eSMART K-ART

Location sound cart dual battery power distribution system with universal fuel gauge

Version 1.2 Updated 14/10/2019

The **AUDIOROOT eSMART K-ART** is a low footprint power distribution box with a total of **16 direct DC power outputs** and **4 x USB 5V ground isolated outputs**. The K-ART includes 10 led illuminated pushbutton power switches, a main pushbutton power switch and **2 battery fuel gauges**. Like it's little brother eSMART BG-DU the **K-ART** is fully compatible with **any type of battery** ranging from 9 to 18V. When used with our eSMART Li-xxWh or LiFe-xxxWh batteries the K-ART provides full battery informations without any calibration routine.

This product was designed for use on small to medium size **location sound carts**. The power distributor can be connected to 2 batteries at once. The 2 batteries will discharge simultaneously thru an integrated ideal diode. These batteries can be of any type of chemistry (SLA, NI-MH or LI-ION) and the 2 fuel gauges provide all the informations required to monitor the batteries state of charge (voltage, current, power, etc…).

The **eSMART K-ART** uses internal coulomb counters and a calibration routine to measure each battery's true capacity and display it's remaining capacity in real time. This power distributor is also fully compatible with our full line of smart batteries. When plugging an AUDIOROOT eSMART battery to the K-ART the user will have access to all the battery's information without the need to perform any type of calibration.

Key features :

- **10 switchable DC power paths** via led illuminated push button switches (on/off state of each switch is stored and recalled automatically on each power up)
- **1 main power** illuminated push button switch
- **12 x HRS 4** DC power outputs (2 on the front, 10 on the rear of the unit, all Hirose outputs are switched on and off by pairs)
- **4 x XLR 4** DC power outputs (1 on the front, 3 on the rear of the unit). Each XLR 4 output has it's own power switch
- **4 ground isolated USB ports** (allways on). 2 outputs are located on the front of the unit and 2 outputs are located on the rear of the unit. The K-ART can source up to a total of 3Amps on the 4 USB ports.
- **Real time SOC battery monitoring** : remaining capacity (%), run time estimation, battery voltage, power consumption, power and coulomb counter
- Polyswitch **2.5A** resetable fuses on each **output**
- Polyswitch **8.0A** resetable fuses on each **battery input**
- A **blinking LED** for each battery indicates when the battery capacity falls below **10 %**
- **Compatible with any battery ranging from 9 to 18V DC**
- Lightweight aluminum anodized enclosure
- Size : 228 x 120 x 44mm
- Weight : 700g

Warning

Do not try to repair this product or replace any of it's elements if this user manual does not give specific instructions on how to do so. This equipement was built with surface mount components and needs special tooling for repair. The removal of the electronic PCB needs special technical skills.

Warranty

The unit has a one year warranty from date of purchase. Only officially appointed dealers or Audioroot are allowed to warranty repair of Audioroot products. Any damage caused by tampering, misuse or dismantling of the instrument will not be covered by the warranty and could be considered a reason for rendering the warranty null and void. Return shipping fees are allways at the customer's charge.

UNPACKING AND INSPECTION

The K-ART power products are carefully checked for good condition before being shipped from the factory. Despite the protective carton and rugged design, shipping may damage the unit. Check for possible carton damage when unpacking the unit. Please save the carton for return shipment if required. AUDIOROOT does not warrant against damage caused by returning products in other cartons than the original ones or improperly packing the products. If shipping damage is evident, notify the transportation company immediately. Only the consignee can file a claim with the carrier for shipping damage. AUDIOROOT will fully co-operate in such an event. Be sure to save the carton for the shipper to inspect.

UNIT CONNECTIONS AND CONTROLS:

1. Main power pushbutton illuminated switch
   - A **short button press** will power up the K-ART by activating the power paths and fuel gauge OLEDs.
   - A **long button press (3 secs)** will shutdown the K-ART, all it's power paths and fuel gauge OLEDs.
   - A **750ms push-release** press will toggle the front LEDs dimming function. (this feature is only available on units shipped after February 1st 2014. Previous units cannot be modified to have this feature).
   - A integrated bright white LED indicates is the unit is ON or OFF .

