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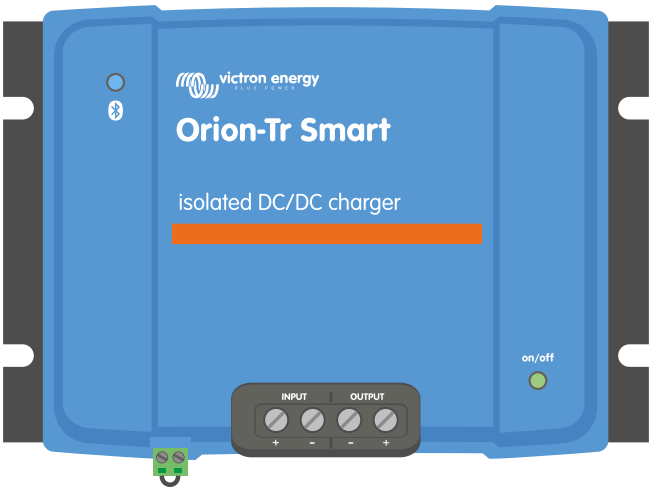

Orion-Tr Smart DC-DC Charger Isolated

Rev 15 - 11/2026
This manual is also available in HTML5.

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1. Safety precautions

- Read this manual carefully before installing and operating the product. It contains important instructions that must be followed during installation, operation and maintenance.
- Save these instructions for future reference on operation and maintenance.

- Never use the product at sites where gas or dust explosions could occur.
- Never place the charger on top of the battery when charging.
- Prevent sparks close to the battery. A battery being charged could emit explosive gasses.
- Danger of explosion from sparking.
- Danger of electric shock.
- Install the product in a heatproof environment. Ensure that there are no chemicals, plastic parts, curtains or other textiles, etc., in the immediate vicinity of the equipment.
- Ensure that the equipment is used under the correct operating conditions. Never operate it in a wet environment.
- It is normal for the Orion Smart DC-DC charger to get hot during operation; keep any heat-sensitive objects away and provide proper ventilation.
- For very hot environments, consider mechanical air extraction.
- The Orion-Tr Smart DC-DC Charger is potted inside. Because of this, there is a noticeable smell when running at maximum power (or close to it) and getting warm/hot. This smell is not harmful to health.
- Avoid covering the charger.
- Refer to the specifications provided by the battery manufacturer to ensure that the battery is suitable for use with this product. The battery manufacturer's safety instructions should always be observed.
- In addition to this manual, the system operation or service manual must include a battery maintenance manual applicable to the type of batteries used.
- This device is not to be used by persons (including children) with reduced physical, sensory or mental capabilities or lack of experience and knowledge unless they have been given supervision or instruction.

- Use flexible multi-stranded copper cables for the connections. The maximum diameter of the individual strands is 0,4mm/0,125mm² (0.016 inch/AWG26). Check the Cable and fuse recommendations [4] section for details.
- The installation must include a fuse in accordance with the recommendations in the table Cable and fuse recommendations [4].
- The product is not protected against reverse polarity. Be sure to check polarity before and during battery connection. For details, see Polarity check before connecting the battery [6].

2. Introduction

The Orion-Tr Smart DC-DC Charger can be used as a power supply or battery charger. In charger mode, the three-state charge algorithm will increase battery life by properly charging the battery. Especially in the case of vehicles with a smart alternator, controlled charging is indispensable. Controlled charging will also protect the alternator in lithium systems where direct charging can overload the alternator due to the low impedance of the lithium battery. In fixed output mode, the output voltage will remain stable independent of the applied load or varying input voltage (within the specified range).

The Orion-Tr Smart DC-DC Charger can be set up to only provide power when the engine is running. This is possible thanks to the built-in engine shutdown detection. This also prevents the onboard voltage of the vehicle from becoming too low. It is not necessary to intervene in the vehicle system, to install a separate motor run sensor or to intervene in the CAN-bus system. Apart from this detection, the Orion smart charger can also be activated by a forced allowed-to-charge feature, e.g. connected to the ignition switch.

The Orion-Tr Smart DC-DC Charger is configured and monitored via the VictronConnect app. Discover all setup possibilities in the VictronConnect manual.

3. Features

Smart alternator compatibility

Vehicle manufacturers are now introducing smart ECU (Engine Control Unit) controlled alternators to increase fuel efficiency and reduce emissions. Smart alternators deliver a variable output voltage and are shut down when they're not needed. The converter has an engine-running detection mechanism. This prevents the converter from discharging the starter battery when the alternator does not supply power. See section 5 of this manual for more details.

Separation of the starter battery and the service battery

The Orion-Tr Smart DC-DC Charger separates the starter and service batteries when the engine is not running.

Extensive electronic protection

Over-temperature protection and power derating when temperature is high.

- Overload protected.
- Short circuit protected.
- Connector over-temperature protection.

Adaptive three-step charging

The Orion-Tr Smart DC-DC Charger is configured for a three-step charging process:

Bulk – Absorption – Float.

Bulk

During this stage, the controller delivers as much charge current as possible to rapidly recharge the batteries.

Absorption

The controller switches to constant voltage mode when the battery voltage reaches the absorption voltage setting. For lead acid batteries, it is important that the absorption time is kept short during shallow discharges to prevent overcharging of the battery. After a deep discharge, the absorption time is automatically increased to make sure that the battery is completely recharged. For lithium batteries, absorption time is fixed, default 2 hours. The fixed or adaptive mode can be chosen in the battery settings, and the minimum absorption time for the adaptive or fixed absorption time mode is adjustable via VictronConnect.

Float

During this stage, float voltage is applied to the battery to maintain it in a fully charged state. When the battery voltage drops substantially below this level due to a high load, for example, for at least 1 minute, a new charge cycle will be triggered.

Flexible charge algorithm

Programmable charge algorithm and eight preprogrammed battery settings. Configurable with VictronConnect.

Adaptive absorption time

Automatically calculates the proper absorption time. Configurable with VictronConnect.

Configuring and monitoring

Bluetooth Smart built-in: the wireless solution to set up, monitor and update the controller using Apple and Android smartphones, tablets or other devices. Several parameters can be customized with the VictronConnect App.

The VictronConnect App can be downloaded from: https://www.victronenergy.com/support-and-downloads/software

Use the VictronConnect manual - to get the most out of the VictronConnect App when connected to an Orion Smart.

Input voltage lock-out

Shut down if the input voltage drops below the lock-out value and restart when the input voltage increases above the restart value. Configurable with VictronConnect.

Remote on/off

Use the remote function to enable and disable the charger remotely with the remote on/off connector or the VictronConnect App. Typical use cases include a user-operated hard-wired switch and automatic control by, for example, a Battery Management System.

4. Installation

4.1. Mounting

- Mount vertically on a non-flammable surface, with the power terminals facing downwards.
- Observe a minimum clearance of 10 cm under and above the product for optimal cooling.
- Mount close to the battery, but never directly above the battery to prevent damage due to gassing of the battery.
- Please see the Appendix [33] of this manual for the dimension drawing; this drawing also indicates the mounting holes.

4.2. Cable and fuse recommendations



- Use flexible multi-stranded copper cables for the battery connections.
- The diameter of the individual strand of the cable used should not exceed 0.4mm (0.016 inch) or have a surface area exceeding 0.125mm² (AWG26).
- The maximum operating temperature is 90°C (194°F).
- A 16mm² cable, for example, should have at least 122 strands (class 5 or higher stranding according to VDE 0295, IEC 60228 and BS6360). Example of suitable cable: class 5 “Tri-rated” cable (it has three approvals: American (UL), Canadian (CSA) and British (BS)).
- In the case of thicker strands, the contact area will be too small, and the resulting high contact resistance will cause severe overheating, eventually resulting in fire. See the below figure for examples of what cable to use and not to use.



Cable type recommendation

For correct connection of a cable to the input/output screw terminals, stranded wires with flexible and very flexible cores can be used according to:

- IEC 60228 - Class 2 (stranded), Class 5 (flexible), Class 6 (very flexible)
- UL486A-B - Class B/C (stranded), Class I (flexible), Class K (very flexible)

Cables with twisted cores are very stiff, which means that they are rarely used in practice. The table below provides an overview of how to recognise the different wire classes.

Single wire diameter in the bundle				
Nominal cross-section	**Class 5 (IEC)**	**Class 6 (IEC)**	**Class I (UL)**	**Class K (UL)**
9AWG			24AWG	30AWG
6mm²	0.3mm	0.2mm		
7AWG			24AWG	30AWG
10mm²	0.4mm	0.2mm	-	-
6AWG	-	-	24AWG	30AWG
16mm²	0.4mm	0.2mm	-	-
4AWG	-	-	24AWG	30AWG

The use of ferrules is not required for cables from the above table. If an even thinner cable is used, a ferrule can help to bundle the loose wires. However, it is up to the installer to make sure that the cable is properly secured. With or without a ferrule, the connecting cable must be adequately clamped to ensure low contact resistance.

Preparation for correct mounting of fine strand wires in the screw terminal block

1. Cut the cable straight with no loose or staggered threads. Using a wire cutter will result in a straight cut.
2. Make sure no fine wires are cut when stripping the insulation.
3. Open the screw on the screw terminal block completely to prevent fine wires from getting caught behind the screw and bunching up. Pay particular attention to this when using the maximum wire diameter.
4. Tighten the screw with the correct torque; see Recommended torque [6] and note the wire size and wire class. Never apply less than the recommended torque.
5. Hold the recommended torque for at least 5 seconds, this will give the screw time to settle to the set torque. This maximises the force on the wire, thereby maintaining a gas-tight contact pattern during heating and cooling cycles over time. Take the time to do it right. This is important. This is a UL486 test requirement and a requirement for all factory and field installations.

