Photonic Universe

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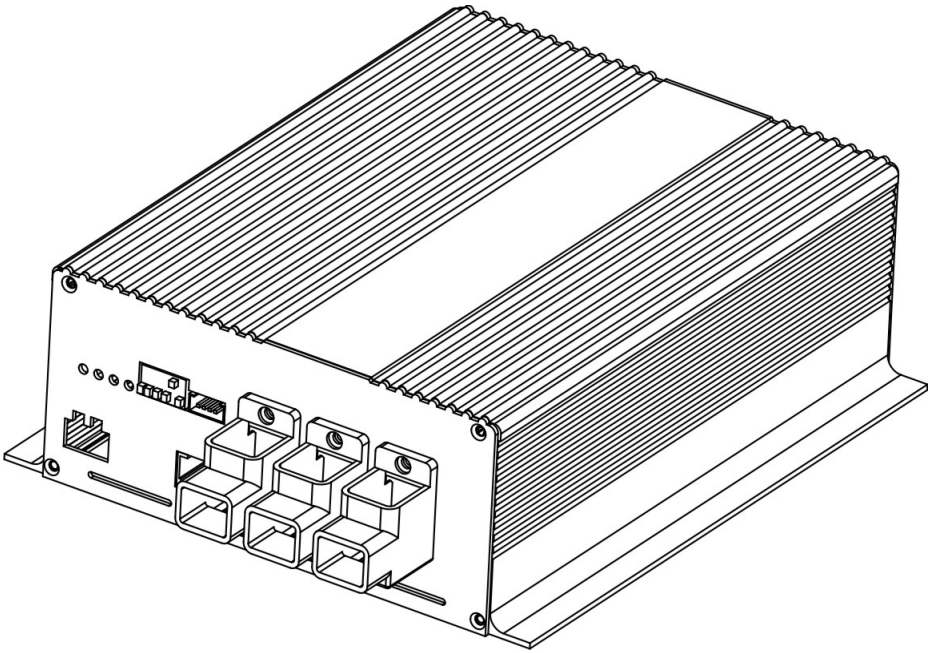
12V to 48V/36V DC to DC Battery Charger

DC1248-16 and DC1236-18 series

INSTRUCTION MANUAL



Overview

This 12V to 48V / 36V Photonic Universe DC-DC battery charger is fully automatic and ideal for leisure vehicles, commercial and special purpose vehicles, boats, and any other systems with multiple batteries or power sources. The charger operates using an adjustable three-stage charging programme and is suitable for lead acid, AGM, GEL, LiFePO4 and Lithium-ion (NCM) batteries. The product features high frequency switching and buck-boost power conversion technology for reliable, consistent performance.

The D+ terminal of the charger can activate the charging function automatically when the vehicle alternator starts, avoiding battery discharge when it stops. A range of protection functions enables the charger to automatically disconnect the target (OUT) battery from the source (IN) battery under extreme conditions, such as in case of overheating, overvoltage, short circuits, and over-currents. Backflow (from OUT to IN) is also prevented so the charge will not flow in the reverse direction.

The charger includes ports for a remote meter or a Bluetooth dongle (both sold separately), allowing data to be viewed on an LCD display or through a mobile phone app when connected.

An optional external temperature sensor (sold separately) can be connected to the charger for automatic adjustment of the charging voltages depending on the ambient temperature (lead-acid batteries only), keeping the charging programme to optimal voltages at very low or high temperatures.

The charger also features an automatic wake-up function for lithium batteries. When the Battery Management System (BMS) of a lithium battery goes into the protection mode, the charger can automatically activate the BMS and continue charging the lithium battery.

Installation

Install the battery charger as close to the target (OUT) battery as possible and keep the surrounding area clean, tidy, and well ventilated. This space should be moisture-proof, water-proof, and corrosion proof. Leave at least 10 cm of space around the charger for proper airflow.

