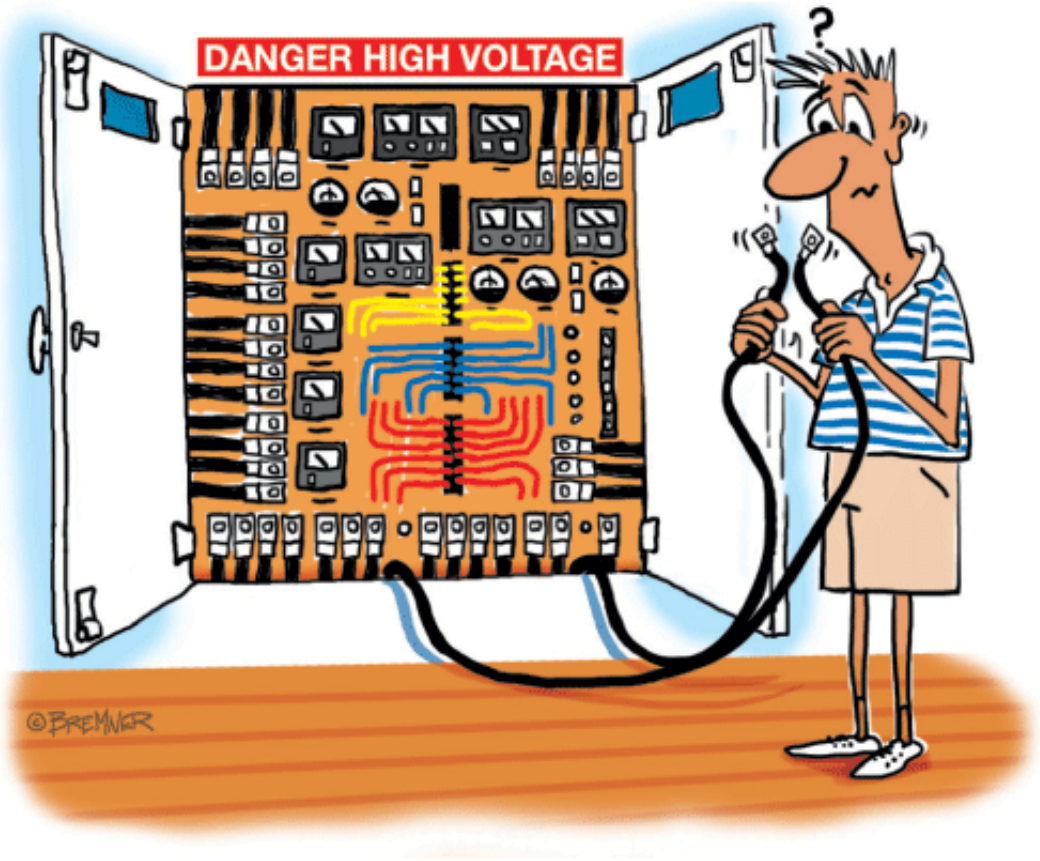
General System Setup

General system setup

System calculations

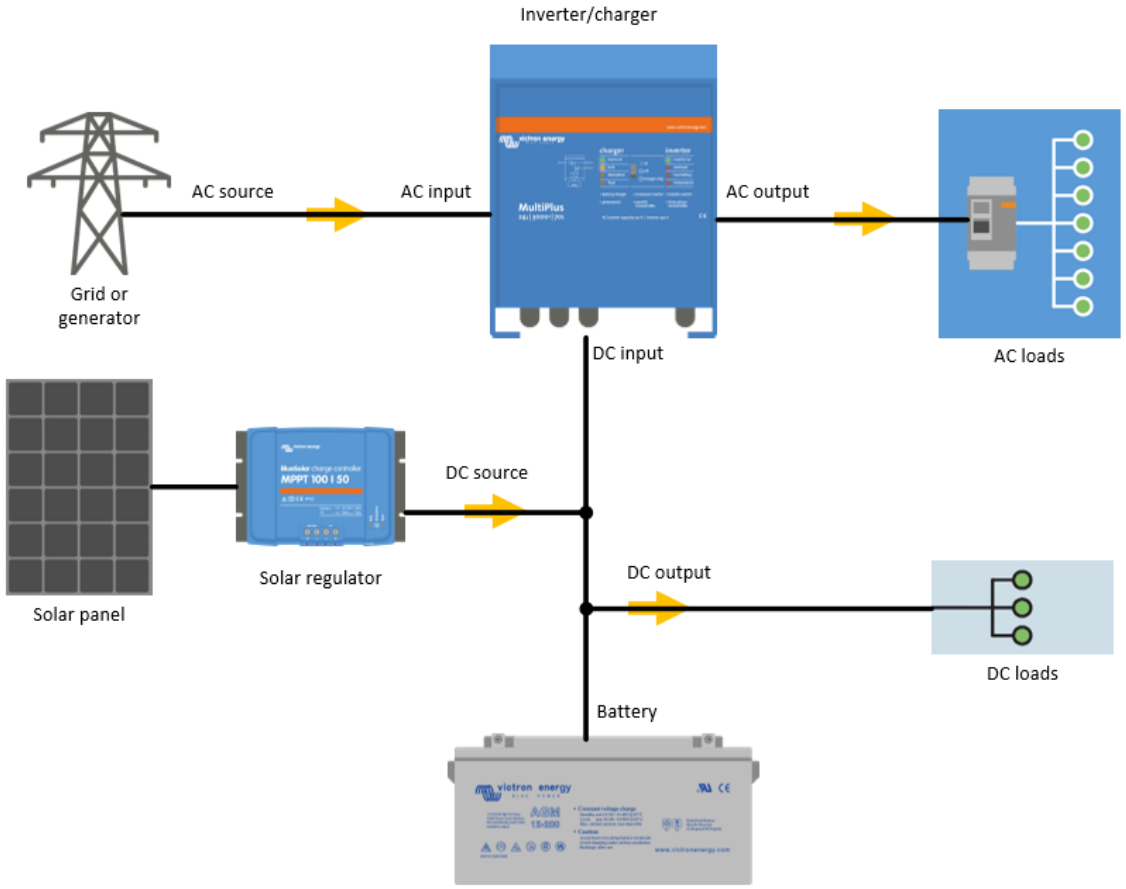
Basic system calculations to calculate the sizes of the:

- Inverter/charger
- Battery bank
- Solar panels
- Generator



A typical system

- The Multi connects to batteries.
- The Multi powers loads, such as lights, TVs or and/or refrigerators. **These are the AC loads.**
- The Multi can be powered by grid, generator and/or AC Solar. **This is the AC input.**
- The Multi can be powered via the batteries by DC solar, alternators and/or DC generator. **This is the DC input.**
- There also might be loads in the system that connect to the battery, like a water pump or lights. **This is the DC load.**



System calculations

Important questions:

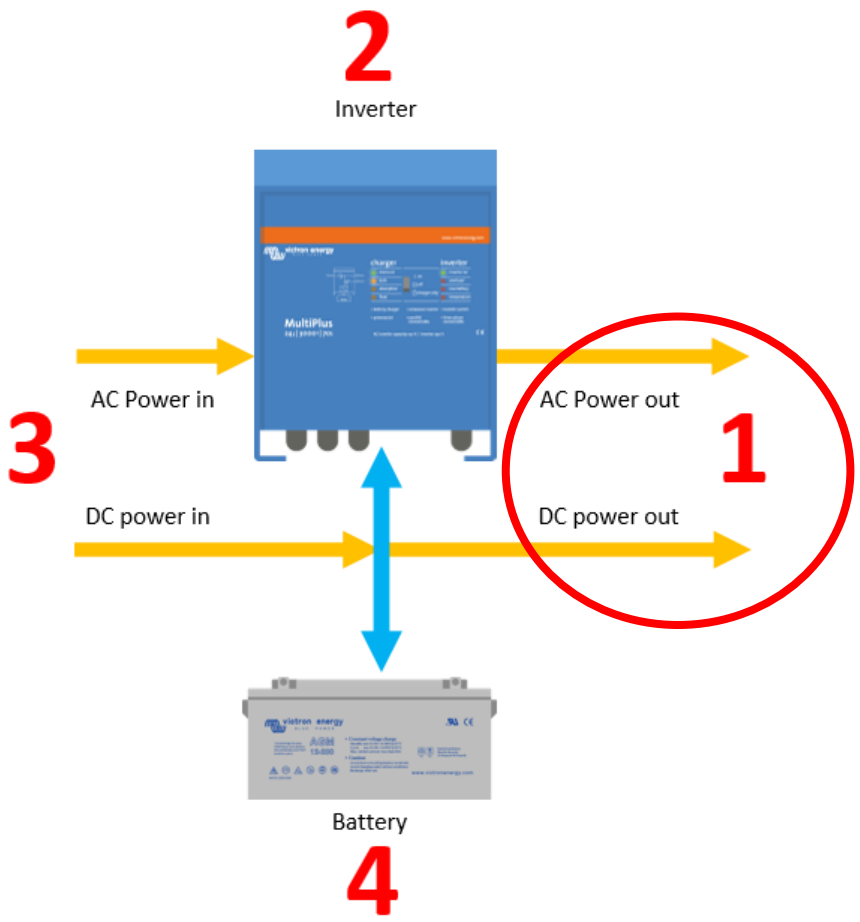
- What is the total use in Wh?
- What battery capacity is needed?
- How long “stand alone” time?
- What charge current is needed?
- Quiet energy (PV) and/or generator?

