Steca Elektronik
SOLARIX PLI 5000-48

INVERTER SYSTEMS
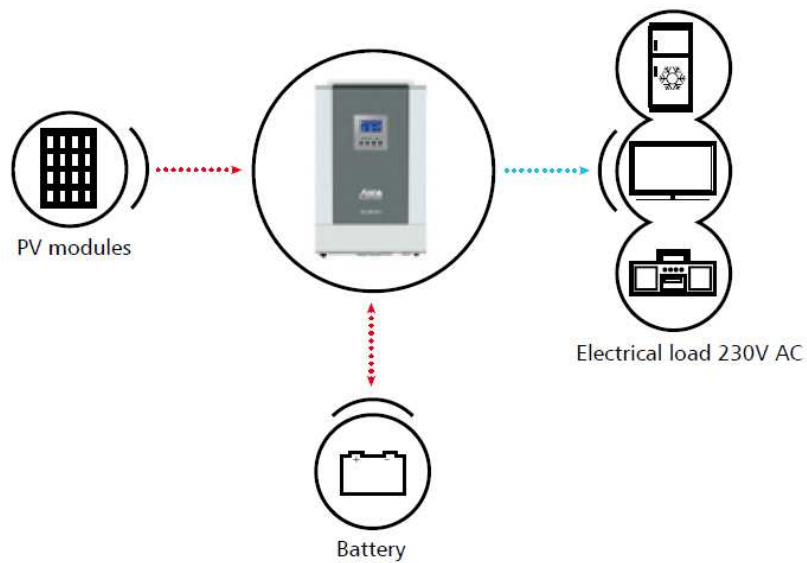## SOLARIX PLI 5000-48

- Inverter / Charger with MPPT charge controller

- All-in-one:

    - 5 kW pure sine wave inverter (10 kW up to 5 s)

    - 80 A MPPT charge controller (max. 145 Voc)

    - 60 A charger from AC source (grid or generator)

    - *Additionally only fuses and surge protector are required in most systems*

- Usable off-grid and on-grid (no grid injection)

- Usable with generator (automatic generator start)

- Solar or grid / generator priority selectable

- Synchronised to grid and fast UPS switching (10 ms)

- Overload bypass to grid selectable

- Very light: 11.5 kg

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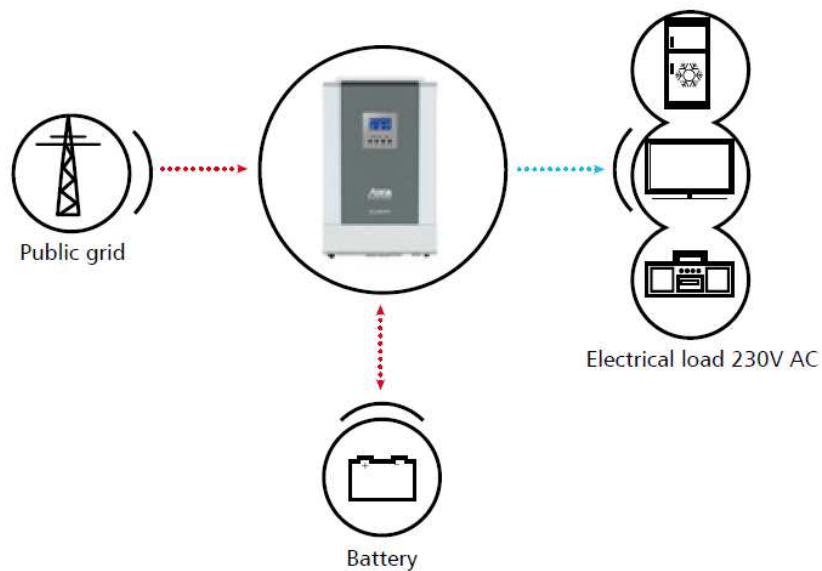## SOLARIX PLI 5000-48

Example: off-grid system

PV modules

Battery

Electrical load 230V AC

- Pure off-grid system (no AC input)
- PV as only energy source

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Example: uninterruptible power supply
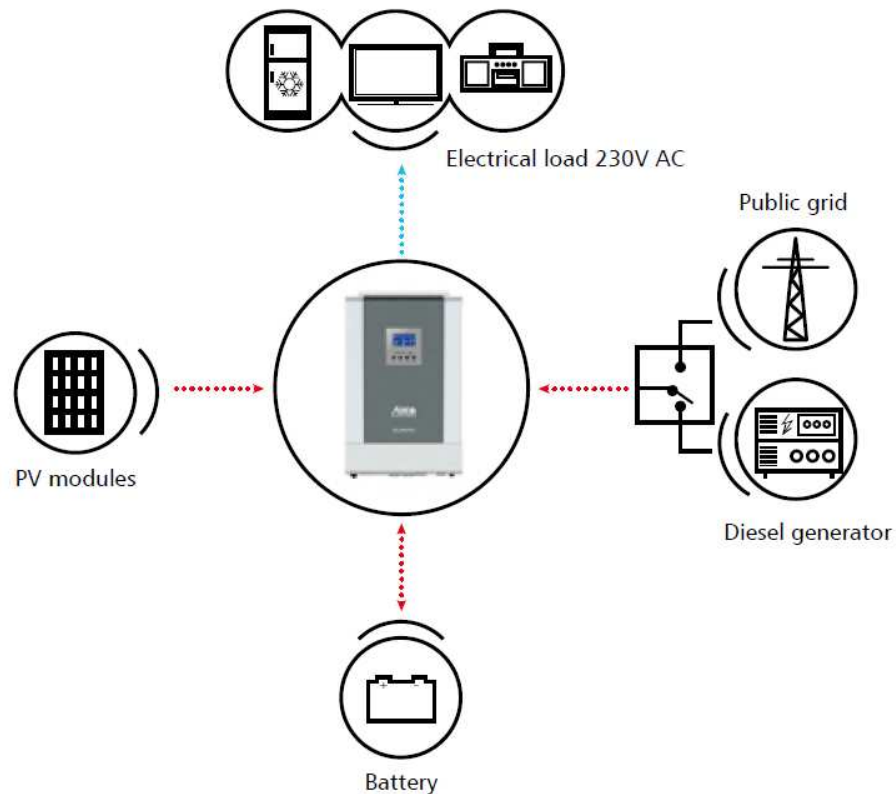
Public grid

Electrical load 230V AC

Battery

- Pure on-grid system
- No PV as only energy source, only grid
- Battery is charged from the grid whenever the grid is available
- Useful when grid fails regularly as backup (10 ms switchover time)

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**Example: solar priority with grid connection**

- Grid-connected system or off-grid with AC generator (external source selector required if both are used)

- PV is priority, alternatively grid / generator can be selected as priority

- Optional charging from the grid / generator
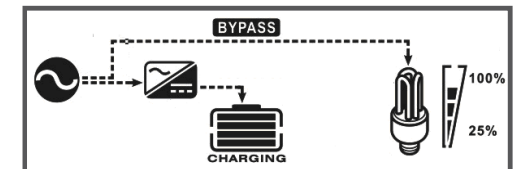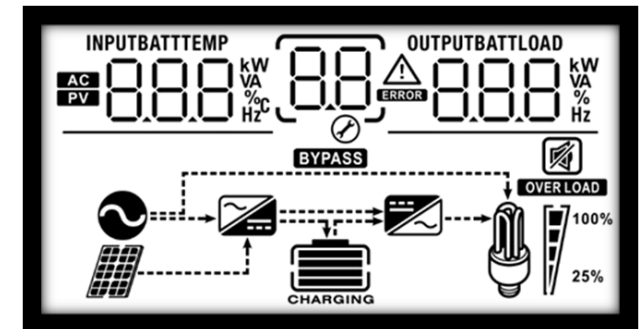
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Shown values:

- AC input / output voltage (default view)

- AC input / output frequency

- PV voltage

- Charging / discharging current

- Charging power

- Battery voltage

- Load VA / Watt / % of nominal inverter power (with overload icon)

- Battery diagram for sate-of-charge approximation and charging status

- Settings menu

- Warning / fault codes

- Alarm muted

- Energy path diagram examples:
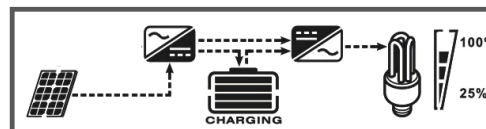
PV charging with inverter on

Grid charging with by-pass mode active

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Energy source priorities

- **Solar → Battery → AC input / utility (SBU)**

1. PV supplies the loads first

2. If PV power is insufficient, the battery supplies the remaining energy

3. When the battery reaches its programmable lower battery limit (not the same as low-voltage disconnect), the AC input is used to supply the loads entirely

Use-case:

- Maximum reduction of grid power consumption by utilising PV and the battery capacity to their fullest extent.

- **AC input first (utility grid)**

1. Whenever a valid AC input source is present, it is used first

2. When no valid AC input source is available, power to the loads is supplied by PV and the battery

Use-case:

- Classic uninterruptible power supply: use the AC input / grid when possible. When the grid fails, supply the loads from PV and battery.
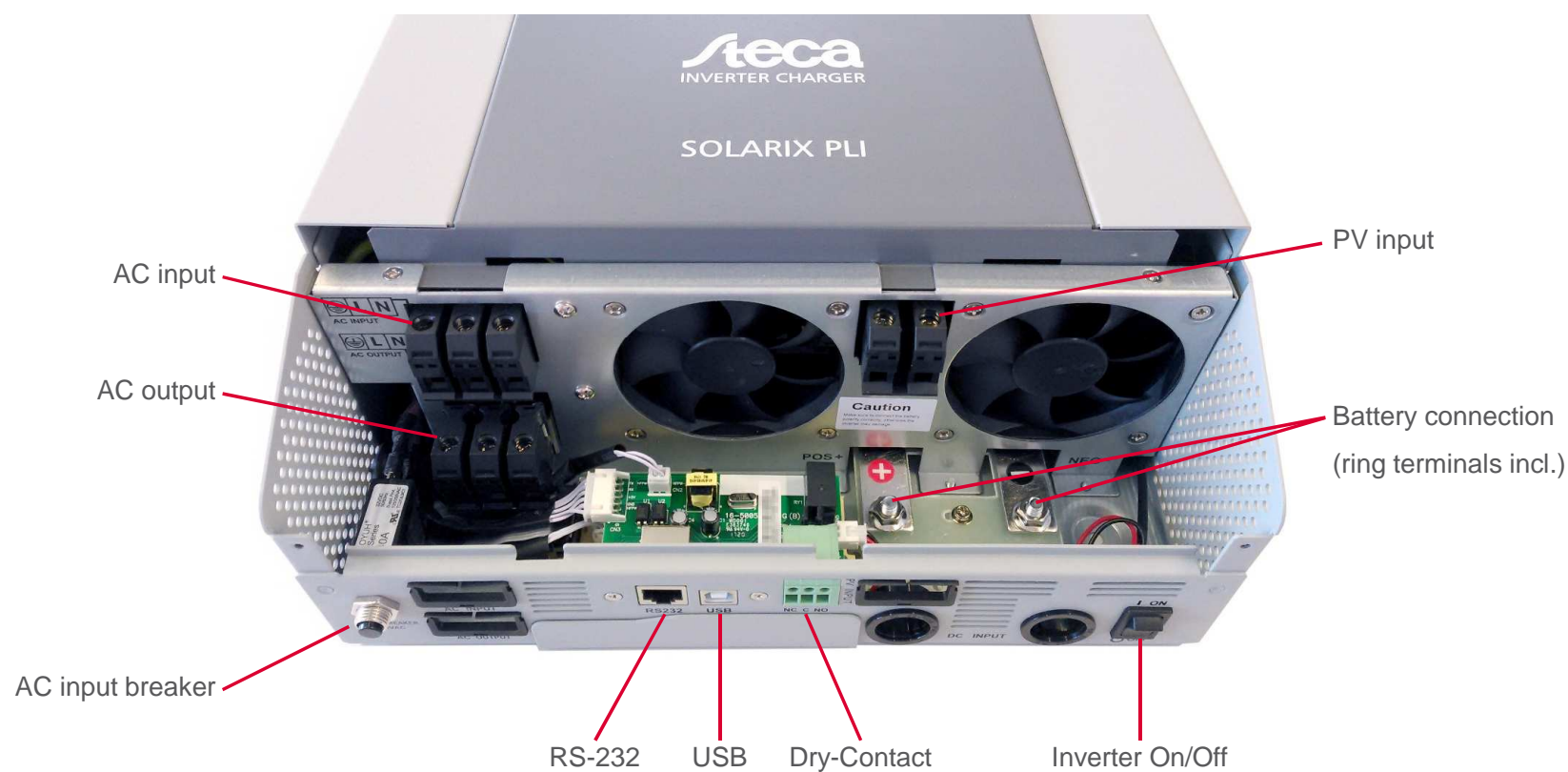
- **Solar first**

1. PV supplies the loads first

2. If PV power is insufficient (but available), the battery supplies the remaining energy

3. When the battery reaches its programmable lower battery limit (not the same as low-voltage disconnect) <u>or</u> when there is no PV energy available (0 Watts), the AC input is used to supply the loads entirely

Use-case:

- Reduction of grid power consumption by utilising PV to its fullest extent, but limiting battery cycling. During the night, when no PV power is available, the Solarix PLI will only supply loads from the AC input (unless the AC input / grid fails, then the battery will supply the loads).
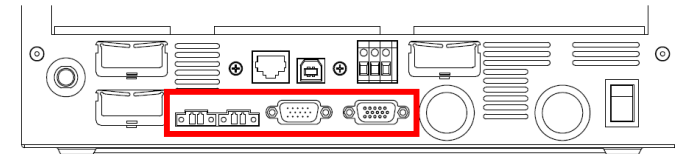
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AC input

AC output

AC input breaker

PV input

Battery connection
(ring terminals incl.)