2. OLED displays
   - The K-ART has 2 full color OLED displays (one for each battery input).
   - The displays show to the user all the needed information regarding the state of charge of the battery.
   - Each OLED display is powered on/off automaticaly when a battery is plugged in/out.

3. Low battery level led indicators
   - These LEDs start to blink when the corresponding battery's capacity falls under 10%.

4. Power paths pushbutton illuminated switches
   - The K-ART has 10 pushbutton illuminated switches that are used to control the operation of the 10 different power path outputs.
   - A **short button press** on a power path pushbutton will activate it's corresponding output(s).
   - A **long button press** on a power path pushbutton will shut off it's corresponding output(s).
   - The state of each power path is indicated by the integrated red LEDs.
   - The ON/OFF state of the 10 power paths is automatically saved and recalled on each power-up.

5. Power path #9 outputs (2 x HRS4) – 2.5A polyswitch fuse protected

6. 5V USB power ports (x2)
   - The K-ART's USB power ports are allways on. This allows the user to recharge USB peripherals even when the unit is turned OFF.

7. Power path #10 output (XLR4) – 4.0A polyswitch fuse protected

1. Power path #1 output (XLR4) – 4.0A polyswitch fuse protected
   - This power output can be fitted with a 12V/20W regulated and ground isolated DC/DC converter (ref: K-ART OPT 20W)

2. Power path #2 output (XLR4) – 4.0A polyswitch fuse protected
   - This power output can be fitted with a 12V/20W regulated and ground isolated DC/DC converter (ref: K-ART OPT 20W)

3. Power path #3 output (XLR4) – 4.0A polyswitch fuse protected

4. Power path #4 outputs (2 x HRS4) – 2.5A polyswitch fuse protected
   - This power output can be fitted with a 12V/12W regulated and ground isolated DC/DC converter (ref: K-ART OPT 12W)

5. Power path #5 outputs (2 x HRS4) – 2.5A polyswitch fuse protected
   - This power output can be fitted with a 12V/12W regulated and ground isolated DC/DC converter (ref: K-ART OPT 12W)

6. Power path #6 outputs (2 x HRS4) – 2.5A polyswitch fuse protected

7. Power path #7 outputs (2 x HRS4) – 2.5A polyswitch fuse protected

8. Power path #8 outputs (2 x HRS4) – 2.5A polyswitch fuse protected

9. 5V USB power ports (x2)
   - The K-ART's USB power ports are allways on. This allows the user to recharge USB peripherals even when the unit is turned OFF.

10. Battery power input #1 (XLR4M)

11. Battery power input #2 (XLR4M)

CONNECTORS WIRING:

- Hirose 4 pin power output connectors (power paths 4,5,6,7,8 and 9)
  - 1 : **DC -**
  - 2 : **Not connected**
  - 3 : **Not connected**
  - 4 : **DC +**

- XLR 4 pin power output connectors (power paths 1,2,3 and 10)
  - 1 : **DC -**
  - 2 : **Not connected**
  - 3 : **Not connected**
  - 4 : **DC +**

- FRONT USB power ports (500mA charging current)
  - 1 : **Vcc (5V)**
  - 2 : 2.0V (thru dividing resistors)
  - 3 : 2.0V (thru dividing resistors)
  - 4 : **GND**

- REAR USB power ports (1000mA charging current)
  - 1 : **Vcc (5V)**
  - 2 : 2.8V (thru dividing resistors)
  - 3 : 2.0V (thru dividing resistors)
  - **4 : GND**

