



Manual

EN

Appendix

## **Buck-Boost DC-DC Converter 25A / 50A / 100A**



## Introduction 400/800/1600

### Full range programmable DC/DC converter 25/50/100A.

The solution for battery charging problems with Euro 5 and Euro 6 engines and alternator charge current protection with lithium systems.



### Applications:

- Controlled charging of an extra/second battery
- Automatic activation and deactivation of electric devices in vehicles controlled by a unique engine running detection protocol

### General features:

- Buck-Boost converter is fully programmable
- Input voltage 10..30 Vdc
- Output voltage 10..30 Vdc
- Output current (max.at 12V) 25, 50 or 100A
- Output current (max.at 24V) 12,5, 25 or 50A
- Adjustable current limiter
- Automatic activation when engine running
- Output for activation/deactivation of loads
- Battery temperature monitoring (optional)
- LED status indicators
- M8 connections
- USB for configuration/monitoring
- Battery monitor

### General description:

The Buck/Boost converter series is a program of specially developed DC/DC converters for fully-controlled charging of an extra battery or a battery bank. Application is necessary in the case of vehicles with an alternator intelligent control, and for general protection of the alternator in lithium systems.

Alternators of Euro 5 and 6 engines, which are controlled by the onboard electronics, often supply too low charging voltage even with the engine running. As a result, a buck/boost converter is necessary to charge the extra battery. In the case of lithium systems, the alternator must be protected against overload, resulting in overheating, which arises because the voltage control of the alternator cannot anticipate zero resistance of lithium battery systems.

To ensure that the start battery of the vehicle is always loaded with priority, the units of Buck/Boost series will only provide power when the engine is running. This is possible thanks to the built-in engine running detection and the related programmable time-delayed switching. This also prevents the onboard voltage of the vehicle from becoming too low. It is not necessary to intervene in the system of the vehicle, install a separate motor run sensor or intervene in the CAN bus system. Apart from this detection, the Buck/Boost series equipment can also be switched on with a programmable input.

The Buck/Boost series is fully programmable through a very simple and easy PC application. The output current has an automatic limitation that is adjustable. The automatic stop becomes active as soon as the temperature comes close to a pre-set maximum.

The output voltage is fully adjustable and is independent of the input voltage due to the automatic Buck/Boost control. This control also ensures that the current will never exceed the set value. Also not when the input voltage is higher than the output voltage.

## Warnings

Read this manual carefully before installing and commissioning the equipment.  
Store the manual carefully and pass it on to a new user of this product!

## Explanation of the symbols used



### **DANGER!**

Safety instruction:  
Failure to comply will result in death or serious injury.



### **WARNING!**

Safety instruction:  
Failure to comply may result in death or serious injury.



### **CAUTION!**

Failure to do so may result in property damage and limit the functionality of the product.



### **INSTRUCTION**

Additional information for operating the product.




## General safety instructions

The manufacturer cannot be held liable for damage in the following cases:




- mounting or connection errors
- product damage by mechanical impacts and overvoltage
- modifications of the product without the express permission of the manufacturer
- use with purposes other than those described in the manual

For safety reasons when installing and using electrical appliances, always observe the risks of electric shock, fire risk and injury!




## General safety

	<p><b>DANGER!</b> Use a fire extinguisher suitable for electrical appliances in the event of a fire. Always have a fire extinguisher at hand in the premises and use it appropriately.</p>
	<p><b>WARNING!</b></p> <ul style="list-style-type: none"> <li>• Use the equipment only according to the instructions.</li> <li>• Make sure that the plus (+) and minus (-) poles never touch each other.</li> <li>• Disconnect the product from the battery when: <ul style="list-style-type: none"> <li>– performing cleaning and maintenance</li> <li>– replacing a fuse (only by specialists)</li> </ul> </li> <li>• for disassembly of the product: <ul style="list-style-type: none"> <li>– Disconnect all connections.</li> <li>– Ensure that all inputs and outputs are energized.</li> </ul> </li> <li>• If the product or connecting cable is visibly damaged, the product should not be put into operation.</li> <li>• If the connection cable of this product is damaged, it must be replaced by a qualified personnel.</li> <li>• Repairs to this product may only be performed by the manufacturer. Improper repairs can lead to considerable hazards.</li> <li>• This product must not be used by children and by persons with reduced physical, sensory or mental abilities or lacking necessary experience and knowledge. Users should have insight into the dangers that the use of the product entails.</li> <li>• Electrical appliances are not toys. Store and use the product for this reason out of reach of children, and ensure that children do not play with the product.</li> </ul>
	<p><b>CAUTION!</b></p> <ul style="list-style-type: none"> <li>• Before commissioning, ensure that the set voltage of the product corresponds to the system voltage of the existing energy supply.</li> <li>• Pay attention that other objects cannot cause a short circuit at the contacts of the device.</li> <li>• Store the product in a dry and cool place.</li> </ul>



