FLYABILITY

ELIOS

CHARGER
DISCHARGER

VERSION 1.1
26/11/2018

FLYABILITY SA
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EPFL INNOVATION PARK BLDG C | 1015 LAUSANNE | SWITZERLAND

FCC NOTICE

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:
(1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications or change to this equipment. Such modifications or change could void the user's authority to operate the equipment.
This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

To maintain compliance with FCC's RF exposure guidelines, this equipment should be installed and operated with a minimum distance of 20cm between the radiator and your body.

REGULATORY NOTICE

Elios Charger Discharger satisfy all relevant and mandatory CE directives and FCC Part 15 Subpart B: 2016. For CE directives:
The product has been tested to meet the following technical standards:

Test Standards	Title	Result
EN 55014-1:2006+ A1:2009+A2:2011	Electromagnetic Compatibility- Requirements for household appliances, electric tools and similar apparatus- Part 1: Emission	Conform
EN 55014-2:2015	Electromagnetic Compatibility- Requirements For Household Appliances, Electric Tools And Similar Apparatus- Part 2: Immunity Product Family Standard	Conform
EN 61000-3-2:2014	Electromagnetic Compatibility (EMC) Part 3-2: Limits for harmonic current emissions (Equipment input current up to and including 16A per phase)	Conform
EN 61000-3-3:2013	Electromagnetic Compatibility (EMC) Part 3-3: Limitation of voltage supply systems for equipment with rated current≤16A	Conform
EN 300 328 V2.1.1	Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques; Harmonized Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU	Conform
EN 301489-1 EN 301489-17	Electromagnetic compatibility and Radio spectrum Matters (ERM); Electro-Magnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements. Part 17: Specific conditions for Broadband Data Transmission Systems.	Conform
EN 62479	Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz - 300 GHz).	Conform
EN 60950-1	Information Technology Equipment-Safety- Part 1: General Requirements	Conform

This symbol means that you must dispose of electrical from the General household waste when it reaches the end of its useful life. Take your charger to your local waste collection point or recycling center. This applies to all countries of the European Union, and to other European countries with a separate waste collection system.

DISCLAIMER

Terms with initial capital letters shall have the following meanings:

"Agreement"	means the conditions of use of this Original Instructions and any other agreement between You and Flyability per which the Product has been delivered to You, including but not limited to Flyability's General Terms and Conditions.
"Flyability"	means Flyability SA, a company incorporated in the Canton of Vaud in Switzerland under federal number CH-550.1.156.670-6 (IDE CHE-348.376.646) having its registered offices at EPFL Innovation Park BLDG C, 1015 Lausanne, Switzerland
"Product"	means all goods and services described in this document.
"You"	means the person or legal entity to which the Product is delivered or who is operating the aircraft

By using the Products, software and systems of Flyability, You fully accept and consent, without reserve, Flyability's warranty and liability terms stated below and all other terms and conditions agreed between You and Flyability.

1. Product limited warranty

By using the Product, You hereby signify that you have read, fully understood and agreed this disclaimer and the original instructions, and You agree that the Product:

(i) May be unfitted to Your needs and purposes; and
(ii) Should not be used under influence of alcohol, drugs or any substances that may impair cognitive abilities; and
(iii) Is subject to local regulations that could prevent its use.

You shall pursue available remedies to You according to the Agreement. The warranty shall exclude defects due to misuse, non-observation of the User Manual, moisture or liquids, explosive gas, proximity or exposure to heat at temperatures exceeding the Operating temperature, excessive strain, abuse, neglect, misapplication, repairs or modifications made by anyone other than Flyability or certified by Flyability. There are no express or implied warranties, representations or conditions other than those stated in this limited warranty and the Agreement. The remedy set forth herein and in the Agreement shall be the sole, exclusive remedy with respect to the Product.