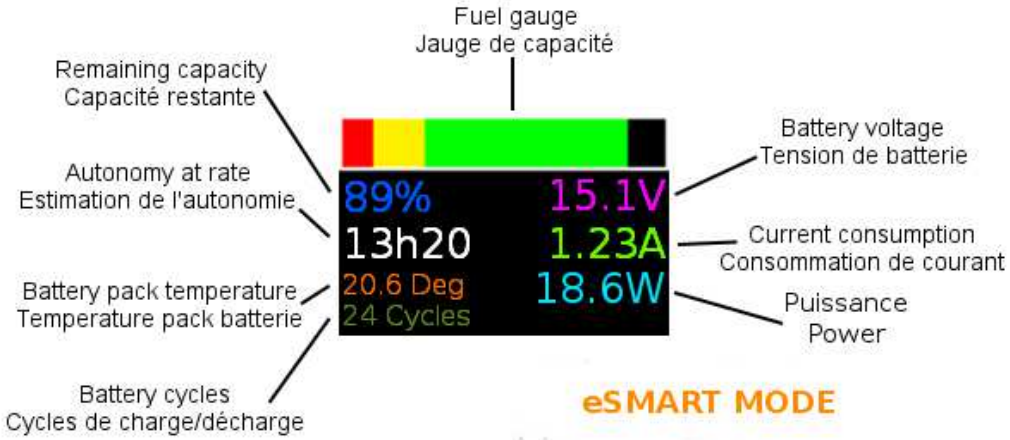
  PLEASE NOTE : The USB ports are configured to allow charging of Apple devices and most other smartphones. This feature is not available on early units shipped prior to september 2013. Please contact your dealer if you wish your unit to be updated with this feature.
  For units shipped after February 1st 2014 the 2 front USB ports can charge an iDevice or other smartphone with a current of up to 500mA. The rear USB ports of the K-ART charge an iDevice or other equipement with a current of up to 1000mA.

- XLR 4 pin battery input connectors (batt 1 and 2)
  - 1 : **DC -**
  - 2 : **eSMART DAT**
  - 3 : **eSMART CLK**
  - 4 : **DC +**

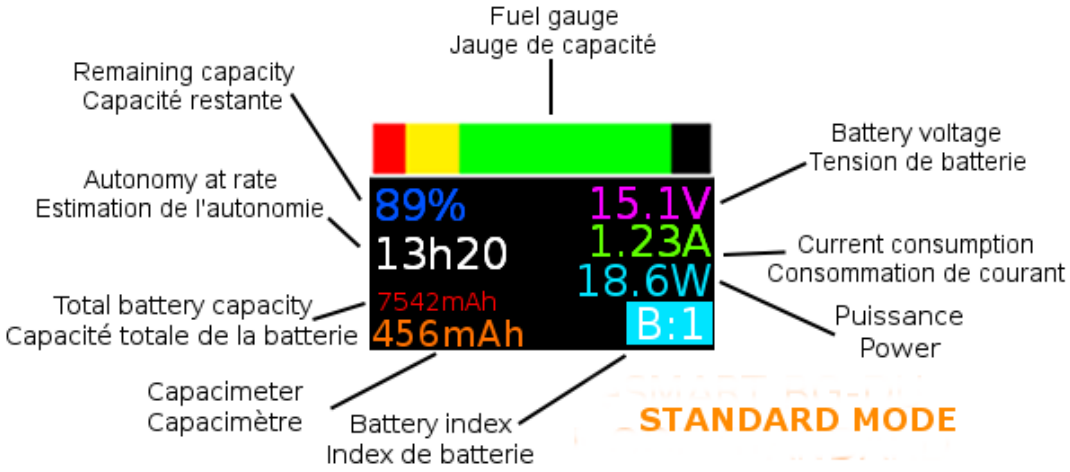
WARNING : Pins 2 and 3 of the XLR 4 battery input connectors should never be connected to pin 4 (DC+) or the internal fuel gauge could be destroyed. Please check wiring of your power cables prior to use with the eSMART K-ART.

