1. Introduction

The engine on detection mechanism simplifies your Orion-Tr Smart DC-DC Charger system by detecting if the engine is running without wiring additional switches or sensors. The factory default setting of the engine on detection is based on a generic smart alternator system which can be re-configured with the VictronConnect app.

The VictronConnect app can be downloaded from:

http://www.victronenergy.nl/support-and-downloads/software/

Use the manual – VictronConnect - to get the most out of the VictronConnect App when it's connected to an Orion Smart: https://www.victronenergy.com/live/victronconnect:start

Configuring the engine on detection depends on the voltage generated by the alternator when the engine is running. Regular alternators will generate a fixed voltage (e.g. 14V) whereas smart alternators generate a variable output voltage which can range from 12.5V to 15V. Especially smart alternators in a regenerative braking system show large alternator voltage variations.

The next sections explain the engine on detection sequence and the engine detection setup with VictronConnect.

2. Engine on detection sequence

0 → 1: When the engine runs the alternator voltage will ramp-up, when Vstarter increases above V(re)start, charging is enabled.
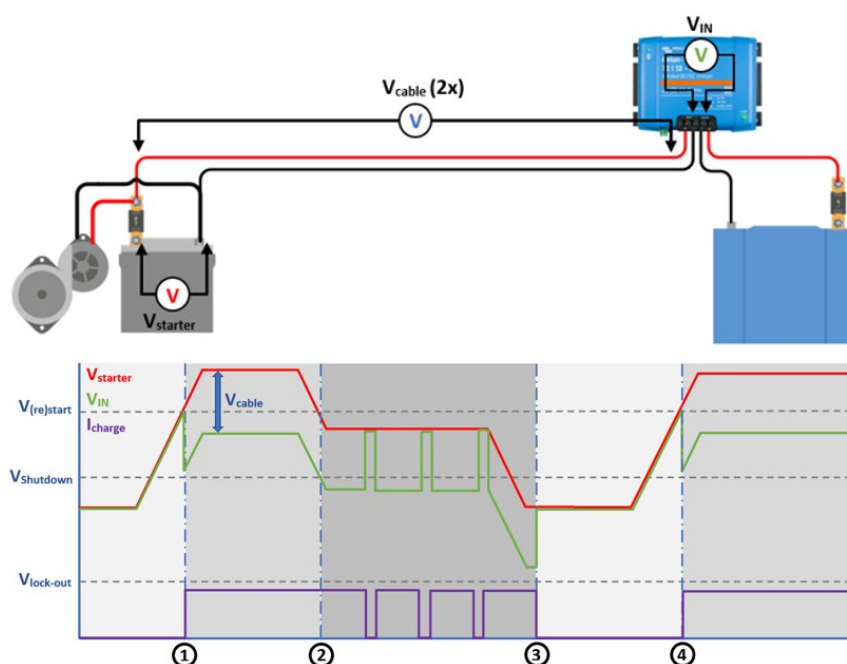
1 → 2: Due to the charge current a voltage drop will be generated across the input cable (Vcable), this voltage reduces the voltage at the input of the charger (VIN). While VIN remains above Vshutdown, charging remains enabled.

2 → 3: If VIN drops below Vshutdown, the "engine on detection sequence" is started. Every minute the charger is paused for 10 seconds to measure VIN. Without current flow VIN is equal to Vstarter, if VIN is above Vshutdown, charging will resume. While remaining in this state, the test is performed every minute.

3 → 4: During the detection sequence VIN dropped below Vshutdown, this means that the engine stopped running and charging is disabled, the charge sequence is paused.

*4 → 5:* VIN increases above V(re)start, the charge sequence continues.

Vlock-out is the minimum alternator voltage at which charging is allowed, below this level charging stops immediately.