2. Product liability

IN NO EVENT OR UNDER ANY CIRCUMSTANCE, UNLESS EXPRESSLY STATED IN THE AGREEMENT, SHALL FLYABILITY SA, ITS DIRECTORS, OFFICERS OR EMPLOYEES BE LIABLE TO YOU OR TO ANY THIRD PERSON CLAIMING RIGHTS DERIVED FROM YOUR RIGHTS, IN CONTRACT, TORT OR OTHERWISE, FOR INDIRECT, SPECIAL, INCIDENTAL, EXEMPLARY, PUNITIVE OR CONSEQUENTIAL DAMAGES OF ANY KIND WHATSOEVER EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGES INCLUDING, BUT NOT LIMITED TO, ANY DAMAGES CAUSED BY YOU OR A THIRD PARTY WHILE OPERATING OR USING THE PRODUCT, ANY DAMAGES CAUSED BY FAILURE OF THE ELECTRONICS OR SOFTWARE, ANY LOSS OF REVENUE, LOSS OF PROFIT, OR LOSS OF DATA WHETHER BASED UPON ANY ALLEGED BREACH OF WARRANTY, REPRESENTATION OR CONDITION, CONTRACT, OR ANY OTHER CONDUCT INCLUDING NEGLIGENCE (INTENTIONAL OR OTHERWISE), GIVING RISE TO SUCH CLAIM. A Party who relies on a breach of the other Party's obligations under this Agreement,

shall take any and all reasonable measures in the circumstances to mitigate the consequences, including loss of profit, resulting from the breach. If it fails to take such measures, the Party in breach may claim a reduction in the damages in the amount by which the consequences should have been mitigated.

YOU SHALL NOT OPERATE THE PRODUCT IN AREAS OR UNDER CIRCUMSTANCES WHERE A FAILURE COULD CAUSE DAMAGES AND/OR HARM TO OBJECTS AND/OR PEOPLE. YOU SHOULD HAVE READ AND UNDERSTOOD THE USER MANUAL COMPLETELY BEFORE OPERATING THE PRODUCT. ANY DAMAGE AND/OR HARM ARISING FROM NOT ACCURATELY FOLLOWING THE PROCESSES AND GUIDANCE FROM THE ORIGINAL INSTRUCTIONS SHALL BE THE SOLE RESPONSIBILITY OF THE OPERATOR OF THE PRODUCT.

ALL USE OF THE PRODUCTS IS UNDER YOUR SOLE RESPONSIBILITY, INCLUDING BUT NOT LIMITED TO, THE COMPLIANCE WITH APPLICABLE LAW AND REGULATIONS OF THE COUNTRY IN WHICH THE PRODUCT IS OPERATED.

Authorizations and regulations
SOME COUNTRIES MAY HAVE LAWS THAT LIMIT OR PROHIBIT THE USE OF RADIO FREQUENCY EQUIPMENT. YOU ARE SOLE RESPONSIBLE FOR SECURING ALL AUTHORIZATIONS, CERTIFICATIONS AND LICENSES REQUIRED FOR THE USE OF THE PRODUCT. FLYABILITY SA DOES NOT PROVIDE ANY LEGAL ADVICE OR COUNSELING AND UNDER NO EVENT SHALL BE LIABLE FOR ANY INFRINGEMENT OF ANY APPLICABLE LAW BY YOU.

