Hub Assistant notes

1. Special states

A system running the Hub-1 or Hub-2 Assistant, has the following special states:

1.1 Grid assist

Normal mode was inverting, but now the system is temporarily connected to the grid to power high loads, which in total exceed the maximum inverter power. As soon as those loads are below threshold for 60 seconds, the system will switch back to invert mode again.

1.2 Prevent feedback (hub-2 only)

Normal mode is connected during the grid (at least during the day). When it sees power flowing back into the grid, it will disconnect from the grid and work in island mode. AC output frequency will be increased, to reduce the PV output power from the PV inverter. As soon as there is no excess of PV available any more, (AC output frequency has dropped back to 50 Hz), the system will connect to the grid again.

Note that preventing this switch-over is not instantaneous, it takes 20 seconds. And when feedback occurs while connected to the grid because of a low battery or overload, the prevent-feedback mechanism will be disabled. (The overload will be active for the time the user specifies in the 'Load connect condition' step. The default value is 60 seconds.)

To summarize: 'prevent feedback' is not the solution when connected behind a meter that immediately disconnects upon feedback.

1.3 Maintenance charge

A full charge cycle will be completed every 28 days (programmable). This full charge cycle includes the absorption charge, which is normally not included. And the maintenance charge cycle also includes an equalization charge if appropriate for the chosen battery type.

Power from the grid will be used, if at the end of the day the cycle has not yet been completed. Put differently: power from the grid will be used when there has not been enough PV power available to complete the maintenance charge.

1.4 PV Reduction / Frequency shift (hub-2 only)

In inverter mode with increased AC output frequency to reduce PV power.

1.5 Sustain

The purpose of the Sustain Mode is to prevent leaving batteries in a deeply discharged state during several days. The Sustain Mode is entered when during 30 seconds the following two conditions are met without interruption:

1. the battery voltage is below the sustain level: 12.5V for Lithium batteries and 12V for other batteries
2. the current drawn from the battery is smaller than 1/10th of the battery capacity

During Sustain, the system will connected to the grid and the internal charger is enabled. The system will stay connected to mains as long as the battery voltage stays low.

Note that, for non-lithium systems, the sustain level is 12 V for the first 24 hours, and after that it is raised to 12.5 Volts DC.

DC voltages specified are for a 12V system. These voltages should be multiplied by 2 or 4 for a 24V or 48V system.

2. Use and working of State of Charge (SOC) in a Hub2 system

In a HUB2 assistant the SOC is used. From the SOC a flag is derived named SOCLow. This flag can be either true or false. The assistant will allow to enter a SOCLowLevel and a SOCHighLevel. This flag is determined as follows:

```
if SOCLow=true then SOCLow:=SOC<SOCHighLevel
else SOCLow:=SOC<SOCLowLevel
```

Now both SOC and SOCLow are used in the HUB2 assistant to determine actions. However the HUB2v2 and HUBv3 behave differently

HUB2v2

When the SOCLow flag is true, next things are performed:

- Power assist is disabled
- LowBat LED in the L1 master is lit (only when connected to grid)
- the system connects to the grid if possible

Under certain conditions the SOC (and with that the SOCLow flag) is changed:

1. SOC is changed to 100% when a connected Lynx-Ion BMS signals a High cell voltage

2. SOC is changed to SOCLowLevel when:
    1. a connected BMS signals 'low cell'
    2. In the L1 master the UBatIn voltage drops below the PreAlarm level during 5 seconds

3. SOC is changed to 'Bulk finished' value from VEConfig when the charge state changes to Absorption.
(This is normal behaviour for a charger and is normally done in the firmware. The HUB2v2 assistant does this because in the 2xx firmware the charge engine is stopped when the Multi is inverting. However in a HUB2 system we want to charge with PV power when the Multi is invertering. Therefore the HUB2V2 assistant contains a 'charge engine')

HUB2v3

When the SOCLow flag is true, next things are performed:

- Power assist is disabled
- LowBat LED is lit
- the system connects to the grid if possible
- when load shedding is active it stays active as long as SOCLow is true

THE SOC value is used for:

- stopping the charge process during 'Low night rate' use when SOC reaches SOCHighLevel
- When, in a Multi phase system, a Low Bat 'overload' occurred, this condition will stay active until the SOC reaches SOCLowLevel. This is needed to prevent the system from switching to invert if also the option 'do not feed back' is enabled.

Under certain conditions the SOC (and with that the SOCLow flag) is changed:

1. Changed to 'low level' -10%
    1. when a connected BMS signals a 'Low cell'
    2. when (on any connected Multi) UBat< ('DC input low shut-down'+1V) for 5 seconds (note: 1V is for 12V systems)
    The user can freely choose 'DC input low shut-down'. The assistant will only change this value while stepping through the assistant and if needed to guarantee that "DC input low restart" is below 11 V for Lead-acid or 12V for Li-Ion batteries. (These are the default levels the assistant uses for 'DC input low Pre-Alarm')
    3. while sustain active
    (sustain is actived when IBat is llow and Ubat< 12 or 12.5 for at least 30 seconds)

2. Changed to 'high level' -10%
    1. when loadshedding enabled and triggered due to overload
    (overload is then also IMains>IMainsLimit)

3. Changed to 100%
    1. when a Lynx BMS signals 'High voltage/cell'

3. FAQ

Why does my Hub-2 system start charging the first day after setting it up?

This is the maintenance charge. If later on you reconnect VEConfigure and make changed to the

Assistant, the same thing will happen: a maintenance charge, using power from the grid (if necessary) to fully charge the batteries.

How long does it take for the Hub-2 clock to sync with the grid?

How does Hub-2 know when it is day or night?

It looks at the direction of the current at the AC output of the Multi or Quattro. If there is excess PV , etc.

Note: configure an hub-2 during day time, because (hoe zat dit ook alweer Peter?)

How does Hub-1 know when it is day or night?

It looks at the direction of the current at the AC input of the Multi or Quattro. When there is power being fed back to the grid, it knows that it has to be day time.

Note that because it looks a the power being fed back to the grid, day/night syncing in a hub-1 system only works well if there really is an excess amount of PV available. If not, for example on most days, or during most part of the day …

Can I add a small solar charger or wind turbine to a hub-2 installation?

Yes you can, and it even has certain advantages as well. [johannes, graag uitleggen].

You might think that the internals of the Hub-2 might get confused. The only thing that might happen is that the battery is a bit more charged than what the Assistant actually thinks, which can't hurt.

During charge, the SOC used for the algorithms is synced at several moments:

Input current limiting options

- It is possible to set (and change) the input current limit with a remote control panel, For example the Digital Multi Control or the Color Control GX.
- This limit will be used when charging the battery during the periodic battery maintenance cycle. During normal operation it will normally not be used. As long as there is enough sun, the Multi will use a lower current than set with the remote control panel.

Why does my shown SOC jump (VE.Bus SOC, not BMV SOC)

The SOC is auto-corrected. For example in a low voltage warning, if the SOC is too high, it will be auto-corrected downwards.

[elaborate]

DISQUS Comments

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