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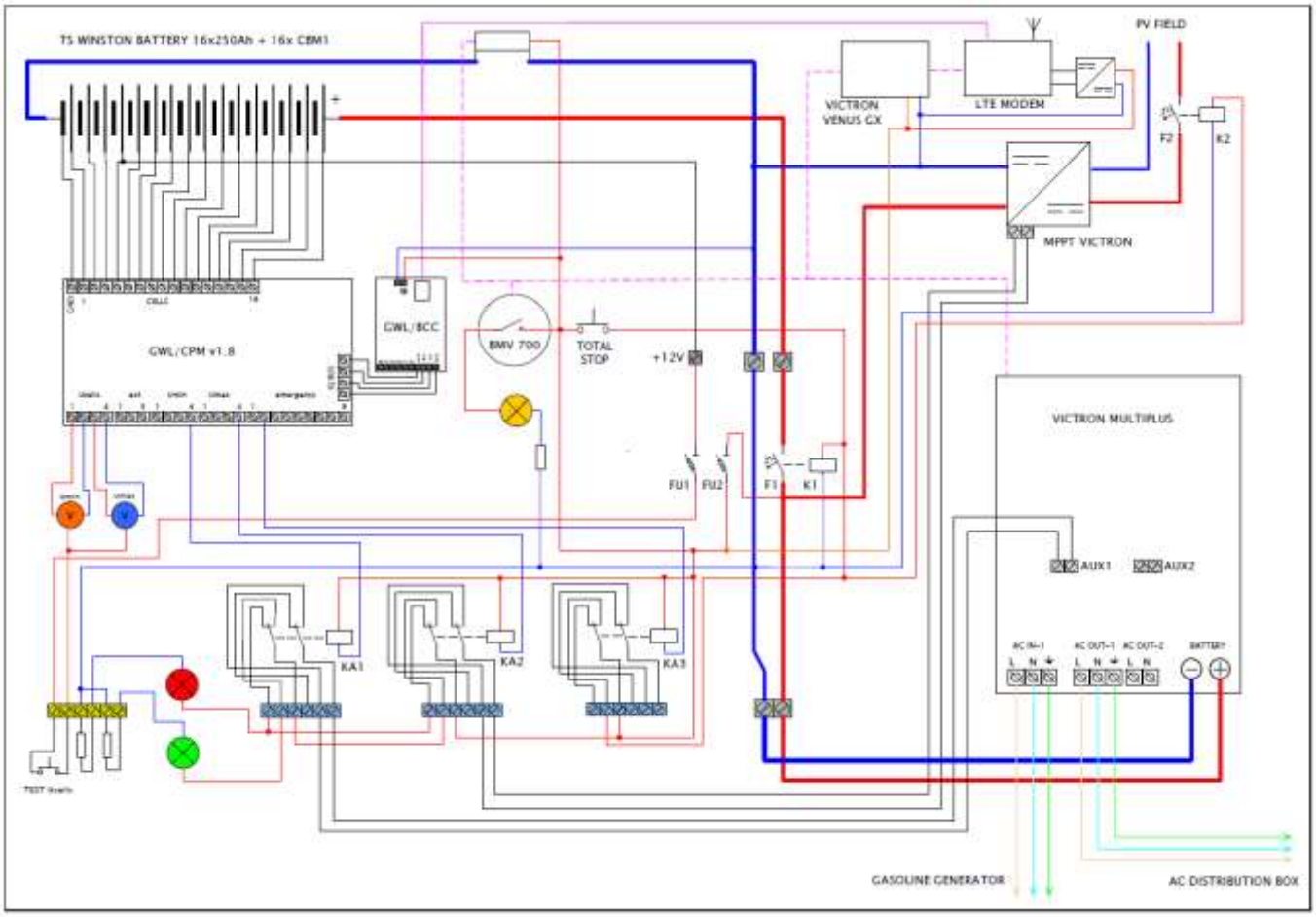
The Pastvina Garden (Pasture Garden)

DIAGRAM



Description: The negative potential of a battery is conducted into a resistor, a so-called shunt, which measures energy flowing in and out of the battery. The connected Victron BMV-700 unit uses the difference between these two values as well as additional parameters (e.g. voltage and efficiency of the charge and discharge) to calculate the remaining energy in the battery (State of Charge - SoC). The negative (GND) charge continues from the measuring resistor directly to the Victron inverter. We do not use circuit breaker features on the negative branch as these are only used on the positive pole.