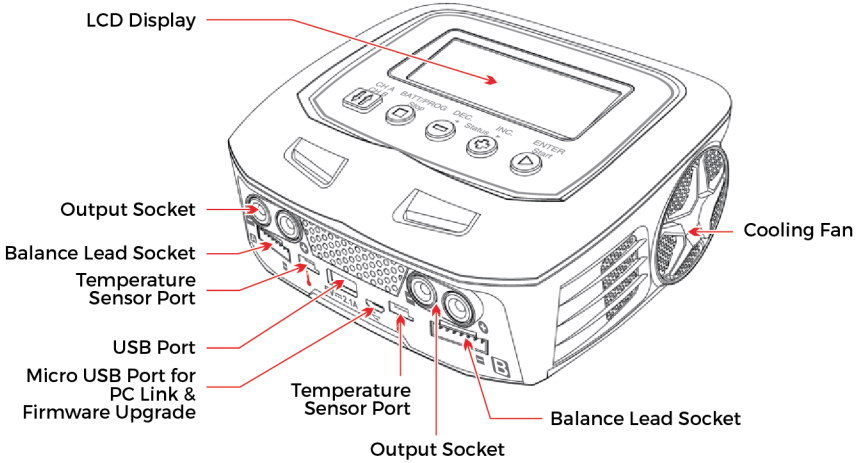
Contents

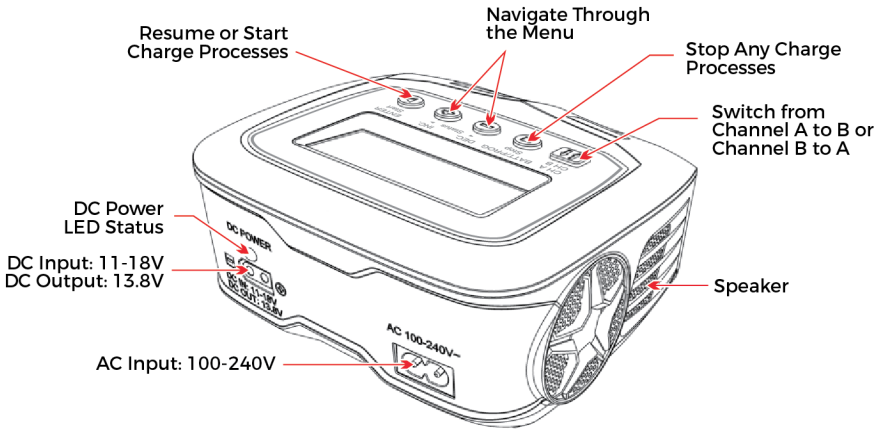
1 Introduction

Please BE SURE to read these INSTRUCTIONS, WARNING and SAFETY NOTES before you use the charger for the first time.

It can be dangerous to mishandle batteries and battery chargers, as there is always a risk of batteries catching fire and exploding.

> MISHANDLING BATTERIES AND BATTERY CHARGERS IS EXTREMELY DANGEROUS, WHICH MAY CAUSE FIRE AND EXPLOSION.





Dual Charger

ELIOS CHARGER DISCHARGER allows you to plug 2 batteries into one charger simultaneously, and it will intelligently charge 2 batteries at once to the desired capacity. On top of that, the batteries can undergo different program, for example one channel can charge a battery while discharge the other battery to storage mode.

AC and DC Power Input

The charger can be powered both by AC and DC current, the input voltages are 100-240VAC and 11-18VDC respectively. In DC mode the total output power is 200W, i.e. 100W per channel. In AC mode the total output power is 100W, distributed between the 2 channels and the DC Output. For example, if both A and B channels are set 40W, then the DC Output will be of 20W (40W + 40W + 20W = 100W).

Optimized Operating System

ELIOS CHARGER DISCHARGER has been specifically designed and optimized to charge Elios batteries safely by preventing misuse such as overcharging which may lead to an explosion. In case of malfunctions or other errors, the charger will automatically interrupt the running program and alarm the user. All the settings are pre-configured by Flyability to ensure maximum safety and ease of use.

DC Power Output

When operated in AC mode, The ELIOS CHARGER DISCHARGER can output 100W at 13.8V (10A maximum) for any additional accessories requiring external power supply such as battery warmer bags.

Cell Balancing

ELIOS CHARGER DISCHARGER will monitor and balance each cell of the battery individually. In case of abnormal cell voltages, the charger will stop the running program automatically and display an error message.

Default Programs

The charger comes with three default programs: “CHARGE”, “STORAGE”, “TRANSPORT”. The “CHARGE” program will charge the battery to 100% and is used when flying the drone. The “STORAGE” program will charge or discharge the battery to approx. 50% and is used to store the batteries for longer periods. This ensure the best compromise between long shelf-life and low battery degradation. The “TRANSPORT” program will charge or discharge the battery below 30% to ensure a safe transport in compliance with the IATA[1] regulations. Batteries in transport mode can be placed on a carry-on bag when flying on a plane.

Battery Status

The ELIOS CHARGER DISCHARGER can perform an automatic check on the batteries and indicate important parameters such as cell voltages, cell voltage imbalance, internal resistance, and internal resistance imbalance.

