

Charge²

User Manual



Charge² is a microcontroller controlled universal USB charger that supports the BC 1.2 specification, Chinese telecommunications standard YD/T 1591-2009, and can emulate a number of manufacturer specific chargers.

For installation into EASA registered non-complex motor-powered and any ELA2 aircraft please refer to the documentation below depending on aircraft type

Fixed wing	JP-Avionics MOD-133
Rotor craft	JP-Avionics MOD-134

Part	Version	Date	Record of Change
C20A-M	1.0	June 2017	Initial release for CS-STAN (Harkwood Services Ltd)

Introduction

Charge² is a microcontroller controlled universal USB charger to enable you to charge devices from a low voltage DC power supply. They conform to the Battery Charging specification 1.2 (BC 1.2), Chinese telecommunications standard YD/T 1591-2009, and can also emulate a wide variety of manufacturer specific chargers to ensure your device is handled correctly at its optimal charging rate.

Charge² has been primarily designed for use in General / Light Aviation aircraft, although it can be used anywhere where there is a suitable DC power supply such as automotive (Car, truck etc.) and marine (canal / narrow boats, inshore craft, sailing boats etc.).

Power connection

The simplest connection is by using the supplied power lead, if you require additional leads they may be purchased from the website.

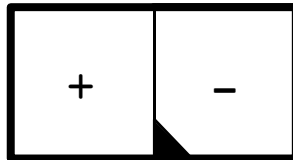
If you make your own lead use 20 AWG (0.5mm² cross section) wire suitable for the intended environment and the following Molex connector part numbers;

1 x Molex bare connector, part 43645-0200

2 x Molex crimp pin, part 43030-0002

The pins should be crimped using a Molex crimp tool, part number 63819-0000

The polarity of the connector is +ve on the left hand side, as seen when looking at the back the unit.



Important Notes

Connect only to a DC power supply, which should be protected by a fuse or breaker rated at 3 Amps maximum for a Charge².

To prevent overheating the body of the units should not be operated or stored in direct sunlight. The units should be protected from direct exposure to rain.

The unit will become warm when in use, this is normal and should not be a cause for concern. If it becomes too hot they will shutdown automatically.

Use only the original or original manufacturer approved cables when charging devices, some third party cables are of poor quality and may cause problems when connecting your devices. Do not use any form of "cheater" cable or adapter cable when connecting your devices, they are not required and will interfere with the correct operation of the ports.

Operation

- Connect the unit to a suitable DC power supply, when power is enabled a self-test is performed during which the ports lights will pulse in sequence.
- Connect devices to be charged

If multiple devices are connected simultaneously or were attached at power on, there could be a short delay for all devices to start charging. This is to ensure that each port is correctly configured for the attached device and the power budget correctly handled.

- Devices can be added and removed, as required

Technical Specifications

Charge²

Input Voltage	11v - 30v DC
Nominal Output Voltage	5.20v – 5.25v DC
Max Input Power	2.4A (@ 11v) 0.8A (@ 30v)
Max Output Power per port	12W
Weight	96g
Dimensions (W H D)	55 x 23 x 85 mm
Panel mount front bezel	74mm x 27mm
USB Output Port	Type A
Operating Temperature	0 °C - 55 °C

All USB ports each independently offering the features below;

- Thermal overload shutdown
- USB charging voltage regulation is maintained within the defined standards, which prevents damage to devices under charge
- Detection and isolation of any short circuit/fault, with auto recovery once the fault is removed (i.e. damaged cable/faulty device)
- Universal device support, without the need to resort to cheater cables
- Software controlled device recognition means new devices/charging requirements can be accommodated via custom charging profiles
- Lights providing status indication of what is happening on each port

Status Lights

Light	Status
Off	Idle
Green	Charging
Red	Fault
Orange	Pending

Idle

The port is awaiting the connection of a device.

Charging

A device has been detected and the optimal charging profile has been found. Note there can be a short delay after a device is connected as port looks for the most suitable profile.

Fault

A fault has been detected on the device connected to the port, which could be either the cable or device itself. Remove the device and wait for the fault to clear, if the fault repeats have the device and/or its cable checked.

Pending

A device has been detected as connected to the port but there is currently insufficient power available to initiate charging. Either remove an already connected device or wait for another device to reduce its consumption (i.e. when it's battery becomes fully charged).

