PYLONTECH


# M1C-UL9540 Integrated Outdoor

# Lithium Iron Phosphate Battery Energy Storage System

# User Manual

TÜVRheinland

C US

60kW File NO.: CU 72404208 0001
30kW File NO.: CU 72404209 0001

This is an ANSI/CAN/UL9540 certified system.

# Table of Contents

# 1. Safety

## 1.1 Validity

This document is valid for the Pylontech Outdoor Battery Cabinet. The system includes lithium iron phosphate battery modules, BMS, inverter, transformers, air conditioner, fire-fighting system, etc.

## 1.2 Target Group

Outdoor Battery Cabinet is a high voltage energy storage system and can ONLY be operated by authorized personnel who must have following skills:

- Trained in the installation and commissioning of the electrical system, as well as the dealing with hazards.
- Full knowledge of the composition and working principle of the entire energy storage system.
- Knowledge of the manual and other related documents.
- Knowledge of the local regulations and directives.

## 1.3 Safety Symbols Instructions

**Instructions relatives aux symboles de sécurité.**

Safety symbols and general information appearing in this document are described below:

**Danger** indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.
**Danger** indique un danger présentant un niveau de risque élevé qui, s'il n'est pas évité, entraînera la mort ou des blessures graves.

**Warning** indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
**Avertissement** indique un danger avec un niveau de risque moyen qui, s'il n'est pas évité, pourrait entraîner la mort ou des blessures graves.

**Caution** indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.

**Attention** indique un danger avec un faible niveau de risque qui, s'il n'est pas évité, pourrait entraîner des blessures mineures ou modérées.

***NOTE*** indicates information considered important, but not hazard related.

**REMARQUE** indique des informations considérées comme importantes, mais non liées aux dangers.

## 1.4 Safety of the Inverter

### 1.4.1 Safety Instructions

**Danger:** Read this entire document before installing or using the **Sol-Ark 30K-3P-208V/ Sol-Ark 60K-3P-480V** Inverter. Failure to follow the instructions or warnings in this document can result in electrical shock, serious injury, or death. Damage to the Sol-Ark Inverter is also possible, potentially rendering it inoperable.

**Danger:** Lisez l'intégralité de ce document avant d'installer ou d'utiliser l'onduleur Sol-Ark 30K-3P-208V/Sol-Ark 60K-3P-480V. Le non-respect des instructions ou des avertissements de ce document peut entraîner un choc électrique, des blessures graves, voire la mort. Des dommages à l'onduleur Sol-Ark sont également possibles, le rendant potentiellement inutilisable.

**Danger:** High Life Risk Due to Fire or Electrocution – ONLY qualified personnel should install the Sol-**Ark 30K- 3P-208V /Sol-Ark 60K-3P-480V** Inverter.

**Danger:** risque de mort élevé dû à un incendie ou à une électrocution – SEUL un personnel qualifié doit installer l'onduleur Sol-Ark 30K-3P-208V/Sol-Ark 60K-3P-480V.

**Warning:** The system must have Ground connections and Neutral connections. Ground MUST be bonded to Neutral ONLY ONCE in the circuit.

**Avertissement:** Le système doit avoir des connexions à la terre et des connexions neutres. La terre DOIT être reliée au neutre UNE SEULE FOIS dans le circuit.

**Warning:** Solar PV+/PV- are UNGROUNDED. Note: you may ground PV Racking/Mounts, but doing so directly to the Sol-Ark will likely result in damage in the case of a direct lightning strike to the PV array. We recommend grounding the frames outside of the Sol-Ark circuit.

**Avertissement:** les panneaux solaires PV+/PV- ne sont PAS MISE À LA TERRE. Remarque: vous pouvez mettre à la terre les racks/supports photovoltaïques, mais le faire directement au Sol-Ark entraînera probablement des dommages en cas de coup de foudre direct sur le générateur photovoltaïque. Nous recommandons de mettre les châssis à la terre en dehors du circuit Sol-Ark.

**Danger:** DO NOT connect the grid to the Load Output Terminal Block.

**Danger:** NE connectez PAS le réseau au bornier de sortie de charge.

**Danger:** DO NOT reverse the polarity of batteries. Damage WILL occur.

Danger: N'inversez PAS la polarité des piles. Des dommages surviendront.

**Danger:** DO NOT exceed 500Voc on any MPPT on the Sol-Ark.

**Danger:** NE PAS dépasser 500 Voc sur n'importe quel MPPT du Sol-Ark.

**Danger:** DO NOT turn off the battery breaker if any current flows in or out of the battery.

**Danger:** NE PAS éteindre le disjoncteur de batterie si du courant entre ou sort de la batterie.

**Warning:** DO NOT use impact drivers to tighten any fasteners on the Sol-Ark.

**Avertissement:** NE PAS utiliser de tournevis à percussion pour serrer les fixations du Sol-Ark.

**Warning:** MUST use Strain Reliefs ON ALL wires entering/exiting the Sol-Ark 30K-3P-208V user area.

**Avertissement:** DOIT utiliser des serre-câbles SUR TOUS les fils entrant/sortant de la zone utilisateur du Sol-Ark 30K-3P-208V.

**Warning**: MUST use conduit (or double insulated wire) for AC Wires entering/exiting Sol-Ark 30K-3P-208V user area.

**Avertissement:** DOIT utiliser un conduit (ou un fil à double isolation) pour les fils CA entrant/sortissant de la zone utilisateur du Sol-Ark 30K-3P-208V.

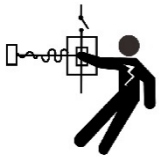
**Warning:** ALL terminals/breakers, including battery, MPPT, and AC Terminal Block inputs, should only have one conductor connecting to them.

**Avertissement:** TOUS les terminaux/disjoncteurs, y compris les entrées de batterie, MPPT et bornier CA, ne doivent être connectés qu'à un seul conducteur.

## 1.5 Safety of the System

### 1.5.1 Safety Symbols

| | | |
|---|---|---|
|  | Danger<br><br>*Danger* | **Lethal voltage!**<br>***Tension mortelle!***<br>● Battery strings will produce high voltage DC power and can causea lethal voltage and an electric shock.<br>*La batterie produira un courant continu à haute tension et peuvent provoquer une tension mortelle et un choc électrique.*<br>● Only qualified person can wire the battery strings.<br>*Seule le personnel qualifié peut effectuer le câblage de la batterie.* |
|  | Warning<br><br>*Avertisse*<br><br>*-ment* | **Risk of battery system damage or personal injury**<br>***Risque d'endommagement du système de batterie ou de blessure corporelle***<br>● DO not pull out the connectors while the system isworking!<br>*NE PAS debrancher les connecteurs lorsque le système fonctionne!*<br>● De-energize all multiple power sources and verify that there is novoltage.<br>*Mettez hors tension toutes les sources d'alimentation et vérifiezqu'il n'y a pas de tension.* |
|  | Caution<br><br>*Attention* | **Risk of battery system failure or life cycle reduction.**<br>***Risque de défaillance ou de réduction de durée de vie du système de batterie.*** |
|  | Symbol<br>in label | **Read the product and operation manual before operating the batterysystem!**<br>***Lisez le manuel du produit avant d'utiliser le système de batterie!*** |
|  | Symbol<br>in label | **Danger! Safety!**<br>***Danger! Sécurité!*** |
|  | Symbol<br>in label | **Warning electric shock!**<br>***Avertissement: choc électrique!*** |

| | | |
|---|---|---|
|  | Symbol in label | Warning electrical shock!<br>*Avertissement: choc électrique!*<br>More than one disconnect switch may be required to de-energize the equipment before servicing. |
|  | Symbol in label | Do not place near flammable material.<br>*Ne placez pas à proximité de matériauxinflammables.* |
|  | Symbol in label | Do not connect the positive and negative reversely.<br>N'inversez pas la connexion des pôles positif et négatif. |
|  | Symbol in label | Do not be around open flame.<br>*Ne placez pas près d'une flamme nue.* |
|  | Symbol in label | Do not place at where the children and pet could touch.<br>*Ne placez pas à la portée des enfants et des animaux domestiques.* |
|  | Symbol in label | The certificate label for Safety by TÜV US.<br>Étiquette de certificat de sécurité TÜV SÜD. |

**Danger:** Batteries deliver electric power, resulting in burns or a fire hazard when short circuit orincorrectly installment occurs.

**Danger:** *Les piles fournissent de l'énergie électrique, ce qui entraîne des brûlures ou un risque d'incendielorsqu'elles sont court-circuitées ou mal installées.*

**Danger:** Lethal voltages are present in the battery terminals and cables. Severe injuries or deathmay occur if the cables and terminals are touched.

**Danger:** *Des tensions mortelles sont présentes dans les bornes et les câbles de la batterie. Des blessures graves,voiremortelles,peuventsurvenirsilescâblesetlesbornessonttouchés.*

**Warning:** Do not open or deform the battery module.

***Avertissement:*** *Ne pas ouvrier ou déformer le module de batterie.*

**Warning:** Whenever operating the battery, wear suitable personal equipment (PPE) such as rubber gloves, rubber boots and goggles.

***Avertissement:*** *Chaque fois que vous travaillez sur la batterie, portez un équipement de protection individuelle(PPE) approprié, tel que des gants en caoutchouc, des bottes en caoutchouc et des lunettes de protection.*

**Warning:** PowerCube-M1-C system working temperature range: 10°C ~ 40°C; Optimum temperature: 18°C ~ 28°C. The ambient temperature beyond the working temperature range may activate the battery system high/low temperature alarm or **protection which further lead to the cycle life reduction as well. Besides, the extreme** working temperature will limit the warranty terms as well.

***Avertissement:*** *Plage de température de fonctionnement du système PowerCube-M1-C: 10°C – 40°C; températureoptimale: 18°C-28°C. En dehors de la plage de température de fonctionnement, la batterie risque deréduire sa durée de vie et même l'alarme de protection contre les températures trop élevées ou tropbasses du système de batterie. Cela affectera la garantie.*

**Warning:** For battery installation, the installer shall refer to NFPA70 standard for operation.

***Avertissement:*** *Lors de l'installation de la batterie à l'extérieur, l'installation doit être effectuée conformément à la Norme NFPA 70.*

**Caution:** Improper setting or maintenance can permanently damage the battery.

**Attention:** Le réglage ou la maintenance incorrecte peuvent endommager en permanence la batterie.

***Caution:*** *Incorrect inverter parameters will lead to the premature aging of battery.*

**Attention:** *Les paramètres de l'inverseur incorrects entraîneront un vieillissement prématuré de la batterie.*

## 1.6 Reference standards

### 1.6.1 System Related Standards

| No. | Description | Code |
|---|---|---|
| 1 | Safety Standard (US) | UL9540 |
| 2 | UN38.3 Safe Transport Standard | UN38.3 |
| 3 | UL EMC Standard | EMS |

### 1.6.2 Battery Related Standards

| No. | Description | Code |
|---|---|---|
| 1 | Safety Standard for Secondary Lithium Batteries | IEC62619<br>IEC63056<br>IEC62477-1<br>IEC62040-1 |
| 2 | UN38.3 Safe Transport Standard | UN38.3 |
| 3 | CE EMC Standard<br>CE EMC Directive 2014/30/EU | EN IEC 61000-6-1:2019<br>EN IEC 61000-6-2:2019<br>EN 61000-6-3:2007+A1<br>EN 61000-6-4:2007+A1<br>IEC 61000-6-1:2016<br>IEC 61000-6-2:2016<br>IEC 61000-6-3:2006+A1<br>IEC 61000-6-4:2018 |
| 4 | UCKA Standard | BS EN IEC 61000-6-2:2019 BS EN 61000-6-2:2005<br>BS EN 61000-6-4:2007+ A1 |
| 5 | Battery Cell Safety Standard | UL1642 |
| 6 | Battery Cell Safety Standard | UL1973 |
| 7 | Battery Cell Safety Standard | JIS C 8715-2 |
| 8 | Battery Safety Standard | UL9540A* |
| 9 | Safety Standard for Electrical Devices<br>CE LVD Directive 2014/35/EU | IEC62477-1 |
| 10 | Safety Standard for Lithium-ion Battery (US) | UL1973 |
| 11 | Safety Standard for Lithium Battery (Germany) | VDE-AR-E 2510-50:2017 |

* Test Organization: TÜV Rheinland

Report: UL 9540A: 2019 (Fourth Edition) Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage

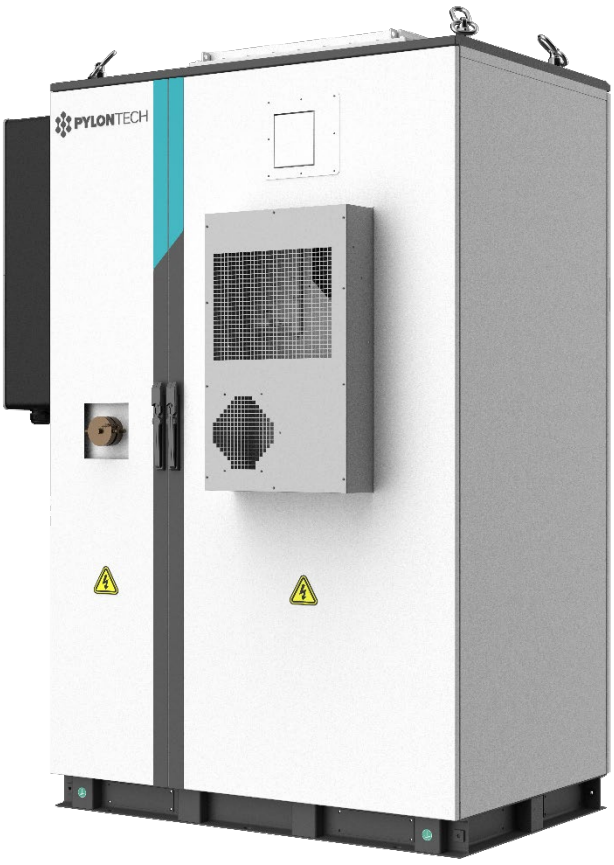
Date: Jan.10,2023

### 1.6.3 Inverter Related Standards

| No. | Description | Code |
|---|---|---|
| 1 | Safety Standard (US) | UL1741 |

## 2. System Introduction


Front View of the Cabinet




Rear View of the Cabinet

***NOTE:*** *The above pictures are for reference only, the appearance of the product is subject to the actual delivery.*

## 2.1 Parameters of the Outdoor Battery Cabinets

### 2.1.1 Parameters of 30kW system

| Specifications | Model Name | Optim US-Am-M1C-A-30kW/xx*-US-yy** (10 batteries per one string, 1~4 strings parallel) | Optim US-Am-M1C-A-30kW/xx*-US-yy** (11~14 batteries per one string, 1~2 strings parallel) |
|---|---|---|---|
| AC side Parameters | Rated Power(kW) | 30 | 30 |
| | Rated Output Voltage (VAC) | 208 | 208 |
| | Max. output current(A) | 84 | 84 |
| | Rated frequency (Hz) | 60 | 60 |
| | Wiring method | Three-phase four wire +PE | Three-phase four wire +PE |
| | ON-Off Grid Switching | 5ms | 5ms |
| Photovoltaic Parameters | Rated Power(kW) | 39 | 39 |
| | Max. output current(A) | 500 | 500 |
| | Max. output current(A) | 36 | 36 |
| | MPPT voltage range(V) | 170-500 | 170-500 |
| | MPPT starting voltage(V) | 150 | 150 |
| | MPPT Interface Qty. | 4 | 4 |
| DC side Parameters | BMS Qty. | m (where m=1,2,3,4) | m (where m=1,2) |
| | Battery string Qty. (same as BMS Qty.) | m (where m=1,2,3,4) | m (where m=1,2) |
| | Battery module Qty. (=battery module Qty in one single string x battery string Qty.) | n (where n =10 x m, m=1,2,3,4) (Here 10 batteries in one string) | n (where n= 11 x m, 12 x m, 13 x m, 14 x m) (Here there can be 11, 12, 13 or 14 batteries in one single string) |
| | Rated Energy(kWh) | 4.736 (single battery energy) x n (battery module Qty.) (where n= 10,11,12,13,14,20,22,24,26,28,30,40) | |
| | Battery rated voltage(V) | See the details in the ***System Configuration List-30kW*** on the next page. | |
| | Maximum DC current (A) | 100 | |
| System Parameters | Firefighting Configuration | See the details in the ***System Configuration List-30kW*** on the next page. | |
| | Cooling Type | Industrial Air Conditioner(2kW) | |
| | Working Temperature range (℃) | -20~50 | |
| | Storage Temperature range (℃) | -20~60 | |
| | Relative Humidity | 0-95%RH, non-condensing | |
| | Noise (dB) | ≤65 | |
| | Altitude (m) | 2000 | |
| | External Dimensions of the Outdoor Cabinet (mm) | 1337(W) x 2195(H) x 1125(D) | |
| | Corrosion Resistance Grade | C3H (Standard Configuration) C5(Optional) | |

| Specifications | Model Name | Optim US-Am-M1C-A-30kW/xx*-US-yy** (10 batteries per one string, 1~4 strings parallel) | Optim US-Am-M1C-A-30kW/xx*-US-yy** (11~14 batteries per one string, 1~2 strings parallel) |
|---|---|---|---|
| | Weight (kg) | 800 x m (BMS Qty.) + 43 x n (battery module Qty.) +80(PCS weight) | |
| | Installation Type | Cabinet installed on the ground (Applicable for hoist and forklift handling) | |
| | IP Rating of the outdoor cabinet | IP55 | |

*"xx "represents the rated energy of the battery system, after calculation, only keeping the integer part, then you will get the numbers as the table ***System Configuration List-30kW*** below.

**"yy" represents the firefighting configuration, referring to the table ***System Configuration List-30kW*** below.

**System Configuration List-30kW**

| Item | Model | Battery String Qty. | Single String Configuration | Rated Voltage (V) | Battery Energy (kWh) | XX (Battery Energy) | yy (firefighting configuration) |
|---|---|---|---|---|---|---|---|
| 1 | Optim US-A1-M1C-A-30kW/xx-US-yy | 1 | 1 BMS + 10 battery modules | 320 | 47.4 | 47 | "yy" represents the firefighting configuration:<br>01: Explosion relief panel<br>02: Explosion relief panel + Sprinkler system<br>03: Ventilation fan<br>04: Ventilation fan + Sprinkler system<br>05: Explosion relief panel +Ventilation fan + Sprinkler system |
| 2 | Optim US-A2-M1C-A-30kW/xx-US- yy | 2 | | | 94.7 | 94 | |
| 3 | Optim US-A3-M1C-A-30kW/xx-US- yy | 3 | | | 142.1 | 142 | |
| 4 | Optim US-A4-M1C-A-30kW/xx-US- yy | 4 | | | 189.4 | 189 | |
| 5 | Optim US-A1-M1C-A-30kW xx -US- yy | 1 | 1 BMS + 11 battery modules | 352 | 52.1 | 52 | |
| 6 | Optim US-A2-M1C-A-30kW/ xx -US- yy | 2 | | | 104.2 | 104 | |
| 7 | Optim US-A1-M1C-A-30kW/ xx -US- yy | 1 | 1 BMS + 12 battery modules | 384 | 56.8 | 56 | |
| 8 | Optim US-A2-M1C-A-30kW/ xx -US- yy | 2 | | | 113.7 | 113 | |
| 9 | Optim US-A1-M1C-A-30kW/ xx -US- yy | 1 | 1 BMS + 13 battery modules | 416 | 61.6 | 61 | |
| 10 | Optim US-A2-M1C-A-30kW/ xx -US- yy | 2 | | | 123.1 | 123 | |
| 11 | Optim US-A1-M1C-A-30kW/ xx -US- yy | 1 | 1 BMS + 14 battery modules | 448 | 66.3 | 66 | |
| 12 | Optim US-A2-M1C-A-30kW/ xx -US- yy | 2 | | | 132.6 | 132 | |

### 2.1.2 Parameters of 60kW system

| Specifications | Model Name | Optim US-Am-M1C-A-60kW/xx*-US-yy** (14~21 batteries per one string, 1~2 strings parallel) |
|---|---|---|
| AC side Parameters | Rated Power(kW) | 60 |
| | Rated Output Voltage (VAC) | 480 |
| | Max. output current(A) | 73 |
| | Rated frequency (Hz) | 60 |
| | Wiring method | Three-phase four wire +PE |
| | ON-Off Grid Switching | 5ms |
| Photovoltaic Parameters | Rated Power(kW) | 78 |
| | Max. output current(A) | 1000 |
| | Max. output current(A) | 36 |
| | MPPT voltage range(V) | 280-850 |
| | MPPT starting voltage(V) | 180 |
| | MPPT Interface Qty. | 4 |
| DC side Parameters | BMS Qty. | m (where m=1,2) |
| | Battery string Qty. (same as BMS Qty.) | m (where m=1,2) |
| | Battery module Qty.<br>(=battery module Qty in one single string x battery string Qty.) | n (where n= 14x m, 15 x m, 16 x m, 17 x m, 18 x m, 19 x m, 20 x m, or 21 x m, m=1 or 2)<br>(Here there can be 14, 15, 16, 17, 18, 19, 20 or 21 batteries in one single string) |
| | Rated Energy(kWh) | 4.736 (single battery energy x n (battery module Qty.)<br>(where n=14,15,16,17,18,19,20,21,28,30,32,34,36,38,40,42) |
| | Battery rated voltage(V) | See the details in the ***System Configuration List-60kW*** on the next page. |
| | Maximum DC current (A) | 100 |
| System Parameters | Firefighting Configuration | See the details in the ***System Configuration List-60kW*** on the next page. |
| | Cooling Type | Industrial Air Conditioner(2kW) |
| | Working Temperature range(℃) | -20~50 |
| | Storage Temperature range(℃) | -20~60 |
| | Relative Humidity | 0-95%RH, non-condensing |
| | Noise (dB) | ≤65 |
| | Altitude (m) | 2000 |
| | External Dimensions of Outdoor Cabinet (mm) | 1110(W) x 2185(H) x 1655(D) |
| | Corrosion Resistance Grade | C3H (Standard Configuration)<br>C5(Optional) |
| | Weight (kg) | 800 x m (BMS Qty.) + 43 x n (battery module Qty.) +80 (PCS weight) |
| | Installation Type | Cabinet installed on the ground.<br>Applicable for hoist and forklift handling |
| | IP Rating of the outdoor cabinet | IP55 |

*"xx "represents the rated energy of the battery system, after calculation, only keeping the integer part, then you will get the numbers as the table ***System Configuration List-60kW*** on the next page.

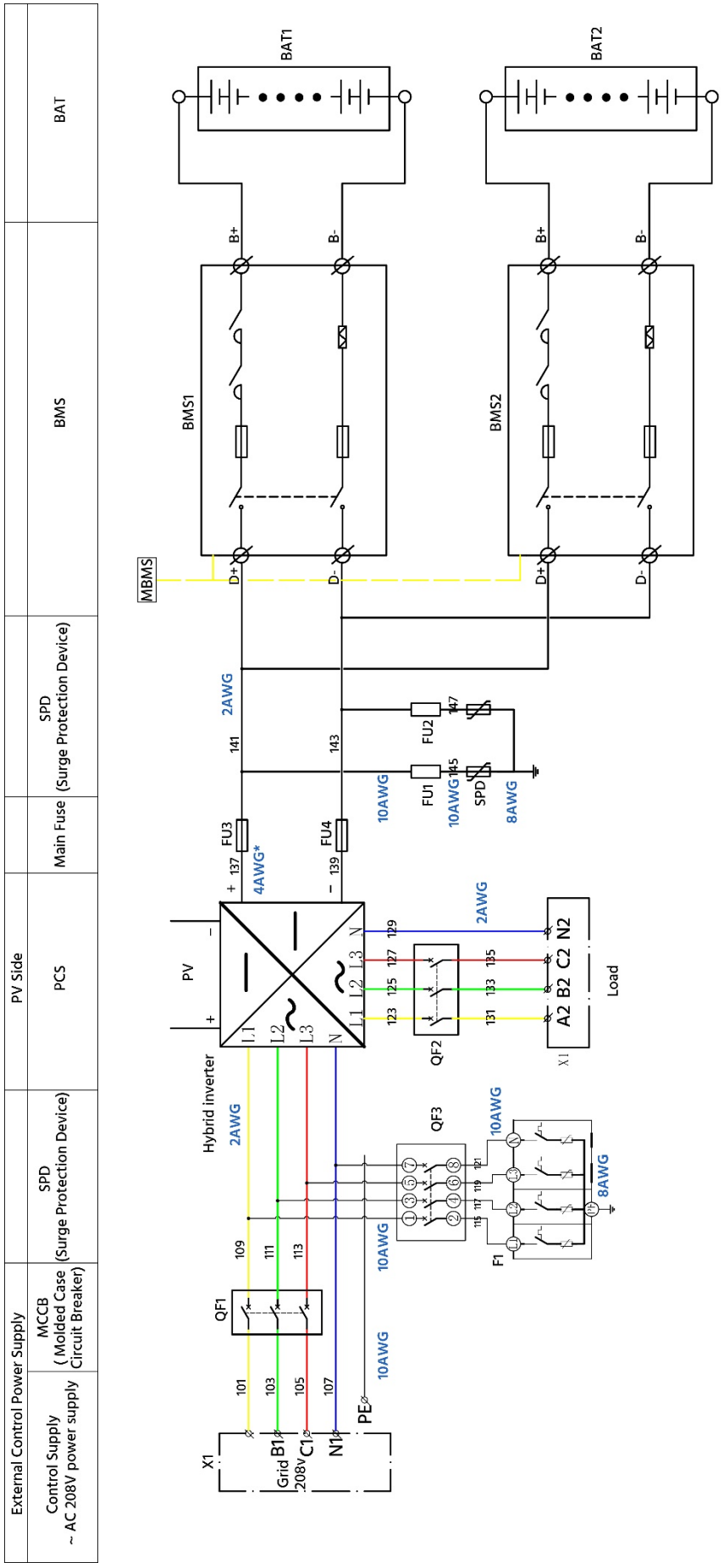
**"yy" represents the firefighting configuration, referring to the table ***System Configuration List-60kW*** on the next page.

