

Installation Photo Report · Tasai, Chiang Rai

Selected site photos of the 6.500 kWp solar PV system at a home in Tasai, Chiang Rai, with notes on each picture, the string and breaker identification, the switch-on procedure, the insulation test, and a review of the combiner box and panel layout.

Site: Tasai, Chiang Rai · **System:** 10 panels (6.500 kWp), single-phase hybrid inverter, grid-tied · **Report date:** 10 October 2026

1. Overview of the installation



10 panels (6.500 kWp) on the carport roof, aerial view after installation.

System overview

The site has a 6.5 kWp solar PV system made up of 10 LONGi Hi-MO X10 panels of 650 W each (model LR7-72HVB-650M), installed in two rows of five on the flat roof of the carport. Because the panels sit on the flat cement roof, they are very convenient to reach for maintenance.

The panels feed a single-phase Solis hybrid inverter connected to the grid, with each row on its own MPPT input. At full capacity the system can produce up to 32 kWh per day, based on about 5 hours of full sun on the panels per day in Thailand. The actual output depends on the customer's consumption.

2. Inverter and control cabinet

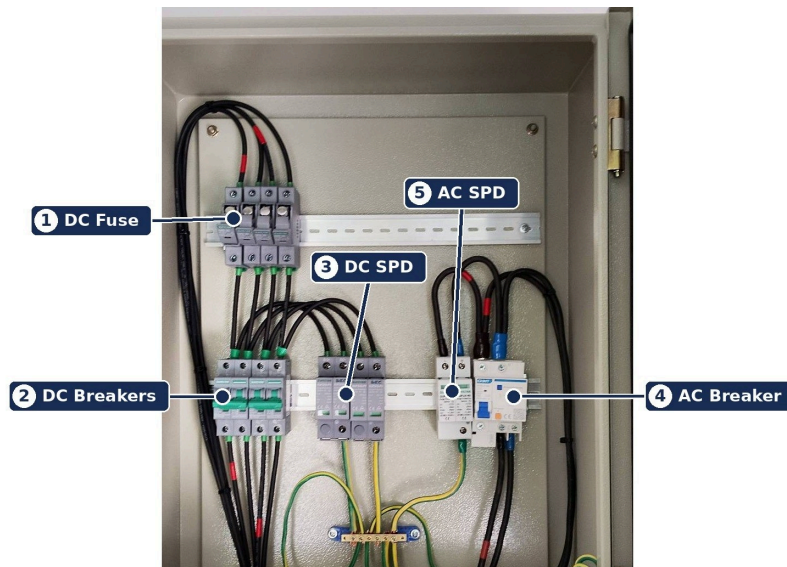


Control cabinet (left) and Solis hybrid inverter (right) on the galvanized steel frame.

The Solis hybrid inverter and the AC/DC control cabinet are mounted on a galvanized steel frame.

- The frame holds both units off the wall, leaving room for ventilation behind them.
- More than 40 cm of clear space is kept around the inverter for heat dissipation.
- Cables run in steel conduit into a wireway below the units.
- EMT conduits run inside the inverter chamber from the wireway to a pull box, which connects to IMC conduit outside, for both the AC and DC cables.

3. Control cabinet components and switch-on procedure



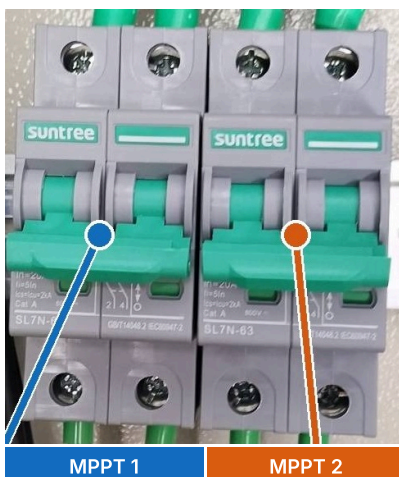
Inside the control cabinet.

Components

1. DC Fuse, 16 A
2. DC Breakers, 16 A
3. DC SPD (surge protection)
4. AC Breaker (RCBO), 63 A
5. AC SPD (surge protection)

To switch on the system

1. Turn on the AC breaker.
2. Press the button on the right of the inverter, then wait about 30 seconds until the screen comes on.
3. Turn on the DC switch on the left of the inverter.
4. Turn on the DC breakers, one at a time.



DC breakers: MPPT 1 and MPPT 2

- **MPPT 1 breaker:** on the left.
- **MPPT 2 breaker:** on the right.

