/OFF</i> – fast charging (+,-); E
	M	Info box
Battery Connected	'+' or '-'	Number of cells correction
	E	Slow start function OFF (S blinking)
	E (1 s)	Stop charging

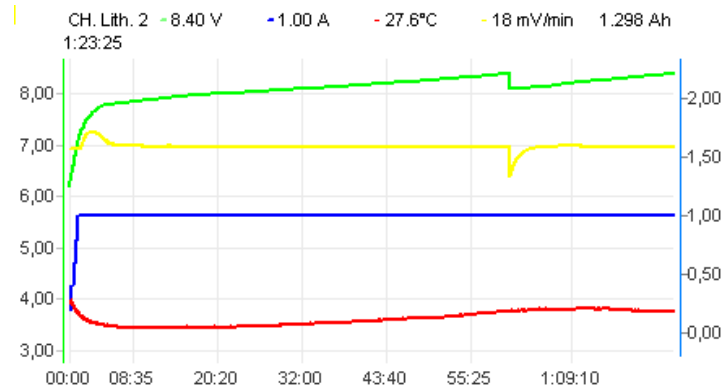
## Important Notices

- Maximal duration of this process – 14 hours.
- Charging current is C/10 (C/3 if battery's manufacturer allows such currents – see manufacturer's specification).

# Charging Lithium batteries - *Lith.* (0,1 – 3A, Lit-Ion/Pol 3,6V, Lit-Tad 3V, fast)

L	i	t	.			1	,	0	A			F	
c	o	n	n	e	c	t	L	i	-	l	i	o	n

F – *Fast* function is on



Charging ends when threshold voltage is detected and simultaneously charging current is decreased. When *Fast* function is on charging current is controlled with pulses, which makes it possible to reduce charging time more than two times.

L	0	2		1	,	0	A		8	,	4	V	E		
0	1	:	2	3	:	2	5		1	,	2	9	8	A	h

every 5 seconds – the other line

V	b	=	1	2	,	5	V		2	7	,	6	°	C
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**Important notice**  
A bold 'A' after a value of current indicates that charger has limited current due to maximum power.

- L 02 - charging, 2 cells
- 1,0A - last measured current
- 8,4V - last measured voltage
- 01:23:25 - time elapsed
- 1,298Ah - energy consumed
- E - current limit indicator
- S - slow start function indicator

Lith.	Keys	Action
Battery Disconnected	'+' or '-'	Changing mode
	E	Setting value of current (+,-); E
	<b>E</b> (1 s)	Setting other parameters: 1. Accumulator type <i>Li-Ion/Li-Ta</i> - (+,-); E 2. <i>Fast ON/OFF</i> – fast charging (+,-); E
	M	Info box
Battery Connected	'+' or '-'	Number of cells correction
	E	Slow start function OFF (S blinking)
	<b>E</b> (1 s)	Stop charging

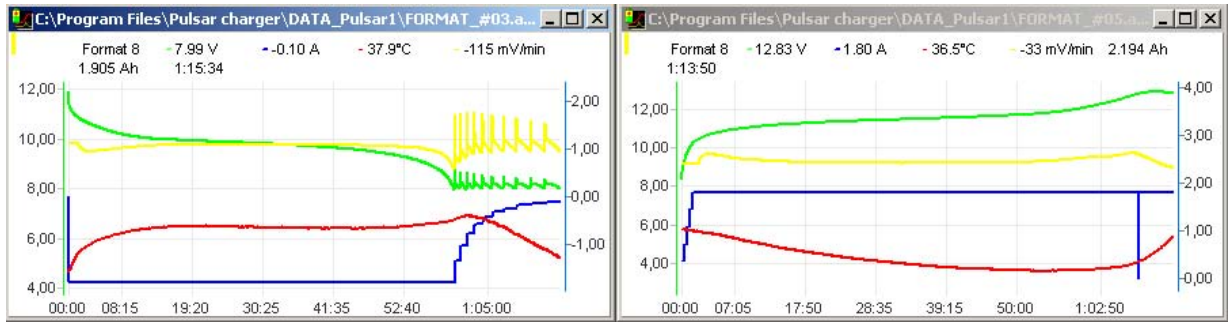
## Important Notices

- Maximal duration of this process – 14 hours.
- Charging current is 1C for Li-Ion and C/3 for Li-Ta batteries.

# Formatting Ni-Cd/Ni-Mh batteries - *Format* (0,1 – 3A, delta peak, cycle)

F	o	r	m	a	t			1	,	8	A			d
c	o	n	n	e	c	t		N	i	-	C	d	*	8

d –  $\Delta$  low function is on  
 D –  $\Delta$  high function is on  
 \*8 – number of cycles



To format a battery means to perform demanded number (1 to 8) of discharging-charging cycles. Discharging is performed in *Auto* mode until 0.9V per cell is reached. Charging is performed in *Simple* mode.