[1] International Air Transport Association – https://www.iata.org/

Capacity Limit

The charging capacity is calculated as the charging current multiplied by time. If the charging capacity exceeds the design capacity of the battery, it indicates a malfunction, therefore the process will be terminated automatically.

Temperature Threshold[2]

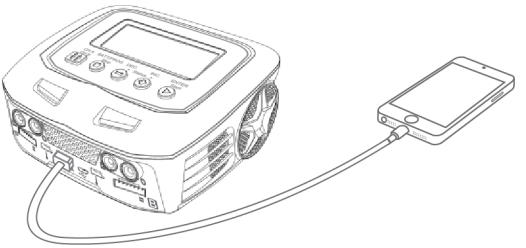
The internal resistance and the internal chemical reaction will cause the battery to heat up during use. An excessive overheating however indicates a malfunction, therefore when the threshold temperature is reached, the running program will be terminated automatically.

Time Limit

During normal operation, the programs will end after a predefined amount of time, exceeding this time limit indicates a malfunction, the running program will be terminated automatically.

USB Power 5V/2.1A

Phone, tablets and other USB-powered devices can be charger using the built-in USB port.



[2] Only available by connecting optional temperature probe, which is not included in the package.

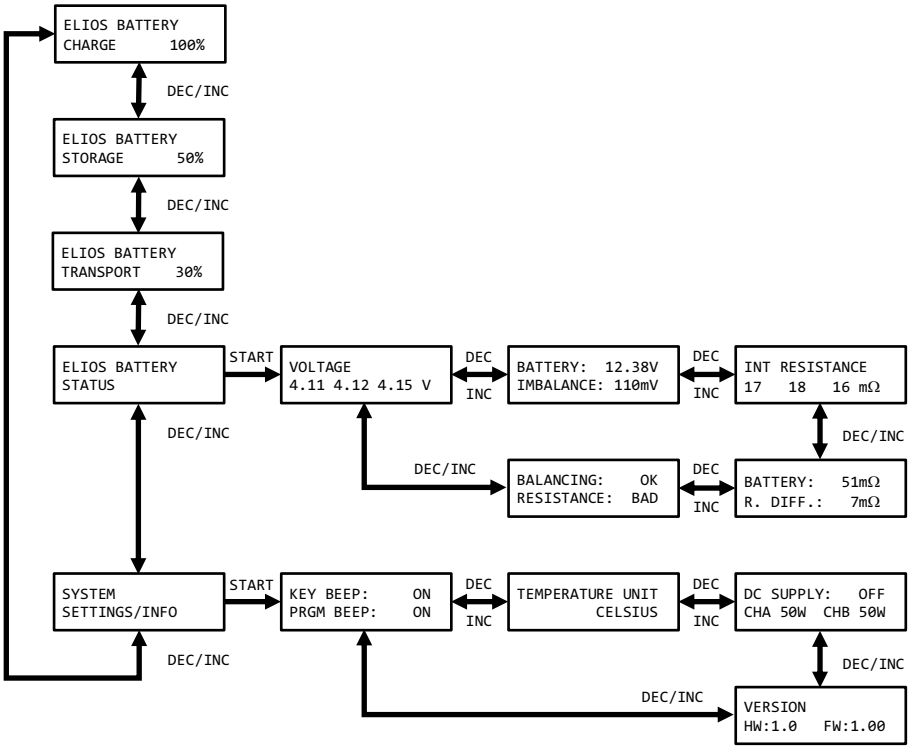
2 Warnings and Safety Notes

THESE WARNINGS AND SAFETY NOTES ARE PARTICULARLY IMPORTANT. PLEASE FOLLOW THE INSTRUCTIONS CAREFULLY FOR MAXIMUM SAFETY; MISHANDLING OF CHARGER AND/OR BATTERY CAN DAMAGE THE EQUIPMENT AND EVEN RESULT IN FIRE.