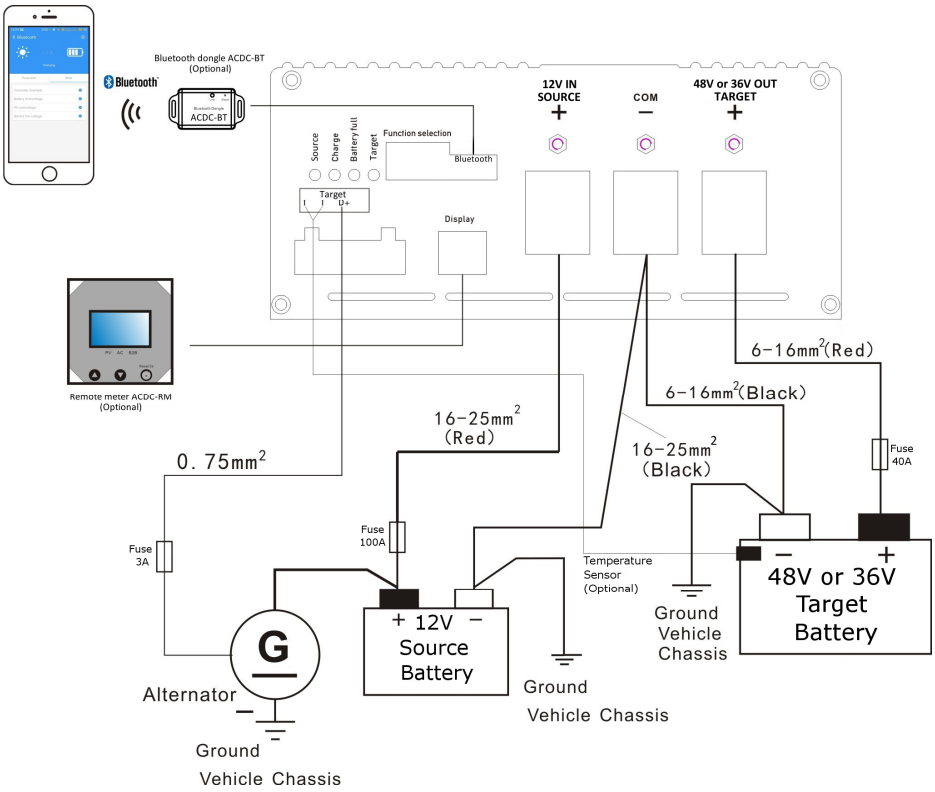
Note: before connecting and using the charger, please choose the type of target battery (lead-acid, GEL, AGM, LiFePO4, Lithium-ion (NCM)) by setting DIP switches 4-6. If you intend to charge a lithium battery in cold temperatures, ensure to verify if your battery can be charged at temperatures below 0°C, and adjust DIP switch 3 as needed. For more information, refer to the DIP switches section in this manual.

Use as short cables as possible, especially between the charger and the target battery. The recommended cable cross-section for “+” and “-” power cables is 1mm2 cross-section for every 3A of maximum charging current. Always connect the cables to the charger terminals first before connecting them to the battery terminals, to ensure you are not working with live cables. When connecting the cables to the battery terminals, ensure the positive and negative poles are not reversed or short-circuited.

Note: the current flowing between the charger and the source battery (12V) will be approximately 3-4 times greater than the current flowing between the charger and the target battery (48V / 36V). The thickness and the current rating of the connecting cables should be chosen accordingly, with the source battery connected by significantly thicker cables.

The fuses need to be located within 15 cm from the terminals of the batteries.

Connection diagram



Note: DIP switch 2 sets the trigger method to start the charger:

- If the trigger is set to D+ signal, the charger will require a D+ signal to operate. If there is no signal applied to the D+ terminal, the charger will not turn on.
- If the trigger is set to voltage control, the charger will turn on and off depending on the voltage of the source battery.

Please refer to the DIP switches section for more details.

Green terminals

The charger features a pluggable terminal block of 3 green terminals. In a place with limited installation space, the terminal block can be unplugged for connection or disconnection of the wires and then re-inserted. The size of the cable for this terminal block is 0.75mm² and the stripping length is about 6mm. Description of the terminal contacts is provided below.

"T T": these are the terminals for connecting an optional temperature sensor for measuring the temperature of the target battery.

If you install a temperature sensor, please ensure that it is not affected by any heat source. Fix it on the case of the target battery or connect it to the negative terminal of the battery.