F	0	8		1	,	8	A		1	2	,	8	V	i	
0	1	:	1	0	:	0	4		2	,	0	8	2	A	h

every 5 seconds – the other line

V	b	=	1	2	,	5	V		3	6	,	6	°	C	4
---	---	---	---	---	---	---	---	--	---	---	---	---	---	---	---

**Important notice**

A bold 'A' after a value of current indicates that charger has limited current due to maximum power.

- F 08 - formatting, 8 cells
- 1,8A - last measured charging or discharging ('-') current
- 12,8V - last measured voltage
- 01:10:04 - time elapsed
- 2,082Ah - energy consumed or returned
- C4 - number of cycles until process is finished

Format	Keys	Action
Battery Disconnected	'+' or '-'	Changing mode
	E	Setting value of current (+,-); E
	E (1 s)	Setting other parameters: 1. <i>Delta low/high</i> - $\Delta v$ value (+,-); E 2. <i>Accumulator type NiCd/NiMh</i> (+,-); E 3. <i>Cycle 1-8</i> – number of cycles (+,-); E
	M	Info box
Battery Connected	'+' or '-'	Number of cells correction
	E	Slow start function OFF (S blinking)
	E (1 s)	Stop formatting

## Important Notices

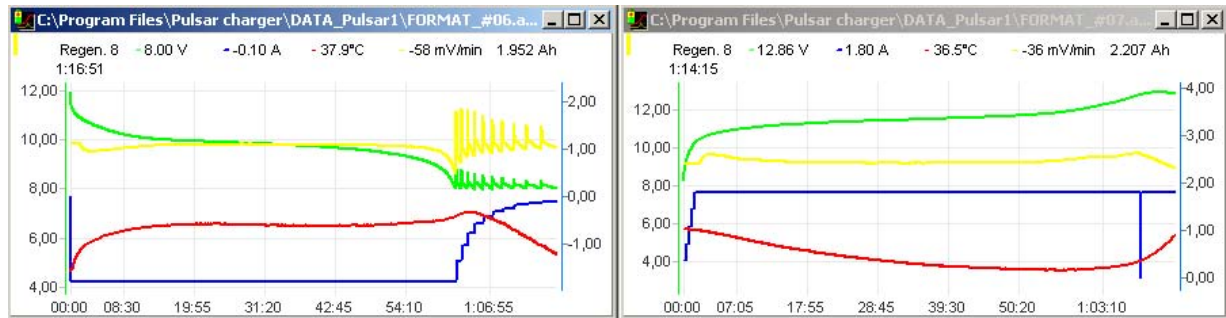
- Maximal duration of this process (one cycle) – 2\*14 hours.
- Charging current should not exceed 1C for Ni-Cd and C/2 for Ni-Mh batteries.
- *Delta high* – mostly for heavily worn out batteries



# Conditioning Ni-Cd/Ni-Mh batteries - *Regen* (0,1 – 3A, delta peak, cycle)

R	e	g	e	n	.			1	,	8	A			D
c	o	n	n	e	c	t		N	i	-	C	d	*	8

- d -  $\Delta$  low function is on
- D -  $\Delta$  high function is on
- \*8 - number of cycles



To recondition a battery means to perform demanded number (1 to 8) of discharging-charging cycles. Discharging is performed in two cycles: *Auto* mode until 0.9V per cell is reached and next one with constant current 100mA until 0.6V per cell is reached. Charging is performed in *Reflex* mode.

C	0	8		1	,	8	A	1	2	,	9	V	i	
0	1	:	1	4	:	1	5	2	,	2	0	7	A	h

every 5 seconds – the other line

V	b	=	1	2	,	5	V	3	6	,	5	°	C	4
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**Important notice**

A bold 'A' after a value of current indicates that charger has limited current due to maximum power.

- C 08 - conditioning, 8 cells
- 1,8A - last measured charging or discharging ('-') current
- 12,9V - last measured voltage
- 01:14:15 - time elapsed
- 2,207Ah - energy consumed or returned
- C4 - number of cycles until process is finished

Regen.	Keys	Action
Battery Disconnected	'+' or '-'	Changing mode
	E	Setting value of current (+,-); E
	<b>E</b> (1 s)	Setting other parameters: 4. <i>Delta low/high</i> - $-\Delta v$ value (+,-); E 5. Accumulator type <i>NiCd/NiMh</i> (+,-); E 6. <i>Cycle 1-8</i> – number of cycles (+,-); E
	M	Info box
Battery Connected	'+' or '-'	Number of cells correction
	E	Slow start function OFF (S blinking)
	<b>E</b> (1 s)	Stop conditioning

### Important Notices

- Maximal duration of this process (one cycle) – 2\*14 hours.
- Charging current should not exceed 1C for Ni-Cd and C/2 for Ni-Mh batteries.
- *Delta high* – mostly for heavily worn out batteries

## Graf PC software

PULSAR charger supports serial port (RS232), what enables you to transmit data. Graf PC is capable of drawing graphs of changes during charging or discharging process. Analysis of voltage, current, voltage time derivative ( $dV/dt$ ) and temperature curves makes it possible to determine precisely status of batteries and decide whether they need conditioning or not.

