File No.:	Version: A.0	

Professional Charger Specification

GP version

P461 (charge pack), D461 (4-slot dock), D861 (8-slot dock)

Revision list

Rev.	Date	Issues	Prepare	Approve
A.0	2020-09-14	Initial	David Liu /Bert Wu	

Edited By: David Liu Date: 2020-08-06	Checked By: Date:	Approved By: Date:

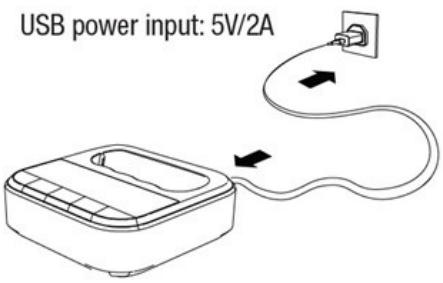
File No.:	Version: A.0	

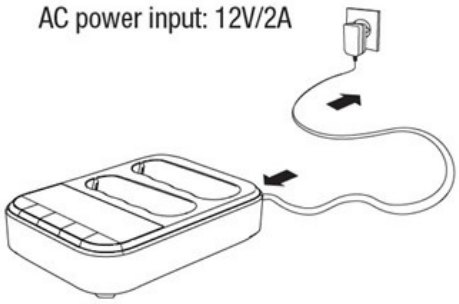
Professional Charger Specification

GP version

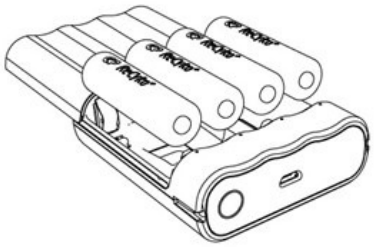
P461 (charge pack), D461 (4-slot dock), D861 (8-slot dock)

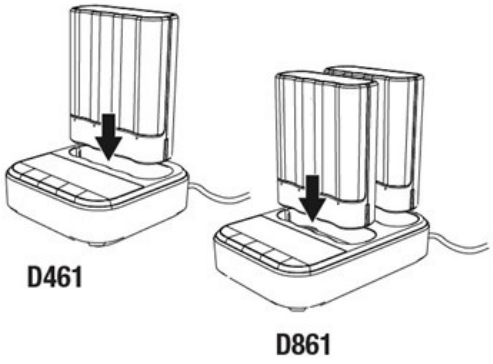
System setup





P461 Battery Charger





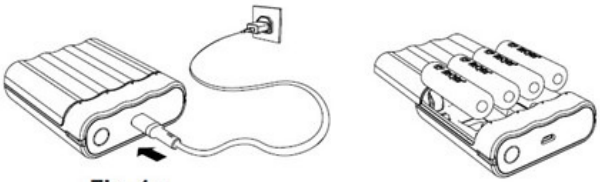
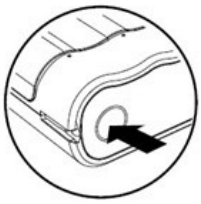
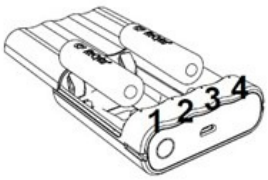


Fig. 1a





P461: Charge Pack

Scope:

This is a Ni-MH battery smart charge organizer with 4 Individual channels.

If no other specified on the test condition, all of the data specified are at room temperature – 25C, voltage and current are tested at the point of the input and the batteries contact plates

Rated input voltage/current: DC 5.0V/2.0A (microUSB socket)

Operation Mode

1) Standalone mode: working with standard micrcoUSB power 5V/2A supply
2) System mode: working with dock unit D461/ D861

Rated charging current: Average current at DC 5.0V 2.0A, @ Battery voltage as 1.4V

FAST mode (also able to work in standalone with microUSB power 5V/2A)

For AA size battery:

CH1 & CH2 only

- (1*AA size): 1730mA +/- 10% (continuous 1730mA charge)
- (2*AA size): 865mA +/-10% (1sec 1730mA charge, 1sec charging OFF)

CH3 & CH4 only

- (1*AA size): 1730mA +/-10% (continuous 1730mA charge)
- (2*AA size): 865mA +/-10% (1sec 1730mA charge, 1sec charging OFF)

CH1 & CH2 + CH3 & CH4:

- CH1 & CH2 (1*AA size): 1730mA+/-10% (continuous 1730mA charge)
- CH3 & CH4 (1*AA size): 1730mA+/-10% (continuous 1730mA charge)

CH1 & CH2 + CH3 & CH4:

- CH1 & CH2 (1*AA size): 865mA+/-10% (1sec 1730mA charge, 1sec charging OFF)
- CH3 & CH4 (2*AA size): 865mA+/-10% (1sec 1730mA charge, 1sec charging OFF)

CH1 & CH2 + CH3 & CH4:

- CH1 & CH2 (2*AA size): 865mA+/-10% (1sec 1730mA charge, 1sec charging OFF)
- CH3 & CH4 (1*AA size): 865mA+/-10% (1sec 1730mA charge, 1sec charging OFF)

CH1 & CH2 + CH3 & CH4:

- CH1 & CH2 (2*AA size): 865mA+/-10% (1sec 1730mA charge, 1sec charging OFF)
- CH3 & CH4 (2*AA size): 865mA+/-10% (1sec 1730mA charge, 1sec charging OFF)

For AAA size battery:

CH1 & CH2 only

- (1*AAA size): 700mA+/-10% (continuous 700mA charge)
- (2*AAA size): 350mA+/-10% (1sec 700mA charge, 1sec charging OFF)

CH3 & CH4 only

- (1*AAA size): 700mA+/-10% (continuous 700mA charge)
- (2*AAA size): 350mA+/-10% (1sec 700mA charge, 1sec charging OFF)

CH1 & CH2 + CH3 & CH4:

- CH1 & CH2 (1*AAA size): 700mA+/-10% (continuous 700mA charge)
- CH3 & CH4 (1*AAA size): 700mA+/-10% (continuous 700mA charge)

CH1 & CH2 + CH3 & CH4:

- CH1 & CH2 (1*AAA size): 350mA+/-10% (1sec 700mA charge, 1sec charging OFF)
- CH3 & CH4 (2*AAA size): 350mA+/-10% (1sec 700mA charge, 1sec charging OFF)

CH1 & CH2 + CH3 & CH4:

- CH1 & CH2 (2*AAA size): 350mA+/-10% (1sec 700mA charge, 1sec charging OFF)
- CH3 & CH4 (1*AAA size): 350mA+/-10% (1sec 700mA charge, 1sec charging OFF)

CH1 & CH2 + CH3 & CH4:

- CH1 & CH2 (2*AAA size): 350mA+/-10% (1sec 700mA charge, 1sec charging OFF)
- CH3 & CH4 (2*AAA size): 350mA+/-10% (1sec 700mA charge, 1sec charging OFF)

Charge time (FAST mode): For AA size 2000mAh or AAA size 850mAh

CH1 & CH2 only

- CH1 & CH2 (1*cell): 1.3hr
- CH1 & CH2 (2*cell): 2.6hr

CH3 & CH4 only

- CH3 & CH4 (1*cell): 1.3hr
- CH3 & CH4 (2*cell): 2.6hr

CH1 & CH2 + CH3 & CH4

- CH1 & CH2 (1*cell) + CH3 & CH4 (1*cell): 1.3hr
- CH1 & CH2 (1*cell) + CH3 & CH4 (2*cell): 2.6hr
- CH1 & CH2 (2*cell) + CH3 & CH4 (1*cell): 2.6hr
- CH1 & CH2 (2*cell) + CH3 & CH4 (2*cell): 2.6hr

ECO mode (MUST work with D461/ D861)

For AA size battery:

CH1 & CH2 only

- (1*AA size): 865mA+/-10% (continuous 50% duty 1730mA charge)
- (2*AA size): 432mA+/-10% (1sec 50% duty 1730mA charge, 1sec charging OFF)

CH3 & CH4 only

- (1*AA size): 865mA+/-10% (continuous 50% duty 1730mA charge)
- (2*AA size): 432mA+/-10% (1sec 50% duty 1730mA charge, 1sec charging OFF)

CH1 & CH2 + CH3 & CH4:

- CH1 & CH2 (1*AA size): 865mA+/-10% (continuous 50% duty 1730mA charge)
- CH3 & CH4 (1*AA size): 865mA+/-10% (continuous 50% duty 1730mA charge)

CH1 & CH2 + CH3 & CH4:

- CH1 & CH2 (1*AA size): 432mA+/-10% (1sec 50% duty 1730mA charge, 1sec charging OFF)
- CH3 & CH4 (2*AA size): 432mA+/-10% (1sec 50% duty 1730mA charge, 1sec charging OFF)

CH1 & CH2 + CH3 & CH4:

- CH1 & CH2 (2*AA size): 432mA+/-10% (1sec 50% duty 1730mA charge, 1sec charging OFF)
- CH3 & CH4 (1*AA size): 432mA+/-10% (1sec 50% duty 1730mA charge, 1sec charging OFF)

CH1 & CH2 + CH3 & CH4:

- CH1 & CH2 (2*AA size): 432mA+/-10% (1sec 50% duty 1730mA charge, 1sec charging OFF)
- CH3 & CH4 (2*AA size): 432mA+/-10% (1sec 50% duty 1730mA charge, 1sec charging OFF)

For AAA size battery:

CH1 & CH2 only

- (1*AAA size): 350mA+/-10% (continuous 50% duty 700mA charge)
- (2*AAA size): 175mA+/-10% (1sec 50% duty 700mA charge, 1sec charging OFF)