**System Configuration List-60kW**

| Item | Model | Battery String Qty. | Single String Configuration | Rated Voltage (V) | Energy (kWh) | XX (Battery Energy) | yy (firefighting configuration) |
|---|---|---|---|---|---|---|---|
| 1 | Optim US-A1-M1C-A-60kW/ xx -US- yy | 1 | 1 BMS + 14 battery modules | 448 | 66.3 | 66 | "yy" represents the firefighting configuration:<br>01: Explosion relief panel<br>02: Explosion relief panel + Sprinkler system<br>03: Ventilation fan<br>04: Ventilation fan + Sprinkler system<br>05: Explosion relief panel +Ventilation fan + Sprinkler system |
| 2 | Optim US-A2-M1C-A-60kW/ xx -US- yy | 2 | | | 132.6 | 132 | |
| 3 | Optim US-A1-M1C-A-60kW/ xx -US- yy | 1 | 1 BMS + 15battery modules | 480 | 71.0 | 71 | |
| 4 | Optim US-A2-M1C-A-60kW/ xx -US- yy | 2 | | | 142.1 | 142 | |
| 5 | Optim US-A1-M1C-A-60kW/ xx -US- yy | 1 | 1 BMS + 16 battery modules | 512 | 75.8 | 75 | |
| 6 | Optim US-A2-M1C-A-60kW/ xx -US- yy | 2 | | | 151.6 | 151 | |
| 7 | Optim US-A1-M1C-A-60kW/ xx -US- yy | 1 | 1 BMS + 17 battery modules | 544 | 80.5 | 80 | |
| 8 | Optim US-A2-M1C-A-60kW/161-US- yy | 2 | | | 161.0 | 161 | |
| 9 | Optim US-A1-M1C-A-60kW/ xx -US- yy | 1 | 1 BMS + 18 battery modules | 576 | 85.2 | 85 | |
| 10 | Optim US-A2-M1C-A-60kW/ xx -US- yy | 2 | | | 170.5 | 170 | |
| 11 | Optim US-A1-M1C-A-60kW/ xx -US- yy | 1 | 1 BMS + 19 battery modules | 608 | 90.0 | 90 | |
| 12 | Optim US-A2-M1C-A-60kW/ xx -US- yy | 2 | | | 180.0 | 180 | |
| 13 | Optim US-A1-M1C-A-60kW/ xx -US- yy | 1 | 1 BMS + 20 battery modules | 640 | 84.7 | 94 | |
| 14 | Optim US-A2-M1C-A-60kW/ xx -US- yy | 2 | | | 189.4 | 189 | |
| 15 | Optim US-A1-M1C-A-60kW/ xx -US- yy | 1 | 1 BMS + 21 battery modules | 672 | 99.5 | 99 | |
| 16 | Optim US-A2-M1C-A-60kW/ xx -US- yy | 2 | | | 198.9 | 198 | |

## 2.2 System Diagram

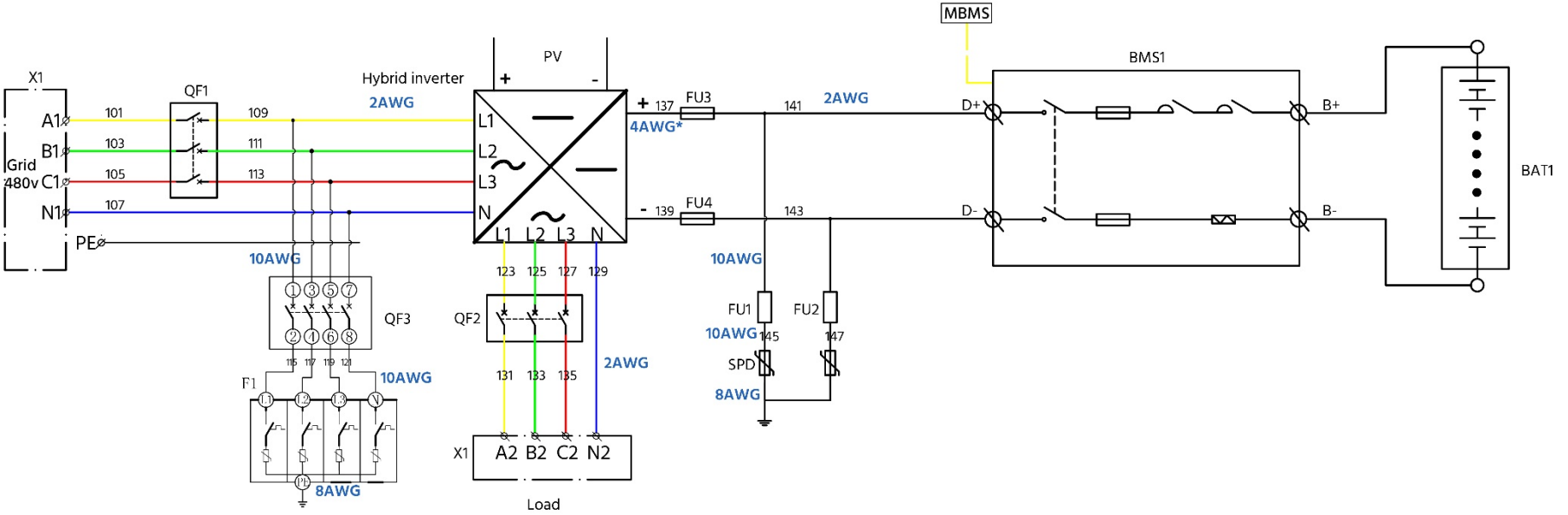
### 2.2.1 Diagram for 30kW System




* There are **two** 4AWG wires in parallel to each DC input of the Sol-Ark 30K-3P-208V.

***NOTE:***
Cable specifications must meet the US standard, phase A black, phase B red, phase C blue, phase N white, ground cable light green or yellow-green , positive red, negative black.
Please refer to **Annex 1 Diagrams of 30K-3P-208V Inverter: Diagram 1** for details.

| External Control Power Supply | | | PV Side | | | | |
|---|---|---|---|---|---|---|---|
| Control Supply<br>~ AC 480 V power supply | MCCB<br>( Molded Case Circuit Breaker) | SPD<br>(Surge Protection Device) | PCS | Main Fuse | SPD<br>(Surge Protection Device) | BMS | BAT |




* There are **two** 4AWG wires in parallel to each DC input of the Sol-Ark 60K-3P-480V.

***NOTE:***

Cable specifications must meet the US standard, phase A black, phase B red, phase C blue, phase N white, ground cable light green or yellow-green , positive red, negative black.

Please refer to **Annex 1 Diagrams of 60K-3P-480V Inverter**: **Diagram 1** for details.

## 2.3 Introduction of the Inverter System

### 2.3.1 Products Descriptions

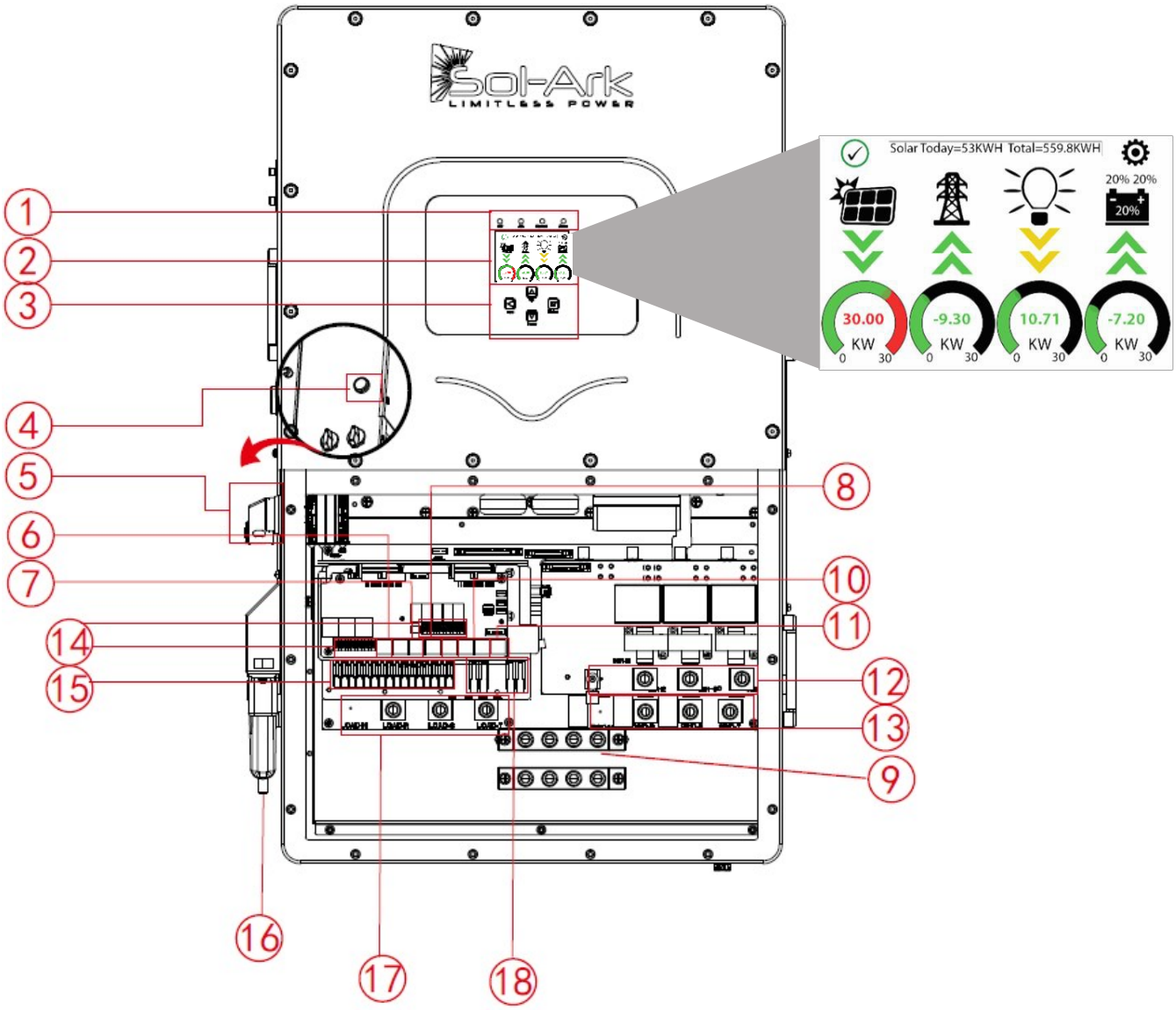
Sol-Ark Series inverters are especially designed for commercial customers.

The systems described in this manual include the following two types of inverters:

- **30K-3P-208V**
- **60K-3P-480V**

The two model's appearances look the same as follows.


### 2.3.1.1 Inverter Components (30K-3P-208V/60K-3P-480V)



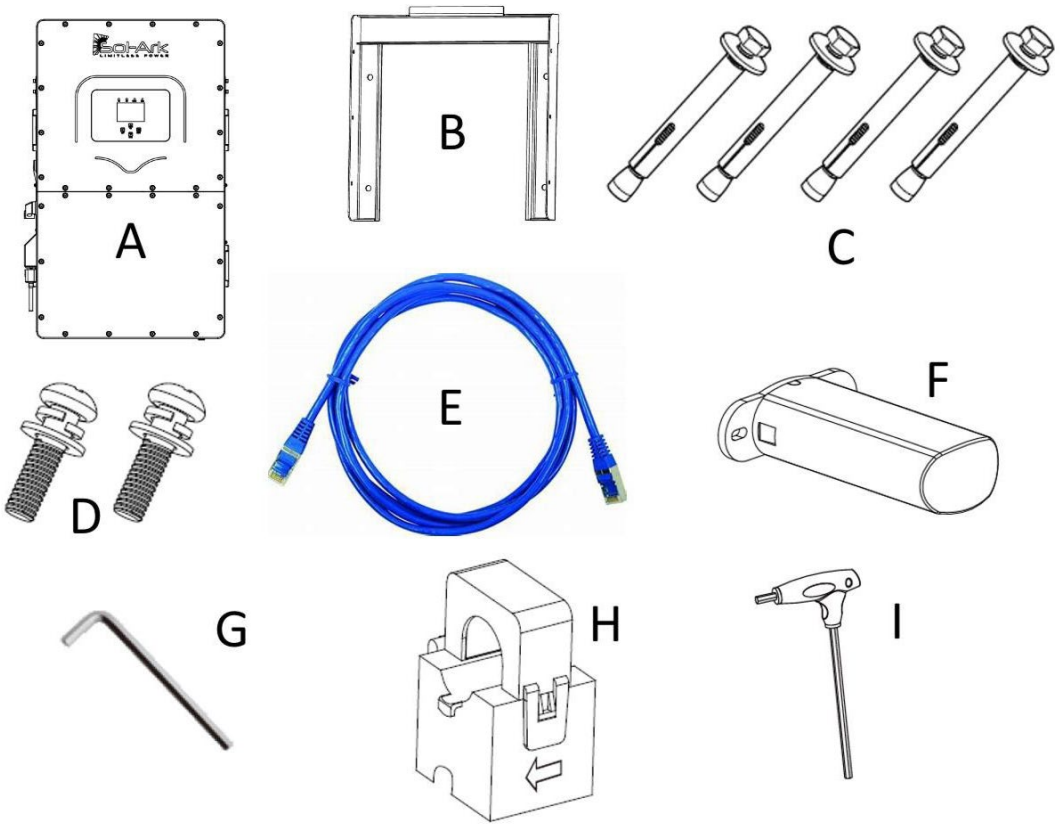

| | | | | | |
|---|---|---|---|---|---|
| 1. | Inverter Indicators | 2. | LCD Display (Touch) | 3. | Function Buttons |
| 4. | ON/OFF Button | 5. | 2 x PV Disconnect | 6. | Meter Port (optional) |
| 7. | Parallel Port | 8. | CAN Port | 9. | Ground / Neutral Bars |
| 10. | BMS Port | 11. | RS485 Port | 12. | Generator Input |
| 13. | Grid Connection | 14. | Function Port | 15. | PV Input MPPTs |
| 16. | Wi-Fi Interface | 17. | Load Connection | 18. | Battery Connections |

### 2.3.2 Packing List

**30K-3P-208/60K-3P-480 Packing list:**
Make sure the following items are included in your package:

| Model | 30K-3P-208V | 60K-3P-480V |
|---|---|---|
| A | Sol-Ark 30K-3P-208V inverter (x 1) | Sol-Ark 60K-3P-480V inverter (x 1) |
| B | Mounting Bracket: For wall mounting the inverter (x 1) | |
| C | Bolts M12x60 (x 4) | |
| D | Bolts M4x12 (x 9) | |
| E | CAT 5 cable for parallel communications (x 2) | |
| F | WIFI Dongle: For software updates and remote monitoring (use M4x10 screws to hold in) | |
| G | L-Type Hex Key (3mm): For opening and closing the user wiring area (x 1) | |
| H | Included Limiter Sensors: 1 3/8" CT sensors (x 3)<br>[Larger sensors available: email sales@sol-ark.com] | |
| I | T-Type Hex Key: For tightening the AC connections (x 1) | |

If there are any missing parts, please contact your local retailer.



### 2.3.3 Specifications

#### 2.3.3.1 Parameters of the Inverter System

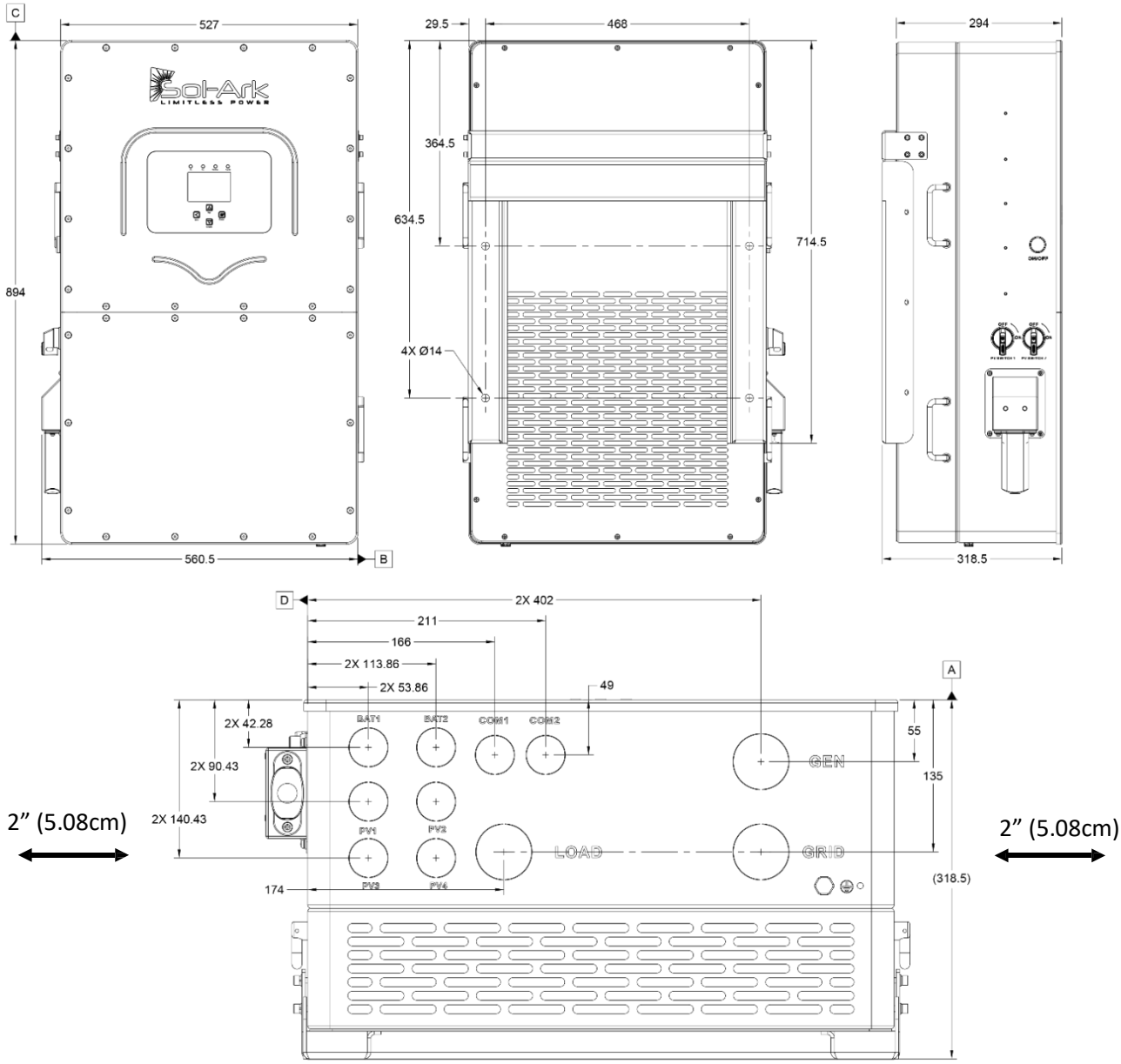
| Models | 30K-3P-208V | 60K-3P-480V |
|---|---|---|
| **Solar Input power(W)** | 39,000 | 78,000 |
| Max Allowed PV Power (W) | 39,000 | 78,000 |
| Max PV Power delivered to Battery & AC outputs | 30,000 | 60,000 |
| Max DC Voltage (VOC) | 500V@36A | 1,000V@36A |
| MPPT Voltage Range(V) | 170~500 | 200~850 |
| Starting voltage(V) | 150 | 180 |
| Number of MPPTs (pc) | 4 | 4 |
| Max Solar Strings Per MPPT (pc) | 2 | 2 |
| Max DC Current Per MPPT(A) (Self Limiting) | 36 | 36 |
| Max AC Coupled Input into the GEN terminal (Micro/String inverters) | 54kW w/no PV*<br>30KVA w/39kW PV dc | 120VA w/no PV*<br>60KVA w/78kW PV dc |
| **AC Output Power(W) (On & OFF-Grid)** | 30,000 | 60,000 |
| Connections | 120V/208V Three Phase | 277/480V Three Phase |
| Continuous AC Power with PV(W) | 30,000 (@3.4A/208V) | 60,000 (@72.2A/480V) |
| Continuous AC Power from Batteries(W) | 30,000 (@83.4A/208V) | 60,000 (@72.2A/480V) |
| Surge AC Power@7sec (VA) | 45,000(@125A/208V) | 120,000(144.4A*277*3) |
| Parallel Stacking (qty.) | Up to12 | Up to12 |
| Frequency (Hz) | 60 | 60 |
| Continuous AC Power with Grid or Generator(W) | 72,000(200A L-L 208V)<br>36,000(200A L-N 120V) | 132,000<br>(160A L-N(277V) |
| CEC Efficiency (%) | 96.5(97.5 peak) | 96.5(97.5 peak) |
| Idle Consumption Typical-No Load (W) | 60 | TBD |
| Sell Back Power Modes | Limited to Household/<br>Fully Grid Tied | Limited to Household/<br>Fully Grid Tied |
| Design (DC to AC) | Transformerless DC | Transformerless DC |
| Response Time (Grid Tide to Off-Grid) (ms) | 5 | 5 |
| Power Factor | +/-08. ~1.0 | +/-08. ~1.0 |
| **Battery Output Power (W)** | 30,000 | 60,000 |
| Type/Number of Inputs | Li-ion/2 inputs | Li-ion/2 inputs |
| Nominal DC input(V) | >300 | >600 |
| Capacity (Ah) | 50~9,900 | 50~9,900 |
| Voltage Range(V) | 150~500 | 160~800 |
| Continuous Battery Charging Output(A) (50A per Input) | 100 | 100 |
| Charging Curve | 3-Stage w/Equalization | 3-Stage w/Equalization |
| Grid to Batt Charging Efficiency (%) | 96.0 | 96.0 |
| Batter Fuse | Integrated | Integrated |
| Current Shunt for Accurate% SOC | Integrated | Integrated |
| External Gen Start Based on Voltage or % SOC | Integrated | Integrated |
| Communication to Lithium Battery (Under closed-Loop Communications | Can Bus & RS485 | Can Bus & RS485 |

| Models | 30K-3P-208V | 60K-3P-480V |
|---|---|---|
| **General** | | |
| Dimensions(H*W*D) | 35.2*20.8*11.6(inch)<br>89.4*52.83*29.46(cm) | |
| Weight | 172(lbs)<br>78(kg) | |
| Enclosure | IP65/NEMA 3R | |
| Ambient Temperature(°C) * | -40~60 | |
| Installation Style | Wall-Mounted | |
| Wi-Fi & LAN Communication | Included | |
| Standard Warranty (year)<br>(verified by HALT Testing) | 10 | |
| **Protections & Certifications of Inverter (30K-3P-208V/60K-3P-480V)** | | |
| Certifications | TÜV Rheinland | Pending |
| Safety Standard | UL1741-2021 3rd Edition (incl UL1741SB),<br>CSA C22.2, IEEE 1547-2018&1547a-2020&1547.1-2020, UL1699B Arc-Fault Circuit-protection Type 1 | Pending |
| PV DC Disconnect Switch-NEC 240.15 | Integrated | Integrated |
| Ground Fault Detection-NEC 690.5 | Integrated | Integrated |
| PV Rapid Shutdown Control- NEC 690.12 | Integrated | Integrated |
| PV Arc Fault Dection-NEC690.11 | Integrated | Integrated |
| PV Input Lightning Protection | Integrated | Integrated |
| PV String Input Reverse Polarity Protection | Integrated | Integrated |
| Surge Protection | DC Type II/ AC Type II | DC Type II/ AC Type II |

* >45°C derating

### 2.3.3.2 Dimensions of the Inverters

Both the two model's dimensions are the same as follows:




**2" Minimum Horizontal Clearance | 6" Minimum Vertical Clearance**

| **Temperature Derating** |
|---|
| DC: 90C-100C Shutdown @ 100C |
| AC: 75C-82C Shutdown @ 82C |

### 2.3.3.3 Torque Values Application Note

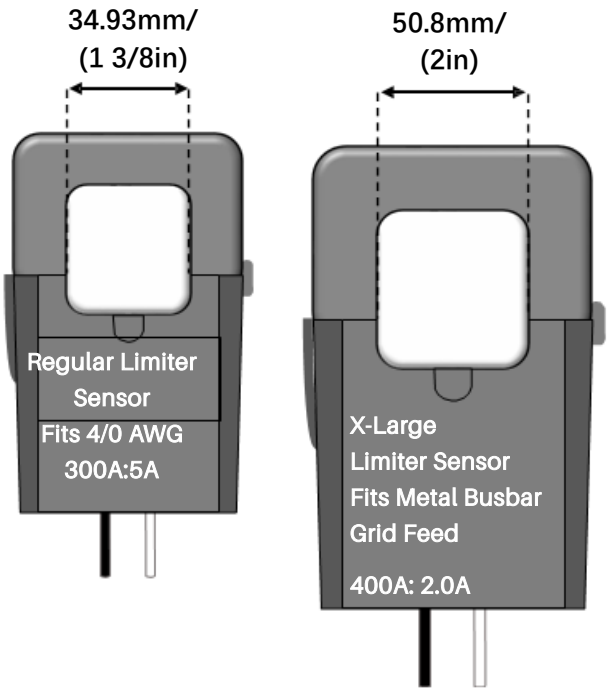
| Model Sol-Ark 30K-3P-208V/ Sol-Ark 60K-3P-480V | | |
|---|---|---|
| Load Terminal Block | 62 IN Lbs | 7 NM |
| Grid Terminal Block | 62 IN Lbs | 7 NM |
| Gen Terminal Block | 62 IN Lbs | 7 NM |
| Neutral / Ground Bus bars | 62 IN Lbs | 7 NM |
| Cover Screws | 15.5 IN Lbs | 1.75 NM |
| Battery Connection | Hand-Pressed Actuation Lever | Hand-Pressed Actuation Lever |

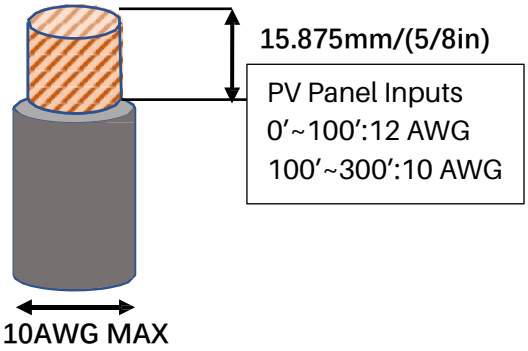
**Warning: DO NOT use Impact Drivers to Tighten Any Fasteners on the Sol-Ark**

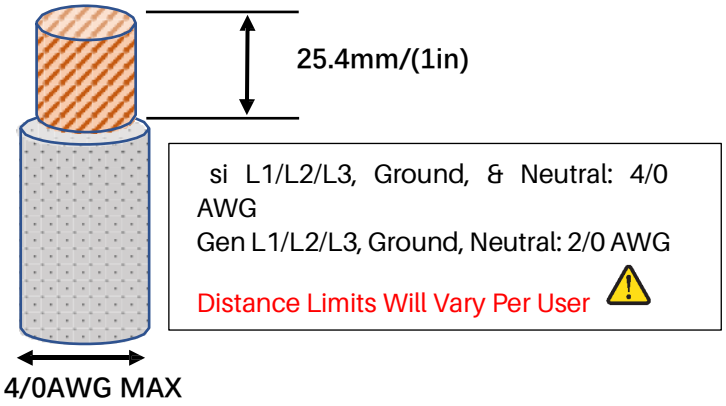
**Avertissement:** NE PAS utiliser de tournevis à percussion pour serrer les fixations du Sol-Ark.