Fuse recommendation

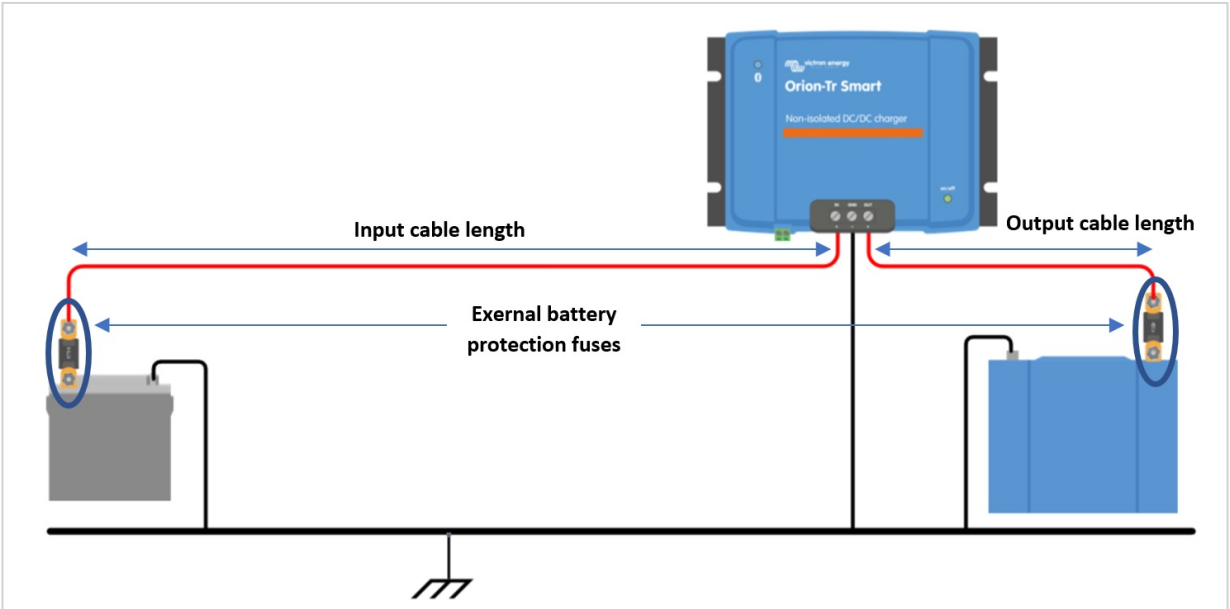


Figure 6: Cable and fuse recommendations

		Minimum cable gauge				
Voltage rating (Input or output)	External battery protection Fuse	0.5m	1m	2m	5m	10m
12V	60A	6mm^2	10mm^2	10mm^2	16mm^2	16mm^2
24V	30A	4mm^2	6mm^2	6mm^2	10mm^2	10mm^2
48V	20A	2.5mm^2	4mm^2	4mm^2	6mm^2	6mm^2

4.3. Polarity check before connecting the battery

The Orion Smart DC-DC Charger is not protected against reverse battery polarity; any damage caused by this is not covered under warranty. A device damaged by reverse polarity cannot be repaired.

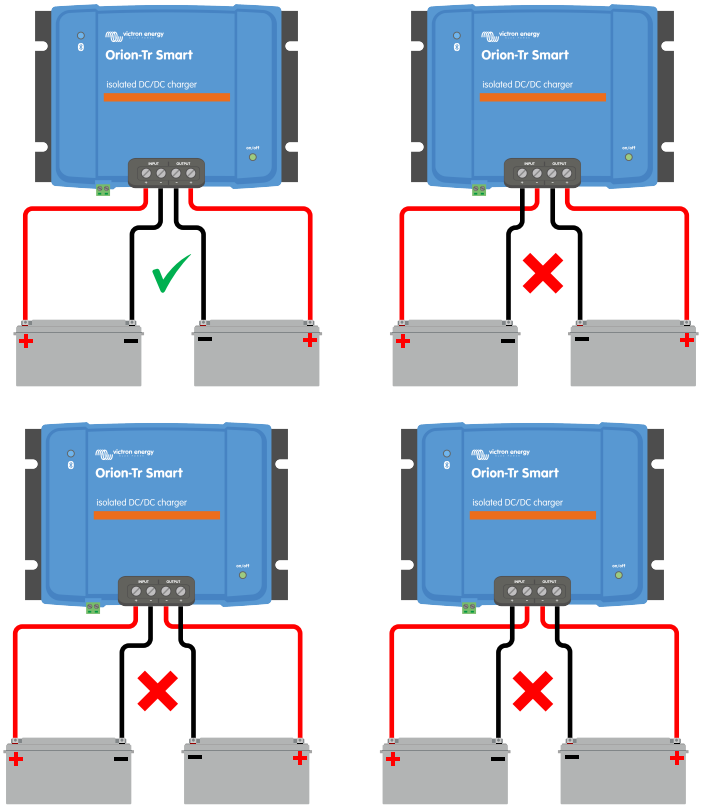
Always verify the battery polarity before connecting or reconnecting the battery cables to the Orion smart charger.

Do not attempt to attach the battery cables to the Orion unless the input and output terminals are safely accessible.

Be careful not to bend individual strands when inserting the cables into the input and output terminals.

Connect the battery cables to the Orion first, verify battery polarity again and only then connect the battery.

A device damaged by reverse polarity cannot be repaired. Do not attempt to open the device. The device is potted and contains no serviceable parts or fuses that can be replaced.



4.4. Recommended torque



Torque: 1.6 Nm

4.5. Connection setup for DC-DC power supply mode

1. Disconnect the remote on/off; remove the wire bridge or unplug the terminal block.
2. Connect the input supply cables.
3. Open the VictronConnect App to set up the product, see Power Supply Mode [29] **(always adjust the output voltage before connecting in parallel or connecting a battery)**.
4. Connect the load. The Orion is now ready for use as a power supply.
5. Reconnect the remote on/off to activate the product.

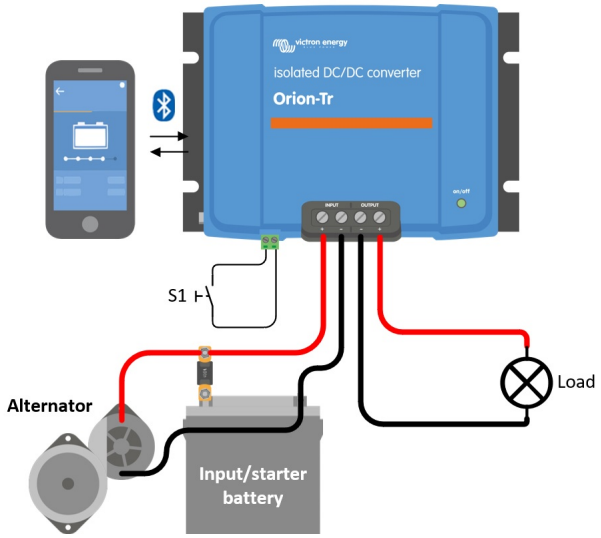


Figure 1: Typical connection setup as DC-DC power supply

4.6. Connection setup for charger mode

1. Disconnect the remote on/off; remove the wire bridge or unplug the terminal block.
2. Connect the input supply cables.
3. Open the VictronConnect App to set up the product, see Charger Mode [30] **(always set up the correct charger algorithm before connecting a battery)**.
4. Connect the battery to be charged.
5. Reconnect the remote on/off to activate the product.

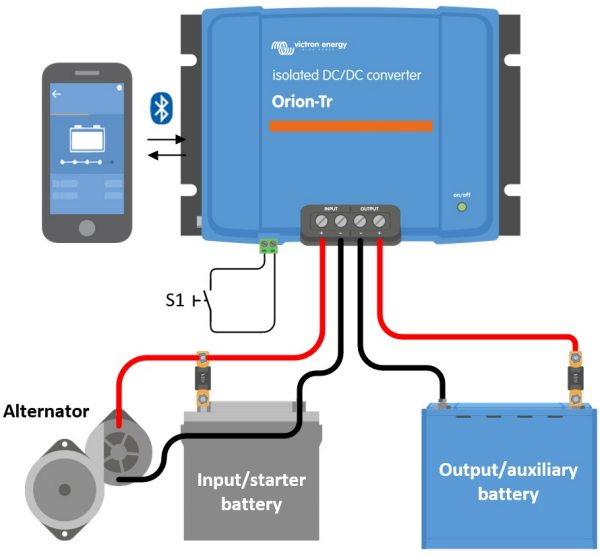


Figure 2: Typical connection setup as charger

4.7. Remote on/off wiring

The remote on/off function switches the Orion-Tr Smart DC-DC Charger Isolated on and off via the two-pole remote connector (L- and H-pin), without the need to interrupt the heavy DC cabling. It gives the versatility to choose from four wiring options, depending on what is available in the installation: a simple switch, a switched positive or negative signal already present in the system, or a BMS charge control contact.

The Orion-Tr Smart DC-DC Charger Isolated is delivered with a wire loop (bridge) installed between the L- and H-pin. With the wire loop in place, the unit is always on. To switch the unit on and off remotely, remove the wire loop and use one of the options below.

The following wiring options are available:

a) A switch wired between the L-H pins (On-level impedance between L-H pins: < 500kΩ)

b) A switch wired between (input/starter) battery plus and H-pin (on level: > 3V)

c) A switch between the L-pin and (input/starter) ground (on level: < 5V)

d) Isolated remote on/off cable e.g. controlled by a (small)BMS

Voltage tolerance L & H pin: +/- 70V_{DC}

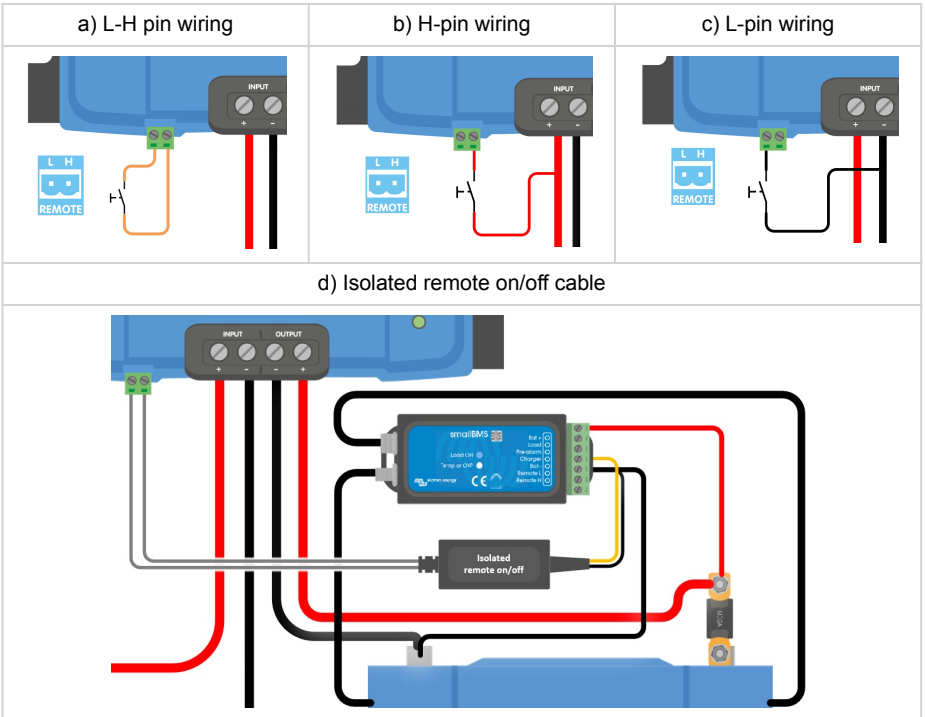


Figure 3: Remote on/off connections

The Orion-Tr Smart DC-DC Charger Isolated is on when at least one of the following conditions is met: the L- and H-pin are interconnected, either by the wire loop or by a switch (option a), the H-pin is pulled to battery plus (option b), the L-pin is pulled to battery minus or ground (option c), or an external device controls the remote input (option d). If none of these conditions is met, the unit is off.

Option a) is the simplest: a plain switch or relay contact, with no connection to the battery poles. Options b) and d) suit installations where a switched positive signal is available, such as a BMS charge control (ATC) contact. Option c) suits installations where a switched negative signal is available, for example a signal switched to the chassis of a vehicle. Option c) cannot be combined with an external engine running signal; see the External engine running signal wiring [9] section.