If the input voltage is too low the pending light will be displayed, every few seconds port 2 and 4 will flash twice to indicate an under-volt condition. When the input voltage returns to normal to charger will wait for a few seconds to ensure the voltage is stable before commencing charging again. This is to prevent the input current from tripping the 5 amp input protection during voltage transients.

Diagnostics Port

On the rear of Charge² is a mini-USB socket which gives additional information over the status lights. It can be used to see the state of the ports and how much power is being drawn per port. When connected to a computer this port emulates a Serial interface. You will need serial console software, such as Hyperterminal, to connect to the port.

```
Baud Rate    57600
Data Bits    8
Parity       None
Stop Bits    1
No Flow Control
```

The port will provide the status of the ports every few seconds or details of any faults detected. E.g.;

```
Port 1: Charging (2264ma)
Port 2: Charging (0967ma)
```

Pressing any key will bring up a menu, from which various options are available. Exiting from the menu returns to the default of outputting the port status every few seconds.

Custom profiles

To support devices that do not confirm to the standards, custom profiles can be entered and assigned to a port. Profile codes are available on the website, should you believe your device requires a custom profile please get in touch to start the process.

Up to 6 custom profiles can be stored at any given time, and each port on the charger can be assigned any one of the profiles.

The profiles themselves are made up of 26 characters, e.g. 04409C0E0468AD2A04008A0A04

To make assignments or enter custom profiles please connect the diagnostics port to a computer and enter the menus.

Option 4 manages the custom profiles, and permits the profile code to be entered along with a short description of the device supported. For example;

```
Profile 1 : 04409C0E0468AD2A04008A0A04 : Nexus 7 Gen 1
Profile 2 : Empty
Profile 3 : Empty
Profile 4 : Empty
Profile 5 : Empty
Profile 6 : Empty
```

```
1. Edit, 2. Clear, 0. Done ?
```

Editing a profile, for example 2,

```
Edit Profile ? 2
Enter Data : -----
```

As you enter the profile code the dashes are replaced by the code, if you press enter before entering a complete code the charger ignores the code and returns to the menu.

When a code is accepted you can enter a description to identify the profile when assigning it to specific ports.

Note: you cannot clear a profile if it is assigned to a port.

To assign a profile use option 3, the current associations will be listed;

```
Profiles Assigned
```

```
Port : 1 -> Auto
```

```
Port : 2 -> Auto
```

```
1. Assign, 2. Clear, 0. Done ?
```

Press 1 to assign a profile and you will be prompted;

```
Assign Port ?
```

Enter the port number and then the list of profiles is given and the following prompt;

```
Select Profile ?
```

Enter the desired profile number and the assignments is made and stored.

```
Profiles Assigned
```

```
Port : 1 -> Nexus 7 Gen 1
```

```
Port : 2 -> Auto
```

```
1. Assign, 2. Clear, 0. Done ?
```

When assigning profiles, returning to the main menu will re-initialise all the ports. This takes a few seconds and when complete ports will start to charge as normal using the configuration specified.

All profiles and port assignments are stored internally in flash memory, so once set they will remain until cleared by the user.

Fault Codes

Faults conditions are displayed via the port indicator lights and on the console of the diagnostics port.

Faults are displayed by flashing the port lights in various combinations, for a set number of flashes, as given below.

Port	Light	Status
Any	3 Flashes	<p>The port(s) flashing has detected an internal fault. If the condition continues following a power cycle please contact support to have the charger serviced. Other ports will remain in operation.</p> <p>Diagnostic port displays</p> <p>Port x: Internal Port Failure</p>
1	2 Flashes	<p>Over-voltage detected Charging suspended until the voltage returns to normal</p> <p>Diagnostic port displays</p> <p>Input Voltage @ xx.x is out of 11v - 30v range.</p>
2	2 Flashes	<p>Under-voltage detected Charging suspended until the voltage returns to normal</p> <p>Diagnostic port displays</p> <p>Input Voltage @ xx.x is out of 11v - 30v range.</p>

Standards Compliance

EU Electromagnetic Compatibility Directive 2004/108/EC
EU RoHS 2 Directive 2011/65/EU

For additional support or information please visit the website www.charge4.co.uk
e-mail charge4@harkwood.co.uk

Charge² is designed and manufactured in Cambridge, UK, by Harkwood Services Ltd.

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