## Safety when assembling the product

	<p><b>DANGER!</b> Do not mount the product in places where there is a risk of a gas or dust explosion.</p>
	<p><b>WARNING!</b> Provide a stable mounting! The product must be securely mounted and attached to prevent it falling, dropping, and preventing contact of the connections with surrounding objects.</p>
	<p><b>CAUTION!</b></p> <ul style="list-style-type: none"> <li>• Do not expose the product to heat sources (solar radiation, heating, etc.).</li> <li>• Avoid additional heating of the product.</li> <li>• Install the product in a dry place protected against splashing water.</li> </ul>



## Safety at the electrical connection of the product

	<p><b>DANGER!</b> Risk of fatal electric shock!</p> <ul style="list-style-type: none"> <li>• When working on the electrical system, make sure that someone is around who can help in case of an emergency.</li> <li>• When installing on boats: Improper installation of electrical appliances on boats can cause corrosion damage to the boat. Have the product connected by a qualified electrician.</li> </ul>
	<p><b>WARNING!</b></p> <ul style="list-style-type: none"> <li>• Provide a sufficient cable intersection.</li> <li>• Mount the cables so that they cannot be damaged by doors or hoods. Crushed cables can lead to life-threatening situations, and should be replaced.</li> <li>• Install the cables in such a manner that they cannot be tripped over, and any damage to cables is excluded.</li> </ul>
	<p><b>CAUTION!</b></p> <ul style="list-style-type: none"> <li>• Use wire conduits if cables are to be routed through sheet walls or other feedthroughs with sharp edges.</li> <li>• Do not combine an AC cable and DC cable in the same channel (wire conduit).</li> <li>• Do not loosen the conduits or sharply kink them.</li> <li>• Attach the cables with the right materials and tools.</li> <li>• Never pull the cables, take sufficiently long cable lengths of sufficient intersection in relation to its length.</li> </ul>

## Safe use of the product

	<p><b>WARNING!</b> If the product is used in environments with lead-acid batteries, the room should be well ventilated. Explosive hydrogen gas is released from these batteries, which can be ignited by electric sparks.</p> <p><b>CAUTION!</b></p> <ul style="list-style-type: none"> <li>• Do not use the appliance             <ul style="list-style-type: none"> <li>– in a salt-containing, damp or wet conditions</li> <li>– nearby aggressive vapours</li> <li>– near flammable materials</li> <li>– in explosive environments</li> </ul> </li> <li>• Before use, check that the cables and connections are dry.</li> <li>• Always disconnect the power supply when working on the product.</li> <li>• Parts of the product may still be energized after the product has been disconnected.</li> <li>• Do not disconnect cables when the product is still in use.</li> </ul>
	<p><b>CAUTION!</b></p> <ul style="list-style-type: none"> <li>• Prevent the product from being covered or being installed in a space that is too small.</li> <li>• Provide proper ventilation.</li> </ul>