4.8. External engine running signal wiring

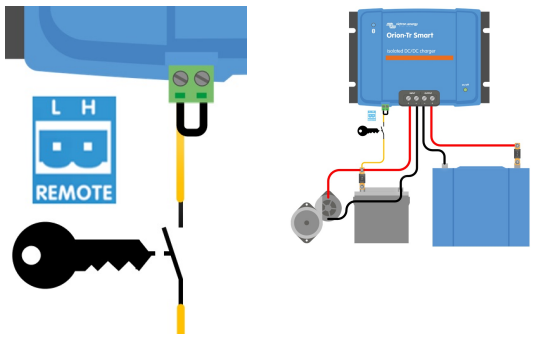
An external engine running signal tells the Orion-Tr Smart DC-DC Charger Isolated that the engine is running. See the Using an external engine running signal [14] section for when such a signal is needed and which sources can provide one.

The signal is connected to the L-pin of the remote connector. Applying >7V to the L-pin overrides the engine shutdown detection and activates the charger, even when engine shutdown has been detected.

The remote on/off circuit of the Orion-Tr Smart DC-DC Charger Isolated is referenced to the input battery (e.g. the starter battery). The input and output circuits are galvanically isolated and do not necessarily share the same negative. The signal must therefore come from the input battery side; a signal referenced to the output (auxiliary) battery will have no effect.

This function does not override or replace the remote on/off function. The Orion-Tr Smart DC-DC Charger Isolated must be switched on via remote on/off for the signal to have effect. This can be the wire loop fitted on delivery, or remote wiring options a), b) or d) as shown in Remote on/off wiring [8]. Option c) cannot be combined with an external engine running signal: both use the L-pin, and connecting the signal to an L-pin that is switched to ground would cause a short circuit. See the examples in Figure 4.

Enable charging with an ignition switch and remote on/off option a)



Enable charging with an ignition switch and remote on/off option d)

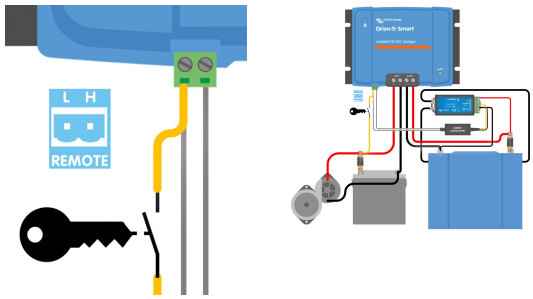


Figure 4: External engine running signal connection diagram

Wiring a signal that is pulled to ground

Some vehicles provide an engine running signal that is pulled to ground (battery minus) while the engine is running, and is open circuit while the engine is off. This is the opposite of what the L-pin expects, so the signal cannot be connected to the L-pin directly. Use a relay to convert it:

1. Connect the relay coil between a fused supply from the starter battery positive and the vehicle's engine running terminal.
2. Connect the normally open relay contact between a fused supply from the starter battery positive and the L-pin.

While the engine runs, the vehicle terminal pulls the relay coil to ground, the relay energises and the contact applies >7V to the L-pin. When the engine stops, the vehicle terminal opens, the relay releases and the signal on the L-pin is no longer present.

Engine running terminals in a vehicle can typically only sink a small current. Use them to drive the relay coil only, never a load. Use a relay with a built-in suppression diode across the coil, or fit one, to protect the vehicle electronics. Consult the vehicle manufacturer's documentation for the availability and ratings of such a signal.

Leave the engine shutdown detection enabled in the VictronConnect App when an external engine running signal is used; see the Using an external engine running signal [14] section.

5. Automatic engine shutdown detection

The automatic engine shutdown detection simplifies the Orion-Tr Smart DC-DC Charger Isolated system by detecting whether the engine is running, without wiring additional switches or sensors. The factory default setting will work with most conventional and smart alternators but can be re-configured with the VictronConnect App.

The detection is based on the alternator voltage. Conventional alternators will generate a fixed voltage (e.g. 14V), whereas the voltage of smart alternators can vary between 12.5V to 15V (for a 12V system). Smart alternators in a regenerative braking system often show large voltage variations.

Engine shutdown detection is only active in charger mode. The feature can be configured, disabled and reactivated as described in the Engine shutdown detection setup with VictronConnect [12] section. In power supply mode, the Input voltage lock-out determines when the output is active.

In installations where the alternator voltage does not give the detection enough to work with, an external engine running signal can be used instead; see the Using an external engine running signal [14] section.

The engine shutdown detection is updated from software version v1.05 onwards.

5.1. How it works

The following procedure describes the operation of the engine shutdown detection sequence.

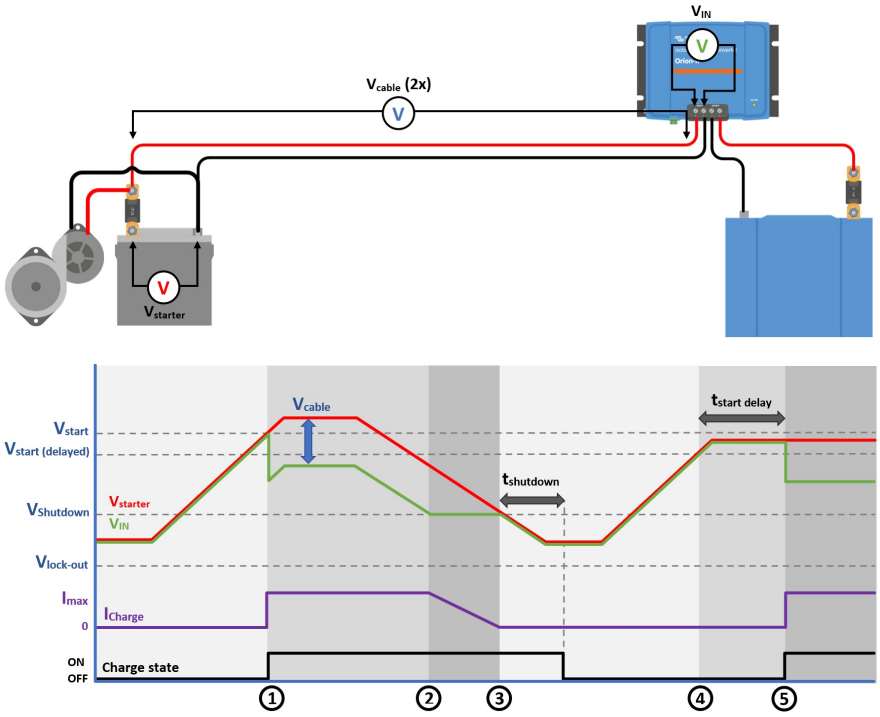


Figure 8: Engine shutdown detection sequence

1. 0 → 1: If the engine runs, the alternator voltage will ramp up. When $V_{starter} > V_{start}$, charging is enabled.
2. 1 → 2: The input current produces a voltage across the input cable (V_{cable}); this voltage reduces the voltage measured by the charger (V_{IN}). If $V_{IN} > V_{shutdown}$, the charger will operate at I_{max}.
3. 2 → 3: If $V_{IN} \leq V_{shutdown}$, the charge current will be reduced to prevent V_{IN} to drop below $V_{shutdown}$.
4. 3 → 4: If $V_{IN} < V_{shutdown}$ for longer than 1min ($t_{shutdown}$), “engine off” is detected and charging is disabled. If $V_{IN} > V_{shutdown}$ before $t_{shutdown}$ runs out, charging remains enabled.
5. 4 → 5: If $V_{start(delay)} < V_{IN} < V_{start}$, charging is enabled after $t_{start\ delay}$ (configurable).

5.2. Engine shutdown detection setup with VictronConnect

Open VictronConnect and press the cog symbol ⚙ to enter the settings.

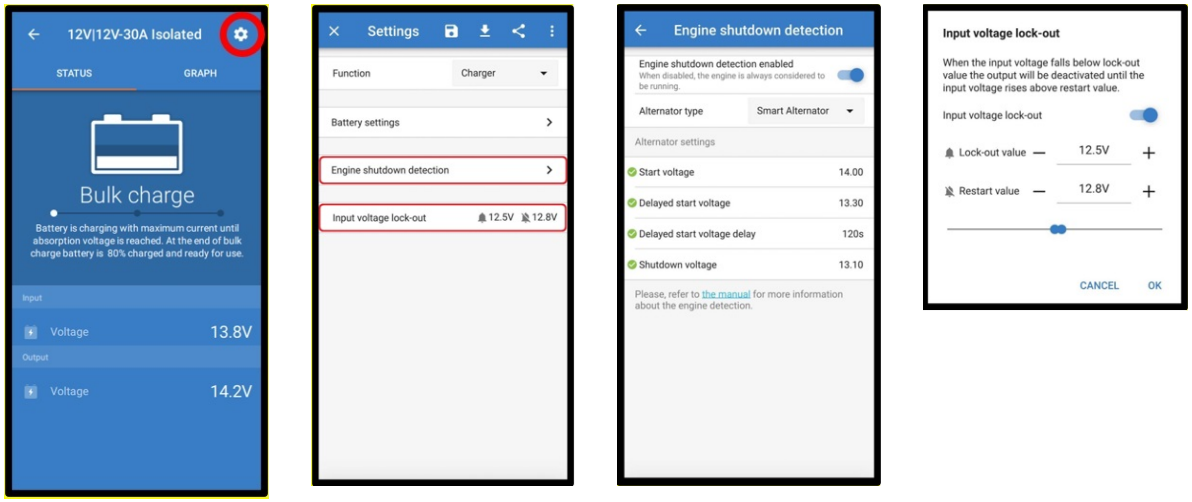


Figure 9: Engine shutdown detection setup menu

The following settings can be changed with VictronConnect:

> The default values displayed are for 12V input models. These values are scaled based on the model's input voltage. For example, for 24V input models, the default values in the manual should be multiplied by 2, and for 48V models, they should be multiplied by 4.

Engine shutdown detection enabled: The engine shutdown detection is always enabled by default when the charger mode is selected. When it is disabled by the user or when power supply mode is selected, the engine is considered to be running, so no shutdown detection will take place. Leave the engine shutdown detection enabled when an external engine running signal is connected: the signal only forces charging on, and disabling the detection makes the charger charge continuously regardless of the signal. See the Using an external engine running signal [14] section.

Alternator type: The alternator type can be selected between “Smart Alternator”, “Regular Alternator”, and “User defined”. When the “Smart Alternator” option is selected, the default values for the smart alternator are/will be applied to the engine shutdown detection settings. The same will happen when the “Regular Alternator” option is selected. When any settings differ from the default values of the last two options, the “User defined” option will be selected. Default: “Smart Alternator”.

Start voltage (V_{start}): At this level, charging starts immediately.

Delayed start voltage ($V_{start(delay)}$): Smart alternators can generate a lower voltage when the engine is running; therefore, a lower start level is necessary for these systems. To ensure that the starter battery is recharged after starting the engine, charging of the auxiliary battery is delayed during this condition. The energy used during starting must be replenished to ensure that the starter battery remains properly charged.

Delayed start voltage delay ($t_{start\ delay}$): Recharge time for the starter battery during start level (delayed). Example: If the starter draws 150A for 5sec to start the engine, about ~0.2Ah is drawn from the starter battery. If, during engine idling, the alternator can only generate 20A, it takes 150A/20A x 5sec =37.5sec to recharge the starter battery.