FUNCTIONNAL MODES :

- **eSMART MODE (or AUTO MODE) –** This mode is automatically selected when an AUDIOROOT eSMART Li-xxWh or LiFe-xxxWh battery is connected to one of the K-ART's battery input. The K-ART's micro controller communicates with the battery and retrieves all informations regarding it's state of charge and displays them on the OLED like this :



- **Standard MODE** – This mode is selected by default when no eSMART Li-xxWh was detected on the input connector. In standard mode the fuel gauge uses it's own collected data (current, voltage, etc...) and the learned total battery capacity to display the battery's state of charge and to predict the autonomy of the system.The total battery capacity is measured by the fuel gauge when running the **calibration process**. This process must be runned by the user manually.The figure below illustrates the OLED screen display arrangement in standard mode.



Total battery capacity : This value indicates the total capacity of the battery that was measured during the calibrating process. This value is related to the battery index number. Up to 8 different capacity values can be saved and selected for use.

Capacimeter : The capacimeter shows in mAh the total current that has been drawn by the system since the battery has been connected. The closest this value gets from the total battery capacity the more the battery gets empty. The capacimeter's value is reset as soon as the battery is disconnected from the fuel gauge. This value is not reset when the K-ART is switched off (only when the battery is removed).

Battery index : This number indicates which battery is actually selected. It's value can be changed using the 2 push buttons located on the front panel of the unit.

Calibration process :

Please note : This process does not need to be executed when using our AUDIOROOT eSMART Li-xxWh or LiFe-xxxWh batteries. The 2 push buttons of the front panel are inoperative when an eSMART battery is connected to the system.

The K-ART's calibration process is very similar to it's little brother eSMART BG-DU. The main difference is that the K-ART can be connected to 2 batteries simultaneously. The K-ART's fuel gauges are fully independent and do not share battery calibration informations. In other words this means that a battery that has been calibrated while being connected to battery input #1 should allways be used on the same input #1. If the user wishes to use the battery on either battery input he will need to perform the claibration process twice (once on each battery input).

We therefore recommend to identify your batteries with a letter/digit pair. For example the user can identify his batteries as 1.A, 1.B, 2.A ,2.B, 3.A, 3.B, etc... were battery 1.A will allways be connected to input #1 and battery 1.B will allways be connected to input #2.

Here are the steps to perform calibration of 2 batteries at a time :

1. Label the 2 batteries you wish to calibrate with a number ranging from 1 to 8 and adding the suffix .A or .B to identify each unit. In this example we will use batteries 3.A and 3.B. The 2 batteries must be fully charged before launching the calibration process.
2. Plug the two batteries on the eSMART K-ART power distributor with a compatible power cable (leave pins 2 and 3 on the XLR4 connectors unused). In our example we will connect battery labeled 3.A to input #1 and battery labeled 3.B to input #2.
3. Plug all the equipment that will be used in normal operation (for exemple a mixer, a recorder and several wireless receivers).
4. Power up the K-ART using the main power pushbutton switch (short press).
5. Activate all used outputs with a short press on each corresponding pushbutton switch (short press) and power ON all your equipment.
6. By using the 2 push buttons select the battery index that was chosen in step 1. In this example battery index is 3. You need to select the battery index on both fuel gauges.
7. Initiate the calibration process by pushing simultaneously the 2 push buttons. This must be done on both fuel gauges.

You can also calibrate only one battery at a time. To do this simply execute the calibration steps above with only one battery connected to the K-ART.

The fuel gauges will now keep measuring and saving the value of the total current drawn. This process can be ended only when the batteries are empty.

In the case of a li-ion or LIFEPO4 battery the calibration process will stop automatically when the low voltage protection circuit of the battery trips.

When calibrating a battery of another chemistry type (lead acid or nimh) the user needs to disconnect the battery manually when it's voltage level gets too low in order to achieve the calibration process correctly (for exemple the low voltage level of a 6 cell lead acid battery is 10.5 Volts : this value can be used to terminate the calibration process of a standard SLA battery).

The fuel gauge is now aware of the batteries' total capacity. The user only needs to recall the corresponding battery pair index number to monitor it's state of charge efficiently and accordingly.

PLEASE NOTE: A battery that has been previously calibrated must allways be connected fully charged to the eSMART K-ART or the state of charge indications will be inaccurate.