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3. Engine detection setup with VictronConnect
Open VictronConnect and press the Cog symbol to enter the settings.
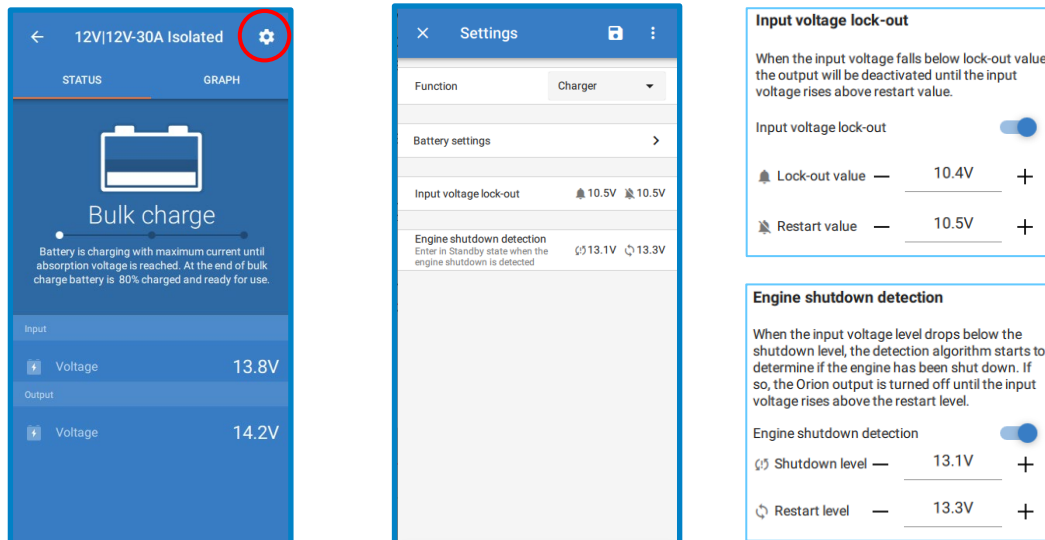
(**Re)start level:** The default setting (13.3V) is based on generic smart alternator setup. Most smart alternators will generate 13.5V when the engine is running, and regular alternators will normally generate >14V. In an application with a regular alternator the restart level can therefore be set to a higher value, e.g. 14V.

Shutdown level: The default setting is 13.1V. this creates a hysteresis between the restart level and prevents excess discharge of the starter battery.

Shutdown level range:
12|12; 12|24 models: 8 to 17V
24|12; 24|24 models: 16 to 35V

Setup input voltage lock-out: Input voltage lock-out is the minimum level at which charging is allowed, below this level charging stops immediately. To determine this setting two criteria are important:
- **Minimum alternator voltage:** A smart alternator can (temporarily) operate at very low alternator voltage (<12.5V) e.g. when the vehicle accelerates. This low voltage is allowed within the one-minute delay during the "engine on detection sequence 2→3". If charging must remain active during this period, the lock-out level must at least be set below the minimum alternator voltage. *Note: If this low voltage period exceeds the one-minute timer charging will be disabled on engine shutdown detection.*
- **Voltage drop across the input cable:** As seen in "engine on detection sequence 1→2", VIN is lowered by Vcable due to the input current. The voltagedrop at Vin caused by Vcable must not trip the voltage lock-out. Therefore, the lock-out value should be: Vlock-out = Valternator(min) – Vcable.
  Example, calculating input cable voltage drop:
  Distance between starter battery and charger: 5m. Valternator(min)= 12.5V. Recommended wire gauge: $16mm^2$.
  Cable resistance: ~1.1mΩ/m @20℃, thus Rcable = 1.1mΩ x 10m (2x 5m) = 11mΩ[1].
  A 12|12-30A Smart Charger will draw about 35A from the input when running at full capacity, resulting in:
  Vcable = 11mΩ x 35A = 385mV.
  Vlock-out =< Valternator(min) – Vcable = 12.5V – 385mV ≈ 12.1V.

The Restart value is normally set 0.1V higher than the Lock-out value to create hysteresis.

1) Cable connections, external fuses, temperature, etc. can influence cable resistance.

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