Shutdown voltage ($V_{shutdown}$): This level corresponds with the engine being off. This keeps the starter battery fully charged and provides a hysteresis with respect to the start level. The hysteresis must be large enough to prevent V_{IN} to drop to $V_{shutdown}$, which would result in charge current reduction. Action will be taken after tshutdown runs out (1 minute); this allows charging during temporary low voltage conditions.

The default values depend on the selected alternator type. Values are given as 12V / 24V / 48V input model.

Setting	Smart Alternator	Regular Alternator
Start voltage (V_{start})	14V / 28V / 56V	14V / 28V / 56V
Delayed start voltage ($V_{start(delay)}$)	13.3V / 26.6V / 53.2V	13.8V / 27.6V / 55.2V
Delayed start voltage delay ($t_{start\ delay}$)	120s	120s
Shutdown voltage ($V_{shutdown}$)	13.1V / 26.2V / 52.4V	13.5V / 27V / 54V

Range for engine start/shutdown levels:

- 12|12; 12|24; 12|48: 8 to 17V

- 24|12; 24|24; 24|48: 16 to 35V
- 48|12; 48|24; 48|48: 32 to 68V

Setup input voltage lock-out: Input voltage lock-out is the minimum level at which charging is allowed; below this level, charging stops immediately. Default (in charger mode): lock-out: 12.5V / restart: 12.8V. Default (in power supply mode): lock-out: 10.5V / restart: 12V.

When 'forced charging' is enabled, current will be drawn from the starter battery if the engine is not running. Setting the lock-out level very low can result in a depleted starter battery.

To set up input voltage lock-out, two criteria are important:

- **Minimum alternator voltage**: A smart alternator can operate at very low alternator voltage (<12.5V), e.g. when the vehicle accelerates. This low voltage is allowed during tshutdown as shown in "engine shutdown detection sequence 3→4". If charging must remain enabled during this period, the lock-out level must at least be set below the minimum alternator voltage.

  If the low voltage period exceeds tshutdown charging will be disabled on engine shutdown detection.

- **Voltage drop across the input cable:** As seen in "engine shutdown detection sequence 1→3", V_{IN} will be lowered by Vcable. When the alternator voltage drops fast (smart alternator), the charge control needs some time to reduce the charge current and keep V_{IN} at $V_{shutdown}$. During this time V_{cable} must not trip the voltage lock-out. Therefore, the lock-out value should be: $V_{lock\text{-}out} \leq V_{shutdown} - V_{cable}$.

Example: Calculate the input cable voltage drop:

- Distance between starter battery and charger: 5m.
- $V_{shutdown}$= 13.1V. Recommended wire gauge: 16mm2.
- Cable resistance: ~1.1mΩ/m @20°C, thus R_{cable} = 1.1mΩ x 10m (2x 5m) = 11mΩ.
- A 12|12-30A Smart Charger will draw about 35A from the input when running at full capacity, resulting in:
  - V_{cable} = 11mΩ x 35A = 385mV.
  - $V_{lock\text{-}out} \leq V_{shutdown} - V_{cable}$ = 13.3V – 385mV ≈ 12.9V.

Cable connections, external fuses, temperature, etc., influence the total cable resistance.

5.3. Setup for Euro 6 vehicles

Euro 6 vehicles use a smart alternator that is managed by the vehicle. While driving, the alternator management system decides whether the alternator is needed, based on the electrical demand of the vehicle and on how much energy can be recovered during braking. As a result, the charge voltage is not constant: it can vary roughly between 12.5V and 15V in a 12V system, and the alternator can be switched off completely for a while. When the alternator is switched off, the voltage at the starter battery falls back to the static battery voltage (~12.6 V). The engine shutdown detection reads that voltage and can conclude that the engine has stopped, even though the vehicle is still driving. During this phase, the Orion-Tr Smart DC-DC Charger Isolated will not charge, potentially resulting in an undercharged auxiliary battery.

The voltages mentioned in this section apply to 12V input models. For 24V input models, scale the values accordingly.

The alternator management system also reacts to the electrical demand in the vehicle. When enough loads are present, the alternator produces at least a float-level voltage (~13.8V), which the engine shutdown detection recognises without difficulty. If the base load in the system is sufficiently high, the alternator remains active for most of the drive and the automatic detection works well.

Whether this happens depends on the vehicle and on the installation, so the engine shutdown detection sometimes needs fine-tuning. Four settings are available for this in the VictronConnect App: the start voltage, the delayed start voltage, the delayed start voltage delay and the shutdown voltage. See the Engine shutdown detection setup with VictronConnect [12] section for a description of each setting. Lowering the start and shutdown voltages makes the detection tolerate the lower charge voltages of a smart alternator, at the cost of a smaller margin above the static battery voltage.

Be aware that charging strategies differ from vehicle to vehicle, even within the same brand and model. Owners of the same vehicle model may find that some can successfully utilise engine shutdown detection, while others experience undercharged auxiliary batteries.

In a vehicle where the alternator is switched off for long periods and the base load is low, fine-tuning may not be enough to keep charging going. An external engine running signal can be used instead; see the Using an external engine running signal [14] section.

5.4. Using an external engine running signal

The engine shutdown detection determines whether the engine is running from the input voltage. In some vehicles the alternator voltage does not follow the engine, for example when a smart alternator is switched off for long periods while driving. In such an installation, a signal from the vehicle can be used to tell the Orion-Tr Smart DC-DC Charger Isolated that the engine is running.

Such a signal is connected to the remote L-pin. While the signal is present, it overrides the engine shutdown detection and charging is forced on. While the signal is absent, the Orion-Tr Smart DC-DC Charger Isolated returns to the engine shutdown detection, which decides whether the engine has stopped. For the wiring, see the External engine running signal wiring [9] section.



Leave the engine shutdown detection enabled in the VictronConnect App when an external engine running signal is used. The signal only forces charging on; stopping charging when the engine is off remains the task of the engine shutdown detection.



When the engine shutdown detection has been switched off in the VictronConnect App ('forced charging'), **current will be drawn from the starter battery even if the engine is not running**, regardless of any external signal that is connected. The input voltage lock-out is then the only limit left to disable charging automatically; make sure this level is not set too low — in most 12V systems 12.5V is sufficiently low.

Which signal to use

Several sources can provide an external signal. Each has its drawbacks, which should be understood before choosing one.

- **Vehicle engine running signal:**

  This is the most accurate source, as the signal comes from the vehicle's own system and follows the engine directly. However, accessing this signal can be challenging, and it may require activating the function in the vehicle's software.

- **Pulled-low engine running signal:**

  Some vehicles provide an engine running signal that is pulled to ground (battery minus) while the engine is running. This is the opposite of what the L-pin expects, so the signal cannot be connected to the L-pin directly. A relay is used to convert it; see the External engine running signal wiring [9] section.

- **D+:**

  The D+ signal, which comes from the alternator, indicates that the alternator is active. In Euro 6 vehicles this signal is often no longer provided, making it unusable. There are D+ simulator devices that generate a signal based on the alternator voltage, but these work from the same voltage that the engine shutdown detection already measures, so in an installation where the alternator voltage is the problem they offer no advantage.

- **Ignition switch:**

  It is common to use the ignition switch to enable charging. While this method is not inherently wrong, it allows the Orion-Tr Smart DC-DC Charger Isolated to discharge the starter battery when the ignition is on but the engine is not running. This requires the user to be vigilant about when charging is permitted, to avoid a flat starter battery. Therefore, we do not recommend using the ignition switch to enable charging.

- **Vibration sensor:**

  This device generates a voltage when it detects engine vibrations. Be aware that external vibrations, such as those from transport on a boat or train, or even loud music, can be mistaken for a running engine. To mitigate this, power the vibration sensor from an ignition-switched source, so that charging is only permitted when both the ignition is on and vibrations are detected.

- **CAN bus interface with engine running output:**

  This device reads the engine running command broadcast on the CAN bus and converts it into an on/off signal. This requires tapping into the CAN bus, and the ease of access varies between vehicles.

6. LED Indicators

The Orion features two LEDs, the blue LED is dedicated to Bluetooth functionality, and the green LED indicates the product status as per the list below.

Green Status LED

- **LED off:**
  - No input voltage
  - Remote shutdown;
  - Shutdown by the user;
  - Connector overtemperature protection
  - User-defined undervoltage lock-out
  - Engine off detected (when in Charger mode)
- **LED on:**
  - Output active on Power supply mode
  - Charger in Float State (Battery charged);
- **LED blinking every 0.8 seconds:**
  - Charger in Bulk or Absorption State (Battery is being charged);

Blue Bluetooth LED

- **LED off:**
  - No input voltage;
- **LED blinking every 3 seconds:**
  - Error – needs to be checked on VictronConnect; see also Error codes [25] for an overview of all Orion error codes displayed in VictronConnect.
- **LED blinking every 0.8 seconds:**
  - Connected via Bluetooth
- **LED blinking every 0.4 seconds:**
  - Identify;
- **LED Blinking once every 5 seconds:**
  - Charger off due to non-error conditions as:
    - Remote shutdown;
    - Shutdown by the user;
    - User-defined undervoltage lock-out;
    - Engine off detected (when in Charger mode);
- **LED on**
  - All other conditions

7. Troubleshooting & Support

Consult this chapter in case of unexpected behaviour or if you suspect a product fault.

The correct troubleshooting and support process is to first consult the common issues as described in this chapter.

If you experience problems with VictronConnect, first consult the VictronConnect manual, especially the troubleshooting chapter.

Should these fail to resolve the issue, scan through popular questions and answers regarding your product and ask the community of experts in the Victron Community In case the problem persists, contact the point of purchase for technical support. If the point of purchase is unknown, refer to the Victron Energy Support webpage.

7.1. The Orion-Tr Smart DC-DC Charger Isolated is not operational

Once powered up and operational, the controller LED(s) will illuminate or flash and can communicate with VictronConnect via Bluetooth.

Once the charger is powered up, VictronConnect can be used to:

1. Check the charger status
2. Check for error messages
3. Update firmware
4. Make or change settings

If the unit does not power up, use this chapter to check the possible reasons why the charger is not operational.

7.1.1. Visual check

Before carrying out any electrical checks, visually inspect the charger for damage.

1. Check for mechanical damage and burn marks.

Note that this kind of damage is usually not covered by warranty.

2. Are the connecting wires making contact with the plug/terminals?

3. Are the wires stripped to the correct length and tightened with the correct torque?

See Recommended torque [6].

4. Inspect the battery terminals.

If there are burn marks on the terminals or if the cables or connectors are molten, this damage is usually not covered by warranty.

7.1.2. Battery supply check

Check that battery voltage is present at the charger's terminals.

Measure the battery voltage at the charger battery terminals with a multimeter.



The reason for measuring the battery voltage at the charger terminals is to rule out possible problems with the wiring, fuses and/or circuit breakers in the path between the battery and the charger.

The charger is powered from the input side; without input voltage the charger stays off, even if the output battery is connected.