CH3 & CH4 only

- (1*AAA size): 350mA+/-10% (continuous 50% duty 700mA charge)
- (2*AAA size): 175mA+/-10% (1sec 50% duty 700mA charge, 1sec charging OFF)

CH1 & CH2 + CH3 & CH4:

- CH1 & CH2 (1*AAA size): 350mA+/-10% (continuous 50% duty 700mA charge)
- CH3 & CH4 (1*AAA size): 350mA+/-10% (continuous 50% duty 700mA charge)

CH1 & CH2 + CH3 & CH4:

- CH1 & CH2 (1*AAA size): 175mA+/-10% (1sec 50% duty 700mA charge, 1sec charging OFF)
- CH3 & CH4 (2*AAA size): 175mA +/-10% (1sec 50% duty 700mA charge, 1sec charging OFF)

CH1 & CH2 + CH3 & CH4:

- CH1 & CH2 (2*AAA size): 175mA +/-10% (1sec 50% duty 700mA charge, 1sec charging OFF)
- CH3 & CH4 (1*AAA size): 175mA +/-10% (1sec 50% duty 700mA charge, 1sec charging OFF)

CH1 & CH2 + CH3 & CH4:

- CH1 & CH2 (2*AAA size): 175mA +/-10% (1sec 50% duty 700mA charge, 1sec charging OFF)
- CH3 & CH4 (2*AAA size): 175mA +/-10% (1sec 50% duty 700mA charge, 1sec charging OFF)

CAPACITY CHECK mode (MUST work with D461/ D861)

Process sequence (for AA size):

- ➔ Slow charge 220mA +/- 20% (1sec 440mA +/-20% charge, 1sec charging OFF), until battery charge full
- ➔ Stop for 30mins cool down
- ➔ Slow discharge 220mA +/-10% @1.3V (1sec 320mA~500mA discharge, 1sec discharge OFF), until battery voltage at 1.0V
- ➔ Calculate the battery capacity
- ➔ Stop for 30mins cool down
- ➔ FAST charge full the battery (ready for user), charging current 865mA +/- 10% (for any cell combinations)
- ➔ Transfer the measurement result to dock unit (D461 /D861)
- ➔ Process complete

Remark:
The whole process takes 10~20hrs, depending on battery capacity.
During process, battery LED indicator 1sec flashing GREEN

CONDITIONING mode (MUST work with D461/ D861)

Process sequence (for AA size):

- ➔ Slow charge 220mA +/- 20% (1sec 440mA +/-20% charge, 1sec charging OFF)
- ➔ If battery voltage unable to reach 1.0V over 3min, then shown warning (battery led indication flashing RED)
- ➔ If battery voltage able to reach 1.0V within 3min, then continue slow charge 220mA +/- 20% (1sec 440mA +/-20% charge, 1sec charging OFF)
- ➔ Slow charge full the battery (ready for user)
- ➔ Process complete

Remark:
The whole process takes 10~15hrs, depending on battery capacity.
During process, battery LED indicator 1sec flashing GREEN

REFRESH mode (MUST work with D461/ D861)

Process sequence (for AA size):

- ➔ Slow discharge 220mA +/-10% @1.3V (1sec 320mA~500mA discharge, 1sec discharge OFF), until battery voltage at 1.0V
- ➔ Calculate the battery capacity
- ➔ Stop for 30mins cool down
- ➔ FAST charge full the battery (ready for user), charging current 865mA +/- 10% (for any cell combinations)
- ➔ Transfer the measurement result to dock unit (D461 /D861)
- ➔ Process complete

Remark:
The whole process takes 10~15hrs, depending on battery capacity.
During process, battery LED indicator 1sec flashing GREEN

RECOVERY mode (MUST work with D461/ D861)

Process sequence (for AA size):

- ➔ Slow discharge 220mA +/-10% @1.3V (1sec 320mA~500mA discharge, 1sec discharge OFF), until battery voltage at 1.0V
- ➔ Stop for 30mins cool down
- ➔ Slow charge 220mA +/- 20% (1sec 440mA +/-20% charge, 1sec charging OFF), until battery charge full
- ➔ Stop for 30mins cool down
- ➔ Repeat above 3 cycles
- ➔ Process complete

Remark:
The whole process takes 60~80hrs, depending on battery capacity.
During process, battery LED indicator 1sec flashing GREEN

Trickle charge current (Input DC 5.0V /2A)

CH1 & CH2:	1*AA size about 170mA
	2*AA size about 85mA
CH3 & CH4:	1*AA size about 170mA
	2*AA size about 85 mA
CH1 & CH2:	1*AAA size about 70mA
	2*AAA size about 35mA
CH3 & CH4:	1*AAA size about 70mA
	2*AAA size about 35mA

Charge current & auto-reduction at high temperature

Room temperature operation: < 28C
High temperature operation: 28~33C

Fast mode charging current:
AA size (1 cell): 1730mA +/-10% (CH1 & CH2 OR CH3 & CH4)
AA size (2 cell): 865mA +/-10% ((CH1 & CH2 OR CH3 & CH4)

AAA size (1 cell) : 700mA +/-10% (CH1 & CH2 OR CH3 & CH4)
AAA size (2 cell): 350mA +/-10% (CH1 & CH2 OR CH3 & CH4)

During FAST charging at high ambient temperature (28C ~33C), when battery temperature reached 49C +/-3C, it will automatically reduce charging current, Whenever battery reached overheat temperature (53~55C),it will stop charging.

Auto-reduction charging current:
CH1 & CH2 only (1 cell) or
CH3 & CH4 only (1 cell) or
CH1 & CH2 (1 cell) + CH3 & CH4 (1cell)
AA size: current 865mA +/-10% (continuous 50% duty 1730mA charging)
AAA size: current 350mA +/-10% (continuous 50% duty 700mA charging)

Other combinations
AA size: 432mA+/-10% (1sec 50% duty 1730mA charge, 1sec charging OFF)
AAA size: 175mA+/-10% (1sec 50% duty 700mA charge, 1sec charging OFF)

Build-in Capacity check button

A build-in capacity check button, press & hold to check the battery is GOOD or BAD capacity
GOOD, green led ON (above 50% capacity): Battery voltage > 1.32V +/- 0.05V
BAD, red led ON (below 50% capacity): Battery voltage < 1.32V +/- 0.05V

Power source warnging detection

During operation, if input power unstable and drop below requirement, the LED indication will flash RED
Input power warning voltage: 4.6V +/- 0.1V

Application: Charge 1/2/3/4 pcs Ni-MH AA/AAA batteries

Indication: (4pcs Dual color LED):

Condition	LED Indication	
	RED	GREEN
Power ON	Off	ON 0.5S
No battery inserted	Off	Off
Charging in progress	Off	Slow flashing
When charging is finished and then switch to trickle charge	OFF	ON
Bad/ Primary battery inserted	Fast flashing	OFF

Charge Termination & battery protection

Safety timer:
- 3hr (FAST charge @ room temp operation)
- 6hr (FAST charge @ high temp operation)
- 18hr (Slow charge)

Battery voltage: > 1.45V

-dV: 5mV

Battery temperature protection: > 53~55C

Primary battery protection

Reverse polarity protection

Battery leakage current: below 100uA per battery

Professional Charger Specification

GP version

P461 (charge pack), D461 (4-slot dock), D861 (8-slot dock)

ENVIRONMENTAL COMPLIANCE

Operating temperature range : 0 ~ +33C
Storage temperature range : -20 ~ +60C

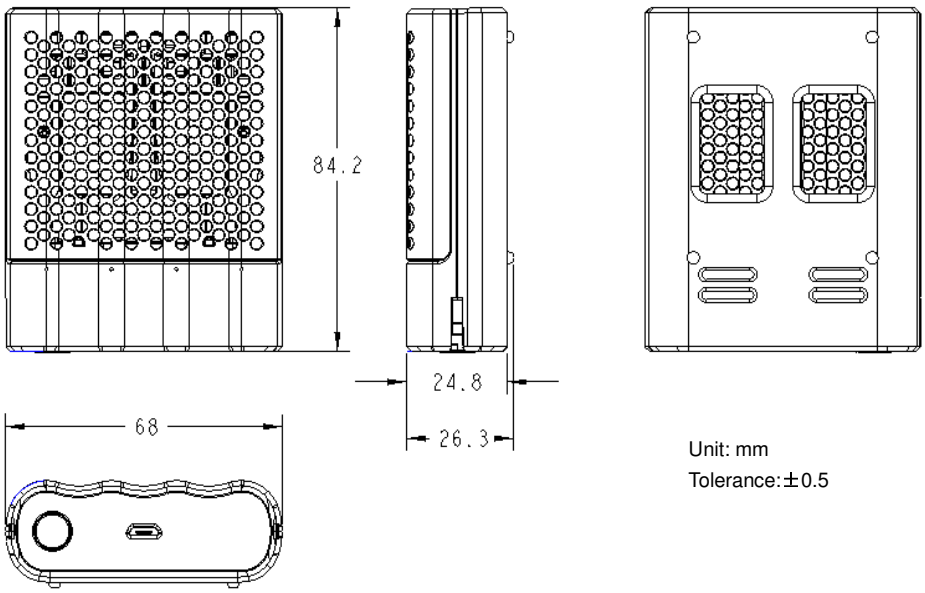
ROHS/REACH compliance

SAFETY & EMC COMPLIANCE

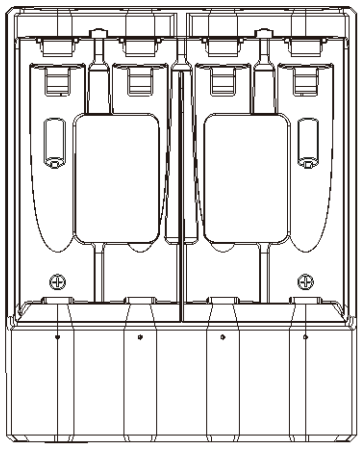
EMC : EN55014-1:2017, EN55014-2:2015, EN61000-3-2:2014 & EN61000-3-3:2013

FCC : FCC Part 15, Subpart B, ANSI C63.4-2014.