RS-232   USB   Dry-Contact   Inverter On/Off

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Parallel / 3-phase kit

- Parallel Kit to extend Solarix PLI systems

- Up to 9 Solarix PLI can be connected together:

    - Maximum 45 kW (9 x 5 kW) = 9 pcs. Solarix PLI per system

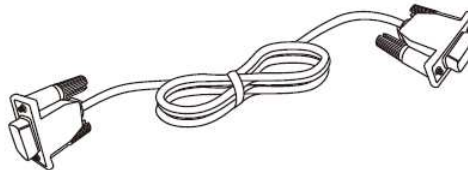   - Maximum 9 pcs. Solarix PLI on one phase

Installed Parallel Board

Parallel Kit contents:
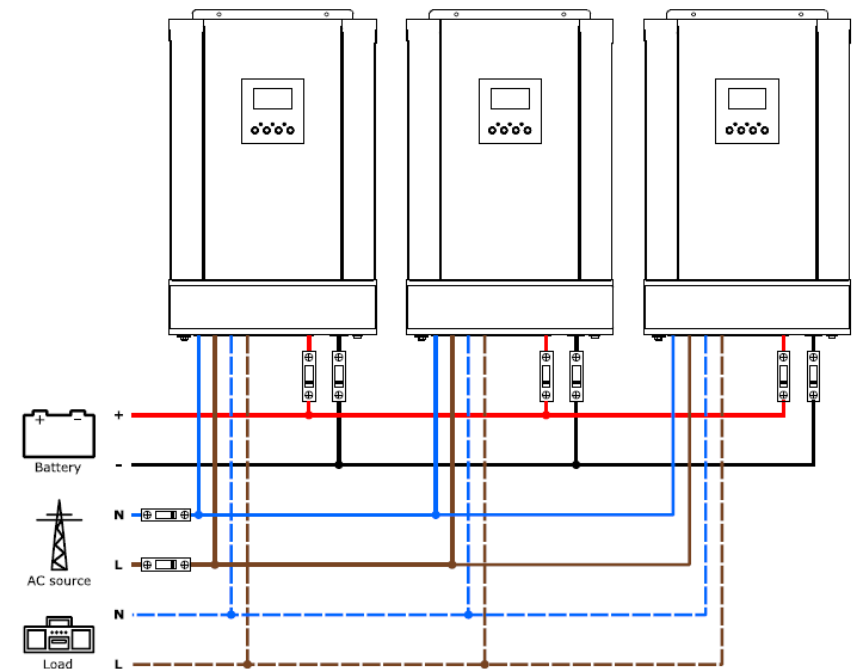

Parallel Board

Communication Cable

Current Sharing Cable
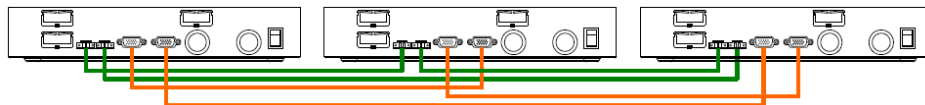
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Parallel connection

- Example: 3x Solarix PLI on one phase

- Up to 9x PLI on one phase possible

Communication and Current Sharing Cables (included in kit):
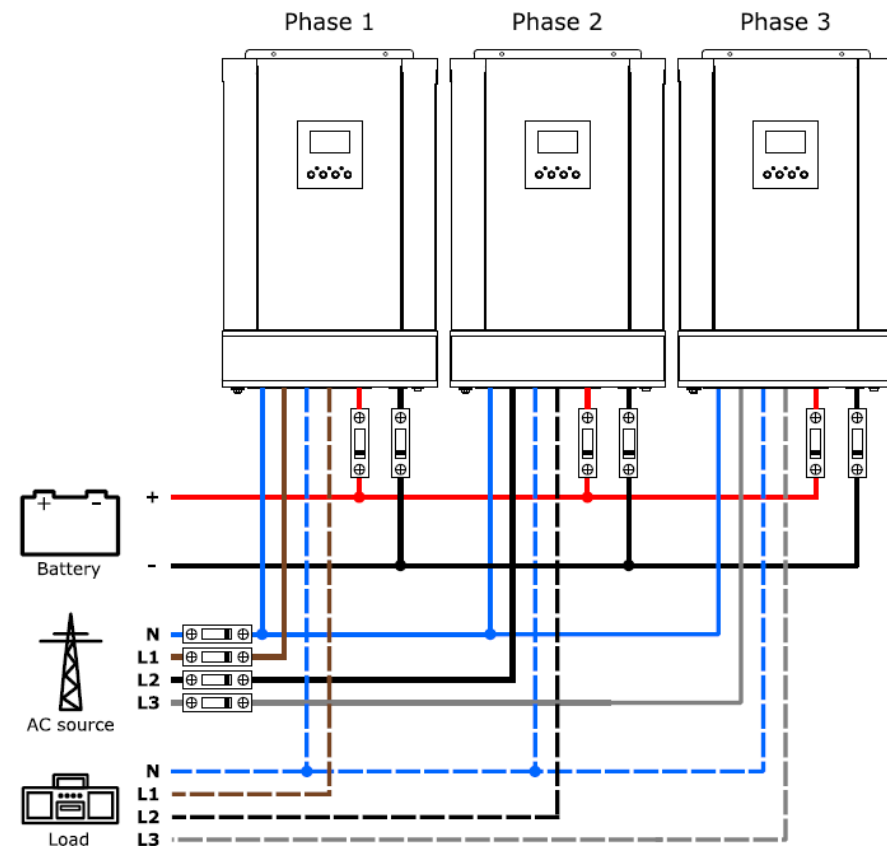
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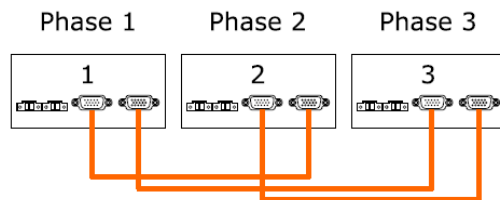
3-phase connection

- Example: 3x Solarix PLI, one on each phase

- At least on PLI per phase, up to 7x PLI on one phase possible

Communication and Current Sharing Cables:

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3-phase connection
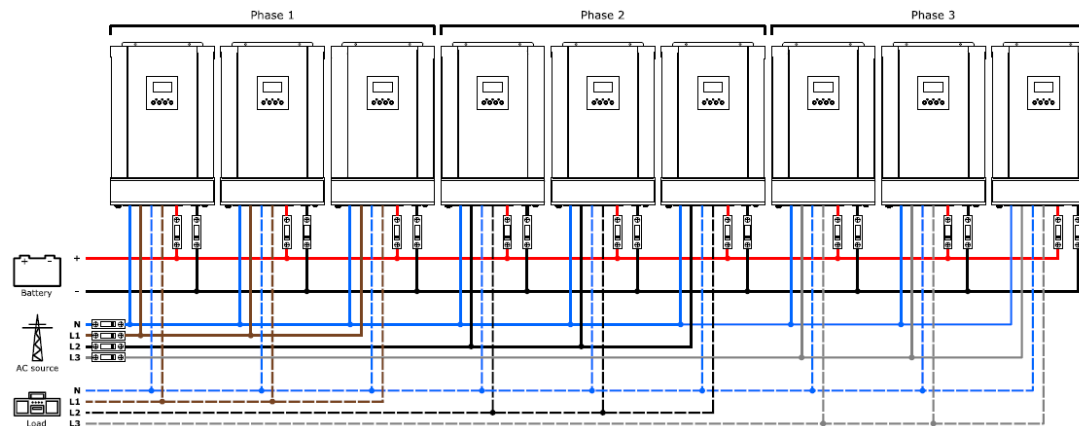
← Example: 3x PLI per phase