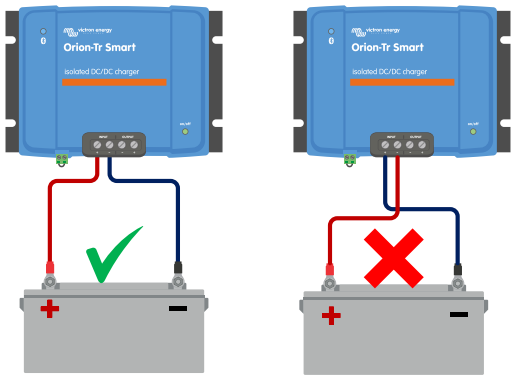
Depending on the result of the measurement, do the following:

Battery voltage	Operational state	Action to take
No voltage	Off	Restore the battery supply. Check the external fuses, and check the wiring for loose or damaged cables and bad crimps. Pull-test the connections.
Correct voltage	Off	Check for reverse battery polarity; see Reverse battery polarity [18]. If the polarity is correct, there might be a fault with the charger. Contact your Victron dealer or distributor.
Correct voltage	On	Check for active errors via the VictronConnect app.

7.1.3. Reverse battery polarity

Reverse polarity is when the positive and the negative battery cables have been accidentally swapped. The battery negative has been connected to the positive terminal and the battery positive has been connected to the negative terminal.

Example of correct and incorrect (reverse) battery polarity



- Be aware that a red or positive labelled cable might not necessarily mean that the cable is indeed a positive cable. A wiring or labelling mistake could have been made during installation.
- Reverse battery polarity can be accompanied with a blown battery fuse (one that is located in the battery cable).

The Orion-Tr Smart DC-DC Charger Isolated is not protected against reverse battery polarity; any damage caused by this is not covered under warranty.

7.2. Battery is not charged

This section lists the possible reasons why the Orion-Tr Smart DC-DC Charger Isolated does not charge the battery, and the steps you can take to remedy the situation.

For example:

- Issues with the battery or system wiring
- Incorrect settings
- The Orion-Tr Smart DC-DC Charger Isolated is remotely controlled by a BMS or other device via its remote on/off terminal

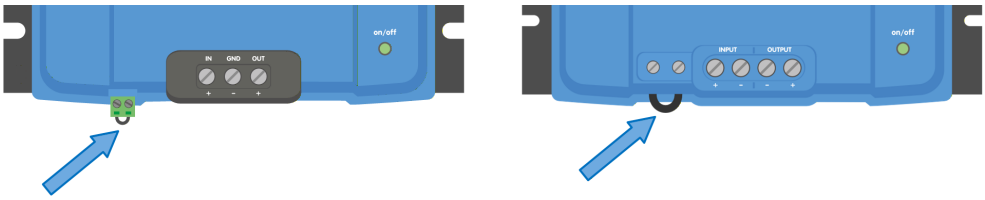
First, check the status field at the top of the status screen in the VictronConnect app. If charging is disabled, the reason is shown there. This can be because the remote input is inactive, the charger is disabled in the battery settings, or charging is disabled because input voltage lock-out or engine shutdown was detected.

The table below lists the possible messages and the action to take.

VictronConnect message	Action to take
Remote input inactive	Check that the terminal block for the remote on/off function is plugged in. Check for continuity if a wire loop or simple switch is used between the L and H pins. If a BMS controls the remote input, check that the ATC connection works. If this does not resolve the issue, see Remote terminal is missing, disconnected or external control is active [19].
Disabled in settings	Enable the charger in the battery settings. See The charger is disabled [19].
Input voltage lock-out	The input voltage is below the lock-out level. See Input voltage lock-out is active [19].
Engine shutdown detected	The charger has detected that the engine is not running. See Engine shutdown is detected [20].

7.2.1. Remote terminal is missing, disconnected or external control is active

The charger only operates when its remote on/off input is active. Most commonly, this is done with the remote connector with a wire link between the L and H terminals.



Remote on/off connector with wire loop

There are two more ways to activate the remote on/off input; see Remote on/off wiring [8] for the wiring details:

- ON when the L terminal is pulled to battery minus or ground (ON switch level < 5V)
- ON when the H terminal is pulled to battery plus (ON switch level > 3V)

General remote on/off terminal check

1. Check that the charger is not being turned off remotely by an external control (see the note below).
2. Check that the remote terminal connector has been plugged in all the way.
3. Check that the wire link, or the remote control wires, are making good electrical contact.

In installations where an external device (such as a switch, relay or BMS) controls the remote on/off, the wire loop is not used. Instead, one or two wires connect the remote terminal to the external device. In that case, check that device and its wiring rather than the wire loop. If in doubt whether an external device is turning the charger off, temporarily place a wire link between the L and H terminals to rule this out. Remove the link and restore the original wiring afterwards.

7.2.2. The charger is disabled

Check the VictronConnect app to make sure the charger has been enabled.



VictronConnect enable/disable charger setting

7.2.3. Input voltage lock-out is active

Charging is disabled because the input voltage is below the configured lock-out level. Charging resumes automatically when the input voltage rises above the restart level.

The input voltage lock-out is a protective feature that prevents the Orion-Tr Smart DC-DC Charger Isolated from draining the starter battery. If the message appears, the question is whether the lock-out is doing its job or whether it is triggering when it should not.

- The input voltage really is low. The engine is off, the starter battery is discharged, or the alternator is not charging. Measure the input voltage at the charger's input terminals, or read it in the VictronConnect app. Charge the starter battery or run the engine.
- The lock-out and restart levels are set too high for the system. A smart alternator can operate at a low voltage for extended periods, tripping the lock-out although the engine is running. Compare the configured levels with the actual alternator voltage range; see Automatic engine shutdown detection [11].
- Voltage drop over the input cable trips the lock-out at full charge current, even though the alternator voltage is fine. Check the input cable cross-section and connections, and take the voltage drop into account when choosing the lock-out level; see the calculation example in Engine shutdown detection setup with VictronConnect [12].

The default lock-out and restart levels differ between charger mode and power supply mode. In power supply mode, the input voltage lock-out determines when the output is active.

7.2.4. Engine shutdown is detected

The Orion-Tr Smart DC-DC Charger Isolated has concluded from the input voltage that the engine is not running. If the engine is indeed off, this is correct behaviour and no action is needed.

If the message appears while the engine is running, check the following:

- The start voltage is set too high for the alternator, so charging never starts. This typically happens when the wrong alternator type is selected: a smart alternator may never reach the start voltage of a regular alternator. Select the correct alternator type or adjust the start voltage; see Engine shutdown detection setup with VictronConnect [12].
- The shutdown voltage is set too high, so charging stops too early and the battery remains undercharged. Adjust the shutdown voltage; see Engine shutdown detection setup with VictronConnect [12].
- The settings are correct, but the alternator voltage sags below the shutdown voltage as soon as charging starts. This is not a settings problem but a sign that the alternator cannot supply the required power; see Insufficient alternator power [21].



Some smart alternators legitimately operate at voltages too low for reliable engine shutdown detection. In that case, use an external engine running signal instead of stretching the voltage settings; see the Using an external engine running signal [14] section.

7.2.5. Battery is full

Once the battery is full, the Orion-Tr Smart DC-DC Charger Isolated will stop charging or greatly reduce the charge current. This is especially the case when at the same time the DC loads in the system are not consuming any power from the battery.

Be aware that it may also be possible for the Orion-Tr Smart DC-DC Charger Isolated to think the battery is full when it is not. This can occur when the charge voltages have been set too low, causing the Orion-Tr Smart DC-DC Charger Isolated to switch to the absorption or float stage prematurely.

7.3. Battery is undercharged

This section deals with possible reasons why the Orion-Tr Smart DC-DC Charger Isolated is not sufficiently charging the batteries and the steps you can take to check or remedy the situation.

Some signs of undercharged batteries:

- The battery takes too long to charge (> 10hrs).
- The batteries are not fully charged at the end of the charge cycle.
- The charge current from the Orion-Tr Smart DC-DC Charger Isolated is less than expected.

7.3.1. Too much DC load

The Orion-Tr Smart DC-DC Charger Isolated not only charges the batteries but also provides power for the system's loads.

The battery will only be charged when the power available exceeds the power being drawn by the loads in the system, like lights, fridge, inverter, and so on.

If the system battery monitor is correctly installed and configured, you can see how much current is going in (or out) of the battery. A positive reading means that current is flowing into the battery, while a negative reading indicates that current is being drawn from the battery.

Turn off all loads and try again to rule this out.

7.3.2. Battery charge voltages are too low

If the battery voltages have been set too low, the batteries will not receive a full charge.

Check if the battery charge voltages (absorption and float) are set correctly. Consult the battery manufacturer's information for the correct charge voltages.

7.3.3. Battery is almost full

The Orion-Tr Smart DC-DC Charger Isolated will reduce its charge current when the battery is almost full.

If the battery's state of charge is unknown, and the current is reducing while the engine is running, it can mistakenly be interpreted as the Orion-Tr Smart DC-DC Charger Isolated being faulty.

The first current reduction takes place during the absorption stage.

During the absorption phase, when the battery is almost full, the current is further reduced gradually.

The float stage starts when the batteries are full. During the float stage the charge current is very low.

To find out what the state of charge (SOC) of the battery is, check the battery monitor (if present), or alternatively, check the charge stage the Orion-Tr Smart DC-DC Charger Isolated is in.

7.3.4. Battery cable voltage drop

If there is a voltage drop over the battery cables, the Orion-Tr Smart DC-DC Charger Isolated will output the correct voltage, but the batteries will receive a lower voltage. Battery charging will take longer, potentially leading to undercharged batteries.

In case there is a large voltage drop, the battery cables and cable connection will need to be checked, and if there are issues, they will need to be rectified.

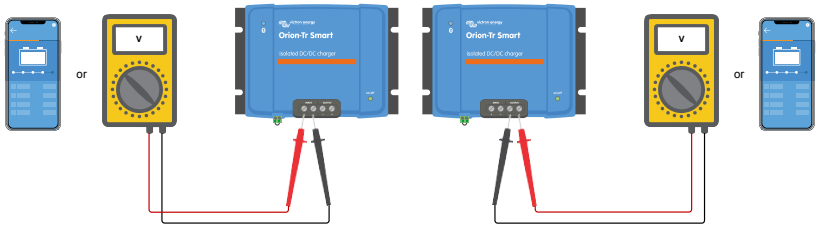
The voltage drop can have the following causes:

- Battery cables with insufficient cross-sectional area
- Badly crimped cable lugs or terminals
- Loose terminal connections
- Bad or loose fuse(s)

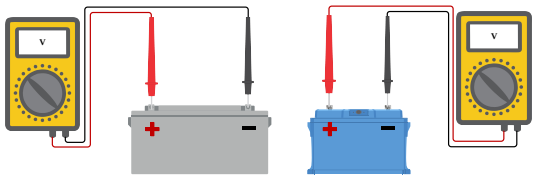
Battery cable voltage drop check

This check can only be performed if the Orion-Tr Smart DC-DC Charger Isolated is in the bulk charge stage and is charging with full current.

1. Measure the voltage on the battery terminals of the Orion-Tr Smart DC-DC Charger Isolated using the VictronConnect app or a multimeter.



2. Measure the battery voltage on the terminals of the batteries using a multimeter.



3. Compare the two voltages to see if there is a voltage difference.

7.3.5. Insufficient alternator power

The Orion-Tr Smart DC-DC Charger Isolated can only deliver its full output when the alternator supplies enough power to the input battery. If the alternator cannot keep up, the input voltage collapses as soon as charging starts, and the charger will reduce or stop charging. Because the charger detects a running engine by the input voltage, an overloaded alternator can look identical to a stopped engine.