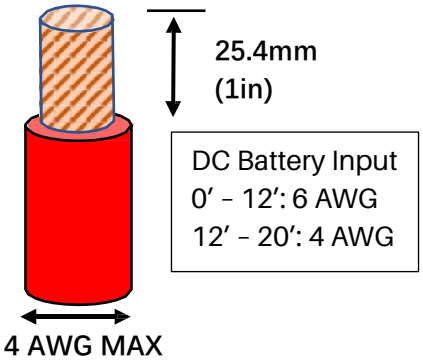
### 2.3.4 Wire Gauge Guide (Copper)

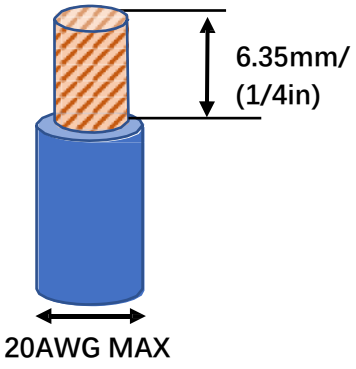
| | |
|---|---|
| PV input | 12 - 10 AWG |
| AC Inputs/Outputs | 1/0 AWG - 4/0 AWG |
| All Sensors | 20 – 24 AWG |
| CT Sensors | 10' Wire Included |
| Batt Temp Sensor | 6' Wire Included |
| RJ45 Cable | 7' Included (Extendable up to 20') |
| Battery input | 6 – 4 AWG (Hand-Tightened Actuation Lever) |




All Sensor Inputs
0' – 100': 24 AWG (Do NOT use > 20AWG)
100' – 400': 23 AWG CAT 6
CT Wires Can Be Extended -Extensions for Limiter Sensors must be twisted pair (See the inverter separate manual for details.)

**(Shielded CAT6 Recommended)**

### 2.3.5 Wiring Diagrams

***NOTE,*** Please see the *Annex 1: Diagrams of 30K-3P-208V Inverter* and *Annex 2: Diagrams of 60K-3P-480V Inverter* for detailed wiring diagrams. Those Wiring Diagrams are examples of common-use cases for Sol-Ark inverters.

Sol-Ark does not provide custom diagrams; however, you may contact support@sol-ark.com for any questions about existing Wiring Diagrams.

## 2.4 Introduction of the Battery System

### 2.4.1 Product Introduction

PowerCube-M1-C, a high voltage battery storage system based on lithium iron phosphate battery, is one of the new energy storage products developed and produced by Pylontech. It can be used to provide reliable power for various types of equipment and systems. PowerCube-M1-C is especially suitable for application scene of high-power output, limited installation space, restricted load-bearing and long cycle life.

### 2.4.2 Accessories Package list of the Battery System

#### 2.4.2.1 Accessories Package list for 10 pcs of M1C battery modules [complied with1pc of 30K-3P-208V Inverter (30KW)]) (For one string)

**NOTE: If for two strings parallel, the quantity shall x(multiply) 2**

| **A. Internal Cable Kits** | | |
|---|---|---|
| Item | Description | QTY. |
| (1) | M1C Power Cable + (Battery Module and Main Controller Serial Connection) (0.19m) | 1 |
| (2) | M1C Power Cable - (Battery Module and Main Controller Serial Connection) (0.32m) | 1 |
| (3) | M1C Power Cable (Battery Module Upper and Lower Serial Connection) (0.24m) | 9 |
| (4) | M1C Power Cable (Battery Module Left and Right rack Serial) (0.35m) | 1 |
| (5) | Battery Cascade Communication Cable (0.18m) | 10 |
| (6) | Battery Cascade Communication Cable (0.5m) | 1 |
| (7) | M6 Screw | 48 |
| (8) | M6L16 nail | 48 |
| **B. External Cable Kits** | | |
| (1) | AC Power Cable (Australia Standard) | 1 |
| (2) | M1C- External Power Cable+(5m) | 1 |
| (3) | M1C- External Power Cable-(5m) | 1 |
| (4) | External Battery CAN Communication Cable (3.5m) | 1 |

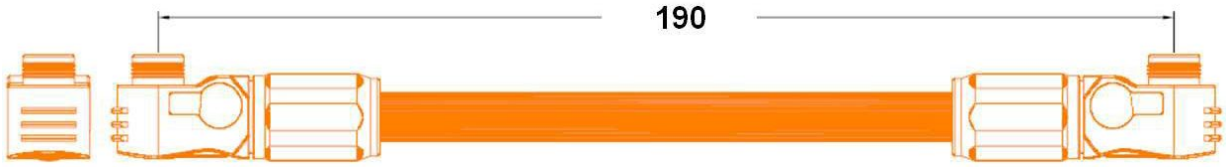
**NOTE**

Power cable uses water-proof connectors. Keep pressing this Lock Button during pulling out the power plug.

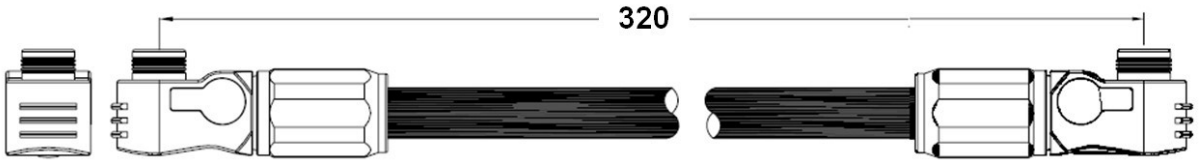
Unpacking and check the Accessories Packing List:

**A. Internal Cable Kits for wiring connection up to Battery Controller**

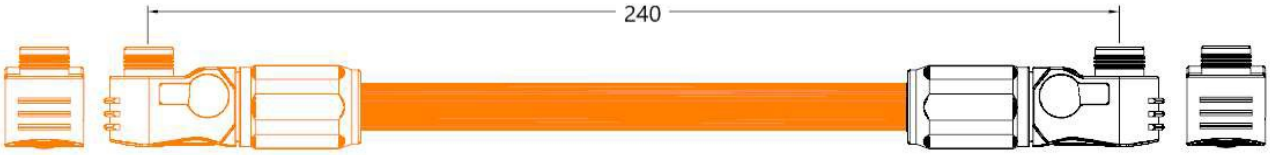
| | | |
|---|---|---|
| (1) Power Cable + (Battery Module and Main Controller Serial Connection) | Orange/0.19m/1/0AWG/ 2 Orange Terminal | 1pc |



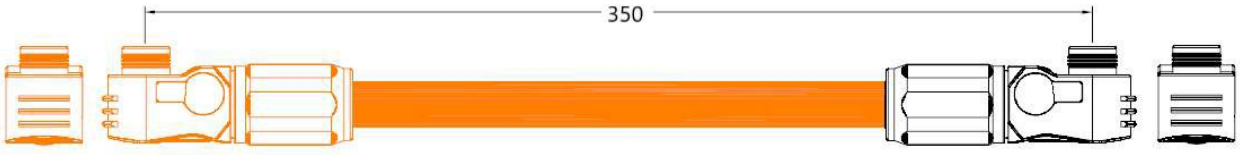

| | | |
|---|---|---|
| (2) Power Cable - (Battery Module and Main Controller Serial Connection) | Black/0.32m/1/0AWG /2 Black Terminal | 1pc |



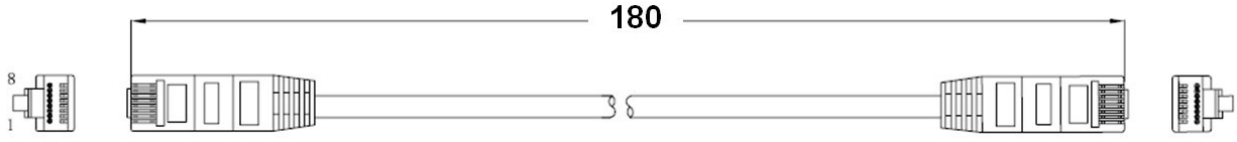

| | | |
|---|---|---|
| (3) Power Cable (Battery Module Upper and Lower Serial Connection) | Orange/0.24m/1/0AWG /Orange & 1 Black Terminal | 9 pcs |



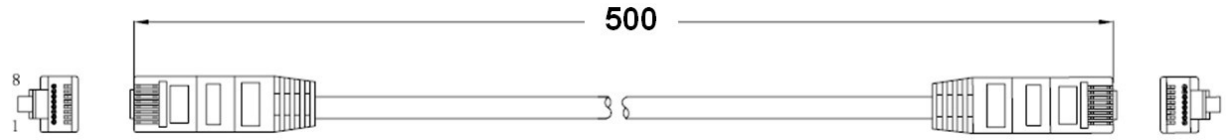

| | | |
|---|---|---|
| (4) Power Cable (Battery Module Left and Right rack Serial | Orange/0.35m/1/0AWG /1Orange & 1 Black Terminal | 1pc |




| | | |
|---|---|---|
| (5) Battery Cascade Communication Cable (0.18m) | Black/0.18m/8 Core Super 5th Class Twisted pair Wire/RJ45 | 1pc |



| | | |
|---|---|---|
| (6) Battery Cascade Communication Cable (0.5m) | Black/0.5m/8 Core Super 5th Class Twisted-pair Wire/RJ45 | 1pc |



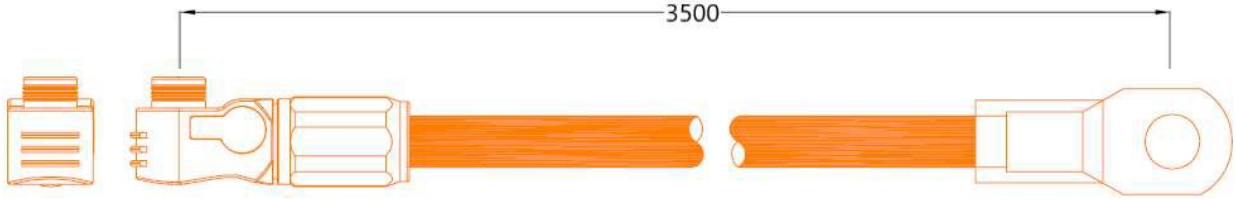

**B. External Cable Kit for wiring connection from Battery Controller to INVERTER/EMS/Power Supply**

**NOTE**

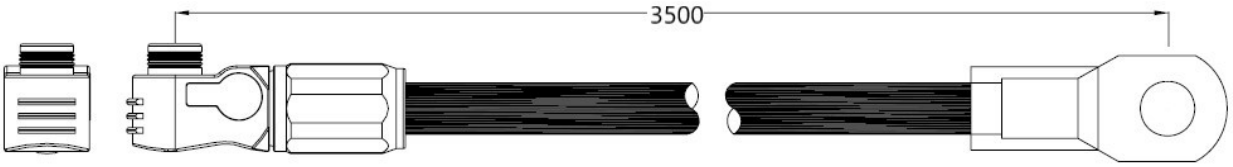
External Cable Kits for wiring connection are available in four lengths,3.5m/5m/7m/10m.

External Cable Kits is a separate kit externally from the battery or control module packaging.

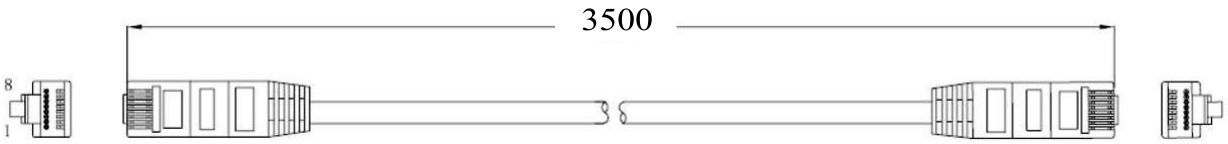
| | | |
|---|---|---|
| (1) External Power Cable+ | Orange/3.5m/1/0AWG/ Phoenix Terminal/50-8 Terminal | 1pc |




| | | |
|---|---|---|
| (2) External Power Cable- | Black/3.5m/1/0AWG /Phoenix Terminal/50-8 Terminal | 1pc |




| | | |
|---|---|---|
| (3) External Battery CAN Communication Cable (direct) | Black/3.5m/Super 5th Class Twisted- pair Wire/2 RJ45 terminal | 1pc |



### 2.4.2.2 Accessories Package list for 21 pcs of M1C battery modules [complied with1pc of 60K-3P-480V Inverter (60KW)] (for one string only)

| C. Internal Cable Kits | | |
|---|---|---|
| Item | Description | QTY. |
| (1) | M1C Power Cable + (Battery Module and Main Controller Serial Connection) (0.19m) | 1 |
| (2) | M1C Power Cable - (Battery Module and Main Controller Serial Connection) (0.32m) | 1 |
| (3) | M1C Power Cable (Battery Module Upper and Lower Serial Connection) (0.24m) | 20 |
| (4) | M1C Power Cable (Battery Module Left and Right rack Serial) (0.35m) | 1 |
| (5) | Battery Cascade Communication Cable (0.18m) | 21 |
| (6) | Battery Cascade Communication Cable (0.5m) | 1 |
| (7) | M6 Screw | 92 |
| (8) | M6L16 nail | 92 |
| **D. External Cable Kits** | | |
| (1) | AC Power Cable (Australia Standard) | 1 |
| (2) | M1C- External Power Cable+(5m) | 1 |
| (3) | M1C- External Power Cable-(5m) | 1 |
| (4) | External Battery CAN Communication Cable (3.5m) | 1 |

***Note:*** The cables specifications are the same as *Section 2.4.2.1,* only differs in **quantities.**

### 2.4.3 Parameters of the Single Battery System

| Product Type | PowerCube-M1-C(30kW) | PowerCube-M1-C(60kW) |
|---|---|---|
| Controller Type | SC1000-200J-C | |
| Battery Module Type | H32148-C | |
| Nominal Voltage (VDC) | 32 × n (where n = 10~14) | 32 × n (where n = 14~21) |
| Rated Capacity (Ah) | 148 | 148 |
| Total Storage Energy (kWh) | 4.736 × n (where n = 10~14) | 4.736 × n (where n = 14~21) |
| Charge Upper Voltage (VDC) | 36 × n (where n = 10~14) | 36 × n (where n = 14~21) |
| Discharge Lower Voltage (VDC) | 27 × n (where n = 10~14) | 27 × n (where n = 14~21) |
| Nominal Current (Amps) | 74 | |
| Max. Continuous Current (Amps) | 148 | |
| Peak Current (Amps) | 220@15 seconds | |
| Over Current/Duration (Amps/ms) | 8000/2 | |
| IP Rating/Protection Class | IP20/I | |
| Operation temp. range(°C) | 10 ~ 40 | |
| Communication type | CANBUS/Modbus RTU/TCP/IP | |
| Storage temp. range(°C) | -20 ~ 60 | |
| Humidity (%) | 5 – 95 (without condensing) | |
| Round-trip efficiency (%, @1C-rate) | 95 | |
| Depth of Discharge (%) | 95 | |
| Dimensions(mm) | 815(W)x 659(D)x 213(H) | |
| Weight (kg) | 114+ 43×n (where n = 10~14) | 114+ 43×n (where n = 14~21) |
| Operation cycle life (cycle)* | >5,000 | |
| Operation Life(year) | 15+ | |
| IP rating | IP20 | |
| Cooling type | Natural cooling | |
| Altitude [m] | <2,000 | |
| Certifications | UL1973, UL9540A, IEC62477-1, IEC62040-1, IEC62619, IEC63056, UKCA, CE LVD, CE EMC, UN38.3, VDE-AR-E 2510-50 | |

*Cycle life is defined based on specific operation conditions, for more details please check with Pylontech service team.

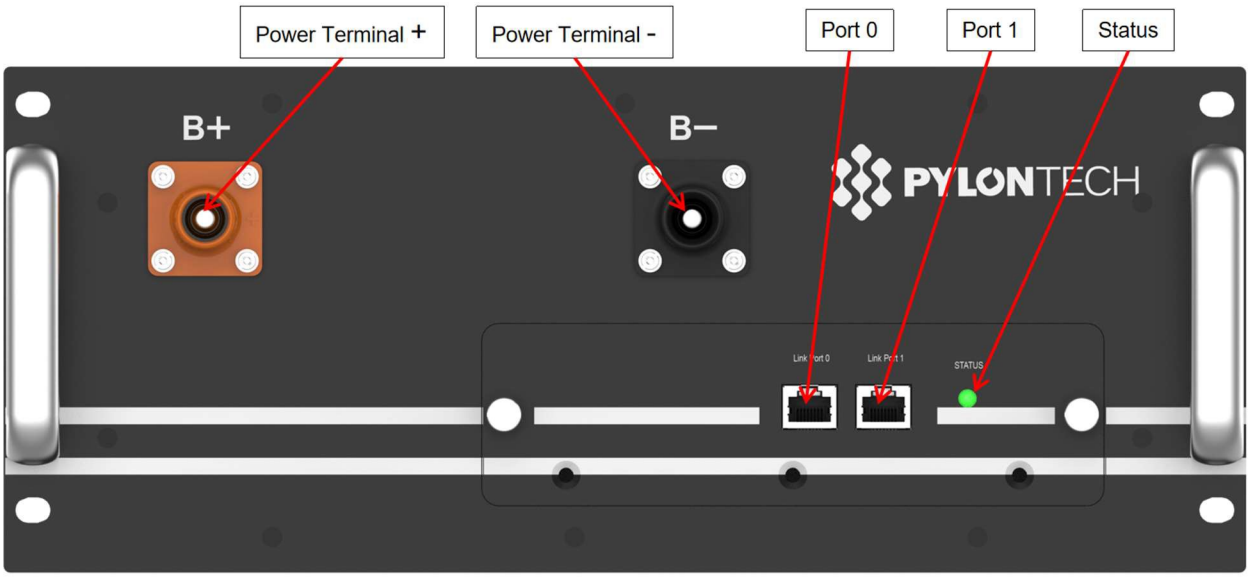
### 2.4.4 Battery Module (H32148-C)


#### 2.4.4.1 Parameters of the Battery Module

| Product Type | H32148-C |
|---|---|
| Cell Technology | Li-ion (LFP) |
| Battery Module Capacity (kWh) | 4.736 |
| Battery Module Voltage (VDC) | 32 |
| Battery Module Capacity (AH) | 148 |
| Dimension (W x D x H, mm) | 330×628×150.5 |
| Protection Class | IP20 |
| Weight (kg) | 43 |
| Operation Cycle Life (cycle)* | 5,000 |
| Operation Temperature(°C) | 0~50 |
| Storage Temperature(°C) | -20~60 |
| Transportation Certificate | UN38.3 |

*Cycle life is defined based on specific operation conditions, for more details please check with Pylontech service team.

### 2.4.4.2 Front Interface of the Battery Module




**Power Terminals +/-**

Connect battery series power cables.

**Status**

Status LED shows the battery module's status (Normal●, Abnormal●).

**Link Port 0, 1**

Link Port 0, 1 Communication Terminal: (RJ45 port), CAN communication, between multiple serial battery modules and control module.

**Power Terminals**

Power cable terminals: there are two pair of terminals with same function, oneconnecting to equipment, the other one paralleling to other battery module forcapacity expanding. For each single module, each terminal can achieve chargingand discharging function.
AS power cables uses water-proofed connectors, it must keep pressing this LockButton during pulling out the power plug.

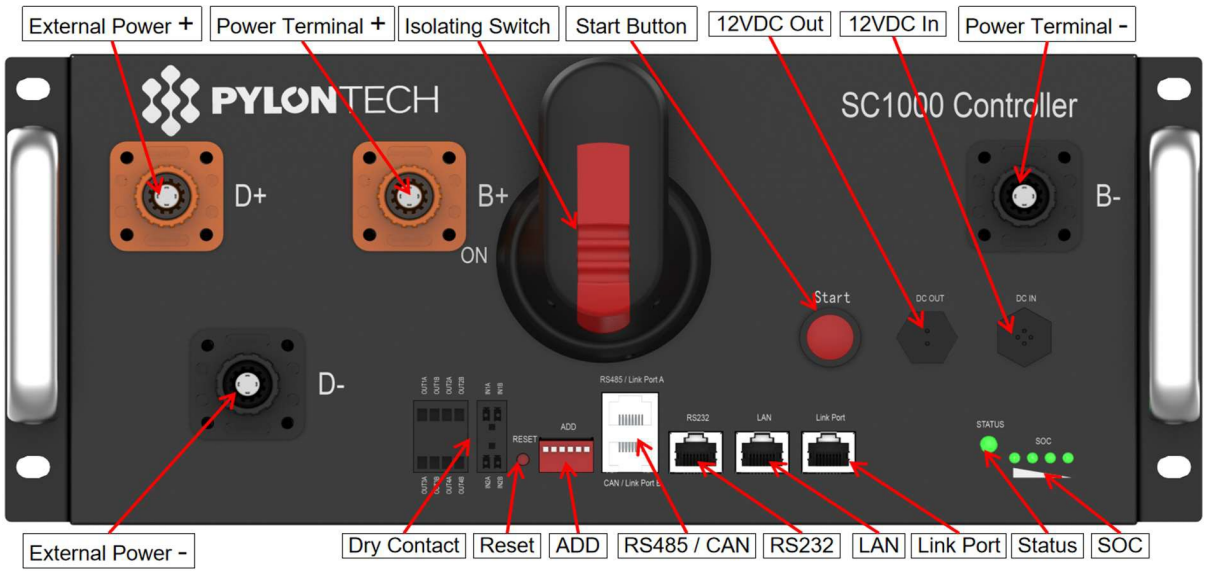
### 2.4.5 Control Module


SC1000-200J-C

#### 2.4.5.1 Parameters of the Control Module

| Product Type | SC1000-200J-C |
|---|---|
| Related Product | M1-C |
| AC Supply for BMS | N/A |
| System Operation Voltage (VDC) | 0~1000 |
| Operation Current (Max.) (A) | 148 |
| Self-consumption Power-Relay Off (W) | 6 |
| Self-consumption Power-Relay On(W) | 15 |
| Dimension (W*D*H, mm) | 330×628×150.5 |
| Communication | MODBUS RTU\CAN\LAN |
| Protection Class | IP20 |
| Weight(kg) | 13 |
| Operation Life (year) | 15+ |
| Operation Temperature(°C) | -20~65 |
| Storage Temperature(°C) | -40~80 |

### 2.4.5.2 Control Module (SC1000-200J-C) Front Interface




**External Power Terminals D+/D-**

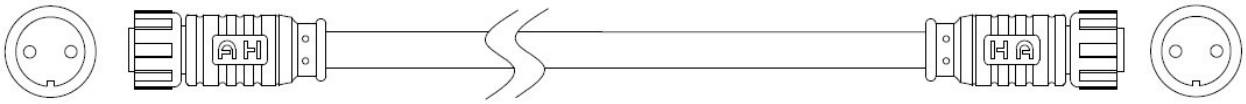
Connect battery system with Inverter.

**Power Terminals B+/B-**

Connect battery power cables in series.

**12VDC Out**

Power supply for MBMS, connects with MBMS' 12VDC IN.



**12VDC In**

In: Back-up 12VDC power supply port.

**Isolating Switch**

Controls the BMS power supply and high voltage DC power output.

**Start Button**

Start function: Keep pressing more than 5 seconds until the buzzer rings, to turn on the control module.


Black start function: If long press (>10 seconds) the start button 30 seconds AFTER the control module powers on. The "STATUS" LED will turn green which means black start function is enabled, and relay will close and output for 10 minutes.

## Dry Contact Terminals

Provides 2 input and 4 output dry contact signal.

## Reset

Reset Button: Long press this button to restart the battery system.

## ADD

ADD: 6-bit dial switches to manually distribute the communication address of the battery system. Down position is OFF, means "0". Upper position is ON, means "1". 1st bit to 5th bits are for address, and the 6th bit dial switch supports a 120Ω resistance.

## CAN / RS485

CAN Communication Terminal: (RJ45 port) follows CAN protocol, for communication between battery system and inverter.

RS485 Communication Terminal: (RJ45 port) follows Modbus RTU/TCP/IP protocol, for communication between battery system and inverter.

## RS232 Terminal

Console Communication Terminal: (RJ45 port) follows RS232 protocol, for manufacturer or professional engineer to debug or service.

