2. CHARGING PRINCIPLES

RE firmware can be operated in various degrees of complexity.

The two most important parameters of the charger are MAXIMUM CURRENT and MAXIMUM VOLTAGE. MAXIMUM CURRENT represents the maximum output current allowed (its default value corresponds to the nominal current of the charger), while MAXIMUM VOLTAGE is the voltage control limit over the which the output current is cut off regardless of the output current request by the BMS. Its default value is 1.2 times the nominal charger voltage (e.g.: 57.6V for a 48V charger). Of course, the BMS can control the voltage by itself.

In the simplest implementation of the RE firmware, the BMS just sends the Current Percentage message (0x6C1) to modulate the output current. So, the output current will be

$$Iout = MAXIMUM\ CURRENT \cdot (CurrentPercentage/100)$$

Most sophisticated controls could require to dynamically change parameters, or even control peripherals such auxiliary outputs or the display. For more information, please refer to Chapter 3.

2.1 Constant power profiles

The maximum possible current that the charger can physically supply depend on the output voltage. The default value of MAXIMUM CURRENT allows constant-current charging profiles up to "nominal charger voltage · 1.25". Anyway, it is possible to achieve even higher currents that linearly decrease over a limited voltage range: this is what is normally called constant-power profile.

The RE firmware implements runtime control that define a so-called Safe Operating Area (SOA), represented in the two figures below (for NG/BG/MG/PF3/SG6 models and for SG3 models, respectively):
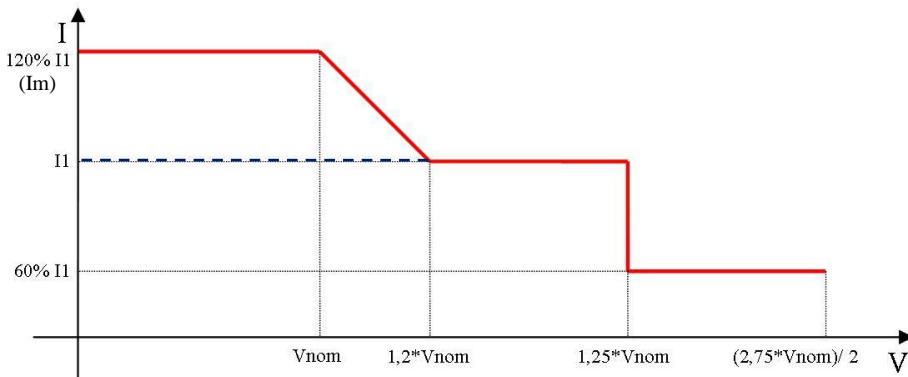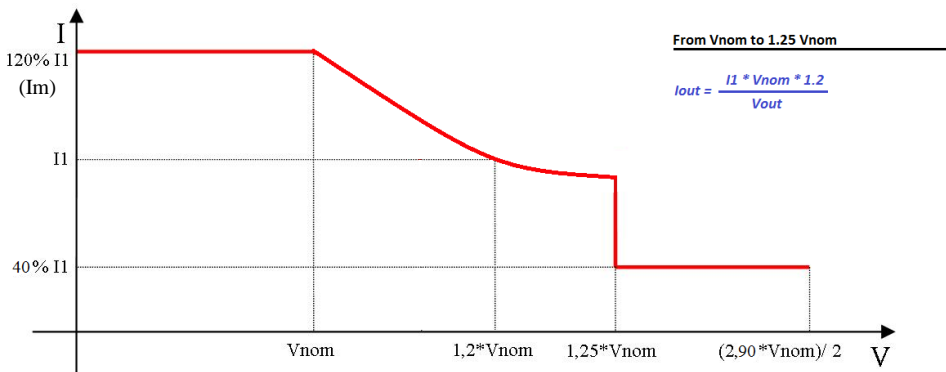
Vnom = nominal voltage of the charger.

Fig.2.1: Safe Operating Area, NG/BG/MG/PF3/SG6 models

In fig.2.1, the blue dashed line represents the default MAXIMUM CURRENT value, while the red line represents the SOA. At runtime, the charger output current is clamped according to the SOA and the actual output voltage. Due to this, the current actually supplied by the charger may be lower than the one requested by the BMS.
Further information on how to change the parameter can be found on paragraph 3.2.
In SG3 models, the SOA has slightly different behavior:

From Vnom to 1.25 Vnom

$$Iout = \frac{I1 * Vnom * 1.2}{Vout}$$

Vnom = nominal voltage of the charger.

Fig.2.2: Safe Operating Area, *SG3 models*

Note: from 1.23Vnom to 1.25Vnom, a tolerance of up to 5% applies to the above formula for the Iout limit.

Finally, when SG3 and PF3 models are connected to 110Vac mains, all the current limits of the SOA are scaled according to the parameter "115 MAX I IN". More information on paragraph 3.9.