1. Never leave the charger unattended when connected to its power supply.
2. If any malfunction is detected, TERMINATE THE PROCESS AT IMMEDIATELY and refer to the operation manual.
3. Keep the charger well away from dust, damp, rain, heat, direct sunshine and vibration.
4. Never drop or crush the charger, do not try to disassemble it.
5. Never exceed the allowable voltages, 11~18 V in DC mode and 100~240V in AC mode respectively
6. This charger and the battery should be put on a heat-resistant, non-inflammable and non-conductive surface.
7. Keep all the inflammable volatile materials away from operating area. Never place them on a car seat, carpet or similar.
8. Only use this device with a genuine and certified Flyability Battery type Elios.
9. Only use the provided connector to connect the battery to the charger and ensure correct polarity: red is positive and black is negative.
10. Never attempt to disassemble the battery pack
11. Never attempt to charge or discharge the following types of batteries.
    - 11.1. A battery that is already fully charged or just slightly discharged.
    - 11.2. Non-rechargeable batteries (Explosion hasard).
    - 11.3. A faulty or damaged battery.
    - 11.4. Batteries installed in a device or which are electrically linked to other components.
12. Before starting a program, make sure that all the wires are correctly and securely connected.

3 Program Flowchart

Note: The flow chart refers to one channel, as the two channels (Channel A and Channel B) are identical.



To stop a program or go back to previous step/screen, press the STOP button once.

CH A/CH B:
Switch from Channel A to B or vice versa.

STOP Button:
Stop the progress or go back to previous step/screen

DEC Button:
Navigate through menus and parameter values

INC Button:
Navigate through menus and parameter values

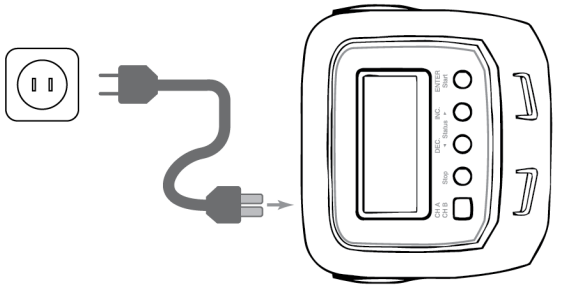
ENTER / START Button:
Start a program, go to the next level of a menu and store a parameter

4 Power and Battery Connection

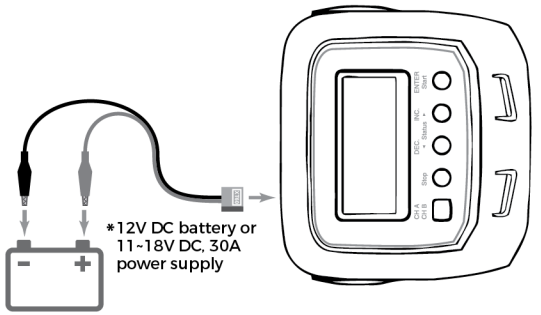
4.1 Connecting to Power Source

There are two kinds of inputs for ELIOS CHARGER DISCHARGER, DC 11-18V and AC 100-240V.

AC 100-240V power source connection.



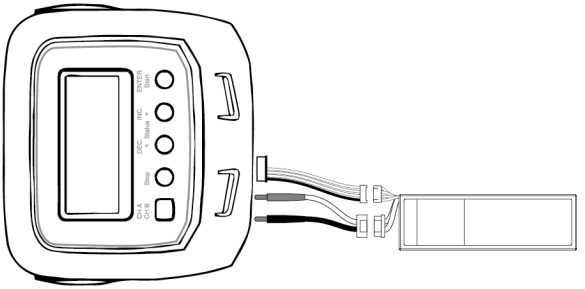
12V DC Battery / DC power supply connection.



4.2 Connecting the Battery

Note: The operating procedure of one channel will be explained, the procedures for channel A and B is identical.

> TO AVOID SHORT CIRCUITS, ALWAYS CONNECT THE CHARGE LEADS TO THE CHARGER FIRST, AND THEN TO THE BATTERY. REVERSE THE SEQUENCE WHEN DISCONNECTING THE PACK.



For safety reasons, the charger can only be used with the balance cables connected. The balance wire must be connected to the charger with the black wire aligned with the negative marking

5 Operating Program

The detailed procedures used to operate the charger will be explained in the following section. The "CHARGE" program will be taken as an example, the programs STORAGE, and TRANSPORT works in the same fashion.

Note: The operating procedure of one channel will be explained, the procedures for channel A and B is identical.