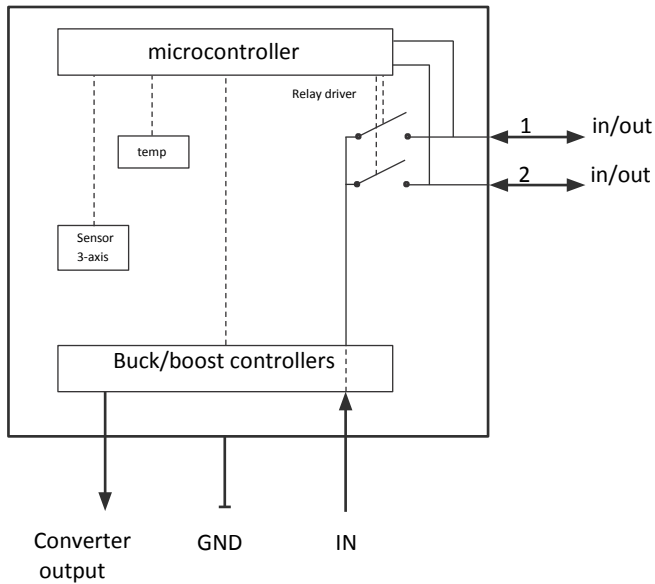
## Safety when handling batteries

	<p><b>WARNING!</b> Batteries may contain harsh and corrosive acids. Avoid any and all physical contact with the battery fluid. In case of skin contact with battery fluids, wash the affected areas of the skin with water. In case of injuries due to acids, please be sure to consult a physician.</p> <p><b>CAUTION!</b></p> <ul style="list-style-type: none"><li>• When working with batteries do not wear metal objects such as watches or rings.</li><li>• Lead-acid batteries can cause short-circuit currents that can lead to serious burns.</li></ul> <p><b>Risk of explosion!</b></p> <ul style="list-style-type: none"><li>• Wear protective goggles and safety clothing when working on batteries. When working with batteries, do not touch your eyes .</li><li>• Do not smoke and make sure there are no sparks nearby the engine or the battery.</li><li>• Do not attempt to charge frozen or defective batteries. In this case, place the battery in a frost-free room and wait until the battery is at ambient temperature. Then start the loading procedure.</li></ul>
	<p><b>CAUTION!</b></p> <ul style="list-style-type: none"><li>• Use only rechargeable batteries.</li><li>• Use sufficient cable intersections.</li><li>• Secure the positive cable with a fuse.</li><li>• Prevent metal parts from falling on the battery. This may result in sparks or short-circuiting of the battery and other electrical parts.</li><li>• Pay attention to the correct polarity when connecting.</li><li>• Please observe the battery and equipment manufacturers' instructions listed in corresponding manuals.</li><li>• In case the battery needs to be removed, always disconnect the ground connection first. Then disconnect all other connections and disconnect all consuming points from the battery before removing it.</li></ul>

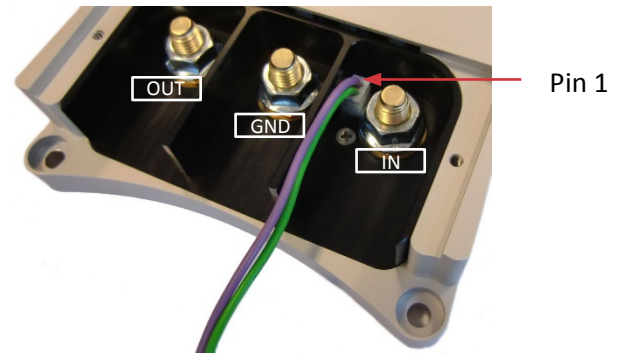
## Connection



### Simplified diagram:



### Connections:



- IN : Converter **input** (alternator/starter battery)
- GND : GND (chassis)
- OUT : Converter **output** (extra battery)
- Pin 1 : Input/output (purple wire)
- Pin 2 : Input/output (green wire)





## LED indicators

The Buck-Boost DC-DC converter is equipped with two RGB LEDs.

The **IN** LED has the following functions:

Green: The converter is switched on (by the engine running detection, or by applying a voltage on pin 1).

Yellow: The input voltage is lower than the set threshold to allow the converter to switch on.

Red: The internal temperature is higher than the set safety threshold. The converter is switched on

Blue: Short light pulses = the engine running detection is active, the converter turns on after a delay.  
Flashes slowly = the converter is switched off and blocked for switching on due to A too low input voltage.

The **OUT** LED has the following functions:

Green: The converter is switched off. The connected battery has a correct terminal voltage.

Yellow: The converter is switched off. The connected battery has too low a terminal voltage.

Red: The converter is switched off. The connected battery is empty or the battery is not connected.

Purple: The converter is switched on and supplies power to the connected battery and/or electrical consuming points.

(The normal alerts of each LED blinks slowly for power saving)

## Engine running detection

The converter has a unique engine running detection in order to be able to detect a running vehicle engine. This prevents the converter from charging the starter battery if the alternator does not supply power.

The converter is switched on:

When the engine is running and the supply voltage is  $\geq$  (adjustable) volts **and** any (adjustable) minute blocking is over.

## Pin 1 input (as an alternative to the engine running detection)

The converter may also be switched on with a switch or relay contact.

Switch on:

The converter is switched on:

If pin 1 input  $\geq$  2 volts, **and** the supply voltage is  $\geq$  (adjustable) volts **and** any blocking is over.