A temperature sensor is highly recommended for lead acid batteries in case if the ambient temperatures vary substantially from the baseline temperature of 25°C. The sensor performs two main functions:

- Charging voltage adjustment. The charging voltage for the target battery is compensated up or down depending on the ambient temperature to regulate the speed of chemical reaction inside the battery. The voltage will increase in the winter and decrease in the summer at the rate of 72mV (48V battery) / 54mV (36V battery) for each degree Celsius away from the reference temperature 25°C.
- Battery protection. When the temperature is lower than -20°C or higher than 50°C, the charger limits the maximum charging current.

The charger can identify whether the temperature sensor is connected or not, or if it is damaged, short-circuited, or when an abnormal temperature is measured. In such case, the charger will automatically set the charging programme to the default temperature 25°C.

Note: there is no temperature compensation for lithium batteries.

"D+": this is the terminal for connecting a "D+" signal (12V +) from the alternator. This terminal controls the ON / OFF function of the charger if:

- The charger is used in a vehicle
- And the source battery (IN) is the vehicle's starter battery
- And DIP switch 2 of the charger is set to "D+" signal (please refer to the DIP switches section for more information).

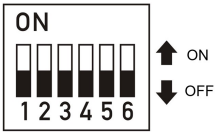
In such case, the charger will only operate at times when the alternator sends a "D+" signal to this "D+" terminal (when the alternator is working). The voltage range for this signal is 8V – 16V.

Alternatively, another connection option in a vehicle where the starter battery is used as a source battery, is to connect "D+" terminal of the charger to the 12V + signal from the ignition of the vehicle. In such case, if the ignition is ON, the charger will be ON and if the ignition is OFF, the charger will be OFF.

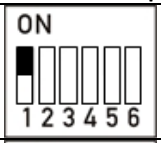
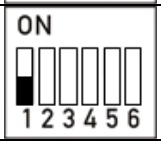
DIP switch 2 can also be set to operate the charger in a voltage control mode. In such case the charger will turn ON and OFF based on the voltage of the source (IN) battery. In this mode, the D+ signal is not required to operate the charger.

"NC": this is reserved as a spare terminal with no function and no need to connect anything.

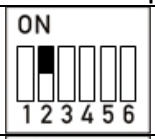
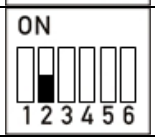
DIP switches



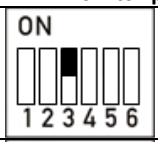
DIP switch 1: select charging power.

DIP switch position		Description
	1: ON	The charger runs at half the rated current
	1: OFF	The charger runs at full power

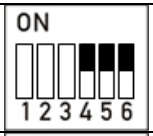
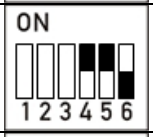
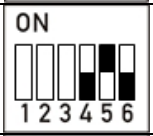
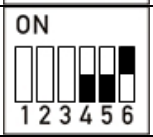
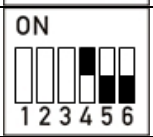
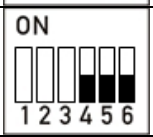
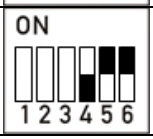
DIP switch 2: select the trigger method to start charging.

DIP switch position		Description
	2: ON	Voltage control mode: no need to connect “D+” signal to enable the charger to start. When the source battery voltage is > 13.2V, the charging will start automatically.
	2: OFF	“D+” control mode: the “D+” signal must be connected for the charger to start charging.

DIP switch 3: select the 0°C charging function for lithium batteries.

DIP switch position		Description
	3: ON	Target lithium battery will not charge if the ambient temperature is below 0°C.
	3: OFF	Target lithium battery will be charged even if the temperature falls below 0°C.

DIP switches 4, 5, and 6: select battery type.

DIP switch position		Battery type	Boost voltage	
			DC1248-16	DC1236-18
	4: ON 5: ON 6: ON	GEL	57.2V	42.9V
	4: ON 5: ON 6: OFF	Lead-acid	57.6V	43.2V
	4: ON 5: OFF 6: ON	AGM	58.8V	44.1V
	4: OFF 5: ON 6: OFF	LiFePO4	55.6V	41.7V
	4: OFF 5: OFF 6: ON	LiFePO4	56.8V	42.6V
	4: ON 5: OFF 6: OFF	LiFePO4	57.6V	43.2V
	4: OFF 5: OFF 6: OFF	LiFePO4	58.4V	43.8V
	4: OFF 5: ON 6: ON	Li-ion	50.4V	37.8V

Note: the battery type should not be changed whilst the charger is powered. If the battery type needs to be changed, first power off the charger, then change the DIP switch configuration, then turn the charger on again.