Typical indications of insufficient alternator power:

- The input voltage drops sharply as soon as charging starts, and recovers as soon as charging stops. Monitor the input voltage in the VictronConnect app, or measure it at the charger's input terminals, with the engine running.
- Charging repeatedly stops with the message "Charge disabled: Engine shutdown detected" although the engine is running. The sagging alternator voltage falls below the shutdown voltage, which the charger interprets as an engine stop.
- Charging cycles on and off: after charging stops, the input voltage recovers above the start voltage, charging restarts, pulls the voltage down again, and so on.
- The battery does not reach full charge despite sufficient engine running time.

Possible causes:

- The alternator delivers less than its rated output. At idle speed, alternator output can drop to roughly 50% of the rating, and a hot alternator reduces its output further. A worn or slipping belt might have a similar effect.
- The charger, or a combination of chargers, is oversized for the alternator. Each charger draws its full input current regardless of what the alternator can supply. This is particularly relevant when several units are connected in parallel.
- Voltage drop over undersized or too-long input cables lowers the voltage at the charger's input terminals even when the alternator itself is fine.

What to do:

- Compare the alternator's continuous rating - including at idle and at operating temperature - with the total input current of all chargers plus the other loads in the system. If the alternator is undersized, reduce the number of paralleled units, use a lower-power model, or fit a more powerful alternator.
- Repeat the test at increased engine speed to confirm idle output is the limiting factor.
- Repeat the test with a cold alternator to check whether alternator temperature is the limiting factor.
- Check the input cable cross-section and connections against the recommendations in the installation chapter.
- Check that the engine shutdown detection settings match the alternator type; see the engine shutdown detection chapter. Note that lowering the shutdown voltage does not solve an overloaded alternator - it only changes when the charger gives up.

7.4. Battery is overcharged



Batteries that are being overcharged are very dangerous! There is a risk of battery explosion, fire or acid leakage. Do not smoke, create sparks or have open flames in the same room as where the batteries are located.



Overcharging batteries will cause battery damage and can be caused by:

- Incorrect charge voltage settings
- High current and undersized batteries
- Battery faults
- Too high current, while the battery is not accepting charge anymore because of ageing or prior mistreatment

7.4.1. Battery charge voltages are too high

If the battery charge voltages are set too high, this will cause the batteries to overcharge.

Check if all the battery charge voltages (absorption and float) are set correctly.

The charge voltages have to match the recommended voltages as stated in the battery manufacturer's documentation.

7.4.2. Battery old or faulty

A battery that is at the end of its service life or has been damaged by incorrect use can be prone to being overcharged.

A battery contains a number of cells that are connected in series. When a battery is old or has been damaged, a likely scenario is that one of these cells is not operational anymore.

When the faulty battery is charged, the damaged cell will not accept charge, and the remaining cells will receive the broken cell's charge voltage and thus will be overcharged.

To fix this, replace the battery. In case of multiple battery systems, replace the whole battery bank. Mixing batteries of different ages in one battery bank is not recommended.

It is hard to tell what exactly happens to a battery during its lifetime. If the system also contains a Victron battery monitor, the historical battery data can be accessed. This will give a complete picture of the battery history, and it can be determined if the battery is near the end of its service life or has been abused.

To check if the battery is close to its cycle life:

1. Find out how many charge and discharge cycles the battery has been subjected to. Battery lifetime correlates to the number of cycles.

2. Check how deep the battery has been discharged on average. A battery will last for fewer cycles if deeply discharged, compared to more cycles if discharged less deep.
3. Refer to the battery datasheet to find out how many cycles at what average discharge the battery is capable of. Compare this with the battery history and determine if the battery is near the end of its service life.

To check if the battery has been misused:

1. Check if the battery has been totally discharged at all. Total and very deep discharge will damage a battery. Check the battery monitor setting history on the VRM portal. Look for the deepest discharge, the lowest battery voltage, and the number of full discharges.
2. Check if the battery has been charged with too high voltage. Very high charge voltage will damage the battery. Check the maximum battery voltage and the high voltage alarms in the battery monitor. Check if the measured maximum voltage has exceeded the battery manufacturer's recommendations.

7.5. Full rated output not reached

There are a few reasons why the Orion-Tr Smart DC-DC Charger Isolated is not reaching its full rated output.

- **Alternator rating (during idling) too small**

  If the alternator power rating is less than the Orion-Tr Smart DC-DC Charger Isolated nominal power rating, it cannot output more power than the connected alternator can provide. To determine whether the alternator is the limiting factor, see Insufficient alternator power [21].

- **Temperature protection active**

  When the Orion-Tr Smart DC-DC Charger Isolated heats up, eventually the output current will derate. When the current is reduced, naturally the output power will reduce as well.

  The Orion-Tr Smart DC-DC Charger Isolated is operational up to an ambient temperature of 55°C, with full rated output up to 40°C when mounted on a vertical surface with the terminals facing downwards and sufficient free space for ventilation. Above 40°C, the output current derates by 3% per °C.

  If the Orion-Tr Smart DC-DC Charger Isolated is located in a closed enclosure, such as a cabinet, make sure that cold air can enter and hot air can leave the enclosure. Mount vents in the enclosure.

  For very hot environments consider mechanical air extraction or provide air conditioning.

7.6. Bluetooth connection issues with VictronConnect

In normal operation, the blue Bluetooth LED blinks every 0.8 seconds when the Orion-Tr Smart DC-DC Charger is advertising and available for connection in VictronConnect. See the LED Indicators [15] section for the meaning of the different LED codes.

If the Bluetooth LED is not blinking, check the following.

Blue LED status	LED duration	Action to take
Off	-	• No input voltage: The Bluetooth controller is powered by the battery connected to the input terminals. Restore the battery supply. • Bluetooth disabled: Bluetooth was set to Disabled in VictronConnect. This setting is permanent and cannot be undone. For more details see the Product Information [32] section. • Enabled for 30 seconds selected: Bluetooth is enabled for 30 seconds after power up. After 30 seconds, Bluetooth turns off until the next power up. Repower the unit (disconnect and reconnect the battery input cable) and connect with VictronConnect within 30 seconds. For more details see the Product Information [32] section. If none of the above applies, the unit may be faulty. Submit a warranty claim.
Blinking	Every 0.8 seconds	• A Bluetooth connection may already be active. Only one phone or tablet can connect at a time. If the Orion is visible in VictronConnect but greyed out, another device may be connected.
For all other connection problems, please consult the VictronConnect manual for troubleshooting Bluetooth connection issues.		

7.7. Error codes

The error codes are displayed in the VictronConnect app.

For the most up-to-date version of this list, see this link: https://www.victronenergy.com/live/mppt-error-codes.

Error 2 - Battery voltage too high

- This error will auto-reset after the battery voltage has dropped. This error can be due to other charging equipment connected to the battery or a fault in the charge controller.

Error 26 - Terminal overheated

- Power terminals overheated; check wiring, including the wiring type and type of strands, and/or fasten bolts if possible.

  This error will auto-reset.

Error 27 - Charger short circuit

- This condition indicates an over-current condition on the battery side. It can occur when a battery is attached to the unit using a contactor. Or in case the charger starts up without a battery connected but connected to an inverter with a large input capacitance.

  This error will auto-reset. If the error does not auto-reset, disconnect the charge controller from all power sources, wait 3 minutes, and power up again. If the error persists, the charge controller is probably faulty.

Error 116 - Calibration data lost

- If the unit does not work and error 116 pops up as the active error, the unit is faulty. Contact your dealer for a replacement.

  If the error is only present in the history data and the unit operates normally, this error can be ignored safely. Explanation: when the units power up for the first time in the factory, it does not have calibration data and an error 116 is logged. Obviously, this should have been cleared, but in the beginning, units left the factory with this message still in the history data.

Error 119 - Settings data lost

- The charger cannot read its configuration and stopped.

  This error will not auto-reset. To get it working again:

  1. First, restore it to factory defaults (top right in VictronConnect, click on the three dots).
  2. Disconnect the charge controller from all power sources.
  3. Wait 3 minutes, and power up again.
  4. Reconfigure the charger

  Please report this to your Victron dealer and ask him to escalate it to Victron, as this error should never happen. Preferably include firmware version and any other specifics (VRM URL, VictronConnect screenshots or similar).

8. Specifications

Orion-Tr Smart DC-DC Charger Isolated 220-280 Watt	12/12-18 (220W)	12/24-10 (240W)	24/12-20 (240W)	24/24-12 (280W)	48/12-20 (240 W)
Input voltage range (1)	8-17 V	8-17 V	16-35V	16-35V	32-70V
Under voltage shut down	7 V	7 V	14V	14V	28 V
Under voltage restart	7.5 V	7.5 V	15V	15V	30 V
Nominal output voltage	12.2 V	24.2 V	12.2V	24.2V	12.2 V
Output voltage adjust range	10-15 V	18-30 V	10-15V	18-30V	10-15 V
Output voltage tolerance	+/- 0.2 V				
Output noise	2 mV rms				
Cont. output current at nominal output voltage and 40°C	18 A	10 A	20 A	12 A	20 A
Maximum output current (10 s) at nominal output voltage minus 20%	25 A	15 A	25 A	15 A	25 A
Short circuit output current	40 A	25 A	50 A	30 A	50 A
Cont. output power at 25° C	280 W	280 W	300 W	320 W	280 W
Cont. output power at 40° C	220 W	240 W	240 W	280 W	240 W
Efficiency	87%	88%	88%	89%	87%
No load input current	< 80 mA	< 100 mA	< 100 mA	< 80 mA	< 80mA
Standby current	Less than 1mA				
Galvanic isolation	200V dc between input, output and case				
Operating temperature range	-20 to +55°C (derate 3% per °C above 40°C)				
Humidity	Max. 95% non-condensing				
DC connection	Screw terminals				
Maximum cable cross-section	16mm² AWG6				
Weight	1.3 kg (3 lb)				
Dimensions h x w x d	131 x 187 x 71 mm (5.2 x 7.4 x 2.8 inch)				
Standards: Safety	EN 60950				
Emission	EN 61000-6-3, EN 55014-1				
Immunity	EN 61000-6-2, EN 61000-6-1, EN 55014-2				
Automotive Directive	ECE R10-5				

Orion-Tr Smart DC-DC Charger Isolated 360 – 400 Watt	12/12-30 (360 W)	12/24-15 (360 W)	12/48-8 (360 W)	24/12-30 (360 W)	24/24-17 (400 W)	24/48-8,5 (400 W)	48/12-30 (360 W)	48/24-16 (380 W)	48/48-8 (380 W)
Input voltage range (1)	8-17 V	8-17 V	8-17 V	16-35 V	16-35 V	16-35 V	32-70 V	32-70 V	32-70 V
Under voltage shut down	7 V	7 V	7 V	14 V	14 V	14 V	28 V	28 V	28 V
Under voltage restart	7.5 V	7.5 V	7.5 V	15 V	15 V	15 V	30 V	30 V	30 V
Nominal output voltage	12.2 V	24.2 V	48.2 V	12.2 V	24.2 V	48.2 V	12.2 V	24.2 V	48.2 V
Output voltage adjust range	10-15 V	18-30 V	40-60 V	10-15 V	18-30 V	40-60 V	10-15 V	18-30 V	40-60 V
Output voltage tolerance	+/- 0.2 V								
Output noise	2 mV rms								