Example: 3x PLI on L1 + 2x PLI on L2 + 1x PLI on L3 →
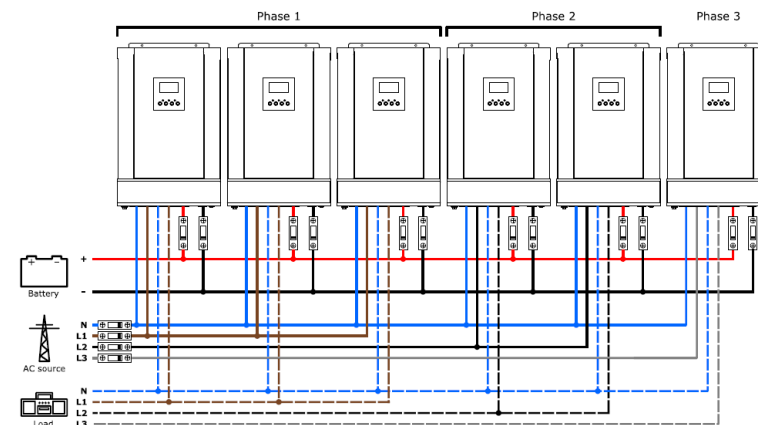
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Block diagram
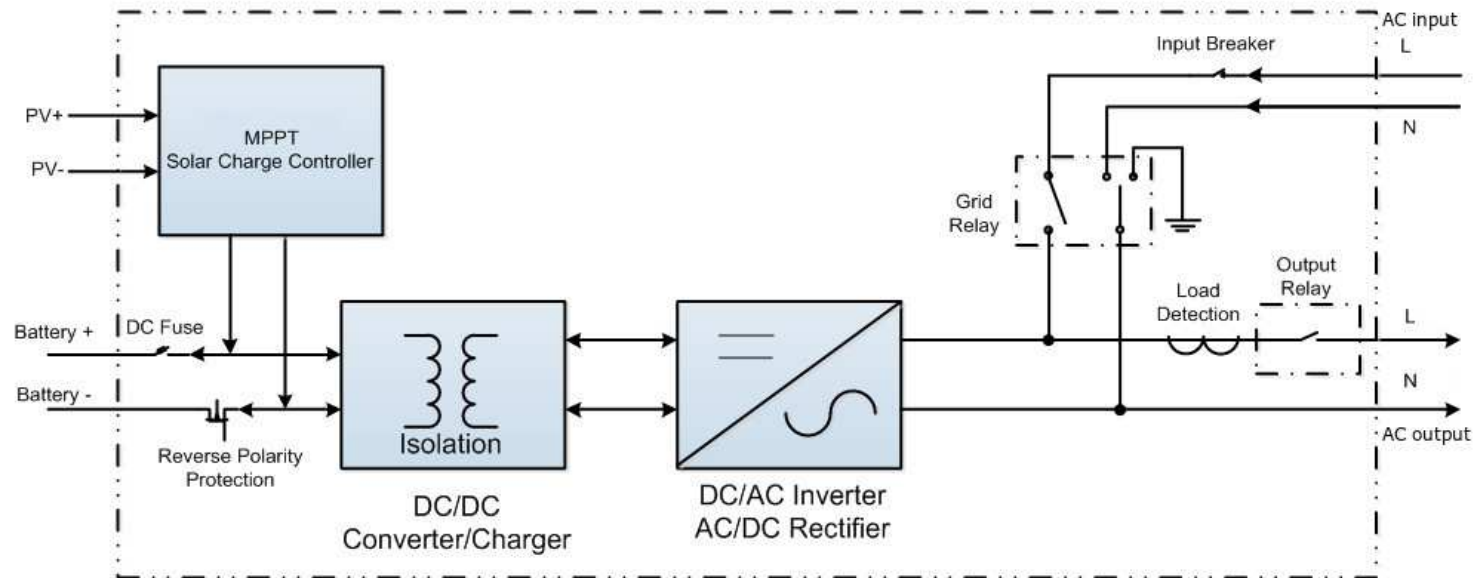
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PV grounding

- It is possible (but not necessary) to ground the positive PV cable, if so required by the PV module manufacturer
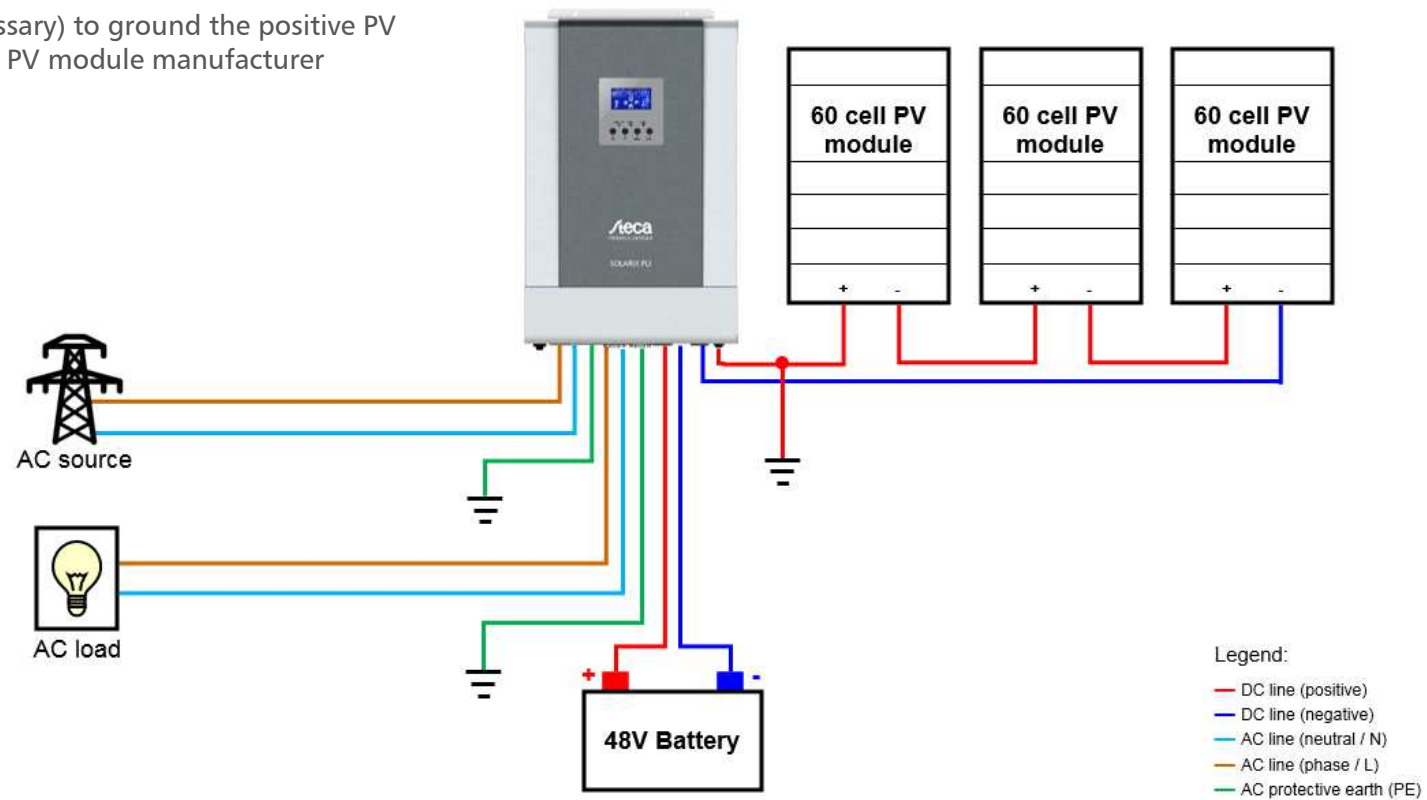
Legend:
— DC line (positive)
— DC line (negative)
— AC line (neutral / N)
— AC line (phase / L)
— AC protective earth (PE)

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PV grounding

- It is possible (but not necessary) to ground the negative
  PV cable, if so required by the PV module manufacturer
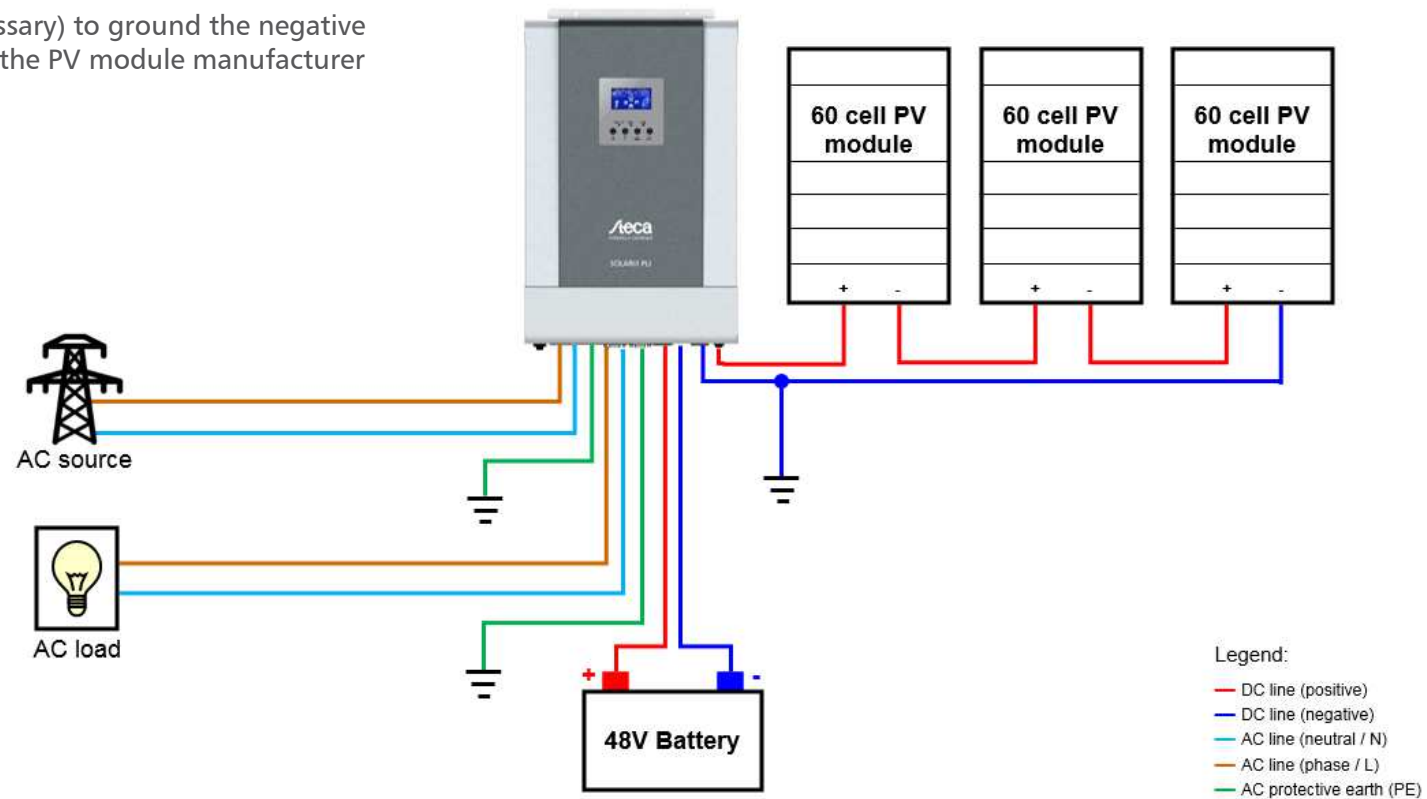
Legend:
- —— DC line (positive)
- —— DC line (negative)
- —— AC line (neutral / N)
- —— AC line (phase / L)
- —— AC protective earth (PE)

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Battery grounding

- It is possible (but not necessary) to ground the **positive** terminal of the battery

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Battery grounding

- It is possible (but not necessary) to ground the **negative** terminal of the battery

Legend:
— DC line (positive)
— DC line (negative)
— AC line (neutral / N)
— AC line (phase / L)
— AC protective earth (PE)

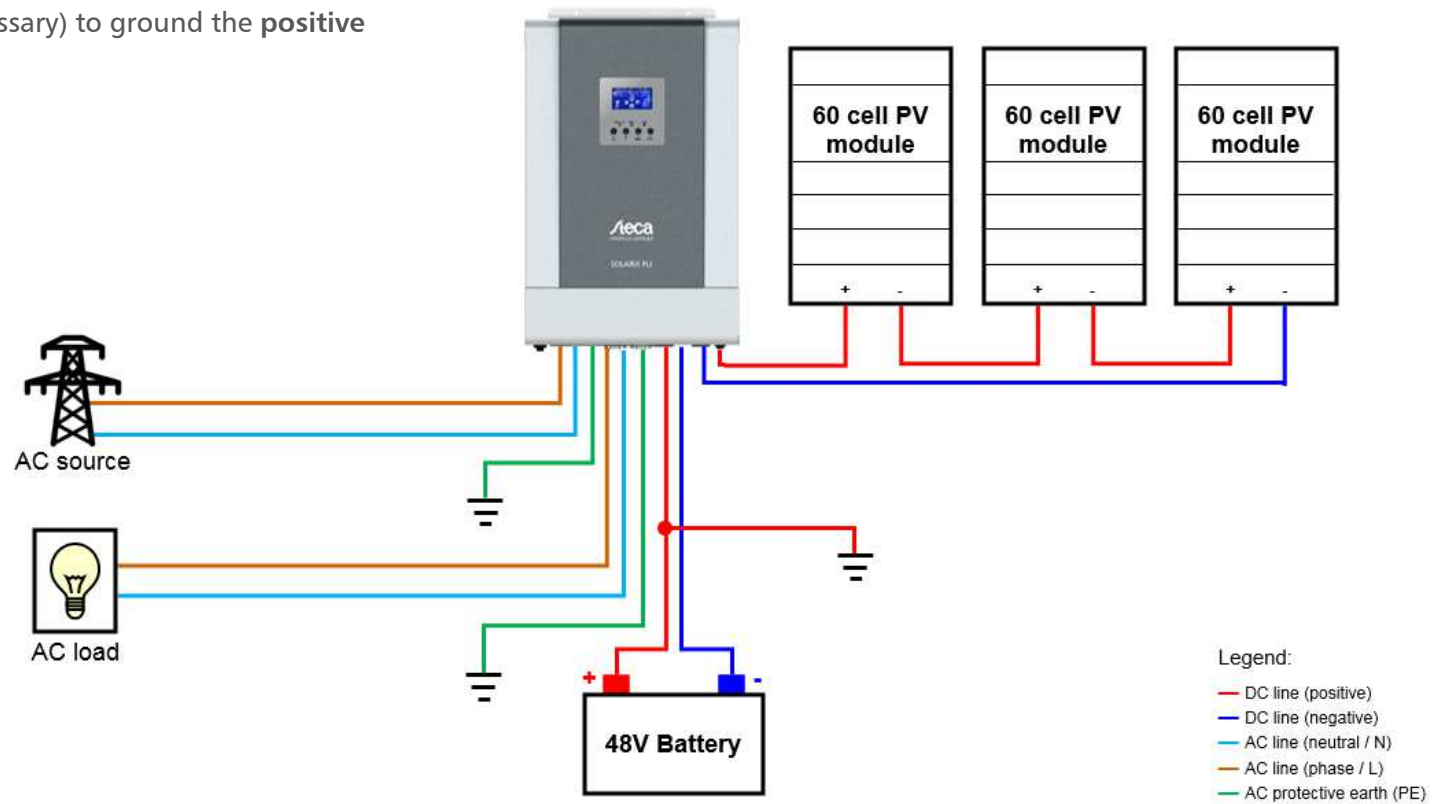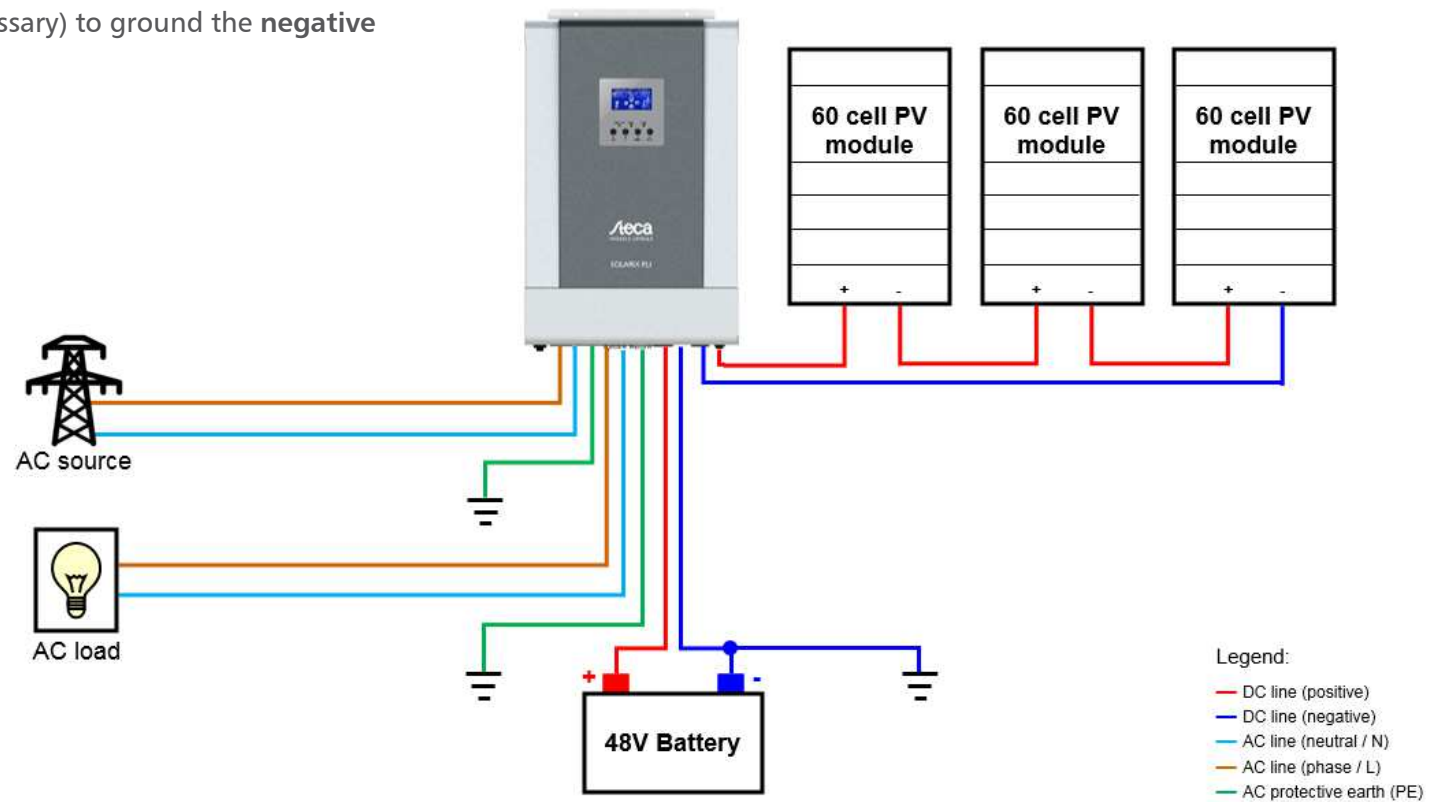# INVERTER SYSTEMS

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Battery and PV grounding

- It is possible (but not necessary) to ground the negative terminal of both the PV cables and the battery.