Step 1: Power out

Power out calculations:

- Make a list of:
  - all AC loads
  - and DC loads

- Determine how long these loads are running



Total use in kWh

- Calculate the power usage of all loads, both AC and DC, over a 24 h time span

AC microwave: 1200 W (from type plate on machine)

Running for 6 minutes a day

Power usage 24 Hours: 1200 x 0.1 = 120 Wh/day

AC fridge: yearly usage 279 kWh/annum (star rating)

Power usage 24 Hours: 279/365 = 764 Wh/day

DC Pump: 12V, 1.3A (from specification sheet)

running for 2 hours a day

Power usage 24 Hours: 12 x 1.3 x 2 = 46 Wh/day

Total use in kWh

- Add all the 24 h power usages of all loads (AC and DC) together.
- This will give you the total power use in kWh per day.

AC Fridge	764 Wh / day
AC Microwave	120 Wh / day
AC lights	180 Wh / day
AC TV	300 Wh / day
DC radio	15 Wh / day
DC lights	400 Wh / day
DC pump	46 Wh / day
Total	1.8 KWh / day

Be realistic

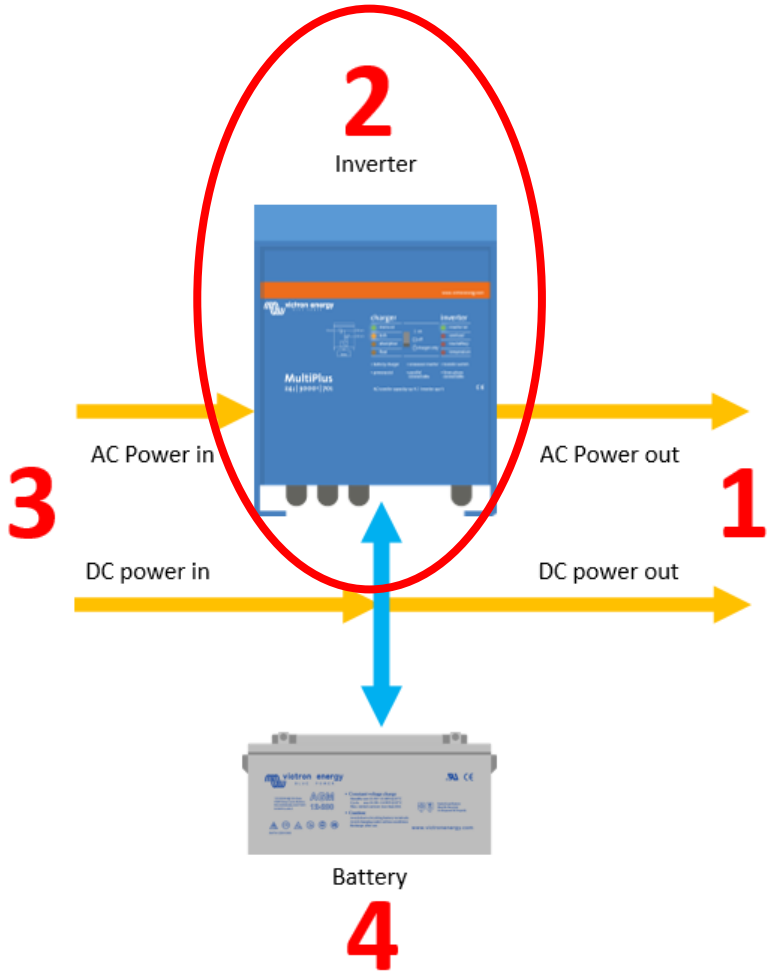
- Be realistic on expected sources/loads
- Focus on major loads in the system and take the worst case scenario

- Be clear on budget and size to your client before all work is started!!!

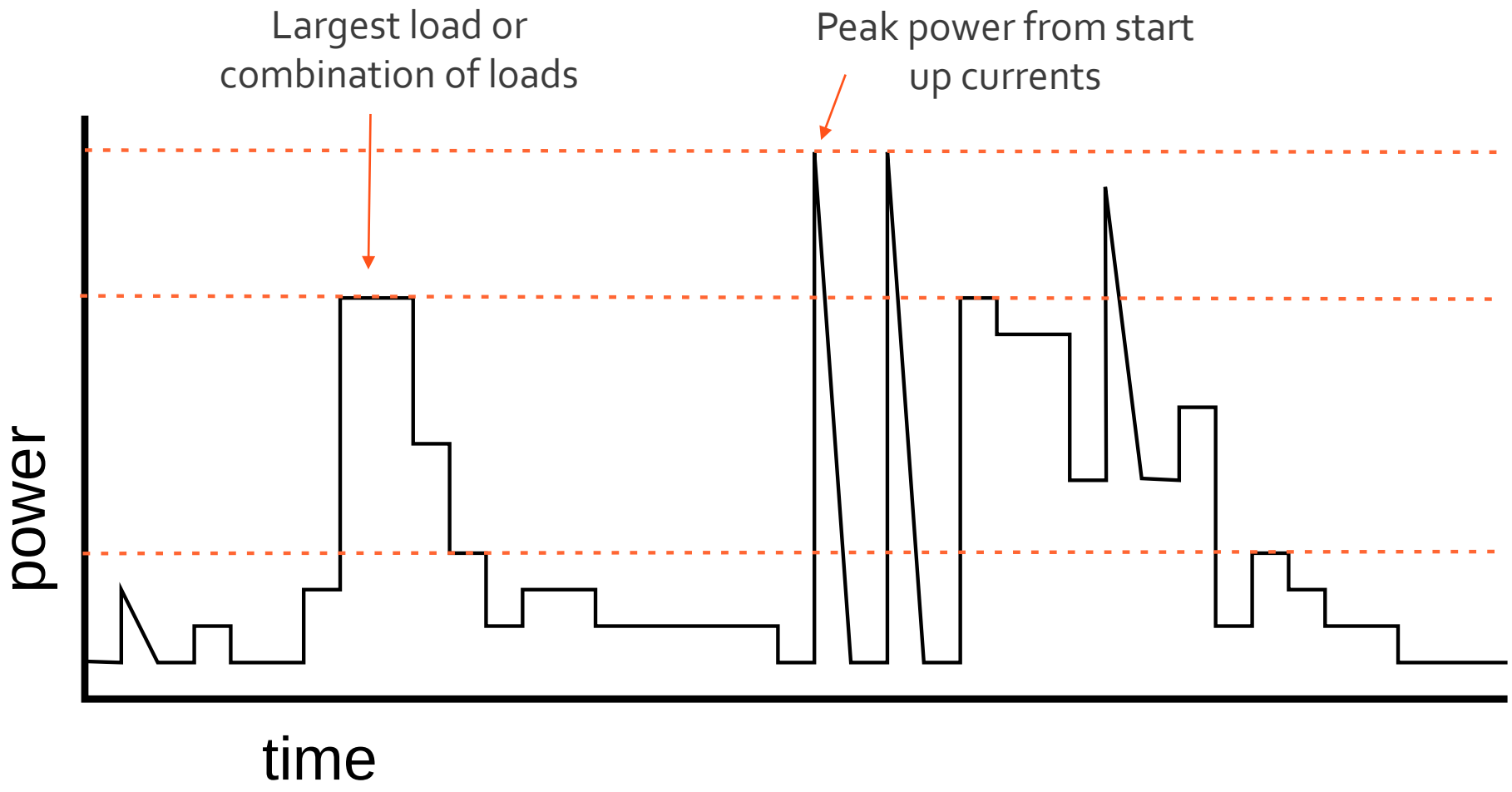
Step 2: Inverter size

Inverter calculations

- The AC loads that are running at the same time determines the inverter size
  - What is the highest expected continuous power.
- Also look closer into loads that could have a high start up power.