Each breaker isolates one string, so one row can be switched off for testing or service while the other keeps running. The colours match the string layout picture: blue for MPPT 1 and orange for MPPT 2.

Warning

Do NOT switch the DC breakers on or off while the inverter is under load.



Solis hybrid inverter. The DC switch is the black knob on its left side.



Inverter display and indicator lights during normal operation.

Indicator lights

- **POWER (red)** and **OPERATION (green)** stay on during normal operation, as in the picture.
- **ALARM (orange)** is the light on the far right, above the screen. If it blinks, please contact Solar ESS: Tel 063 151 6694, 089 429 6832.

4. String layout: MPPT 1 and MPPT 2



String layout seen from above.

- **MPPT 2:** the row of 5 panels located by the street.
- **MPPT 1:** the row of 5 panels located by the house, second from the street.

Each row is one string on its own MPPT input of the inverter, so the two rows work independently.

5. The panels: LONGi Hi-MO X10, half-cut back-contact

The ten panels are LONGi Hi-MO X10 650 W (model LR7-72HVH-650M). Three things set this panel apart from an ordinary one.

The technology

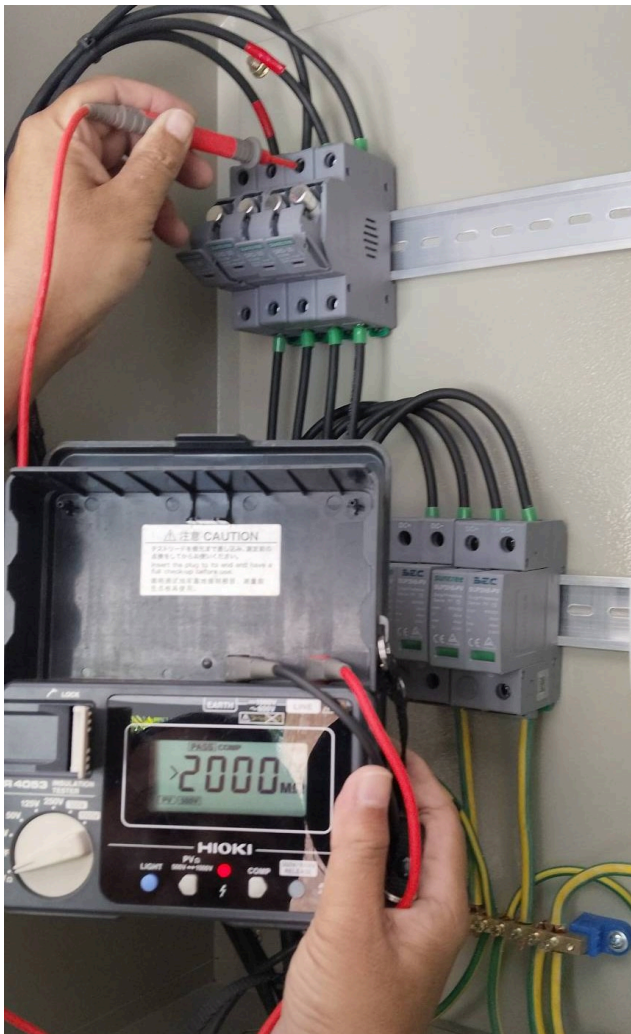
- **Back-contact cells (HPBC 2.0):** all the metal contacts are on the back of the cell. The front has no busbars or grid lines, so the whole face collects light. The 650 W model reaches 24.1% module efficiency, and the series goes up to 24.8%.
- **N-type TaiRay wafer:** LONGi's own silicon wafer, with more even resistance, fewer metal impurities and greater mechanical strength.
- **Half-cut cells:** each cell is cut in two, giving 144 half cells (6 × 24) wired as an upper and a lower half of the panel.

What it gives this house

- **Lower losses and cooler cells:** a half cell carries half the current, so resistive loss inside the panel falls to about a quarter.
- **Better in partial shade:** the two halves work independently, so shade on one half leaves the other producing. LONGi states over 70% less power loss under shading than conventional TOPCon panels, and hot-spot temperatures more than 28% lower. This helps beside the palm and shrubs.
- **Holds output in heat:** power falls only 0.26% per °C, which suits Chiang Rai's hot season.
- **Long life:** at most 1% loss in the first year and 0.35% a year after, with a 15-year product and 30-year power warranty.

Figures are LONGi's published data for the Hi-MO X10 series; the shading and hot-spot figures are the manufacturer's own comparison.

6. Insulation testing



Insulation resistance test at the DC fuse holder with a Hioki IR4053 insulation tester.

The DC string wiring was tested for insulation resistance at the DC fuse holder in the control cabinet, before the system was energised.

- **Instrument:** Hioki IR4053 insulation tester, in its PV insulation mode.
- **Reading:** more than 2000 MΩ, which is above the top of the meter's range.
- **Result:** PASS, as shown on the meter display.

The usual minimum for a PV string of this size is 1 MΩ, so the reading is far above the requirement. It shows that there is no leakage from the DC cables or panels to earth, and that the cable insulation was not damaged during installation.

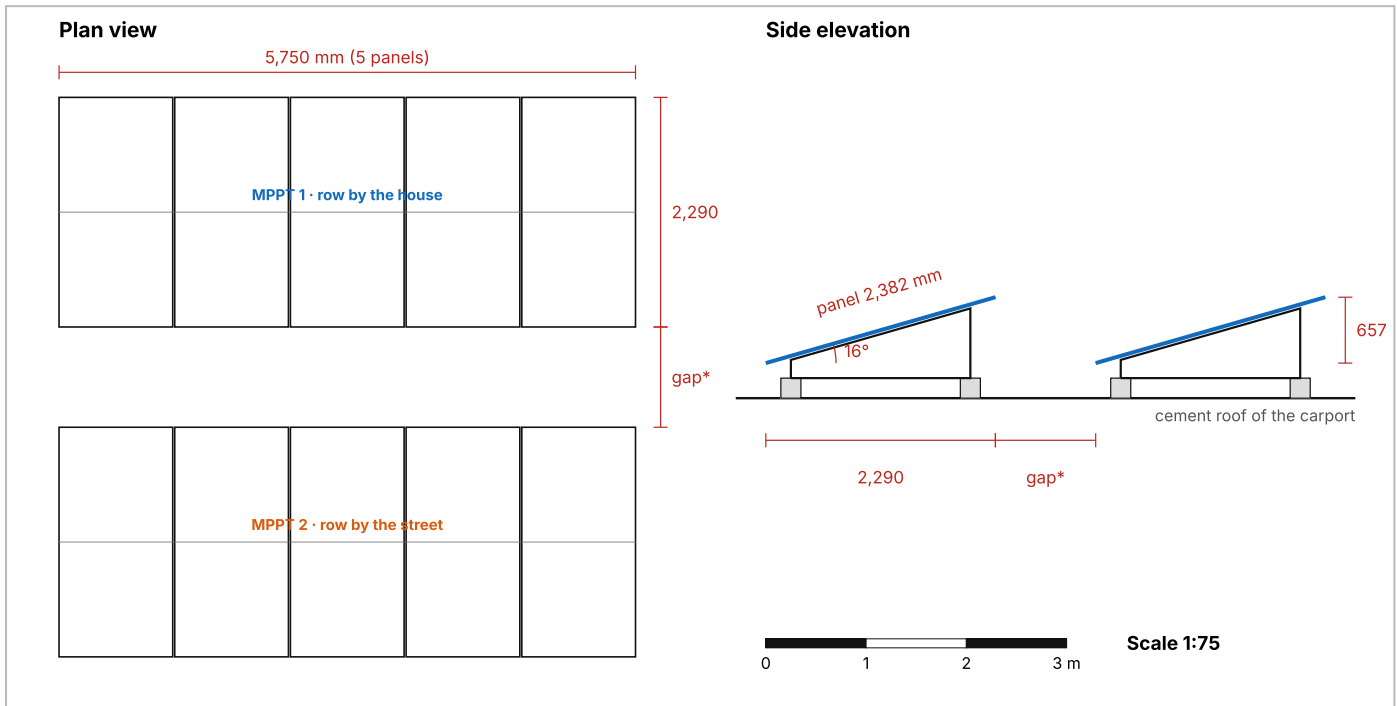
7. Combiner box review

The combiner box is a sound, serviceable build with a complete protection chain. On the DC side each string has its own fuses, a 2-pole DC breaker and a DC surge protector, and the AC side has its own breaker and AC surge protector in the same place. Because each MPPT has its own breaker, one string can be isolated while the other keeps running, and the string fuses add a second layer of protection.

The workmanship is careful: ferrules on the cable ends, polarity marked with red tape and solar-rated DC cable throughout. Both surge protectors and the enclosure are bonded to one central earth bar. The metal enclosure with bottom conduit entry is robust, and the spare DIN rail leaves room for a battery or an ATS later.

For further improvement: a few finishing points can be taken up at the next service visit. These are labels inside the box for MPPT 1 and 2, AC and DC and the device names; a wire duct and shorter, straighter earth leads to the surge protectors; neat routing of the door earth strap; and a divider between the AC and DC sides.

8. Panel layout review



Single-line drawing of the panel structure, scale 1:75 on A4. Blue line: panel; below it the steel triangle on cement cubes. Panel size 2,382 × 1,134 mm from the LONGi datasheet; tilt about 16°. *Row gap, support heights and cube size are approximate and to be measured on site.

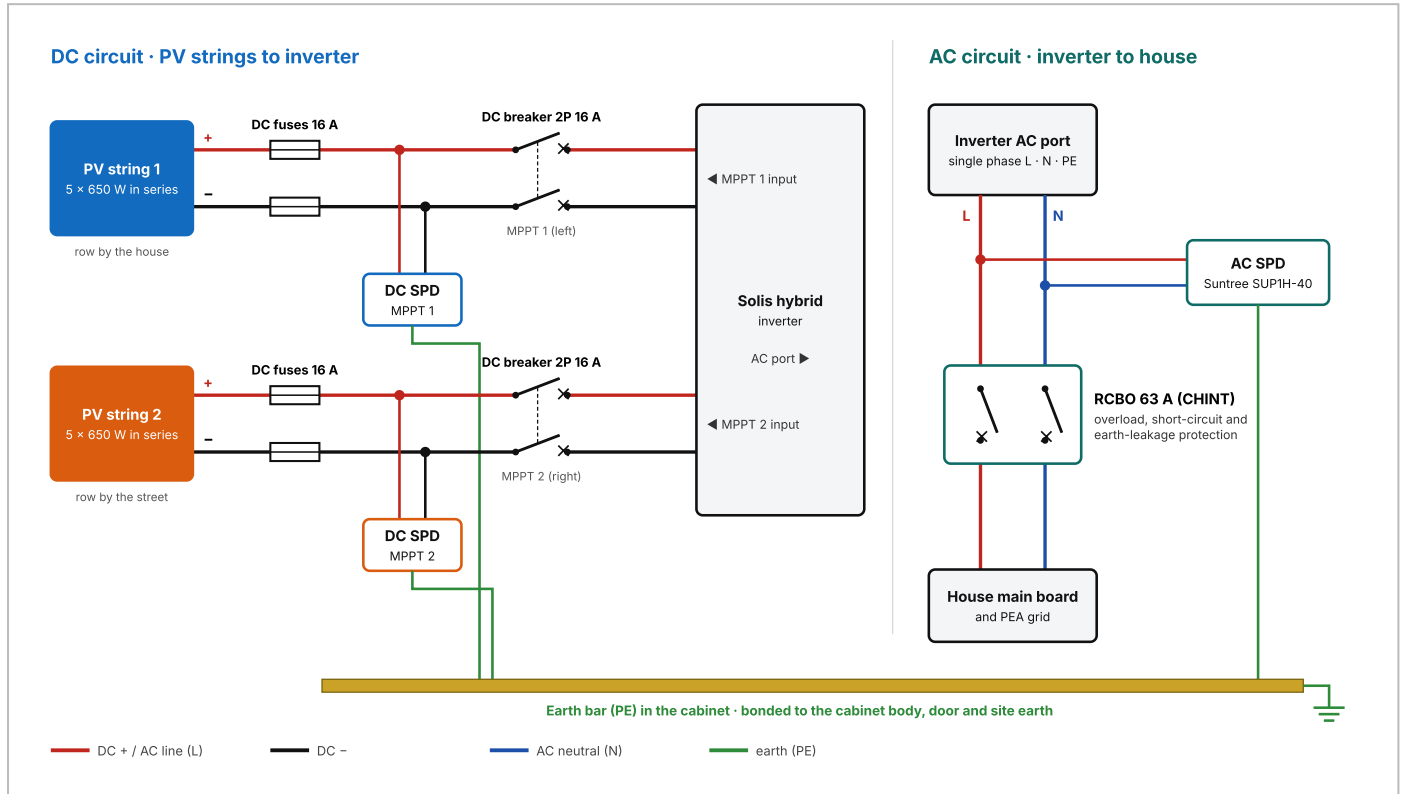
The layout is well planned for this roof. Ten panels in portrait sit in two rows of five, each row on its own MPPT, so shade or a fault on one row does not pull down the other. The tilt of about 16° toward the south is close to the optimum for Chiang Rai and lets the rain wash the panels.

The panels are carried on aluminium rails over welded steel triangles, which stand on sealed cement cubes fixed to the flat roof. The open underside lets air move behind the panels, which keeps them cooler and improves output, and the raised feet let water drain underneath. The walkway between the rows gives easy access for cleaning and service and limits row-to-row shading, and the west side of the roof is still free for a later expansion.

For further improvement and routine care: clip the remaining loose cable leads under the panels to the rails; touch up the weld joints with cold-galvanizing spray and a top coat; confirm the rail positions against the manufacturer's clamping zone; keep the palm and shrubs beside the MPPT 1 row trimmed; and include the anchors under each cube in the periodic inspection. The row spacing looks adequate for midday sun all year; early-morning and late-afternoon shading in December will be confirmed once the gap between the rows is measured.

9. Circuit diagram of the control cabinet

Circuit of the control cabinet as installed: DC from the two panel strings to the inverter, and AC from the inverter to the house.



DC side

- DC fuses:** Suntime, 16 A, one on + and one on - of each string.
- DC breaker:** Suntime, 2-pole, 16 A, one per string. MPPT 1 is on the left, MPPT 2 on the right.
- DC surge protector:** Suntime SUP2H8-PV, Type 2, 800 VDC, 20/40 kA, one per string, connected between the fuses and the breaker.

AC side and earthing

- RCBO:** CHINT NXBLE-63, overload, short-circuit and earth-leakage protection.
- AC surge protector:** Suntime SUP1H-40, Type 2, 275 V, 20/40 kA.
- Enclosure:** KJL No. 4 waterproof steel cabinet.
- Earth bar:** all surge protectors, the cabinet body and the door are bonded to one earth bar.

10. Tools used in this electrical checkup

Tools used by Solar ESS for the electrical checkup of this system, together with the Hioki IR4053 insulation tester (section 6) and the Fluke thermal camera (section 11).



Hioki DT4261 true-RMS digital multimeter: AC and DC voltage and continuity checks.



PeakTech 3360 true-RMS digital multimeter: second meter for cross-checking readings.



Hioki FT6031-50 earth tester: earth resistance of the grounding system (manufacturer's product picture).

11. Thermal check of the control cabinet



Thermal image of the control cabinet (Fluke, emissivity 0.95).

The control cabinet was scanned with a Fluke thermal camera to check every connection point for a fault or abnormally high temperature.

- **Conditions:** system in normal operation, about 1.7 kW at around 3 pm.
- **Temperature range:** 35.0 to 38.4 °C across the whole cabinet, a spread of 3.4 °C.
- **Warmest point:** 38.4 °C on the AC side, at the RCBO and AC surge protector, only 2 to 3 °C above its surroundings.
- **DC side:** the string cables, fuses and DC breakers are evenly warm, with no single terminal standing out.

Result

No fault or abnormal temperature was found at any connection point. All connections in the cabinet are at an even, normal temperature.

12. Materials used

No.	Item	Brand / model	Rating	Qty
1	Solar panel	LONGi Hi-MO X10, LR7-72HVH-650M	650 W, Vmp 44.56 V, Imp 14.59 A, Voc 53.90 V, Isc 15.29 A	10
2	Hybrid inverter	Solis	10 kW	1
3	DC fuse holder with fuse	Suntree	16 A	4
4	DC breaker, 2-pole	Suntree	16 A	2
5	DC surge protector	Suntree SUP2H8-PV	800 VDC, 20/40 kA, Type 2	2
6	RCBO	CHINT NXBLE-63	63 A frame, 300 mA earth leakage	1
7	AC surge protector	Suntree SUP1H-40	275 V, 20/40 kA, Type 2	2
8	Moulded-case breaker, 2-pole	CHINT NXM-125S/2300	125 A	1
9	Moulded-case breaker, 2-pole	CHINT NXM-125S/2300	100 A	1
10	Steel cabinet with DIN rail	KJL No. 4	waterproof	2
11	Outdoor junction box	Nano	sealed, with cable glands	1
12	Earth bar and earth cable		brass bar, green/yellow cable 10 sq.mm	1
13	Conduits, wireway, pull box, steel frame	Panasonic and KJL	galvanized	1 set