## LAN Terminal

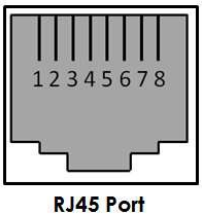
Console Communication Terminal: (RJ45 port) follows Modbus protocol, used for communication betweenMBMS, switches or upper controller.

## Link Port

Link Port Communication Terminal: (RJ45 port) follows RS485 protocol, for communication between multiple serial battery modules and the control module.

Definitions of RJ45 Port Pin

| No. | CAN | RS485 | RS232 |
|---|---|---|---|
| 1 | --- | --- | --- |
| 2 | GND | --- | --- |
| 3 | --- | --- | TX |
| 4 | CANH | --- | --- |
| 5 | CANL | --- | --- |
| 6 | --- | GND | RX |
| 7 | --- | RS485A | --- |
| 8 | --- | RS485B | GND |



RJ45 Port

RJ45 Plug

## Status LED

Status light: to show the battery module's status (RUN●, Alarm and Protection●).

## LED Status Indicators

Battery capacity indicator: 4 green lamps, each light represents 25% capacity. LED Indicators Instructions

**LED Indicators Instructions**

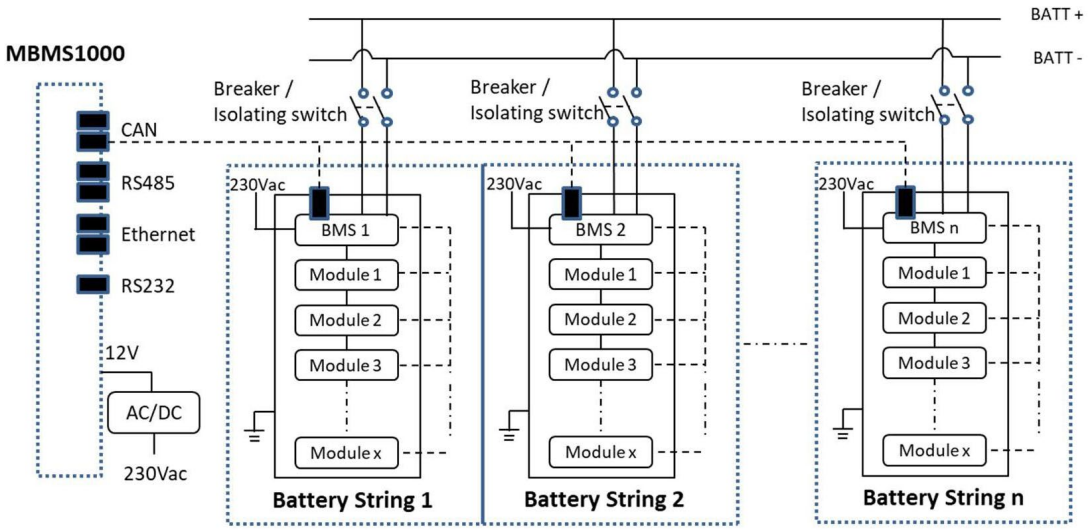
| Battery Status | Protection / Alarm / Normal | STATUS (green) | STATUS (red) | Capacity SOC | | | | Descriptions |
|---|---|---|---|---|---|---|---|---|
| | | ● | ● | ● | ● | ● | ● | |
| Shut Down | | Off | Off | Off | Off | Off | Off | All off |
| Sleep | Normal | Flash1 | Off | Off | Off | Off | Off | Indicates Sleep Mode, to save the power. |
| Idle | Normal | Light | Off | Off | Off | Off | Off | Indicates Save Power Mode. |
| | Alarm | Light | Off | Off | Off | Off | Off | Indicates the battery voltage or temperature is high or low. |
| | Protection | Off | Light | Off | Off | Off | Off | Indicates the battery voltage or temperature is over or under. |
| Charge | Normal | Light | Off | The highest capacity indicator LED flashes (flash 1), others lighting | | | | The highest capacity indicator LED flashes (flash 1), others lighting, horse race lamp when SOC＞= DODH; |
| | Alarm | Light | Off | | | | | |
| | Protection | Off | Light | Off | Off | Off | Off | Stop charging, STATUS (red) lighting |
| Discharge | Normal | Flash2 | Off | Indicates based on capacity | | | | Indicate based on capacity |
| | Alarm | Flash2 | Off | | | | | |
| | Protection | Off | Light | Off | Off | Off | Off | Stop discharging, STATUS (red) lighting |
| Abnormal | Power On Fault | Off | flash 2 | Off | Off | Off | Off | Stop charging/discharging, STATUS (red) lighting |
| | Other Fault | Off | Light | Off | Off | Off | Off | |
| | STL Fault | Off | flash 1 | flash 2 | | | | MCU self-check problem |

The flashing instructions:

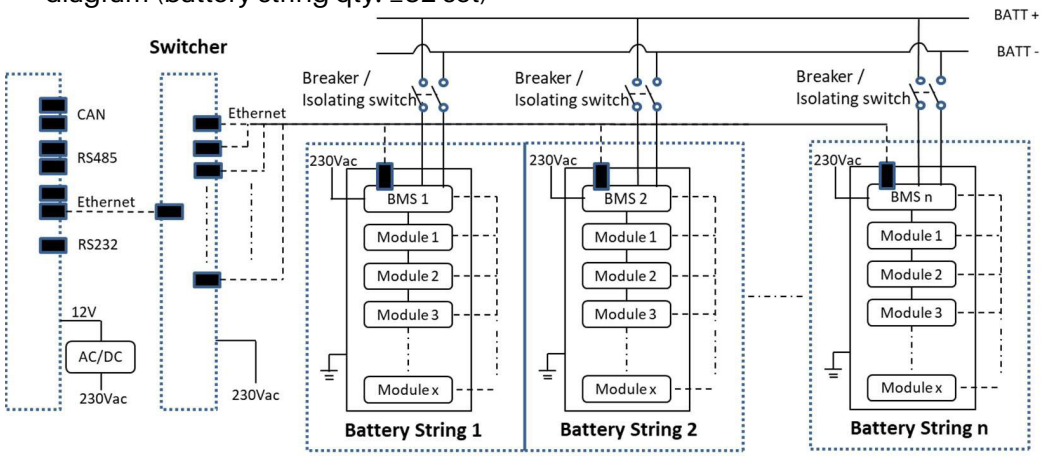
- flash 1 - 0.5 seconds light / 0.5 seconds off.
- flash 2 – 1 second light / 1 second off.

### 2.4.6 System Diagram

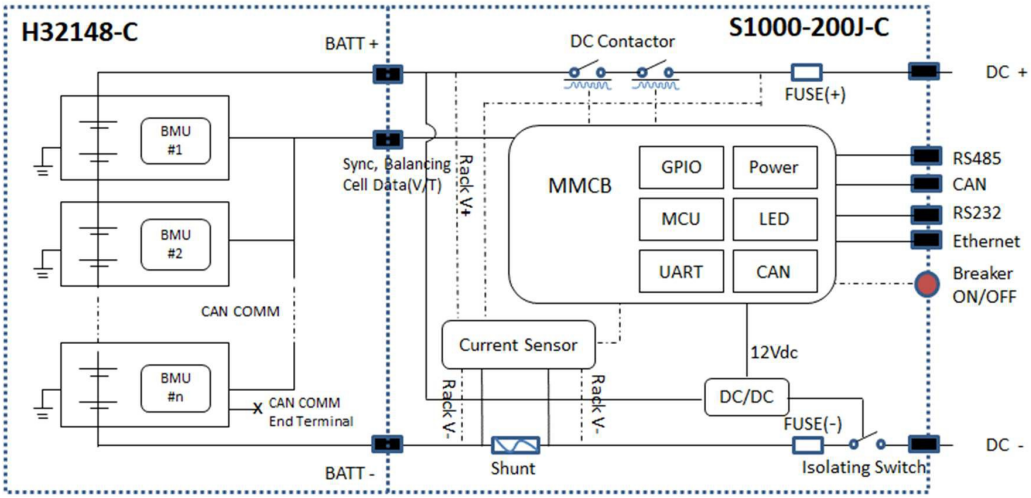
#### 2.4.6.1 Multiple battery string in parallel connection by CAN communication between MBMS and BMS diagram (battery string qty. ≤6)




#### 2.4.6.2 Multi battery string in parallel connection by Ethernet communication between MBMS and BMS diagram (battery string qty. ≤32 set)

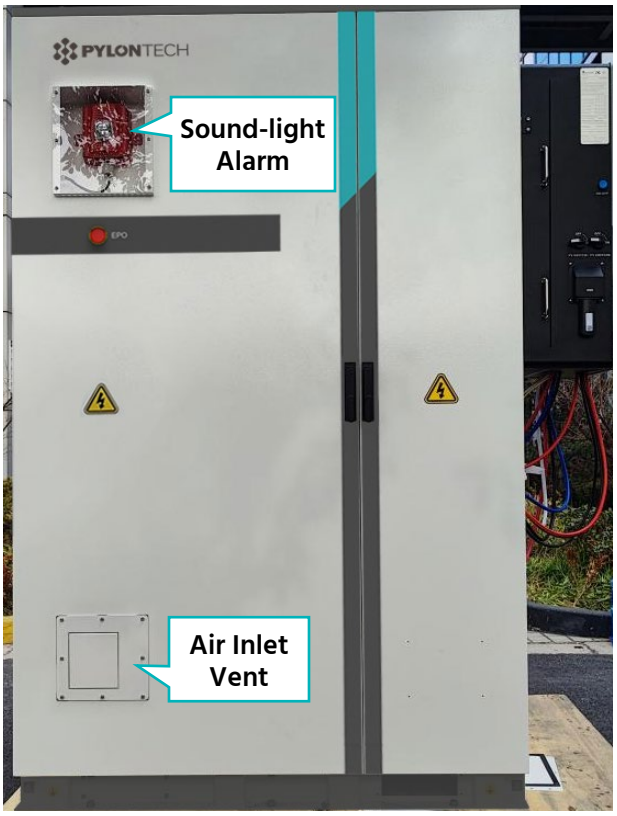


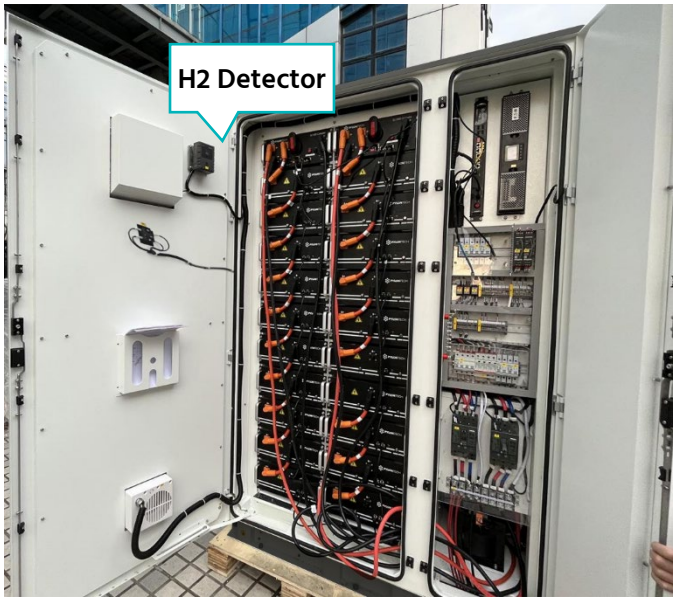

#### 2.4.6.3 Diagram between BMS and battery modules (internal power supply):



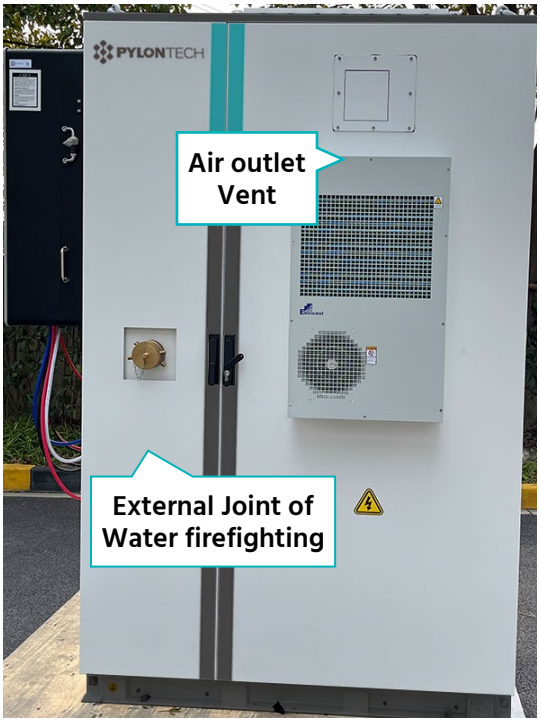
## 2.5 Safety Features Installed with the System

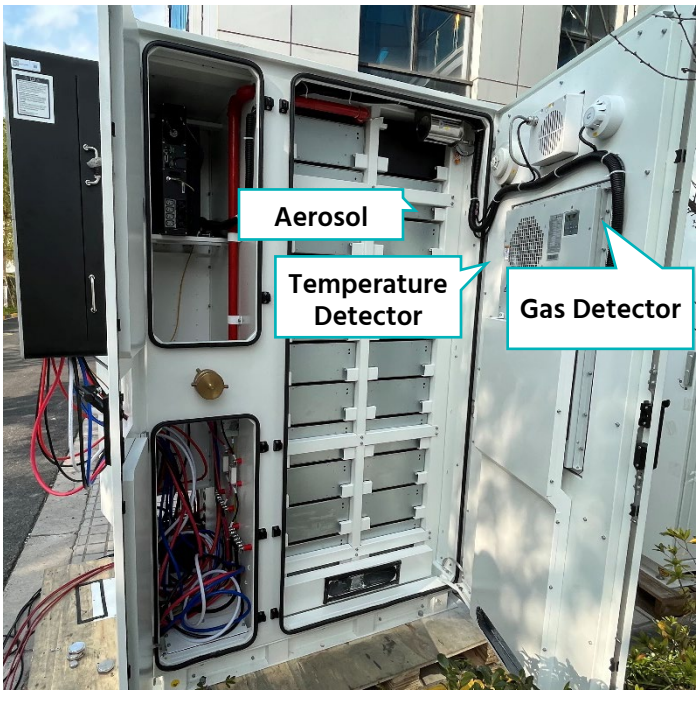
This system is equipped with the safety features, e.g. fire suppression system, smoke detector, temperature detector, gas detector, blow vent (air inlet vent and outlet vent), battery system over temperature protection, etc. When a fire or other emergency occurs or the temperature reaches certain point, aerosols will be released from the fire extinguisher to suppress the fire. At the same time, the fire alarm will sound until the system is powered off.




View of the Front Door

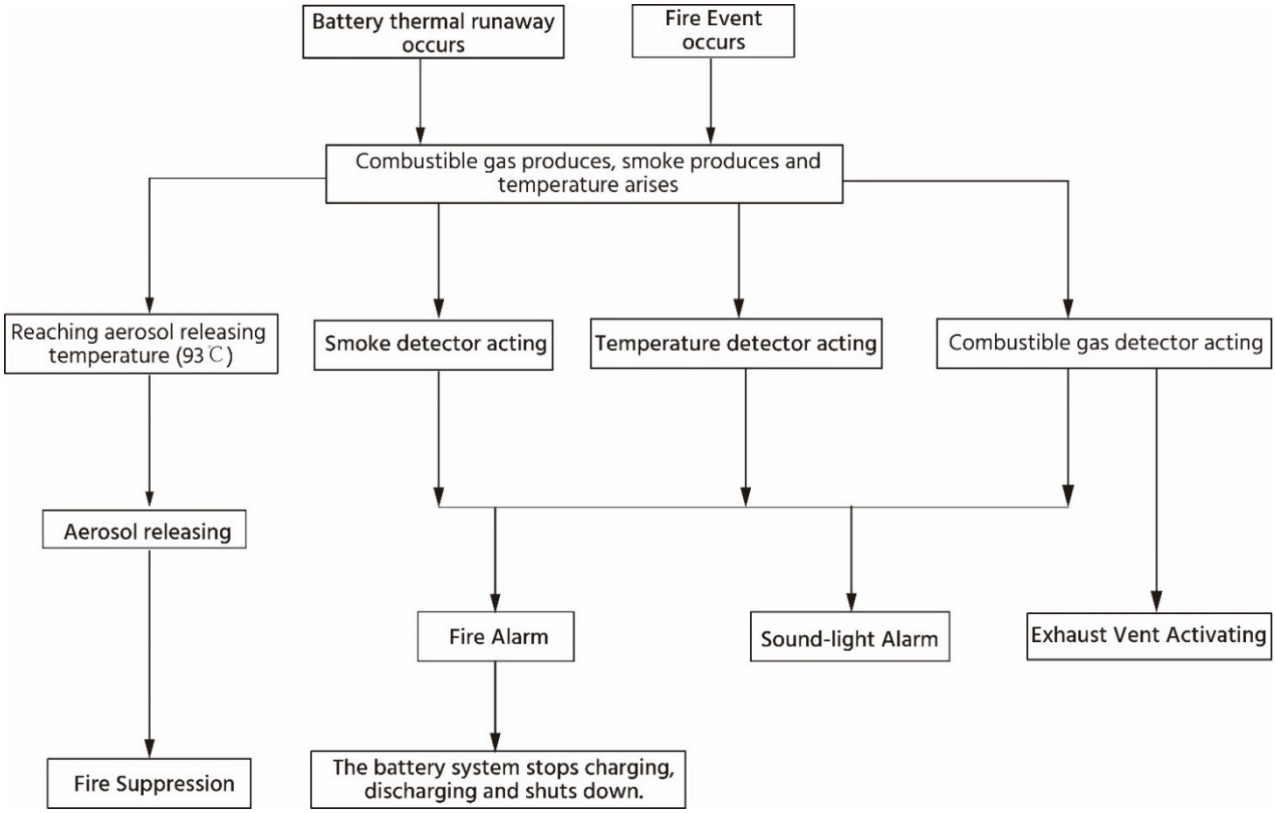


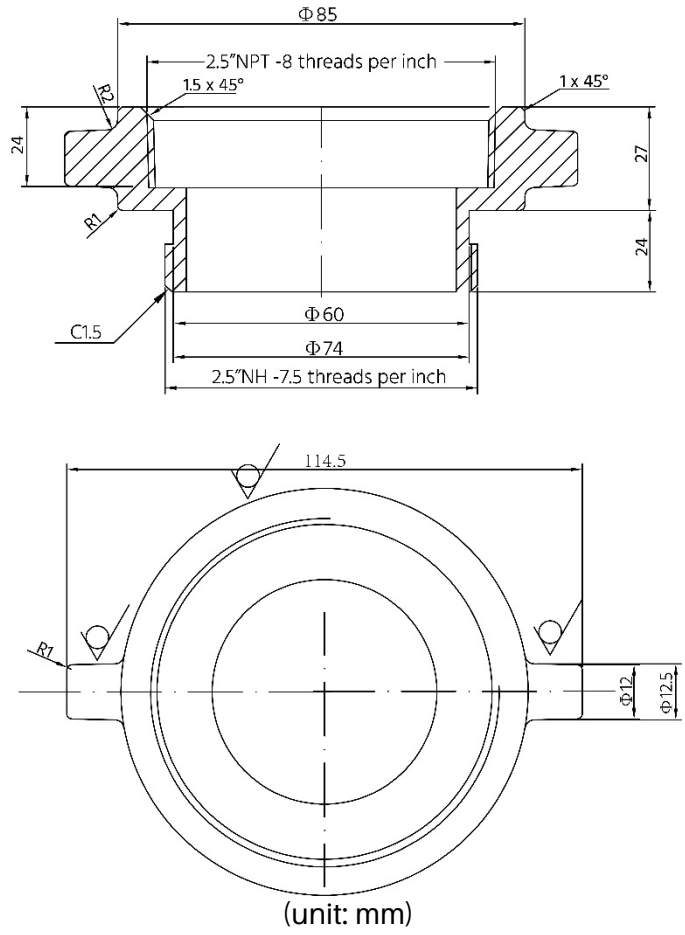

View of the Rear Door

### 2.5.1 Fire Suppression System

The control logic of the fire suppression system is shown in the following diagram.




### Drawing of the external joint of water firefighting




(unit: mm)

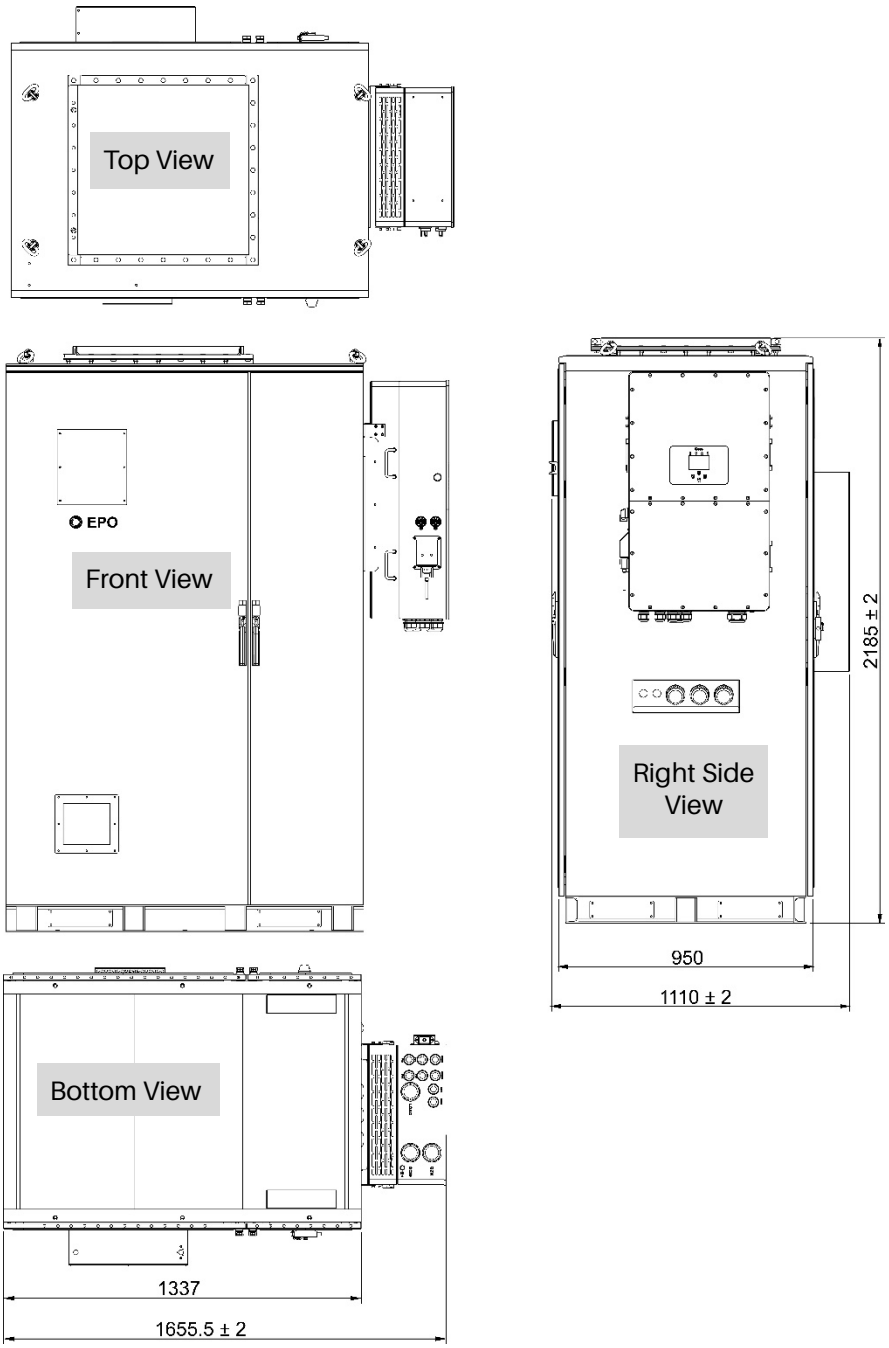
# 3. System Installation and Operation

## 3.1 Outdoor battery cabinet layout

### 3.1.1 External Dimensions

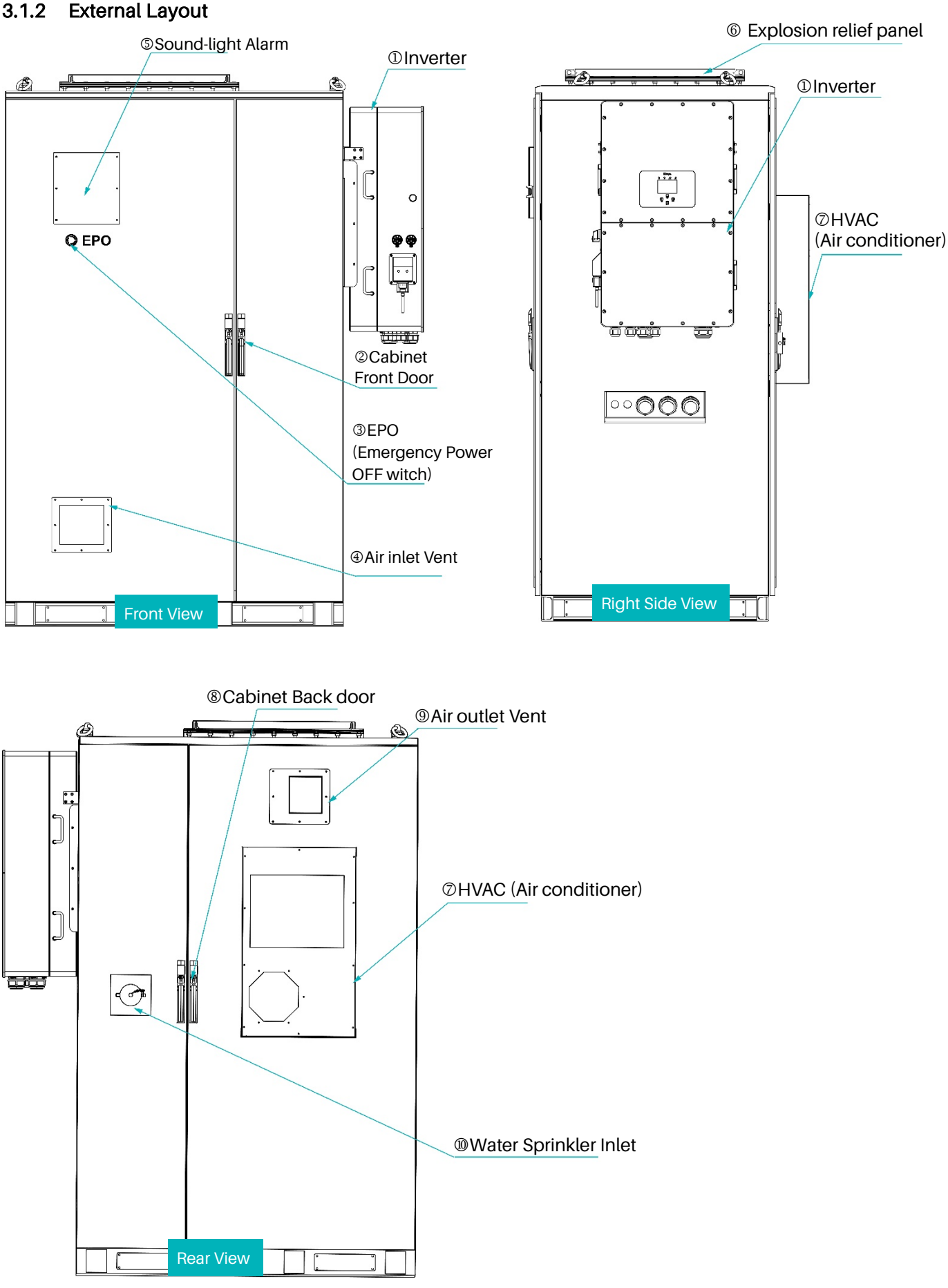
External dimensions are the same for both the 30 kW and 60 kW systems:

- Optim US-Am-M1C-A-30kW/xx-US-yy (10 batteries per one string, 1~4 strings parallel; where m = 1, 2, 3 or 4, xx=47, 94, 142,189, yy = 01, 02, 03, 04, or 05)
- Optim US-Am-M1C-A-30kW/xx-US-yy (11~14 batteries per one string, 1~2 strings parallel; where m = 1, or 2; xx = 52, 56, 61, 66, 104, 113, 123 or 132; yy = 01, 02, 03, 04, or 05)
- Optim US-Am-M1C-A-60kW/xx-US-yy (11~14 batteries per one string, 1~2 strings parallel; where m=1 or 2, xx= 66, 71, 75, 80, 85, 90, 94, 99, 132, 142, 151, 161, 170, 180, 189, or 198; yy = 01, 02, 03, 04, or 05)



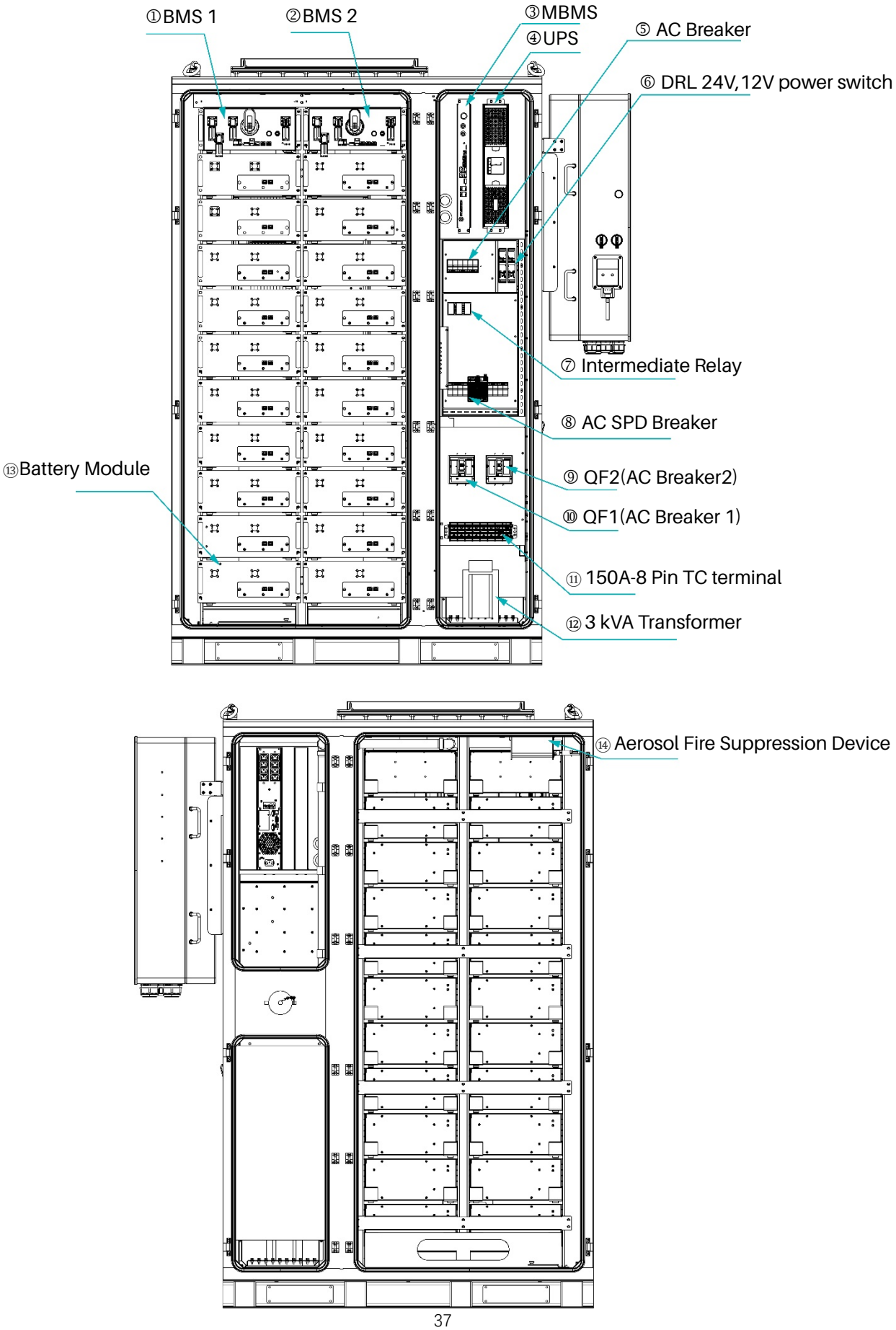

(Unit: mm)

### 3.1.2 External Layout



### 3.1.3 Internal Layout

Following is the layout of a 30Kw system with up to two BMS units and two battery strings. Other configurations can also refer to this drawing, only differs on the Qty. of BMS units and battery modules.



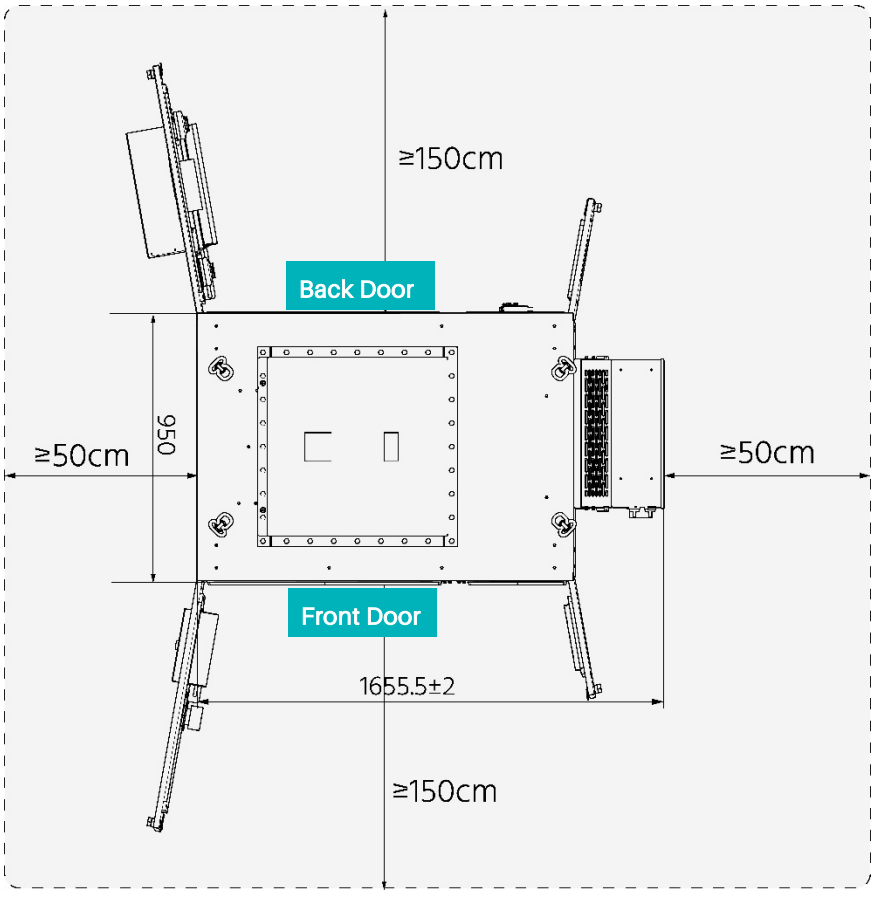
### 3.1.4 Installation Environment

The following requirements must be met for installation:

- The IP rating of the outdoor cabinet is IP55, which meets the normal outdoor placement environment. And the standard anti-corrosion grade is C3H, so it is necessary to pay attention to stay away from high salt spray, high corrosion environment, away from heat sources and flammable and explosive materials.
- The installation ground must be able to bear the total weight of the cabinet.
- The foundation must ensure the stability and reliability of the installation position of the outdoor battery cabinet.
- The installation environment should be as far away from the living area as possible. If there is a large flow of people in the installation site, it is recommended to install a fence.
- The ambient temperature should be guaranteed between -20-60℃ to ensure that the outdoor integrated cabinet can operate normally.

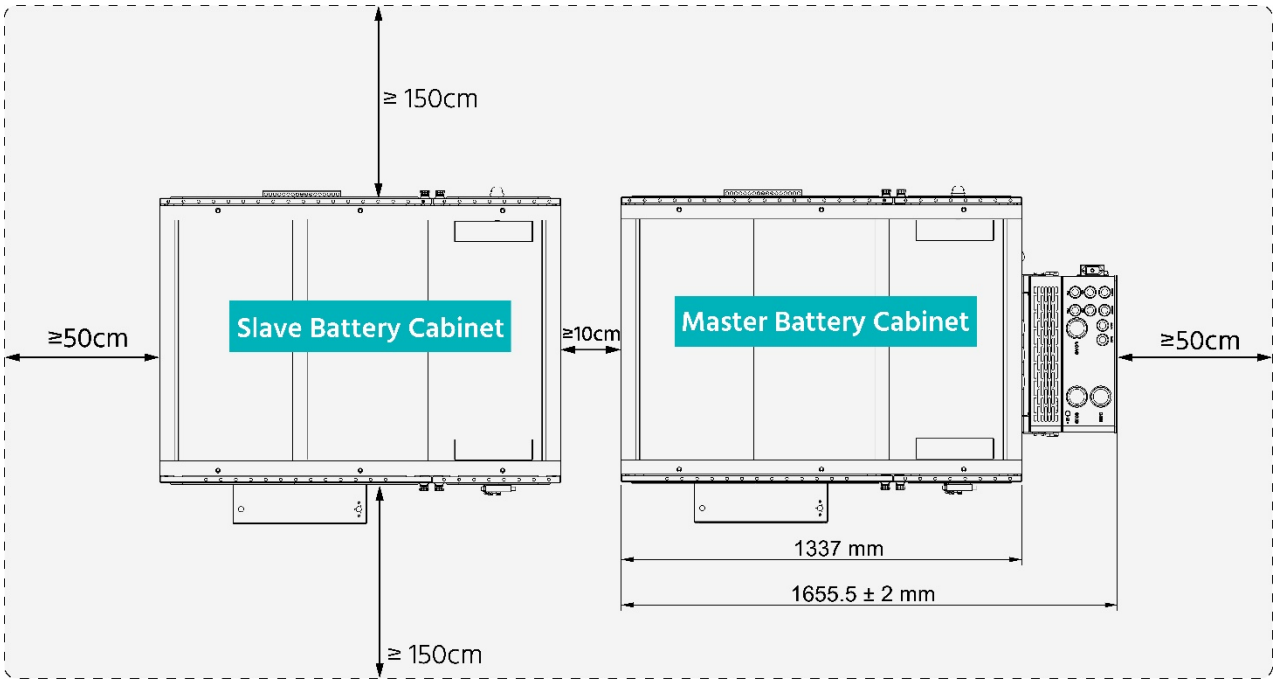
### 3.1.5 Installation Clearance

1. The external dimension of the system is 1337 x 2195 x 1125mm (width× height × depth), referring to *section 3.1.1* for details. And the installation site must have enough space to place the equipment.
2. The installation space of **one system with one cabinet** is shown in the figure below. It is recommended to reserve the space more than 150 cm between the cabinet front/back door and the wall or the peripheral equipment for maintenance. For the space between the left/right side of the cabinet and wall or the peripheral equipment, it is recommended to reserve more than 50 cm.

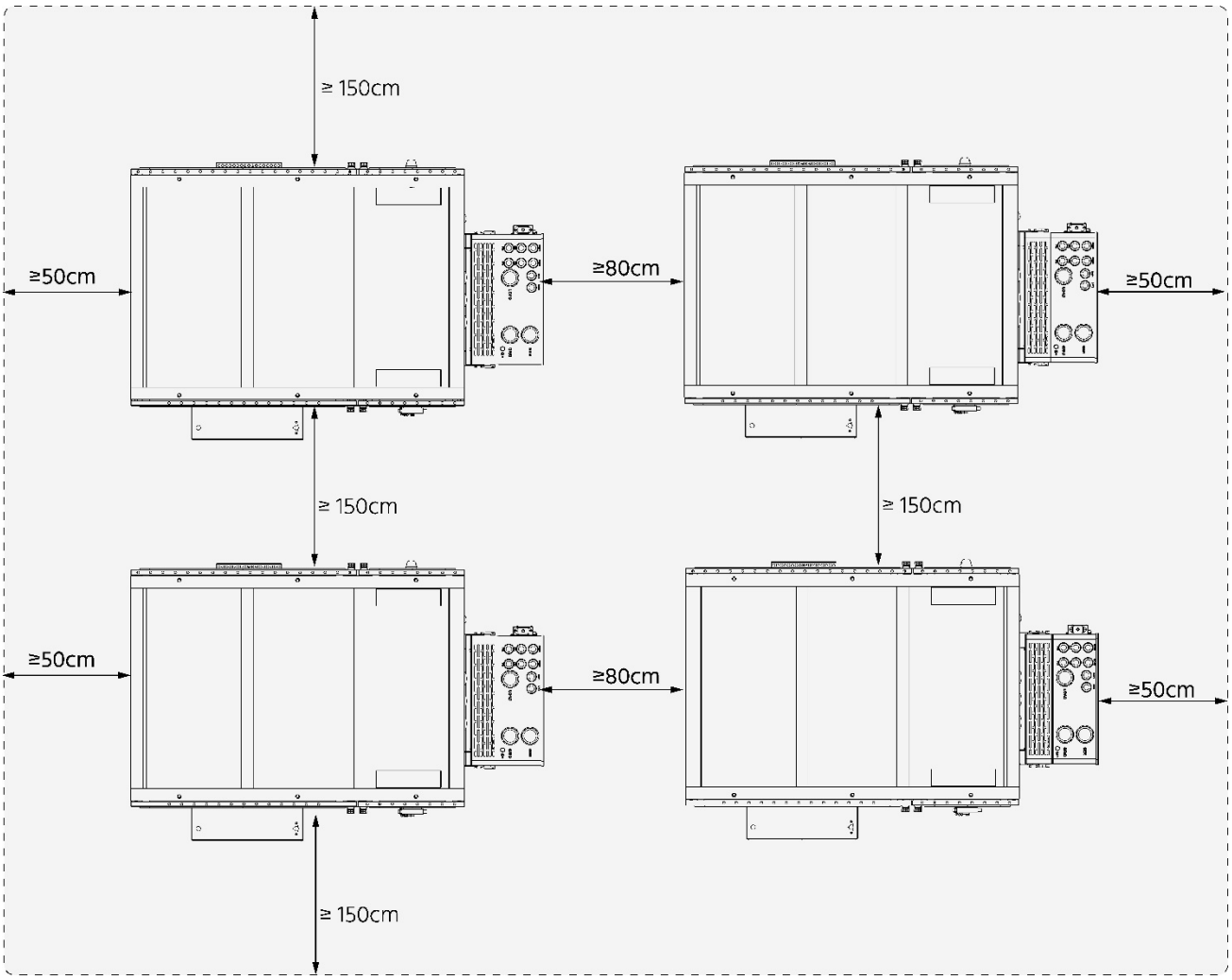



(Unit: mm)

4. For the space requirements of one system with multiple cabinets, refer to the drawing below.



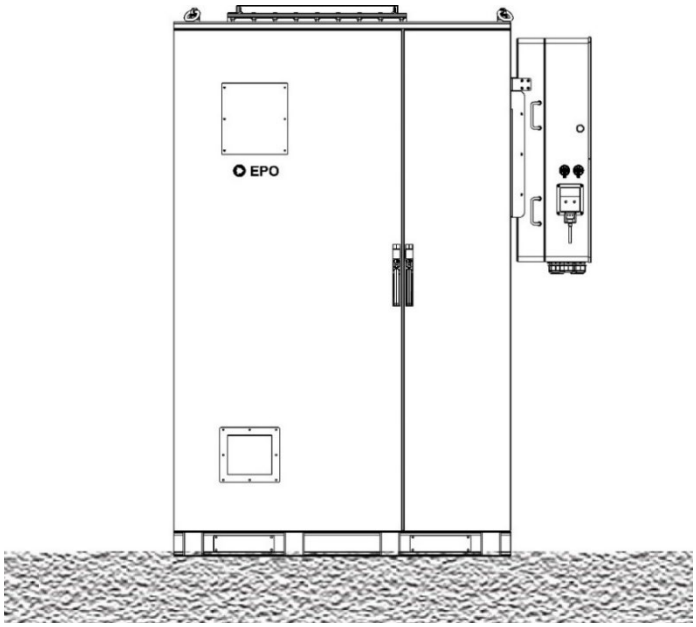

4. For the space requirements of multiple systems, refer to the drawing below.



### 3.1.6 Requirements of the installation foundation

The installation foundation should be concrete or channel steel support structure, which should be flat, firm, safe and reliable. Uneven surfaces and depressions are strictly prohibited. The installation foundation must meet the following height requirements, whichever is higher:

- above the highest water level in the history of the area; or
- at least 300mm above the level ground

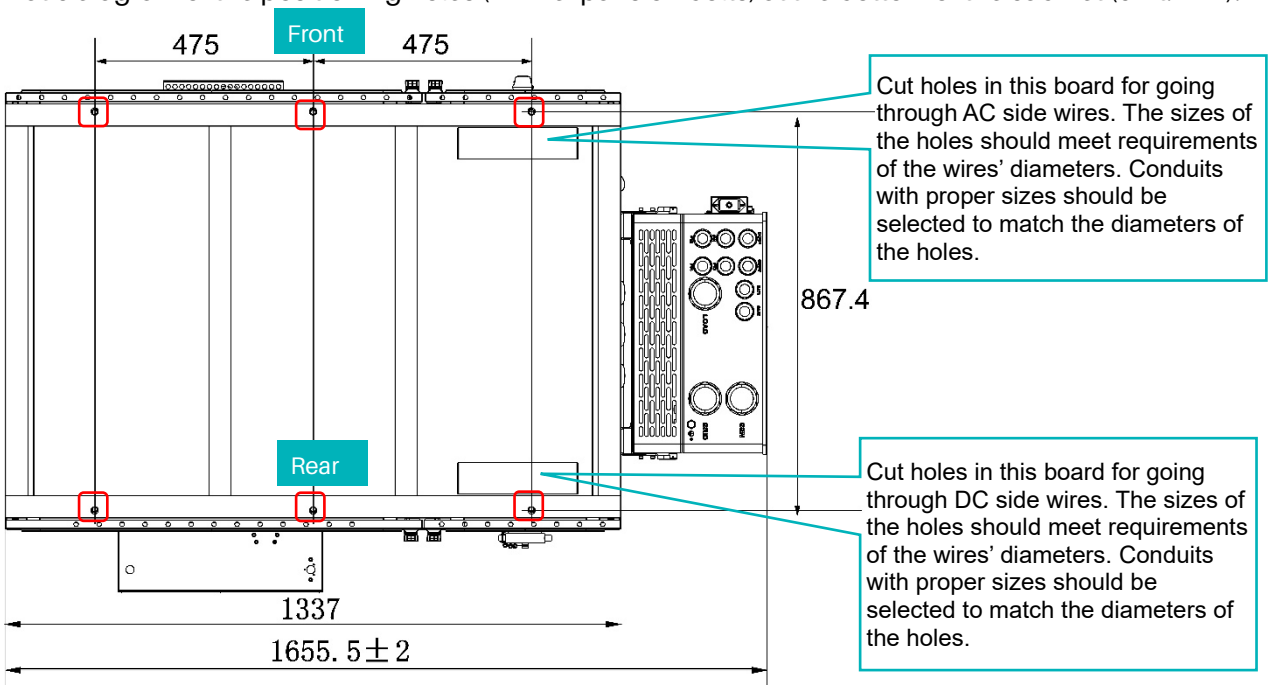



The cabinet should be fixed through the bottom, and the holes should be pre-opened according to the fixed hole position at the bottom of the foundation, and the opening size must be consistent with the fixed hole position of the cabinet.

**Warning**: The inlet and outlet holes in the lower part of the outdoor cabinet need to be sealed with fireproof mud after the cable is connected.
And the entire outdoor cabinet base needs to be sealed with fireproof mud, waterproof and insect-proof.

**Avertissement:** Les trous d'entrée et de sortie dans la partie inférieure de l'armoire extérieure doivent être scellés avec de la boue ignifuge une fois le câble connecté.Et toute la base de l'armoire extérieure doit être scellée avec de la boue ignifuge, imperméable et résistante aux insectes.

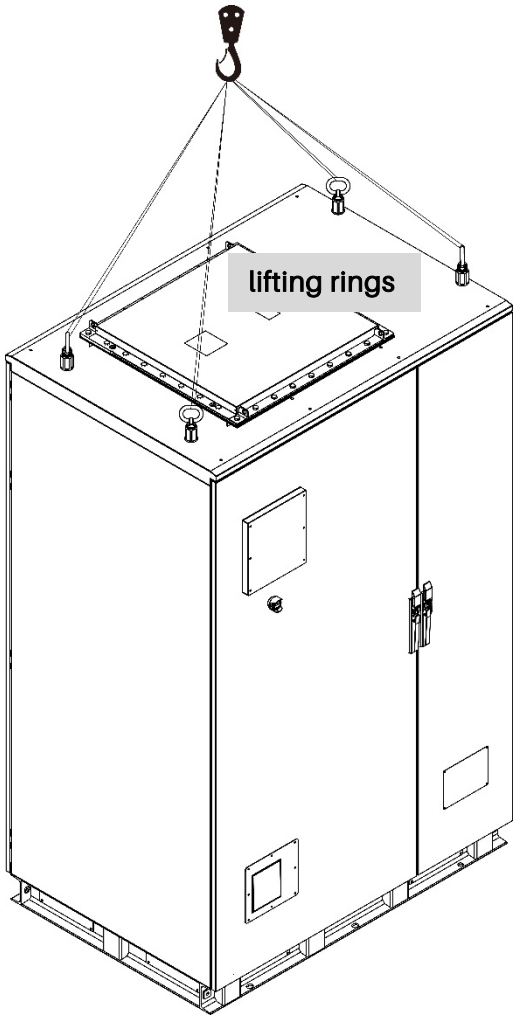
Schematic diagram of the positioning holes (M12 expansion bolts) at the bottom of the cabinet (unit: mm).

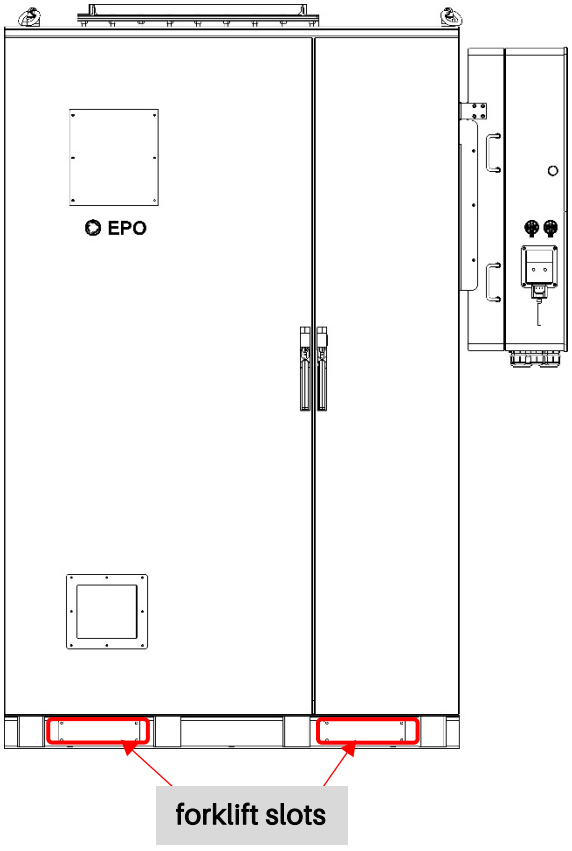


### 3.1.7 Handling and installation of the cabinet

- Outdoor battery cabinet needs to be handled by forklift or hoist lifting; When handling, move carefully to avoid impact or fall.
- Keep the handling process slow and smooth.
- During moving, the tilt angle of the device shall not exceed 15°, and it shall not be suddenly lowered or lifted.

**Positions of the lifting rings and forklift slots:**



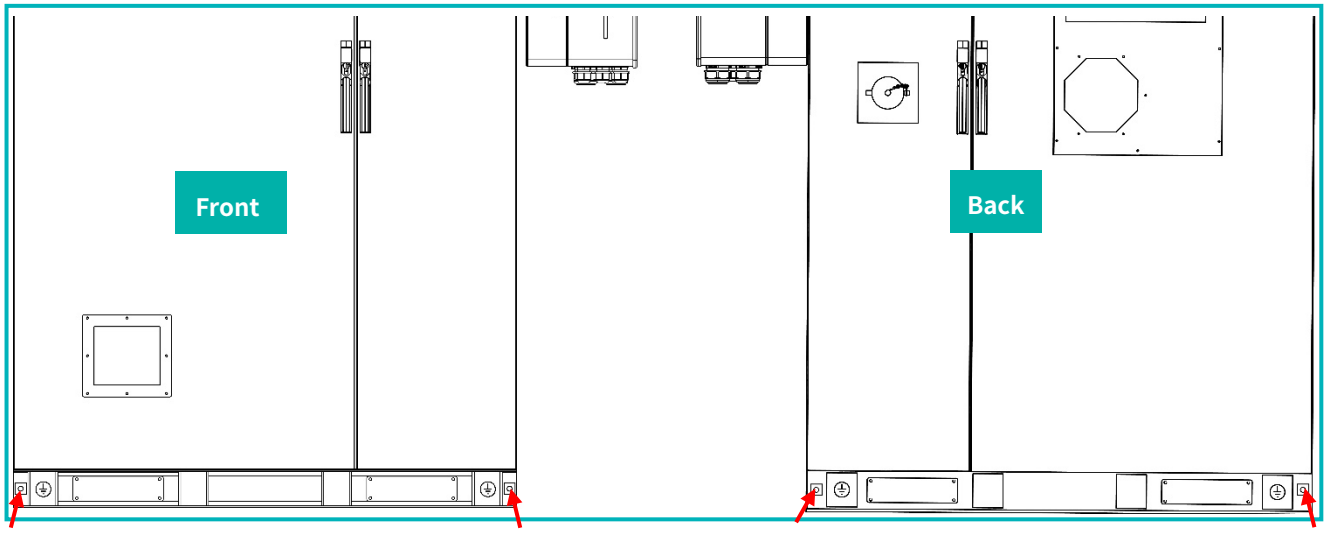




**Danger:** Pay attention to the falling risk which can cause severe injury or death. Do not stand under a lifted load. Make sure no unauthorized personnel are in the vicinity of a lifted load.

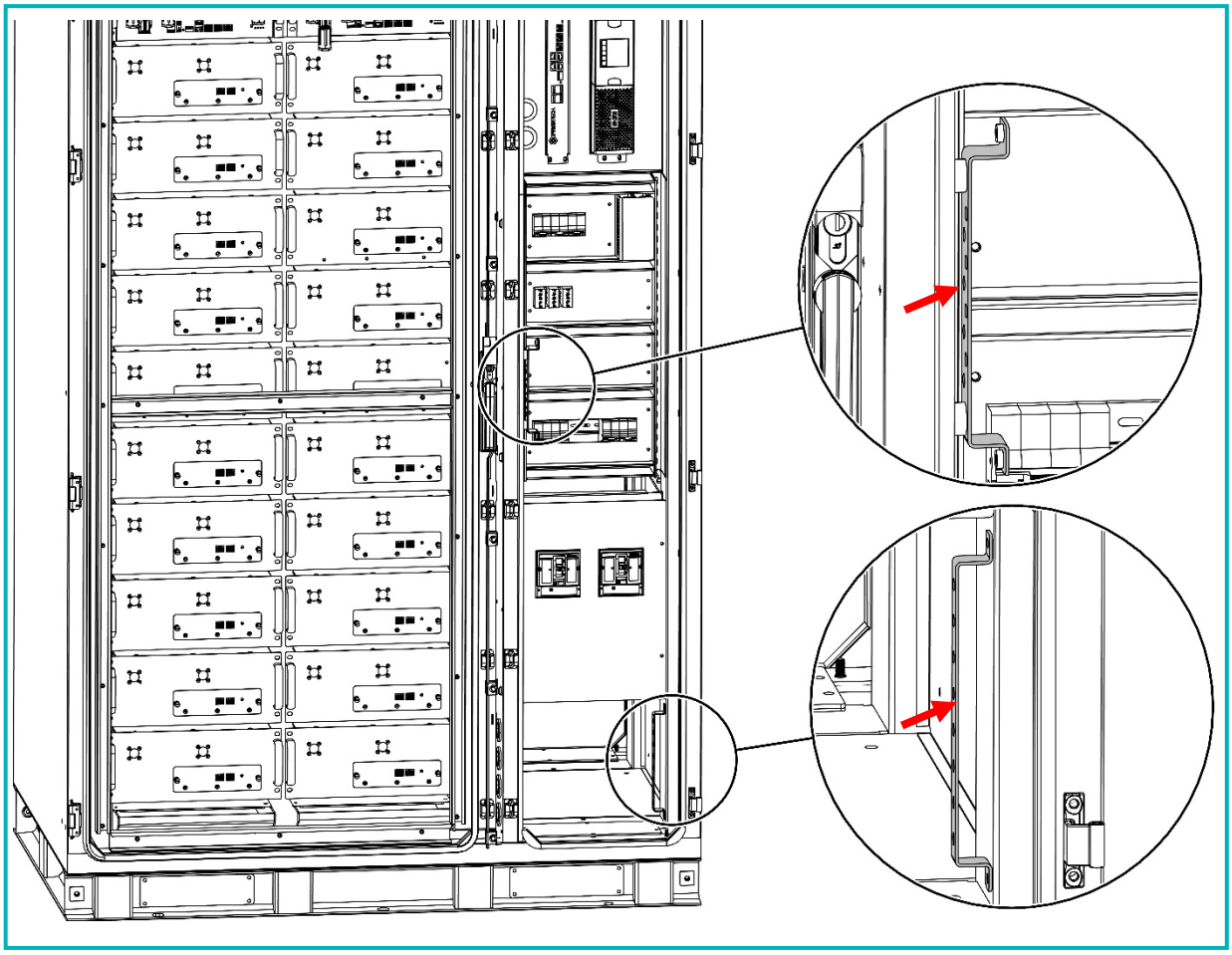
1. Use a lifting device to place the cabinet on the foundation, aligning the 6 fixing holes.
2. Install the 6 fixing bolts.
3. The fixing screws bolts should be protected by anti-corrosion paint to avoid rust.

### 3.1.8 Cabinet Grounding

- PE (to the ground): Choose one of the four grounding points to connect the cabinet to the ground. (Grounding Screw specification: M10 x 30)




- Grounding bar (electrical PE): Grounding cable(s) connected to grounding bar inside the cabinet. (Grounding Screw specification: M16 x16)



## 3.2 Installation and Operation of the Inverter

### 3.2.1 Deciding the Site's Backup Circuits

1. Ensure you keep the Inverter within its amperage limits.
   - ON-Grid = 200A pass through (160A software limitation)
   - OFF-Grid = 30kW = 83.4A Continuous | 45kVA = 125A Peak (10s)
2. Verify each load circuit by measuring typical and max Amps with a clip-on Amp meter. Amps x 120V = Watts.
3. Install a subpanel for backup loads if there is a chance of exceeding any amperage limits while powering the entire site off-grid; failure to do so will result in an outage and potential damage to the Inverter.
4. If you have Arc-Fault / GFI breakers, DO NOT use a multi-circuit transfer switch.

### 3.2.2 Grounding Cables Installation

**Danger:** The system must have Ground connections and Neutral connections. Ground MUST be bonded to Neutral ONLY ONCE in the circuit.

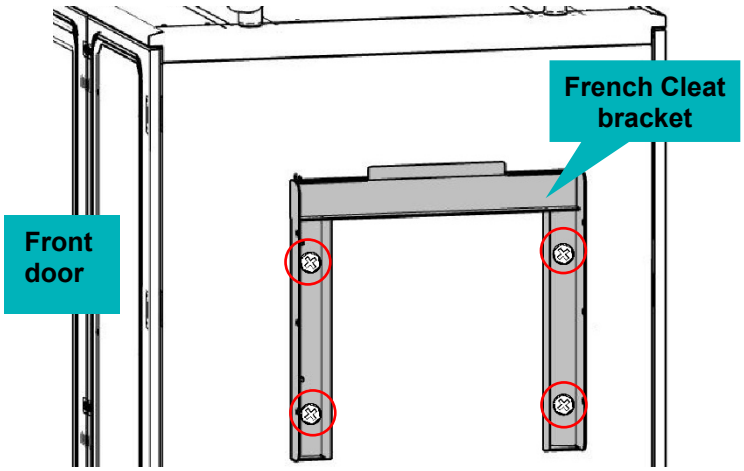
**Danger:** Le système doit avoir des connexions à la terre et des connexions neutres. La terre DOIT être reliée au neutre UNE SEULE FOIS dans le circuit.

See *Section 2.1.1.1* for the Ground / Neutral Bars position.

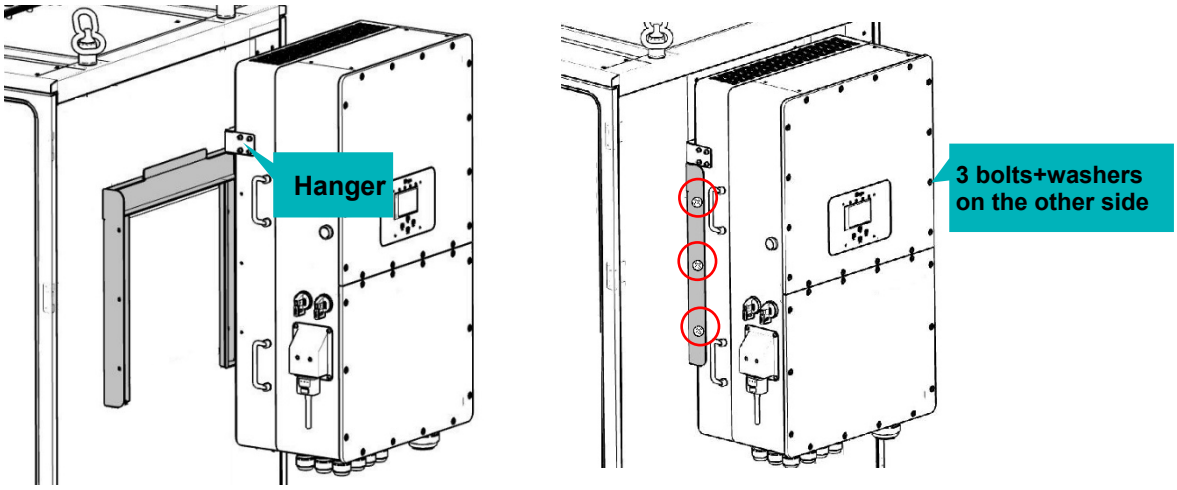
### 3.2.3 Mounting the Inverter on the outdoor cabinet

Please follow the steps below to mount the invert to the outdoor cabinet.

1. Aligning the four holes in the cabinet sideboard, fix the French Cleat bracket to the cabinet, with four bolts+washers (M12x25), shown as below.




2. Install the inverter on the embedded bracket by hanging the hanger of the inverter onto the bracket. Then fasten three bolts+washers (M4x12) on both sides of the PCS to the bracket.



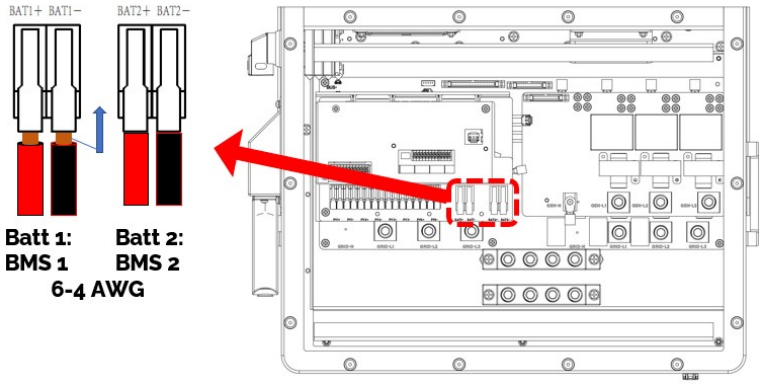
### 3.2.4 Physical Installation (Small Commercial Backup)

1. Use the output from 200A Fused Disconnect (from the grid) for the Grid input connection to the Sol-Ark.
2. Connect the Load output from the Sol-Ark directly to the Main Service Panel (at least 2/0 AWG).
3. Connect a Generator (150A @ 120V x3) or AC-Coupled system to the GEN terminal blocks.

### 3.2.5 Integrating Batteries (Inverter POWERED "OFF")

1. Connect batteries to the inverter as shown below.
2. Ensure the external battery disconnect is OFF while connecting batteries, or arcing may occur.
3. The 30K-3P reaches a maximum of 100A battery charge/discharge when using both battery terminals. When using one set of terminals, the max battery charge/discharge is 50A.

Do NOT pull actuation levers more than 45 degrees away from vertical when installing the batt cables.




**Warning:** Sol-Ark inverter is a High Voltage Battery system. Do NOT wire the battery bank to any other nominal voltage.

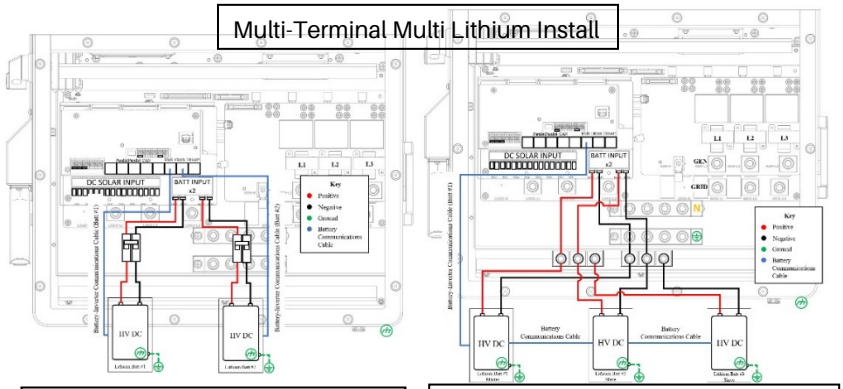
**Avertissement:** L'onduleur Sol-Ark est un système de batterie haute tension. Ne connectez PAS le groupe de batteries à une autre tension nominale.

When using 48V batteries, do not exceed eight (8) batteries in series.

Stay within the voltage range: **MIN** 160V~**MAX** 500V.

**Danger:** Do not connect the positive and negative reversely.
**Danger:** N'inversez pas la connexion des pôles positif et négatif.

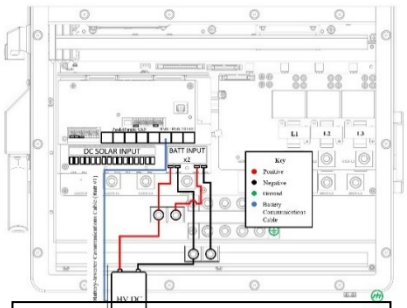
Multi-Terminal Multi Lithium Install



Note: Each pair of battery terminals is rated for 50A, so Lithium Batt #1 and Lithium Batt #2 will each receive up to 50A of charge and discharge.

If using the paralleled Lithium Batts of the same make and model, then remove "Battery-Inverter Communications Cable (Batt #2)".

Multi-Terminal Single Battery Install



Use the "Multi-Terminal Single Battery" install if your **single** battery bank has a max charge/discharge current **>40A**, up to a total of 100A.

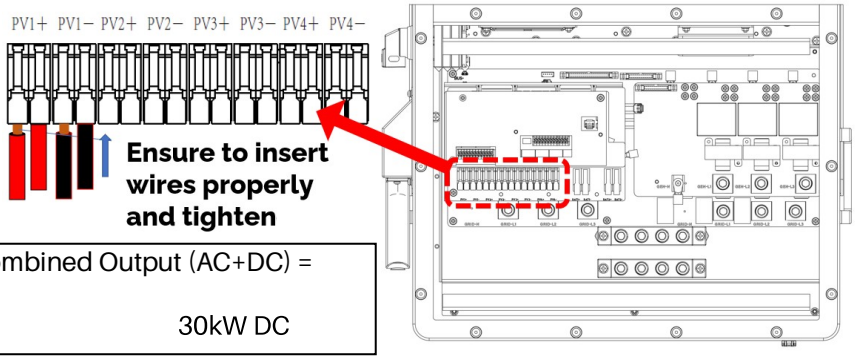
Check Battery Integration Guide for specific instructions on Closed Loop Comm Integration: www.sol-ark.com/support/

### Connecting PV Panels

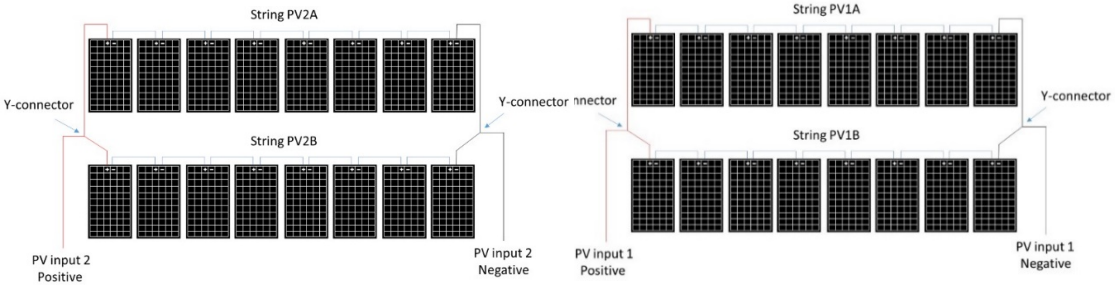
1. Sol-Ark has QUADRUPLE (4) MPPTs for four separate PV input pairs (~8 strings)
2. MAX PV input = 39kW (± 5%) / system | 9.75kW / MPPT | MAX 500$V_{OC}$ PV | MAX $I_{SC}$ /MPPT 44A (limiting to 36A)

**Danger:** Damage will occur if PV VOC > 500V.
**Danger:** Des dommages se produiront si PV COV > 500 V.

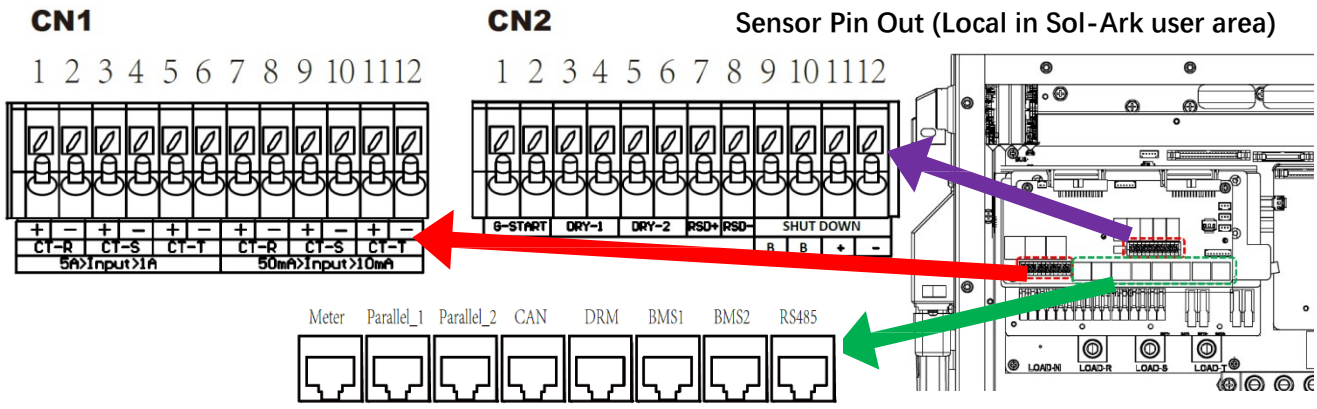
3. Parallel strings per MPPT must be the same Voltage.
4. PV1 A/B must be the same voltage if using all two (2) strings.
5. Arrays on the same MPPT CAN face different directions.
6. Ground the panel MOUNTS/FRAMES to any ground outside the circuit via 12AWG wire.
7. **IF using Y-Connectors: Running two strings in parallel, totaling 36A (self-limiting).**
8. Connect the solar panel strings as indicated by the following diagram:




Maximum combined Output (AC+DC) = 72kW
54kW AC + 30kW DC




### 3.2.5.1 Sensors Integration and Accessory Placement

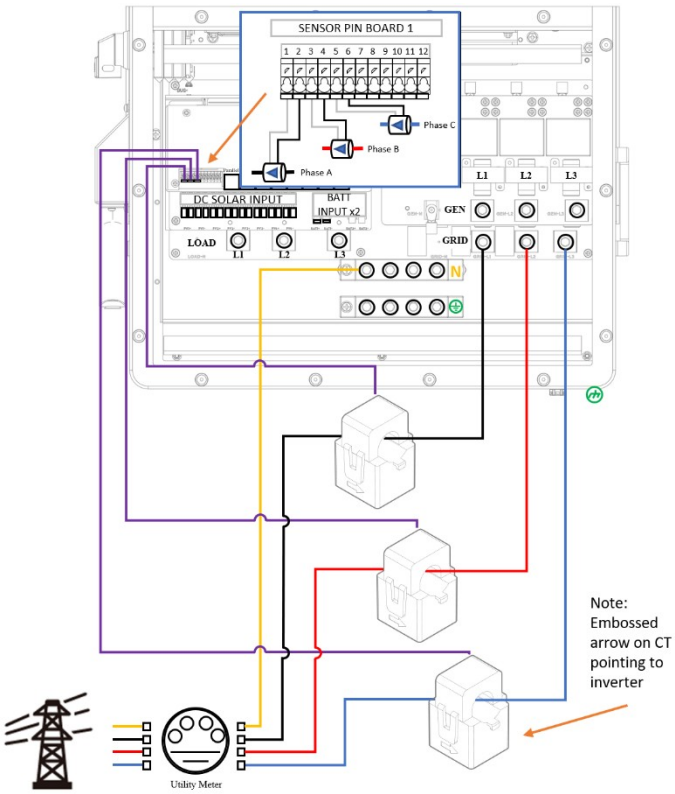



(1,2,7,8) CT-R: Current transformer (L1) used for Limited Power to Home mode and Peak Shaving; Polarity matters
(3,4,9,10) CT-S: Current transformer (L2) used for Limited Power to Home mode and Peak Shaving; Polarity matters
(5,6,11,12) CT-T: Current transf. (L3) used for Limited Power to Home mode and Peak Shaving; Polarity matters
(1,2) G-Start: dry contact signal for startup the generator. When the "GEN signal" is active, the open contact (GS) will close (no voltage output).
(3,4) Dry-1 and (5,6) Dry-2: Reserved
(7,8) Optional RSD: 12V power supply for RSD transmitters; Rated for a **maximum of 1.2W (100mA @12V)**
(9,10) Emergency stop: Short these pins to initiate emergency stop.
Meter: For external energy meter communication
Parallel_1 & Parallel_2: Parallel communications ports 1 and 2
CAN: Reserved DRM: Reserved RS-485: RS-485 port
BMS1 & BMS2: BMS ports 1 and 2 for battery communications

### Limiter Sensors (CT Sensors) [diagram to the right]

- Install sensors on incoming electrical service wires L1, L2, & L3 (see Diagrams Section)
- Limited Power to Home Mode (meter zero) and Peak Shaving Modes require CT sensors
- To ensure the sensors will fit, please check the wire size before ordering (regular CTs accommodate up to 4/0 AWG) [Larger available: sales@sol-ark.com]

(See the inverter separate manual for details.)




### GEN Start Signal (Two-Wire)

- The signal comes from a normally open relay that closes when the Gen Start state is active

### CANbus & RS485

- To connect batteries to the Sol-Ark 30K-3P-208V via RJ45, you need to splice the end connecting to the 30K
- Use the middle two conductors
- RS485 is SunSpec draft 4 (will not work with draft 3)

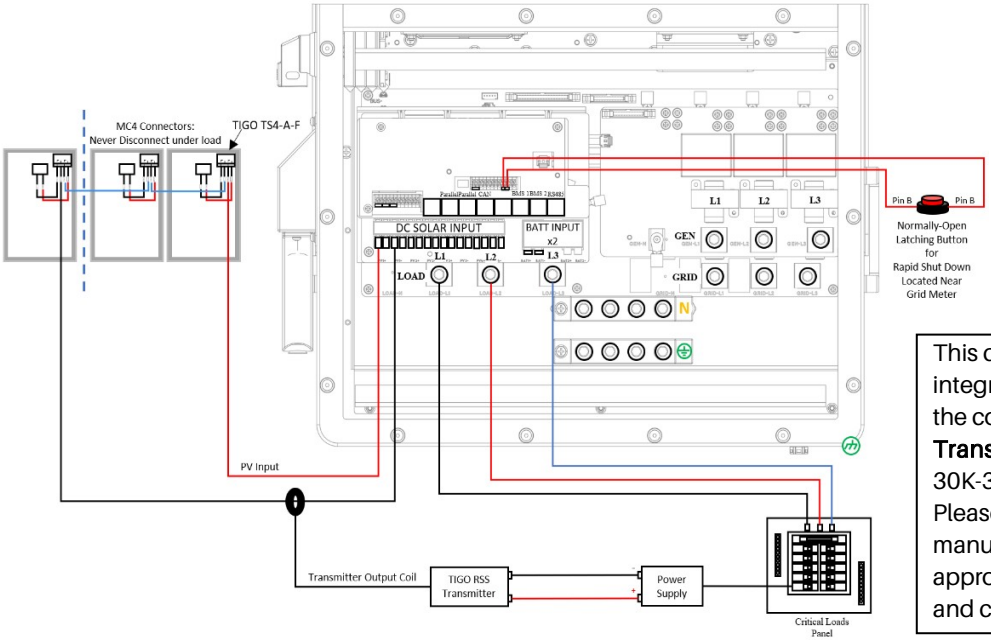
### Wi-Fi Antenna (Dongles)

Remote monitoring and software updates require an internet connection through the Wi-Fi dongle (ethernet available)

### Emergency Stop Signal & PV Rapid Shutdown Signal

Pins 9(B) and 10 (B) in the sensor pinboard 2 use an ordinarily open & latching switch to connect the two emergency stop pins that cut off the RSD power supply when triggered, thus stopping the inverter AC output.