Orion-Tr Smart DC-DC Charger Isolated 360 – 400 Watt	12/12-30 (360 W)	12/24-15 (360 W)	12/48-8 (360 W)	24/12-30 (360 W)	24/24-17 (400 W)	24/48-8,5 (400 W)	48/12-30 (360 W)	48/24-16 (380 W)	48/48-8 (380 W)
Cont. output current at nominal output voltage and 40°C	30 A	15 A	8 A	30 A	17 A	8.5 A	30 A	16 A	8 A
Maximum output current (10 s) at nominal output voltage minus 20%	40 A	25 A	15 A	45 A	25 A	15 A	40 A	25 A	15 A
Short circuit output current	60 A	40 A	25 A	60 A	40 A	25 A	60 A	40 A	25 A
Cont. output power at 25°C	430 W	430 W	430 W	430 W	480 W	480 W	430 W	430 W	430 W
Cont. output power at 40°C	360 W	360 W	360 W	360 W	400 W	400 W	360 W	380 W	380 W
Efficiency	87%	88%	89%	88%	89%	89%	87%	89%	89%
No load input current	< 80 mA	< 100 mA	< 220 mA	< 100 mA	< 80mA	< 120 mA	< 80 mA	< 80 mA	< 80 mA
Standby current	Less than 1 mA								
Galvanic isolation	200 V dc between input, output and case								
Operating temperature range	-20 to +55° C (derate 3% per °C above 40° C)								
Humidity	Max. 95% non-condensing								
DC connection	Screw terminals								
Maximum cable cross-section	16 mm² AWG6								
Weight	12 V input and/or 12 V output models: 1.8 kg (4 lb) Other models: 1.6 kg (3.5 lb)								
Dimensions hxwxd	12 V input and/or 12 V output models: 131 x 187 x 86 mm (5.2 x 7.4 x 3.4 inch) Other models: 131 x 187 x 71 mm (5.2 x 7.4 x 2.8 inch)								
Standards: Safety	EN 60950								
Emission	EN 61000-6-3, EN 55014-1								
Immunity	EN 61000-6-2, EN 61000-6-1, EN 55014-2								
Automotive Directive	ECE R10-5								

1) If set to nominal or lower than nominal, the output voltage will remain stable within the specified input voltage range (buck-boost function). If the output voltage is set higher than nominal by a certain percentage, the minimum input voltage at which the output voltage remains stable (does not decrease) increases by the same percentage.

Note 1) The VictronConnect App will not display current in or current out.

Note 2) The Orion-Tr Smart DC-DC Charger Isolated is not equipped with a VE.Direct port.

9. VictronConnect - Orion Smart DC-DC Charger

9.1. Introduction

Thank you for using VictronConnect. This guide will help you get the most out of your Orion Smart DC-DC Charger and it requires a minimum knowledge of this charger that can be found in the introduction. The information available here applies to all Orion Smart DC-DC Chargers. To simplify the reference to the Orion Smart DC-DC Charger, it will be refer as just Orion Smart in this guide.

More general information about the VictonConnect App - how to install it; how to pair it with your device; and how to update firmware, for example - can be found by referring to the overall VictronConnect manual.

Note: Where input and battery voltage are referred to in these instructions, a 12V input and battery is assumed. Please multiply the given values by 2 for installations configured for 24V, and by 4 for those configured for 48V.

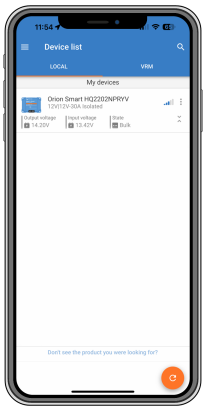
9.2. Live Data Information

9.2.1. Instant Readout over BLE

VictronConnect can display key data of the Orion Smart (and other compatible smart products) on the Device list page without the need to connect to the product. This includes visual notifications of warnings, alarms, and errors that enable diagnostics at a glance.

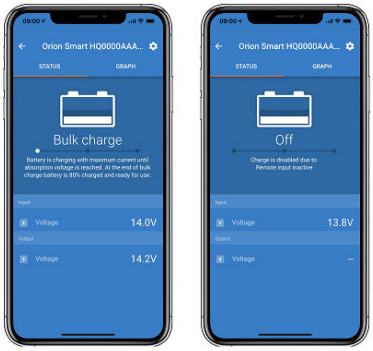
The advantage is:

- Better range than a regular Bluetooth connection
- No need to connect to the smart product
- Key data at a glance
- Encrypted data



Please see the Instant Readout chapter in the VictronConnect manual for more information and how to set it up.

9.2.2. Charger Mode - STATUS tab

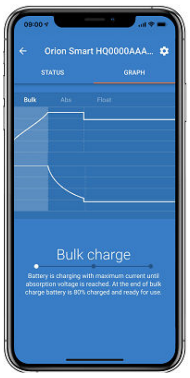


- **Orion Smart [SERIAL NUMBER]** confirms the connected device. A custom name can also be set if desired.
- **Mode icon** shows in which mode the Orion Smart is operating (**Charger** in this case)
- **Charger State**:

- Bulk: During this stage the Orion Smart delivers as much charge current as possible to rapidly charge the batteries. When the battery voltage reaches the Absorption voltage setting, the Orion Smart activates the Absorption stage.
- Absorption: During this stage the Orion Smart switches to the constant voltage mode, where a pre-set absorption voltage, suitable to the battery type (See *Settings* below), is applied. When the Absorption time is elapsed, the Orion Smart activates the Float stage.
- Float: During this stage the float voltage is applied to the battery to maintain a fully-charged state. When the battery voltage drops below Re-bulk voltage during at least 1 minute, a new charge cycle will be triggered.

- **Input Voltage** shows the voltage measured on the input terminals of the device.
- **Output voltage** shows the voltage measured on the output terminals of the device.
  - When the Orion Smart is on Off state, it will not measure the output voltage, so this value will appear as '—'
- **Off Reason** shows the reason why the Orion Smart is disabled (appears under the “Charger State” text when the Orion Smart is Off)

9.2.3. Charger Mode - GRAPH tab



- **Orion Smart [SERIAL NUMBER]** confirms the connected device. A custom name can also be set if desired.
- **Charger State Graph** indicate in which state the charger currently is and show a short description of the current state.

9.2.4. Power Supply Mode



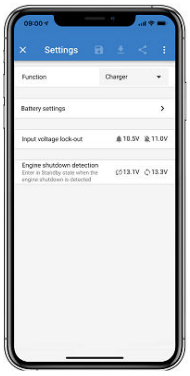
- **Orion Smart [SERIAL NUMBER]** confirms the connected device. A custom name can also be set if desired.
- **Mode icon** shows in which mode the Orion Smart is operating (**Power Supply** in this case)
- **Input Voltage** shows the voltage measured on the input terminals of the device
- **Output voltage** shows the voltage measured on the output terminals of the device
  - When the Orion Smart is on Off state, it will not measure the output voltage, so this value will appear as '—'
- **Off Reason** shows the reason why the Orion Smart is disabled (appears under the “Power Supply Mode” text when the Orion Smart is disabled)

9.3. Settings

VictronConnect allows the user to change and adjust several different settings from the Orion Smart. This is done through the settings option that can be accessed by clicking the ⚙ icon on the right top corner of the screen. The settings options are different according to the operation mode that is selected.

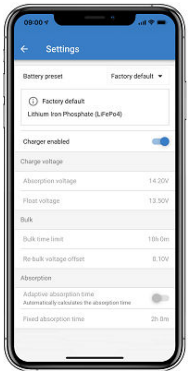
9.3.1. Charger Mode

When on Charger Mode, these are the available settings.



- **Function** allow to choose between “Charger” or “Power supply”. When charger mode is selected, the Orion Smart will follow the three state charge algorithm. For more information about the charge algorithm, please read the Orion Smart manual.
- **Battery settings** allow to change the battery settings in order to adjust the absorption voltage, float voltage and others to fit the battery being charged. The battery setting is explained better on the next item.
- **Input voltage lock-out** allow to choose between two thresholds. One to set the lock-out and another one to reset it. Normally, a minimum 0.5V (for 12V input Orion Smart) difference is used for a better performance. The protection can still be disabled if desired by the user. For more information about the input voltage lock-out, please read the Orion Smart manual.
- **Engine shutdown detection** allow to choose between two thresholds. One to set the detect the engine shutdown and another one to detect when it is running. Normally, a minimum 0.2V (for 12V input Orion Smart) difference is used for a better performance. The engine shutdown detection can still be disabled if desired by the user. For more information about the engine shutdown detection, please read the Orion Smart manual.

9.3.2. Charger Mode - Battery Settings

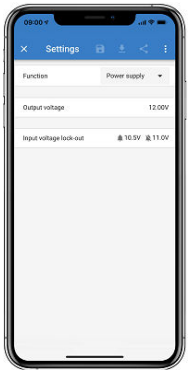


- **Charger enabled**
  - Toggling this setting turns the Orion Smart off. The batteries will not be charged.
- **Charger settings - Battery preset**
  - Battery preset allows to select the battery type; accept factory defaults; or enter your own preset values to be used for the battery charge algorithm. The Absorption voltage, Float voltage, Bulk time limit, Re-bulk voltage offset, Adaptive absorption time and Absorption time, settings are all configured to a preset value - but can be user-defined.
  - User-defined presets can be stored in the preset library - in this way installers will not have to define all the values each time they are configuring a new installation.
  - By selecting Edit Presets, custom parameters can be set as follows:
    - **Absorption voltage**

  - Set the absorption voltage
- **Float voltage**
  - Set the float voltage
- **Bulk time limit**
  - Set the maximum bulk time allowed for the charger.
- **Re-bulk offset voltage**
  - The re-bulk offset voltage determines what is the offset between the float voltage (or absorption if it is lower) and the re-bulk voltage. The re-bulk voltage is the battery voltage threshold that triggers another charge cycle. For example, when the charger cannot maintain the battery voltage due to a high load, the battery voltage will fall and a new charge cycle will be started once the battery voltage drops below the re-bulk voltage.
- **Absorption time**
  - The absorption time depends on whether the adaptive absorption time algorithm is used or not. If **Adaptive absorption time** is not enabled, the charger uses a **Fixed absorption time** that is user selectable and can be set down to 0. Now when the **Adaptive absorption time** is set, the charger will determine the absorption time based on the bulk elapsed time of that charge cycle. The **Maximum absorption time** is also set by the user in this case. The minimum value for this is 30 minutes.

9.3.3. Power Supply Mode

When on Power Supply Mode, these are the available settings.