Note: any lithium battery used with this charger must have a Battery Management System (BMS). Charging of lithium batteries without BMS is not permitted.

Reduced current charging

The charger will measure the voltage of the source battery at the start and will continue measuring it throughout the charging process. If the voltage of the source battery is low at any point, the charging current will be reduced, until the *Recovery voltage* value is reached. The exact amount of charging current will depend on the D+ signal setting (DIP switch 2).

1. When DIP switch 2 is OFF ("D+" signal is required to start charging).

- Measurement of the source battery voltage at the start:

Note: the charger will need to detect a voltage from the source battery before charging, otherwise it will not start.

Source battery voltage at the start	Input current		Output current	
	DC1248-16	DC1236-18	DC1248-16	DC1236-18
>= 12.6V	70A	63A	15.4A	18.5A
< 12.6V	20A	20A	4.4A	5.8A

- Measurement of the source battery voltage during charging:

Source battery voltage during charging	Input current		Recovery voltage	Input current after recovery	
	DC1248-16	DC1236-18		DC1248-16	DC1236-18
< 12.3V	60A	52A	12.6V	70A	63A
< 12.1V	50A	44A	12.45V	60A	52A
< 11.9V	40A	36A	12.3V	50A	44A
< 11.7V	30A	28A	12.15V	40A	36A
< 11.5V	20A	20A	12.0V	30A	28A
< 11.2V	Stops charging		12.6V	70A	61.5A

2. When DIP switch 2 is ON (i.e. there is no need to connect the "D+" signal), the charger automatically starts charging when the source battery voltage is >= 13.2V, and reduces the charging current if the voltage of the source battery drops during charging.

Source battery voltage during charging	Input current		Recovery voltage	Input current after recovery	
	DC1248-16	DC1236-18		DC1248-16	DC1236-18
>= 13.2V	70A	63A	-	-	-
< 12.6V	60A	52A	13.0V	70A	63A
< 12.4V	50A	44A	12.9V	60A	52A
< 12.2V	40A	36A	12.8V	50A	44A
< 11.9V	Stops charging		13.2V	70A	63A

LED indicators

Note: when the charger starts, it performs a self-test during which all of the LED indicators are on for 1 second.

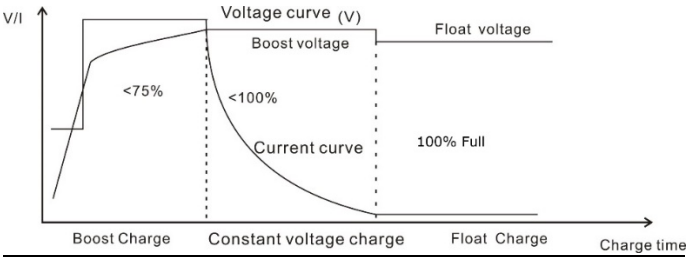
LED	Colour	LED status	Charger status
Source	Green	OFF	No D+ signal, no charging
		Slow flashing (1 flash / 5 seconds)	Source battery voltage is < 11.5V. If the source battery voltage reduces further to < 11.2V, the charging will stop. It resumes when the voltage returns to 12.5V.
		Fast flashing (1 flash / 1 second)	Source battery voltage is higher than 16V
		ON	Source battery voltage is normal
Charge	Yellow	OFF	No charging
		Slow flashing (1 flash / 2 seconds)	Lithium battery does not charge below 0°C
		Fast flashing (1 flash / 1 second)	Charger is overheated
		Extended flashing (4 seconds ON and 1 second OFF)	Reduced current charging (battery temperature > 50°C or < -20°C)
		ON	Charging
Battery full	Green	OFF	No charging
		Short flashing (1 flash / 5 seconds)	Boost (constant current) charging stage
		Fast flashing (1 flash / 1 second)	Absorption (constant voltage) charging stage
		ON	Battery full
Target	Red	Slow flashing (1 flash / 5 seconds)	Target battery voltage is normal
		Fast flashing (1 flash / 1 second)	Target battery over-voltage, high voltage disconnect (HVD)
		ON	Target battery low-voltage, low voltage disconnect (LVD)

Charging process

Boost (constant current) charging stage: during this stage, the charger will charge the target battery with the maximum rated current until the target battery voltage reaches the boost voltage.

Absorption (constant voltage) charging stage: when the target battery voltage reaches the boost voltage, the charger will enter the absorption (constant voltage) charging stage. During this stage the charger will maintain the boost voltage and the charging current will gradually reduce. This stage will last for 1 or 2 hours depending on the battery type.

Float charging stage: after the absorption stage, the charger will reduce the charging voltage to the float voltage and continue charging the target battery with a low current to maintain it at this level.



Equalisation: for selected battery types, the charger will perform equalisation charging by timer once a month with a higher charging voltage, in order to bring all battery cells to the same level. Equalisation charging will last for 2 hours. Please refer to the battery types table for more information.

Note: if the target battery voltage is > 50.4V (for 48V battery) / > 37.8V (for 36V battery) at the start of the charging process, the charger will not perform the absorption (constant voltage) stage and will instead charge to the boost voltage level and then go straight to the float charging stage.

Protection functions

Protection	Description
Target battery overvoltage	If the target battery voltage is > High Voltage Disconnect (HVD) voltage, the charging will stop. If the target battery voltage is > boost voltage value + 0.2V for 10 seconds, the charging will stop.
Target battery low voltage	If the target battery voltage is < Low Voltage Disconnect (LVD) voltage, the charging will stop.
Source battery low voltage	• "D+" signal control mode: if the source battery voltage is between 11.2V - 12.3V, the charging current is reduced. If the source battery voltage is < 11.2V, the charging stops. • Voltage control mode: if the source battery voltage is < 12.6V, the charging current is reduced. If the source battery voltage is < 11.9V, the charging stops.
Overpower	DC1248-16: the input current is kept within the maximum of 70A, the input power is kept within the maximum of 923W. DC1236-18: the input current is kept within the maximum of 61A, the input power is kept within the maximum of 826W.
Battery reverse polarity	If the target or the source battery is connected with a reverse polarity, it will blow the fuse inside the charger and may also cause hardware damage to the charger. Please contact the supplier of the charger with all the details, including which battery was connected with a reversed polarity.

Overheating (internal temperature)	• If the temperature is > 70°C / 68°C but < 72°C / 70°C, the charger tries to limit the input current to reduce the temperature. • If the temperature is > 72°C / 70°C, the charging stops. • If the temperature is > 60°C for 2 minutes, the charging stops. In case if overheating protection stops charging, the charger can automatically resume charging when the temperature falls below 50°C. The charger will resume in half-power charging mode. Full power mode can be restored if the charger is turned off and on again. *(where the values are separated by /, the first value refers to the DC1248-16 model and the second value to the DC1236-18 model)*

Charging parameters

Battery type	GEL	Lead-acid	AGM	LiFePO4	Lithium-ion (NCM)
Boost charging voltage	57.2/42.9V	57.6/43.2V	58.8/44.1V	55.6/41.7V 56.8/42.6V 57.6/43.2V 58.4/43.8V	50.4/37.8V
Absorption (constant voltage) charging time	2h	2h	2h	1h	1h
Float charging voltage	55.2/41.4V	54/40.5V	54/40.5V	55.2/41.4V	50/37.5V
Equalisation charging voltage	-	58.4/43.4V	59.2/44.2V	-	-
High voltage disconnect (HVD) protection	62/46.5V	62/46.5V	62/46.5V	62/46.5V	54/40.5V
High voltage recovery voltage	54.8/41.1V	54.8/41.1V	54.8/41.1V	59.2/44.4V	51.2/38.4V
Low voltage alarm	44/33V	44/33V	44/33V	44/33V	37.2/27.9V
Boost charging recovery voltage*	52.8/39.6V	52.8/39.6V	52.8/39.6V	52.8/39.6V	48/36V
Safety charging voltage when < -20°C or > 50°C	51.2/38.4V	51.2/38.4V	51.2/38.4V	52/39V	48/36V

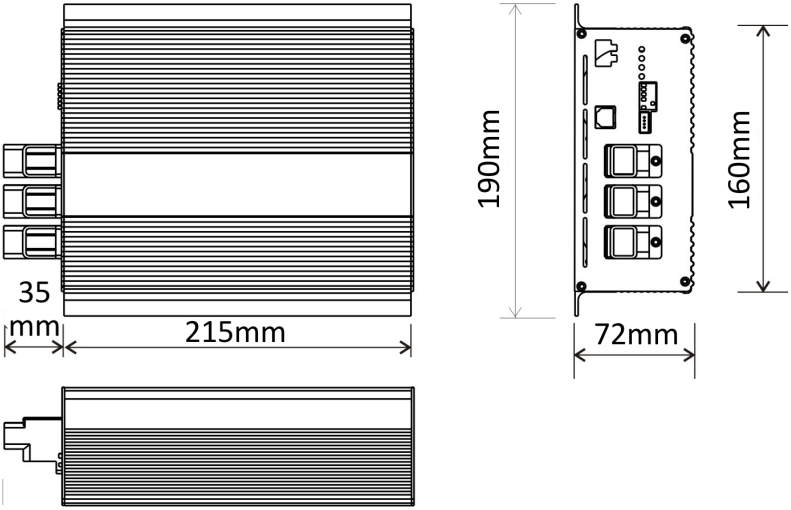
(where the values are separated by /, the first value refers to the DC1248-16 model and the second value to the DC1236-18 model)

* *When the charger is in the Float charging stage and the target battery voltage drops to this level, the charger re-enters the Boost charging stage with the maximum charging current.*

Specifications

Model	DC1248-16	DC1236-18
Target battery		
GEL, Lead-acid, AGM rated voltage	48V	36V
LiFePO4 rated voltage	51.2V	38.4V
Lithium-ion (NCM) rated voltage	44.4V	33.3V
Battery operating voltage range	28V - 59.2V	21V - 44.4V
Source battery		
Battery rated voltage	12V	
Minimum recommended capacity	60AH	
Battery voltage input range	11.5V - 16V	
Maximum input power	910W	820W
Maximum input current	70A	63A
Maximum charging current of target battery	15.4A	18.5A
Effective “D+” signal voltage range	8 - 16V	
Temperature compensation	-72mV/°C	-54mV/°C
Target battery temperature sensor input "T T"	Yes	
Standby current	< 35mA	
Weight	1.7kg	
Dimensions	215 × 190 × 72mm	
Operating temperatures	-20°C to 50°C	

Dimensions



CB and CBR circuit breakers (optional)

Optional surface mounted (CB series) and recess mounted (CBR series) DC circuit breakers can be purchased from Photonic Universe and used instead of fuses when connecting this charger to the source and target batteries. The range of circuit breakers includes 30A - 80A circuit breakers rated for 12V / 24V / 48V systems with product codes ***CB30*** – ***CB80, CBR40***, ***CBR80***.

Temperature Sensor DCDC-TS (optional)

This charger is compatible with an optional temperature sensor **DCDC-TS**. The sensor will measure the external temperature of the target battery and provide the real time temperature readings to the charger for voltage adjustment and protection (see the above section about "T T" terminals for reference). The voltage adjustment applied for lead acid batteries is 72mV/°C for 48V batteries and 54mV/°C for 36V batteries. If the temperature sensor is not connected, the charger will charge the target battery based on the default temperature settings for 25°C.

Remote Monitor ACDC-RM (optional)

An optional remote LCD monitor **ACDC-RM** can be connected to the charger to display charging parameters such as real time battery voltage, charging current, charging Ah, charging Wh and any fault information.

Bluetooth dongle ACDC-BT (optional)

Using an optional Bluetooth dongle **ACDC-BT**, the charger can be connected to a mobile phone app to allow the user to monitor charging parameters such as real time battery voltage, charging current, charging Ah, charging Wh and any fault information.

To setup the Bluetooth dongle and connection to the mobile phone, please install the correct and up-to-date version of the app using the name, links or QR codes for the app provided in a separate user manual for the Bluetooth dongle.

If you would like to purchase any of these optional extras, please visit our online shop

www.PhotonicUniverse.com

or call 0203 150 1111 (international +44 203 150 1111) for a phone order.

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