## Important when installing!

### Basic settings

At the time of commissioning, the following basic settings shall be applied:

Setting	12V – 12V	24V – 24V	12V – 24V
20 Output voltage	14,4V	28,8V	28,8V
22 Maximum output current	60% of the current supplied by the vehicle's alternator (max.)		
24 Undervoltage threshold	11,8V – 12,2V	23,8V – 24,2V	11,8V – 12,2V

### On-board voltage

The on-board voltage under setting 24 of the TS Config software shall not be set too low. This value may be adjusted by a qualified electrician only!

## Input fuse

Use the following input fuse and cable intersection depending on the TS-Buck/Boost type:

Buck-Boost type	Input fuse	Cable thickness (< 5 m)
400	40 Ampere (A)	25 mm <sup>2</sup>
800	60 Ampere (A)	35 mm <sup>2</sup>
1600 *)	125 Ampere (A)	70 mm <sup>2</sup>

**\*) CAUTION! When using the 1600 type, a dynamo is required with sufficient load capacity to maintain the 120 A flow which the converter needs to be able to supply (at 100 A charging current).**

First connect all GND cables to the converter, the battery and the chassis, and then only the positive (+) cable. This is important because in the converter everything refers to GND.

When the two plus (+) cables are connected without GND, the potential difference between the plus (+) connections ensures uncontrolled and unsecured currents!

Always check that the GND connection on the middle M8 connection is correctly connected.

The converter has no reverse polarity protection!

## Converter operation

The Buck-Boost DC-DC converter operates on the principle of buck-boost.

This means that the input voltage may be both higher and lower than the set output voltage. The amount of the charge current remains in both situations always fully under control.

A brief overview of possible conversions:

Buck-Boost type	12V – 12V Default	24V – 24V Default	12V – 24V Default
400 charging current max.	25A	15A	10A
800 charging current max.	50A	25A	20A
1600 charging current max.	100A	50A	50A

## Charging current limiter

The output current is determined by the following factors:

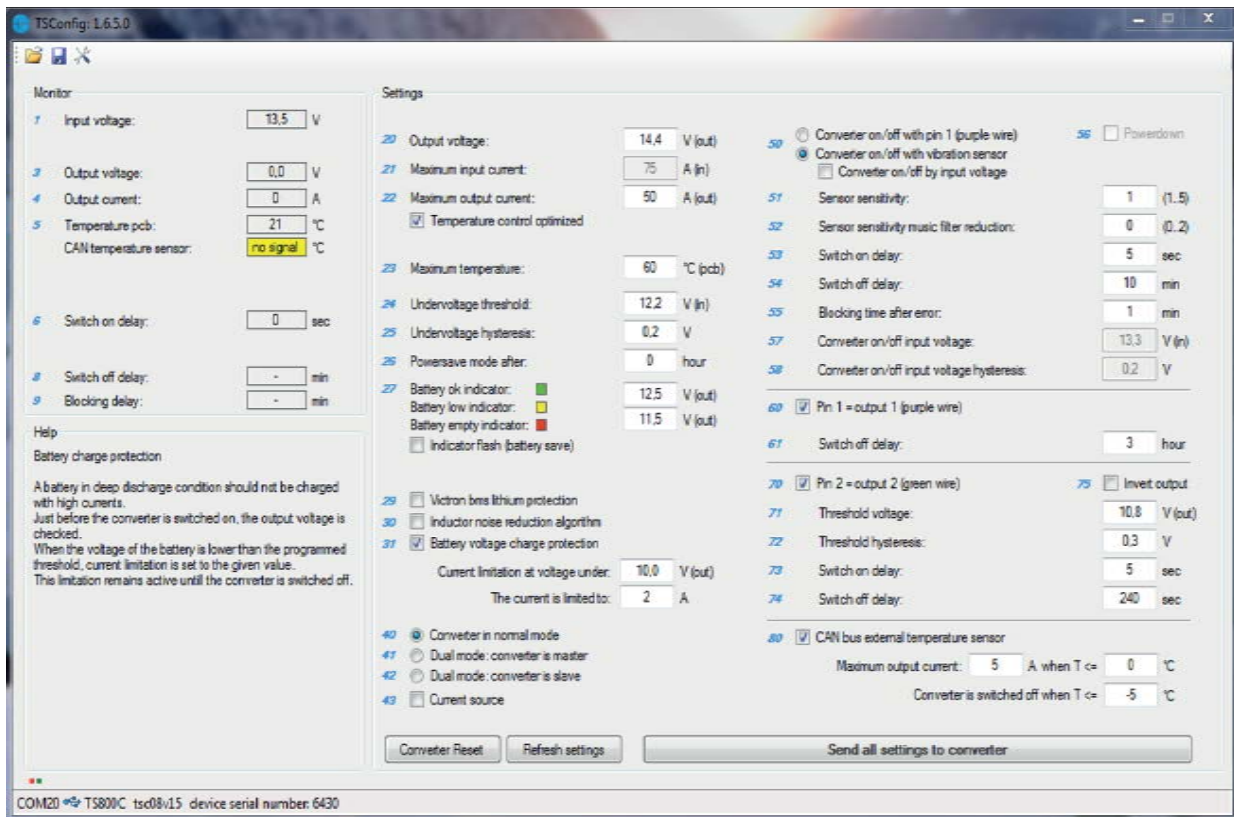
Setting: The maximum desired charging current (0..50A) is set via the USB connection (with the Windows application *TSConfig*).