Outline dimension



Unit: mm
Tolerance:±0.5



Outline without Battery Cover

Silkscreen requirement

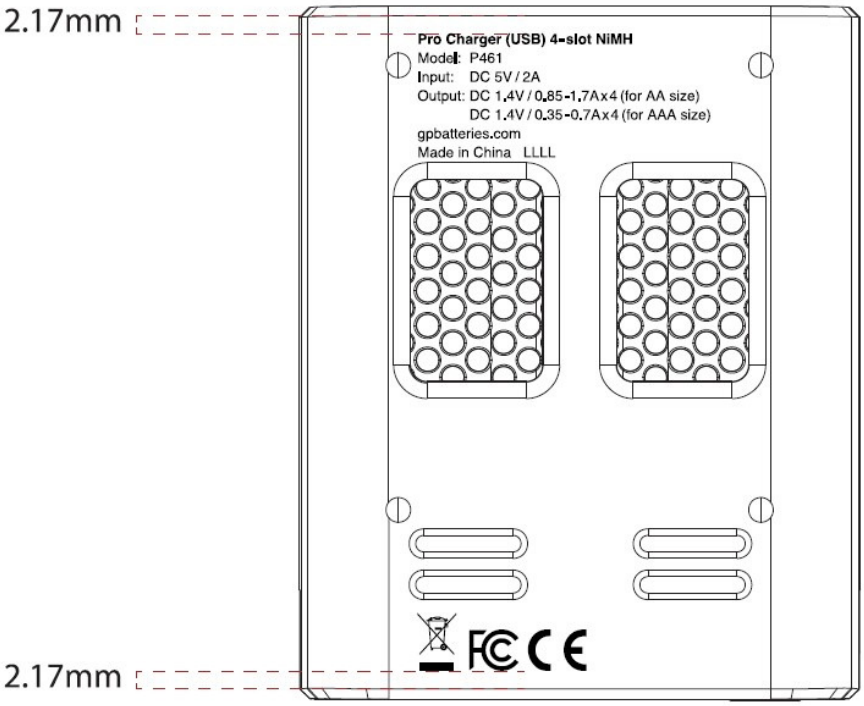
File No.:	Version: A.0	

Professional Charger Specification

GP version

P461 (charge pack), D461 (4-slot dock), D861 (8-slot dock)

Pantone 376C



Pantone Black tone on tone

MECHANICAL CHARACTERISTICS

Housing (Plastic):Outer housing shall be constructed of a UL94V0 approved flame retardant material as a minimum.

Button
No distinct resistance and no function fail when pressing the button.
Durability : 1000cycles, 5s/time, No visibly damaged, No defects that would impair normal operations.

Drop resistance : No visibly damaged at 1m & 6 times, on concrete floor. No defects that would impair normal operations.

Assembly test with charging station:
Normal function test: When the charger is inserted or removed, there is no excessive resistance to make movement difficult, No defects that would impair normal operations.
Durability for insertion and withdrawal : 1000 cycles, cycle rate of 360 cycles per hour. No visibly damaged, No defects that would impair normal operations.

Protection from reverse insertion of battery : No positive terminal electrical contact

Pull force with inserted GP 2600mAH NiMH battery <20N

Compressed strength with inserted GP 1300mAH NiMH battery : No dropping of when the unit having battery facing the floor without Battery Cover.

USB Connectors
Durability for insertion and withdrawal : 1000 cycles, cycle rate of 500 cycles per hour if using auto tester, 200 cycles per hour if manual

No visibly damaged, No defects that would impair normal operations

Meet the insertion & withdrawal force requirement after 1000 cycles at a maximum rate of 12.5mm/min. (refer to USB requirements)
MicroUSB insertion force < 35N
MicroUSB withdrawal force > 8N

Good visible alignment

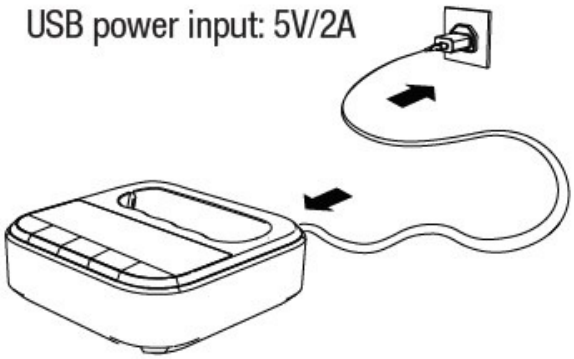
Cosmetic & Graphics : Detail requirement defined by ID Design Team
No visible scratch & dirt & flashes & chromatic aberration on surface.
Assembly gap of all mating parts： no movable gap
Graphic & printing robustness & endurance : refer GP – PQ

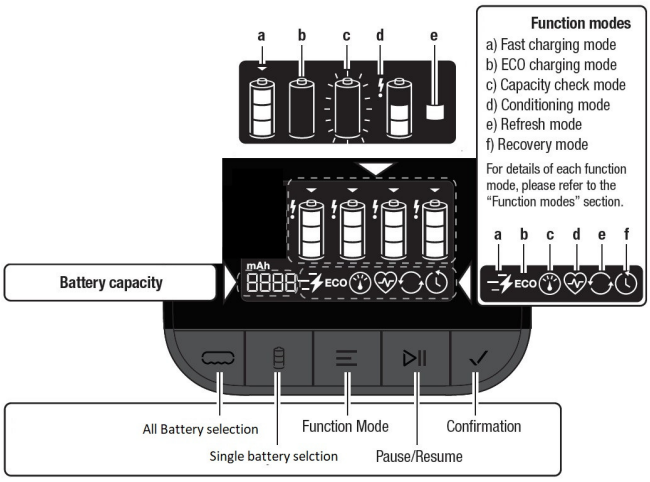
D461: 4-slot dock

Scope:

This is a 4-slot dock unit to work with P461, also compatible with existing M451, B421.
It provides five functional keys and LCD display for user to select the battery charging mode setting and display the battery charging status.

If no other specified on the test condition, all of the data specified are at room temperature – 25C.





Function keys

- All cell: Press to select all battery
- Single cell: Press to select single battery
- Mode: Press to select function mode
- Pause/Resume: Press to pause, press again to resume
- Confirm: Press to confirm mode selected.

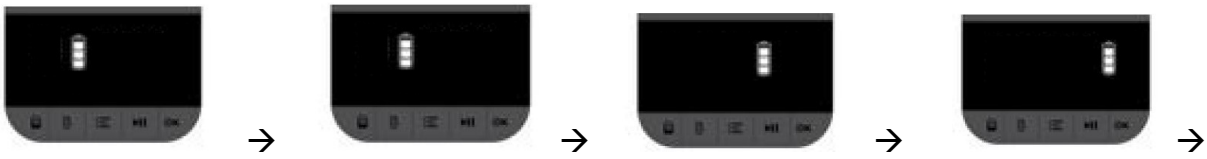
Basic operation

For detail UI operation, please refer Appendix.

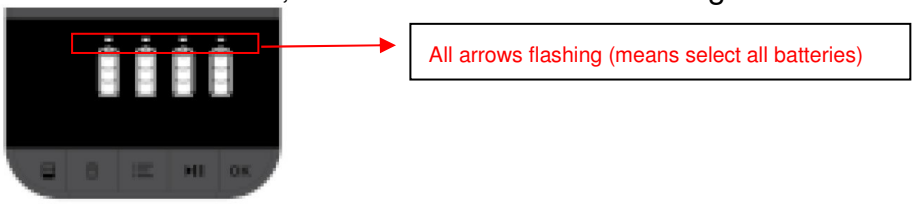
Edit mode sequence:
select “Battery” (1/2/3/4/all batteries) → select “Mode” → Press “Confirm”.

➔ Plug in microUSB power (5V/2A) at back of device, LCD shows standby display

➔ Plug in P461 (with batteries) into slot, LCD shows charging pack detection animation.



➔ When detection done, LCD shows below and waiting user for mode selection.



If ALL arrows flashing, means selected all batteries for setting.
If ONE arrow flashing, means selected individual battery for setting.

User can press “Single cell” key to toggle the individual battery for setting.
User can press “All cell” key to select all batteries for setting.

REMARK: If without mode selection within **5 sec**, it will select default “FAST” charge to P461 for all battery.

➔ User can press Mode key to select function modes, as below.

FAST: fast charging
ECO: standard charging
CAPACITY CHECK: check battery capacity after full charge
CONIDTIONING: rescue batteries (below 1V) due to long storage.
REFRESH: check remained capacity of the batteries.
RECOVERY: recovery the battery to health condition by 3cycles slow charge & slow discharge.