### Installation

GrafPC is a Windows application. When you start GrafPC for a first time, you will be asked to choose serial port which is used to connect Pulsar Charger (COM 1-4), and correction of folder name which GrafPC is installed (when software is not installed in default folder).

**Zooming and Moving the graph** – Press left mouse button and drag mouse to right-down direction. Rectangle will be drawn and view inside rectangle will be zoomed after the button is released. To move the graph move the mouse with Pressed right button in needed direction. Double clicking left mouse button will return to default view.

**Data Window** - Shows numerical data

After clicking **Data** button window with numerical data will appear (voltage, increase of voltage, current, temperature, time and capacity).

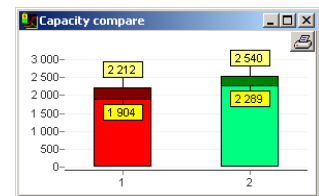
Pressing button with single cell icon, displays the voltage and the increase of voltage count for single cell.



**Capacity compare Window** – comparison of battery capacity from several processes. A column graph allows for quick data comparison, i.e. format or regeneration of packet

Red column shows discharging process (light red to the first change of voltage with *Auto* function)

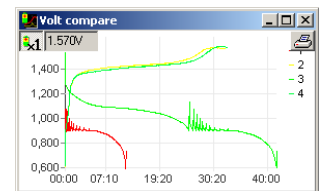
Green column shows charging process (light green to the inflexion point detection).



**Volt compare Window** - comparison of battery voltage from several processes.

When cursor is placed on the voltage line (cursor – cross) and we click left mouse button a value of voltage will be shown in the *Voltage* window.

Pressing button with single cell icon, displays the voltage count for single cell.



**The T i dV Buttons** - turn on/off drawing the temperature and increase of voltage curves

**Rec Button** – Start/Stop data recording

**Multisession recording** – automatic recording of all data i.e. from the format process.

*Save All* (Filename format - *name#01.acp* – where #01 is a number of the next saved window)

**Opening multisession files** – automatic opening all data i.e., from the format process.

Opening file saved as *name#01.acp* causes opening all files which the same name with numbers after '#' sign.

## Additional Information

- **Stop of the charging process should be done by pressing the E key for 1s and not by disconnecting the battery.**
- Disconnecting a battery pack during work should be as quick as possible. It is unacceptable to reconnect the battery pack without entering main menu of the charger.
- **Correction of cell quantity should be done always after start of charging process. It is important especially with Li-Ion, Li-Pol, Li-Ta and Pb-bat cells, when battery is not totally discharged. Overstate cell quantity will damage battery or even in some cases it could cause auto-ignition of the battery.**
- Analysis of Inflexion point and Delta peak starts after 2 minutes for Ni-Cd and 4 minutes for NiMh batteries. After that time automatic stop of charging could occur.
- PULSAR charger must be protected from water.  
You must not use PULSAR charger during rain – water can get inside and cause severe damage.
- PULSAR charger must be protected from dust.  
Built-in fan cools internal radiator and DC/DC converter's coil. Electronic parts can be damaged if there is too much dust in the charger. You must not use PULSAR charger laying directly on a sand, ground or grass.
- The openings in the case must never be covered or sealed.  
PULSAR charger works with heavy loads so it becomes heated - it is essential to provide proper ventilation.
- It is not allowed to change supply cables. They are designed to endure currents up to 20A.
- You must supply PULSAR directly from a car accumulator. It is not allowed to supply charger from car lighter socket – this can severely damage car wiring system.
- Make sure all cables connecting a battery pack are at least 2mm in diameter and are not longer than 20cm.

# Warranty

ELPROG guarantees this product against defective components and faulty workmanship for a period of 12 months. Any defect in materials or workmanship occurring within 12 months from the date of purchase subject to the following conditions will be rectified free of charge by ELPROG within 14 working days.

## Conditions

1. This guarantee must have been completed at time of purchase (this is your proof of the date of purchase).
2. The guarantee applies only to faults caused by defective components, or faulty workmanship on the part of the manufacturer.
3. The guarantee does not cover failures caused by accident, misuse, neglect, normal wear and tear, alternations and/or adjustment made to the charger.

Type Pulsar ver. 1.12

Date \_\_\_\_\_

Notes: