

ALL-IN-ONE

Hybrid Inverter

KR-L8K • KR-L10K • KR-L12K • KR-L15K-SPUS



KR-L8K-SPUS 8 kW

KR-L10K-SPUS 10 kW

KR-L12K-SPUS 12 kW

KR-L15K-SPUS 15 kW

- 120/240 V split phase, 60 Hz
- 3 MPPT solar inputs
- 51.2 V lithium or lead-acid battery
- Built-in PV, battery and load breakers



User Manual

Distributed and supported by Fantastech Energy Solution LLC • Goshen, Indiana

Read Before Operating

KOOR All-in-One Hybrid Inverter · KR-L8K · KR-L10K · KR-L12K · KR-L15K-SPUS



READ THE INSTRUCTIONS COMPLETELY BEFORE OPERATING THE EQUIPMENT.

- 1 Check the utility voltage before you turn the unit ON.
- 2 Verify the inverter's programmed grid type before you connect it to the utility.
- 3 By default, the unit is programmed for 120/240 V split phase at 60 Hz.
- 4 Disregarding these instructions could result in permanent damage to the unit.



DISCLAIMER

UNLESS SPECIFICALLY AGREED TO IN WRITING:

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All-in-One Hybrid Inverter — Quick Start

KR-L8K · KR-L10K · KR-L12K · KR-L15K-SPUS | 120/240 V split phase, 60 Hz



Keep this sheet with the inverter. It covers the steps you use on the job. Full detail, settings and fault codes are in the **User Manual** in this same book. Qualified electrical personnel only.

1 WHAT IS ON THE UNIT

Front panel — indicator LEDs

- 1 **Green**, marked “DC” — ON: the inverter is running. Flashing: standby.
- 2 **Blue**, marked “AC” — ON: communication with the battery BMS is normal.
- 3 **Yellow**, marked “Normal” — ON: the inverter is in EPS (backup) mode.
- 4 **Red**, marked “Alarm” — the inverter is in fault mode.

Buttons

- 5 **UP** — go to the previous selection
- 6 **DOWN** — go to the next selection
- 7 **ENTER** — confirm the selection
- 8 **ESC** — exit setting mode

Outside of the unit

- 9 PV DC disconnect
- 10 LCD screen
- 11 BAT breaker
- 12 Parallel RJ45 ports
- 13 Input pinouts for sensors and accessories
- 14 **BMS RJ45 ports** (RS485 / CAN)
- 15 Load breaker
- 16 Wi-Fi port (for the Wi-Fi logger stick)
- 17 ON/OFF button

Inside the wiring compartment

- 18 Battery terminals
- 19 I-LOAD terminals
- 20 3 PV inputs (MPPT trackers), 2 strings each
- 21 GEN (generator) terminals
- 22 LOAD terminals
- 23 Ground busbar
- 24 GRID terminals

Parallel systems

Up to **6 units** in parallel — up to **90 kW**. All units must run the **same software version** (compare the MCU version numbers in the Device Info menu). A parallel system **requires one joint battery bank**. All inputs and outputs must be shared across every inverter, except the DC solar (PV) inputs.

2 WHERE IT CAN HANG

Site limits

Max. ambient temp	+60 °C (output derates above +45 °C)
Min. ambient temp	-25 °C
Relative humidity	Up to 100% (no condensation)
Altitude	Up to 4000 m (derates above 2000 m)
Enclosure	High sealed design, NEMA 4X
Clearance	At least 500 mm free on every side

Yes

- Solid vertical wall, unit straight up and down
- Out of direct sunlight, rain and snow
- Out of reach of children
- Dry, ventilated, 500 mm clear all around

No

- No tilting forward or backward, and never lay it down
- No water pipes or cables buried in the wall behind it
- No flammable material, no corrosive or explosive area
- No direct sun, rain or snow on the unit

3 MOUNTING — 5 STEPS

- 1 Mark the bracket holes on the wall.
- 2 Drill **10 mm** holes.
- 3 Fasten the bracket to the wall.
- 4 Lift the inverter onto the bracket.
- 5 Lock it down with the M8 anti-collision bolts.

4 GENERATOR — FANTASTECH RULES · WIRE COLORS

Generator	Land it on
120/240 V split phase, under 15 kW	GEN port (63 A)
120/240 V, 15 kW or bigger	GRID port
120/208 V (two legs of a three-phase generator)	GRID port — never the GEN port
Three-phase power	NEVER to the GEN port

Generator charge time: set the Start 1 minute after the End — for example End 00:00, Start 00:01. The charge window then covers the whole day, so the battery **always charges whenever the generator runs**. Other generator settings: User Manual 6.8 and 9.9.

Wire colors — every job, every drawing

L1	Black
L2	Red
L3	Blue (120/208 V only)
Neutral	White (drawn grey in the manual)
Ground	Green or bare copper
DC +	Red — battery and PV positive
DC -	Black — battery and PV negative

Check the box and the unit for damage before you sign for it. Box contents list: User Manual 4.2.

Quick Start — Wiring, Start-Up and Checks

KR-L8K · KR-L10K · KR-L12K · KR-L15K-SPUS | 120/240 V split phase, 60 Hz



5 CABLES

#	Cable	Type	Size
1	Grounding	Single-core green (or green/yellow) copper, outdoor rated	6 mm ² (10 AWG)
2	AC output	Two or three different-color multi-core copper	2/0 AWG or bigger
3	PV input	PV cable (such as PV1-F)	12-10 AWG
4	Battery	Red and black multi-core copper	2/0-4/0 AWG
5	Communication	CAT5e	—

Conductor	Strip length	Finish the end with
PV conductors (12-10 AWG)	6-8 mm (1/4-5/16 in)	Wire ferrules if stranded
Battery conductors (2/0-4/0 AWG)	6-8 mm (1/4-5/16 in)	Crimped OT ring lugs
GRID and LOAD conductors	8-10 mm (5/16-3/8 in)	Wire ferrules if stranded

Terminal sizes (User Manual 6.2.2): ring lug for up to 4/0 AWG — 1 in [25.4 mm] wide, 3/8 in [10 mm] hole; ferrule for up to 4 AWG (GEN and I-LOAD wire, 6-4 AWG) — 5/8 in [16 mm]; ferrule for up to 10 AWG — 5/8 in [16 mm]; ferrule for up to 20 AWG — 1/4 in [6.35 mm]. Strip lengths are from User Manual 6.5, 6.6.1 and 6.7.3.

Before you touch a terminal

- **Every switch OFF** — PV, battery, grid, load, generator. Never work on it with power on.
- The lithium battery has its **own** power line and comm line — use the ones that came with it.
- The inverter ships with the basic comm line — use it directly.
- **Do not reverse battery polarity.** It damages the system and voids the warranty.
- Never land the grid on the **LOAD** output terminals.

PV check before you land it

Meter every string open-circuit before you connect it. **550 Vdc** is the absolute maximum; size every string so its cold-corrected Voc is **at or below 525 Vdc**.

PV+ = RED · PV- = BLACK. Crimp the pin, push the cable in firmly and press the catch until it clicks.

6 COMMUNICATION PORTS

	Port	What it is for
A	NTC	Temperature sensor for a lead-acid battery
B	CT interface	Current sensor clamps
C	GEN (NO)	Generator auto-start dry contact. When the GEN signal is active, the contact closes — no voltage output .
D	±12 V RSD	Power for the RSD PLC transmitter (500 mA max.)
E	EPO	Reserved for an external emergency stop
F	Meter RS485	Energy meter communication
G	ATS	240 Vac output port, live when the inverter is on
H	Battery comm	CAN and RS485 to the battery BMS
I	Parallel comm	CAN and RS485 between inverters
J	Parallel CAN resistor	DIP switch — switch 1 always ON; 2-3-4 ON on the end inverters (6.9.1)

BMS RJ45 pinout (battery port)

Pin	Signal	Pin	Signal
1	BAT RS485 A	5	BAT CAN L
2	BAT RS485 B	6	NC
3	NC	7	BAT RS485 B
4	BAT CAN H	8	BAT RS485 A

Only the **master** battery gets a comm cable to the inverter. Set the battery type, Com Type and brand on the screen (User Manual 9.7). Comms come up in 1-2 minutes. Damage from the wrong protocol is not covered by the warranty.

7 TURN IT ON — IN THIS ORDER

- 1 Turn on the **battery** breaker(s). Wake the battery up if it has a power button.
- 2 Press the **power button** in to ON. Wait for the LED (a few minutes).
- 3 Turn on the **PV** switch, then the **GRID** disconnect.
- 4 Turn on the **LOAD** breaker and the **GEN** breaker. Then set the inverter up (User Manual, chapter 9).

8 SHUT IT DOWN

- 1 All AC breakers off: **GRID, GEN, LOAD**.
- 2 **PV** switch off, then the **power button** off (wait for "OFF").
- 3 **Battery** breaker(s) off last. Wait about 1 minute before you touch anything.

Shutdown is start-up backwards. Before you power on, make sure every voltage and current is inside the inverter spec — outside it, the inverter gets damaged. Questions before you energize it? Call Fantastech at 574-218-1973.

9 POST-INSTALL CHECK

☐ Inverter mounted correctly and firmly	☐ All switches off
☐ Wi-Fi logger stick installed correctly and firmly	☐ Ground wire connection confirmed and reliable
☐ Cable runs reasonable, no broken insulation	☐ All wires correct and securely connected
☐ Cable ties trimmed, no sharp corners	☐ Exposed terminals protected, no open ports
☐ All packing and scrap material cleaned up and hauled out	

10 APP AND MONITORING

App	SOLARMAN Smart — App Store (iPhone) or Google Play (Android)
Add the logger	Scan the barcode on the stick label, or type its serial number (SN).
PWD	Type the stick's PWD in lowercase (label FEE32734 → fee32734).
Site Wi-Fi	Join the stick's own Wi-Fi, open 10.10.100.254 in the phone's browser, pick the site Wi-Fi and save.
After that	The stick uploads every 5 minutes. A new logger shows Offline until its first upload — wait at least 10 minutes. Full steps: User Manual chapter 8.

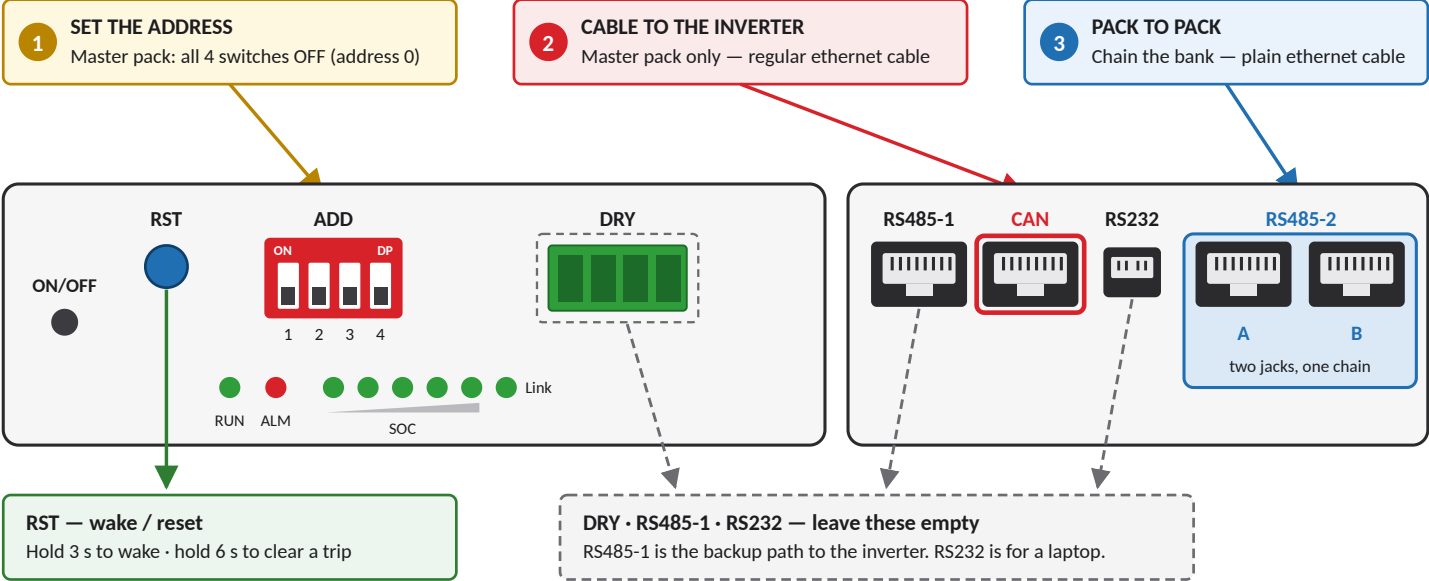
Appendix — KOOR batteries on a KOOR All-in-One

Where every comm cable plugs in | KR-L8K · KR-L10K · KR-L12K · KR-L15K-SPUS



Four of these jacks look the same, and three of them say RS485. Only two jacks get a cable on a normal job. Go by the words stamped on the panel. This page shows the KOOR battery comm panel on the KOOR 16K Pro tower and the KOOR Active Stack S314.

THE COMM PANEL — AS YOU FACE THE BATTERY



Drawn from a photo of a real KOOR 16K Pro panel and the KOOR Active Stack S314 User Manual, section 5.2

WHAT GOES IN EACH ONE

	Stamped on the panel	What plugs in	Which packs	Cable
1	ADD (red DIP switch)	Nothing — it is a switch	Every pack, a different number each	Master = address 0: all 4 switches OFF. Next packs 1, 2, 3... no repeats. Set them before power-on.
2	CAN — the right-hand jack of the RS485-1/CAN pair	Goes to the inverter BMS RJ45 port	Master pack only	A regular straight ethernet cable. Both ends wired the same. Nothing crossed, nothing special built — this is how Fantastech has done it many times.
3	RS485-2 — the pair on the far right	Pack to pack, down the line	Every pack in the bank	Plain straight ethernet, all 8 pins fine. Out of B on one pack, into A on the next. Keep it the same all the way down.
-	DRY, RS485-1, RS232	Nothing on a normal job	—	RS485-1 is the backup path to the inverter if CAN will not come up. RS232 is the laptop / BMS-software port. DRY is a dry contact.

Two jacks stay empty on purpose. On the master pack, the **A** jack of RS485-2 has nothing coming into it. On the last pack in the line, the **B** jack has nothing leaving it. That is how you know the chain is a line and not a ring.

16K Pro and Active Stack wire the same. Regular ethernet on both, no crossing, no custom cable. This panel is drawn from a **16K Pro**. The Active Stack has the same layout, but its manual shows the last pair stamped **RS485A / RS485B** instead of RS485-2 — go by what is on the panel in front of you.

Appendix — KOOR batteries on a KOOR All-in-One

Which jack, how the packs chain, DIP addresses | KR-L8K · KR-L10K · KR-L12K · KR-L15K-SPUS

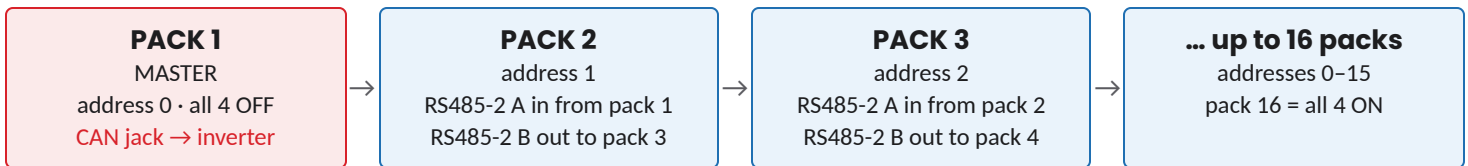


Read this first. Batteries covered: KOOR Active Stack S314 (51.2 V, 314 Ah, 16 kWh) and the KOOR 16K Pro tower. Two cables, a DIP switch and Pylon on the battery are the whole job. One **regular ethernet cable** runs from the master battery jack marked **CAN** to the inverter, and one runs from each pack to the next on **RS485-2**. Set every address before power-up, then set every pack to **Pylon** (power-up step 5).

1 WHICH JACK GOES WHERE

On the inverter		The cable — a regular ethernet cable	
Port	BMS RJ45 port — port H on the communication board (User Manual 6.3), item 14 in the Quick Start	Type	Straight CAT5e or CAT6, both ends wired the same
Not this one	The Parallel RJ45 ports (Quick Start item 12, port I) are inverter-to-inverter only	Battery end	The jack stamped CAN — the right one of the RS485-1/CAN pair
Signal	Pin 4 = CAN-H · pin 5 = CAN-L · pins 1, 2, 7, 8 = RS485	Inverter end	The BMS RJ45 port
On the battery		Signals	CAN-H on pin 4, CAN-L on pin 5, straight through
Active Stack S314	The jack stamped CAN — the right one of the RS485-1/CAN pair. Pin 4 = CAN-H, pin 5 = CAN-L. RS485-2 is the pack-to-pack pair. RS485-1 is the backup path to the inverter.	Both KOOR batteries wire the same. Active Stack or 16K Pro, it is a regular ethernet cable off the CAN jack. No crossed cable, no cable to build. Fantastech has put this combination in many times.	
16K Pro tower	Same — the jack stamped CAN. It wires the same way as the Active Stack.		

2 HOW THE PACKS CHAIN — ONE PACK TALKS, THE REST REPORT THROUGH IT



- Only the master gets a cable to the inverter. Nothing else does.
- The rest chain in a line on the RS485-2 pair: out of B on one pack, into A on the next, all the way down.
- Never run a cable from the last pack back to the master. It is a line, not a ring.
- The master RS485-2 A jack stays empty. The last pack RS485-2 B jack stays empty.
- No two packs share an address.
- Adding a pack later? Keep it within 2 V of the others, or it trips charge overcurrent and will not take a charge.

Set every DIP switch before anything is powered up. The BMS reads its address at power-on. Changed one after? Hold RST 3 s (sleep), then 3 s again (wake) on that pack.

Master address — ADDRESS 0: all 4 switches OFF. It is the pack cabled to the inverter. The rest get 1, 2, 3 ... up to 15 (16 packs in all), no repeats.

3 DIP SWITCHES — SET EACH PACK LIKE ITS PICTURE · BIGGER PICTURES ON THE NEXT PAGE



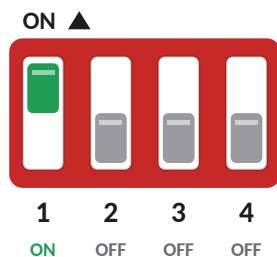
Appendix — Setting the battery address switches

One small red switch on every battery pack, marked ADD | KOOR Active Stack S314 and KOOR 16K Pro



Every battery pack gets its own number. Pack 1 is the master — the one with the cable to the inverter — and it gets all 4 switches OFF (address 0). Set the switches with the batteries **turned off**. Find your pack number below and make the switches look exactly like the picture.

1 HOW TO READ THE SWITCH



Slider pushed UP, toward ON
= that switch is ON

Slider pushed DOWN
= that switch is OFF

Switches are numbered 1, 2, 3, 4 from the left.
Use a small screwdriver or a pen tip.
This one reads: 1 ON, 2 OFF, 3 OFF, 4 OFF.

2 SET EACH PACK LIKE ITS PICTURE — GREEN SLIDER = PUSHED UP TO ON



Only 1 battery? It is the master — all 4 switches OFF. No two packs may have the same picture. If you change a switch after the battery is on, hold RST 3 s (sleep), then 3 s again (wake) on that pack so it reads the new number.

Appendix — KOOR batteries on a KOOR All-in-One

Settings, power-up and troubleshooting | KR-L8K · KR-L10K · KR-L12K · KR-L15K-SPUS



4 INVERTER SETTINGS — BATTERY MENU

Setting	Set it to	Why
Batt1 Type	Lithium	Other choices are Lead-acid, DC Source and No Battery.
Com Type	CAN	Both KOOR batteries talk on CAN. RS485 is the fallback, not the first pick.
Company	Pylon	Pick the Pylon entry on the list. Depending on the firmware in front of you, it reads Pylon LV2 or Pylontech V1 — either one is the Pylon protocol. The inverter then matches the protocol on its own.
Activate Batt	Use it once	Wakes a sleeping pack if the inverter sees nothing.
Grid Charge	Per job	On for grid or generator charging, off for PV only.
Parallel bat1&bat2	See note	Only if one bank feeds both battery ports. Then the comm cable goes to the BMS1 port.
Max A Charge / Max A Disch	Lower of the two	Whichever is smaller, the bank limit or the inverter limit. With CAN comms up, the BMS reports its own limits.

Why Pylon. KOOR batteries speak the Pylon low-voltage protocol over CAN, and **both ends must be on it** — some packs come set to a different protocol, so set Pylon on every pack too. A KOOR All-in-One in the field came up right on the Pylon setting, and KOOR batteries on KOOR off-grid inverters use the same Pylon-over-CAN setting.

5 POWER-UP ORDER

- 1 Everything off.** Set every DIP address before a single pack is powered.
- 2 Cable it.** Chain the packs on RS485-2, then run a regular ethernet cable from the master CAN jack to the inverter BMS port.
- 3 Recheck the DIPs.** Master on address 0 (all 4 OFF), no two packs alike.
- 4 Batteries on.** DC breaker on every pack, then each power switch. Wake the master if it sits dark.
- 5 Pylon on the battery.** Every pack: CAN protocol = Pylon (battery app, password 1234), then **RST 3 s**, 3 s.
- 6 Inverter on.** Turn on the inverter BAT breaker, then press the power button in to ON (User Manual 7.1.4).
- 7 Set the inverter menu.** Lithium → CAN → Pylon.

How you know it worked — three things, all of them:

- The **blue LED** (marked “AC”) on the inverter is **ON** (BMS communication normal)
 - A **live SOC %** shows on the screen
 - **Charge and discharge limits** show, and they change
- Give it **1 to 2 minutes** after you pick the brand.

6 IT WILL NOT TALK — WORK DOWN THIS LIST

What you see	What to check
Blue LED off, no SOC	Cable in the wrong jack, or a bad cable. It goes in the jack stamped CAN , not RS485-1. Swap in a known-good ethernet cable.
Blue LED off, cable is right	Is the battery on Pylon? Set CAN protocol = Pylon on every pack (battery app), restart each pack. Then Com Type CAN and Company Pylon on the inverter. Wait 2 minutes.
Only some packs show	Two packs share an address, or the chain is broken. Count them on the PACKS tab of the battery screen.
Master dark	Pack asleep. Wake it at the battery, then use Activate Batt on the inverter.
Nothing at all	Check the master DC breaker and power switch before anything else.

Do not leave it on Lead-acid and walk away. The manual lets you pick Lead-acid when lithium will not communicate. That runs the bank **open loop** — no SOC, no BMS limits, no protection handoff. Use it to finish a day, never to finish a job. Stuck on comms? Call Fantastech at 574-218-1973 and we will get the comms right.

Damage from the wrong communication protocol is not covered by the warranty. Neither is reversed battery polarity. Meter before you land anything.

Where this came from. The KOOR All-in-One User Manual (section 6.6 and the Battery Settings menu, section 9.7); the KOOR Active Stack S314 User Manual, section 4.3; the KOOR off-grid 12K manuals, Appendix A; and a KOOR All-in-One brought up in the field on the Pylon setting. **Fantastech has installed this combination many times** — if it will not talk, the cause is almost always the wrong jack, a bad cable, a pack not set to Pylon, or a duplicate address.

Limited Warranty — Terms

KOOR All-in-One Hybrid Inverter · KR-L8K · KR-L10K · KR-L12K · KR-L15K-SPUS | sold and warranted by Fantastech Energy Solution LLC



WHAT IS COVERED AND FOR HOW LONG

KOOR All-in-One Hybrid Inverter — 10 years KOOR batteries — 10 years

The term runs from the date of installation, but it ends no later than six months after the same term would end if counted from the date the unit left the factory.

(KOOR off-grid inverters, sold separately, carry a 5-year warranty.)

The warranty covers **defects of design, components and manufacturing**. It applies to devices bought from Fantastech and installed at the address on the Warranty Registration Card. It is non-transferable unless Fantastech agrees in writing.

WHAT IS NOT COVERED

- Incorrect installation or commissioning.
- Failure to follow the User Manual, the installation guide or the maintenance instructions.
- Unauthorized modifications, changes or attempted repairs.
- Incorrect use or inappropriate operation, including reversed battery polarity and use of the wrong battery communication protocol.
- Insufficient ventilation of the device.
- Failure to observe applicable safety regulations and electrical code.
- Breaking the product seal — opening the casing — without written approval.
- Force majeure: lightning, over-voltage, storm, flood, fire.
- Transport damage, and superficial or cosmetic defects — dents, marks, scratches — that do not affect how the inverter works.

HOW A CLAIM WORKS

- **Report it within 14 days** of the first sign of a problem. Call 574-218-1973 or e-mail derek@fantastech.org.
- Send the completed Warranty Registration Card (at the back of this manual), the purchase invoice, the installation or commissioning report, and any extended warranty certificate if you have one.
- Send pictures and the fault code or fault screen. It is the fastest way to get a unit moving.
- Fantastech decides whether the unit is repaired on site, repaired at the shop, or exchanged for a replacement device of equivalent value for model and age.
- On an exchange, the remainder of the original warranty carries over to the replacement device. A replacement does not start a new warranty term and does not come with a new certificate.
- Because of ongoing product improvement, a replacement part or unit may not match your system monitoring or other components, and the cost of changing those out is not part of this warranty.

LIMITS

- This warranty covers the equipment. It does not cover labor, travel, lift or crane rental, lost production, lost profits, or other direct or indirect costs, unless Fantastech agrees to them in writing beforehand.
- Claims beyond the rights stated here — including costs of removal and reinstallation — are not covered.
- Your rights under statutory liability and product liability law are unaffected by this warranty.

Keep a copy of your Warranty Registration Card and your invoice together. Both are needed to support a claim. If the card was never sent in, send it with the claim.

Contents

1. About This Manual	3
1.1 Applicable Models	3
1.2 Target Group	3
1.3 Symbol Definitions	3
1.4 Updates	3
2. Safety Precautions	4
2.1 General Safety	4
2.2 PV String Safety	4
2.3 Inverter Safety	5
2.4 Battery Safety	6
2.5 Personnel Requirements	6
3. Product Introduction	7
3.1 Product Features	7
3.2 Working Modes	8
3.3 Appearance	9
4. Check and Storage	14
4.1 Check Before Receiving	14
4.2 What's in the Box	14
4.3 Storage	15
5. Installation	16
5.1 Installation Requirements	16
5.2 Inverter Installation	19
6. Electrical Connection	21
6.1 Safety Precautions	21
6.2 Connection Requirements	21
6.3 System Integration	23
6.4 PE Cable Connection	26
6.5 PV Connection	26
6.6 Battery Connection	28
6.7 Grid & EPS Load Connection	31
6.8 Use a Generator	36
6.9 System Parallel Operation	40
7. Operating Modes and Functions	48
7.1 Operate the Inverter and Run a Test	48
7.2 Operating Modes and Functions	49
7.3 Generator Function	51
7.4 Smart Load Function	52

7.5 Off-Grid Installation Tips	52
7.6 Battery Charge Controller	53
8. Monitoring (SOLARMAN Smart)	54
8.1 What You Need	54
8.2 Install the Logger Stick	54
8.3 Get the App	54
8.4 Add Your System	54
8.5 Connect the Stick to the Site Wi-Fi	55
8.6 After It Connects	55
9. Operation	56
9.1 Indicator Panel	56
9.2 LCD Operation Flow Chart	57
9.3 LCD Display Icons	58
9.4 System Setup Menu	60
9.5 Basic Settings Menu	61
9.6 Work Mode Settings Menu	62
9.7 Battery Settings Menu	64
9.8 Grid Settings Menu	66
9.9 Generator Port Settings Menu	69
9.10 Advanced Settings Menu	72
9.11 Record Menu	73
9.12 Device Info Setup Menu	74
9.13 Factory Setting Menu	75
10. Troubleshooting	76
11. Maintenance	81
11.1 Power On the Inverter for the First Time	81
11.2 Power Off the Inverter	81
11.3 Removing the Inverter	81
11.4 Disposing of the Inverter	81
12. Appendix	82
12.1 Routine Maintenance	82
12.2 Limited Warranty	82

1. About This Manual

This manual covers the product information, installation, electrical connection, commissioning, troubleshooting and maintenance of the inverter. Read the whole manual before you install or operate the product. All installers and users must know the product's features, functions and safety precautions. This manual may be updated without notice. For more product details and the latest documents, contact Fantastech (574-218-1973, derek@fantastech.org).

1.1 Applicable Models

Model	Nominal output power	Nominal output voltage
KR-L8K-SPUS	8 kW	120 Vac / 240 Vac (split phase); 208 Vac (two legs of a three-phase wye) 2L/N/PE (L1, L2, neutral and ground)
KR-L10K-SPUS	10 kW	
KR-L12K-SPUS	12 kW	
KR-L15K-SPUS	15 kW	

1.2 Target Group

This manual is for qualified electrical technicians who install and commission hybrid inverters in energy storage systems and electrical systems.

1.3 Symbol Definitions

This manual uses the following types of safety instructions and general information:

DANGER "Danger" marks a hazard with a high level of risk. If it is not avoided, it **will** cause death or serious injury.

WARNING "Warning" marks a hazard with a medium level of risk. If it is not avoided, it **could** cause death or serious injury.

CAUTION "Caution" marks a hazard with a low level of risk. If it is not avoided, it could cause minor or moderate injury.

NOTICE "Notice" gives tips and methods to solve product problems and save time.

1.4 Updates

The latest issue of this document contains all the updates made in earlier issues.

Version	Date	Changes
V1.0	2024-11-11	First issue
KOOR edition 1	2026-09	Rewritten in plain English for the KOOR KR-L8K-L15K-SPUS series

2. Safety Precautions

Follow the safety instructions in this manual at all times when you work on or operate the inverter.

2.1 General Safety

NOTICE

- The information in this manual may change because of product updates or other reasons. Unless stated otherwise, this manual does not replace the labels on the product or its safety precautions. All descriptions here are for guidance only.
- Before you install, read the Quick Start at the front of this manual. For more information, read the rest of this manual.
- All installation work must be done by trained, knowledgeable technicians who know the local codes and safety rules.
- Use insulated tools and wear personal protective equipment (PPE) when you work on the equipment. Wear anti-static gloves, clothes and wrist straps when you touch electronic parts. This protects the inverter from damage.
- Follow the installation, operation and setup instructions in this manual exactly. KOOR is not liable for equipment damage or personal injury if you do not follow the instructions. For warranty details, see the Limited Warranty — Terms page at the front of this manual.

2.2 PV String Safety

DANGER

Connect the DC cables with the PV connectors supplied with the inverter. KOOR is not liable for equipment damage if other connectors or terminals are used.

WARNING

- Make sure the module frames and the racking system are securely grounded.
- Make sure the DC cables are connected tightly, securely and correctly.
- Check the DC cables with a multimeter before you connect them, so the polarity is not reversed. Also check that the voltage is within the allowed range (see the Vmax PV row in section 3.3.4).
- Do not connect one PV string to more than one inverter at the same time. This can damage the inverter.
- The PV modules used with the inverter must have an IEC 61730 Class A rating.
- When light falls on the PV array, the array sends DC voltage to the inverter.

2.3 Inverter Safety

WARNING

- The voltage and frequency at the connection point must meet the grid-connection requirements.
- Extra protective devices, such as circuit breakers or fuses, are recommended on the AC side. Rate the protective device at no less than 1.25 times the AC rated output current.
- Make sure all ground connections are tight. When there are several inverters, make sure the grounding points on all the enclosures are equipotentially bonded.
- Off-grid use is not recommended if the PV system has no batteries. If you use it that way, problems with the system's power supply are not covered by the warranty.
- PV power is not steady. If no battery is connected, there is no EPS (backup) function.
- Do **NOT** connect the grid to the "LOAD" output terminals.

DANGER

- All labels and warning marks must stay visible after installation. Do not cover, write on or damage any label on the equipment.
- The warning labels on the inverter are shown below.

Label	Meaning	Label	Meaning
	DANGER: high voltage. Disconnect all incoming power and turn off the product before you work on it.		Delayed discharge. After power-off, wait 5 minutes until the components are fully discharged.
	Read the user manual before you work on this device.		Hazards exist. Wear proper PPE before any work.
	Hot surface. Do not touch the product while it is running, or you may be burned.		Grounding point.
	CE mark. The inverter meets the basic requirements of the directives for low voltage and electromagnetic compatibility.		Do not throw the inverter away with household waste. Dispose of it as local laws and regulations require, or send it back to KOOR through Fantastech.
	RCM mark.		

2.4 Battery Safety

WARNING

- The battery used with the inverter must be approved by KOOR. For the approved battery list, contact Fantastech (574-218-1973, derek@fantastech.org).
- Before you install, read the battery's own user manual to learn about the product and its precautions. Follow its requirements exactly.
- If the battery is completely discharged, charge it exactly as that battery model's user manual says.
- Factors such as temperature, humidity and weather can limit the battery current and affect the load it can carry.
- If the battery will not start, contact Fantastech right away. Otherwise the battery may be damaged for good.
- Check the DC cables with a multimeter before you connect them, so the polarity is not reversed. Also check that the voltage is within the allowed range.
- Do not connect one battery group to more than one inverter at the same time. This can damage the inverter.
- Lead-acid batteries, including but not limited to flooded lead-acid (FLA), gel and absorbent glass mat (AGM) batteries, often need special charging methods and may work best only under certain conditions. The inverter may not fully meet these needs by default. You may need to change its charge and discharge settings.
- If you plan to use one of these battery types, ask the battery maker for advice on best practices, compatibility and overall system sizing for your application.

2.5 Personnel Requirements

NOTICE

- People who install or maintain the equipment must be fully trained. They must know the safety precautions and the correct way to operate the equipment.
- Only qualified professionals or trained personnel may install, operate, maintain or replace the equipment or its parts.

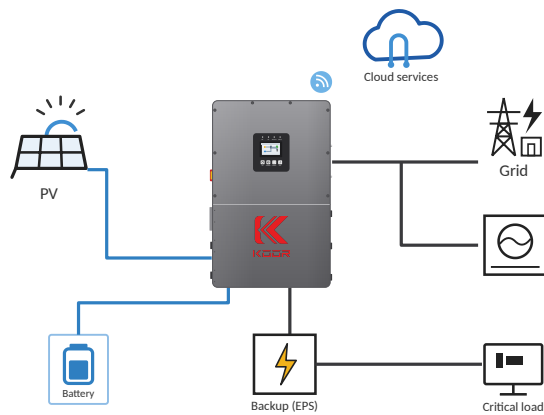
3. Product Introduction

3.1 Product Features

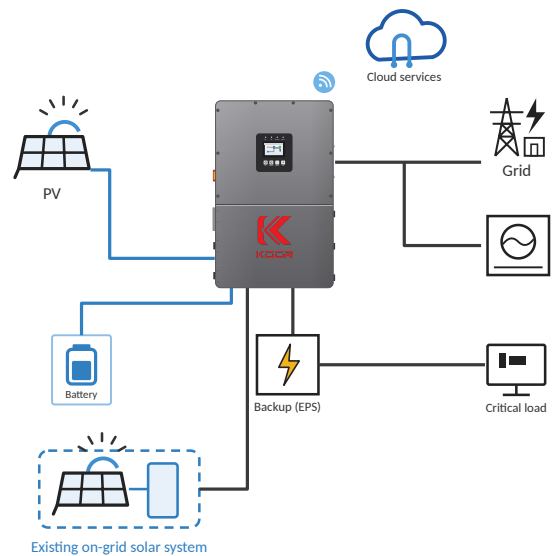
Intended use

This is a multifunction inverter. It combines an inverter, a solar charger and a battery charger in one wall-mounted unit, to give uninterruptible power. The inverter works with a phone app (SOLARMAN Smart, see chapter 8). In the app you can watch the inverter's operating status in real time, including battery information, PV generation, alarm information and more. The simple operating interface makes it easy to set the right work mode for each use, to meet many different needs.

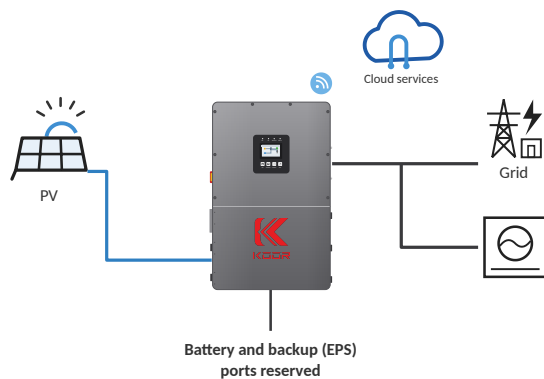
This unit and its system are suitable for the following uses:



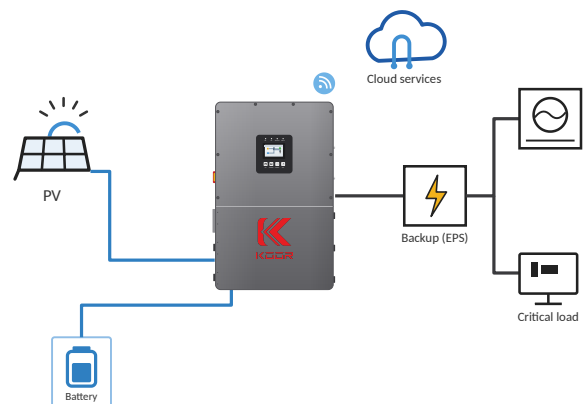
A: Solar and battery storage system



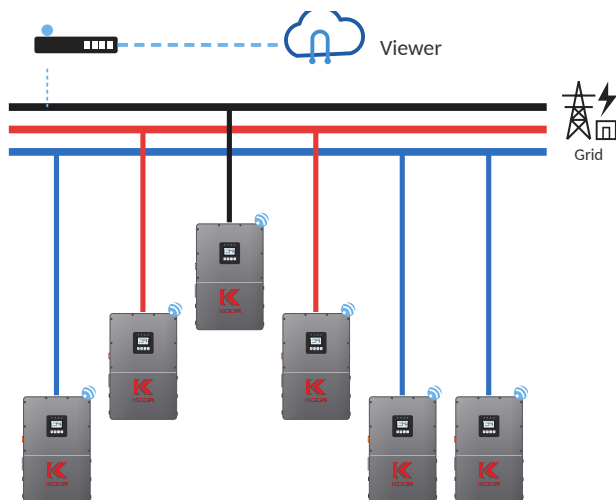
B: AC coupling with an existing on-grid solar system



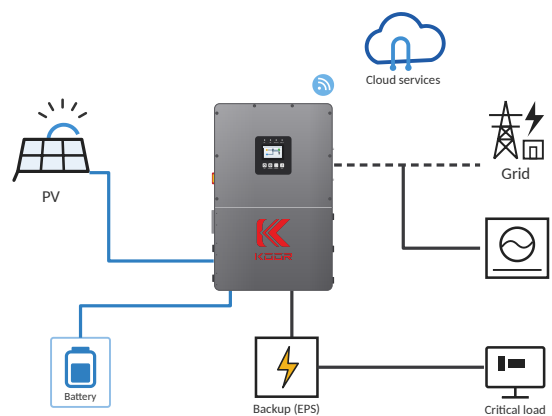
C: On-grid solar system without a battery (supports EPS even without a battery); battery and backup (EPS) ports reserved



D: Off-grid and backup applications



E: Single-phase and three-phase parallel system



F: Energy storage system with peak shaving

3.2 Working Modes

The KR-L8K-L15K-SPUS series hybrid inverter has the work modes below. Pick the mode that fits your system and site.

Work mode	Description
Self-Use (with PV power)	Priority: load > battery > grid PV energy is used first to cover your own use. Extra energy charges the batteries, and what is left is exported to the grid.
Self-Use (without PV power)	Priority: load > battery When there is no PV power, the battery discharges first to power the local loads. The grid supplies power when the battery capacity is not enough.
TOU¹ Balance	In this mode you set time periods and the time-of-use price for each one. It is for sites with good PV output, time-of-use pricing and high power use. It balances how much PV power you use against how much money you save. Peak price: runs in Self-Use mode. Flat price: PV powers the loads first. When PV power is not enough, battery discharge is limited, so stored energy lasts longer. Valley price: charging the battery comes first. The battery charges at full power until it is full.
TOU¹ ECO	Use this mode for peak shaving and valley filling. It gives the most savings where peak and valley electricity prices are far apart. Peak price: the battery discharges at full power to sell electricity to the grid at the high price. Flat price: runs in Self-Use mode. Valley price: buys electricity from the grid at the low price to charge the battery at full power.
Backup Only	Priority: load > battery In this mode the system charges the battery until it is full and keeps it full, ready for a grid outage. When the grid is off, the system supplies emergency power from PV or the battery to the home loads.
Grid Priority	Priority: load > grid In this mode, PV power is sent to the grid first. You can use it to answer grid requests at peak times. In this mode you can also set the battery SOC at which battery discharge ends.

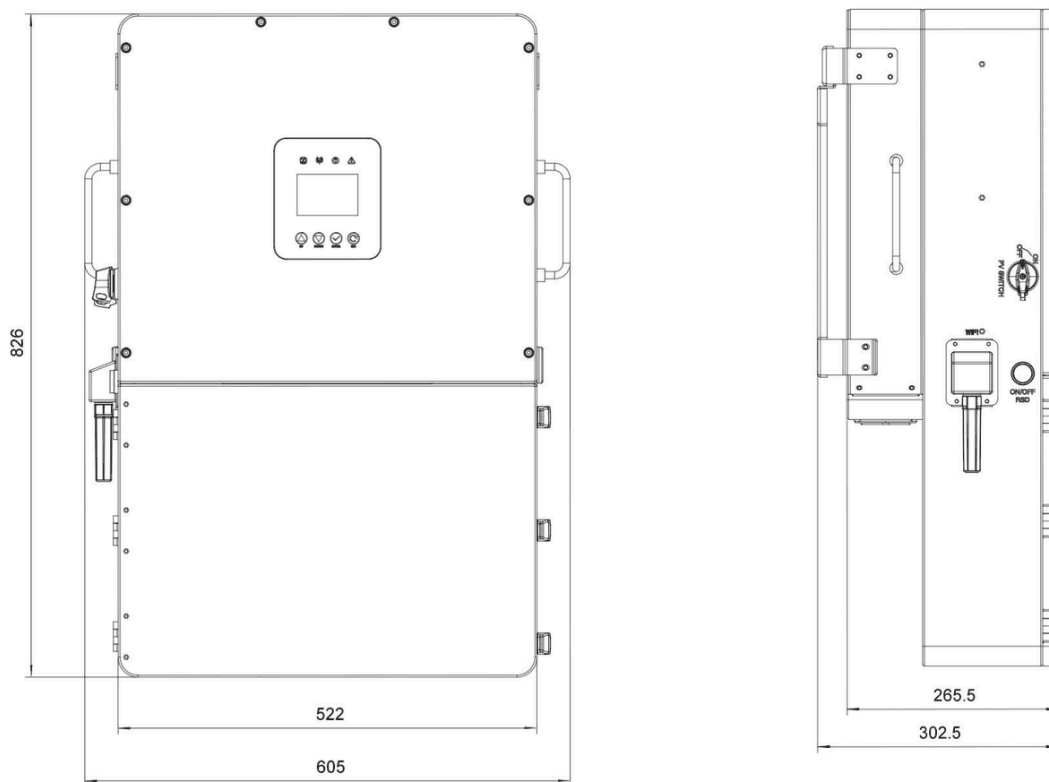
¹ TOU means time of use.

DANGER Make sure the total load power is within the EPS output rating. If it is not, the inverter shuts down with an "over load" warning. When "over load" appears, reduce the load power until it is within the EPS output range, then turn the inverter on. For nonlinear loads, check that the inrush (starting) power is also within the EPS output range.

3.3 Appearance

3.3.1 Dimensions

Keep the size of the inverter in mind when you choose a location for the system. Leave enough space above, below and on the left and right sides of the inverter so heat can escape (see section 5.1).

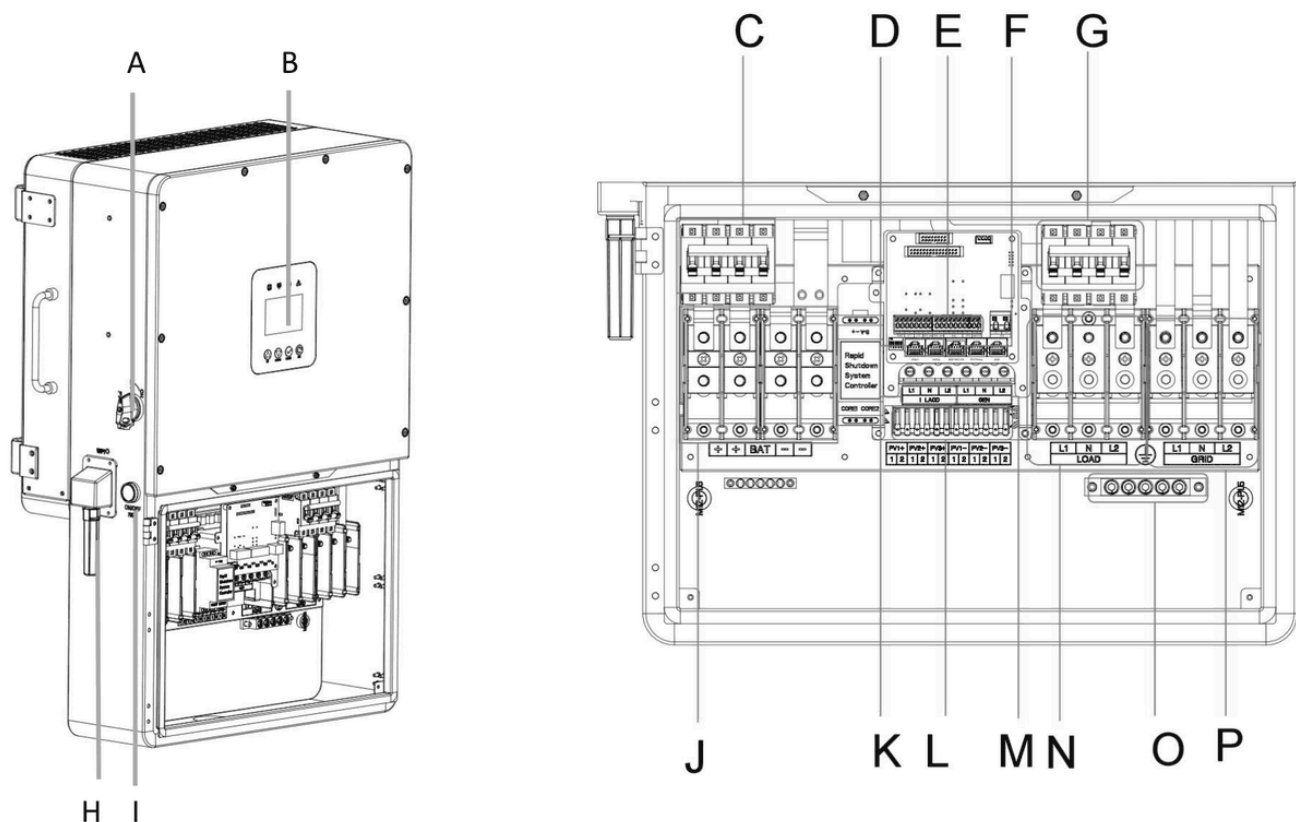


Front and side views, in mm: 522 wide (605 across the handles), 826 high, 265.5 deep (302.5 with the wall bracket)

Protect the LCD screen from direct exposure to UV light.

The inverter has a NEMA 4X enclosure. It is rated for outdoor installation, but it can also be installed indoors.

3.3.2 General Description



Parts of the inverter (left) and the wiring compartment (right); the letters match the table below

Item	Name	Item	Name
A	PV DC disconnect	J	BAT terminals (battery)
B	LCD screen	K	I-LOAD terminals
C	BAT breaker	L	3 × PV inputs
D	Parallel RJ45 ports	M	GEN terminals (generator)
E	Input pinouts for sensors and accessories	N	LOAD terminals
F	BMS RJ45 ports (RS485/CAN)	O	Ground busbar
G	LOAD breaker	P	GRID terminals
H	Wi-Fi		
I	ON/OFF button		

The terminal block for item K is marked "I LAOD" in the drawing; the correct name is I-LOAD.

3.3.3 Nameplate

The nameplate is on the side of the inverter. It lists the model number, serial number, electrical ratings and certification marks. Check the model number on the nameplate before you install or order parts.

3.3.4 Specification

Model	KR-L8K-SPUS	KR-L10K-SPUS	KR-L12K-SPUS	KR-L15K-SPUS
Product type	Hybrid inverter			
Battery				
Battery type	Li-ion / lead-acid			
Battery voltage range	40–60 Vdc			
Rated battery voltage	51.2 Vdc			
Max. charge/discharge power	8 kW	10 kW	12 kW	15 kW
Rated charge/discharge current	167 Adc	210 Adc	250 Adc	275 Adc
Max. charge/discharge current	167 Adc	210 Adc	250 Adc	275 Adc
Reverse connection protection	Yes			
Communication interface	CAN / RS485			
Input (PV)				
Recommended max. PV array power (total per inverter)	12 kW	15 kW	18 kW	22.5 kW
Max. operating PV input current (PV1 / PV2 / PV3)	26 Adc + 26 Adc + 26 Adc (26 Adc per tracker)			
Max. PV Isc (PV1 / PV2 / PV3)	26 Adc + 26 Adc + 26 Adc (26 Adc per tracker)			
Vmax PV (max. PV input voltage)	550 Vdc (design cold Voc at or below 525 Vdc)			
MPPT voltage range	120–480 Vdc			
Full-power MPPT voltage range	120–480 Vdc	125–480 Vdc	145–480 Vdc	195–480 Vdc
Start-up voltage	120 Vdc			
Number of MPP trackers	3			
Strings per MPP tracker	2			
Number of PV inputs	6			
Grid AC input and AC output				
Grid rated voltage	120 Vac / 240 Vac (split phase); 208 Vac (two legs of a three-phase wye)			
Grid rated frequency	60 Hz			
Grid rated input active power	8 kW	10 kW	12 kW	15 kW
Grid rated input apparent power	8 kVA	10 kVA	12 kVA	15 kVA
Grid max. input active power	48 kW	48 kW	48 kW	48 kW
Grid max. input apparent power	48 kVA	48 kVA	48 kVA	48 kVA
Grid rated output active power	8 kW	10 kW	12 kW	15 kW
Grid rated output apparent power	8 kVA	10 kVA	12 kVA	15 kVA
Grid max. output active power	8 kW	10 kW	12 kW	15 kW
Grid max. output apparent power	8 kVA	10 kVA	12 kVA	15 kVA

Model	KR-L8K-SPUS	KR-L10K-SPUS	KR-L12K-SPUS	KR-L15K-SPUS
Grid rated input current	33.4 Aac	41.7 Aac	50 Aac	62.5 Aac
Grid max. input current	200 Aac	200 Aac	200 Aac	200 Aac
Grid rated output current	33.4 Aac	41.7 Aac	50 Aac	62.5 Aac
Grid max. output current	33.4 Aac	41.7 Aac	50 Aac	62.5 Aac
Grid power factor	0.8 leading to 0.8 lagging			
Grid input and output inrush current	500 Aac @ 3 μs			
Max. grid output fault current	67 Aac @ 0.2 μs	84 Aac @ 0.2 μs	100 Aac @ 0.2 μs	125 Aac @ 0.2 μs
Max. grid output overcurrent protection	240 Vac / 200 Aac			
Grid input Icc (rated conditional short-circuit current)	500 Aac			
Grid input Icw (rated short-time withstand current)	500 Aac			
Total harmonic distortion (THDi, rated power)	<3%			
EPS output				
EPS rated output voltage	120 Vac / 240 Vac (split phase); 208 Vac (two legs of a three-phase wye)			
EPS rated output frequency	60 Hz			
EPS rated output active power	8 kW	10 kW	12 kW	15 kW
EPS rated output apparent power	8 kVA	10 kVA	12 kVA	15 kVA
EPS max. output active power	8 kW	10 kW	12 kW	15 kW
EPS max. output apparent power	8 kVA	10 kVA	12 kVA	15 kVA
EPS rated output current	33.4 Aac	41.7 Aac	50 Aac	62.5 Aac
EPS output power factor	0.8 leading to 0.8 lagging			
EPS output peak power	200% overload (<10 s)			
EPS output inrush current	200 Aac @ 10 ms			
EPS max. output fault current	200 Aac @ 10 ms			
Switch time	<10 ms			
Total harmonic distortion (THDv, linear load)	<2%			
Compatible with generator	Yes — generator input with auto-start dry contact			
Efficiency				
MPPT efficiency	99.50%			
California efficiency	96.50%			
Max. efficiency	97.50%			

Model	KR-L8K-SPUS	KR-L10K-SPUS	KR-L12K-SPUS	KR-L15K-SPUS
Standards				
Safety	UL 1741, UL 1741 SA/SB, UL 1699B, CSA C22.2, IEEE 1547, CA Rule 21, HECO Rule 14H, PREPA — see product label			
EMC	FCC Part 15 Class B, SunSpec			
General				
Degree of ingress protection	NEMA 4X			
Protection class	I			
Environment category	Indoor and outdoor			
Wet location classification	Yes			
Pollution degree	PD3			
Operating altitude	4000 m (derate above 2000 m)			
Operating ambient temperature	-25 to +60 °C (linear derating to 60% from +45 °C to +60 °C)			
Operating relative humidity	0–100% (non-condensing)			
Storage temperature	-25 to +60 °C			
Storage relative humidity	0–100% (non-condensing)			
Noise emission (typical)	<45 dB			
Overvoltage category	AC: III; PV: II			
Electrical supply system	TN, TT			
Dimensions (W × H × D)	496 × 806 × 270.5 mm			
Net weight	55 kg			
Cooling	Intelligent air cooling			
Topology	Non-isolated			
Active anti-islanding method	Active frequency drift			
Communication	RS485: yes · Wi-Fi: yes · Bluetooth: optional · LAN: optional CAN: yes · DRM: yes · Meter: optional			
Display and indicators	LCD + LED + app			
Warranty	10 years (see Limited Warranty — Terms at the front of this manual)			

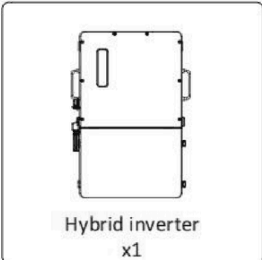
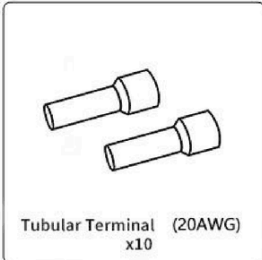
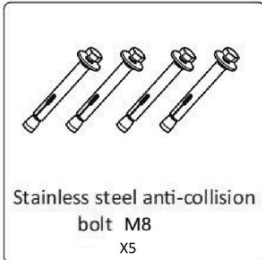
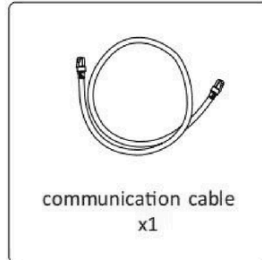
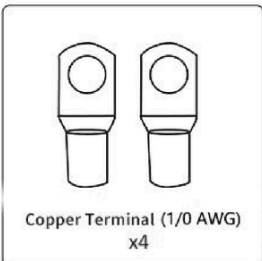
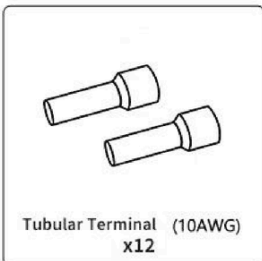
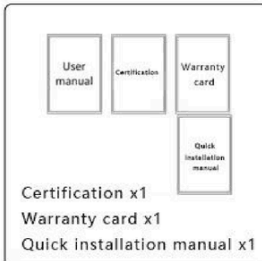
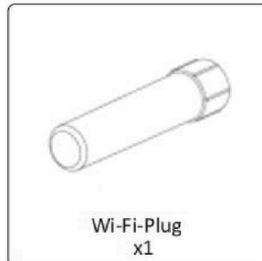
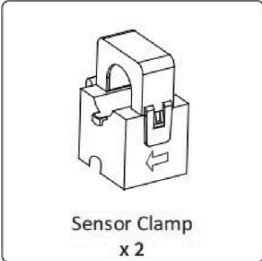
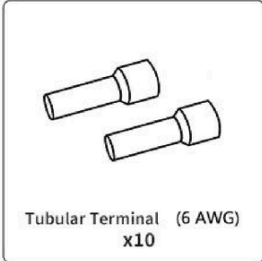
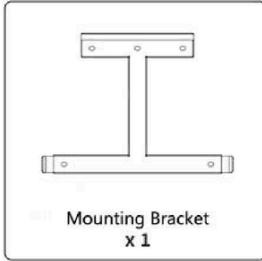
4. Check and Storage

4.1 Check Before Receiving

Check the following items before you accept the product.

- 1. Check the outer packing box for damage, such as holes, cracks, dents or other signs of damage. If you find any damage, do not unpack the box. Contact Fantastech (574-218-1973, derek@fantastech.org) as soon as possible.
- 2. Check the inverter model. If it is not the model you ordered, do not unpack the product. Contact Fantastech.
- 3. Check the delivery for the correct model, complete contents and undamaged appearance. If you find any damage, contact Fantastech as soon as possible.

4.2 What's in the Box

 Hybrid inverter x1	 Tubular Terminal (20AWG) x10	 Stainless steel anti-collision bolt M8 x5	 communication cable x1
 Copper Terminal (1/0 AWG) x4	 Tubular Terminal (10AWG) x12	 Certification x1 Warranty card x1 Quick installation manual x1	 Wi-Fi-Plug x1
 Sensor Clamp x 2	 Tubular Terminal (6 AWG) x10	 Mounting Bracket x 1	 Desiccant 50g 1x

Box contents (the pictures show what each item looks like; the table below gives the quantity)

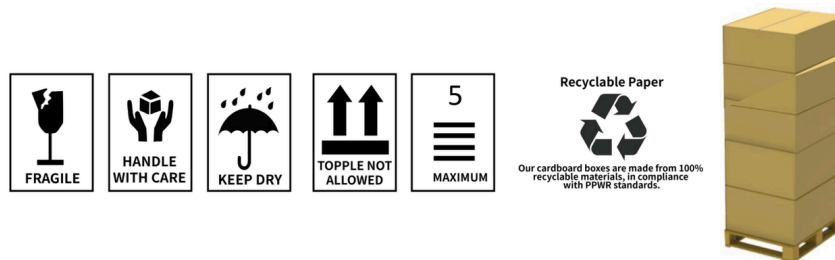
No.	Item	Quantity
1	Hybrid inverter (KOOR All-in-One)	1
2	Tubular terminal (wire ferrule), 20 AWG	10
3	Stainless steel anti-collision bolt, M8	5
4	Communication cable	1
5	Copper terminal (ring lug), 1/0 AWG	4
6	Tubular terminal (wire ferrule), 10 AWG	12
7	User manual	1
8	Certification	1
9	Warranty card	1
10	Quick installation manual	1
11	Wi-Fi plug (the Wi-Fi logger stick, see chapter 8)	1
12	Sensor clamp (CT)	2
13	Tubular terminal (wire ferrule), 6 AWG	10
14	Mounting bracket	1
15	Desiccant, 50 g	1

If an item is missing or damaged, contact Fantastech.

4.3 Storage

If you will not install or use the equipment right away, make sure the storage place meets these requirements:

1. Do not unpack the outer package. Do not throw the desiccant away.
2. Store the equipment in a clean place. Make sure the temperature and humidity are suitable and there is no condensation.
3. Stack the inverters to the height and in the direction shown on the packing box.
4. Stack the inverters with care so they cannot fall.
5. If the inverter has been stored for a long time, have it checked by a qualified professional before you put it into use.
6. Storage temperature range: -25 to +60 °C. Storage humidity: 0–100%.
7. The box should be able to carry loads of more than 75 kg.



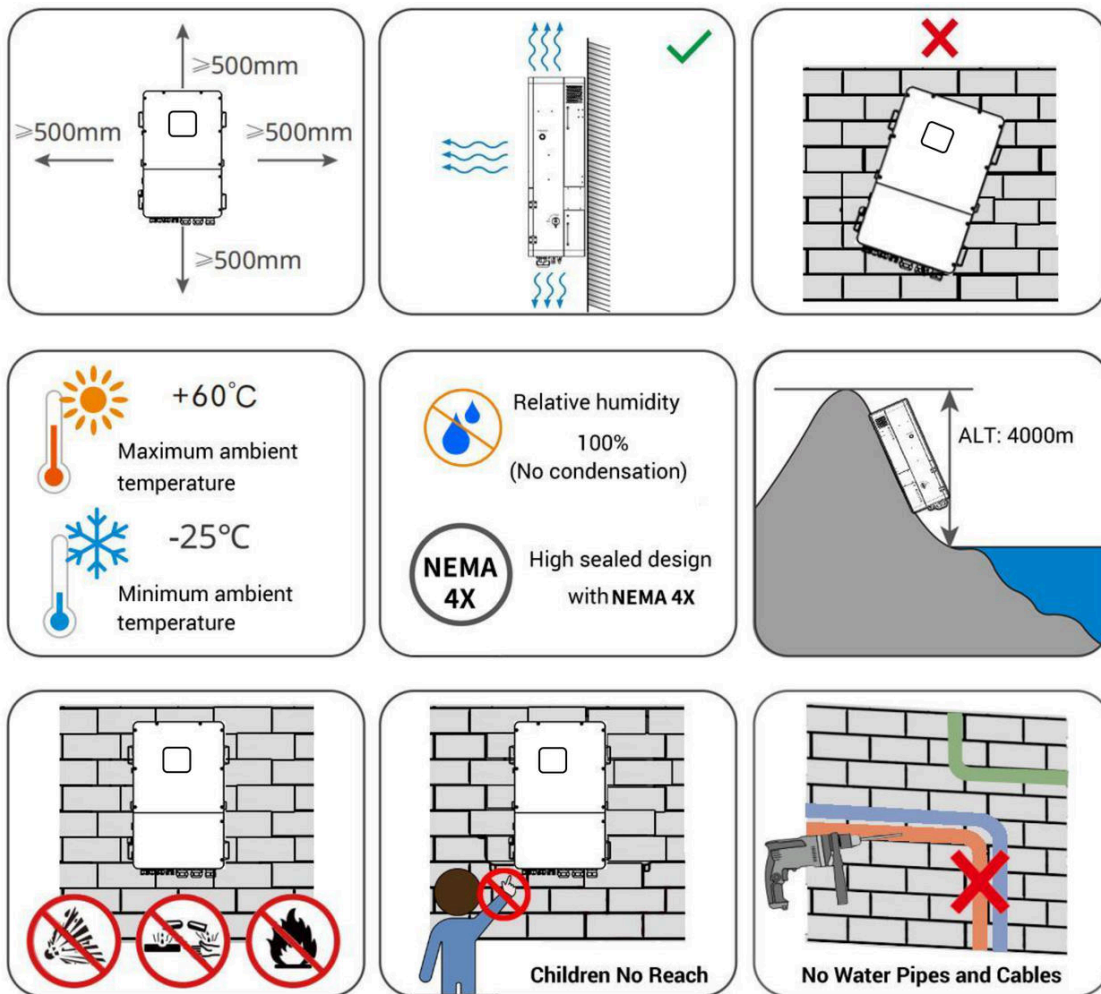
Packing box marks: fragile, handle with care, keep dry, topple not allowed, stack 5 high maximum, recyclable paper; boxes stacked on a pallet

5. Installation

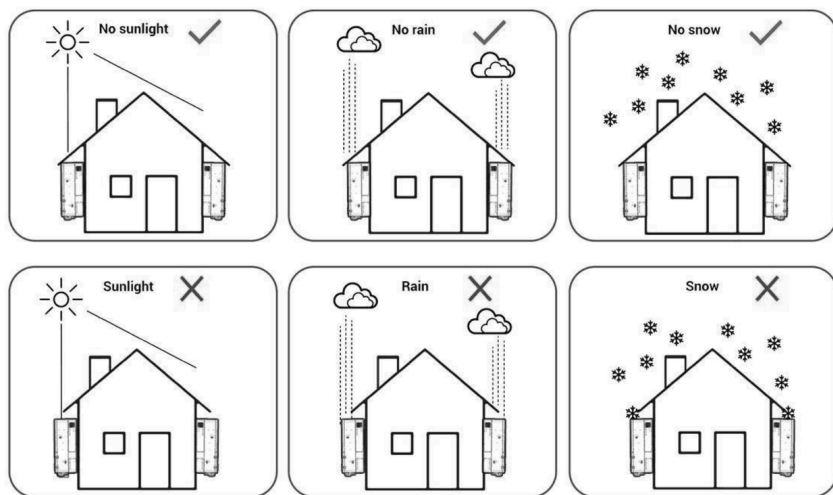
5.1 Installation Requirements

Installation Environment Requirements

1. Do not install the equipment near flammable, explosive or corrosive materials.
2. Do not install the equipment where people can easily touch it, especially within the reach of children. The equipment gets hot when it is working. Do not touch its surface, or you may be burned.
3. When you drill holes, stay clear of water pipes and cables buried in the wall.
4. Install the equipment in a sheltered place, out of direct sunlight, rain and snow. Build a sunshade if one is needed.
5. The installation place must be well ventilated so heat can escape, and large enough to work in.
6. The equipment has a high ingress protection rating (NEMA 4X). It can be installed indoors or outdoors. The temperature and humidity at the site must stay within the allowed range.
7. Install the equipment at a height that makes it easy to operate and maintain, make the electrical connections, and read the indicators and labels.
8. Install the inverter below its maximum working altitude of 4000 m.
9. The PV modules used with the inverter must have an IEC 61730 Class A rating.
10. Provide overcurrent protection (such as a circuit breaker rated 400 Vac / 200 Aac) before the AC input and after the LOAD output. Make sure the installation position does not block access to the disconnecting means.
11. Make sure the inverter has enough space around it for ventilation after it is installed. Leave at least 500 mm on every side, as shown in the installation drawing below.
12. This inverter has no internal isolation transformer between the PV input and the battery / AC output circuits. Basic insulation is provided between the PV input / battery / AC output circuits and the metal enclosure / earth. Reinforced (double) insulation is provided between the PV input / battery / AC output circuits and the communication circuits (DRM / meter / Wi-Fi / RS485).
13. For the PV input ratings, see the specification table in section 3.3.4. Do not ground the PV array.
14. Install the equipment away from electromagnetic interference. If radio stations or wireless communication equipment working below 30 MHz are near the installation site, install the equipment as follows:
 - Add a multi-turn ferrite core on the DC input line or the AC output line of the inverter, or add a low-pass EMI filter.
 - Keep the inverter more than 30 m away from the wireless equipment that causes the interference.



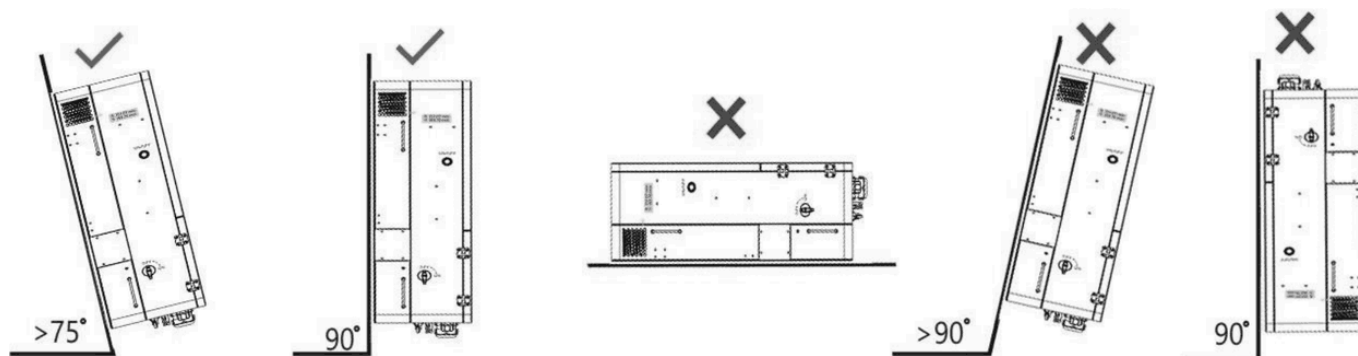
Top row: leave at least 500 mm on every side; mount upright with air flow around it; do not mount tilted sideways. Middle row: ambient temperature -25 to +60 °C; relative humidity up to 100% (no condensation), NEMA 4X sealed design; altitude up to 4000 m. Bottom row: keep away from explosive, corrosive and flammable materials; keep out of reach of children; do not drill into water pipes or cables



Install where the inverter is sheltered from sunlight, rain and snow (top row), not where it is exposed to them (bottom row)

Installation Angle Requirements

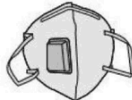
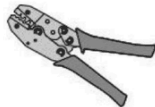
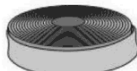
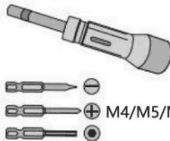
- Install the inverter upright (vertical), or tilted back by no more than 15 degrees.
- Do not install the inverter upside down, tilted forward, or lying flat.



Allowed: tilted back no more than 15° (angle to the floor more than 75°) or upright at 90°. Not allowed: lying flat, tilted forward (more than 90°), or upside down

Installation Tool Requirements

The following tools are recommended for installing the equipment. Use other tools on site if needed.

				
Goggles	Safety shoes	Safety gloves	Dust mask	Tube type bundle terminal crimping pliers
				
Diagonal pliers	Wire stripper	Hammer drill	Heat gun	Hydraulic crimping pliers
				
Marker	Level	Heat shrink tube	Rubber hammer	Vacuum cleaner
				
Multimeter	Cable tie	Torque wrench	L-type Hexagon wrench	10/13/22mm socket or wrench.

Recommended installation tools (see the table below for the correct tool names)

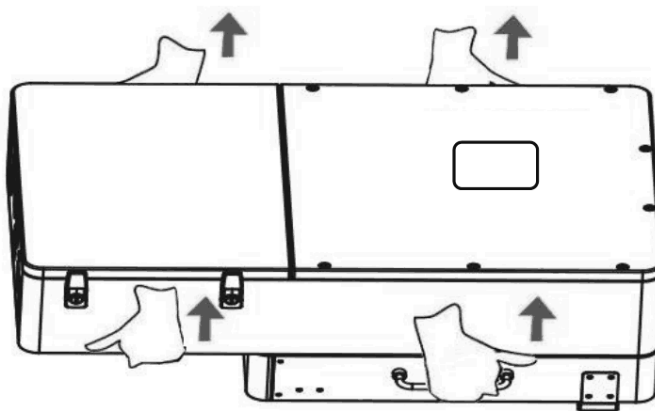
Picture row	Tools, left to right
1	Goggles · Safety shoes · Safety gloves · Dust mask · Ferrule crimping pliers
2	Diagonal pliers · Wire stripper · Hammer drill · Heat gun · Hydraulic crimping pliers
3	Marker · Level · Heat shrink tube · Rubber hammer · Vacuum cleaner
4	Multimeter · Cable tie · Torque screwdriver (with M4/M5/M6 bits) · Hex key (Allen wrench) · 10/13/22 mm socket or wrench

Three tiles in the picture carry the wrong name: "Tube type bundle terminal crimping pliers" are ferrule crimping pliers, "Torque wrench" is a torque screwdriver, and "L-type Hexagon wrench" is a hex key (Allen wrench).

5.2 Inverter Installation

5.2.1 Moving the Inverter

CAUTION The unit is heavy. Do not lift it alone. While lifting, make sure the unit is held firmly so it cannot tip over or drop. Parts used to support or hold the unit in place must be designed and made to keep the risk of injury, and of fixings coming loose, as low as possible. Make sure the lifting method cannot let the unit slip out of chains or slings, turn over, or slide off the lifting devices.



Moving the inverter: lift it from below at both ends

- Transport must be done by trained people (truck operators, hook-up personnel) who wear the needed protective equipment: overalls, safety shoes, protective gloves, helmets and goggles.
- Do not walk or stand under or near the load. Avoid sudden movements and jolts when you unload and position the unit. Handle the unit with care when you move it on site.
- Do not use any part of the unit as a lever. If the unit is not balanced, add ballast. Do not hold up any part that sticks out by hand. Install the inverter so that the operating panel is easy to reach and the electrical power connection point is easy to access.
- Keep the inverter accessible for maintenance and repair work.
- Check the load capacity and hardness of the supporting surface. Per IEC 62109-1, the load rating of the mounting bracket must be at least four times the weight of the device. Wear, corrosion, material fatigue and ageing weaken the support over time. Work out the support from the design data of the supporting material, and consult a structural engineer.

5.2.2 Installing Steps

NOTICE

- Use screws or anchors that suit the support surface and can carry the weight of the inverter.
- When you drill holes, stay clear of water pipes and cables buried in the wall.
- Wear goggles and a dust mask when you drill, so you do not breathe in the dust or get it in your eyes.
- Make sure the inverter is firmly installed so it cannot fall.

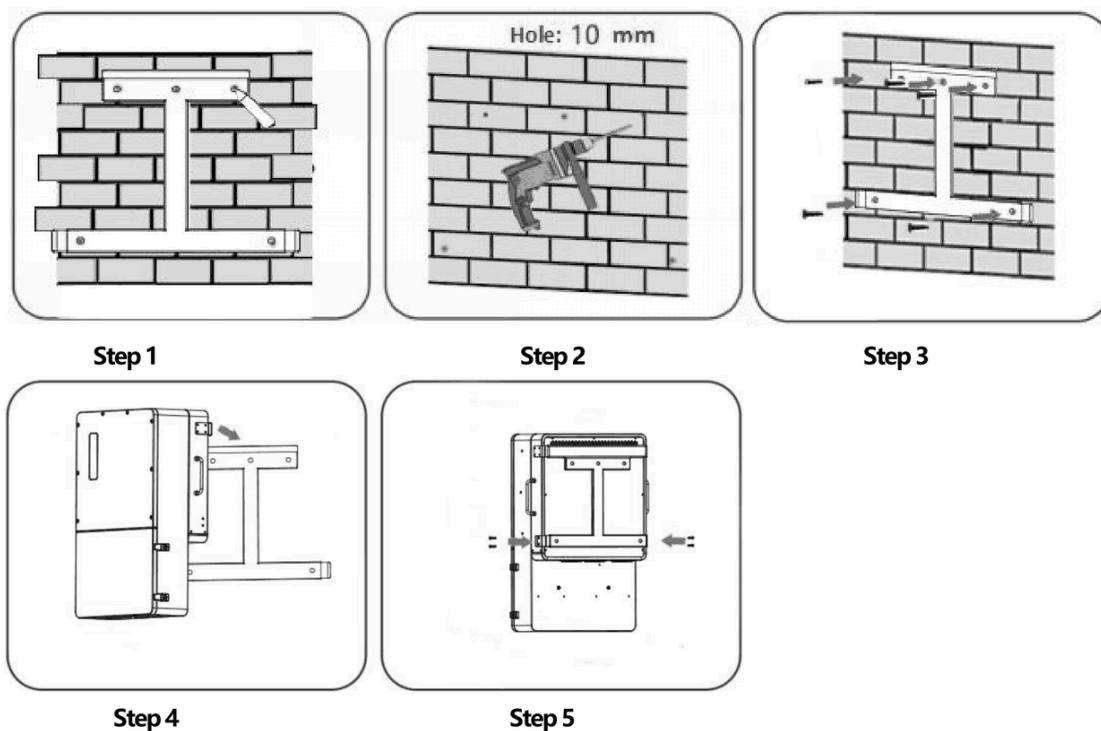
Step 1: Hold the mounting bracket flush against the wall and mark the positions of the holes.

Step 2: Drill 10 mm holes at the marked positions.

Step 3: Fasten the mounting bracket to the wall through the drilled holes and tighten the screws.

Step 4: Hang the inverter on the mounting bracket.

Step 5: After the inverter is hung, lock the four screws at both ends (two at each side).



Installing steps 1 to 5 (step 2: hole diameter 10 mm)

6. Electrical Connection

6.1 Safety Precautions

DANGER

- All work, cables and parts used for the electrical connection must comply with local laws and regulations.
- Before you make any electrical connection, turn off the DC switch and the AC output switch to power off the inverter. Then wait at least 5 minutes so the capacitors can discharge. Do not work with the power on. Otherwise, electric shock may occur.
- Tie cables of the same type together, and keep them apart from cables of other types. Do not let cables tangle or cross.
- A cable under too much tension may make a poor connection. Leave some slack in each cable before you connect it to the inverter cable port.
- When you crimp a terminal, make sure the bare conductor is in full contact with the terminal. Do not crimp the cable jacket into the terminal. Otherwise, the inverter may not operate, or the loose connection may heat up during operation and damage the terminal block.

NOTICE

- Wear personal protective equipment, such as safety shoes, safety gloves and insulating gloves, during electrical connections.
- All electrical connections must be made by qualified professionals.
- Cable colors in this manual are for reference only. Cable specifications must meet local laws and regulations.

6.2 Connection Requirements

6.2.1 AC / DC Connection Requirements

Port	Terminal / breaker rating	Terminal wire size range (min.-max.)
GRID	200 Aac (15 kW)	2/0-4/0 AWG
LOAD	200 Aac (15 kW)	2/0-4/0 AWG
GEN	63 Aac	6-4 AWG
MPPT	26 Adc (per MPPT)	12-10 AWG
Battery port	200 Adc × 2	2/0-4/0 AWG
I-LOAD	90 Aac	6-4 AWG

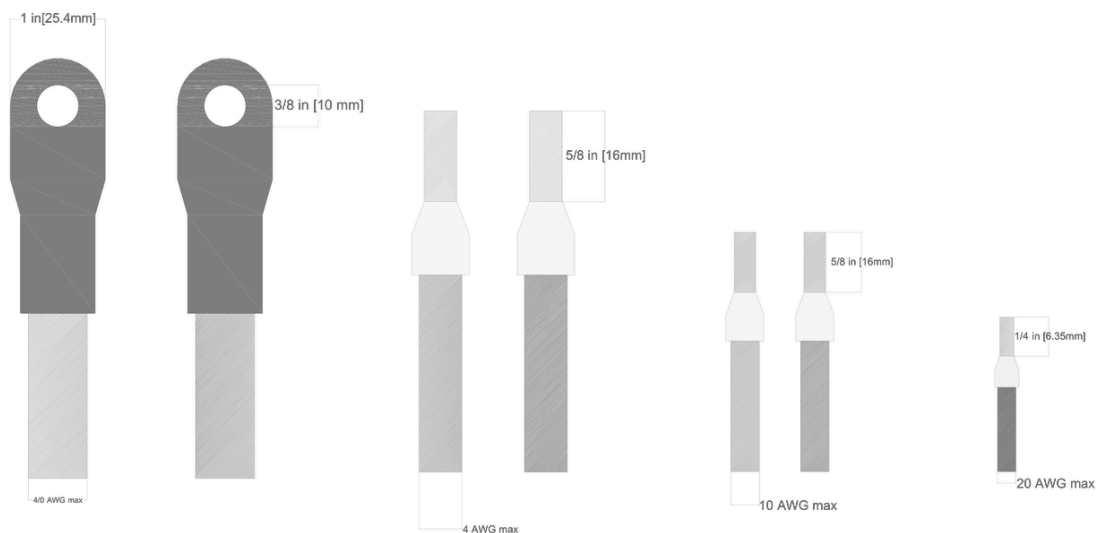
Wire colors

Every wiring drawing in this manual uses the standard US wire colors. Use the same colors on the job so anyone who opens the system later can read it.

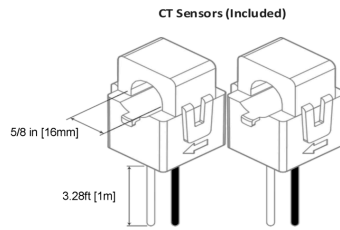
Wire	Color
 L1	Black
 L2	Red
 L3 (120/208 V only)	Blue
 Neutral (N)	White (drawn grey in the drawings so it shows on white paper)
 Ground	Green, or bare copper
 DC positive (+)	Red — battery and PV
 DC negative (-)	Black — battery and PV

6.2.2 Sensors and Communications Requirements

Component	Wire size range	Maximum distance
CT sensor	16–20 AWG	0–13 ft (4 m): 16 AWG, included 13–20 ft (6 m): CAT6, extendable
Communications	23–24 AWG	0–100 ft (30 m): 24 AWG 100–400 ft (120 m): 23 AWG
RJ45 parallel communication	CAT5e or better	0–7 ft (2.1 m): included 7–20 ft (6 m): extendable



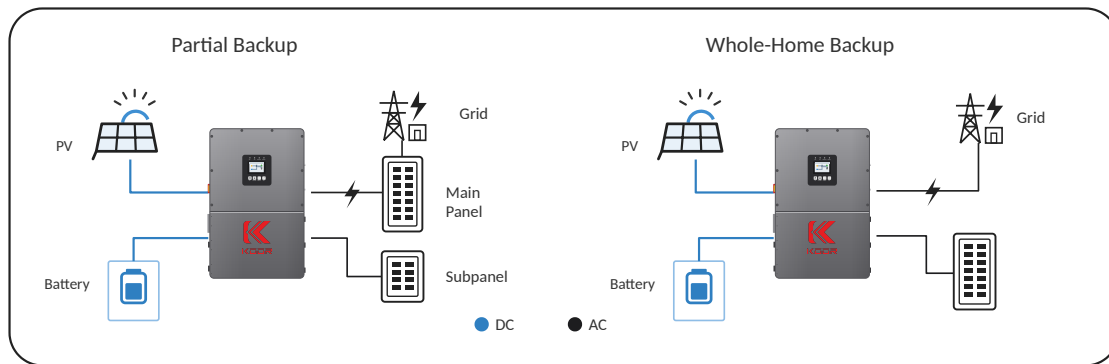
Terminal and ferrule sizes: ring terminal for up to 4/0 AWG (1 in [25.4 mm] and 3/8 in [10 mm]); ferrules for up to 4 AWG (5/8 in [16 mm]), up to 10 AWG (5/8 in [16 mm]) and up to 20 AWG (1/4 in [6.35 mm])



CT sensors (included): 5/8 in (16 mm) opening, 3.28 ft (1 m) leads

6.3 System Integration

The system connection diagrams are shown below (U.S. version).



System connection: Partial Backup (left) and Whole-Home Backup (right). Blue lines are DC; black lines are AC.

Single system installation guide

Partial Backup (Essential Loads Only)

- Connect the output of the back-feed breaker or line-side tap (depending on your interconnection method) to the "GRID" terminal of the inverter.
- Install an external disconnect switch between the point of interconnection and the inverter. Size the disconnect according to local electrical code.
- Connect the "LOAD" terminal of the inverter to the essential loads panel. Choose the wire gauge according to electrical code.

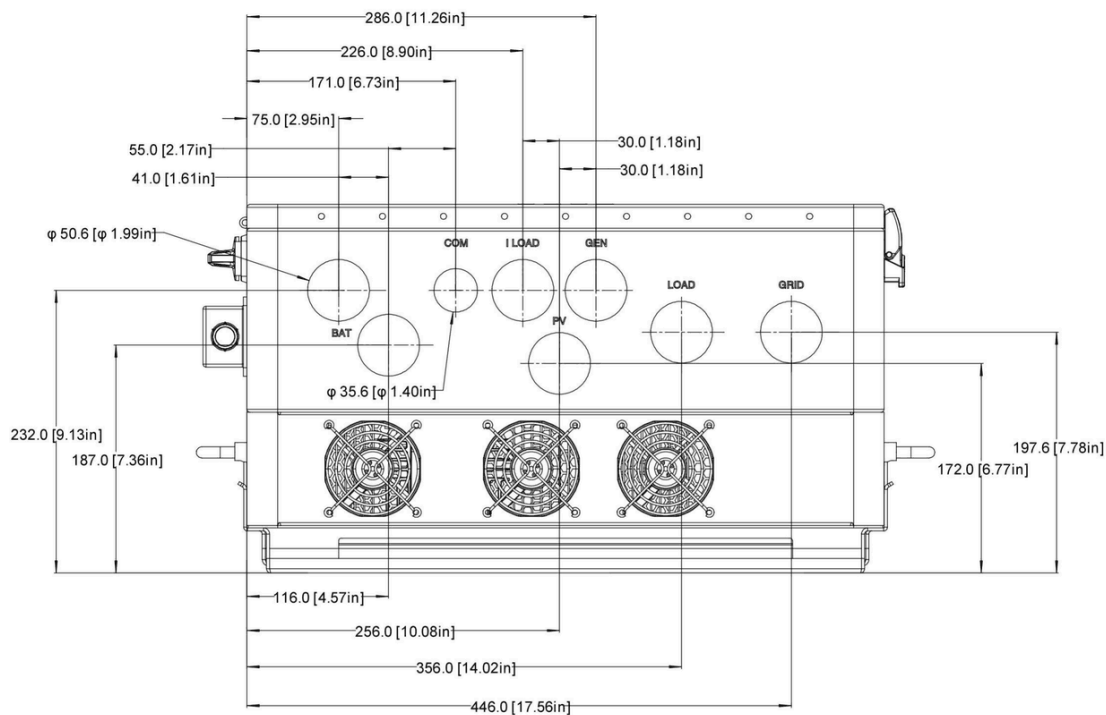
Whole-Home Backup (Entire Load)

- Connect the utility grid directly to the inverter's "GRID" terminal.
- Install an external disconnect switch between the grid and the inverter. Size the disconnect according to code requirements.
- Connect the "LOAD" terminal to the main service panel. Size the wire according to code.

AC Generator or AC-Coupled Source (Optional)

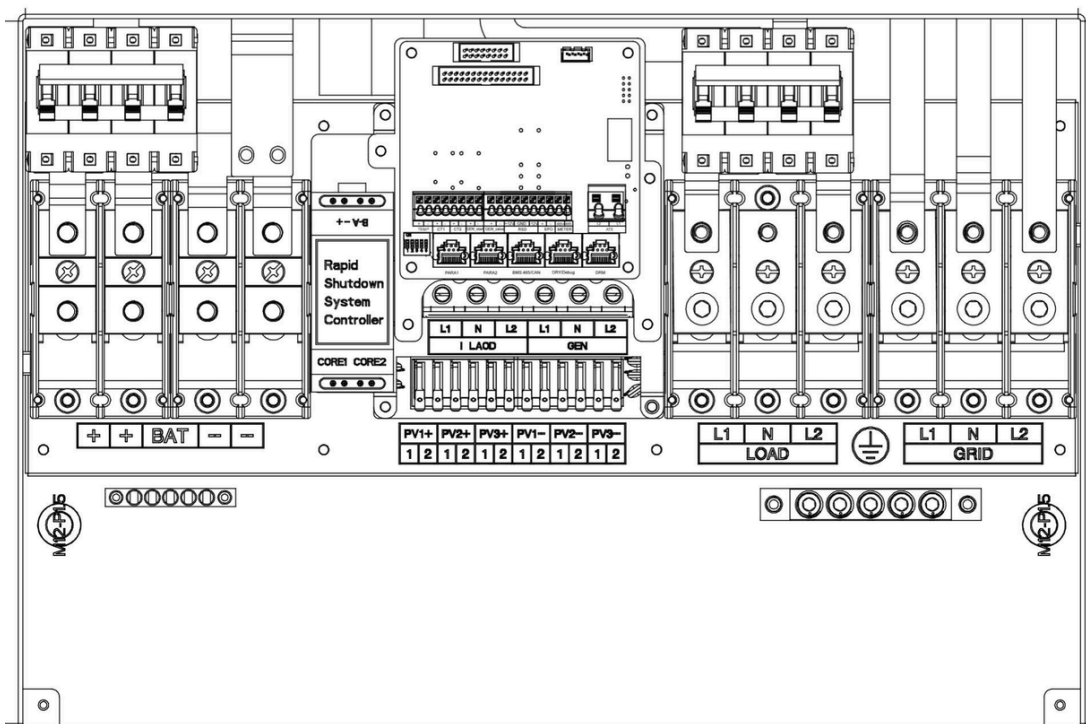
- A generator or an AC-coupled power source (for example, a string inverter or microinverters) can be connected to the "GEN" terminal.
- The maximum input for the GEN terminal is 63 A (15 kW).
- Only one AC source may be connected to the GEN terminal at a time.

Bottom view of cable box knockouts



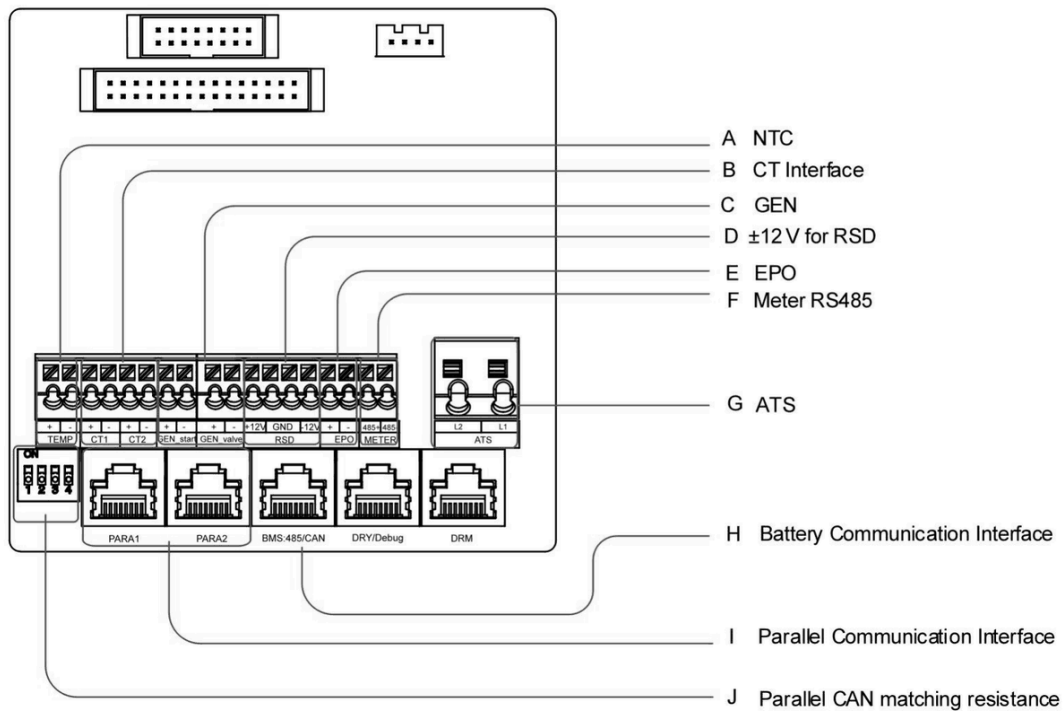
Cable box knockouts, bottom view (dimensions in mm [in]): BAT, COM, I-LOAD, GEN, PV, LOAD and GRID

Overview of cable box



Cable box overview. The terminal labeled "I LAOD" in the drawing is the I-LOAD terminal.

Communication terminals



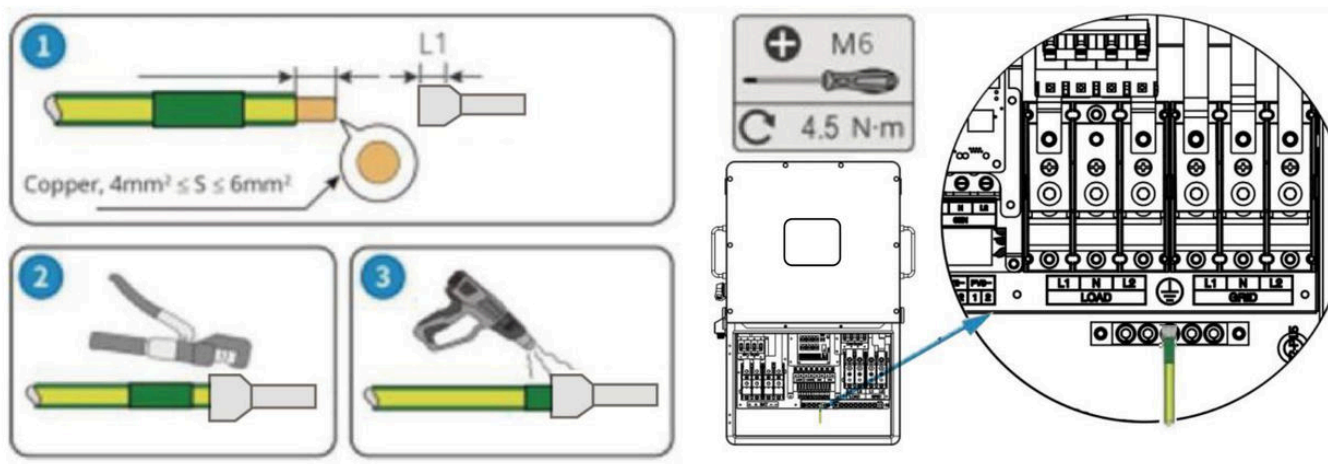
Communication board terminals A to J

- A. **NTC:** Connection for the lead-acid battery temperature sensor.
- B. **CT interface:** See section 6.7.4 for the pin definition.
- C. **GEN (NO):** Connection for the generator auto-start function. This is a dry-contact signal to start the generator. When the "GEN signal" is active, the normally open contact (GS) closes (no voltage output).
- D. **±12 V for RSD:** Power supply for the RSD PLC transmitter (max. current 500 mA).
- E. **EPO:** Reserved for an external EPO (emergency power off).
- F. **Meter RS485:** For meter communication.
- G. **ATS:** 240 Vac output port when the inverter is on.
- H. **Battery communication port (CAN & RS485):** See section 6.6.2 for the pin definition.
- I. **Parallel communication port (CAN & RS485):** See section 6.9.1 for parallel system connection.
- J. **Parallel CAN matching resistance:** Set the DIP switch when inverters are used in parallel (see section 6.9.1).

6.4 PE Cable Connection

WARNING

- The PE cable connected to the inverter enclosure cannot replace the PE cable connected to the AC output port. Both PE cables must be securely connected.
- When there are multiple inverters, make sure all grounding points on the enclosures are bonded together so they are at the same potential (equipotential bonding).
- To improve the corrosion resistance of the terminal, KOOR recommends that you apply silicone sealant or paint to the ground terminal after you install the PE cable.
- Prepare PE cables to the recommended specification:
 - Type: outdoor single-core copper wire
 - Cross-sectional area: 6 mm^2 (10 AWG)



PE cable: (1) strip the cable (copper, $4 \text{ mm}^2 \leq S \leq 6 \text{ mm}^2$), (2) crimp the terminal, (3) shrink the heat-shrink tubing; then fasten it to the ground terminal (M6 screw, Phillips screwdriver, 4.5 N·m)

6.5 PV Connection

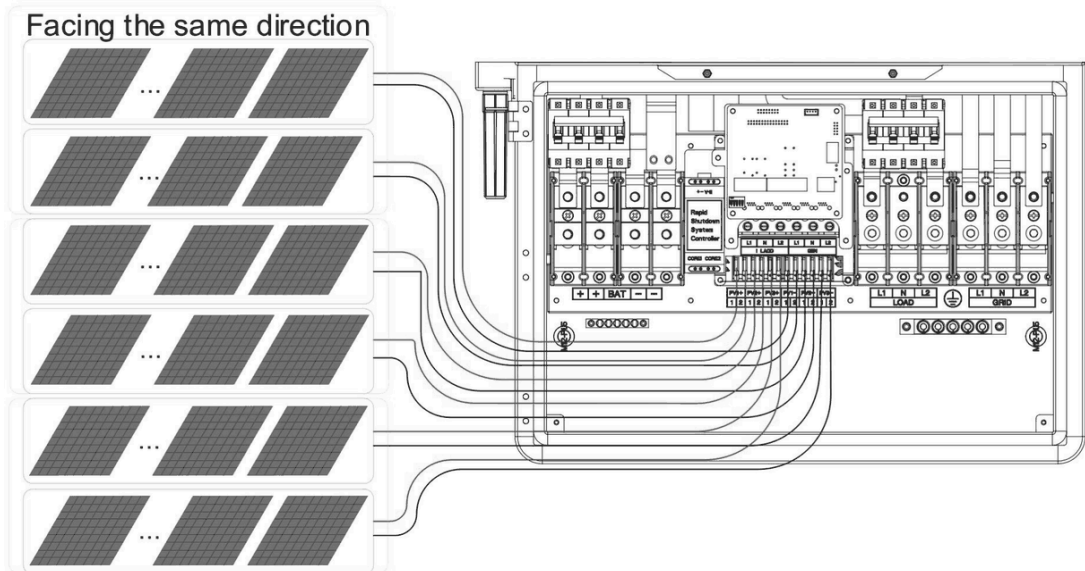
The PV connection of this hybrid inverter is the same as that of a traditional grid-tied solar inverter (string inverter).

WARNING

Check the lowest ambient temperature at the installation site. The Voc on the solar panel nameplate is measured at 25 °C (STC). As the temperature drops, the panel Voc rises. Size every string so that its open-circuit voltage, corrected for the lowest temperature, stays at or below 525 Vdc. The absolute maximum PV input voltage of the inverter is 550 Vdc.

NOTE

- The inverter has three MPPTs. You can connect two strings of solar panels to each MPPT.
- When you connect two strings to the same MPPT, make sure each string has the same number of panels. Keep the location and orientation of the two strings as alike as possible. The inverter automatically limits the total input current of each MPPT to 26 A.
- The inverter limits the maximum solar input power to 12 kW (KR-L8K), 15 kW (KR-L10K), 18 kW (KR-L12K) or 22.5 kW (KR-L15K).
- Strings in parallel on the same MPPT must have the same design open-circuit voltage (Voc). Otherwise, the system will be limited to the lowest string voltage.
- If panels facing different directions are connected to the same MPPT, PV efficiency will be lost.
- For ground-mounted arrays, KOOR recommends an auxiliary grounding electrode near the array. It keeps the earth-to-ground resistance of the grounding system low. This auxiliary electrode must follow the NEC and local code.
- Connect the solar panel strings as shown in the configuration below.



PV string connection: six strings facing the same direction, two strings on each MPPT (PV1, PV2, PV3)

PV connection steps

- a. Strip 1/4–5/16 in (6–8 mm) of insulation from the positive and negative conductors of the PV string.
- b. If the PV string wires are stranded, use wire ferrules.
- c. Install the conduit connector in the PV connection port.
- d. Pass the PV conductors through the conduit fittings and into the inverter.
- e. Check that the cable connections are correct and secure. Then make sure the conduit and conduit fittings are properly tightened and sealed into the cable hole.

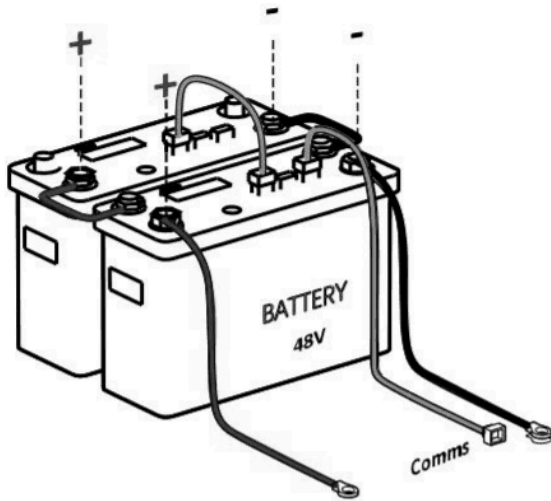
6.6 Battery Connection

Battery connection guidelines for the KR-L8K-L15K-SPUS series

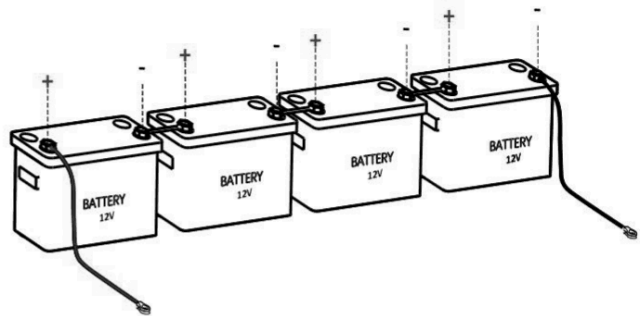
IMPORTANT Make sure the inverter is turned OFF before you connect any batteries.

- Connect your battery bank in the configuration that fits the battery voltage (see the wiring diagrams below).
- Battery breakers must be OFF during wiring.
- If your battery bank does not have built-in breakers, take all necessary safety precautions when you handle exposed terminals or cables.
- When both sets of battery terminals are used, the maximum battery charge/discharge current is 167 A (KR-L8K), 210 A (KR-L10K), 250 A (KR-L12K) or 275 A (KR-L15K).
- If you use only one set of battery terminals, the charge/discharge current is limited accordingly.
- This inverter is designed for a 48 Vdc nominal system.
- **DO NOT** connect the inverter to a battery configuration outside the 40–60 Vdc range.
- If you use 12 V batteries, **do not** put more than 4 batteries in series (max. 48 V nominal).

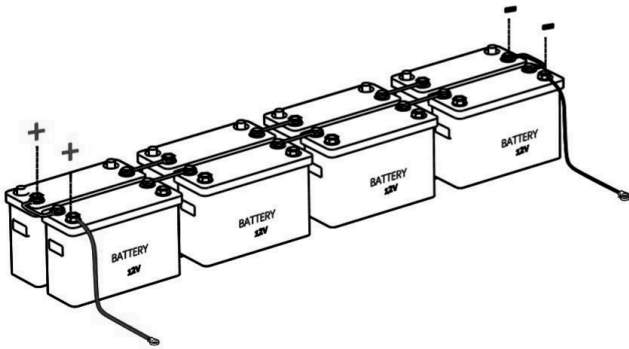
The inverter supports many battery chemistries, as long as the voltage stays within 40–60 Vdc. Depending on the battery voltage, wire the battery bank in one of the configurations shown below.



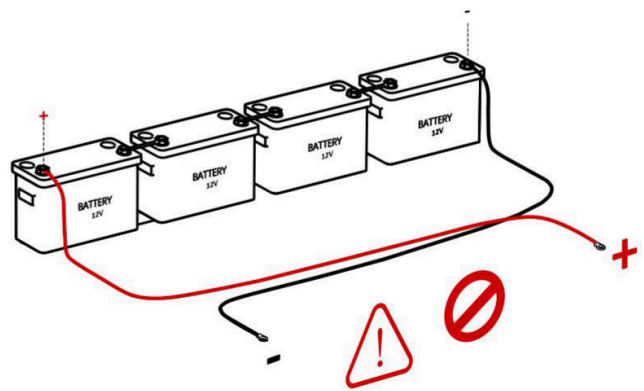
48 V batteries in parallel connection



12 V batteries in series connection



Series and parallel connections for a complete 48 V battery bank



Reversed polarity: never do this

WARNING DO NOT reverse the polarity. The system will be damaged, and the warranty will be void!

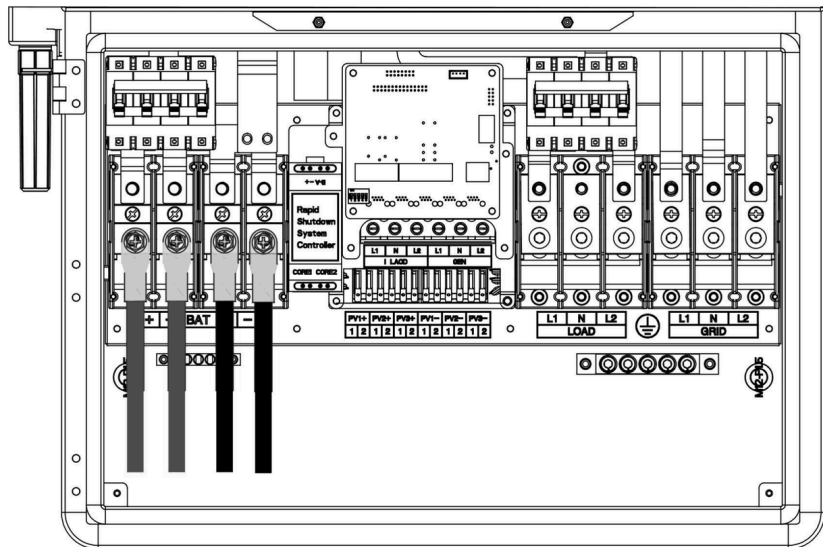
6.6.1 Battery Power Cable Connection

To connect the battery terminals:

1. Strip 1/4–5/16 in (6–8 mm) of insulation from the cable ends and crimp on the OT ring terminals.
2. Lay the battery power cables. Connect the positive cable to BAT+ and the negative cable to BAT–.
3. Use the lock nut to secure the conduit fittings to the enclosure.
4. Fasten the OT rings of the battery positive and negative cables to the terminal block, following the markings.

Multi-terminal installation

The inverter's two battery input terminals are connected in parallel inside the inverter. This gives the battery banks a common connection and makes battery installation simpler. To get the full rated charge/discharge current (167 A for KR-L8K, 210 A for KR-L10K, 250 A for KR-L12K, 275 A for KR-L15K), connect the batteries to both input terminals. If you use 3 or more batteries, use external busbars for the (+) and (–) connections.



Battery cables connected to both sets of BAT terminals (two positive, two negative)

WARNING Multiple inverters in a parallel system

- All parallel inverters must connect to a single battery bank. Otherwise, the system will NOT operate properly.
- DO NOT use separate battery banks in parallel systems.
- Follow all values specified by the battery manufacturer to ensure proper charging and discharging.

Battery charging setpoint examples (48 V nominal)

Battery type	Absorption	Float	Equalize (every 30 days)
AGM	57.6 V	53.6 V	57.6 V
Gel	56.4 V	54.0 V	–
Lithium	54.6 V	54.3 V	–

Calculating battery bank amp-hours: examples (AGM)

Number of batteries	Voltage per battery	Ah per battery	Ah at 48 V (strings of four 12 V batteries in series)	Max. charge / discharge (A)
4	12 V	230 Ah	230 Ah	100 A
8	12 V	230 Ah	460 Ah	200 A
12	12 V	230 Ah	690 Ah	275 A
16	12 V	230 Ah	920 Ah	275 A

The 275 A figures are the KR-L15K limit. The inverter's maximum battery charge/discharge current is 167 A (KR-L8K), 210 A (KR-L10K), 250 A (KR-L12K) or 275 A (KR-L15K). On the smaller models, the current is limited to that model's maximum.

To make the battery settings on the inverter screen, see section 9.7 Battery Settings Menu.

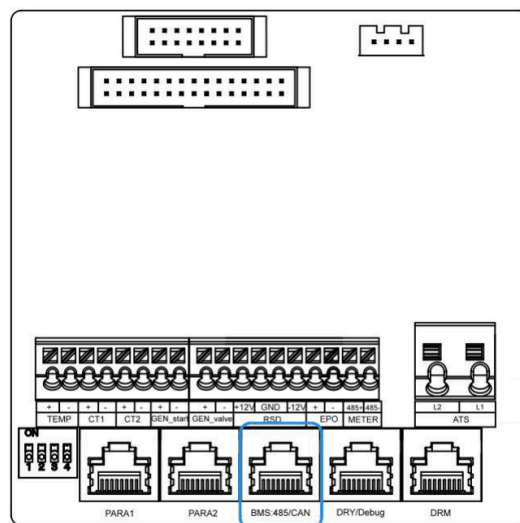
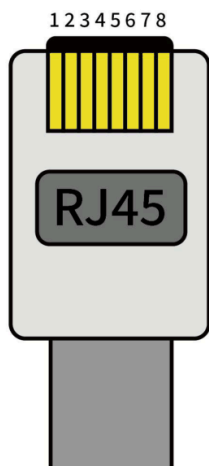
WARNING Reverse polarity will damage the inverter! Before you connect or disconnect the battery, make sure the built-in battery circuit breaker is in the "OFF" position.

6.6.2 Battery Communication Cable Connection

When you select a lithium-ion battery type, you must use the correct battery communication cable to connect the battery to the inverter. If the lithium battery cannot communicate with the inverter, select the "lead-acid" battery type.

The inverter's battery communication port is an RJ45 socket. Its pins are listed below. Make the communication cable to match the pins of the inverter port and the battery communication port. The inverter supports both CAN and RS485 communication.

Pin	Description
1	BAT RS485 A
2	BAT RS485 B
3	NC
4	BAT CAN H
5	BAT CAN L
6	NC
7	BAT RS485 B
8	BAT RS485 A



RJ45 pin numbers (left) and the battery communication port, BMS:485/CAN (right, circled in blue)

After the battery power cables and the communication cable are connected, set the battery type, communication type and battery brand on the inverter screen (Batt1 Type, Com Type and Company; see section 9.7 Battery Settings Menu). After you select the right battery protocol, communication is established within 1–2 minutes.

WARNING Damage caused by improper use of the communication protocols (CAN bus or Modbus) is not covered by the warranty. The Modbus map is available on request, for "READ" operations only. To get the Modbus map, contact Fantastech (574-218-1973, derek@fantastech.org).

6.7 Grid & EPS Load Connection

6.7.1 Grid Type and Regulation Selection

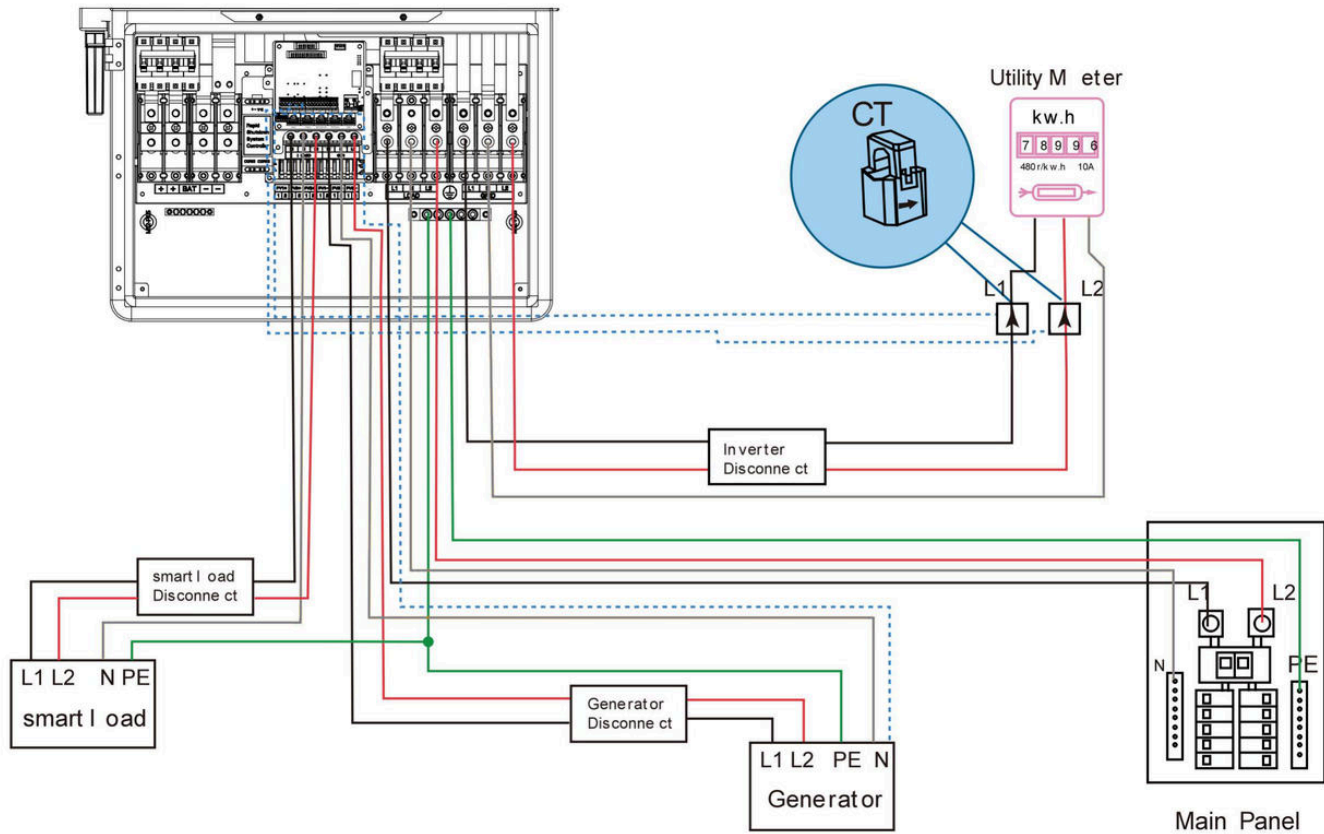
This inverter can be used on 120/240 V split-phase systems or on 120/208 V systems (two legs of a three-phase wye). If you connect the inverter to the grid, make sure the grid settings are set correctly. Select the grid type and grid regulation on the inverter screen. See section 9.8 Grid Settings Menu (Grid Mode, Grid Volt and Grid Freq).

6.7.2 Split-Phase Grid and EPS Load Connection

The wiring diagram below is for a 120/240 V service. The wiring for a 120/208 V service is mostly the same, except for the generator: a 120/208 V generator never goes on the GEN port (see 6.8.1).

When the bus rating of the main panel meets the requirements of NEC 705.12(B)(3), the inverter can be connected on the load side of the service disconnecting means. If it does not, a line-side connection can be made. This avoids a costly upgrade of the main panel.

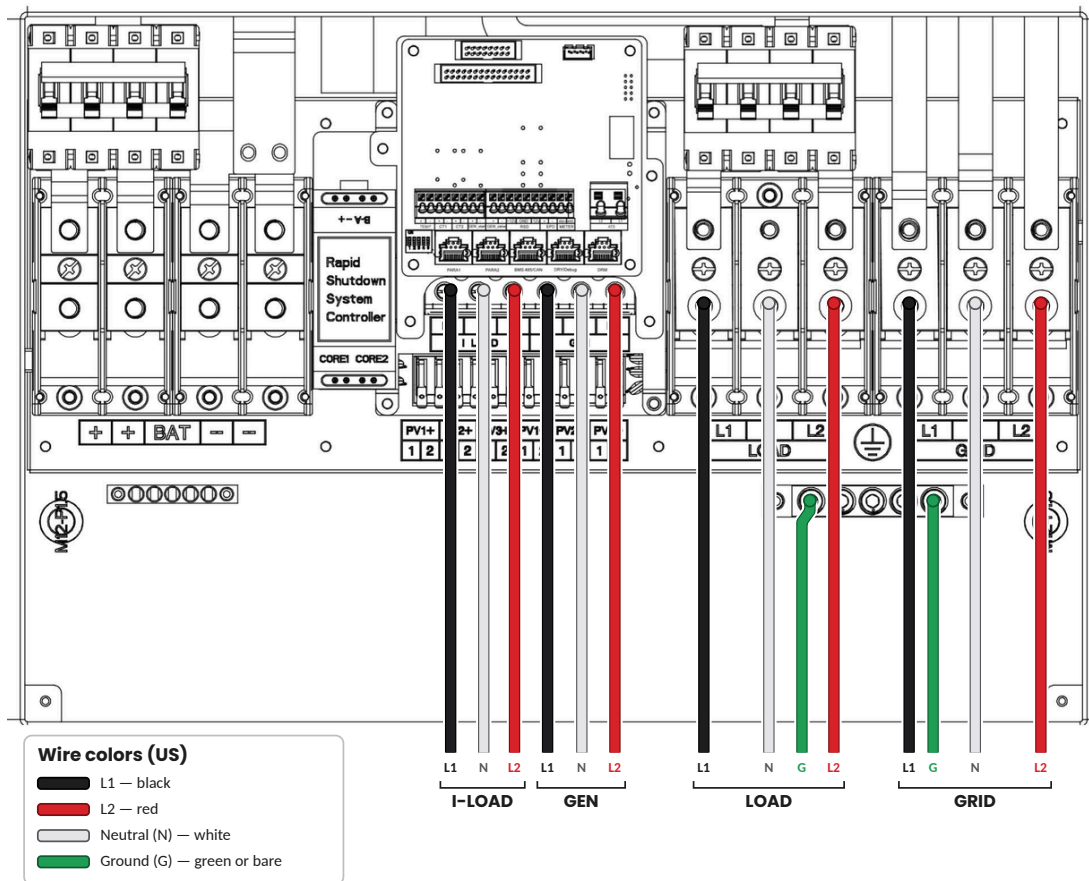
Grid and EPS load connection



120/240 V grid and EPS load wiring, with smart load and generator. Labels in the drawing read: Utility Meter, CT, Inverter Disconnect, Main Panel, Smart Load Disconnect, Smart Load, Generator Disconnect and Generator. Wire colors: black = L1, red = L2, grey = neutral (white wire), green = ground, blue dotted = communication and CT cables.

6.7.3 AC Cable Connection

1. Strip 5/16–3/8 in (8–10 mm) of insulation from the cable.
2. If the cable is stranded, put a wire ferrule on the end of each wire.
3. Fasten the conduit fitting to the enclosure with the top nut of the fitting.
4. Fasten the grid wires and the EPS load wires to the terminal block, as marked on the block.
5. Fasten the conduit to the conduit fitting.
6. Check that all cable connections are correct and tight. Make sure the conduit and conduit fittings are tightened and sealed into the cable entry hole.



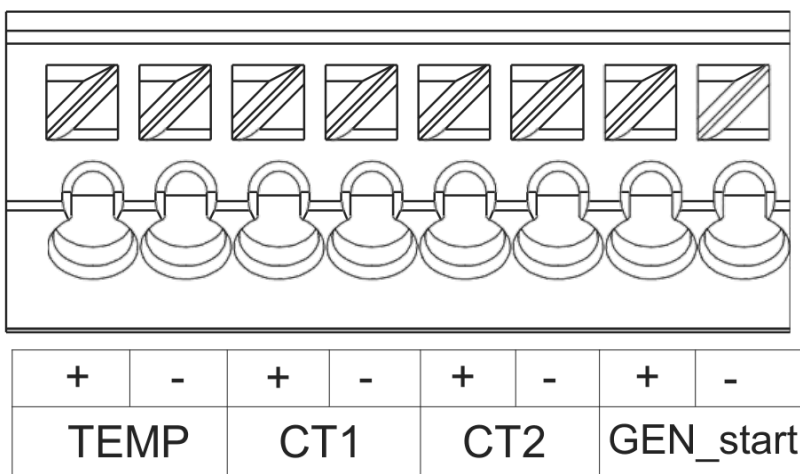
AC wiring at the I-LOAD, GEN, LOAD and GRID terminals and the ground bar. Each cable is L1 (black), N (white) and L2 (red); the ground (green) goes to the ground bar.

WARNING Before you supply power to the EPS load, make sure the built-in load circuit breaker is in the "ON" position.

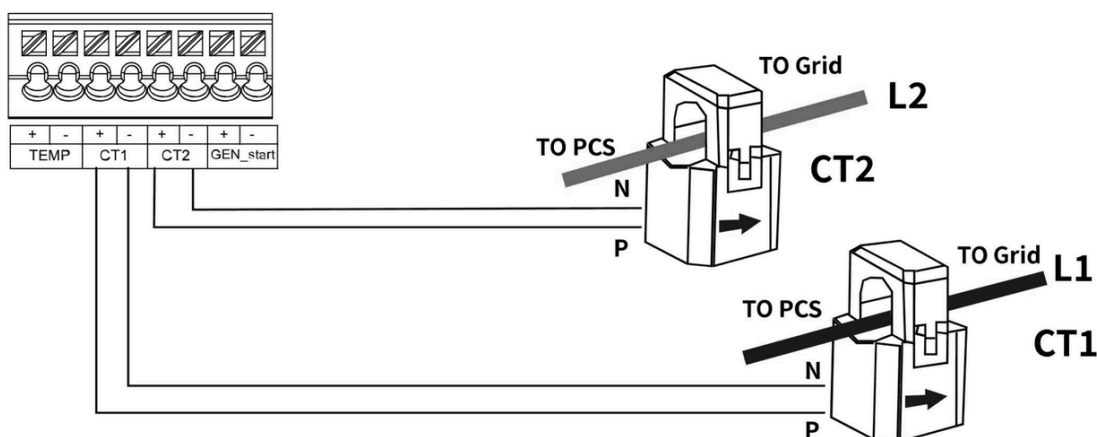
6.7.4 CT / Energy Meter Connection

To measure the power going to and coming from the grid, you must install a pair of CTs or a three-phase meter at the service entrance point. Put them inside the main service panel or near it. Two CTs come with each inverter.

CT interface pin definition



CT interface terminals: TEMP (+/-), CT1 (+/-), CT2 (+/-) and GEN_start (+/-)



CT wiring. "TO PCS" in the drawing means "to the inverter"; "TO Grid" means toward the utility grid.

Use the wiring diagram to find the correct place for each CT. Clamp the two CTs onto the L1 and L2 wires at the service entrance point of the main service panel.

- CT1 (labeled L1) goes on L1.
- CT2 (labeled L2) goes on L2.

WARNING

- Install the sensors on the incoming electrical service wires (L1, L2, and L3 if the system is three-phase).
- The arrows molded into the sensors must point toward the grid.
- If the system is three-phase, the arrows must point toward the inverter(s).

If the CTs are installed wrong, the screen may show wrong readings and the inverter may not work properly. If a CT is installed in the wrong direction, you can reverse it in the inverter settings with **CT Direction Reversal** (use it only if CT1 or CT2 is not installed correctly). This setting is in the **Advanced Settings** tab. You should not need to change it if the CTs are installed correctly.

CT clamping ratio

CT (current transformer) compatibility and setup

- The inverter supports a standard CT ratio of 2000:1.
- The CTs in the accessory package have a 2000:1 ratio and are pre-calibrated for use with the system.
- If you use a third-party CT, make sure its ratio is either 1000:1 or 2000:1.

CAUTION Set the correct CT ratio for the CT you use. Make the setting on the inverter screen (section 9.8 Grid Settings Menu, CT Ratio). A wrong CT ratio setting can cause wrong power readings or make the system behave wrongly.

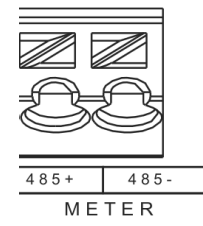
Temperature sensor

The temperature sensor connects to the **TEMP** terminals, the first pair on the terminal strip shown in the CT interface pin definition above.

- The temperature sensor terminal is required when you use lead-acid batteries.
- Place the sensor between two batteries.
- Hold it in place with tape. Keep it away from the battery terminals so it does not overheat.
- The sensor has no polarity. It lets the inverter adjust the charging voltage and the capacity calculation as the temperature changes.
- Lithium batteries do NOT need the external temperature sensor.

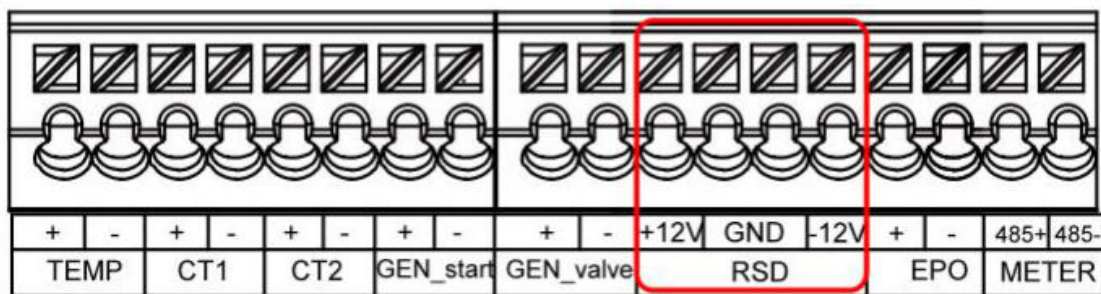
Energy meter connection

If you use an energy meter for import/export monitoring instead of CTs, connect it to the **485A** and **485B** terminals on the inverter for communication. On the terminal strip these are marked **485+** and **485-** under **METER**. These terminals use RS485.



METER terminals 485+ and 485-

6.7.5 Emergency Stop and Rapid Shutdown Connection



Communication terminal strip. The RSD terminals (+12V, GND, -12V) are boxed in red; the E-Stop terminals are marked EPO.

Emergency stop (E-Stop) and RSD connection guidelines

- Connect the emergency stop (E-Stop) button to its control pins on the inverter (marked EPO).

- Connect the rapid shutdown (RSD) transmitter to the RSD terminal. The RSD terminal supplies 12 Vdc or 24 Vdc power.
- The maximum current output of the RSD terminal is 500 mA. Make sure the RSD transmitter or other connected device does not go over this limit.

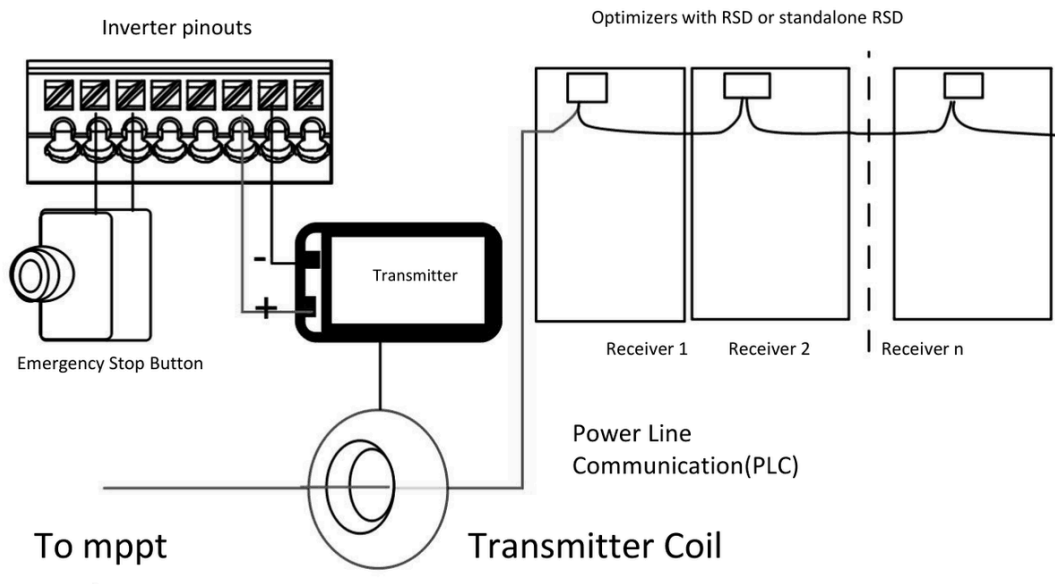
The E-Stop pins on the inverter are a normally open (NO) contact. When the circuit is closed, it triggers the rapid shutdown (RSD) function.

The inverter has two power terminals for the RSD transmitter: +12V and -12V.

- **12 V RSD transmitters:** connect the transmitter to +12V and GND.
- **24 V RSD transmitters:** connect the transmitter to +12V and -12V.

CAUTION Make sure the current draw of the RSD transmitter does not go over 500 mA. This is the maximum output of the inverter's RSD terminal.

The diagram below shows one way to wire the transmitter for rapid shutdown. Make sure the transmitter does not draw more current than the RSD terminal can supply.



Rapid shutdown wiring: the Emergency Stop Button and the Transmitter connect to the inverter pinouts. The Transmitter Coil sits on the PV wire "To mppt" (to the inverter's MPPT input) and sends a power line communication (PLC) signal to Receiver 1, Receiver 2 ... Receiver n (optimizers with RSD, or standalone RSD units).

NOTICE The built-in 12 Vdc power supply of the inverter is rated for 500 mA. Do not exceed it! If you are not sure of the current (A) rating of the transmitter, contact Fantastech (574-218-1973, derek@fantastech.org) before you connect it.

6.8 Use a Generator

6.8.1 Generator System Connection

This hybrid inverter can be used with a generator. The inverter has a **GEN** port for connecting the generator.

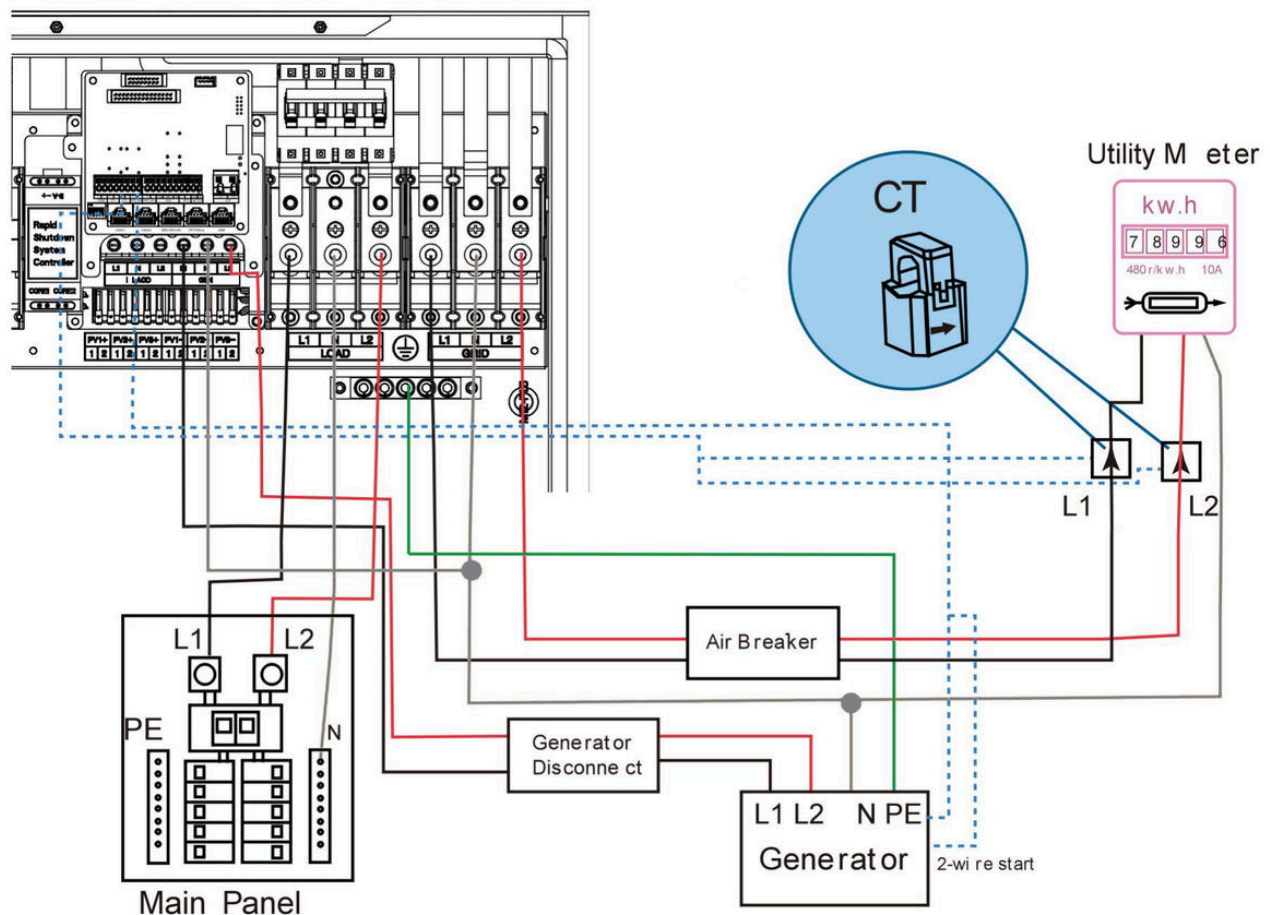
FANTASTECH RULES Which port the generator goes on:

- 120/240 V split-phase generator under 15 kW → GEN port (63 A breaker).
- 120/240 V generator 15 kW or bigger → GRID port.
- 120/208 V generator (two legs of a three-phase generator) → GRID port. Never the GEN port.
- Never run three-phase power to the GEN port.
- **Generator charge time:** set the Start 1 minute after the End (for example End 00:00, Start 00:01). The charge window then covers the whole day, so the battery always charges whenever the generator runs.

Generator requirements

- The generator should have a **neutral-grounding connection** and give both **240 V and 120 V output**. The generator's capacity should be equal to or greater than the capacity of the system.
- A THD (total harmonic distortion) of less than 15% is preferred.
- Make sure the generator is connected correctly and meets the voltage and capacity requirements, so it works properly with the inverter. Always follow the generator manufacturer's instructions for installation and connection.
- Do NOT use "Grid Sell" in off-grid systems. It can damage the generator.

Generator connection — whole-home backup

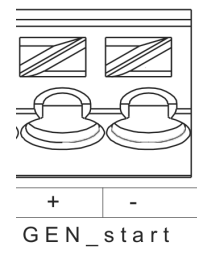


Generator connection for whole-home backup. Labels in the drawing read: Utility Meter, CT, Air Breaker (circuit breaker), Main Panel, Generator Disconnect, Generator and 2-wire start. Wire colors: black = L1, red = L2, grey = neutral (white wire), green = ground, blue dotted = communication and CT cables.

When the generator starts, it powers all loads connected to the EPS and charges the battery at the same time.

The AC circuit breaker on the GEN port is rated for 63 A. When the generator is running, make sure the total load current plus charging current does not go over 63 A.

Every KOOR inverter has generator auto-start. It uses a dry-contact **GEN_start** signal that is driven by the battery SOC or voltage (see section 6.8.2). To let the inverter start the generator remotely, connect the generator's start signal (2-wire start) to the **GEN_start** terminals on the communication terminal block.



GEN_start terminals (+/-)

6.8.2 Generator Start and Stop Settings

These conditions depend on the **Battery (Bat) Operation Mode** settings. The system uses the **battery's state of charge (SOC)** or the **battery voltage** to decide whether the generator needs to start or stop.

Generator start conditions

The generator starts in these cases:

- **Power failure:** the grid or other power sources are lost.
- **Battery discharge cutoff:** the battery discharges to the cutoff voltage or SOC setting.
- **Forced charging:** the battery needs a forced charge.
- **Battery voltage or SOC below the generator start threshold:** the battery voltage or SOC falls below the set generator charging start voltage/SOC.

Generator stop conditions

The generator stops when the **battery voltage** or **SOC** is higher than the **charging endpoint voltage/SOC** setting. This means the battery is charged enough and the generator is no longer needed.

With these settings, the generator runs only when it is needed. This makes the best use of the battery and cuts down on generator run time.

Make these settings on the inverter screen. See section 9.9 Generator Port Settings Menu for how to use the screen. Example settings:

Setting (section 9.9)	Example value	Range shown in the example
Gen Warm Time	10 s	0–1000 s
Start SOC (start generator)	25%	10–100%
Stop SOC (stop generator)	95%	10–100%
Gen Rated Power (generator maximum power used)	8 kW	0.0–800.0 kW
Max Run Time (generator maximum running time)	600 min	0–1440 min

6.8.3 AC Coupling Installation and Connection

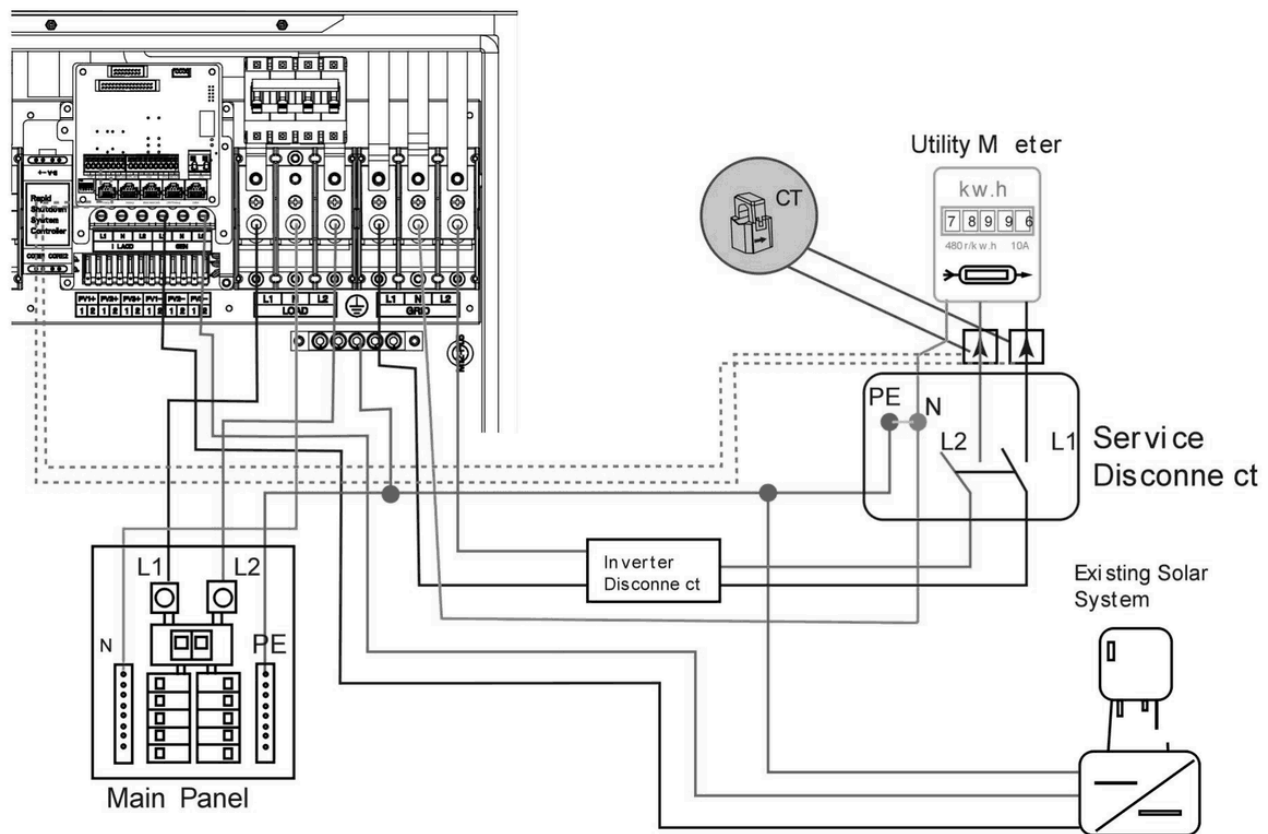
The inverter supports adding AC-coupled solar. You can raise the maximum solar input power by coupling microinverters or string inverters into the "GEN" or "LOAD" terminals. A fully AC-coupled solar system is not recommended, because power control and monitoring are limited. Using DC-coupled modules, or a mix of DC-coupled and AC-coupled solar panels, is always preferred.

Inverters used for AC coupling should be certified to UL 1741 SA/SB. This certification confirms that the inverter can disconnect from the grid based on frequency. It also makes sure the KOOR inverter can safely shift the frequency to control the AC-coupled production.

AC coupling to "GEN" or "LOAD"

- Can produce solar power during grid outages.
- Can produce solar power for off-grid systems.
- Can monitor solar production.
- The "GEN" input cannot be used when AC coupling is connected to "LOAD". Also, the switchover time to backup power is longer.

Connection for an AC-coupled solar system



AC-coupled solar system connection. Labels in the drawing read: Utility Meter, CT, Service Disconnect, Inverter Disconnect, Main Panel and Existing Solar System. Wire colors: black = L1, red = L2, grey = neutral (white wire), green = ground, blue dotted = communication and CT cables.

When the "Grid" is ON, the GEN terminal is connected to the inverter's internal "Grid" terminal. In this case, the hybrid inverter passes the power of the grid-interactive (AC-coupled) inverter through (bypass) to the grid and the EPS

(Emergency Power Supply) system.

When the grid is disconnected, the **GEN** terminal is connected to the inverter's internal **EPS** terminal. The loads are then powered by solar energy first. If the solar power is more than the loads use, the extra energy is stored in the battery.

When the solar power is more than the load power plus the battery's maximum charging power (for example, when the battery is almost full), the inverter signals the grid-interactive inverter to lower its output. It does this with a **frequency-shifting power reduction** method. This keeps power production and use in balance within the microgrid, so the system runs efficiently and does not overproduce.

6.9 System Parallel Operation

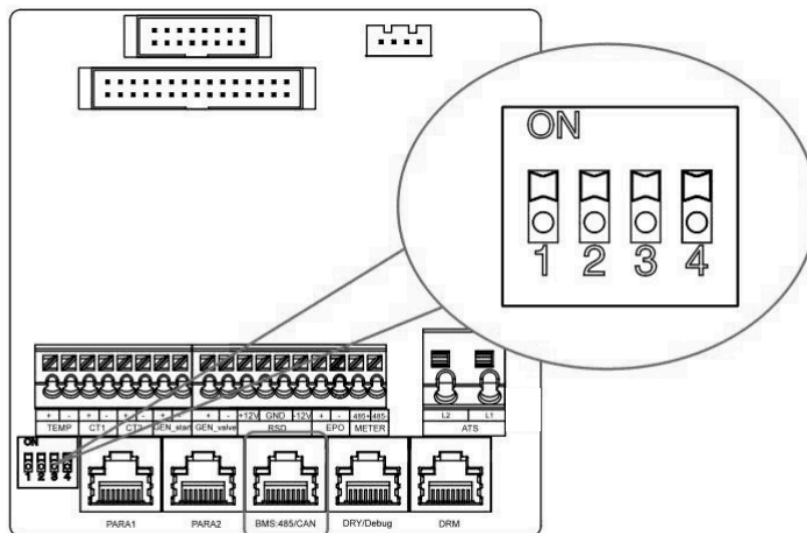
6.9.1 Parallel System Connection

NOTICE

- The inverter can run in parallel with other units. This lets you add power and energy capacity to suit the job. Up to 6 units can be connected in parallel, for a total of up to 90 kW (six KR-L15K-SPUS units).
- All units in parallel must have the same software version. Compare the "MCU" version numbers on every inverter before you start. The software version (ARM, INV, DCDC) is shown in the Device Info menu (see section 9.12).
- A parallel system **MUST** use one shared (joint) battery bank.
- All inputs and outputs must be shared by **ALL** the parallel inverters. The only exception is the PV (DC solar) inputs.

DIP switch settings for parallel systems

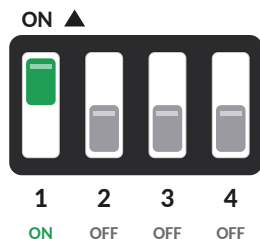
The DIP switch is on the communication board, next to the PARA1 port.



Communication board with the DIP switch shown enlarged

This switch tells each inverter whether it sits at an **end** of the parallel cable chain. **Switch 1 always stays up (ON) on every inverter.** Switches 2, 3 and 4 do the job: they are ON on the two inverters at the ends of the chain and OFF on every inverter in between. A single inverter on its own has switches 2, 3 and 4 OFF.

How to read the switch



Slider pushed UP, toward ON
= that switch is ON

Slider pushed DOWN
= that switch is OFF

Switches are numbered 1, 2, 3, 4 from the left.
Use a small screwdriver or a pen tip.
This one reads: 1 ON, 2 OFF, 3 OFF, 4 OFF.

Green slider pushed up toward ON = ON. Grey slider pushed down = OFF.

Set your inverters like this

Find the row for the number of inverters in your system. Set each inverter's switch like its picture. Switch 1 is always up. 2-3-4 ON = push switches 2, 3 and 4 up toward ON. 2-3-4 OFF = push switches 2, 3 and 4 down. Inverter 1 is the master.

1 inverter in the system	Inverter 1 (Master) 1 2 3 4 2-3-4 OFF					
2 inverters in the system	Inverter 1 (Master) 1 2 3 4 2-3-4 ON		Inverter 2 1 2 3 4 2-3-4 ON			
3 inverters in the system	Inverter 1 (Master) 1 2 3 4 2-3-4 ON		Inverter 2 1 2 3 4 2-3-4 OFF		Inverter 3 1 2 3 4 2-3-4 ON	
4 inverters in the system	Inverter 1 (Master) 1 2 3 4 2-3-4 ON		Inverter 2 1 2 3 4 2-3-4 OFF		Inverter 3 1 2 3 4 2-3-4 OFF	
5 inverters in the system	Inverter 1 (Master) 1 2 3 4 2-3-4 ON		Inverter 2 1 2 3 4 2-3-4 OFF		Inverter 3 1 2 3 4 2-3-4 OFF	
	Inverter 4 1 2 3 4 2-3-4 OFF		Inverter 5 1 2 3 4 2-3-4 ON			
6 inverters in the system	Inverter 1 (Master) 1 2 3 4 2-3-4 ON		Inverter 2 1 2 3 4 2-3-4 OFF		Inverter 3 1 2 3 4 2-3-4 OFF	
	Inverter 4 1 2 3 4 2-3-4 OFF		Inverter 5 1 2 3 4 2-3-4 OFF		Inverter 6 1 2 3 4 2-3-4 ON	

Parallel DIP switch settings for 1 to 6 inverters. Switch 1 is always ON. Switches 2, 3 and 4 are ON on the inverters at both ends of the chain and OFF on the ones in between.

The same settings as a table (switches 2, 3 and 4 — switch 1 is always ON):

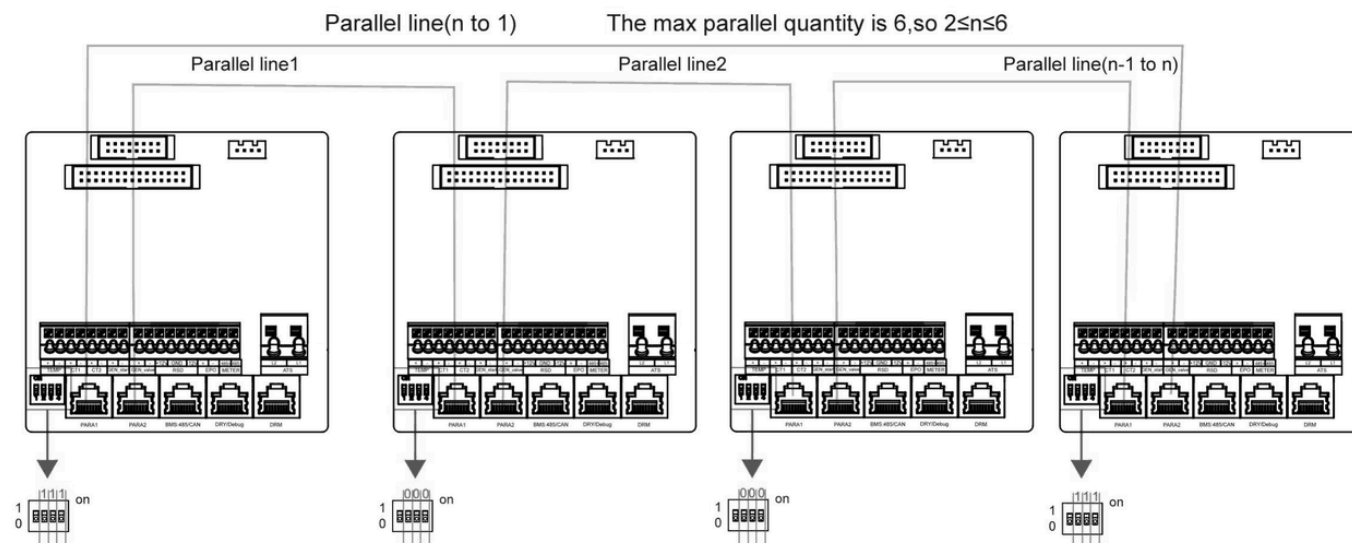
Units in system	Inverter 1 (Master)	Inverter 2	Inverter 3	Inverter 4	Inverter 5	Inverter 6
1	OFF	—	—	—	—	—
2	ON	ON	—	—	—	—
3	ON	OFF	ON	—	—	—
4	ON	OFF	OFF	ON	—	—
5	ON	OFF	OFF	OFF	ON	—
6	ON	OFF	OFF	OFF	OFF	ON

CAN termination for the daisy chain

The parallel cables link the inverters in a daisy chain. Set the CAN termination switches (DIP switches 2, 3 and 4 above) to ON on the first and last inverters in the chain. Switch 1 stays ON on every inverter.

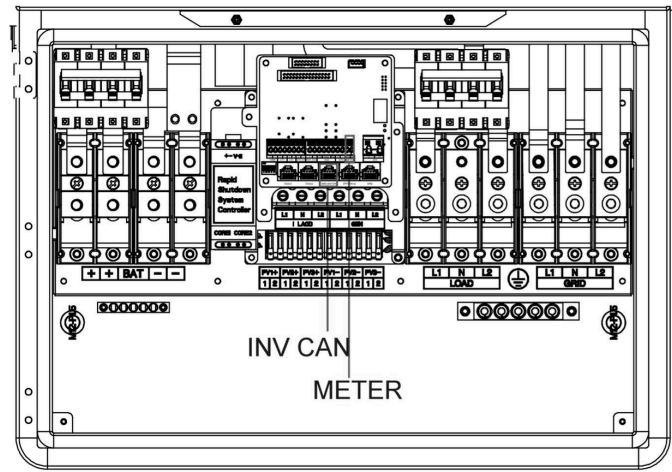
Steps:

1. **First inverter:** Set the CAN termination resistor switch to **ON**. This enables communication and sets the starting point of the CAN bus.
2. **Last inverter:** Set the CAN termination resistor switch to **ON** as well. This terminates the communication line properly at the end of the bus.
3. **Intermediate inverters:** Leave the termination resistor switch **OFF** on every inverter between the first and last units in the chain. These units act as repeaters and do not need termination.



Parallel cables between the PARA1 and PARA2 ports ($2 \leq n \leq 6$ units). DIP switches 2, 3 and 4: ON (1) on the first and last units, OFF (0) on the units in between. Switch 1 stays ON.

If the **parallel cables** are too short or not available, you can make a **direct pin-to-pin cable** to extend the connections between the inverters.



Wiring area with the INV CAN and METER connection points marked

Parallel settings on the inverter screen

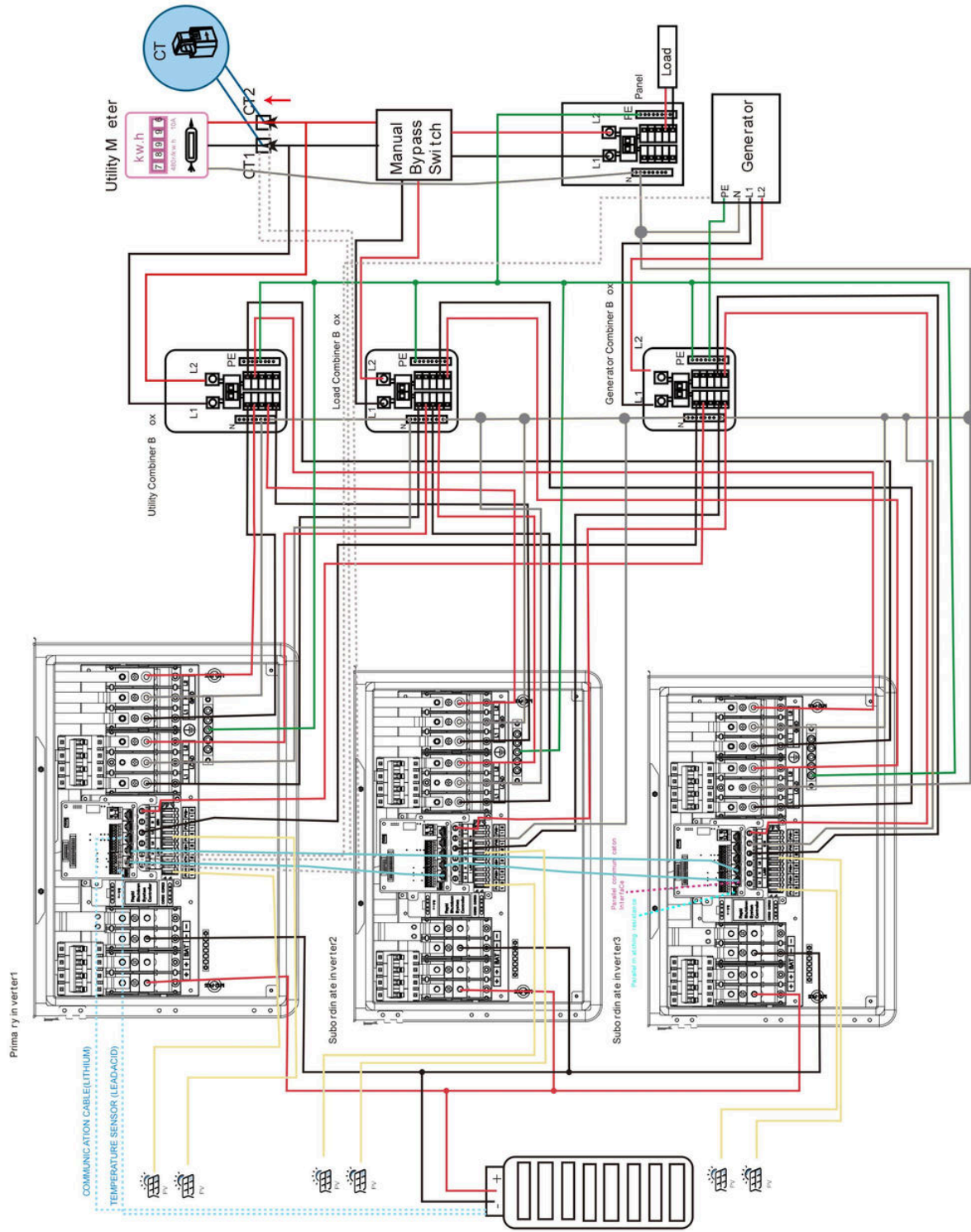
Make the parallel settings on each inverter's screen. See section 9.10 (Advanced Settings Menu) for how to use the screen. Example for a three-inverter system:

Setting	Master	Slave 1	Slave 2
Parallel Type	Master	Slave	Slave
Parallel Num (total number of inverters)	3	3	3
Parallel Addr	1	2	3

Parallel wiring diagrams

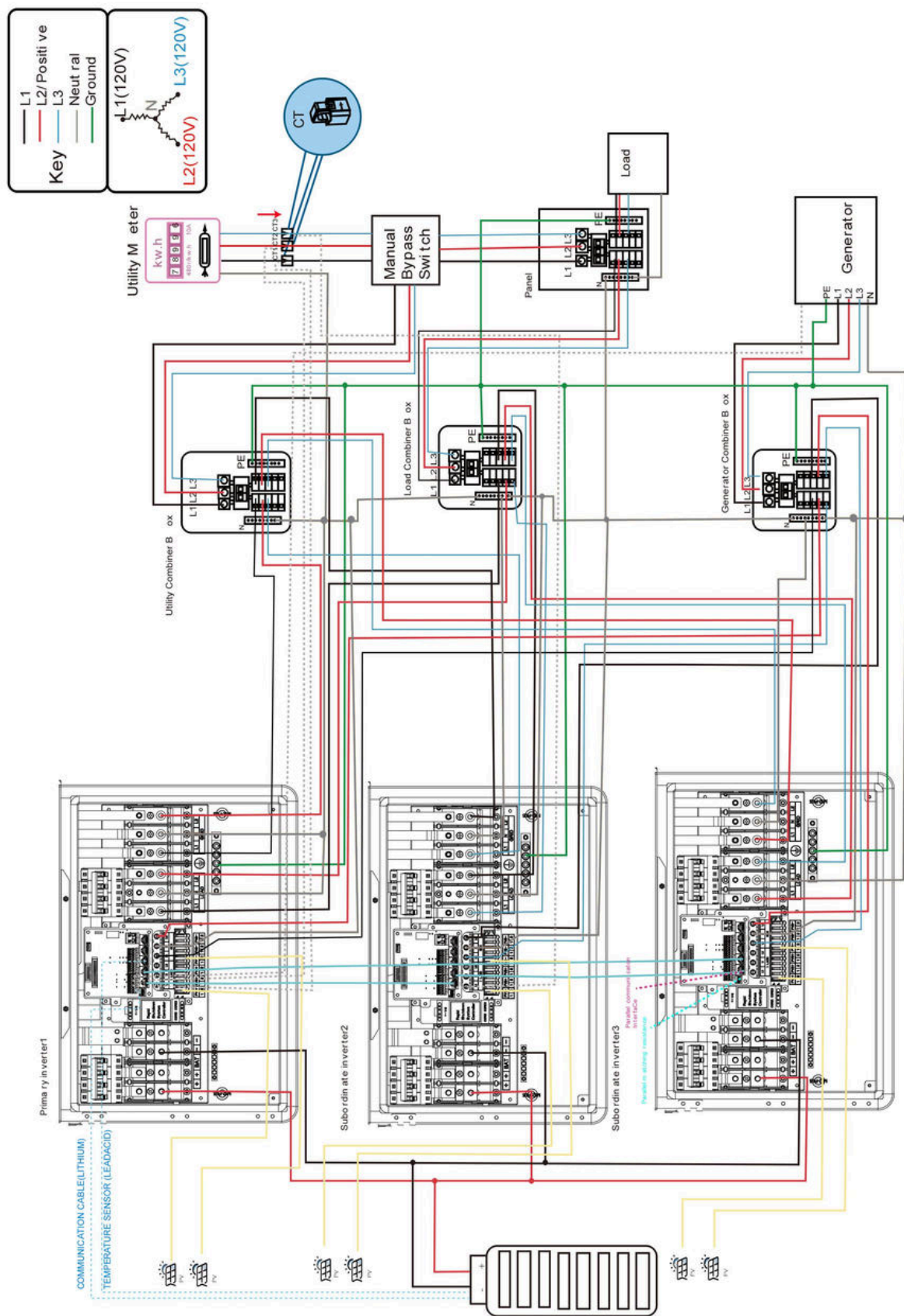
The wiring diagrams for parallel connection are shown below. In each diagram, "Parallel matching resistance" points to the CAN termination DIP switch, and "Parallel communication interface" points to the parallel cable ports. The diagrams are printed sideways so they can be as large as possible. Turn the manual a quarter turn to the right to read them.

A. Three 15 kW units in parallel, 120/240 V



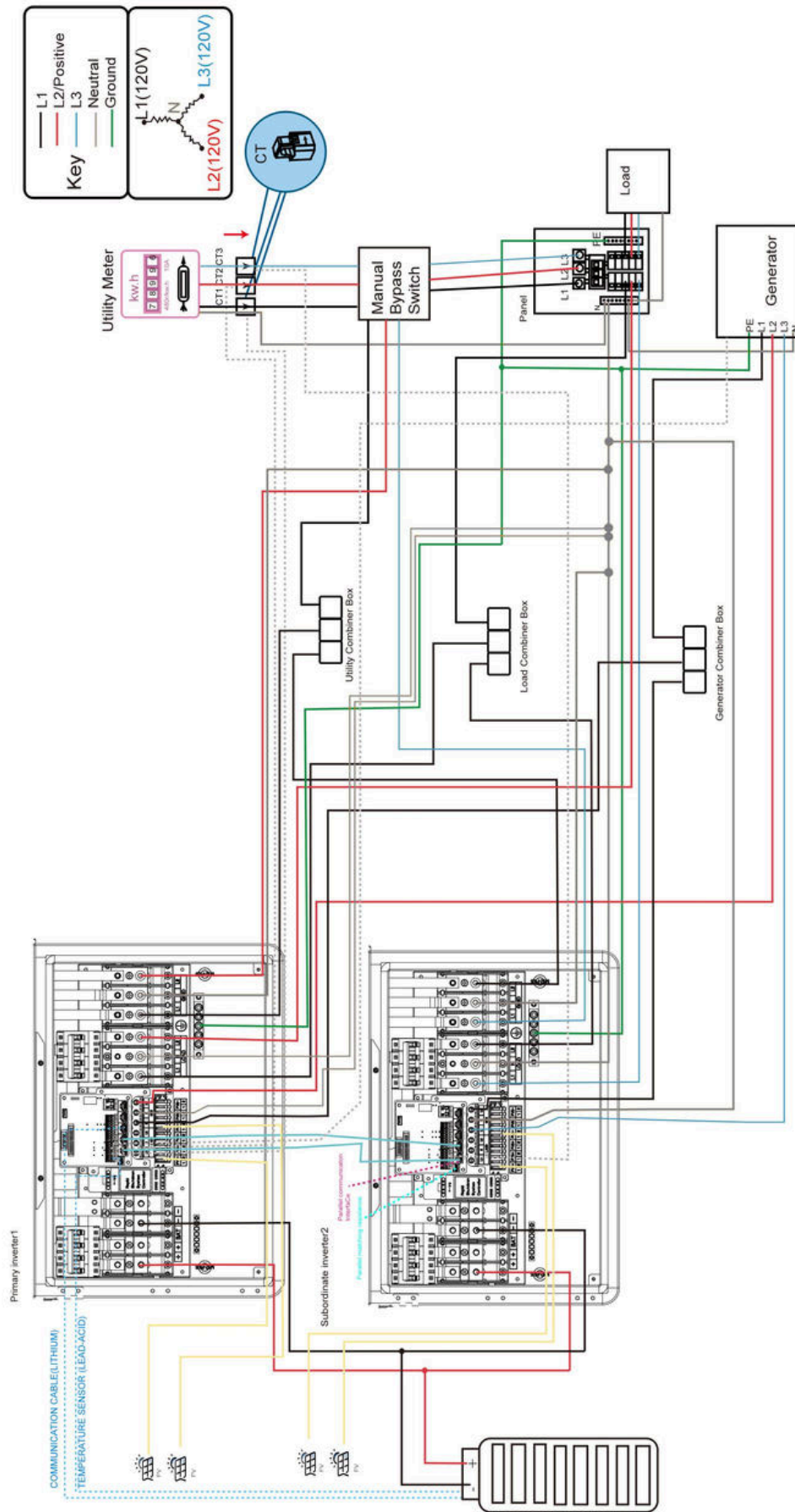
Primary inverter 1 and subordinate inverters 2 and 3 on one battery bank, with utility, load and generator combiner boxes, manual bypass switch, utility meter with CT1 and CT2, panel, load and generator. Wire colors: black = L1 and battery -, red = L2 and battery +, grey = neutral (white wire), green = ground, yellow = PV, dotted = communication.

B. Three 15 kW units in parallel, 120/208 V



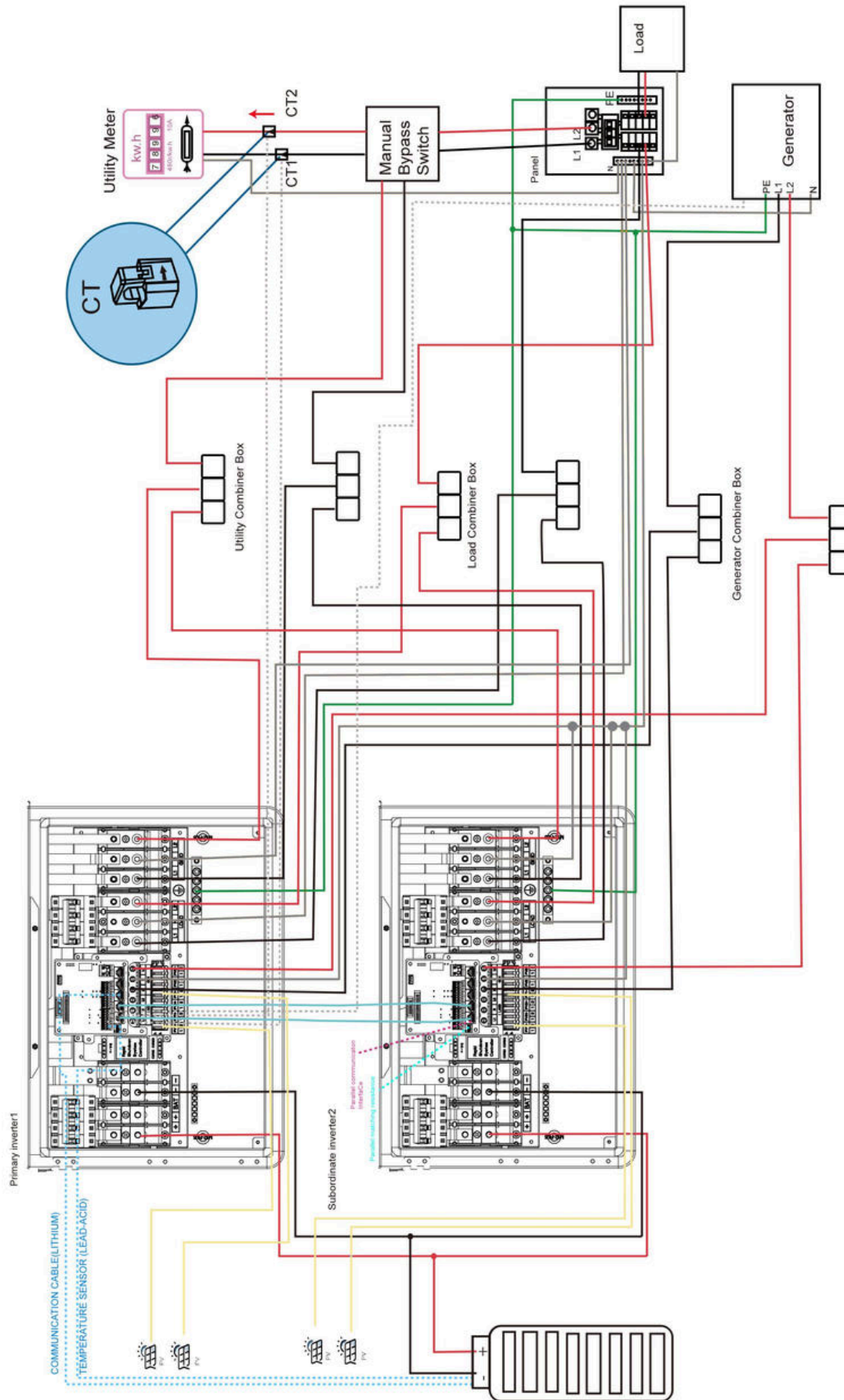
Primary inverter 1 and subordinate inverters 2 and 3, with CT1, CT2 and CT3. Key: black = L1 and battery +; red = L2 and battery -; blue = L3; grey = neutral (white wire); green = ground; yellow = PV. L1, L2 and L3 are each 120 V to N.

c. Two 15 kW units in parallel, 120/208 V



Primary inverter 1 and subordinate inverter 2, with CT1, CT2 and CT3. Key: black = L1 and battery +; red = L2 and battery -; blue = L3; grey = neutral (white wire); green = ground; yellow = PV. L1, L2 and L3 are each 120 V to N.

D. Two 15 kW units in parallel, 120/240 V



Primary inverter 1 and subordinate inverter 2 on one battery bank, with utility, load and generator combiner boxes, manual bypass switch, utility meter with CT1 and CT2, panel, load and generator. Wire colors: black = L1 and battery -, red = L2 and battery +, grey = neutral (white wire), green = ground, yellow = PV, dotted = communication.

7. Operating Modes and Functions

7.1 Operate the Inverter and Run a Test

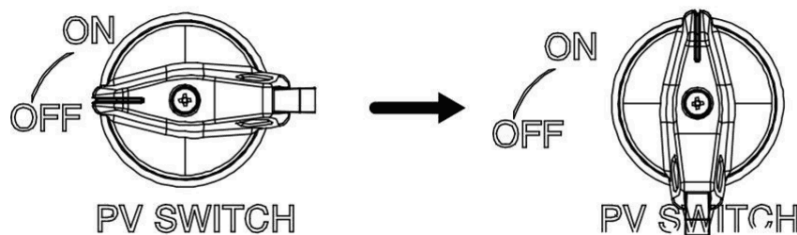
The inverter needs at least one energy source to run: battery, PV or grid.

7.1.1 Check the Voltage of the Battery Bank

- The battery voltage must be 40–60 Vdc.
- If the batteries have their own internal switches, turn them ON. Measure the voltage of each battery.
- Check that the battery bank voltage at the inverter's battery terminals is correct.
- DO NOT reverse the polarity. DO NOT turn OFF the battery disconnect while any current is flowing into or out of the battery.

7.1.2 Check the Voltage of Each PV Input Circuit

- The PV input voltage must never go above 550 Vdc. Size every string so its cold-corrected open-circuit voltage (Voc) stays at or below 525 Vdc.
- The input voltage must be above the start-up voltage of 120 Vdc.
- Do not ground PV+ or PV-.
- Check the polarity of each PV string. If a string is connected backward, the inverter reads 0 Vdc on that input, and the reversed polarity will cause long-term damage.
- PV power alone only turns on the LCD screen. The inverter needs the grid, the batteries or both to operate.
- The PV DC disconnect switch on the side of the inverter turns the PV ON or OFF.



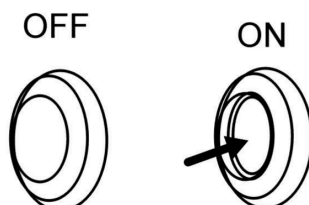
PV switch: turn it from OFF (left) to ON (right)

7.1.3 Check the Grid Input Voltage

- Use a multimeter to measure the AC voltage at the "GRID" terminals.
- Measure line (L) to neutral (N) on the "GRID" terminals. Make sure it reads 120 Vac on both L1 and L2.
- Measure line (L) to line (L) on the "GRID" terminals. Make sure it reads 240 Vac. If the reading is close to 220 Vac or 210 Vac, check whether the grid is single-phase or three-phase.
- Check that the voltage between neutral and ground is 0 Vac.
- Check that the voltage between "GRID" L1 and "LOAD" L1 is 0 Vac. Do the same for L2.

7.1.4 Power ON the Inverter

1. Turn ON the battery breaker(s).
2. Press the power button down to the ON position. Wait for the LED indicator to turn on. This may take a few minutes.
3. Turn ON the PV DC disconnect switch.
4. Turn ON the external "GRID" disconnect.
5. Turn ON the internal "LOAD" breaker and the external "GEN" breaker.



Power button: OFF (left) and pressed in to ON (right)

7.1.5 Power Cycle Sequence

1. Turn OFF all AC breakers and disconnects ("GRID", "GEN" and "LOAD").
2. Turn OFF the built-in PV DC disconnect switch on the side of the inverter.
3. Press the power button and make sure it is in the OFF position. An "OFF" message appears after the LED turns off.
4. Turn OFF the battery breakers.
5. Wait about 1 minute so the inverter is completely de-energized.
6. Make sure the inverter is properly connected to the batteries, solar panels, "GRID", "GEN" and "LOAD".
7. To turn the inverter back ON, do these steps in reverse order.

7.2 Operating Modes and Functions

The inverter has several operating modes and functions to meet different customer needs. They are described below.

You choose the work mode on the inverter screen with the **Work Mode** setting (section 9.6 Work Mode Settings Menu, Page 2). The screen lists the modes as Self Use, TOU ECO, Backup Power and Grid Priority. In this manual they are called Self-Use, TOU ECO, Backup Only and Grid Priority.

7.2.1 Self-Use Mode (Default)

In **Self-Use** mode, the system uses this order of priority:

- **Power for the loads comes from:** Solar → Battery → Grid
- **Solar energy goes to:** Load → Battery → Grid

When solar power is available, it powers the local loads first. Extra solar energy is stored in the battery. Anything left over is exported to the grid. When solar power is not enough, the system uses battery energy to help power the loads. The system draws power from the grid only when solar and battery together are not enough.

Self-Use is the default operating mode. It is designed to **use as much of your own solar energy as possible**. This lowers your need for grid power and cuts your electricity costs.

When to use it

Self-Use mode is a good fit for homes and businesses that want lower energy bills and more energy independence by making full use of their own solar power.

Battery reserve settings

- **On-grid Battery Reserve SOC (10–100%):** While the inverter is connected to the grid, the battery holds this charge. When the battery SOC is low, the battery is charged and discharging is not allowed.
- **Off-grid Battery Reserve SOC (10–100%):** While the inverter is off-grid, the battery holds this charge. When the SOC is low, the battery charges and discharging is not allowed.

Make these settings on the inverter screen. See section 9.6 Work Mode Settings Menu (Page 2), where they are named **On-Grid Bat Restart SOC** and **Off-Grid Bat Restart SOC**.

7.2.2 TOU ECO Mode

TOU ECO (time-of-use economy) mode is designed to save the most money. It changes how the system uses and stores energy to follow time-of-use (TOU) electricity prices.

- **Peak price periods — priority: Load → Grid → Battery.** Earn the most by selling solar energy to the grid while the price is high.
- **Flat price periods — priority: Load → Battery → Grid.** Use solar power mainly for your own loads and store the extra in the battery.
- **Valley price periods — priority: Battery → Load → Grid.** Charge the battery from the grid while electricity is cheap, and use the stored energy during expensive periods.

You can set the peak, flat and valley time periods to match your local electricity rates and your own usage. Set them on the inverter screen or through the monitoring app.

Time setting

Set the time periods for peak and valley electricity prices. Tap "+" to add a time period. Tap "-" to delete a time period. On the inverter screen, the time periods are set in section 9.6 Work Mode Settings Menu (Page 3, TOU Mode Settings).

When to use it

TOU ECO mode is a good fit where electricity prices change a lot from one time of day to another. It lowers electricity costs and earns the most by charging when electricity is cheap and discharging or selling when it is expensive.

Make this setting on the inverter screen. See section 9.6 Work Mode Settings Menu.

7.2.3 Backup Only Mode

Backup Only mode is designed to charge the battery as fully as possible and keep that energy in reserve for backup during grid outages or an unstable grid.

In this mode, during normal operation the system stores solar energy in the battery first, instead of sending it to the loads or exporting it to the grid. The battery **discharges only when the grid fails or is not available**.

PV power priority: Battery → Load → Grid

When to use it

Backup Only mode is a good fit for areas with frequent power outages or an unstable grid, or where critical loads (such as medical equipment, servers or refrigeration) must keep running at all times. It puts available energy and system

reliability ahead of cost savings or feed-in income.

Make this setting on the inverter screen, where this mode is listed as **Backup Power**. See section 9.6 Work Mode Settings Menu.

7.2.4 Grid Priority Mode

Grid Priority mode is designed to export power to the grid whenever there is enough, to earn the most feed-in income.

In this mode, the system supplies power in this order:

Power supply priority: Load → Grid → Battery

Solar energy first powers the local loads. Any extra energy is then exported to the grid for income. The battery is charged only if there is still surplus after the loads and the grid export are met.

When to use it

Grid Priority mode is a good fit where there are **good feed-in tariffs (FiTs)** or net metering rules. It suits users who want to **earn the most from their solar power**, more than they want to use their own energy or keep backup power.

Make this setting on the inverter screen. See section 9.6 Work Mode Settings Menu.

7.3 Generator Function

The generator function lets the inverter run a generator connected to the GEN port. To use it, set **Gen Port Function** to **Generator** on the inverter screen (section 9.9 Generator Port Settings Menu).

The inverter starts the generator automatically through the GEN_start dry contact (wiring in section 6.8.1). The generator starts when the battery SOC (or battery voltage) falls to the **Start** setting. It stops when the battery reaches the **Stop** setting. While the generator runs, its power is used to charge the battery.

Settings

- **Gen Warm Time:** Generator warm-up time. After the inverter sends the start signal, it waits this long before it accepts generator power.
- **Start SOC / Stop SOC:** The battery SOC levels at which the generator starts and stops automatically.
- **Gen Rated Power:** The maximum power output of the generator.
- **Max Run Time:** The longest time the generator may run without stopping. This applies when the inverter controls the generator automatically.
- **Cooling Time:** The generator cool-down period after it stops. This applies when the inverter controls the generator.
- **Gen Force:** Force-starts the generator. Turn it on the first time you connect a generator, so the inverter recognizes and starts it.

Example

- Generator Start SOC = 50%
- Generator Stop SOC = 90%

How it works

- When the battery SOC falls to 50%, the inverter starts the generator. The generator's power charges the battery.
- When the battery SOC reaches 90%, the inverter stops the generator.

When to use it

Use this function when a generator backs up the battery, for example in an off-grid system or during a long grid outage. The battery is recharged without anyone having to start the generator by hand.

7.4 Smart Load Function

The **Smart Load** function lets the GEN port, which is normally a power input, work as a load output. When Smart Load is on, the inverter powers the load on that port when the **battery state of charge (SOC)** is above the levels you set. To use it, set **Gen Port Function** to **Smart Load** on the inverter screen (section 9.9 Generator Port Settings Menu).

IMPORTANT Do not connect a generator when the Smart Load function is on. This can **damage the equipment**.

Settings

- **Stop Output SOC:** When the battery SOC drops to this level, the smart load output turns off automatically.
- **Stop Output Volt:** If voltage-based control is selected, the smart load output turns off when the battery voltage reaches this value.
- **Control Start Time:** The start of the time window in which the SOC or voltage conditions apply.
- **Control End Time:** The end of the time window in which the SOC or voltage conditions apply.

NOTE Outside the time window you set, the SOC and voltage limits do not apply to the smart load output. It then follows the same discharge behavior as the EPS output.

Example

- Smart Load Start SOC = 90%
- Smart Load Stop SOC = 50%

How it works

- When the battery SOC reaches 90%, the Smart Load port turns on automatically and powers the connected load.
- When the battery SOC falls below 50%, the Smart Load port turns off automatically.

When to use it

Use this function when you want solar energy to power non-critical loads only when the battery is well charged and solar production is above a certain level. This way, only extra power goes to those loads.

7.5 Off-Grid Installation Tips

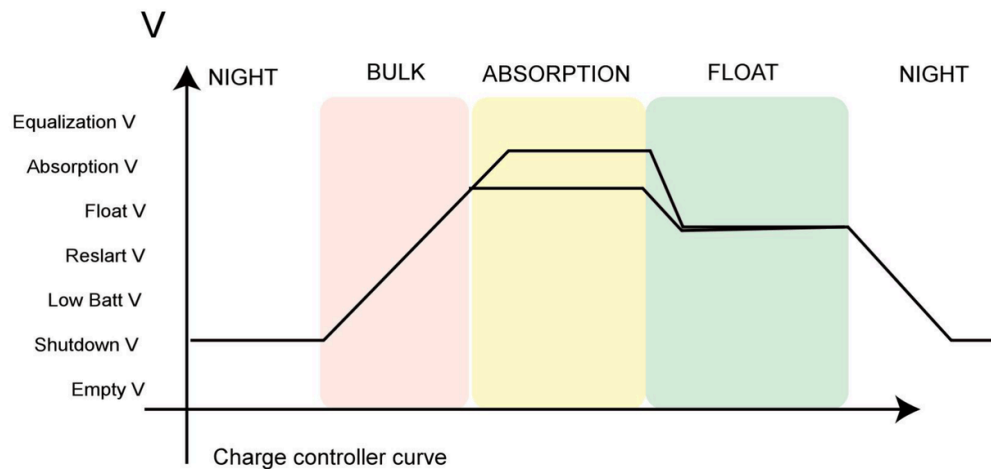
- **Limit sensors (CTs)** are **not needed** in a fully off-grid system, **unless** "Grid Priority" is turned on with a generator connected to the **GRID** terminal.
- The **recommended** way is to connect generators to the **GRID** terminal. This makes it easier to work with a service panel that is set up as a "GEN" input.
- A **transfer switch is not needed** in an off-grid system. The **LOAD** output can be connected directly to the main panel.
- **Do not use "Grid Sell" mode** in an off-grid system.

- When you use a **generator in an off-grid system**, the recommended **Grid Mode** setting is "**General Standard**" (section 9.8 Grid Settings Menu).
- The **Auto Generator Start (AGS)** function turns on when the battery voltage or SOC drops below the "**Start Voltage / SOC**" level you set (section 7.3).
- If you add a **wind turbine**, you must install a **48 V wind charge controller with a dump load** to keep the battery from overcharging. The wind charge controller must be **connected directly to the battery bank**.
- Make sure the **battery capacity** is set correctly and the charge and discharge current limits are set within safe ranges (section 9.7 Battery Settings Menu).

7.6 Battery Charge Controller

Three-stage charging: Bulk, Absorption and Float

The MPPT charges the battery in stages so charging is fast, efficient and safe. The figure below shows the order of the stages.



Charge controller curve: battery voltage through the Night, Bulk, Absorption, Float and Night periods (the label "Restart V" means Restart V)

Bulk stage

In the Bulk stage, the battery is below 100% state of charge and has not yet reached the Absorption voltage setpoint. The controller sends 100% of the available solar power to recharge the battery.

Absorption stage

When the battery reaches the Absorption voltage setpoint, the inverter holds the battery voltage at that setpoint (constant-voltage regulation). This prevents overheating and too much battery gassing. The battery is allowed to reach full charge at the Absorption voltage setpoint. Absorption lasts until the battery charge current (A) drops to 2% of the programmed battery capacity (Ah).

Float stage

After the Absorption stage has fully charged the battery, the MPPT lowers the battery voltage to the Float voltage setpoint. When a battery is 100% charged, no more chemical reactions can take place, and all charging current turns into heat and gassing. The Float stage gives a small maintenance charge while it reduces the heating and gassing of the fully charged battery. The purpose of the Float stage is to protect the battery from long-term overcharge.

8. Monitoring (SOLARMAN Smart)

Your KOOR inverter can send its data to your phone over the internet. It uses the free SOLARMAN Smart app and the Wi-Fi logger stick that comes in the box with the inverter.

8.1 What You Need

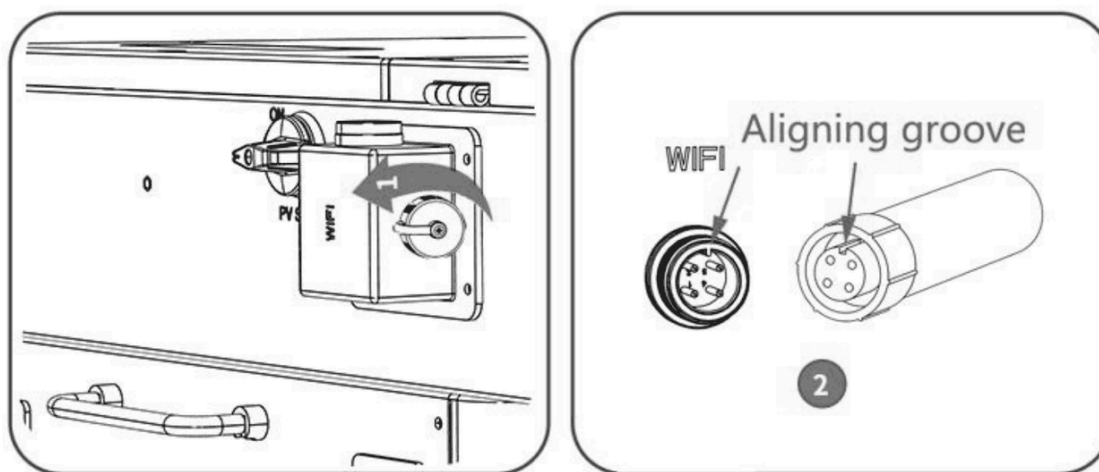
- The Wi-Fi logger stick from the inverter box.
- A smartphone (iPhone or Android).
- The name and password of the Wi-Fi network at the site. The Wi-Fi signal must reach the inverter.

NOTE No Wi-Fi at the site? A 4G LTE hotspot can be used instead. Call Fantastech at 574-218-1973.

8.2 Install the Logger Stick

The stick plugs into the Wi-Fi port on the inverter (item H in section 3.3.2). Follow these steps:

1. Remove the waterproof cover from the Wi-Fi port.
2. Line up the groove on the stick's connector with the key in the Wi-Fi port.
3. Push the stick straight into the port.
4. Turn the stick's locking ring to lock the stick in place.



Step 1: remove the waterproof cover. Step 2: line up the aligning groove with the Wi-Fi port.

8.3 Get the App

1. On an iPhone, open the App Store. On an Android phone, open Google Play.
2. Search for **SOLARMAN Smart** and install it.
3. Open the app and create an account with your e-mail address.

8.4 Add Your System

1. In the app, create a new plant. Enter a name, the site address and the size of the solar array.

2. Add the logger to the plant. Scan the barcode on the logger stick label, or type the logger serial number (SN) printed on the label.
3. When the app asks for the PWD, type the PWD from the stick label in **lowercase letters**.

IMPORTANT The PWD is printed on the label in CAPITAL letters, but the app rejects it in capitals. Type the same letters and numbers in lowercase. Example: a label that reads FEE32734 is entered as fee32734.

8.5 Connect the Stick to the Site Wi-Fi

1. With the inverter on, the logger stick sends out its own Wi-Fi network. On your phone, open the Wi-Fi settings and join the stick's network.
2. Open the phone's web browser and go to **10.10.100.254**.
3. Pick the site's Wi-Fi network from the list, type its password, and save. The stick restarts and joins the site Wi-Fi.

8.6 After It Connects

- The stick uploads new data every 5 minutes.
- A newly added logger shows **Offline** until its first upload. Wait at least 10 minutes before you check again.
- If it stays Offline, make sure the site Wi-Fi reaches the inverter and join the stick to the Wi-Fi again (section 8.5). If it still will not connect, call Fantastech at 574-218-1973.

9. Operation

9.1 Indicator Panel

The operation panel is on the front of the inverter. It has four indicator LEDs (A to D), an LCD touchscreen and four buttons (E to H).



Operation panel: indicator LEDs A-D and buttons E-H



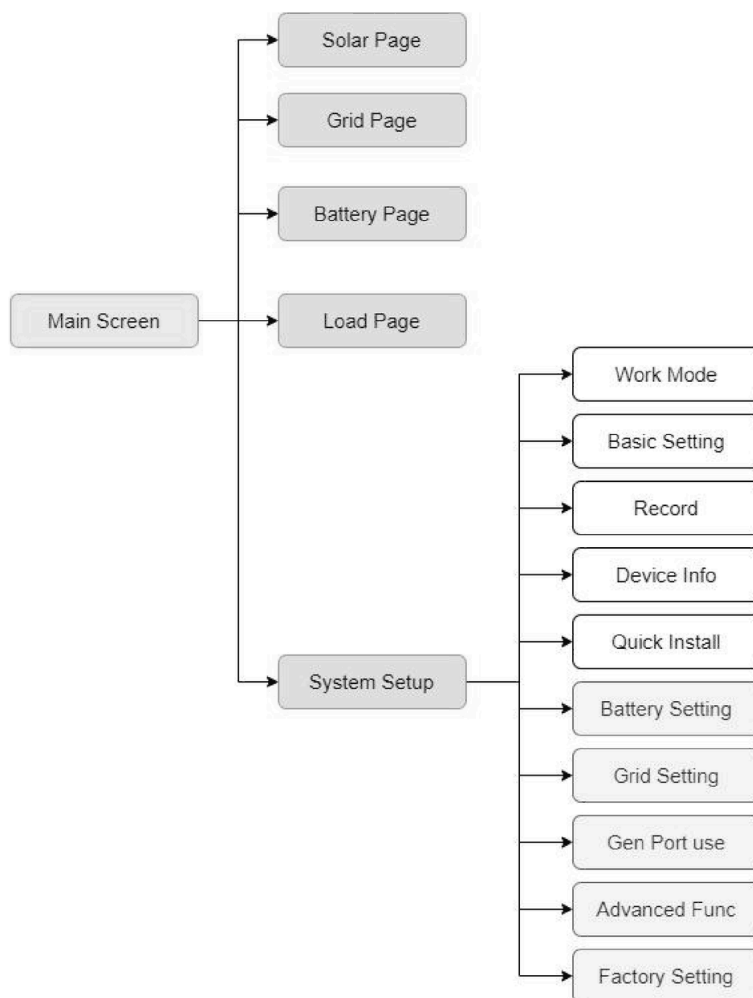
Location of the operation panel on the inverter

The panel prints the labels DC, AC, Normal and Alarm above the four LEDs. The table below gives the label, the color and the meaning of each LED. The button printed "ESE" on the panel is the ESC button.

Name	Item	Label on panel	Function
Indicator LED	A	DC	Green. On: the inverter is running. Flashing: the inverter is in standby.
	B	AC	Blue. On: communication with the BMS is normal.
	C	Normal	Yellow. On: the inverter is in EPS mode.
	D	Alarm	Red. The inverter is in fault mode.
Button	E	UP	Go to the previous selection.
	F	DOWN	Go to the next selection.
	G	ENTER	Confirm the selection.
	H	ESC (printed "ESE")	Exit setting mode.

9.2 LCD Operation Flow Chart

From the main screen you can open the Solar, Grid, Battery and Load pages and the System Setup menu. The chart below shows the menus under System Setup.



LCD menu structure

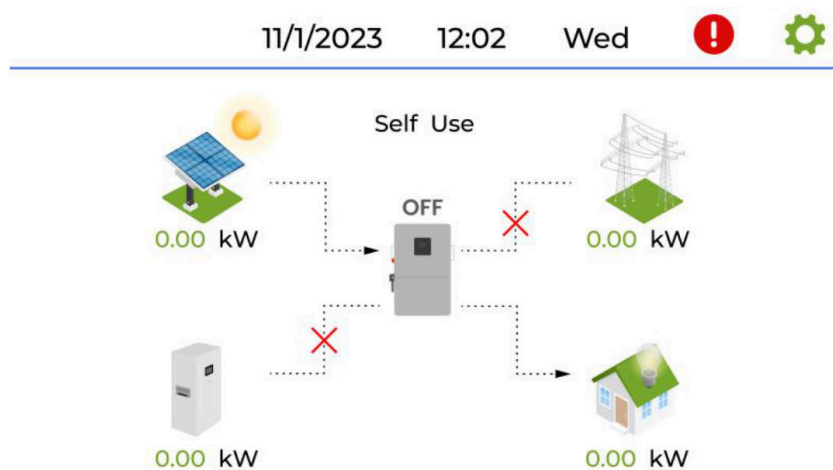
Where each menu is described in this manual:

- Solar, Grid, Battery and Load pages: sections 9.3.2 to 9.3.5.
- Work Mode: section 9.6.
- Basic Setting: section 9.5.
- Record: section 9.11.
- Device Info: section 9.12.
- Battery Setting: section 9.7.
- Grid Setting: section 9.8.
- Gen Port use: section 9.9.
- Advanced Func: section 9.10.
- Factory Setting: section 9.13.
- Quick Install: this menu item is not covered in this manual.

9.3 LCD Display Icons

9.3.1 Main Screen

The LCD is a touchscreen. The main screen shows the overall information of the inverter.



LCD main screen

1. System information display

- **1.1 Date and time.** The current system date and time are shown at the top of the screen.
- **1.2 Warning icon (red "!").** A red "!" means there is a system fault or an abnormal condition. Tap the icon to open the fault detail page. There you can check the alarm messages and fault codes. Follow the on-screen guidance or chapter 10 (Troubleshooting) to fix the problem.
- **1.3 Settings icon (gear).** Tap it to open the system settings menu. It includes settings such as operating mode, battery parameters and grid settings.

2. Inverter status and operating mode

- **2.1 Inverter power status.** The icon in the center is the inverter. It shows whether the inverter is ON or OFF.
- **2.2 Current operating mode.** The active system mode is shown above the inverter icon. Possible modes include TOU ECO, Self-Use, Backup Only and others (see section 7.2). This helps you see how the system is working right now.

3. Real-time energy device overview

The four device icons show the status and power of the main energy parts. You can tap each icon:

- **3.1 Top left: PV.** Shows the real-time solar power. Tap it to see the detailed PV status (section 9.3.2).
- **3.2 Top right: Grid.** Shows the grid import power. Tap it to see the grid connection information (section 9.3.3).
- **3.3 Bottom left: Battery.** Shows the battery state of charge (SOC) and the charge or discharge power. Tap it to see the battery details (section 9.3.4).
- **3.4 Bottom right: Load.** Shows the real-time load use. Tap it to see the detailed load information (section 9.3.5).

4. Energy flow and connection indicators

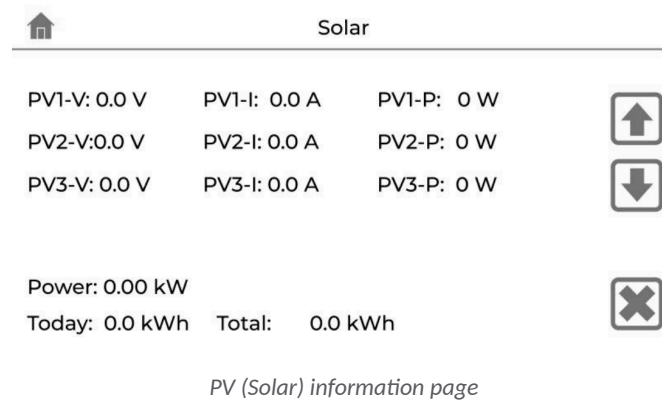
- **4.1 Arrows.** The arrows show the real-time power flow paths. The arrow direction is the direction of power flow (for example, from PV to the load).

- **4.2 Red "X" icons.** A red "X" means a path or device is not connected or not active. Examples: the battery is not installed, or the grid is offline.

How to read the power values (plus and minus signs):

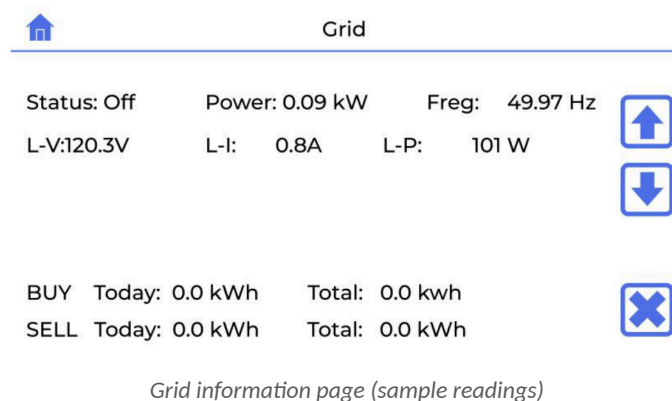
- PV power and load power are always positive.
- Grid power: negative means power is taken from the grid. Positive means power is sold to the grid.
- Battery power: negative means the battery is charging. Positive means the battery is discharging.

9.3.2 PV Information Page Overview



This page may vary depending on the system configuration. Tap the PV icon on the main screen to open the PV information page. PV1 to PV3 show the voltage (V), current (I) and power (P) of each of the three PV input channels. Below these readings you can see the total PV power right now (Power), the energy generated today (Today) and the total energy generated to date (Total). Use the arrow buttons on the side of the screen to scroll to more data pages.

9.3.3 Grid Information Page Overview



This page may vary depending on the system configuration.

- **Power** shows the total grid power.
- **Freq** is the present grid frequency. (The screen prints it as "Freq".)
- **L-V, L-I and L-P** show the single-phase voltage, current and power.
- At the bottom of the page, **BUY** shows the energy bought from the grid today (Today) and in total (Total). **SELL** shows the same for energy sold to the grid.

9.3.4 Battery Information Page Overview

Battery	
Battery 1: Idle	 
Bat-V: -0.1 V	
Bat-I: -0.0 A	
Bat-P: -0.0 W	
temp: 0.0C	
SOC: 0.0%	

Battery information page

This page shows the operating information of Battery 1. It may vary depending on the system configuration.

The main readings are the battery status (for example, Idle), voltage (Bat-V), current (Bat-I), power (Bat-P), temperature (temp) and state of charge (SOC).

9.3.5 Load Information Page Overview



Load

EPS Load: 0 W

Home Load: 0 W

Smart Load: 0 W

Total Load: 0 W

Toady: 0.0 kWh

Total: 11.5 kWh







EPS-RU:0.0 V

EPS-RI: 0.1A

Pwr:0 W

EPS-SU:0.0 V

EPS-SI: 0.1A

Pwr:0 W

Load information page

This page may vary depending on the system configuration. It shows the EPS load power (EPS Load), the household load power (Home Load), the smart load power (Smart Load) and the total load power (Total Load). Today and Total show the load energy for today and in total. (The screen prints "Today" as "Toady".)

Below these values, the page shows the voltage, current and power of the two AC lines, R and S (L1 and L2):

- R (L1): EPS-RU (voltage), EPS-RI (current) and Pwr (power).
- S (L2): EPS-SU (voltage), EPS-SI (current) and Pwr (power).

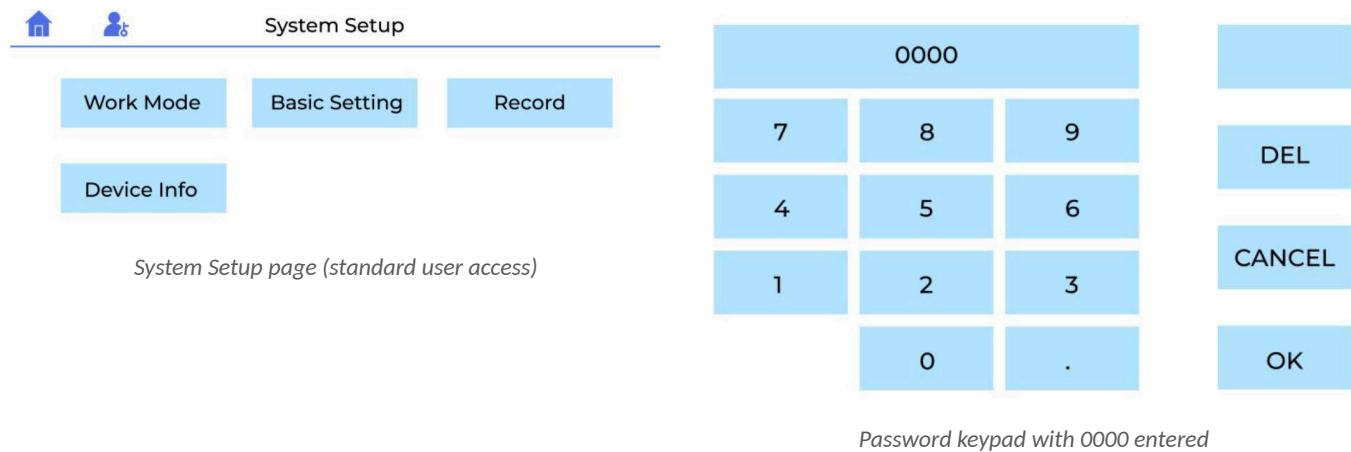
9.4 System Setup Menu

The System Setup menu has two access levels: standard user access (password 0000) and advanced user access (password 7777).

Standard user access

This is the settings page you can open with standard user permissions. It has four menus: Work Mode, Basic Setting, Record and Device Info.

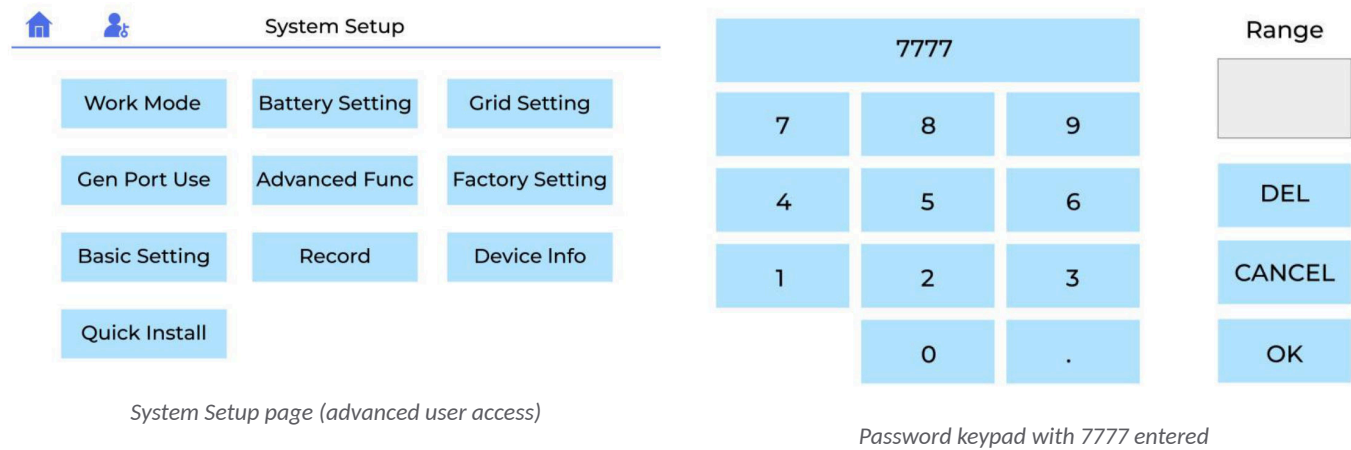
To enter basic settings mode, tap the user icon (a person with a key) in the upper-left corner of the screen. Then enter the password **0000**.



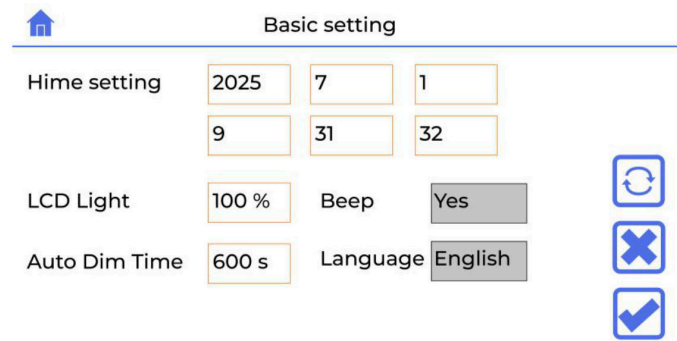
Advanced user access

To enter advanced settings mode, tap the same user icon in the upper-left corner of the System Setup screen. Then enter the password **7777**.

When the password is accepted, the Advanced Settings page opens. From there you can reach more settings that are not available with standard access.



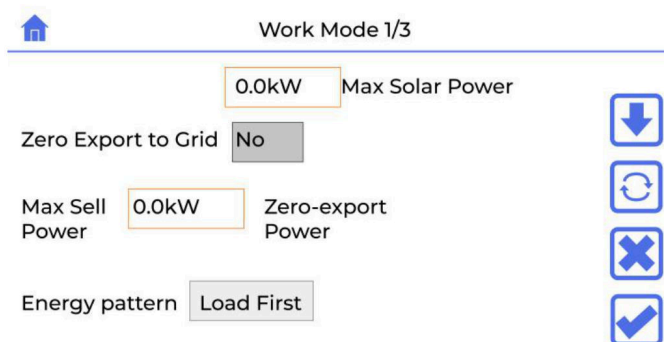
9.5 Basic Settings Menu



Setting	What it does
Time Setting	Sets the system date and time: year, month, day, hour and minute.
LCD Light	Sets the screen brightness level.
Beep	Turns the buzzer on or off. It is on by default. When it is on, the buzzer sounds each time you touch the screen or press a key.
Auto Dim Time	Sets how long the screen waits before it dims or turns off by itself.
Language	Selects the language used on the screen.

9.6 Work Mode Settings Menu

Work Mode Settings — Page 1



Work Mode 1/3 screen

Setting	What it does
Max Solar Power	Sets the maximum PV input power.
Zero Export to Grid	When enabled, the inverter limits the power it exports to the grid. The actual export limit is set by Zero-export Power .
Zero-export Power	Sets the inverter's export power limit to the grid. This setting works only when Zero Export to Grid is enabled.
Max Sell Power	Sets the maximum power that can be exported to the grid.
Energy pattern	Sets the system's energy priority. At this time only Load First is supported. Load First: PV power supplies the load first. Any extra PV energy then charges the battery. If PV power is not enough, the grid supplies the load.

Work Mode Settings — Page 2

 Work Mode 2/3

Power On/Off	OFF	
Auto Power On	No	
Work Mode	TOU ECO	
On-Grid Bat Restart Soc	Self Use	
Off-Grid Bat Restart Soc	TOU ECO	
Charge Max soc	Backup Power	
	Grid Priority	

Work Mode 2/3 with the Work Mode list open

 Work Mode 2/3

Power On/Off	OFF	
Auto Power On	No	
Work Mode	TOU ECO	
On-Grid Bat Restart Soc	10 %	
Off-Grid Bat Restart Soc	10 %	
Charge Max soc	100 %	

Work Mode 2/3 with example values

Setting	What it does
Power On/Off	Turns the inverter ON or OFF by hand.
Auto Power On	Turns automatic startup and shutdown on or off. When it is on, the inverter powers on by itself.
Work Mode	Sets the system's working mode. The choices are Self Use , TOU ECO , Backup Power and Grid Priority . The modes are explained in section 7.2.
On-Grid Bat Restart SOC	Used when the inverter is connected to the grid. This SOC setting controls when the battery is allowed to discharge (10% in the example screen). If the battery SOC drops below (Restart SOC – 3), the inverter starts forced charging to raise the SOC back to 10%.
Off-Grid Bat Restart SOC	Used when the inverter is off-grid (not connected to the utility). This SOC setting controls when the battery is allowed to discharge (10% in the example screen).
Charge Max SOC	Sets the highest battery SOC for charging. When the battery reaches this SOC, charging stops by itself.

Work Mode Settings — Page 3 (TOU Mode Settings)

 Work Mode--TOU 3/3

	Time	Type	Curr	SOC	
-	00:00 12:30	Disch	50 A	20 %	
-	12:30 16:30	Self Use	50 A	40 %	
+	16:30 23:59	Charge	30 A	90 %	
					

Work Mode TOU 3/3 screen with three time slots

NOTE TOU scheduling works only when **Work Mode** on Work Mode Settings — Page 2 is set to **TOU ECO**. Only then do the time-based settings take effect.

- **Time:** Sets the time slots used for energy management. The whole 24-hour day must be divided into back-to-back periods that do not overlap. Each time slot has a start time and an end time. You can add up to 6 time slots by

tapping the "+" icon.

- **Type:** Sets what the system does during the time slot.
 - **Discharge** (Disch): the battery discharges according to the settings for that slot.
 - **Self Use** and **Charge:** see the example schedule below for how the system behaves.
- **Curr** and **SOC:** the example schedule below shows how the current and SOC values for each slot are used.

Example schedule

Time period	Priority type	Zero Export disabled	Zero Export enabled
00:00–12:30	Discharge	The battery discharges if SOC > 20% (up to a 50 A limit). Extra PV is exported to the grid.	Same discharge behavior. Extra PV charges the battery so it is not wasted.
12:30–16:30	Self Use	The battery discharges if SOC > 40% when PV cannot meet the load. The battery charges if SOC < 36%, using PV or the grid. Remaining PV is exported.	Same behavior. No export allowed: extra PV that is not used for the load or for charging is curtailed.
16:30–23:59	Charge	The battery charges if SOC < 90%, using PV + grid (up to 30 A). Extra PV is exported.	Same charging behavior. No export allowed: any extra PV after charging is curtailed.

9.7 Battery Settings Menu

Battery1 Setting1 — Page 1


Battery1 Setting1 1/2

Max A Charge	275 A	Batt 1Type	DC Source
Max A Disch	275 A	Activate Batt	No
Max Power Ch	15 kW	Com Type	1-CAN
Max Power Disch	15 kW	Company	PYLON HV
Grid Charge	No		
Parallel bat1&bat2	No		






Battery1 Setting1 1/2 screen (example values)

Setting	What it does
Max A Charge / Max A Disch	Set the maximum battery charging current and the maximum battery discharging current .
Max Power Ch / Max Power Disch	Set the maximum charging power and the maximum discharging power for the battery.
Grid Charge	Turns battery charging from the utility grid on or off.
Parallel bat1&bat2	For inverter models with two battery ports. Turning this on lets one battery connect to both Battery Port 1 and Battery Port 2 at the same time. In this case, connect the battery communication cable to the inverter's BMS1 port .
Batt1 Type	Selects the battery type. The choices are Lithium , Lead-acid , DC Source and No Battery .
Activate Batt	Starts battery activation (wake-up) by hand.
Com Type	Selects the battery communication protocol: CAN or RS485 .
Company	Selects the battery manufacturer. The system then picks the correct communication protocol for that brand by itself.

The example screen shows 275 A and 15 kW, the KR-L15K-SPUS values. The maximum battery charge/discharge current is 167 / 210 / 250 / 275 A for the KR-L8K / L10K / L12K / L15K-SPUS.

Battery1 Setting2 — Page 2


Battery1 Setting2 2/2

Float V	56.0 V	Ch Ratio	0.20	
EqualizationV	57.0 V	TEMPCO(mV/C/Cell)	2	
Shutdown	40.0 V	Parallel Num	1	  
High Batt	61.0 V	Batt capacity	100 Ah	
Low Batt	38.0 V			

Battery1 Setting2 2/2 screen (example values)

Setting	What it does
Float V	Sets the battery float charging voltage .
Ch Ratio	Sets the charging C-rate (charging ratio). Used only for lead-acid batteries .
Equalization V	Sets the equalization charging voltage .
TEMPCO (mV/°C/cell)	Battery temperature compensation coefficient . Used only for lead-acid batteries .
Shutdown	Sets the battery discharge cutoff voltage that protects the battery.
Parallel Num	Sets the number of battery groups connected in parallel . This setting is needed only for lead-acid batteries used in more than one parallel cluster.
High Batt / Low Batt	Set the battery port over-voltage and under-voltage protection points .
Batt Capacity	Sets the battery capacity . Used only for lead-acid batteries .

9.8 Grid Settings Menu

Grid Settings — Page 1


Grid Code selection 1/4

Grid Mode	US 1547			
Grid Volt	240V	Grid Sensor	None	   
Grid Freq	60Hz	CT Ratio	2000	
Zero Export	No	Meter Addr	1	
Zero Export Power	0.0W	Meter Select	CHNT	
Max Sell Power	0.0W	Max Buy Power	0.0W	

Grid Code selection 1/4 screen (example values)

Setting	What it does
Grid Mode	Selects the national grid standard for the region where the inverter is installed (for example US 1547, as shown on the screen).
Grid Sensor	Sets how the inverter measures grid-side current. The choices are: None: the inverter measures the current inside, at its grid port.
	CT: an external current transformer (CT) measures the current.
	Meter: an external smart meter, connected by RS485, supplies the grid data.
Grid Volt	Sets the nominal grid voltage required by the local standard.
Grid Freq	Sets the nominal grid frequency of the local grid.
CT Ratio	Sets the CT transformation ratio.
Zero Export	When enabled, the inverter limits the power it exports to the grid. The limit is set by Zero Export Power .
Zero Export Power	Sets the maximum export power of the inverter. It works only when Zero Export is enabled.

Setting	What it does
Meter Addr	Sets the RS485 address of the external energy meter.
Meter Select	Selects the meter manufacturer. Make sure the model you select matches the meter that is installed.
Max Sell Power	Sets the maximum output power allowed to be exported to the grid.
Max Buy Power	Sets the maximum input power the inverter is allowed to draw from the grid.

Grid Settings — Page 2



Grid connect 2/4

Out Active Power	15kW	L/HVRT Mode	No	
Normal Ramp rate	60s	L/HPRP Mode	No	
Normal Connection Time	60s	P-V Mode	No	
Reconnect Ramp rate	10s	P-P Mode	No	
Reconnection Time	60s	Q-V Mode	No	
PF	1.0	APF Mode	No	

Grid connect 2/4 screen (the screen reads "Reconnection Tiime"; it means Reconnection Time)

NOTICE This page has reserved functions. Changing them is not recommended. Contact Fantastech (574-218-1973, derek@fantastech.org) or your installer before you change them.

Setting	What it does
Out Active Power	Sets the maximum active power output to the grid.
Normal Ramp rate	Sets the power ramp-up time after the inverter starts.
Normal Connection Time	Sets the time delay after startup before the inverter sends active power to the grid.
Reconnect Ramp rate	Sets the ramp-up time for active power after the inverter recovers from a fault.
Reconnection Time	Sets the reconnection delay after a fault is cleared.

Grid Settings — Page 3



Grid Protection1 3/4

High volt 1	110.0 %	Low volt 1	88.0 %	
High volt 2	120.0 %	Low volt 2	88.0 %	
		Low volt 3	50.0 %	
High volt time 1	13.00	Low volt time 1	21.00	
High volt time 2	0.16 s	Low volt time 2	21.00	
		Low volt time 3	2.00 s	
High volt recv	105.0%	Low volt recv	91.7 %	

Grid Protection1 3/4 screen (example values)

NOTICE This page has reserved functions. Changing them is not recommended. Contact Fantastech or your installer before you change them.

Setting	What it does
High volt 1 / High volt 2	Level 1 and Level 2 over-voltage protection points, as a percentage of the nominal voltage.
High volt time 1 / High volt time 2	Time delays before Level 1 and Level 2 over-voltage protection trips.
High volt recv	Grid over-voltage recovery point.
Low volt 1 / Low volt 2	Level 1 and Level 2 under-voltage protection points, also as a percentage of the nominal voltage.

Example: to change the grid voltage range the inverter accepts for grid connection, you only need to set **High Volt 1** and **Low Volt 1**.

Nominal voltage	High Volt 1 at 120%	Low Volt 1 at 80%
230 Vac	Over-voltage point 276 Vac	Under-voltage point 184 Vac
220 Vac	Over-voltage point 264 Vac	Under-voltage point 176 Vac

The example uses 230 Vac and 220 Vac nominal voltages. The Grid Settings — Page 1 screen shown above is set for a 240 Vac grid. The percentages work the same way on any nominal voltage.

Grid Settings — Page 4


Grid Protection2 4/4

High freq 1	61.0Hz	Low freq 1	58.5Hz	
High freq 2	62.0Hz	Low freq 2	56.5Hz	
High freq time 1	56.5	Low freq time 1	56.5	
High freq time 2	56.5	Low freq time 2	56.5	
High freq recv	60.5Hz	Low freq recv	59.5Hz	

Grid Protection2 4/4 screen (the screen reads "freq" on some labels; it means freq)

NOTICE This page has reserved functions. Changing them is not recommended. Contact Fantastech or your installer before you change them.

Setting	What it does
High freq 1 / High freq 2	First- and second-level over-frequency protection points (in Hz). These values are usually based on the system's nominal frequency (for example 50 Hz or 60 Hz).
High freq time 1 / High freq time 2	The delay time before protection acts when the grid frequency goes above the matching point.
High freq recv	The recovery point for over-frequency protection. When the frequency comes back down below this value, the inverter reconnects to the grid or resumes operation.

Setting	What it does
Low freq 1 / Low freq 2	First- and second-level under-frequency protection points. If the frequency falls below these values, protection trips.
Low freq time 1 / Low freq time 2	The delay time before under-frequency protection acts once the frequency drops below the set limits.
Low freq recv	The recovery point for under-frequency protection. The inverter reconnects or resumes operation when the grid frequency rises above this value.

Example: the system nominal frequency is 50 Hz, with these settings:

- **High Freq 1 = 52 Hz, Low Freq 1 = 47 Hz:** the system trips first-level protection when the frequency goes above 52 Hz or below 47 Hz, after the set time delays.
- **High Freq 2 = 53 Hz, Low Freq 2 = 46 Hz:** larger deviations trip second-level protection.

The example uses a 50 Hz grid. The screen above shows settings for a 60 Hz grid.

9.9 Generator Port Settings Menu

Gen Port Function

Gen Port Function selects what the generator port is used for. The choices are:

- **Generator:** the port is an input for generator power. Once the generator starts, its power is used to charge the battery.
- **Smart Load:** the port is a dedicated load output, with working conditions you set for smart-load control (see Smart Load Configuration below and section 7.4).

The screenshot shows the 'Generator Setting 1/2' screen. It features a home icon at the top left. The settings are as follows:

Gen Port Function	No		
Gen Warm Time	10 s	Start SOC	25 %
Gen Rated Power	80 W	Stop SOC	95 %
Max Run Time	600 min		
Cooling Time	10 min		
Gen Force	No		

On the right side of the screen, there is a vertical stack of four blue icons: a downward arrow, a circular arrow, an 'X', and a checkmark.

Generator Setting 1/2 screen (example values)

When **Gen Port Function** is set to **Generator**, these settings take effect:

Setting	What it does
Gen Warm Time	Generator warm-up time. After the inverter sends the start signal, it waits this long before it accepts generator power.
Start SOC / Stop SOC	The battery SOC points at which the generator starts and stops automatically.
Gen Rated Power	The maximum power output of the generator.
Max Run Time	The longest time the generator runs without stopping. Used when the inverter controls the generator automatically.
Cooling Time	The generator cool-down period after it stops. Used when the inverter controls the generator.
Gen Force	Force-starts the generator. Turn it on the first time a generator is connected, so the inverter recognizes and activates the generator.

NOTE Every KOOR inverter has generator auto-start. The inverter starts and stops the generator through the GEN_start dry contact (wiring in section 6.8.1). The generator starts when the battery SOC falls to the **Start SOC** setting and stops when it reaches the **Stop SOC** setting. Section 6.8.2 lists all start and stop conditions. The GEN breaker is rated 63 A: the generator input must not exceed 63 A.

FANTASTECH RULE **Generator charge time:** set the Start 1 minute after the End (for example End 00:00, Start 00:01), so the battery always charges whenever the generator runs. Which port the generator goes on: section 6.8.1.

Smart Load Configuration

This page takes effect only when **Gen Port Function** is set to **Smart Load**. In this mode the port is a dedicated load output, with working conditions you set for smart-load control.


Smart Load 2/2

Stop Output Soc

0 %

Stop Output Volt

0 V

ControlStart Time

00:00

Control End Time

00:00



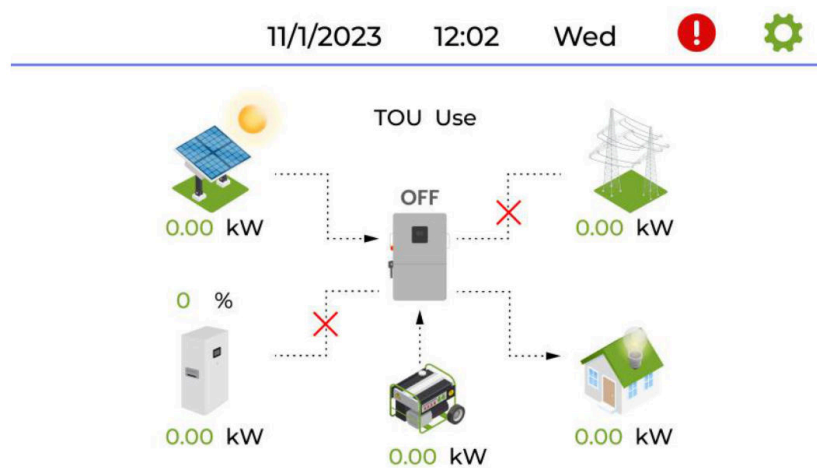



Smart Load 2/2 screen (the screen reads "ControlStart Time"; it means Control Start Time)

Setting	What it does
Stop Output SOC	When the battery SOC drops to this point, the smart load output turns off by itself.
Stop Output Volt	If voltage control is selected, the smart load output turns off when the battery voltage reaches this value.
Control Start Time	The start of the time window in which the SOC or voltage control conditions apply.
Control End Time	The end of the time window in which the SOC or voltage control conditions apply.

NOTE Outside the set time window, the smart load output is not limited by the SOC or voltage conditions. It follows the same discharge behavior as the EPS output.

Accessing Generator Data from the Home Page



Home screen with the generator icon (bottom center)

Once the generator function is turned on, a generator icon appears on the home screen. Tap this icon to open the Generator Details Page, described next.

Generator Details Page

The **Generator** page shows live readings from the generator. What this page shows can vary with the setup of each system.

Generator

L1-V: 0.0 V	L2-U: 0.0 V	L3-U: 0.0 V
L1-I: 0.0 A	L2-I: 0.0A	L3-U: 0.0 A
L1-P: 0.0 kW	L2-P: 0.0 kW	L3-U: 0.0 kW

Today: 0.0 kWh
Total: 0.0 kWh

Total Power: 0.0 kW

↑

↓

✕

- L1 / L2 / L3:** the voltage, current and power of each phase.
- Today:** the energy generated today.
- Total:** the total energy generated to date.
- Total Power:** the total generator power output right now.

Generator details page

9.10 Advanced Settings Menu

Use the **Advanced Function** page to set up parallel operation, the Wi-Fi baud rate and the EMS communication settings.


Advanced Function

Parallel Type	Single	  
Parallel Num	1	
Parallel Addr	1	
WiFi Baud	19200	
EMS Port	AFCI_485	
EMS Baud	19200	

Advanced Function page (single inverter)

Parallel settings

Setting (screen name)	What it does
Parallel Type	Sets the parallel operating mode of the system. The screens in this section show Single , Master and Slave .
Parallel Num	Sets the total number of inverters in the system (master + slaves).
Parallel Addr	Sets the address of this inverter in the system. The master inverter is always address 1. The slave inverters follow in order (2, 3, ...).

Wi-Fi and EMS communication settings

Setting (screen name)	What it does
WiFi Baud	Sets the baud rate for communication between the inverter and the data logger.
EMS Port	Picks the spare RS485 port on the inverter that is used for EMS (Energy Management System) communication. Default: AFCI_485 . You can change it to suit the actual use.
EMS Baud	Sets the communication baud rate for the EMS port. Default: 19200 .

Example: parallel system with three inverters

The screens below show how to set up a parallel system with one master inverter and two slave inverters. Every setting must be the same on all units except **Parallel Addr**. Parallel Addr must be different on each unit.

(1) Master inverter

(2) Slave inverter 1

(3) Slave inverter 2

Setting	(1) Master inverter	(2) Slave inverter 1	(3) Slave inverter 2
Parallel Type	Master	Slave	Slave
Parallel Num	3 (total number of inverters)	3	3
Parallel Addr	1	2	3
WiFi Baud	19200	19200	19200
EMS Port	AFCL_485	AFCL_485	AFCL_485
EMS Baud	19200	19200	19200
Role	This inverter is the master unit. It controls and synchronizes the whole system.	This inverter works as Slave 1, with address 2.	This inverter works as Slave 2, with address 3.

IMPORTANT

1. All inverters must have the same WiFi Baud rate and the same EMS Baud rate.
2. Make sure the wiring and grounding between all units are correct.
3. Make sure all inverters have the same firmware version.
4. Communication cables (for example RS485 or CAN) must be connected securely.

9.11 Record Menu

The **Records** page holds the fault logs and the operation log. It has three buttons:

- **Current Faults:** shows the active faults and alarms of the inverter. Each entry gives the time stamp, the fault code and a description of the current problem.
- **History Faults:** shows the fault and alarm history of the inverter. It records the start time, the recovery time and the details of each fault event.
- **Operate Logs:** lists user operations, such as changing the inverter mode, turning the system on or off, or changing system settings. Use these logs to track system changes and user actions.

	Records			Current Fault
Current Faults	History Faults	Operate Logs		

9.12 Device Info Setup Menu

Device Info		 	Screen label	What it shows
Device type:			Device type	The category or class of the inverter.
SN:			SN	The serial number: the unique number given to each unit.
Model:			Model	The model number of the inverter.
ARM:	V2.01		ARM / INV / DCDC	The software (firmware) versions now installed: ARM, INV and DCDC.
INV:	V3.69		Run Time	The total running time of the inverter since it was first started.
DCDC:	V3.69			
Run Time:	00:00:39:39			

9.13 Factory Setting Menu

RESERVED This menu is reserved. Changing these settings is not recommended. Contact Fantastech (574-218-1973, derek@fantastech.org) or your installer before you change any setting here.

 Factory Setting 1/3

DRM	No	Preventive PID	No	
Factory Reset	No	Active island	No	
AFCI	No	BatTempCompen	No	
Bat Warn	No	Bat Wake-up	No	
GRID Warn	No	ISO	No	
Ext-Control	No	Leakage Curr	No	

Factory Setting, screen 1/3

 Factory Setting 2/3

Device Reset	No	MPPT Ctrl Mode	MPPT	
Record Clear	No	MPPT Para Mode	Two-Para	
AFCI Alarm Clear	No	MPPT Num	2	
Rolay self-test	No	MPPT Power	25 %	
Device lock	No	MPPT Disturbed	8	
Exec quick	No	CVT Volt	500V	

Factory Setting, screen 2/3

 Factory Setting 2/3

Device Reset	No	MPPT Ctrl Mode	MPPT	
Record Clear	No	MPPT Para Mode	Two-Para	
AFCI Alarm Clear	No	MPPT Num	2	
Rolay self-test	No	MPPT Power	30kW	
Device lock	No	MPPT Disturbed	8	
Exec quick	No	CVT Volt	500V	

Factory Setting, screen 2/3 — second example

10. Troubleshooting

This chapter helps you find and fix most problems that can occur with the KR-L8K-L15K-SPUS series inverters. It helps you narrow down the source of a problem. Read the troubleshooting steps below.

1. Check the inverter screen for warning or fault messages and fault codes. The **Current Fault** list in the Record menu (section 9.11) shows the active faults and alarms.
2. If a message is shown, write it down before you do anything else.
3. Try the fix given for that code in the tables below.
4. If the problem continues, contact Fantastech (574-218-1973, derek@fantastech.org).

NOTE Short words used in the code names: inv = inverter; bat / BAT = battery; volt = voltage; curr = current; OC = overcurrent; OV = overvoltage; ch = charge; disch = discharge; temp = temperature; comm = communication; para = parameter; err = error; SW = software; HW = hardware; EPO = emergency power off; NTC = temperature sensor.

Fault codes

Code	Description	What to do
F01	inv over volt	The inverter has a fault. Turn off the PV, grid and battery. Wait 5 minutes, then turn the inverter back on. Check whether the problem is gone. If the problem continues, contact Fantastech.
F02	inv under volt	
F03	short circuit	
F04	inv over curr	
F05	over load	The load is too high, or the inverter has derated (lowered its output). Reduce the load. If the problem continues, contact Fantastech.
F07	inv bus over volt	The inverter has a fault. Turn off the PV, grid and battery. Wait 5 minutes, then turn the inverter back on. Check whether the problem is gone. If the problem continues, contact Fantastech.
F08	inv bus under volt	
F09	bus unbalance	
F10	leakage self-test fail	
F11	leakage over limit	
F12	relay self-test fail	
F13	inv locked	
F14	busbar buffer fail	
F15	inv over temp	

Code	Description	What to do
F17	parallel total count err	Check that the parallel communication cable is connected correctly. If the problem continues, contact Fantastech.
F18	parallel comm fail	
F19	parallel SW mismatch	
F20	parallel HW mismatch	
F21	parallel model mismatch	
F22	parallel para sync	
F23	master conflict	
F24	slave id conflict	
F25	parallel signal err	
F26	master no slave	
F33	inv flash fault	The inverter's internal communication or data storage has an error. Turn off the PV, grid and battery. Wait 5 minutes, then turn the inverter back on. Check whether the problem is gone. If the problem continues, contact Fantastech.
F34	inv-dc comm fault	
F35	inv phase-locked	
F36	inner para match fail	
F38	inv master fault	
F39	inv parallel comm fail	
F40	inv parallel signal err	
F41	inv curr DC component high	
F42	inv parallel overload	
F43	inv load curr unbalance	
F44	inv parallel system fault	The inverter has a fault. Turn off the PV, grid and battery. Wait 5 minutes, then turn the inverter back on. Check whether the problem is gone. If the problem continues, contact Fantastech.
F49	dc bus over volt	
F50	dc bus under volt	
F51	midbus over volt	
F52	midbus under volt	
F53	dc bat disch OC	
F54	dc bat ch OC	
F55	LLC HW over curr	
F56	dc bat over volt	
F57	dc bat under volt	
F60	bat reverse connect	Check that the positive (+) and negative (-) battery power cables are not reversed.
F63	dc over temp	Make sure the inverter is out of direct sunlight. Make sure it is in a cool, well-ventilated area. Make sure it is mounted vertically and the ambient temperature is below the inverter's upper temperature limit.

Code	Description	What to do
F64	Fan fault	First turn off the inverter. Then ask Fantastech whether your software (firmware) version is the latest one. If it is not, upgrade the firmware.
F65	meter comm lost	Check that the meter communication cable is in good condition.
F66	arm-inv comm lost	The inverter's internal communication or data storage has an error. Turn off the PV, grid and battery. Wait 5 minutes, then turn the inverter back on. Check whether the problem is gone. If the problem continues, contact Fantastech.
F67	arm-dcdc comm lost	
F68	wifi comm lost	Check the Wi-Fi logger stick. Make sure it is pushed all the way in and locked (section 8.2) and that it is joined to the site Wi-Fi (section 8.5). If the app shows the logger Offline, see section 8.6. If the problem continues, contact Fantastech.
F69	bms1-can comm lost	Make sure the battery you use is compatible with the inverter. Check that the communication cables and ports between the battery and the inverter are connected correctly.
F70	dsp para match err	The inverter's internal communication or data storage has an error. Turn off the PV, grid and battery. Wait 5 minutes, then turn the inverter back on. Check whether the problem is gone. If the problem continues, contact Fantastech.
F71	EPO	If the inverter does not go back to normal, contact Fantastech.
F72	ambient temp high	Make sure the inverter is out of direct sunlight. Make sure it is in a cool, well-ventilated area. Make sure it is mounted vertically and the ambient temperature is below the inverter's upper temperature limit.
F73	bms1-485 comm lost	Make sure the battery you use is compatible with the inverter. Check that the communication cables and ports between the battery and the inverter are connected correctly.
F74	arm flash error	The inverter's internal communication or data storage has an error. Turn off the PV, grid and battery. Wait 5 minutes, then turn the inverter back on. Check whether the problem is gone. If the problem continues, contact Fantastech.
F75	NTC disconnect	
F76	dsp para set fail	
F81	dc-inv comm lost	
F82	dc flash fault	
F83	dc fault locked	
F86	PV1 over volt	The inverter has a fault. Turn off the PV, grid and battery. Wait 5 minutes, then turn the inverter back on. Check whether the problem is gone. If the problem continues, contact Fantastech.
F87	PV2 over volt	
F88	PV1 over curr	
F89	PV2 over curr	Check that the PV cables are connected correctly.
F90	PV1 reverse connect	
F91	PV2 reverse connect	The inverter has a fault. Turn off the PV, grid and battery. Wait 5 minutes, then turn the inverter back on. Check whether the problem is gone. If the problem continues, contact Fantastech.
F93	PV3 overvoltage protection	
F94	PV3 overcurrent protection	

Code	Description	What to do
F95	PV3 reverse connect protection	Check that the PV cables are connected correctly.
F96	DC insulation fault	If the inverter does not go back to normal, contact Fantastech.

Warning codes

Code	Description	What to do
W01	Overload alarm	The load is too high, or the inverter has derated (lowered its output). Reduce the load. If the problem continues, contact Fantastech.
W02	INV overtemperature alarm	Make sure the inverter is out of direct sunlight. Make sure it is in a cool, well-ventilated area. Make sure it is mounted vertically and the ambient temperature is below the inverter's upper temperature limit.
W03	Grid over frequency alarm	The power grid is abnormal. The inverter goes back to normal operation by itself after the grid recovers. If the problem continues, contact Fantastech. Note: GARDA = power grid amplitude quick check alarm.
W04	Grid under frequency alarm	
W05	Grid overvoltage alarm	
W06	Grid undervoltage alarm	
W07	Gen freq abnormal alarm	Frequency: Check the generator's output frequency with a frequency meter. Make sure the generator engine speed is steady (an engine RPM that is too high or too low changes the frequency). Adjust the engine governor if needed. Do not overload the generator; overloading can make the frequency swing. Voltage and wiring: Measure the generator output voltage with a multimeter. Make sure the generator runs within its rated voltage (typically 220/230 Vac or 380/400 Vac, depending on the system). Check for loose or faulty wiring between the generator and the inverter input.
W08	DC BAT overvoltage alarm	If the lithium battery has an internal fault: turn off the PV, grid and battery. Wait 5 minutes, then turn the inverter and the lithium battery back on. Check whether the problem is gone. If the problem continues, contact Fantastech.
W09	DC BAT undervoltage alarm	
W10	BAT not connected	
W11	DC over-temp alarm	Make sure the inverter is out of direct sunlight. Make sure it is in a cool, well-ventilated area. Make sure it is mounted vertically and the ambient temperature is below the inverter's upper temperature limit.
W12	Grid phase rapid inspection	The power grid is abnormal. The inverter goes back to normal operation by itself after the grid recovers. If the problem continues, contact Fantastech.
W13	Grid fast inspection alarm	
W14	BAT Ch&Disch prohibited alarm	If the lithium battery has an internal fault: turn off the PV, grid and battery. Wait 5 minutes, then turn the inverter and the lithium battery back on. Check whether the problem is gone. If the problem continues, contact Fantastech.

Code	Description	What to do
W19	Grid phase deficiency alarm	The power grid is abnormal. The inverter goes back to normal operation by itself after the grid recovers. If the problem continues, contact Fantastech. Note: GARDA = power grid amplitude quick check alarm.
W20	Grid long time OV alarm	
W21	Grid phase abnormal alarm	
W22	Grid amplitude fast inspection alarm	
W23	Grid DC component fast detection	The power grid is abnormal. The inverter goes back to normal operation by itself after the grid recovers. If the problem continues, contact Fantastech.
W24	Grid phase fast inspection alarm	
W25	PV1 undervoltage alarm	If the lithium battery has an internal fault: turn off the PV, grid and battery. Wait 5 minutes, then turn the inverter and the lithium battery back on. Check whether the problem is gone. If the problem continues, contact Fantastech.
W26	PV2 undervoltage alarm	
W27	PV3 undervoltage alarm	

NOTICE

If the inverter's information panel does not show a fault light, go through this list. Make sure the present state of the installation lets the unit work properly.

- Is the inverter in a clean, dry place with enough ventilation?
- Are the DC input breakers turned on (closed)?
- Are the cables the right size and short enough?
- Are the input and output connections and wiring in good condition?
- Are the configuration settings correct for your installation?
- Are the display panel and the communication cable connected correctly and undamaged?

For more help, contact Fantastech (574-218-1973, derek@fantastech.org). Be ready to describe your system installation and to give the model and serial number of the unit.

11. Maintenance

11.1 Power On the Inverter for the First Time

DANGER Important: follow these steps, in this order, to turn on the inverter.

1. Turn the PV switch to the ON position.
2. Turn on the battery. Turn on the DC switch between the battery and the inverter.
3. Turn on the AC circuit breaker between the inverter GRID port and the power grid.
4. Turn on (close) the AC circuit breaker between the inverter LOAD port and the emergency (backup) loads.
5. Send the startup command by hand on the inverter screen: **Power On/Off** in the Work Mode Settings menu (section 9.6). For safety, you can set **Auto Power On** after this first power-on so the inverter starts by itself.
6. The inverter should now start running.

11.2 Power Off the Inverter

- DANGER**
- Power off the inverter before any operation or maintenance work. Otherwise, electric shock may occur.
 - Delayed discharge: after power off, wait until the internal components have discharged.

1. Turn off the AC breaker on the GRID side of the inverter.
2. Turn off the AC breaker on the LOAD (backup) side of the inverter.
3. Turn off the battery breaker between the inverter and the battery.
4. Turn off the PV switch of the inverter.

11.3 Removing the Inverter

WARNING Make sure the inverter is powered off. Wear proper PPE before any work.

1. Disconnect all the cables: DC cables, AC cables, communication cables, the communication module and PE (ground) cables.
2. Remove the inverter from the mounting plate.
3. Remove the mounting plate.
4. Store the inverter properly. If the inverter will be used later, make sure the storage conditions meet the requirements in section 4.3 Storage.

11.4 Disposing of the Inverter

If the inverter can no longer work, dispose of it according to the local disposal rules. Do not throw the inverter away with household waste.

WARNING Make sure the inverter is powered off. Wear proper PPE before any work.

12. Appendix

12.1 Routine Maintenance

Item	What to do	How often
System cleaning	Check the heat sink, air intake and air outlet for foreign matter or dust.	Once every 6–12 months
PV switch	Turn the DC switch on and off ten times in a row to make sure it works properly.	Once a year
Electrical connections	Check that the cables are connected securely. Check whether any cable is broken or has exposed copper core.	Once every 6–12 months
Sealing	Check that all terminals and ports are sealed properly. Reseal a cable hole if it is not sealed or is too big.	Once a year

12.2 Limited Warranty

KOOR All-in-One inverters are warranted by Fantastech Energy Solution LLC for 10 years from the date of installation. The full terms are on the Limited Warranty — Terms page at the front of this manual, and the registration card is at the back.

The warranty does not cover any product or product part that has been modified or damaged by any of the following:

- Installation or removal (for example: batteries of the wrong voltage, batteries connected backward, water or rain damage to electronics, preventable damage to solar wires).
- Alteration or disassembly.
- Normal wear and tear.
- Accident or abuse.
- Unauthorized firmware or software updates, or changes to the software code.
- Corrosion.
- Repair or service by an unauthorized repair facility.
- Operation or installation that goes against the KOOR product instructions.
- Fire, floods or acts of nature.
- Shipping or transportation.
- Incidental or consequential damage caused by other components of the power system.
- Any product whose serial number has been altered, defaced or removed.

WARNING Fantastech Energy Solution LLC expressly disclaims any responsibility for performance problems caused by improper installation. Installers and users are solely responsible for following the proper installation procedures in the documentation provided. Fantastech Energy Solution LLC disclaims any liability for changes to the installation that might cause electrical malfunctions or any other problems related to the KOOR product.

Warranty Registration Card

KOOR All-in-One Hybrid Inverter · KR-L8K · KR-L10K · KR-L12K · KR-L15K-SPUS



FANTASTECH LIMITED WARRANTY
KOOR All-in-One Hybrid Inverter and KOOR batteries — from the date of installation

10
YEARS

Fill this card out when the system is turned on, keep a copy with your invoice, and send it back to Fantastech. Registering takes two minutes, and it is what lets us handle a claim fast if you ever need one.

Cut out or photocopy this page, fill it in, and mail it to Fantastech — or take a clear photo of it and e-mail it to derek@fantastech.org.

OWNER

Customer name

Phone

E-mail

Install address — street, city, state, ZIP

EQUIPMENT

Inverter model	Inverter serial number (S/N)
Battery model	Battery serial number(s)
Fantastech order number	Purchase date
Dealer / installer	Commissioning date

SEND THE FINISHED CARD TO FANTASTECH

E-mail — fastest
derek@fantastech.org
Snap a picture of this card with your phone and send it. Include a picture of your invoice.

Mail
Fantastech Energy Solution LLC
3645 S 1200 W
Goshen, IN 46528

Phone
574-218-1973
Call us with the serial number and we will fill it in for you.



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