Temperature: If the converter temperature comes close to the set maximum temperature, the charging current is automatically limited so that the temperature is never permitted high.

## TSConfig application

The Buck/Boost converters can be configured extensively with TSConfig software. This software also includes a monitor window, where real-time operation of the converter can be tracked.

The following image shows a screenshot of the TSConfig software:

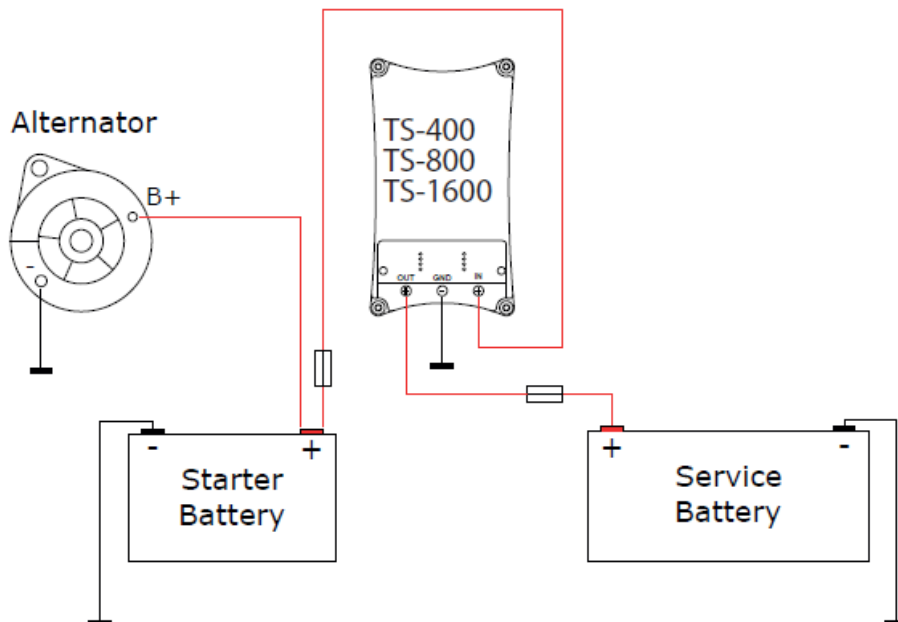


The TSConfig software and manual can be downloaded from: <https://www.victronenergy.com/support-and-downloads/software>

## Technical specifications

Buck-Boost DC-DC Converter	25A	50A	100A
Input voltage range	10-35V		
Threshold undervoltage	10V		
Output voltage range	10-30V		
Maximum charging current	12V : 25A    24V : 15A	12V : 50A    24V : 25A	12V: 100A    24V: 50A
Power consumption			
Converter switched off, LEDs from energy saving mode)	5mA		
Input voltage on/off (pin 1, purple wire)			
Threshold voltage 'On'	> 2 V		
Maximum input voltage	60 V		
Output pin 1 and pin 2			
Output voltage as enabled	$V_{pinout} = V_{in}$		
Maximum voltage (per pin)	$I_{pinout} = 1,5 A$		
GENERAL			
Operating temperature range	-25...+80°C		
Ambient temperature	Max power at 40°C		
Weight	0,6 kg	1.4 kg	4,1 kg
Dimensions	165 x 120 x 30 mm	213 x 120 x 30 mm	288 x 162 x 95 mm

## Wiring diagram





Distributor:

Serial number:

Version: 05

Date : January 15<sup>th</sup>, 2019

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