5.1 Connecting to Power Source

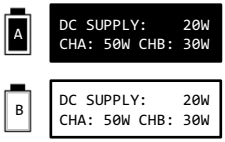
There are two kinds of inputs for ELIOS CHARGER DISCHARGER, DC 11-18V and AC 100-240V.

5.1.1 Operating in AC Mode

ELIOS CHARGER DISCHARGER comes with built-in AC/DC converter and can therefore be connected directly the main AC socket. (100-240V AC) using the provided power cord.

Note: The total output power in AC mode is 100W for Channel A, Channel B and DC Output

In AC mode, the charger supports Power Distribution, i.e. the power can be shared between Channel A, Channel B and DC Output. The max power of a channel can be changed as follows (Channel A take as example):



Channel B and DC Output will share the remaining power automatically. For example, if DC Output power is set as 20W and Channel A as 50W, the Channel B will use the remaining power of 30W.

NOTE 1:
The max power of a channel cannot be change while the channel is being used.

NOTE 2:
If DC Output is working, the max power of Channel A and Channel B can be changed.

5.1.2 Operating in DC Mode

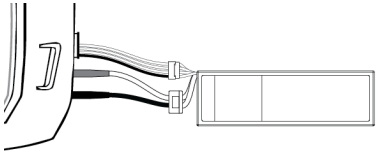
Connect ELIOS CHARGER DISCHARGER to an AC/DC power supply with supplied DC power cord or use the DC connectors with terminal clips to attach directly to 12V car batteries. It is paramount that you use either a fully charged 13.8V car battery or a high-quality AC/DC power supply in the range of 11-18V DC output with a minimum power of 300W or higher to insure reliable operation.

5.2 Connecting the Battery

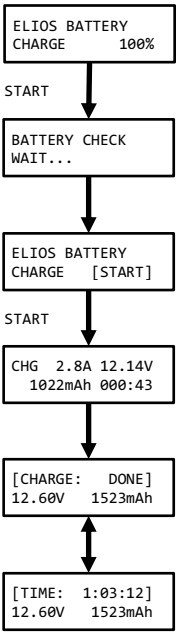
> TO AVOID SHORT CIRCUITS BETWEEN THE BANANA PLUGS, ALWAYS CONNECT THE CHARGE LEADS TO THE CHARGER FIRST, AND ONLY THEN TO THE BATTERY. REVERSE THE SEQUENCE WHEN DISCONNECTING THE PACK.

The balance wire attached to the battery must be connected to the charger with the black wire aligned with the negative marking. Care must be taken to maintain correct polarity! (See the wiring diagram below.)

This diagram shows the correct way to connect your battery to the Elios Charger Discharger while charging.



5.3 Elios Battery Charge



The charger is checking the battery cell.

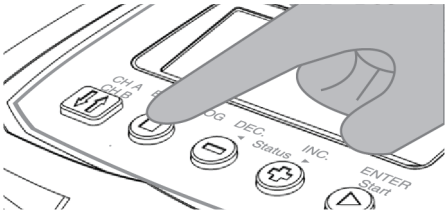
Press STOP to return to the previous screen. Press START to proceed.

Charging Status Monitor
During charge process, real-time status will be shown as seen on the left.

Program Complete
Once the battery is fully charged, the screen will read “DONE” and the charger will emit a sound. The charger also displays battery voltage, charged capacity and elapsed time.

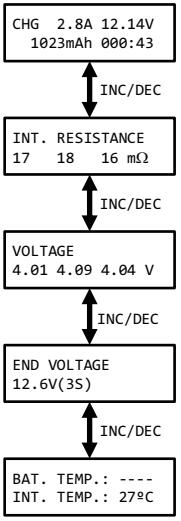
Program Stop

While running the program, press STOP to interrupt the charging process.



Additional Information

Press INC or DEC during the charging or discharging process to display additional information on the LCD screen.



Real-time status: selected program, charge current, battery voltage, charged capacity and elapsed time

Internal resistance of each cell in the battery pack.