Pins 7 and 8 in the sensor pinboard 2 provide the 12V / 100mA signal power lost when the Sol-Ark shuts down using the front button.




This diagram illustrates how to integrate the **Tigo TS4-A-F** and the corresponding **Tigo RSS Transmitter** with the Sol-Ark 30K-3P-N.
Please refer to your RSD manufacturer's website for appropriate hardware needs and compatibility.

### Wi-Fi Antenna (Dongles)

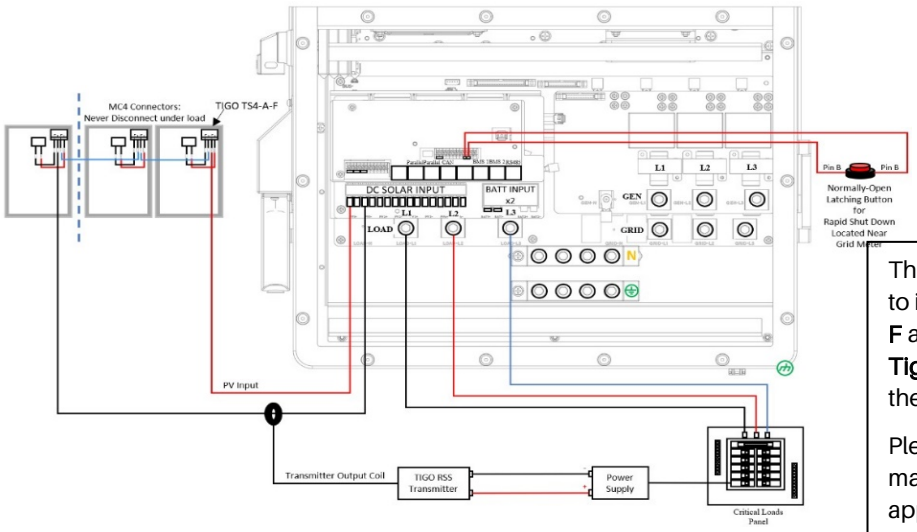
Remote monitoring and software updates require an internet connection through the Wi-Fi dongle (ethernet available)

### Emergency Stop Signal & PV Rapid Shutdown Signal

Pins 9(B) and 10 (B) in the sensor pinboard 2 use an ordinarily open & latching switch to connect the two

emergency stop pins that cut off the RSD power supply when triggered, thus stopping the inverter AC output.

Pins 7 and 8 in the sensor pinboard 2 provide the 12V / 100mA signal power lost when the Sol-Ark shuts down using the front button.




This diagram illustrates how to integrate the **Tigo TS4-A-F** and the corresponding **Tigo RSS Transmitter** with the Sol-Ark 30K-3P-N.

Please refer to your RSD manufacturer's website for appropriate hardware needs and compatibility.

Rapid Shutdown: TIGO TS4-A-O | TIGO TS4-A-F | TIGO TS4-O | TIGO TS4-O-DUO | APsmart RSD S-PLC / RSD-D

***PARALLEL SYSTEMS: Emergency Stop should be connected to the Master with address 01 and will initiate emergency stop for all paralleled systems from the one button.***

- The Built-in 12V power supply in the user area of the Sol-Ark (Pins 7 and 8) is rated for 100mA (1.2W).

  L'alimentation 12 V intégrée dans la zone utilisateur du Sol-Ark (broches 7 et 8) est évaluée à 100 mA (1,2 W).
- Transmitter fits inside the user area of the Sol-Ark 30K-3P-208V but can cause interference (sometimes requires placing it outside of the user area).
  L'émetteur s'insère dans la zone utilisateur du Sol-Ark 30K-3P-208V mais peut provoquer des interférences (il faut parfois le placer en dehors de la zone utilisateur).
- TIGO Optimizers are compatible with the Sol-Ark 30K-3P-208V (Do not use the built in 12V Power supply in the Sol-Ark user area to Power the Tigo Optimizer TX transmitter).
  Les optimiseurs TIGO sont compatibles avec le Sol-Ark 30K-3P-208V (n'utilisez pas l'alimentation 12 V intégrée dans la zone utilisateur Sol-Ark pour alimenter l'émetteur

***NOTE:*** If you are unsure whether the transmitter power supply is compatible with pins 7 & 8 of the inverter, contact the RSD manufacturer.

### 3.2.6 Powering-Up & Testing the Sol-Ark 30K-3P-208V.

**Warning:** Verify Grid, Battery, PV voltage BEFORE turning on the unit **(WHILE THE UNIT IS OFF).**

**Avertissement:** Vérifiez la tension du réseau, de la batterie et du PV AVANT d'allumer l'unité (PENDANT QUE L'UNITÉ EST ÉTEINTE).

Turn ON with one of three sources of power:

1) PV 2) Grid 3) ON/OFF Battery

1. Check the voltage on each PV input circuit

A. It should be no higher than 500Voc Temp. corrected.
B. DO NOT connect PV+ OR PV- to GND
C. Verify polarity (backward polarity shows 0V)

2. Check Grid Input Voltage

A. Measure L1, L2, & L3 to Neutral. Ensure 120VAC.

B. Measure L1/L2, L1/L3, L2/L3. Ensure 208 VAC
C. Check Neutral and Ground are ~0 VAC
D. Verify L1 voltage on AC in/out is 0 VAC with the main L1 connection in the panel. Same for L2 & L3

3. Check Battery Voltage

A. Turn on the battery switch (if using a Lithium battery)
B. Turn on the external battery disconnect
C. The voltage should be nominal 300VDC [150VDC ~ 500 VDC]

4. Provide Power to Sol-Ark

A. Turn on the Grid disconnect and Load Breaker(s)
B. Turn BOTH PV disconnect switches to the "ON" position
C. Press the ON/OFF Button on the left side, and the blue light should turn on.

### Power Cycle Sequence

1. Make sure that Sol-Ark 30K-3P-208V is properly connected to the batteries, panels, grid, etc. (see system wiring diagram)
2. Turn on the external battery disconnect.
3. Turn on grid power from the disconnect.
4. Make sure Solar panel inputs are not connected to Ground, then Turn on DC disconnect switches (x2)
5. Press the power button on the left SIDE of the unit.
6. Turn on external load disconnect.
7. Reverse the steps to turn off.

**Danger: DO NOT** turn off Battery Disconnect if any current is flowing in or out of the battery.
**Danger:** NE PAS éteindre la déconnexion de la batterie si du courant entre ou sort de la batterie.

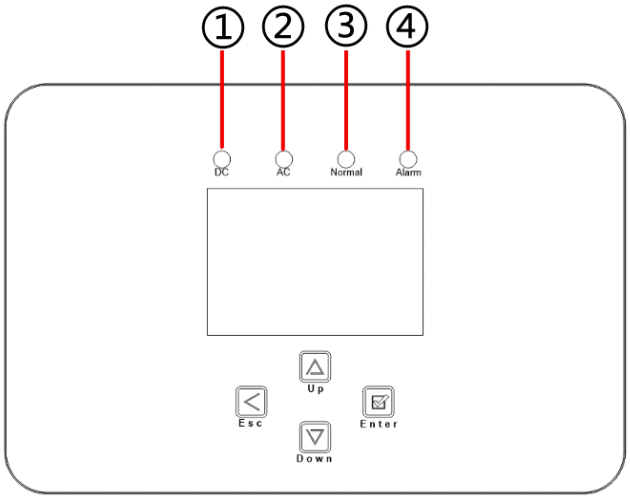
Indicator LED's

①DC
Green = DC Solar Panels are producing
Off = Solar Panels are not producing

②AC
Green = Grid (or Gen or AC Coupled) is Connected
Off = grid is not Connected

③Normal
Green = Sol-Ark is working properly
Off = Sol-Ark is not working properly

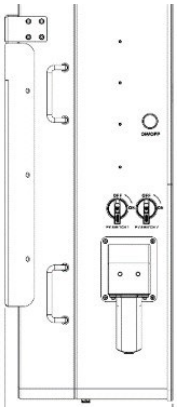
④Alarm
Red = Alarm. Check the alarms menu.
Off = No alarms




***NOTE,*** Maximum combined OUTPUT (AC Coupled + DC inverted)

180A x 120V x3 SW Limit of 65,000W

### 3.2.6.1 Remote Monitoring Setup



- **Ethernet Dongle**

A. Open the dongle (Black device) enclosure and thread the Ethernet cable through the hole and plug it into the RJ45 port.

B. Reassemble the dongle housing, plug into the Sol-Ark, and secure it with screws (x2, M4x12)

If all is well, you will see solid red and green lights.

C. Register the dongle via the app or www.mysol-ark.com.

- **Wi-Fi (Via Cell Phone or computer)**

A. Plug the Wi-Fi dongle into the Wi-Fi port on the LEFT side of the Sol-Ark

B. Using your device, look for an "EAP" network containing the last five digits of the dongle S/N

C. Password: 12345678

D. Follow the instructions on the upcoming pages

## 3.2.7 PV (PowerView)APP of the Inverter

### 3.2.7.1 APP Connection and Setup

You can access PowerView on a computer with the link: http://www.mysol-ark.com

1. Download PV (PowerView) Pro App

iPhone: (Will only show up as PV Pro)
https://apps.apple.com/lk/app/powerview-pro/id1247121391

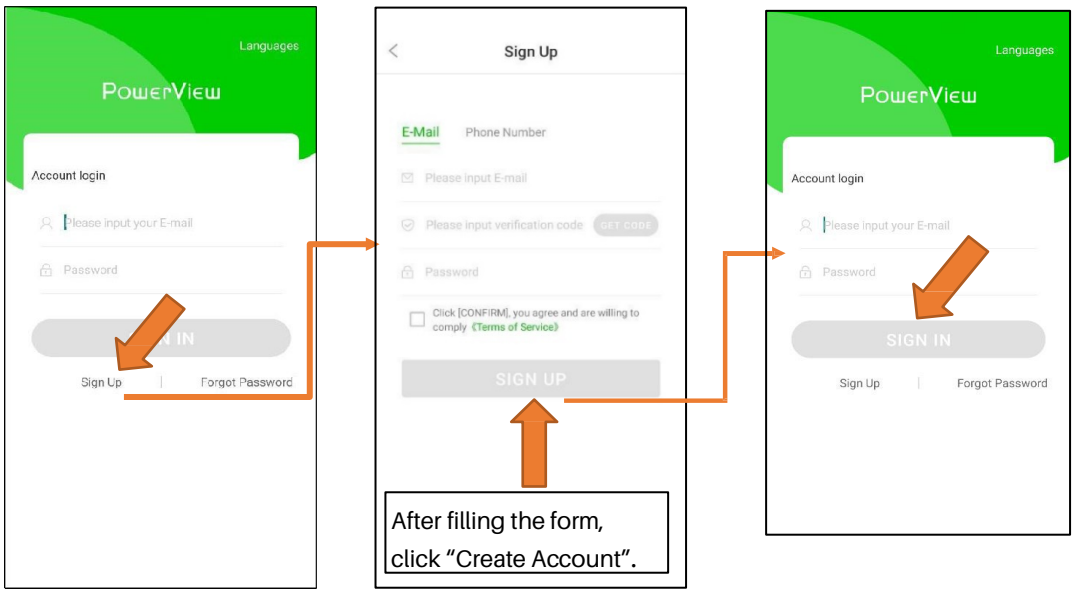
Android
https://play.google.com/store/apps/details?id=com.elinter.app.powerview&hl=en_US&gl=US

***NOTE:*** If you plan to add an install to your installer account for monitoring multiple installs, you must first make the plant under the customer's account.
Once created, the customer can share the plant, with Manager permissions, to the installer via the app ("…" under My Plants) or webpage (press the "…" next to the plant name in Power View).

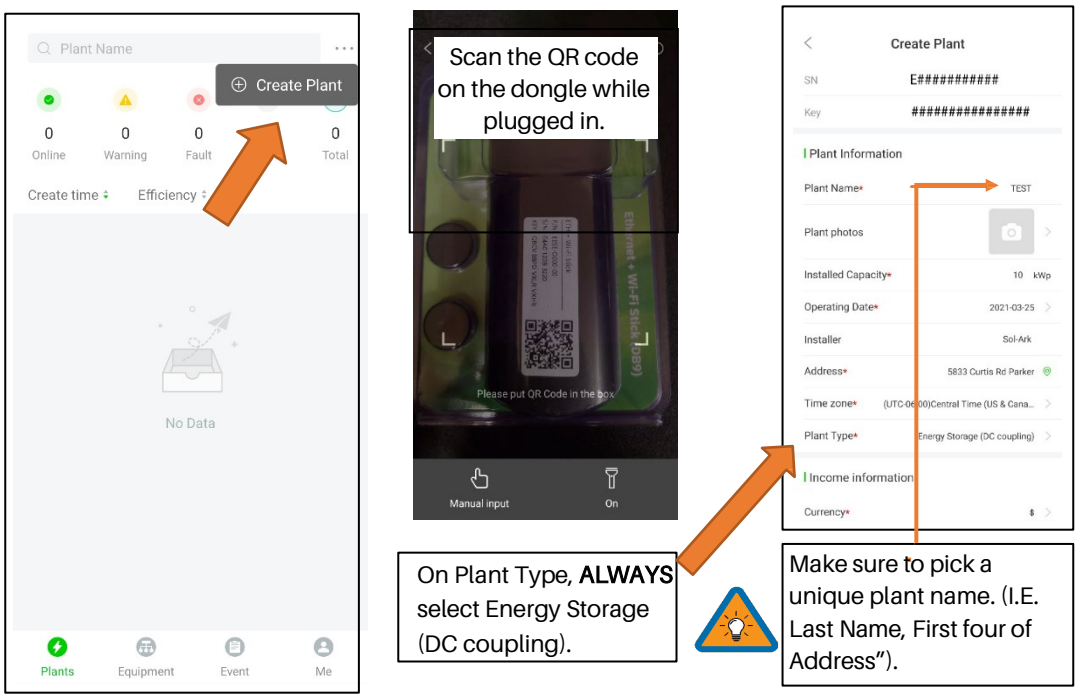
PV Pro App-Tutorial Video

PV Pro WebsiteTutorial Video

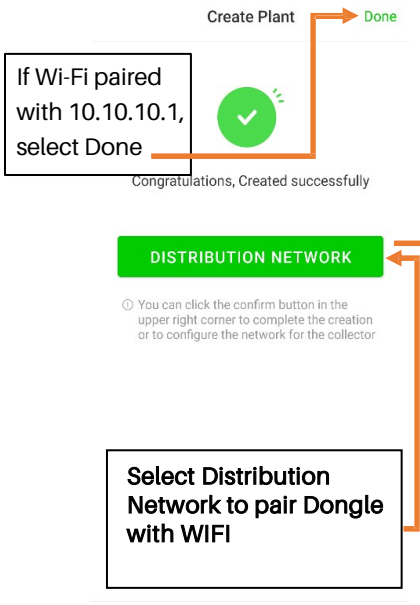
2. Create an Account and Sign In


Languages
PowerView
Account login
Please input your E-mail
Password
Sign Up
Forgot Password
Sign Up
E-Mail
Phone Number
Please input E-mail
Please input verification code
GET CODE
Password
Click [CONFIRM], you agree and are willing to comply {Terms of Service}
SIGN UP
After filling the form, click "Create Account".
Languages
PowerView
Account login
Please input your E-mail
Password
SIGN IN
Sign Up
Forgot Password

1. Add a Plant

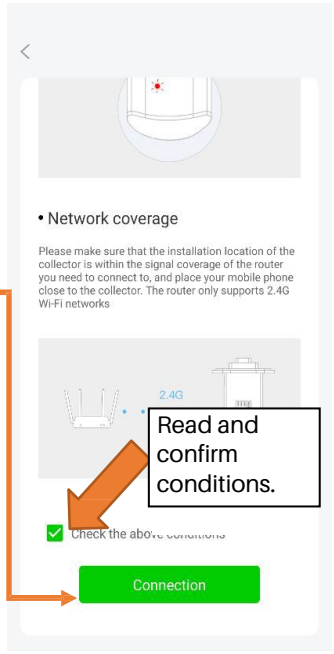

Plant Name
Create Plant
0
Online
0
Warning
0
Fault
0
Total
Create time
Efficiency
No Data
Plants
Equipment
Event
Me
Scan the QR code on the dongle while plugged in.
Please put QR Code in the box
Manual input
On
On Plant Type, ALWAYS select Energy Storage (DC coupling).
Create Plant
SN
E###########
Key
################
Plant Information
Plant Name*
TEST
Plant photos
Installed Capacity*
10 kWp
Operating Date*
2021-03-25
Installer
Sol-Ark
Address*
5833 Curtis Rd Parker
Time zone*
Plant Type*
Energy Storage (DC coupling)
Income information
Currency*
Make sure to pick a unique plant name. (I.E. Last Name, First four of Address").

## 3. Connect the System to the Internet

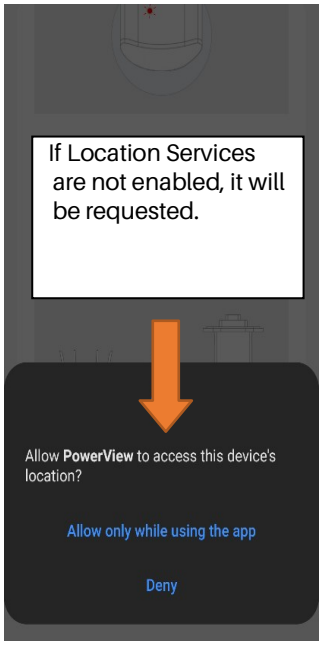



If Wi-Fi paired with 10.10.10.1, select Done

**Select Distribution Network to pair Dongle with WIFI**



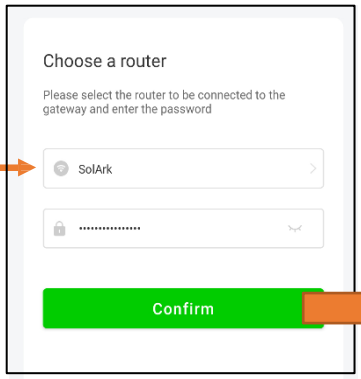

Read and confirm conditions.




If Location Services are not enabled, it will be requested.

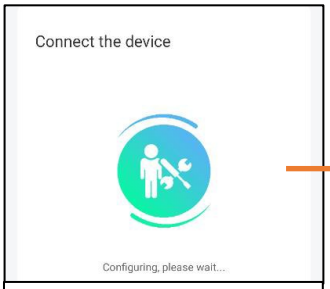
Once you see this screen, go to your DEVICE's Wi-Fi settings and connect to the Wi-Fi network that starts with: EAP-#####

Password: "12345678"
Return to app once connected




Select the local Wi-Fi network that will be providing the internet connection to the system.

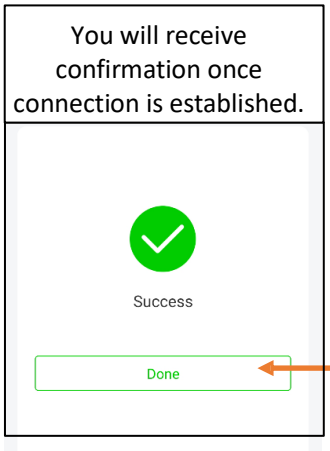
**Do NOT select the dongle's Wi-Fi network.**



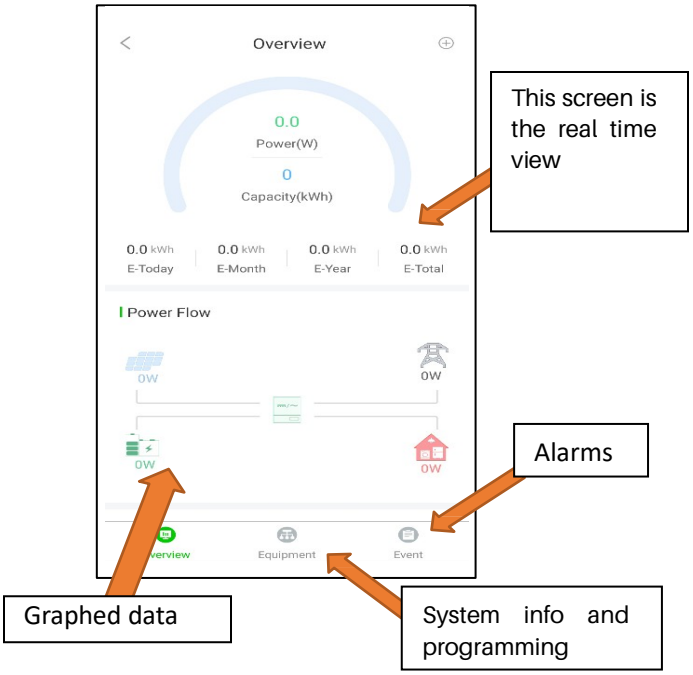

The app will buffer for a few seconds.

It takes about 60sec for the lights to turn on after setup Red LED: Connected to Sol-Ark and has power
Green LED: Connected to Internet and Server
Flashing Green LED: Connected to router but not server (usually a VPN or firewall issue).

You will receive confirmation once connection is established.



### 3.2.7.2 Start Monitoring the Data



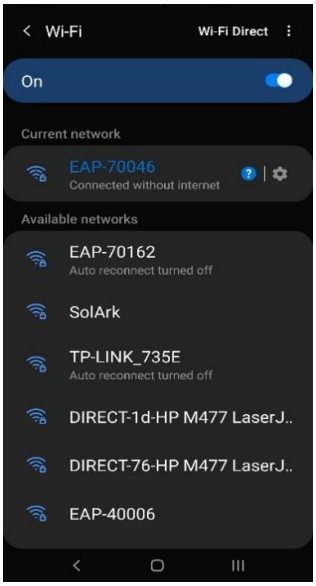

If you are installing parallel systems, DO NOT create a plant for each inverter. Create one plant for the Master unit and then use the browser version of Power View (mysol-ark.com).
Click on the "..." for the MASTER's plant and hit "Add Gateway" then put the S/N and Key of the SLAVE's dongle.
These Wiring Diagrams are examples of common-use cases for Sol-Ark inverters.

### 3.2.7.3 IP Address Setup Instructions (PC or Smartphone)

Please ***NOTE*** that this method only achieves internet connectivity. For registration and account management, please use the app and/or www.mysol-ark.com

1. Connect to the Dongle Network

A. Settings → Wi-Fi → Select the Network with EAP- ##### (The last five digits of your SN number)

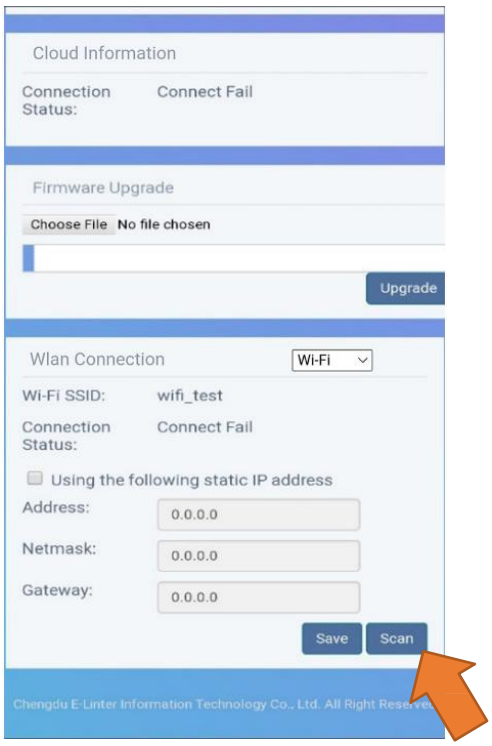


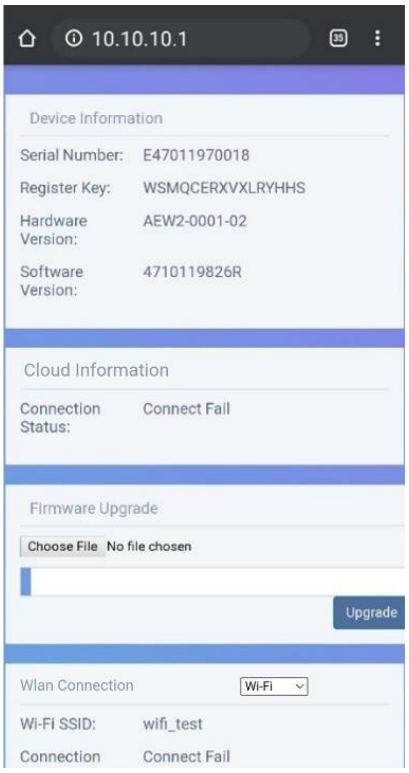


Password: 12345678
***Disclaimer*:** The Wi-Fi dongle does not have internet; You still need to be connected to the dongle for this process.

2. Login to Web Portal using ANY Search Browser

A. Open Google or Safari → type in the search bar: 10.10.10.1
B. Scroll Down to "Wi-Fi Connection".
C. Press "Scan" to search local networks.