Average load of a system during a day



Peak load: This has to match the peak load capability of the Multi

Largest load: This determines the Multi size

Average load:

This determines the generator size in relation to its running hours

Inverter size

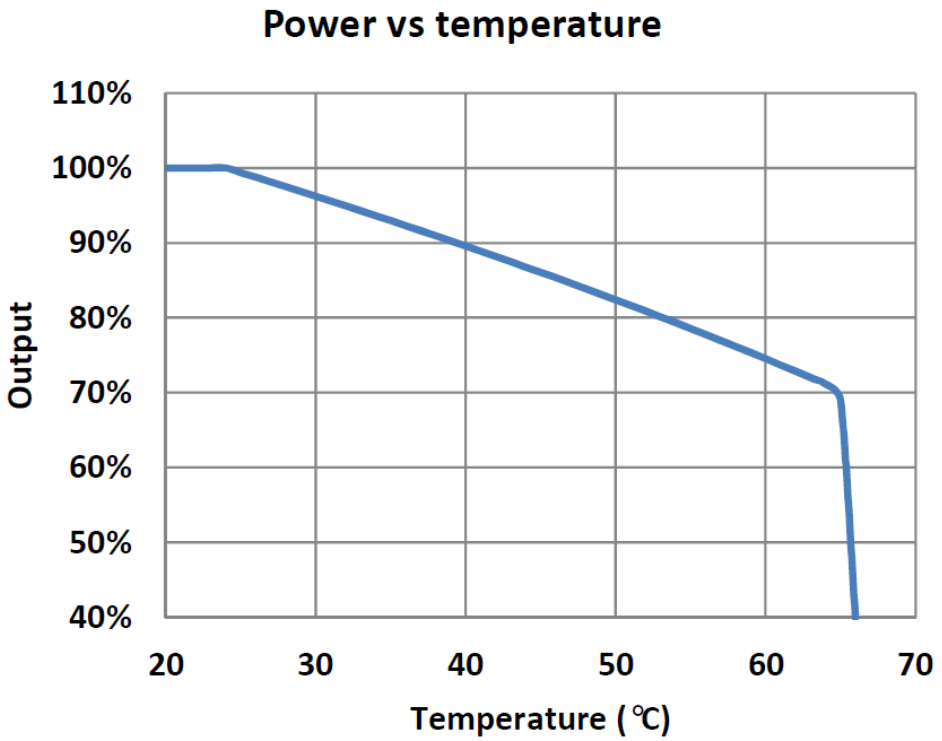
- The inverter needs to be more powerful than the biggest load or a combination of loads that are running at the same time
- A good rule of thumb is to take the total power of all loads and size the inverter to 80% of that
- In below example: 80% of 11,9 kW is 9kW. So select an 10 kVA inverter

Load	Peak power (W)	Hours in use	Usage factor	Total energy (W/h)
Washing machine	2500	2	20%	1000
Lights	280	4	100%	1120
Fridge	120	24	30%	864
Pumps	7000	0.1	100%	700
Coffee maker	2000	0.3	100%	600
Total	11900		Total	4284

Temperature deration

- Determine the worst scenario ambient temperature of the site the system is going to be in
- When calculating the inverter size always take the temperature deration in consideration

Cont. output power at 25°C (VA) (2)	1200
Cont. output power at 25°C (W)	1000
Cont. output power at 40°C (W)	900
Cont. output power at 65°C (W)	600



Step 3: Power in

Power in calculations

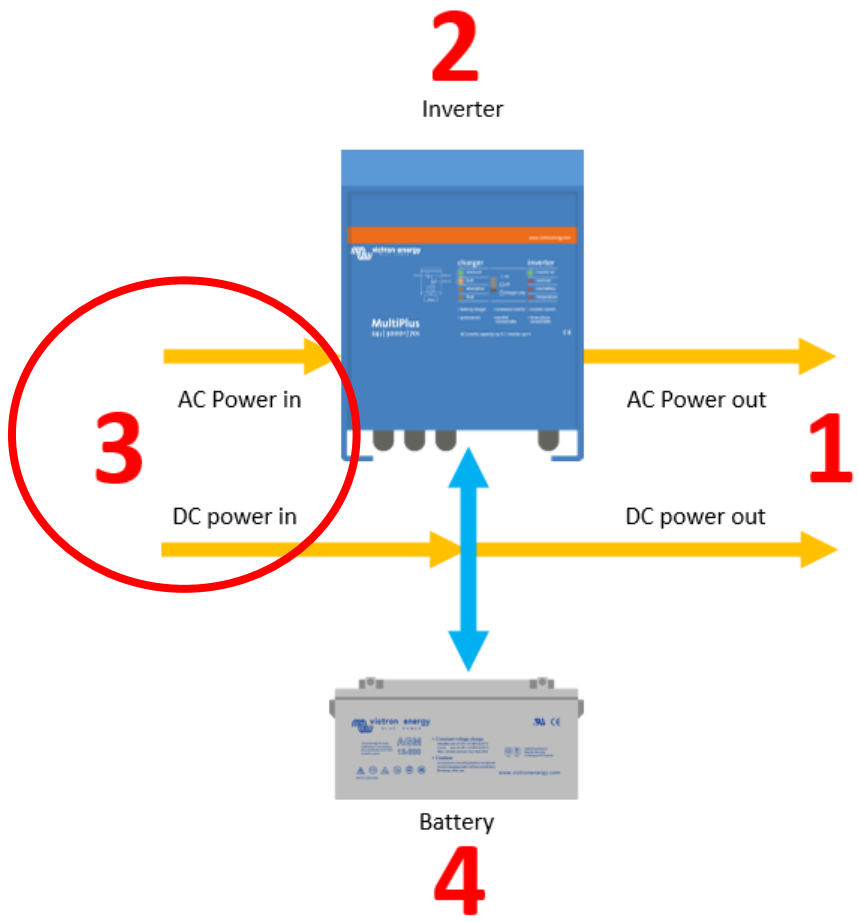
Find out what type of power is coming into the system and for how long

AC power:

- Generator, Grid

DC power

- Solar, wind, alternator, DC generator

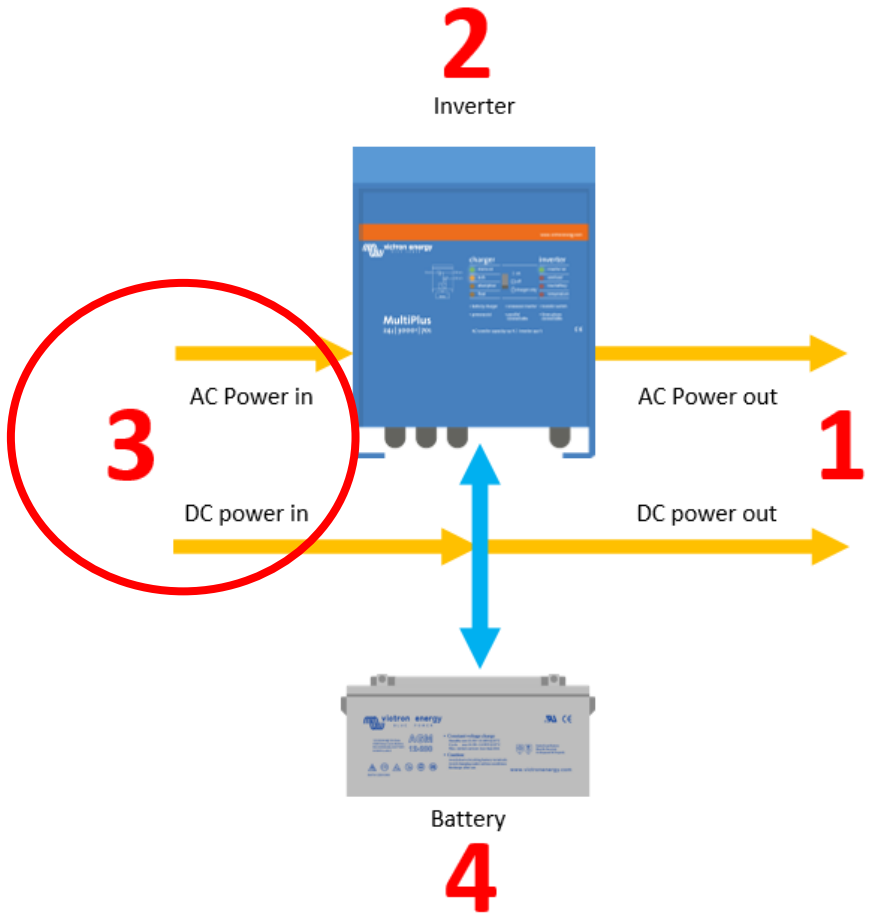


Power in calculations

All input power together > output power + losses

Add more sources if needed

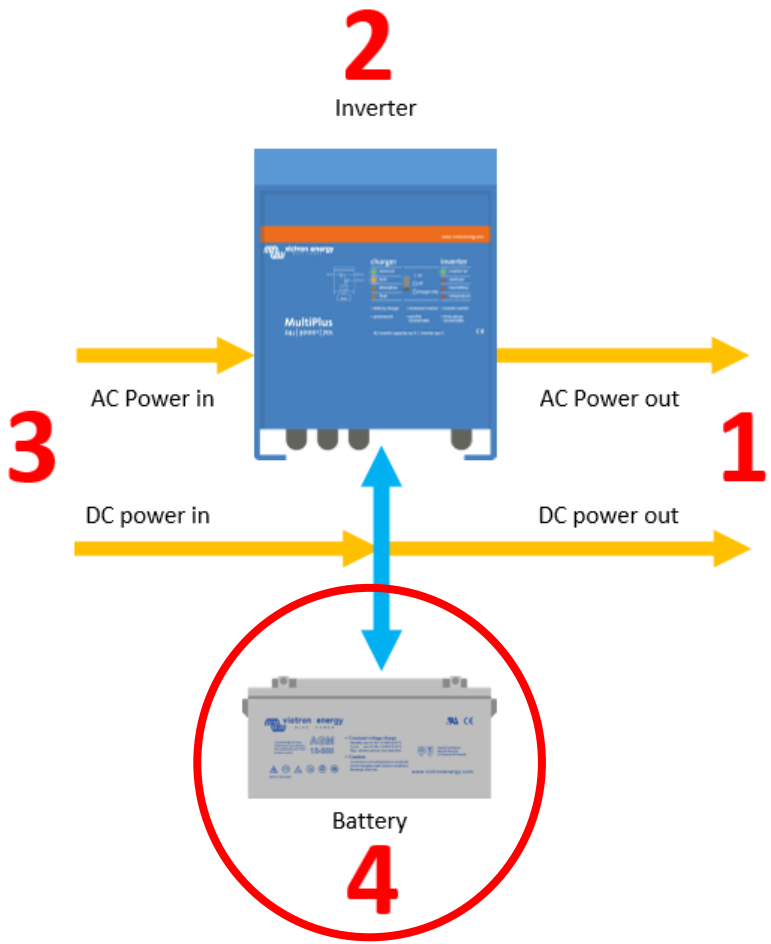
- Waterturbine
- Generator
- Grid
- Alternator
- Or more PV



Step 4: Battery size

Battery calculations

- Battery capacity
- System stand alone time
- Depth of discharge
- Charge current
- Discharge current



Battery capacity

- The battery capacity that is needed to run the system for 24 hours without the need to charge.

- Depending on the battery type, the batteries should not be discharged more than 50%

Power usage per day = 1800 Wh
This is for a 12V battery: 1800 / 12 = 150 Ah
Maximum 50 % discharge: 150 / 0.5 = 300Ah

Battery capacity

- Check with manual Inverter, MultiPlus or Quattro

	24/800	24/1200	12/800	12/1200	12/1600
			24/1600		
Recommended battery capacity (Ah)	40 – 200	40 – 400	100 – 400	150 – 700	200 – 700

Standalone time

- Decide how long this system should function without the need for charging from AC

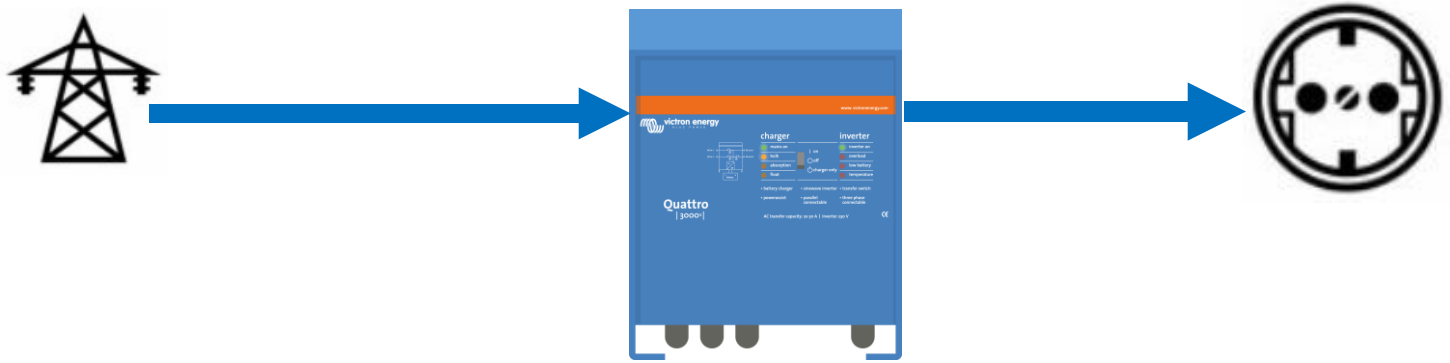
Stand alone time = 3 days:
Battery capacity for 1 day = 300 Ah
Battery capacity needed for 3 days = 3x300 = 900Ah

Charge current

- The charge current should be 10-20% of the battery capacity, depending on the type of battery

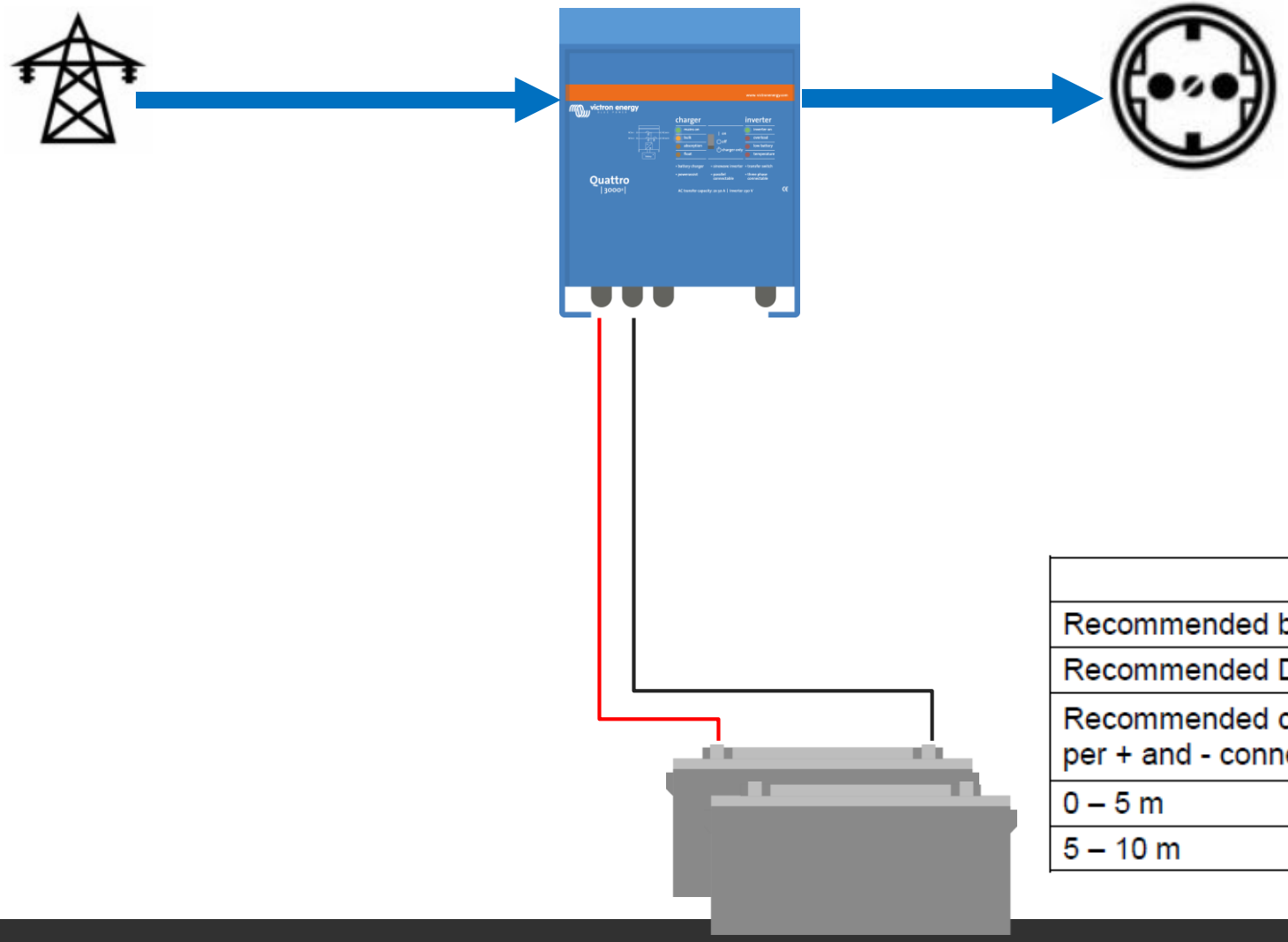
Charge current 15% of capacity: 300Ah x 0.15 = 45A
or
3 days stand alone 900Ah x 0.15 = 135A