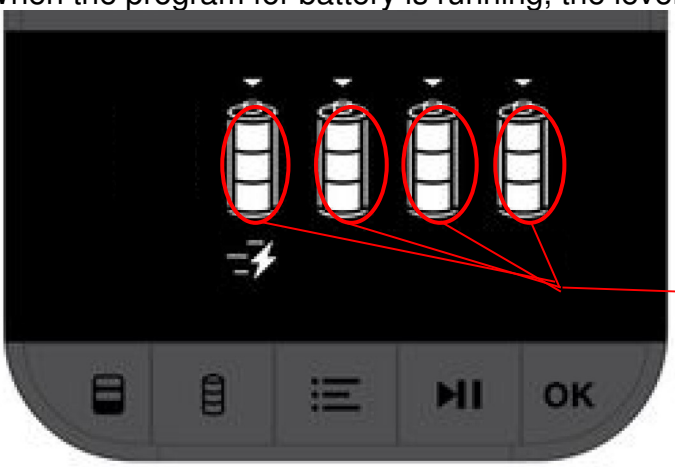
REMARK: For above functions in details, please refer at P461 section.

➔ When Mode is selected for individual battery, press “Confirm” key. It will go to next battery for Mode selection. Repeat Mode selection for all batteries. When the Mode for last battery is also confirmed, it will exit the Edit mode and start to run the program.

When All battery is selected, just need to select the Mode and press “Confirm” key, it will exit the Edit mode and start to run the program.

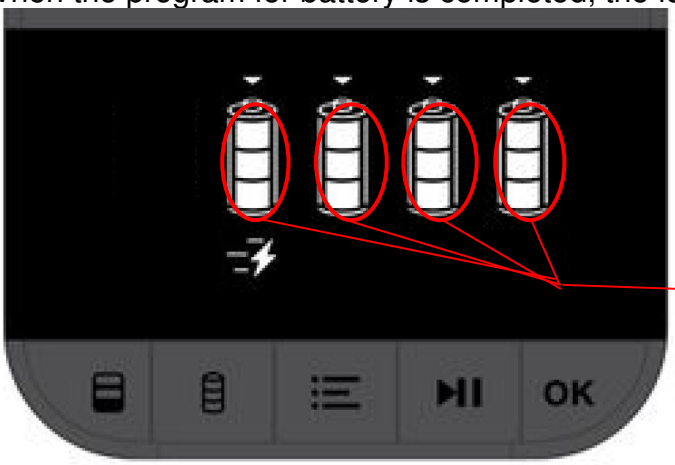
During charging

When the program for battery is running, the level icons inside battery will flashing/ animation.



When program is running, battery levels icon **flashing/ animation.**

When the program for battery is completed, the level icons inside battery stay solid.

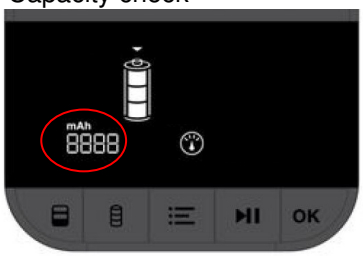


When program is completed, battery levels icon stays **solid**.

Capacity Check and Refresh function

If the battery has been selected “Capacity check” or “Refresh” function and completed, capacity measurement result will show when it is at view status mode.

Capacity check



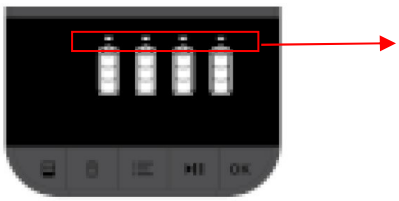
Refresh

Viewing status

During charging in operation, user can press “Single cell” to go into viewing status to check individual battery status.
Press “Single cell” again to go to next battery.
Toggle cycle: Cell 1/2/3/4

Edit mode

During charging in operation, user can press & hold “Mode” key for 2sec, it will go into the Edit mode to change individual/ all battery program setting. Follow basic operation procedures to change setting accordingly.



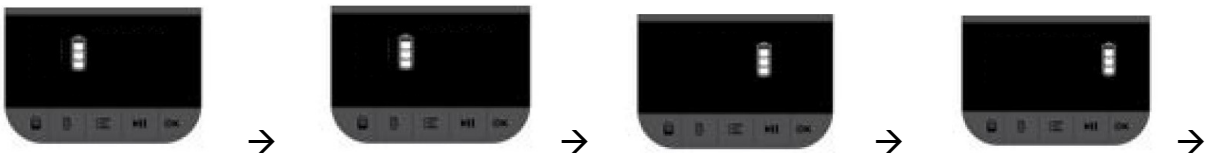
All arrows flashing (means select all batteries)

During Edit mode, user can press & hold “Mode” key for 2sec to exit, it will run the program that has been set. If no key press for 45sec (timeout), it will automatically to exit the Edit mode also.

Pause/ Resume

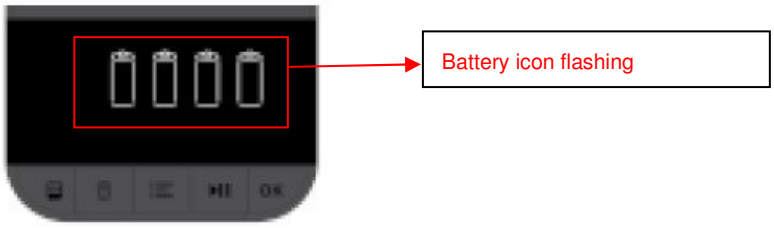
During charging in operation, user can press “Pause/Resume” key, device will store the charging program setting. User can unplug P461 to check/change the batteries, then can re-plug the P461 into the dock, user can press “Pause/Resume” key again to restore the charging program setting.

LCD display animation as below.



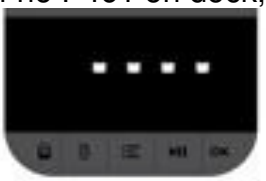
Battery Slot Missing

When the P461 is unplug, the LCD will display below.



Standby

If no P461 on dock, the LCD will display below.



Auto display OFF & wakeup

Auto-OFF
When the device is idle for 2mins, it will turn OFF the LCD display

Auto-wakeup
- P461/ M451/ B421 plug into dock, it will wake up automatically
- Press “All battery” or “Confirm” key, it will wake up automatically.

Compatibility

When works with P461 (Professional SCO), it provides all the features as mentioned below.
When works with M451 (Mainstream SCO) or B421 (Basic SCO), it provides the charging functions ONLY. The charging current follows their original electrical specification.

Power source

MicroUSB 5V/ 2A provide by USB wall charger or Powerbank

Electrical consumption (Power supply 5Vdc),

Average measurement

Standby mode (without P461): 32mA +/-10%

OFF display mode (without P461): 32mA +/-10%

FAST charge mode (P461 with all batteries): 1450mA +/-10%

ECO charge mode (P461 with all batteries): 750mA +/-10%

CAPACITY CHEK charge mode (P461 with all batteries): 330mA +/- 10%

CONDITIONING charge mode (P461 with all batteries): 330mA +/- 10%

REFRESH charge mode (P461 with all batteries): 73mA +/- 10%

RECOVERY charge mode (P461 with all batteries): 73mA +/- 10%

ENVIRONMENTAL COMPLIANCE

Operating temperature range : 0 ~ +33C

Storage temperature range : -20 ~ +60C

ROHS/REACH compliance

SAFETY & EMC COMPLIANCE

EMC : EN55014-1:2017, EN55014-2:2015, EN61000-3-2:2014 & EN61000-3-3:2013

FCC : FCC Part 15, Subpart B, ANSI C63.4-2014.