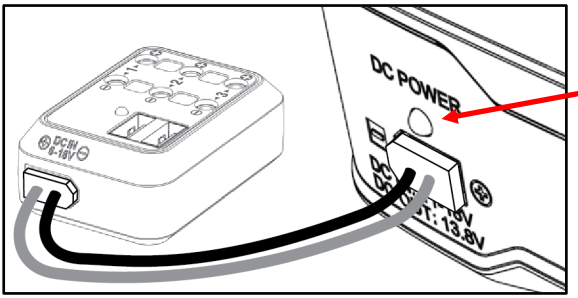
Voltage of each cell in the battery pack.

Target voltage of the program.

Battery and Internal Charger temperature. In order to show the battery temperature, the temperature probe must be connected.

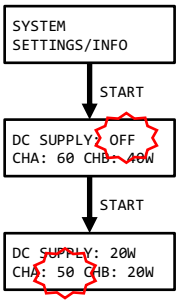
6 DC Output

The ELIOS CHARGER DISCHARGER is capable of supply DC power the DC Output, this function only works when the charger is working on AC mode, i.e. is powered via the AC power cord. The status LED turns green to indicate that the DC Output is ready to use. The output voltage is 13.8V and the output power adjustable from 10W to 100W. The total DC power output of the charge is 100W, shared between the two channels and the DC Output (Channel A + Channel B + DC Output = 100 Watts)



DC Power LED Status	
OFF	DC Power Off
Green	0-30% Load
Yellow	31-60% Load
Red	61-100% Load
Red blinking	Over Load

6.1 Operating Instruction



To enable the DC Output, go the system settings page

Turn on the DC Output and select the max output power. (please note the output voltage is 13.8V)

Changing the max power of Channel A or B, will automatically adjust the max power of the DC Output is the sum exceed 100W.

Caution: The maximum DC Output is 100 Watts. Please make sure that equipment will not exceed this limit before connecting it to the DC Output.

If the DC Output max power exceeded, the LED will flash red and the DC Output will stop working.

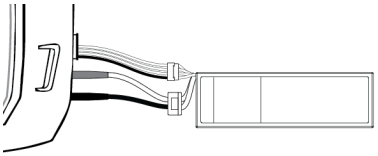
7 System Settings

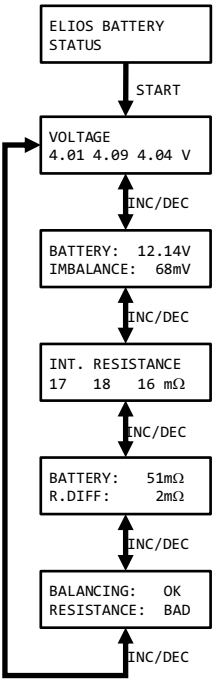
The default system settings can be changed in the "SYSTEM SETTINGS/INFO" page. Select the desired page by using the INC/DEC button, press "START" to make to select a parameter, which will start flashing indicating that it can be modified. Use the INC/DEC buttons to set the desired value and press "START" to store the parameter.

ITEM	SELECTION	DESCRIPTION
DC SUPPLY: OFF CH1: 50 CH2: 50W	OFF/ 10-100W	Turn on/off and select the max power of the DC Output. This function only works in AC mode, The max DC power for the whole charger is 100W.
TEMPERATURE UNIT CELSIUS	Celsius/Fahrenheit	Select the temperature display unit, either Celsius or Fahrenheit.
KEY BEEP: OFF PRGM BEEP: ON	OFF/ON	KEY BEEP: emit a sound when pressing a key PRGM BEEP: emit a sound when starting/stopping a program or when error occurs. Beeps settings are global variables, i.e. effects both channels regardless of what channel was selected when making the change
VERSION HW: 1.0 FW: 1.00		Hardware and firmware version.

8 Battery Status

Note: In order to check the battery status, both power and balance cables must be connected to the charger.





Press START to enter the ELIOS BATTERY STATUS program.

Voltage of each cell in the battery pack.

Total battery voltage and battery voltage imbalance
(voltage imbalance = max cell voltage – min cell voltage)

Internal resistance for each cell

Total battery internal resistance and battery resistance imbalance
(resistance imbalance = max cell resistance – min cell resistance)

Indicate whether voltage imbalance and internal resistance are within acceptable tolerances.
Caution: Low imbalance and internal resistance are indicators of an health battery, however capacity is not measured during this quick check, therefore no guarantee in the flight time can be given.