60 cell PV module

60 cell PV module

60 cell PV module

AC source

AC load

48V Battery

Legend:
— DC line (positive)
— DC line (negative)
— AC line (neutral / N)
— AC line (phase / L)
— AC protective earth (PE)
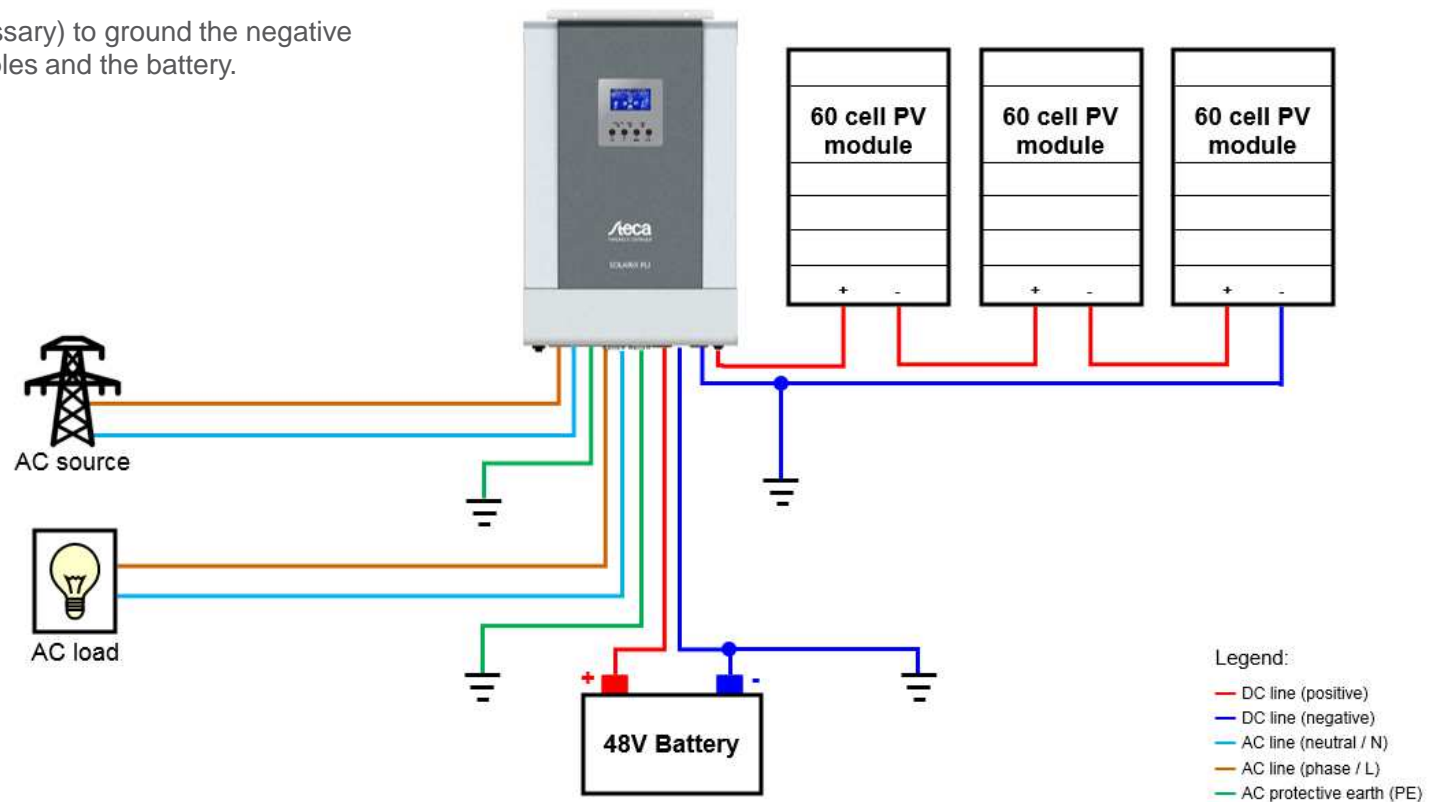
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Battery and PV grounding

What type of battery / PV grounding is not possible?

- It is **not** permitted to ground a PV cable and the opposite polarity of the battery terminal at the same time

- It is **not** permitted to ground the positive PV cable and the positive battery terminal at the same time

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AC grounding & operator protection

- It is necessary to ground the PE (protective earth) terminals of the AC input and AC output of the Solarix PLI

- When the Solarix PLI is running in inverter / battery mode (disconnected from the AC input), neutral (N) is automatically tied to PE, therefore a residual current device (RCD) will function between the AC output and the loads in this mode

- Possible alternatives:

1. Take advantage of the automatic N to PE bridging of the inverter

2. Use an insulation monitor

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AC grounding & operator protection: automatic N to PE bridging

- N and PE (protective earth) are <u>automatically bridged</u> when the inverter operates in off-grid mode so that an RCD will function between the inverter and the AC loads

- Reliable protection with comparatively cheap RCD

N and PE (protective earth) are automatically connected when the inverter is in off-grid mode

AC source

AC load

RCD

48V Battery

Legend:
— DC line (positive)
— DC line (negative)
— AC line (neutral / N)
— AC line (phase / L)
— AC protective earth (PE)
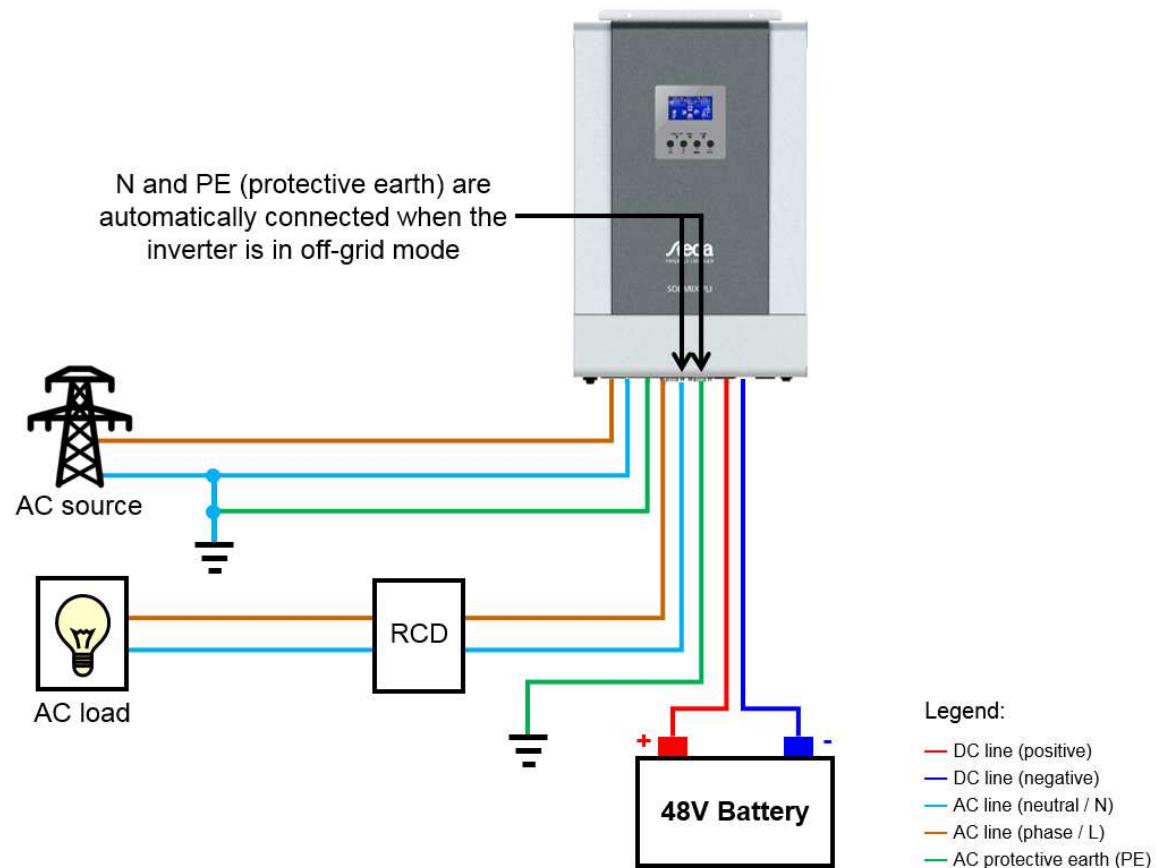
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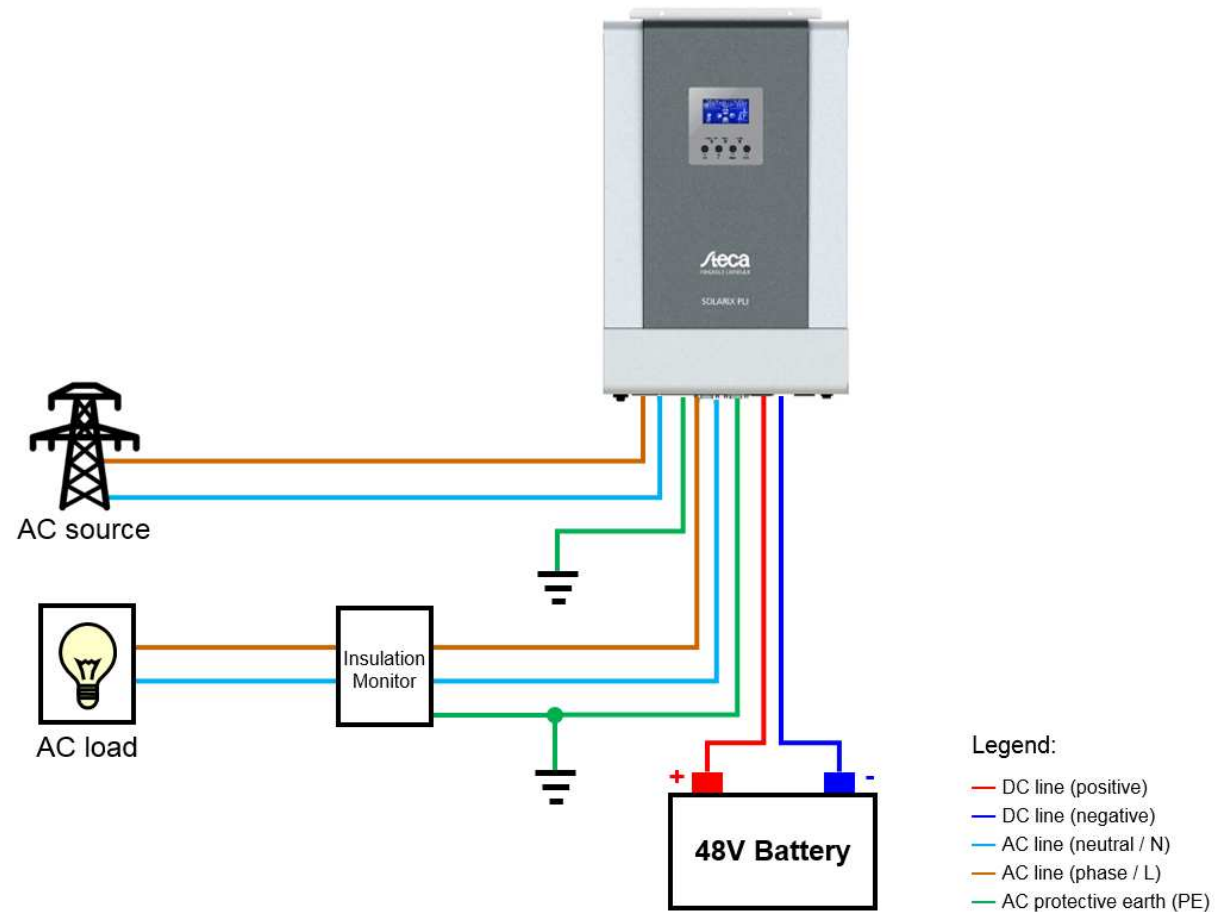## SOLARIX PLI 5000-48