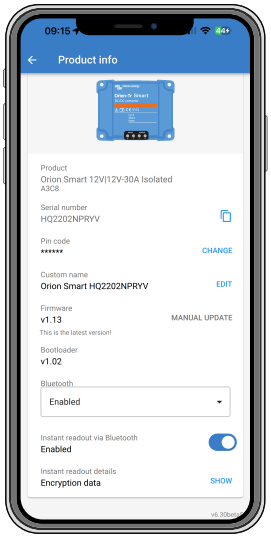


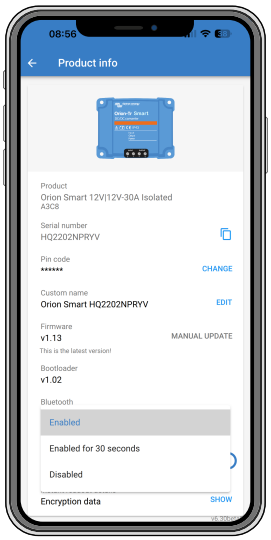
- **Function** allow to choose between “Charger” or “Power supply”. When power supply mode is selected, the Orion Smart will keep the output voltage as set on the setting.
- **Output voltage** allow to choose the output voltage when power supply mode is selected. Note that the minimum and maximum voltages needs to be within the product limit (i.e.: 10V to 15V for 12V output Orion Smart)
- **Input voltage lock-out** allow to choose between two thresholds. One to set the lock-out and another one to reset it. Normally, a minimum 0.5V (for 12V input Orion Smart) difference is used for a better performance. The protection can still be disabled if desired by the user. For more information about the input voltage lock-out, please read the Orion Smart manual.

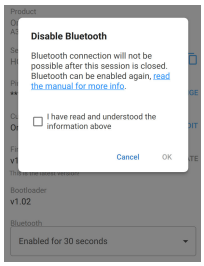
9.4. Product Information

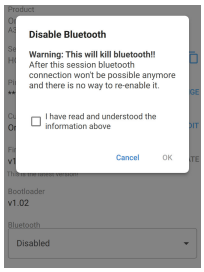
Select the menu icon ⋮ in the top right of the Settings screen to open the Product information screen.

- **Product:** Displays the Orion Smart model.
- **Serial number:** Displays the serial number of the unit.
- **Pin code:** Allows the PIN code to be changed. It is recommended to change the default PIN code to prevent unauthorised access to settings and information.
- **Custom name:** Allows the product name to be changed. By default, it shows “Orion Smart” followed by the serial number.
- **Firmware:** Displays the currently installed firmware version and allows a firmware update to be performed.
- **Bootloader:** Displays the bootloader version.
- **Bluetooth:** Select one of the following three options:
  - **Enabled:** Bluetooth is permanently enabled (default). Choose Enabled when ease of access and frequent configuration outweigh any security concerns.
  - **Enabled for 30 seconds:** Bluetooth is enabled for 30 seconds after power up to allow temporary service or commissioning access. After this period, Bluetooth switches off automatically, reducing permanent Bluetooth exposure. To enable Bluetooth again, repower the unit (disconnect and reconnect the battery input cable).
  - **Disabled: Warning: Selecting this option permanently disables Bluetooth after the VictronConnect session is closed. Bluetooth cannot be enabled again. Use this option only for installations where Bluetooth access must be permanently prevented.**
- **Instant Readout via Bluetooth:** Enables Instant Readout live data.
- **Instant Readout details:** Displays Instant Readout encryption details, such as the MAC address and encryption key.



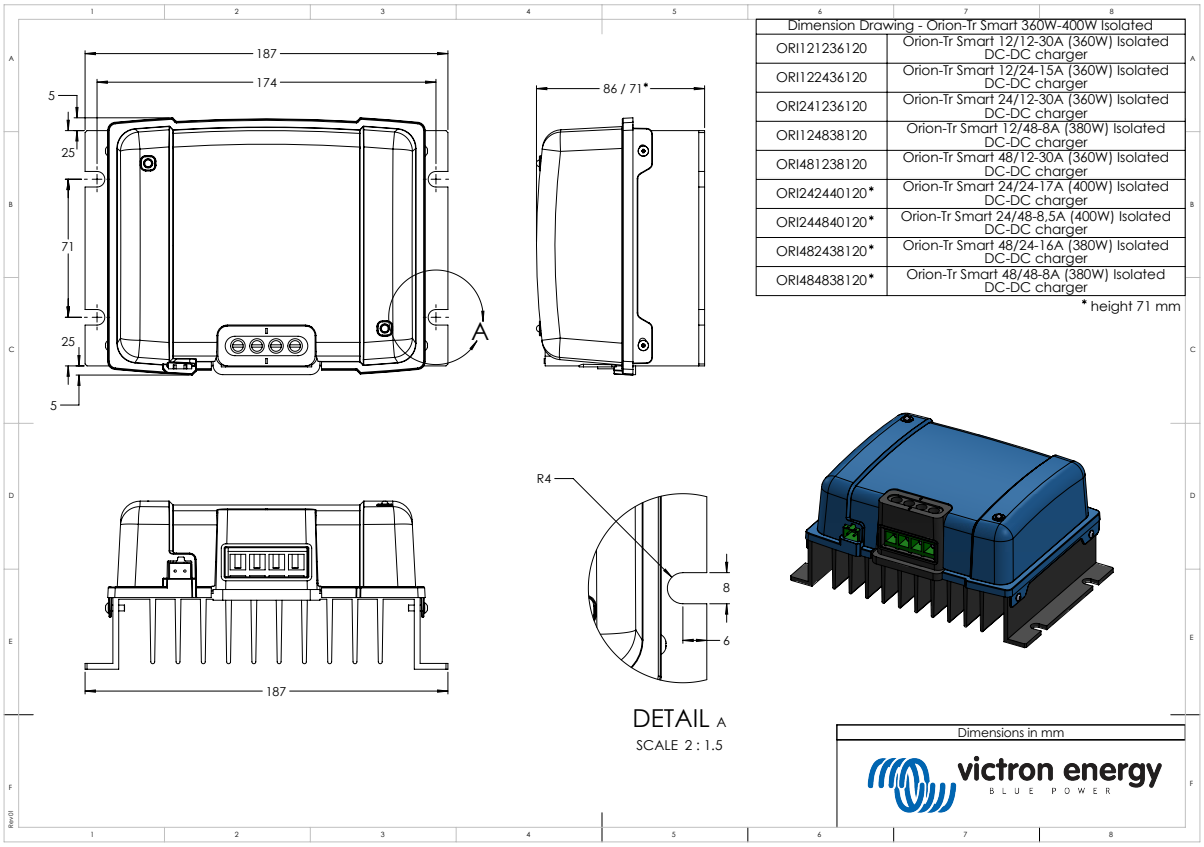






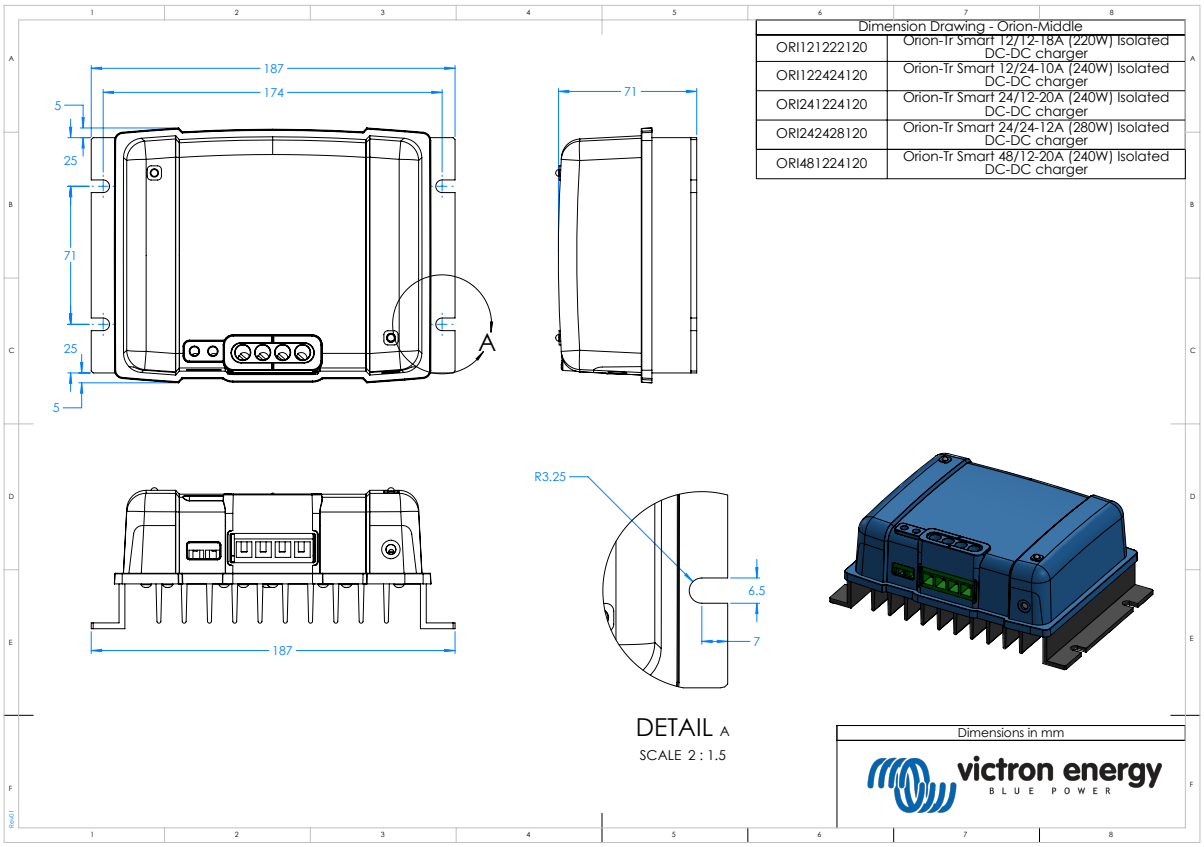
10. Appendix

10.1. Dimension drawing



Dimension Drawing - Orion-Tr Smart 360W-400W Isolated	
ORI121236120	Orion-Tr Smart 12/12-30A (360W) Isolated DC-DC charger
ORI122436120	Orion-Tr Smart 12/24-15A (360W) Isolated DC-DC charger
ORI241236120	Orion-Tr Smart 24/12-30A (360W) Isolated DC-DC charger
ORI124838120	Orion-Tr Smart 12/48-8A (380W) Isolated DC-DC charger
ORI481238120	Orion-Tr Smart 48/12-30A (360W) Isolated DC-DC charger
ORI242440120*	Orion-Tr Smart 24/24-17A (400W) Isolated DC-DC charger
ORI244840120*	Orion-Tr Smart 24/48-8,5A (400W) Isolated DC-DC charger
ORI482438120*	Orion-Tr Smart 48/24-16A (380W) Isolated DC-DC charger
ORI484838120*	Orion-Tr Smart 48/48-8A (380W) Isolated DC-DC charger

* height 71 mm



Dimension Drawing - Orion-Middle	
ORI121222120	Orion-Tr Smart 12/12-18A (220W) Isolated DC-DC charger
ORI122424120	Orion-Tr Smart 12/24-10A (240W) Isolated DC-DC charger
ORI241224120	Orion-Tr Smart 24/12-20A (240W) Isolated DC-DC charger
ORI242428120	Orion-Tr Smart 24/24-12A (280W) Isolated DC-DC charger
ORI481224120	Orion-Tr Smart 48/12-20A (240W) Isolated DC-DC charger