System setup MultiPlus



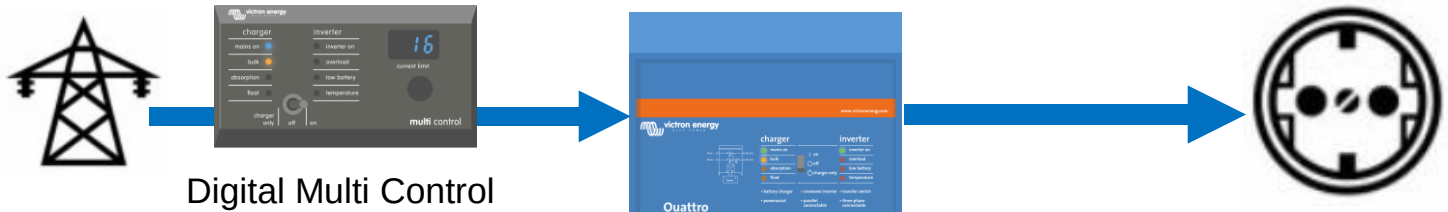
UPS output

System setup Batteries, DC cables



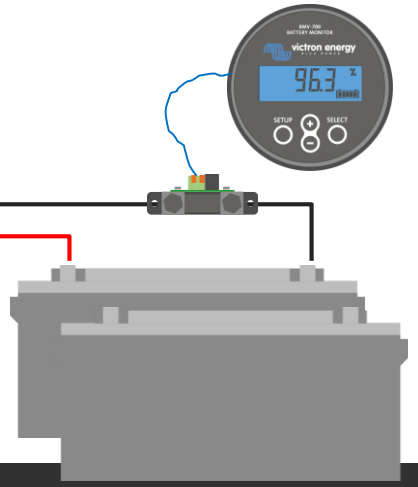
	12/3000/120	24/3000/70	48/3000/35
Recommended battery capacity (Ah)	400–1200	200–700	100–400
Recommended DC fuse	400A	300A	125A
Recommended cross section (mm^2) per + and - connection terminal			
0 – 5 m	2x 50 mm^2	50 mm^2	35 mm^2
5 – 10 m	2x 70 mm^2	2x 50 mm^2	2x 35 mm^2