The positive potential of the battery is connected to the inverter via a DC 125A circuit breaker controlled by an emergency K1 trigger switch.

The battery is charged from the PV field with a maximum power of 2.52kWp. Both the negative and the positive pole are connected via a DC 32A circuit breaker with a K2 trigger switch. The output from the MPPT regulator is connected to the battery terminals via the emergency disconnect K1 feature (on the positive pole).

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The emergency K1 switch (disconnects the main battery) is controlled by the impulse from the CPM module using an auxiliary KA3 emergency relay. It is activated if the voltage of any cell cell in the battery falls below

2.5V or rises above 4.1V. The auxiliary KA3 relay then activates the K2 switch, which also disconnects the PV field. It is also possible to activate this emergency switch by pressing the “TOTAL STOP” button. A manual intervention of the operator is required to restore the system and make it functional again following an emergency disconnection.

The auxiliary KA2 relay is disconnected via the CPM module if the voltage of any cell in the battery rises above 3.8V. The KA2 disconnects the indication contacts on the MPPT regulator, switching off the battery charging from the PV field. This only occurs if a battery is imbalanced, meaning if the voltage of the entire battery is still within the permitted range (max. of 57V) while the voltage of a cell inside in the battery already exceeded the permitted range (3.8V). The end of charging in relation to the overall voltage of the battery is controlled by the MPPT regulator using its internal logic.

The auxiliary KA1 relay is disconnected via the CPM module if the voltage of any cell in the battery falls below 2.8V. The KA1 disconnects the indication AUX1 contacts on the inverter and switches off the battery discharge. This only occurs when the battery is imbalanced, i.e. if the voltage of the entire battery is still within the permitted range (a min. of 48V) but the voltage in one of the cells in the battery falls below the permitted range (2.8V). Standard end of discharge in relation to the overall battery voltage is controlled by the inverter using its internal logic.

When the KA2 or the KA1 are disconnected, the signaling voltage is also disconnected (conducted in a series via NC KA1 and KA2 contacts) and the green

LED pilot on the light panel switches off. Conversely, the red LED pilot switches on via the NO contacts on KA1 and KA2 also connected in a series. This is a simple indicator for novice users, which means that users who are not trained do not need to understand the system parameters and be familiar with terminology such as SoC, voltage, output, input, capacity etc.

The orange LED pilot on the indicator on the light panel is switched on via the BMV-700 module in the event that the amount of the remaining energy in the battery falls under 30% of the full state. It shows novice users that the system is still running but it would be desirable to limit consumption.

Trained operators can then monitor all the detailed system parameters:

- value of the remaining energy in the battery (on the BMV-700 or Venus display)
- the lowest and highest voltage of cells in the battery (on panel voltmeters)
- input delivery via the PV field (displayed on the Venus controller)
- input of appliances connected on the inverter (displayed in the Venus controller)
- number of the weakest and strongest cell (on the CPM module)
- total system status, such as discharge, charge, malfunction (displayed on the Venus controller)

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Additional facts:

- The Umin and Umax control voltmeters require separate charging and that is why auxiliary ~12V voltage is conducted directly from the 4th cell of the battery via a tube FU1 0.2A fuse and the “Test Ucells” button, which is used for short-term charging of these measuring devices. There is thus no risk of disbalancing the battery.
- The control 52V voltage for switches and relays is conducted behind the emergency switch-off trigger and is protected by a tube FU2 10A fuse. The BCC and BMV-700 units are also charged from it as is the Venus and the DC-to-DC converter, which charges the Mikrotik LTE modem (52V => 12V).
- The system status can be monitored remotely on a standard www browser thanks to the LTE modem.
- An extra power source, such as a petrol generator, can be connected to the system easily. This can be useful if the gains from PV are small while the energy consumption demands are high – e.g. construction work with power tools during the winter. In that case, the output of the generator and the converter adds up.