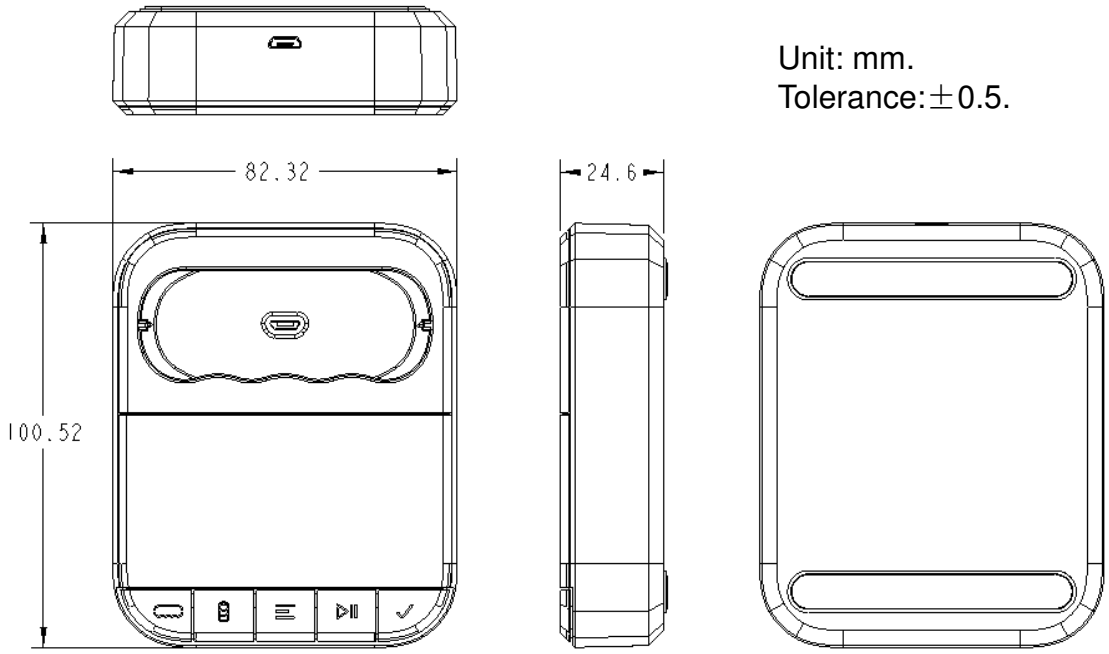
File No.:	Version: A.0	

Professional Charger Specification

GP version

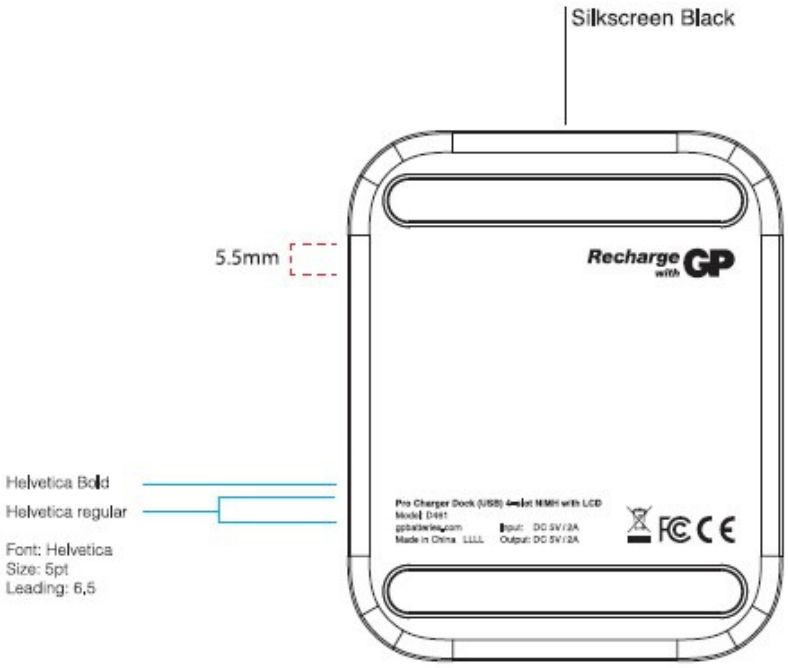
P461 (charge pack), D461 (4-slot dock), D861 (8-slot dock)

Outline dimension



Unit: mm.
Tolerance:±0.5.

Silkscreen requirement



MECHANICAL CHARACTERISTICS

Housing (Plastic):Outer housing shall be constructed of a UL94V0 approved flame retardant material as a minimum.

Button
No distinct resistance and no function fail when pressing the button.
Durability : 1000cycles, 5s/time, No visibly damaged, No defects that would impair normal operations.

Drop resistance : No visibly damaged at 1m & 6 times, on concrete floor. No defects that would impair normal operations.

Assembly test with charging station:

Normal function test: When the charger is inserted or removed, there is no excessive resistance to make movement difficult, No defects that would impair normal operations.

Durability for insertion and withdrawal : 1000 cycles, cycle rate of 360 cycles per hour. No visibly damaged, No defects that would impair normal operations.

Protection from reverse insertion of battery : No positive terminal electrical contact

Charging pack (P461) Pull & Insert force <30N

USB Connectors
Durability for insertion and withdrawal : 1000 cycles, cycle rate of 500 cycles per hour if using auto tester, 200 cycles per hour if manual

No visibly damaged, No defects that would impair normal operations

Meet the insertion & withdrawal force requirement after 1000 cycles at a maximum rate of 12.5mm/min. (refer to USB requirements)
MicroB insertion force < 35N
MicroB withdrawal force > 8N

Good visible alignment

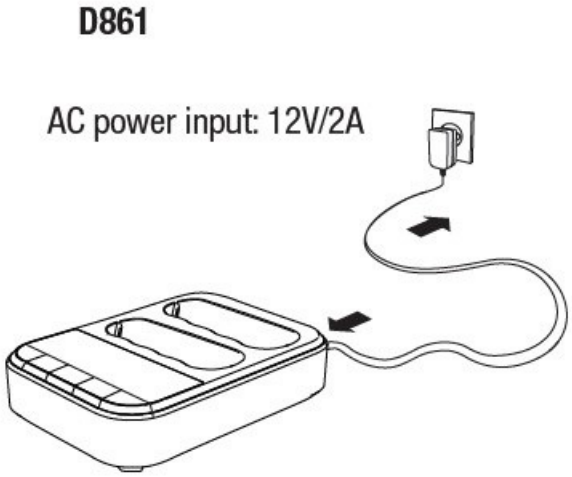
Cosmetic & Graphics : Detail requirement defined by ID Design Team
- No visible scratch & dirt & flashes & chromatic aberration on surface.
- Assembly gap of all mating parts： no movable gap
- Graphic & printing robustness & endurance : refer GP – PQ

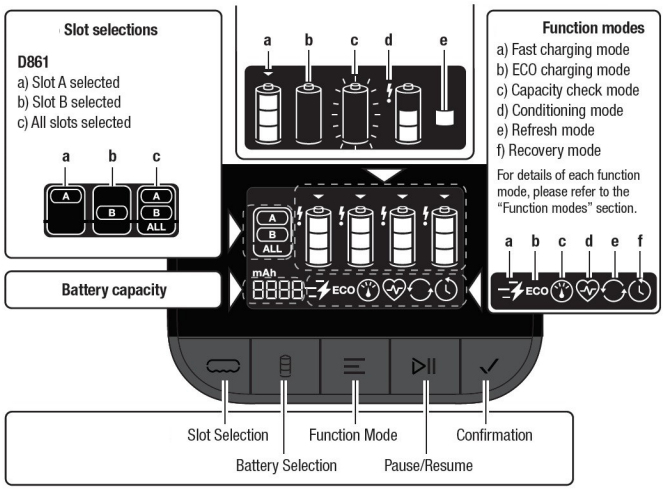
D861: 8-slot dock

Scope:

This is a 8-slot dock unit to work with P461, also compatible with existing M451, B421.
It provides five functional keys and LCD display for user to select the battery charging mode setting and display the battery charging status.

If no other specified on the test condition, all of the data specified are at room temperature – 25C.





Function keys

- Slot: Press to select all battery
- Battery: Press to select single battery
- Mode: Press to select function mode
- Pause/Resume: Press to pause, press again to resume
- Confirm: Press to confirm mode selected.

Basic operation

For detail UI operation, please refer Appendix.

Edit mode sequence:
select “Slot” (A/B/ALL) → select “Battery” (1/2/3/4/all batteries) → select “Mode” → Press “Confirm”.

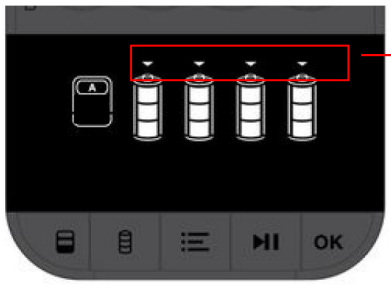
➔ Plug in AC/DC wall adaptor (12V/2A) at back of device, LCD shows standby display

➔ Plug in P461 (with batteries) into slot, LCD shows charging pack detection animation.

➔ When detection done, LCD shows below and waiting user for battery selection.

If P461 plug in Slot A, slot “A” icon flashing
If P461 plug in Slot B, slot “B” icon flashing

User can press “Battery” key to select battery for mode setting. Toggle cycle ALL/ 1/ 2/ 3/ 4.



Battery arrows flashing.
Press battery key to toggle all/ 1/ 2/ 3/ 4

REMARK: If without battery selection within **5 sec**, it will select default “FAST” charge to P461 for all battery.

➔ User can press Mode key to select function modes, as below.

FAST: fast charging
ECO: standard charging
CAPACITY CHECK: check battery capacity after full charge
CONIDTIONING: rescue batteries (below 1V) due to long storage.
REFRESH: check remained capacity of the batteries.
RECOVERY: recovery the battery to health condition by 3cycles slow charge & slow discharge.

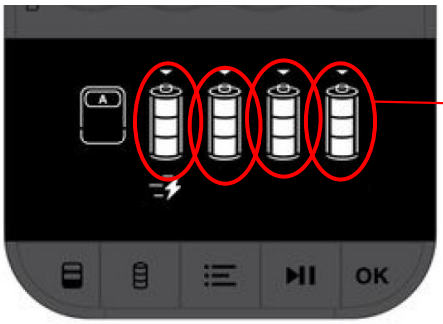
REMARK: For above functions in details, please refer at P461 section.

➔ When Mode is selected for individual battery, press “Confirm” key. It will go to next battery for Mode selection. Repeat Mode selection for all batteries. When the Mode for last battery is also confirmed, it will exit the Edit mode and start to run the program.

When All battery is selected, just need to select the Mode and press “Confirm” key, it will exit the Edit mode and start to run the program.

During charging

When the program for battery is running, the level icons inside battery will flashing/ animation.



When program is running, battery levels icon **flashing/ animation.**

When the program for battery is completed, the level icons inside battery stay solid.

When program is completed, battery levels icon stays **solid**.

Capacity Check and Refresh function

If the battery has been selected “Capacity check” or “Refresh” function and completed, capacity measurement result will show when it is at view status mode.

Capacity check

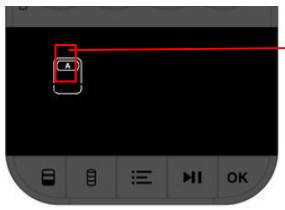
Refresh

Viewing status

During charging in operation, user can press “Battery” to go into viewing status to check individual battery status.
Press “Battery” again to go to next battery.
Toggle cycle: Battery 1/2/3/4

Edit mode

During charging in operation, user can press & hold “Mode” key for 2sec, it will go into the Edit mode to change individual/ all battery program setting. Follow basic operation procedures to change setting accordingly.



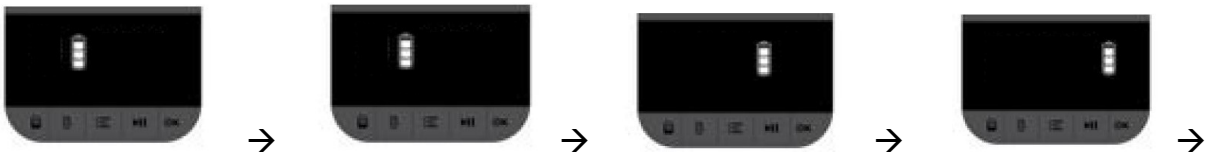
If P461 plug in Slot A, slot “A” icon flashing
If P461 plug in Slot B, slot “B” icon flashing

During Edit mode, user can press & hold “Mode” key for 2sec to exit, it will run the program that has been set. If no key press for 45sec (timeout), it will automatically to exit the Edit mode also.

Pause/ Resume

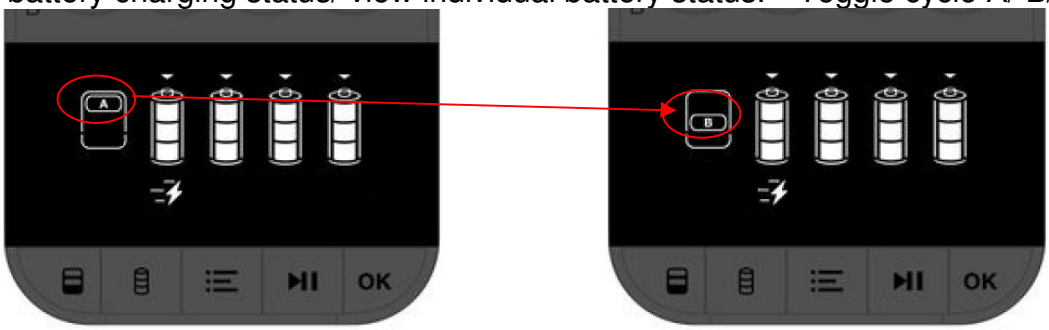
During charging in operation, user can press “Pause/Resume” key, device will store the charging program setting. User can unplug P461 to check/change the batteries, then can re-plug the P461 into the dock, user can press “Pause/Resume” key again to restore the charging program setting.

LCD display animation as below.



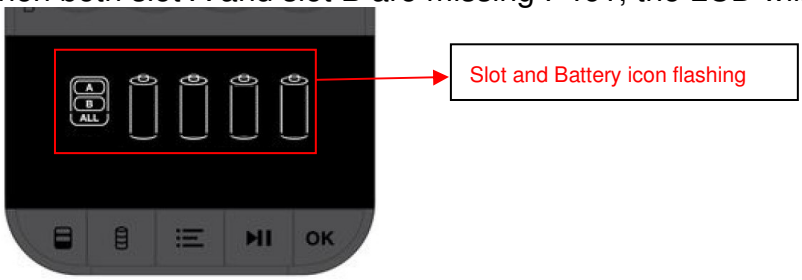
Change Slot A/B during charging

When both slot A and slot B have P461, user can press “Slot” key to change to another slot for battery charging status/ view individual battery status. Toggle cycle A/ B/ ALL



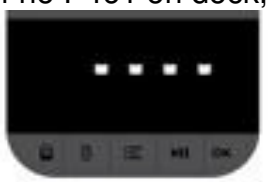
Battery Slot Missing

When both slot A and slot B are missing P461, the LCD will display below.



Standby

If no P461 on dock, the LCD will display below.



Auto display OFF & wakeup

Auto-OFF
When the device is idle for 2mins, it will turn OFF the LCD display

Auto-wakeup
- P461/ M451/ B421 plug into dock, it will wake up automatically
- Press “Slot” or “Confirm” key, it will wake up automatically.

Compatibility

When works with P461 (Professional SCO), it provides all the features as mentioned below. When works with M451 (Mainstream SCO) or B421 (Basic SCO), it provides the charging functions ONLY. The charging current follows their original electrical specification.

Power source

AC/DC wall adaptor 12V/ 2A

Electrical consumption (Power supply 12Vdc), both Slot A & B with P461,

Average measurement

Standby mode (without P461): 60mA +/-10%

OFF display mode (without P461): 60mA+/-10%

FAST charge mode (Both P461 with all batteries): 1300mA +/-10%

ECO charge mode (Both P461 with all batteries): 750mA +/-10%

CAPACITY CHEK charge mode (Both P461 with all batteries): 300mA +/- 10%

CONDITIONING charge mode (Both P461 with all batteries): 300mA +/- 10%

REFRESH charge mode (Both P461 with all batteries): 110mA +/- 10%

RECOVERY charge mode (Both P461 with all batteries): 110mA +/- 10%

ENVIRONMENTAL COMPLIANCE

Operating temperature range : 0 ~ +33C

Storage temperature range : -20 ~ +60℃

ROHS/REACH compliance

SAFETY & EMC COMPLIANCE

EMC : EN55014-1:2017, EN55014-2:2015, EN61000-3-2:2014 & EN61000-3-3:2013

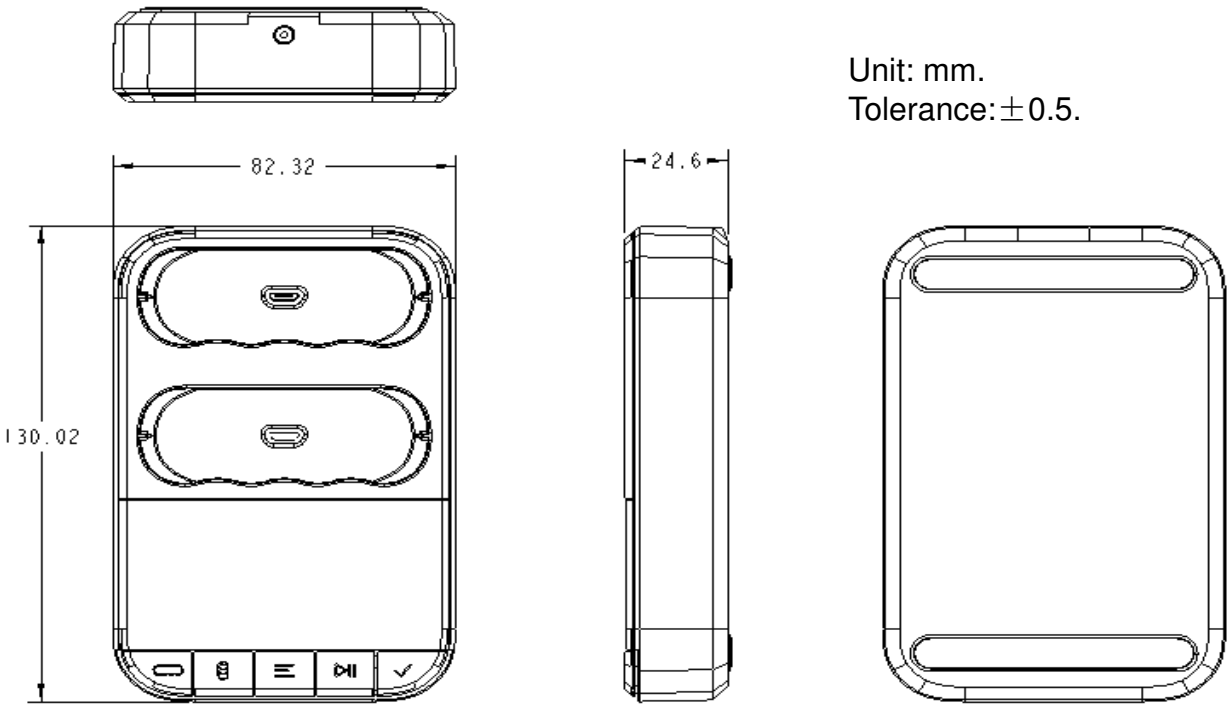
FCC : FCC Part 15, Subpart B, ANSI C63.4-2014.

Professional Charger Specification

GP version

P461 (charge pack), D461 (4-slot dock), D861 (8-slot dock)