9 Warning and Error Message

9.1 Warning Message

Note: Each warning can be overridden by pressing the START once.

LOW CHARGER TEMP. 5ºC [START]	At startup, the charger detected a too low ambient temperature to ensure optimal charge performance for the battery.
HIGH CHARGER TEMP 45ºC [START]	At startup, the charger detected a too high ambient temperature to ensure optimal charge performance for the battery.
HIGH INT. RES. 135mΩ [START]	Before starting a CHARGE, STORAGE, TRANSPORT program, the charger detected that the internal resistance of the battery is abnormally high.
HIGH IMBALANCE 53mV. [START]	Before starting a CHARGE, STORAGE, TRANSPORT program, the charger detected that the battery imbalance is abnormally high.

9.2 Error Message

REVERSE POLARITY	Incorrect polarity connected
CONNECTION BREAK	The battery connection is interrupted.
BATTERY NOT DETECTED	The battery power connector is not connected to the charger or the battery connection is wrong.
NO POWER DISTRIBUTED	No power is allocated to the charger channel.
DC IN TOO LOW	Input voltage is less than 11V
DC IN TOO HIGH	Input voltage is higher than 18V
CELL ERROR LOW VOLTAGE	Voltage of one cell in the battery pack is too low.
CELL ERROR HIGH VOLTAGE	Voltage of one cell in the battery pack is too High.
CELL ERROR VOLTAGE – INVALID	Voltage of one cell in the battery pack is invalid.
INT. TEMP. TOO HI	The internal temperature of the unit goes too high.
EXT. TEMP. TOO HI	The external temperature of the battery goes too high
OVER CHARGE CAPACITY LIMIT	The battery capacity is more than the maximum capacity allowed.
OVER TIME LIMIT	The charging time is longer than the maximum charging time allowed
BATTERY IS FULL	The battery voltage is higher than the maximum voltage allowed in CHARGE mode.

10 Commonly Used Terms

Final charge voltage

The voltage at which the battery's charge limit (capacity limit) is reached. The charge process switches from a high current to a low maintenance rate (trickle charge) at this point. From this point on further high current charging would cause overheating and eventual terminal damage to the pack.

Final discharge voltage

The voltage at which the battery's discharge limit is reached. The chemical composition of the batteries determines the level of this voltage. Below this voltage the battery enters the deep discharge zone. Individual cells within the pack may become reverse polarized in this condition, and this can cause permanent damage.

A, mA

Unit of measurement relating to charge or discharge current. 1000 mA = 1 A (A=Ampere, mA=Milliampere)

Ah, mAh

Unit of measurement for the capacity of a battery (Amperes x time unit; h = hour). If a pack is charged for one hour at a current of 2 A, it has been fed 2 Ah of capacity. It receives the same quantity of charge (2 Ah) if it is charged for 4 hours at 0.5 A, or 15 minutes (=1/4 h) at 8 A.

Nominal voltage(V)

Multiply the total number of cells in the pack by 3.7. Elios battery is a 3-cell LiPo wired in series will have a nominal voltage of 11.1 volts (3x3.7).

11 Specification

DC INPUT VOLTAGE	11-18V
AC INPUT VOLTAGE	100-240V
DISPLAY TYPE	128x64 LCD
SIZE	153x140x67mm
WEIGHT	668g
DC POWER SUPPLY OUTPUT	13.8V / Max. 100W
EXTERNAL PORT	2-6S Balance Socket-XH Battery Socket AC Input DC input/output XT-60 USB Output 5V-2.1A Temperature Probe Socket Micro USB
CHARGE VOLTAGE	4.18-4.25V
BALANCE CURRENT	300mA/Cell
READING VOLTAGE RANGE	0.1-26.1V
CHARGE CURRENT	(0.1-10.0A) x 2
CHARGE POWER	100W in AC mode, 200W in DC mode
DISCHARGE CURRENT	(0.1-2.0A) x 2
STORAGE VOLTAGE	3.87V
TRANSPORT VOLTAGE	3.75V