**AC grounding & operator protection:
insulation monitor**

- Reliable protection with and simple
  setup with insulation monitor

- Works with virtually any grounding
  system of the grid (including IT system)

- Insulation monitor is more difficult to
  source and more expensive than RCD

AC source

AC load

Insulation Monitor

48V Battery

Legend:
— DC line (positive)
— DC line (negative)
— AC line (neutral / N)
— AC line (phase / L)
— AC protective earth (PE)

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PV sizing example

Relevant PV module information:

- Total power of PV modules (in Wp)

- Voltage of PV modules (Umpp and Uoc)

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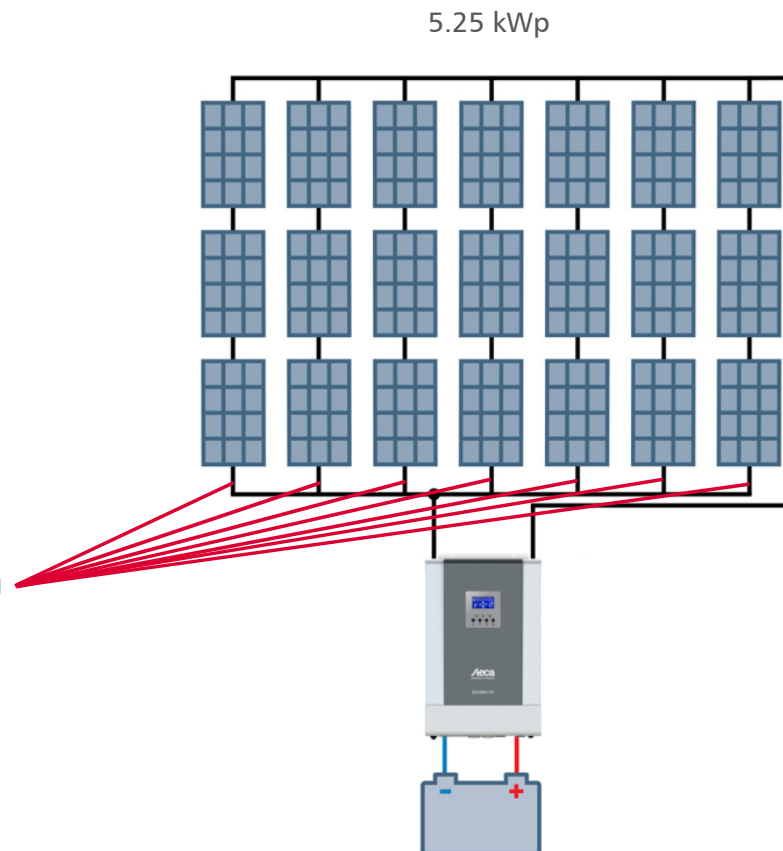## SOLARIX PLI 5000-48

PV sizing example

- The minimum voltages:
    - For 48 V Solarix PLI systems the PV voltage should be 68 Vmpp or higher

- The absolute maximum voltages <u>under all temperature conditions</u>
  (check the temperature coefficient of your PV modules) :
    - 145 Voc (115 Vmpp) for the Solarix PLI 5000-48

- Recommendations:
    - For 36-cell crystalline modules use 5 modules in series per string
    - For 60-cell crystalline modules use 3 modules in series per string
    - For 72-cell crystalline modules use 2 modules in series per string

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PV sizing example

- PV module specifications:
  - 250 Wp modules (60 cells)
  - U_{mpp} = 31.2V
  - U_{oc} = 37.6V
  - I_{sc} = 8.5A

- Battery voltage 48V, therefore maximum usable power 4800 W

- String fuses are likely required when using more than 2 strings in parallel

5.25 kWp

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Further considerations

- Ensure a sufficient battery capacity, especially when using an inverter on the same battery.
  Minimum battery size:

    - *(Nominal AC Power * 5h) / Battery voltage = Min. capacity in Ah*

- Use of a surge protector (SPD) at the PV input is strongly recommended!
  The maximum SPD DC operating voltage must only be slightly above
  the maximum Voc of the PV input.

  Example: Citel DS240S-130DC for Solarix PLI

- As with any electronics: keep as cool as possible

Thank you
FOR YOUR ATTENTION

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