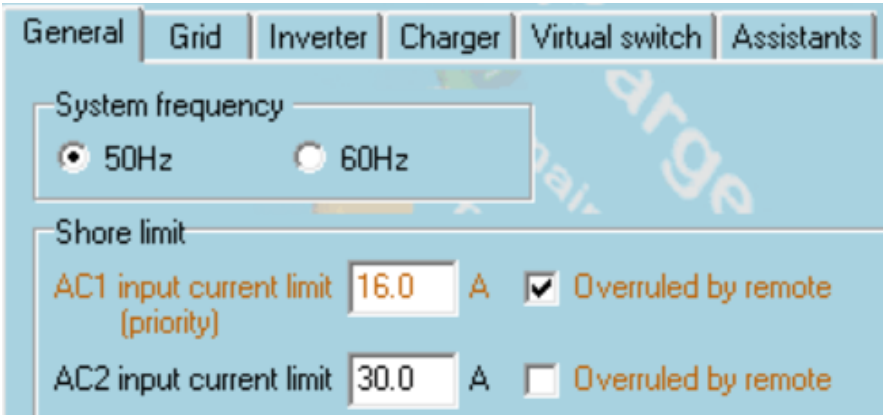
System setup Digital Multi Control, BMV

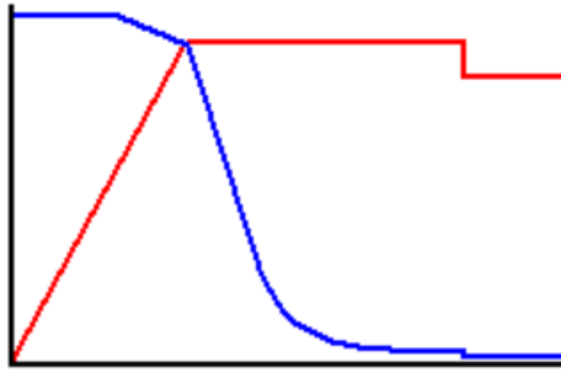


Digital Multi Control

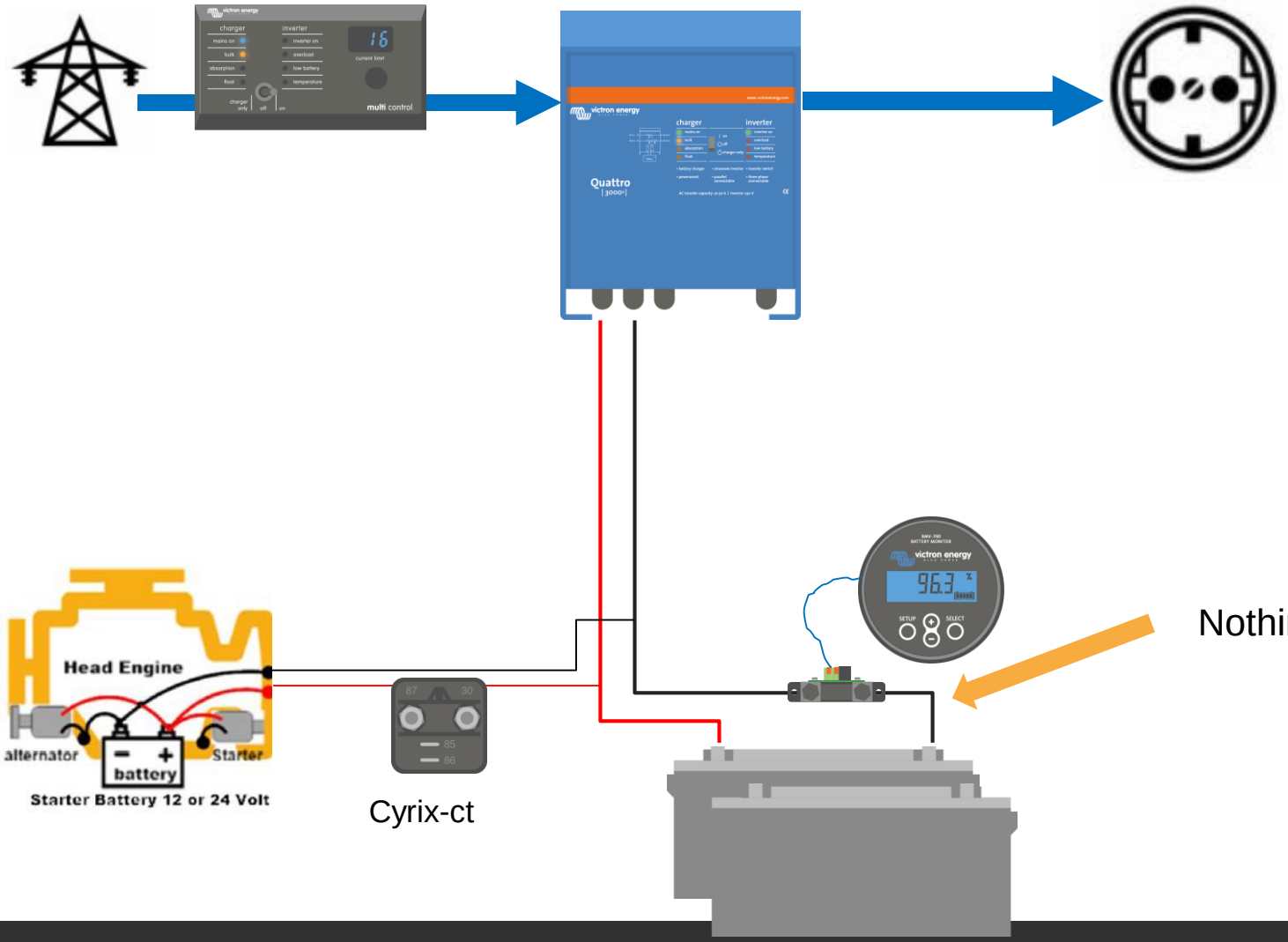
BMV





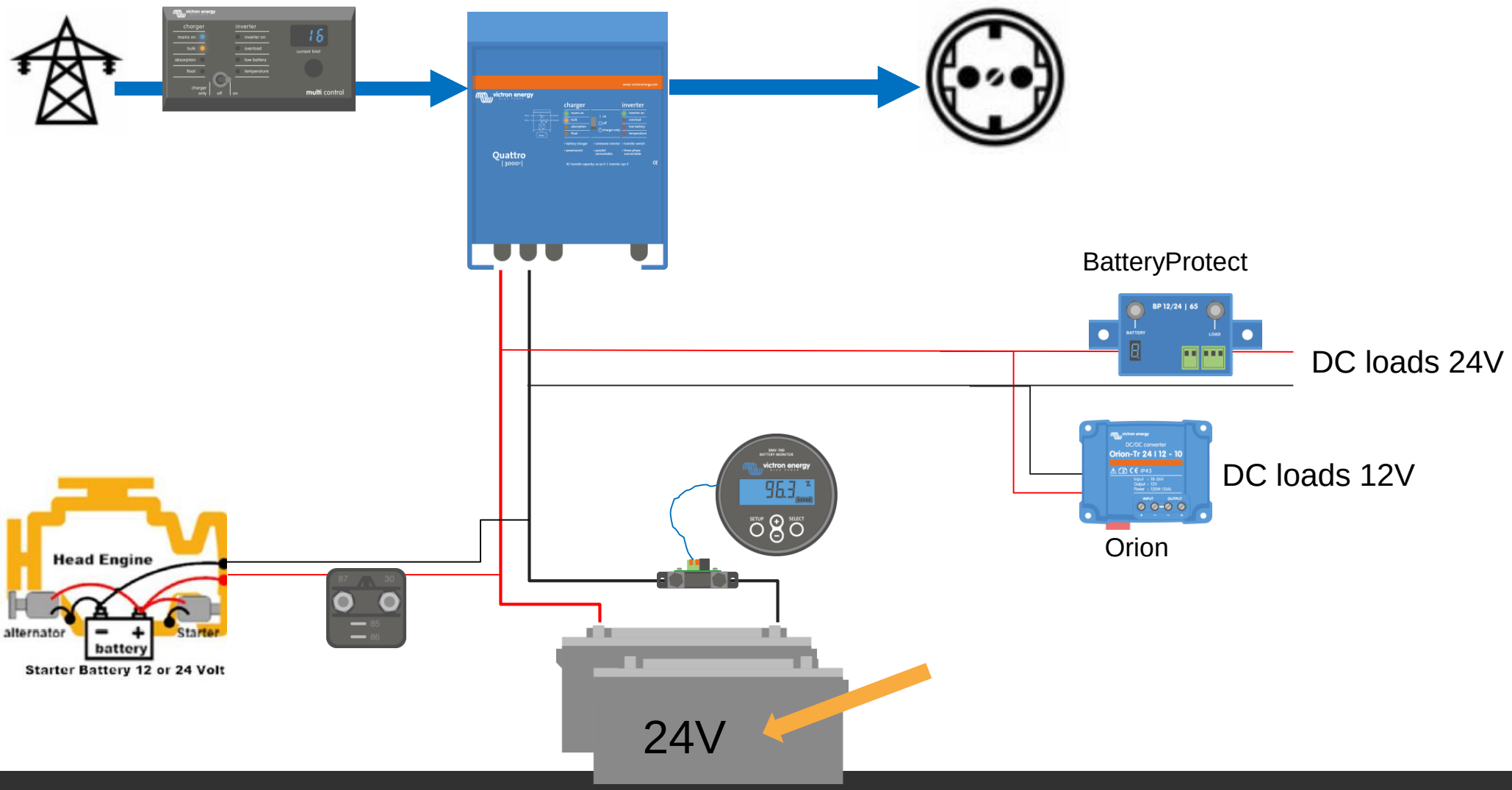


System setup Add DC source with Cyrix

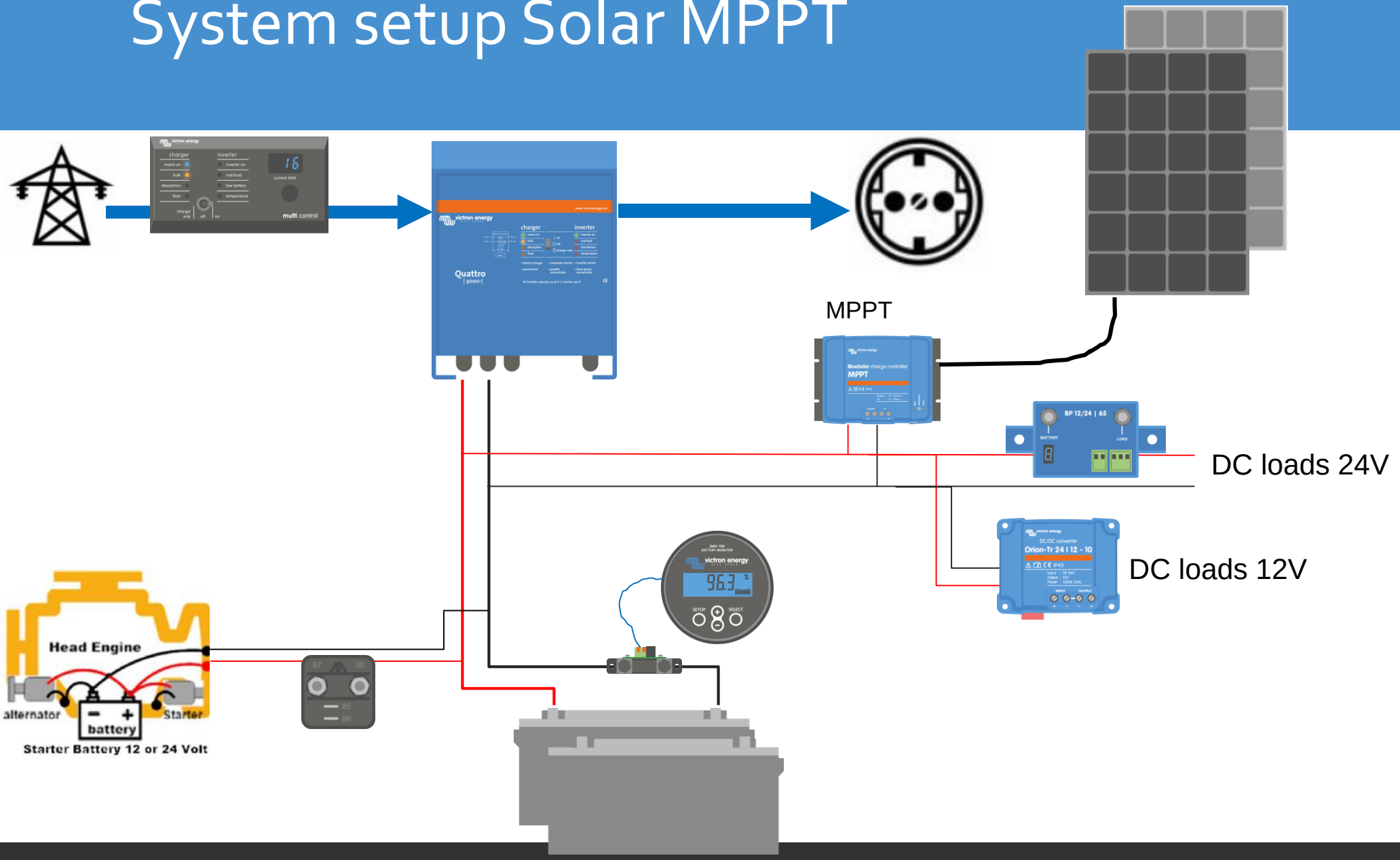


Nothing connected between shunt and battery -

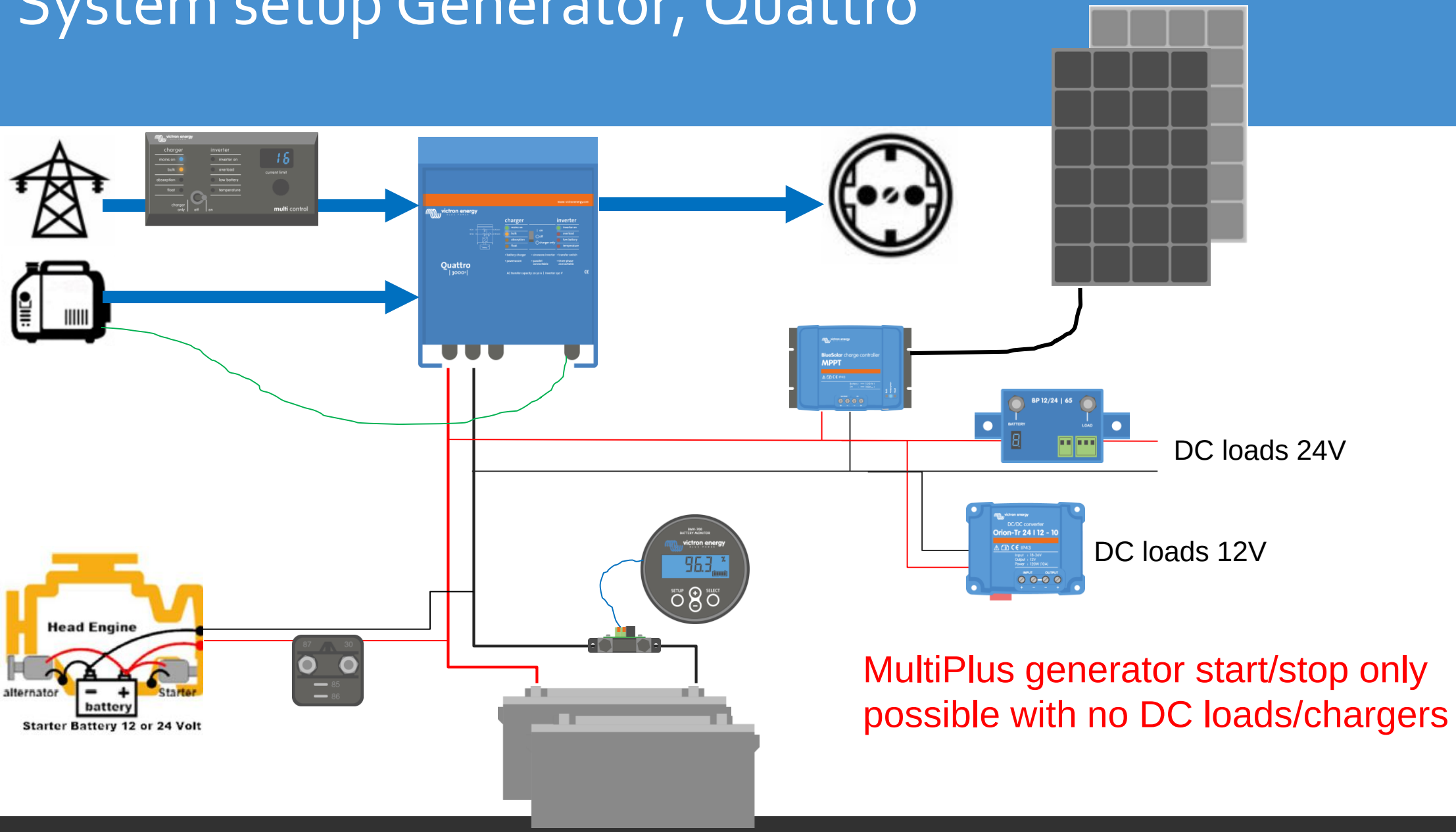
System setup DC loads, BatteryProtect, Orion