Outline dimension



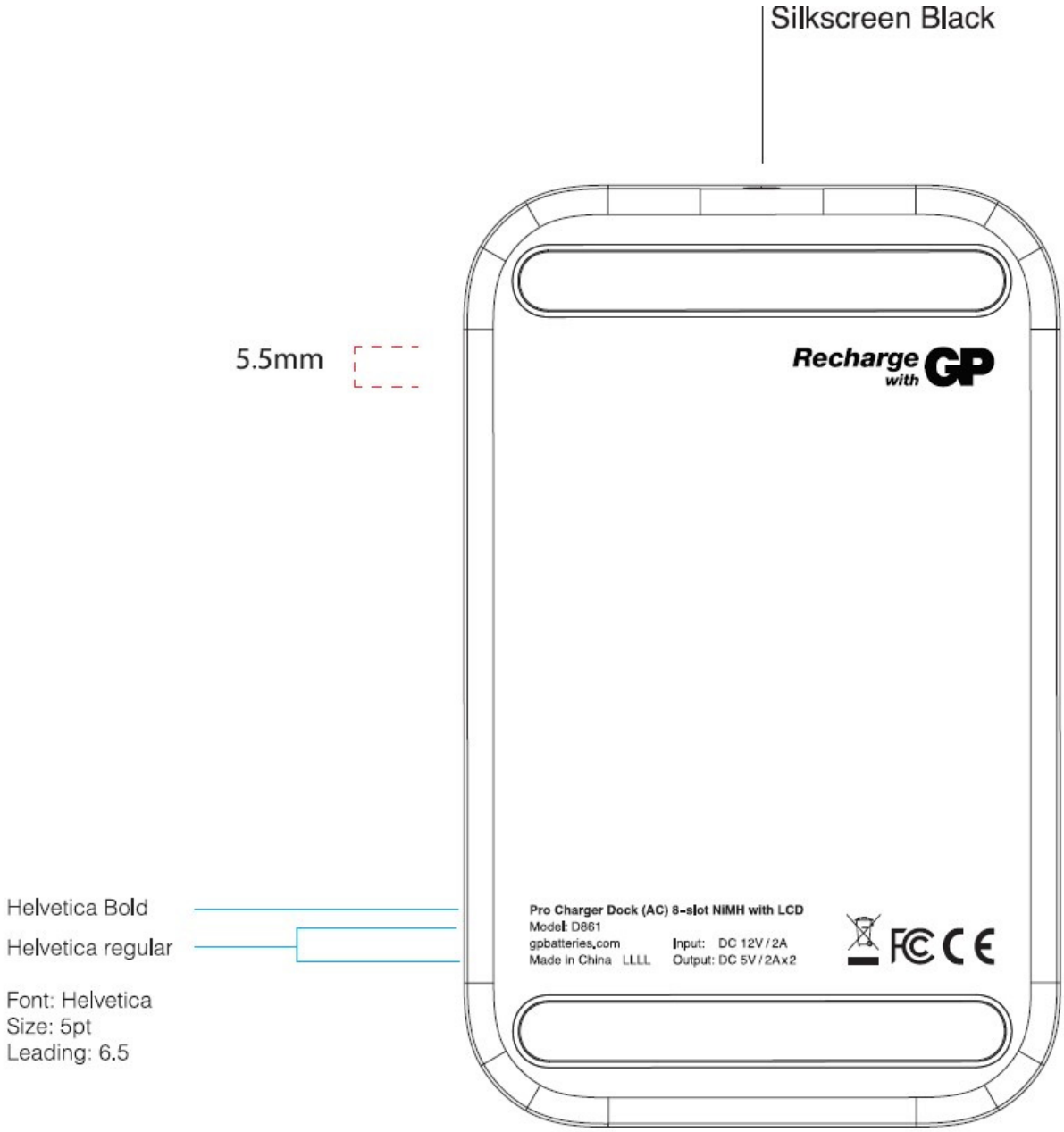
Unit: mm.
Tolerance:±0.5.

Professional Charger Specification

GP version

P461 (charge pack), D461 (4-slot dock), D861 (8-slot dock)

Silkscreen requirement



MECHANICAL CHARACTERISTICS

Housing (Plastic):Outer housing shall be constructed of a UL94V0 approved flame retardant material as a minimum.

Button
No distinct resistance and no function fail when pressing the button.
Durability : 1000cycles, 5s/time, No visibly damaged, No defects that would impair normal operations.

Drop resistance : No visibly damaged at 1m & 6 times, on concrete floor. No defects that would impair normal operations.

Assembly test with charging station:

Normal function test: When the charger is inserted or removed, there is no excessive resistance to make movement difficult, No defects that would impair normal operations.

Durability for insertion and withdrawal : 1000 cycles, cycle rate of 360 cycles per hour. No visibly damaged, No defects that would impair normal operations.

Protection from reverse insertion of battery : No positive terminal electrical contact

Charging pack (P461) Pull & Insert force <30N

USB Connectors
Durability for insertion and withdrawal : 1000 cycles, cycle rate of 500 cycles per hour if using auto tester, 200 cycles per hour if manual

No visibly damaged, No defects that would impair normal operations

Meet the insertion & withdrawal force requirement after 1000 cycles at a maximum rate of 12.5mm/min. (refer to USB requirements)
MicroB insertion force < 35N
MicroB withdrawal force > 8N

Good visible alignment

Cosmetic & Graphics : Detail requirement defined by ID Design Team
- No visible scratch & dirt & flashes & chromatic aberration on surface.
- Assembly gap of all mating parts： no movable gap
- Graphic & printing robustness & endurance : refer GP – PQ

UI brief - Professional Charger

Target release	05 July 2019
Document status	RELEASED
Document owner	UX Team
UX Designer	@Kwan Wong, @Kwok Lau
Product Designer	@Cali Wong @Chi Ho Cheng
Product Manager	@vincent_lam
Technical Lead	@patrick_lee

History

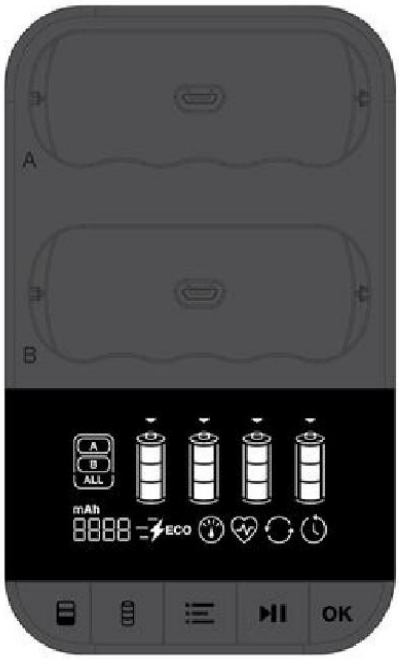
Date	Version	Released Note
26 Aug 2020	1.6	Updated after sample review
21 May 2020	1.5	Updated after reviewing the first prototype, agree with Patrick and Vincent.
27 Mar 2020	1.4	Updated based on discussion with Patrick
26 Nov 2019	1.3	Updated based on new icons
19 Aug 2019	/	Change request from Vincent Lam
09 Aug 2019	1.2	updated based on new icons
05 July 2019	1.0	Released version 1.0

A. Introduction

This document outlines the detailed UI for the professional charger range and serves it purpose to brief involved stakeholders.

Note all images are outputted in wireframe. The wireframe can be used to brief graphic designers

B. Proposed Layout



	Icon	Component	Description
1		Slot	To select slot
2		Cell	To select cell
3		Mode	To assign program for battery
4		Play/pause	Pause running program and resume pause program
5	OK	OK	To confirm action

C. Operations procedure

Below procedure should be used in combination with the following mockup

GET STARTED							
	STEP	Button	Event	Parameter	Description	Action	Implementation notes
C.1	1	SLOT *(Once Slot is selected cannot be invoked)*	SELECT SLOT *(each press cycles through A>B>ALL)*	A	Select Battery SLOT A only	IF SLOT = **A** THEN go to **STEP 2**	User press CELL to continue to STEP 2 ***For 4-slot professional charger, it does not have A/B parameter - SLOT button is to select ALL 4 CELLS instead.***

				B	Select Battery SLOT B only	IF SLOT = **B** THEN go to **STEP 2**	User press CELL to continue to STEP 2 ***For 4-slot professional charger, it does not have A/B parameter - SLOT button is to select ALL 4 CELLS instead.***
				ALL	Select Battery ALL SLOTS	IF SLOT = **ALL** then go to **STEP 3**	User press MODE to continue to STEP 3 When all slots are selected, CELLS cannot be selected
C.2	2	CELL *(can be invoked anytime unless specified otherwise)*	SELECT CELL *(each press cycles through ALL>1>2>3>4)*	1 - 2 - 3 - 4	Select ALL 4 CELLS	IF CELL = **ALL** THEN go to **STEP 3**	User press MODE to continue to STEP 3 ***For 4-slot professional charger, it does not have 1 -2 -3 -4 parameter - replaced by SLOT button.***
				1	Select 1st CELL only	IF CELL = **1** THEN go to **STEP 3**	User press MODE to continue to STEP 3
				2	Select 2nd CELL only	IF CELL = **2** THEN go to **STEP 3**	User press MODE to continue to STEP 3
				3	Select 3rd CELL only	IF CELL = **3** THEN go to **STEP 3**	User press MODE to continue to STEP 3
				4	Select 4th CELL only	IF CELL = **4** THEN go to **STEP 3**	User press MODE to continue to STEP 3
C.3	3	MODE *(can be invoked anytime if a slot or cell has been assigned or unless specified otherwise)*	SELECT MODE *(each press cycles through FAST CHARGE > ECO CHARGE > CAP CHECK > CONDITIONING > REFRESH > RECOVERY)*	FAST CHARGE	To charge batteries at high speed	IF MODE = FAST CHARGE THEN run CHARGE program	User MUST press OK to select CHARGE mode, THEN go to next CELL until end of sequence
				ECO CHARGE	To charge batteries at slow speed	IF MODE = FAST CHARGE THEN run CHARGE program	User MUST press OK to select CHARGE mode, THEN go to next CELL until end of sequence
				CAP CHECK	To find out the actual capacity of the cell	IF MODE = CAP CHECK THEN RUN CAP CHECK program	User MUST press OK to select CAP CHECK program, THEN go to next CELL until end of sequence
				CONDITIONING	To restore battery function of over-discharged battery	IF MODE = CAP CHECK THEN run CONDITIONING program	User MUST press OK to select CONDITIONING program, THEN go to next CELL until end of sequence
				REFRESH	To estimate battery remained capacity	IF MODE = CAP CHECK THEN run REFRESH program	User MUST press OK to select REFRESH program, THEN go to next CELL until end of sequence
				RECOVERY	To recover cell capacity	IF MODE = CAP CHECK THEN run RECOVERY program	User MUST press OK to select RECOVERY program, THEN go to next CELL until end of sequence
Remark: CELL and MODE select for mainstream charger or lower charger are disabled							
PAUSE/RESUME PROGRAM							
Can only be run when at least 1 program is running							
C.4		PAUSE /RESUME	PAUSE PROGRAM		Pause all running programs	IF PAUSE = ENABLED THEN pause all running programs and save all progress and settings && DISPLAY = pause state	PAUSE can only be initiated if at least 1 program is in progress
C.5		PAUSE /RESUME	RESUME PROGRAM		Resume any saved program and progress settings	IF RESUME = ENABLED THEN resume all saved programs and progress	RESUME can only be initiated from a PAUSE state IF a cell or slot is missing then discard the missing cell or slot
Remark: PAUSE/RESUME for mainstream charger or lower charger is disabled							

VIEW CELL STATUS (status display)							
When a program is in progress only, user can view state of each cell							
C.10	1	SLOT	SELECT SLOT *(each press cycles between A>B)*	A	Select Battery SLOT A only	IF SLOT = **A** THEN go to **STEP 2**	User press CELL to continue to STEP 2
				B	Select Battery SLOT B only	IF SLOT = **B** THEN go to **STEP 2**	User press CELL to continue to STEP 2
C.11	2	CELL	SELECT CELL *(each press cycles between 1>2>3>4>ALL)*	1	Select 1st CELL only	IF CELL = 1 THEN display current program state	only show mAh in CAPACITY CHECK mode or REFRESH mode
				2	Select 2nd CELL only	IF CELL = 2 THEN display current program state	only show mAh in CAPACITY CHECK mode or REFRESH mode
				3	Select 3rd CELL only	IF CELL = 3 THEN display current program state	only show mAh in CAPACITY CHECK mode or REFRESH mode
				4	Select 4th CELL only	IF CELL = 4 THEN display current program state	only show mAh in CAPACITY CHECK mode or REFRESH mode
Remark: VIEW CELL STATUS for mainstream charger or lower charger are disabled							
EDIT MODE							
When a program is in progress only, user can assign a new program to each cell							
C.12		MODE **(press 2 seconds)** *(can be invoked anytime unless specified otherwise)*	EDIT MODE	/	Select SLOT / CELL to proceed next step	IF press MODE for 2s THEN GO TO STEP 1 of **get started** procedure	
Remark: EDIT MODE for mainstream charger or lower charger are disabled							

EXIT EDIT MODE CONDITIONS					
	Condition	**Trigger**	**Description**	**Action**	**Implementation notes**
C.13	MANUALLY EXIT	LONG PRESS (2s) MODE BUTTON	User manually interrupts edit mode, and choses to exit before finishing the sequence	RUN assigned programs	IF CELL is SKIPPED THEN assign FAST CHARGING to CELL
C.14	TIMEOUT	IDLE 45s	Exit automatically after programs are assigned to every cell, THEN run programs	RUN assigned programs	Every press of button resets the timer to 45s IF CELL is SKIPPED THEN assign FAST CHARGING to CELL
C.15	END OF SEQUENCE SELECTION	Reach END of Sequence	Run fast charging mode	RUN assigned programs	IF 2 SLOTS are available THEN when reach end of sequence of selected SLOT then EXIT and run programs. IF 1 SLOT is available, when reach end of sequence then EXIT and run programs IF CELL is SKIPPED THEN assign FAST CHARGING to CELL
Remark: EDIT MODE for mainstream charger or lower charger are disabled					

D. Other requirements

	User Story	**Notes**
D.1	If battery slot is missing THEN display = on and go to **Stand-By** state	

D.2	If battery slot is inserted, THEN display is ON and goto Battery slot detection display(E.33)	
D.3	If a battery slot is removed && PAUSE program is not initiated THEN all program/progress/settings for all cells in the removed SLOT are reset	
D.4	If all battery slots are removed go to **Battery Slot Missing state**	
D.5	If only 1 slot is inserted THEN auto-detect the inserted slot && go to step 2 of **getting started** procedure	
D.6	If a program is in progress, press SLOT and/or Cell once is viewing only. MODE && OK are disabled	

E. Display states

	Event	State	Frequency	Remarks
E.1	Slot selecting: Slot A		500ms Interval	***For 4-slot professional charger, it does not have A/B parameter***
E.2	Slot selecting: Slot B		500ms Interval	***For 4-slot professional charger, it does not have A/B parameter***
E.3	Slot selecting: ALL slot		500ms Interval	***For 4-slot professional charger, it does not have A/B parameter***
E.4	Cell selecting: Cell 1 - 2 - 3 - 4		500ms Interval	***For 4-slot professional charger, it does not have A/B parameter***
E.5	Cell selecting: Cell 1		500ms Interval	***For 4-slot professional charger, it does not have A/B parameter***
E.6	Cell selecting: Cell 2		500ms Interval	***For 4-slot professional charger, it does not have A/B parameter***
E.7	Cell selecting: Cell 3		500ms Interval	***For 4-slot professional charger, it does not have A/B parameter***
E.8	Cell selecting: Cell 4		500ms Interval	***For 4-slot professional charger, it does not have A/B parameter***

E.9	Charge in progress (0%-30%)		500ms Interval	***For 4-slot professional charger, it does not have A/B parameter***
E.10	Charge in progress (30%-60%)		500ms Interval	***For 4-slot professional charger, it does not have A/B parameter***
E.11	Charge in progress (60%-90%)		500ms Interval	***For 4-slot professional charger, it does not have A/B parameter***
E.12	Mode selecting: Charge - Fast		500ms Interval	***For 4-slot professional charger, it does not have A/B parameter*** This occurs before confirmation.
E.13	Mode selecting: Charge - Eco		500ms Interval	***For 4-slot professional charger, it does not have A/B parameter*** This occurs before confirmation.
E.14	Mode selecting: Capacity check		500ms Interval	***For 4-slot professional charger, it does not have A/B parameter*** This occurs before confirmation.
E.15	Mode selecting: Conditioning		500ms Interval	***For 4-slot professional charger, it does not have A/B parameter*** This occurs before confirmation.
E.16	Mode selecting: Refresh		500ms Interval	***For 4-slot professional charger, it does not have A/B parameter*** This occurs before confirmation.
E.17	Mode selecting: Recovery		500ms Interval	***For 4-slot professional charger, it does not have A/B parameter*** This occurs before confirmation.
E.18	Status display: Fast charging		500ms Interval	***For 4-slot professional charger, it does not have A/B parameter*** This occurs when you check the status before it finishes.
E.19	Status display: Eco charging		500ms Interval	***For 4-slot professional charger, it does not have A/B parameter*** This occurs when you check the status before it finishes.

E.20	Status display: Capacity check		500ms Interval	***For 4-slot professional charger, it does not have A/B parameter*** This occurs when you check the status before it finishes.
E.21	Status display: Conditioning		500ms Interval	***For 4-slot professional charger, it does not have A/B parameter*** This occurs when you check the status before it finishes.
E.22	Status display: Refresh		500ms Interval	***For 4-slot professional charger, it does not have A/B parameter*** This occurs when you check the status before it finishes.
E.23	Status display: Recovery		500ms Interval	***For 4-slot professional charger, it does not have A/B parameter*** This occurs when you check the status before it finishes.
	Status display Example : follow VIEW CELL STATUS mode (C.10 - C.11)	1. When charging is done, if user does not select any cell, it does not display the mode.  2.  3.  4.  5. 	500ms Interval	***For 4-slot professional charger, it does not have A/B parameter*** This occurs when you check the status before it finishes.
E.24	Charge: HI complete		Solid	***For 4-slot professional charger, it does not have A/B parameter***

E.25	Charge: LO complete		Solid	***For 4-slot professional charger, it does not have A/B parameter***
E.26	Capacity Check complete		Solid	***For 4-slot professional charger, it does not have A/B parameter*** IF cell > 1 THEN do not display capacity (user then needs to manually select each cell to see the capacity)
E.27	Conditioning complete		Solid	***For 4-slot professional charger, it does not have A/B parameter***
E.28	Refresh complete		Solid	***For 4-slot professional charger, it does not have A/B parameter***
E.29	Recovery complete		Solid	***For 4-slot professional charger, it does not have A/B parameter***
	Complete Status display Example : follow VIEW CELL STATUS mode (C. 10 - C.11)	1.  2.  3.  4. 	Solid	***For 4-slot professional charger, it does not have A/B parameter***
E.30	Mode in progress		500ms Interval	***For 4-slot professional charger, it does not have A/B parameter***
E.31	Aged battery indicator		Solid	***For 4-slot professional charger, it does not have A/B parameter***

E.32	Dead Battery/error indicator		250ms Interval	***For 4-slot professional charger, it does not have A/B parameter***
E.33	Program paused/ Battery slot detection		750ms Interval	***For 4-slot professional charger, it does not have A/B parameter*** Note: To reset Pause state: ***1.*** Remove all slots and press resume ***2.*** Insert at least 1 Battery Slot THEN press Resume, once resume, pull Battery Slot
E.34	Battery Slot Missing		750ms Interval	***For 4-slot professional charger, it does not have A/B parameter*** T=10s THEN go to standby mode
E.35	Standby		Solid	***For 4-slot professional charger, it does not have A/B parameter***

F. Timeouts

	State	Action	Timer	Notes
1	No slot is inserted	go to Standby	Immediate	
2	Battery Slot Missing State	Standby	10 seconds	
3	No slot is selected	Run fast charging mode	5 seconds	
4	No program is assigned to cell	Run fast charging mode	45 seconds	
5	Standby	Display E.30	Until any slot is inserted	
6	Mode checking	Back to charge in progress	10 seconds	after checking the mode, when no button is pressed then back to charge in progress mode unless Slot is removed
7	Pause	Auto-Resume	120 seconds	If user doesn't press pause/play button after 120 seconds, THEN go to resume
8	Standby	Screen off	120 seconds	