System setup Solar MPPT

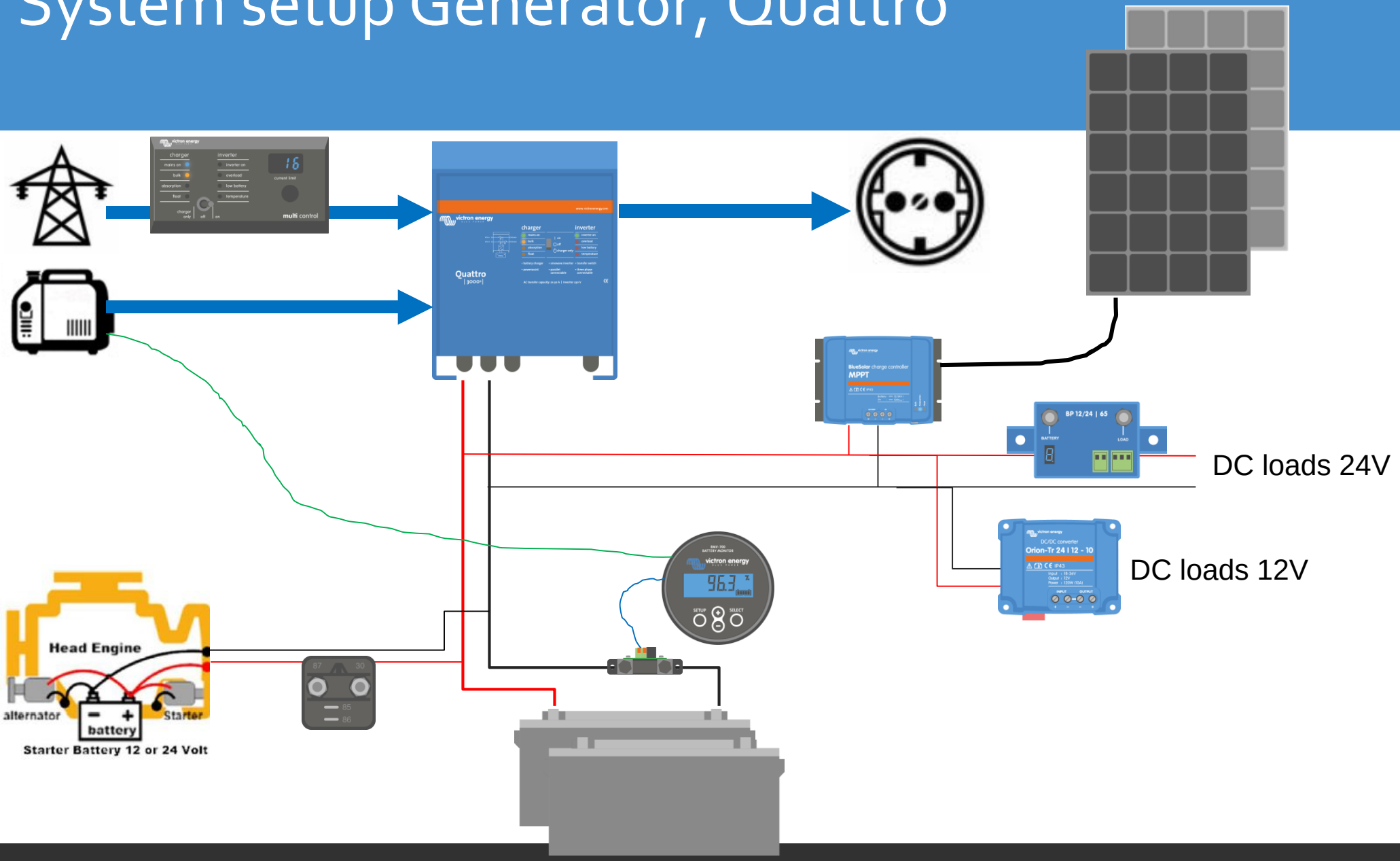


System setup Generator, Quattro

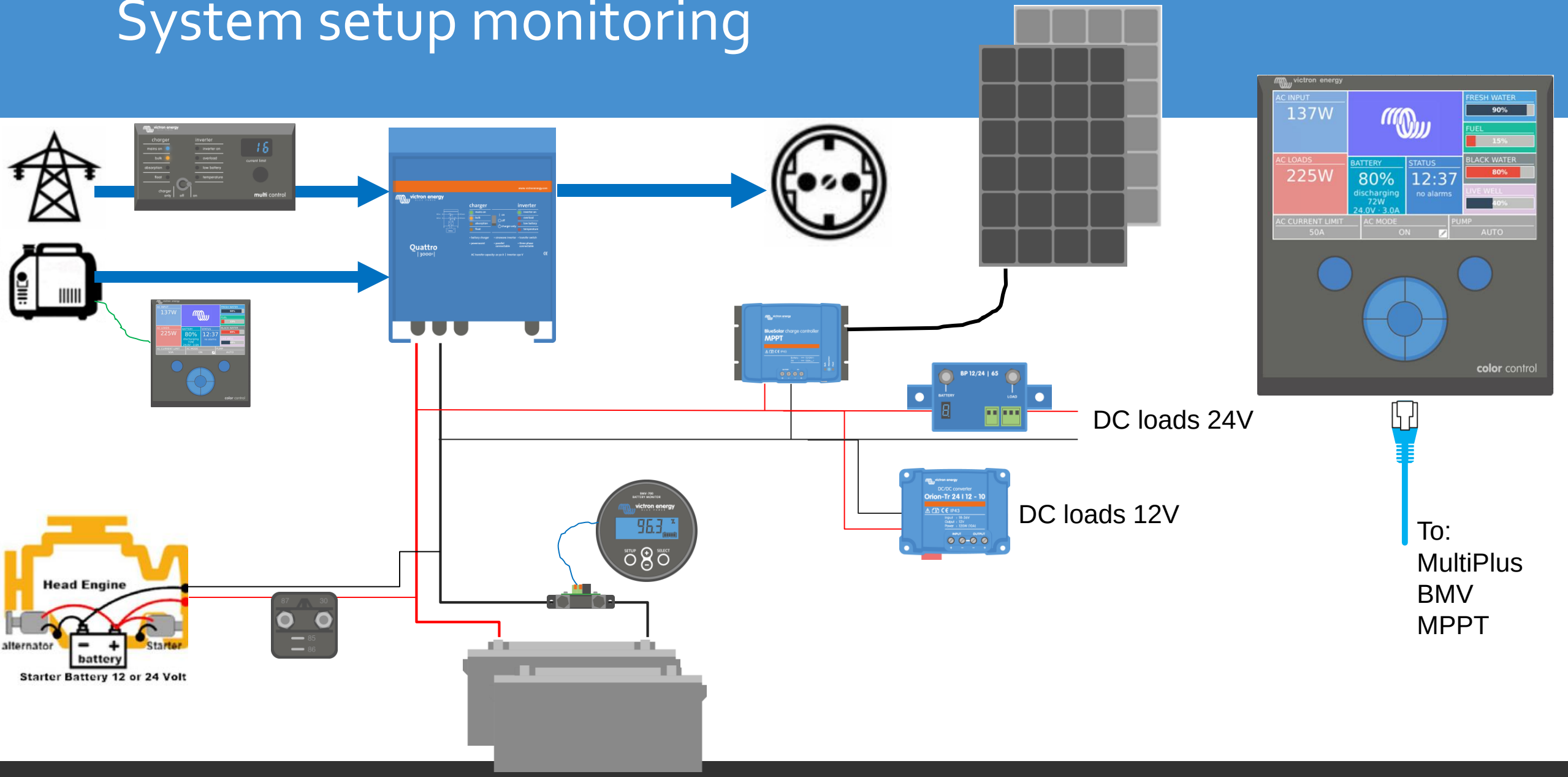


MultiPlus generator start/stop only possible with no DC loads/chargers

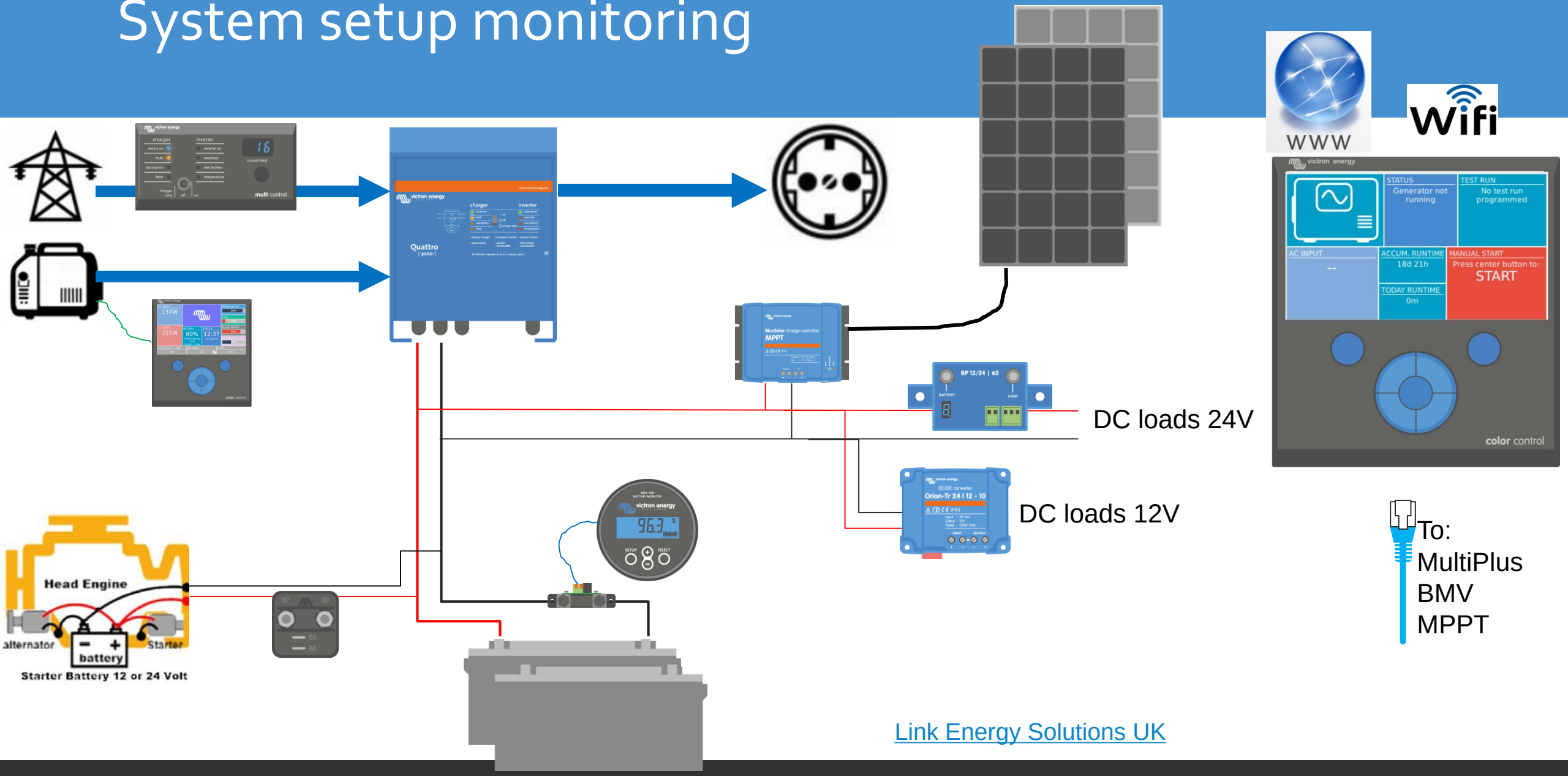
System setup Generator, Quattro



System setup monitoring



System setup monitoring



[Link Energy Solutions UK]

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