3. Select Your HOME Network

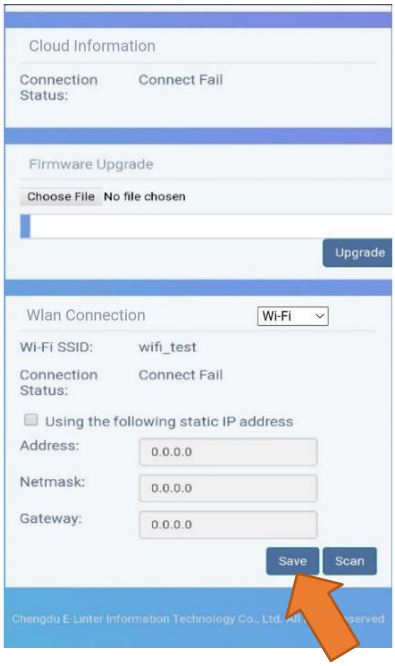
A. Find the home network
B. Enter personal Wi-Fi Password
C. DO NOT SELECT DONGLE NETWORK
D. Select "Connect"


*Disclaimer*

Connecting the dongle via the IP address only connects the dongle to the internet.

*YOU MUST STILL CREATE AN ACCOUNT VIA THE POWER VIEW APP*

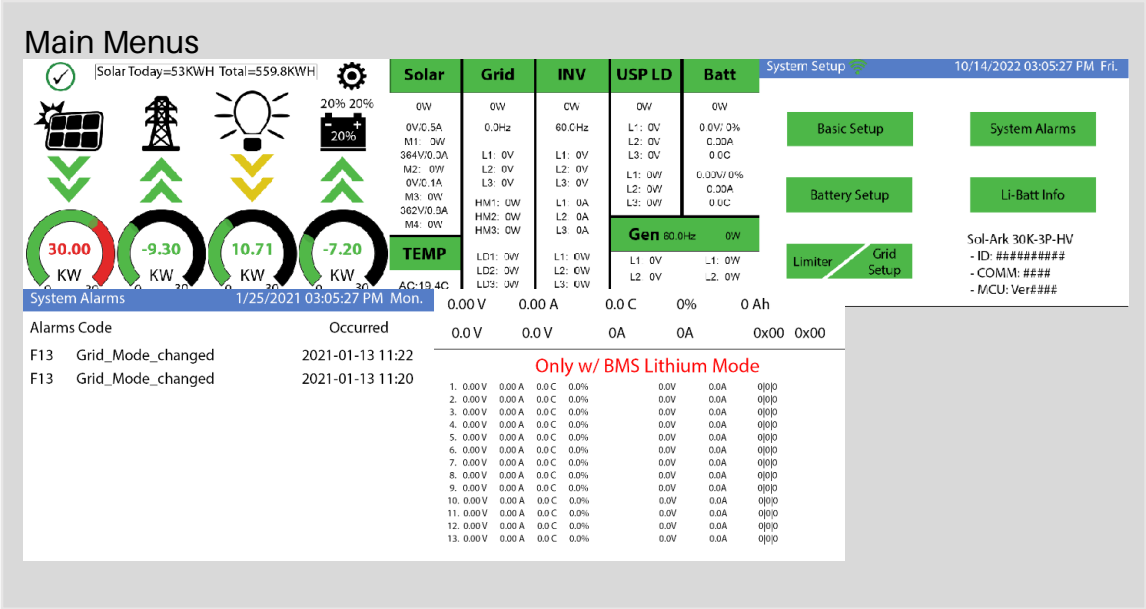
4. Save Your Information

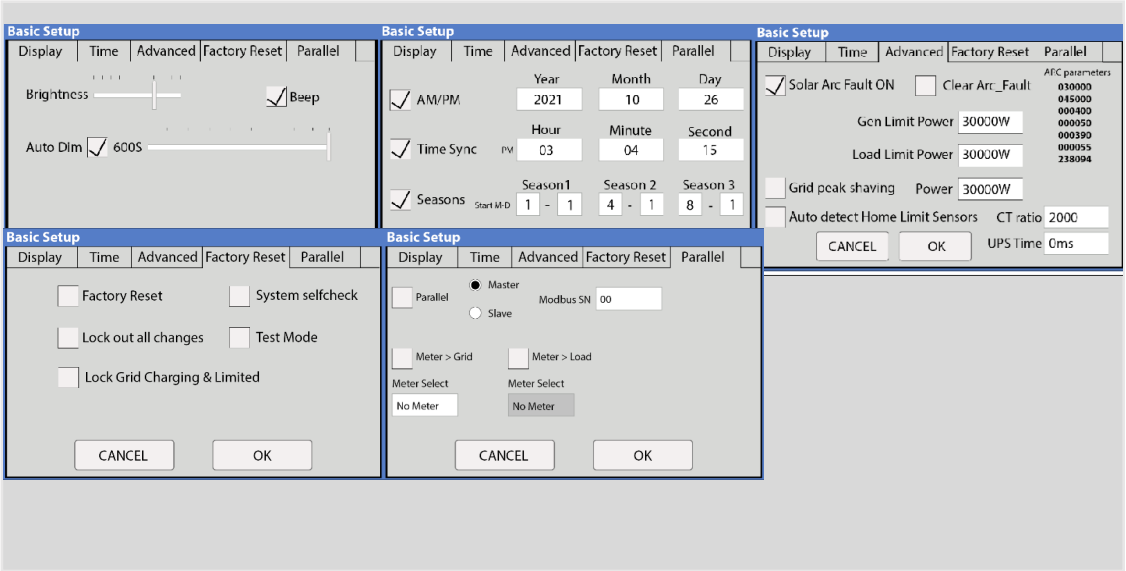



If successful, you should see a Red and Green Light on the Dongle showing a successful connection. Red light may blink at a ~ 1s rate.

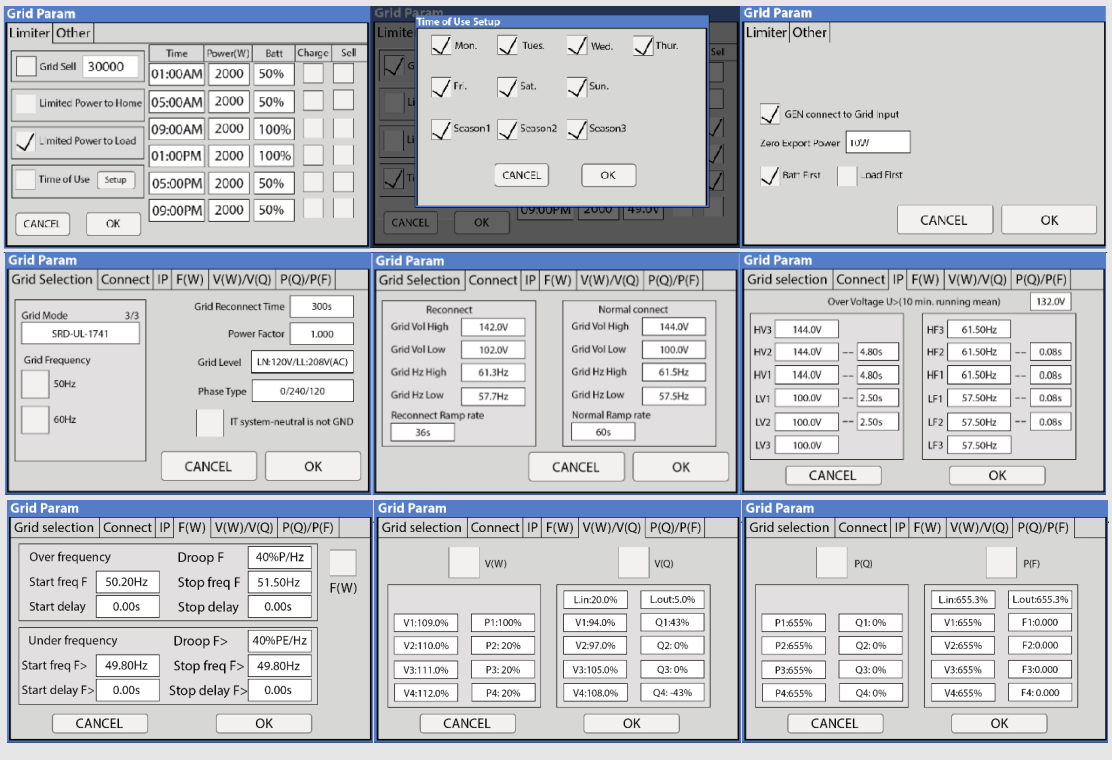
**Red LED:** Connected to Sol-Ark and has power.
**Green LED**: Connected to Internet and Server
**Flashing Green LED**: Connected to router but not server (usually a VPN or firewall issue)


### 3.2.7.4 GUI Screens



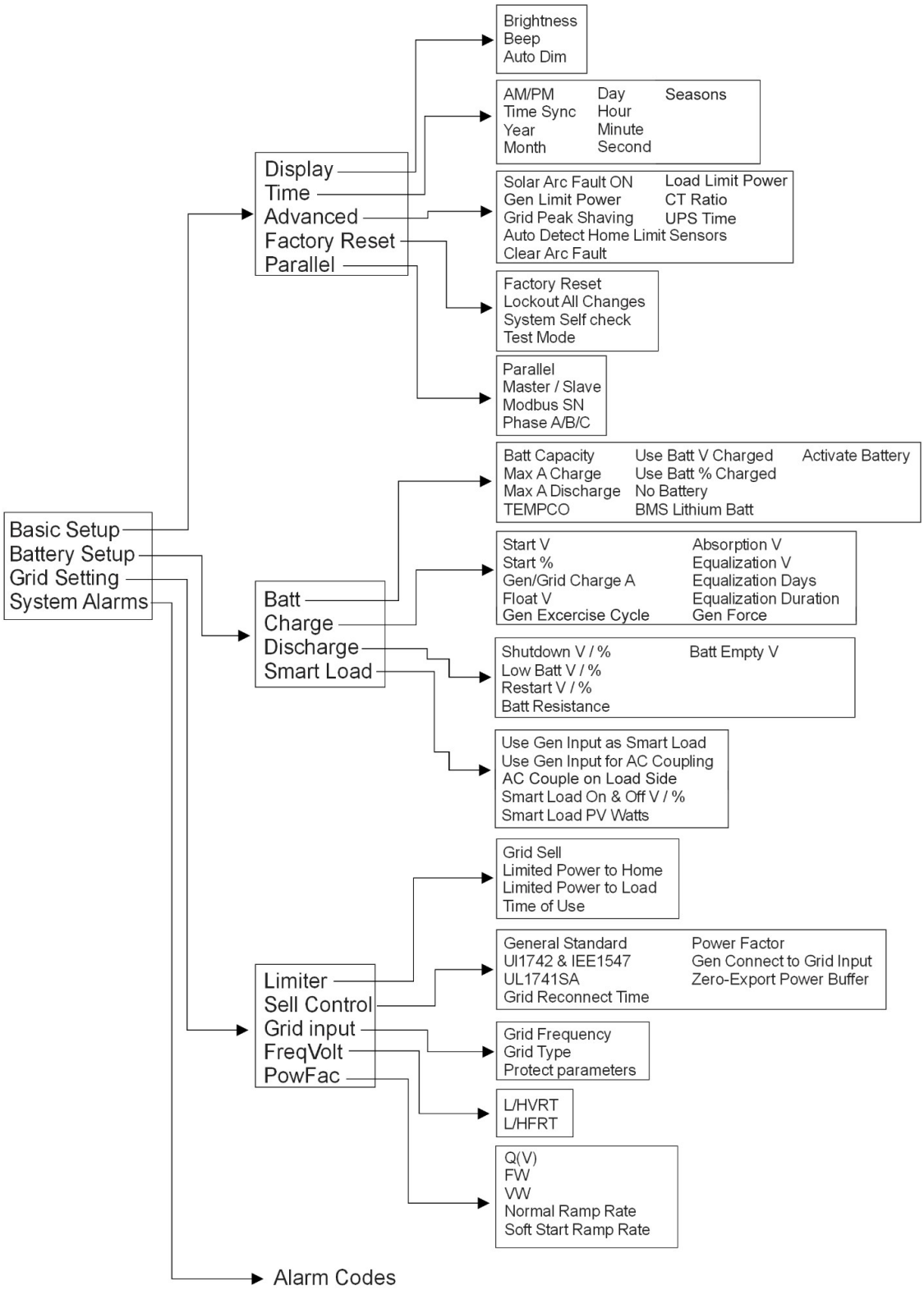



## Limiter/Grid Setup

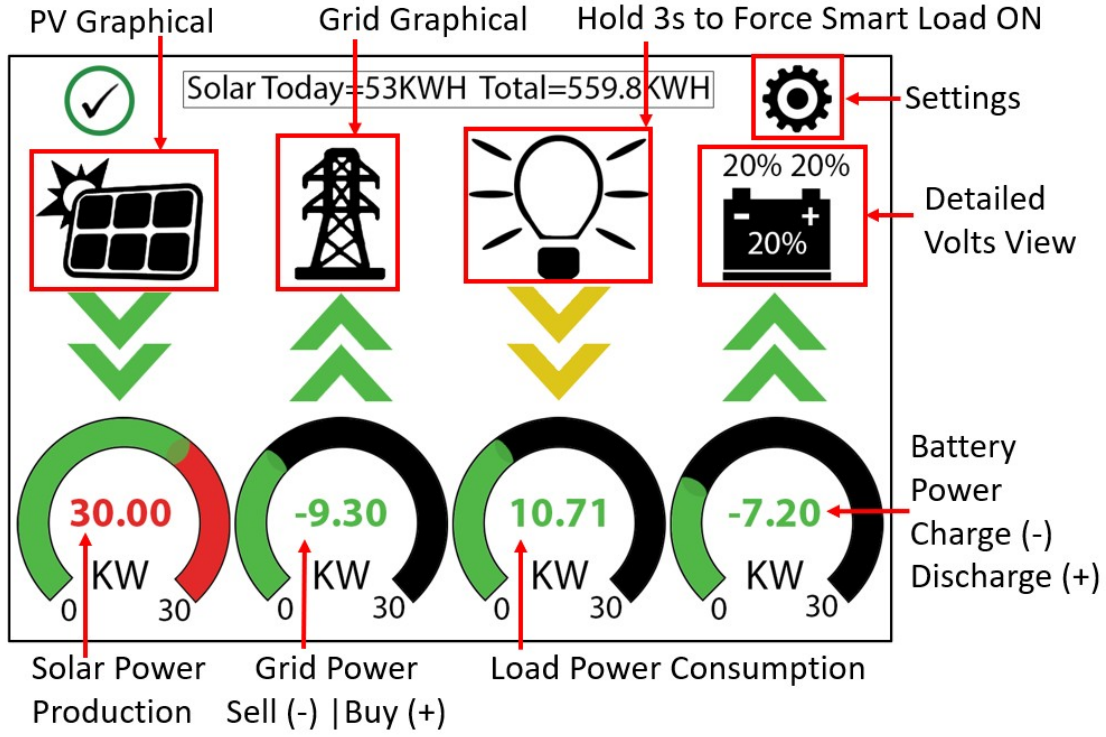


### 3.2.7.5 Programming Guide

1. Sol-Ark Menus



2. Main Screens (Touchscreen)




**Detailed Volts View (Press Batt Icon)**

- Top row = Total power for the column
- Solar Column: Displays voltage and amps per MPPT

**Danger:** PV Voltage not to exceed 500V.

**Danger:** Des dommages se produiront si PV COV > 500 V.

| Solar | Grid | INV | USP LD | Batt |
|---|---|---|---|---|
| 0W | 0W | 0W | 0W | 0W |
| 0V/0.5A<br>M1: 0W<br>364V/0.0A<br>M2: 0W<br>0V/0.1A<br>M3: 0W<br>362V/0.8A<br>M4: 0W | 0.0Hz<br>L1: 0V<br>L2: 0V<br>L3: 0V<br>HM1: 0W<br>HM2: 0W<br>HM3: 0W | 60.0Hz<br>L1: 0V<br>L2: 0V<br>L3: 0V<br>L1: 0A<br>L2: 0A<br>L3: 0A | L1: 0V<br>L2: 0V<br>L3: 0V<br>L1: 0W<br>L2: 0W<br>L3: 0W | 0.0V/ 0%<br>0.00A<br>0.0C<br>0.00V/ 0%<br>0.00A<br>0.0C |
| TEMP<br>AC:19.4C | LD1: 0W<br>LD2: 0W<br>LD3: 0W | L1: 0W<br>L2: 0W<br>L3: 0W | Gen 60.0Hz 0W<br>L1: 0V<br>L2: 0V<br>L3: 0V | L1: 0W<br>L2: 0W<br>L3: 0W |

- Grid Column
  - If selling to the Grid, Grid Watts = negative
  - If buying from the Grid, Grid Watts = positive
  - HM = power detected by the external current sensors on the entire home L1 / L2 / L3
  - LD = power detected using internal sensors
- INV Column: Voltage, Amps, and Watts for L1, L2, L3
- UPS LD Column: Load Voltage and Watts for L1, L2, L3
- Batt Column: Voltage/Percentage, Amps, and Temp for Batt 1 and Batt 2
- GEN Column: Generator or AC Coupled Input Volts and watts for L1, L2, L3
- AC Temp = Temperature of AC conversion electronics
  - Batt → AC
  - PV → AC

**PV Solar Graphical View**

A. Displays power production over time for the PV array.
B. Use up/down buttons to navigate between days.
C. Month view, Year view, and Total view

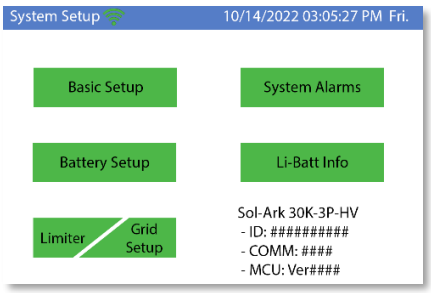
***NOTE:*** Reversed Grid Watt values may indicate incorrectly installed current sensors (reversed polarity).

**Grid Graphical View**

A. Displays power drawn from and sold to the grid over time.
B. Bars above the line indicate power bought from the grid.
C. Bars below the line indicate power sold back to the grid.
D. Line Frequency: useful when using off-grid when the generator is connected to grid input to verify the generator output frequency.

*This view can help determine when the peak power is used in the Home and for Time of Use programming.*

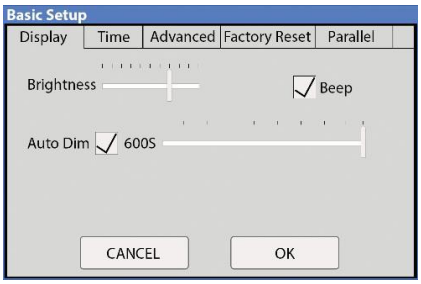
## System Setup Menu




A. ID = LCD serial #. Sol-Ark Technical Support uses the Wi-Fi serial #.
B. COMM = LCD software version
C. MCU = Inverter software version

3. Basic Setup

## Display



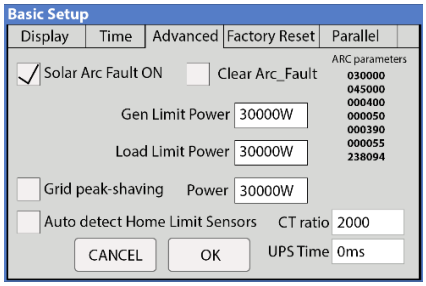

A. Brightness adjustment
B. Auto dim (must be enabled for the warranty to cover the LCD screen)
C. Enable/disable BEEP

## Time

A. Set the date and time for the system
B. Set up to three (3) seasons for Time of Use to follow

## Load Limit Power

Set the total AC Output of the Sol-Ark; curtails excess power. The default value is always the Maximum output of the Inverter.

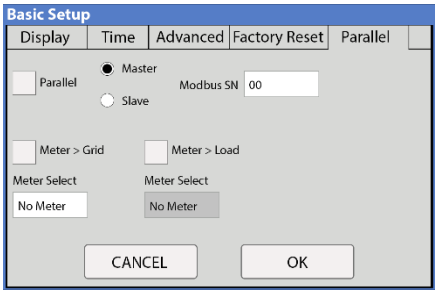



## Grid Peak Shaving

Set the Sol-Ark's threshold to begin contributing power to keep the power drawn from the grid below the threshold.

## CT Ratio

Set the CT ratio; the Default value is 6000. Please DO NOT change this value unless you speak with support; 3rd party CT sensors require our permission not to void the warranty.




## UPS Time

Set the UPS transfer time to the chosen value; any value below 5ms will default to a 5ms transfer time.

## Parallel (connecting multiple systems) *

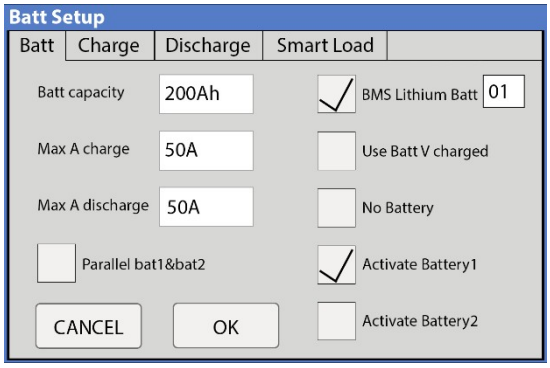
Please contact Sol-Ark technical support for parallel operation details.


3. System Alarms

A. Lists all recorded System alarms in chronological order.
B. Use this for Solar Engineering to help with troubleshooting.

4. Battery Setup

## Battery




**Batt Capacity:** Enter the battery bank's size connected to the system.

***NOTE,*** Seris = add Voltage | Parallel = add Amp-Hours

**Max A Charge:** set the max charge rate for the batteries (This also sets the PV → Battery charge rate).

**Max A Discharge:** set the max discharge for the battery bank (In off- grid mode, the battery bank will discharge 120% of this value for 10 seconds before the Inverter shuts down to prevent battery damage).

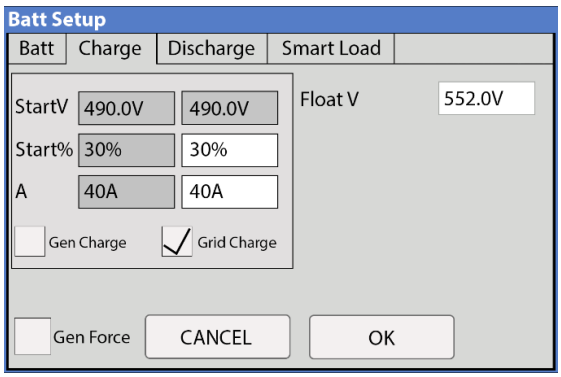
**Parallel bat1&bat2:** Select this to parallel the two battery terminals of the Sol-Ark 30K-3P-208V.

**BMS Lithium Batt:** Closed-Loop Communications and ensure correct Serial Number (01,02, etc.) for the battery.

**Use Batt V Charged:** Displays battery charge and other system values in terms of voltage.

Activate Battery 1&2: KEEP ON. This feature will help recover an overly discharged battery by slowly charging from the solar array or grid.

## Charge




**Float V**: Set value according to the manual of the batteries connected to the system.

**Gen Charge**: uses the gen input of the system to charge the battery bank from an attached three-phase generator.

**Start V**: Set the voltage at which the system will AutoStart a connected 3P generator to charge the battery bank.

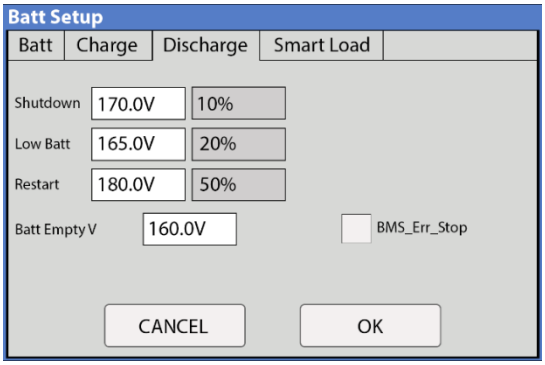
**Start percentage**: Set the SOC% at which the system will AutoStart a corresponding 3P generator to charge the battery bank.

A: Charge rate from the attached Generator in Amps (DC); **size this value according to the generator size**

**Grid Charge**: use the Grid input to charge batteries from the grid or a sizeable 208VAC three-phase generator only.

**Gen Force:** This is the test function for Gen AutoStart. Enable to trigger two-wire start (pins 1,2 on sensor pinboard 2) and turn on the generator. Disable to disengage the two-wire start and turn off the generator. The generator will not provide power during this test if grid power is available.

## Discharge



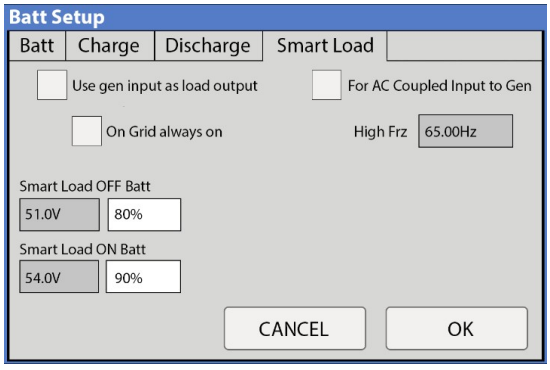

**Shutdown V**: battery voltage at which the Inverter will shut down (battery symbol on the home screen will turn red)

**Low Batt**: Low battery voltage (battery symbol on the home screen will turn yellow)

**Restart**: battery voltage at which AC output will resume after a shutdown

**Batt Empty V**: sets reserve capacity and improves % SOC calculations. It is not Batt_I adjusted.

## Smart Load (Gen Terminal)




A. This mode utilizes the Gen input connection as an OUTPUT that only receives power when the battery exceeds a user-programmable threshold.

B. Enable "Use gen input as load output" to power high- power loads such as a water heater, irrigation pump, AC unit, pool pump, etc. We call these luxury loads.

**Smart Load OFF Batt**

Battery voltage at which the Gen Load will stop receiving power.

**Smart Load ON Batt**

Battery voltage at which the Gen Load will start receiving power.

***NOTE:*** Using Gen load for a water heater, we recommend that only one leg (120V) be connected to the bottom element. This significantly reduces the power consumption of the water heater while retaining core functionality (it will heat water, only slower).

**Danger:** Per NEC, the Gen Load is limited to 57.6kW [160A @120V x 3] (Do not exceed!)

**Danger:** Selon NEC, la charge de génération est limitée à 57,6 kW [160 A à 120 V x 3] (ne dépassez pas !)

**Solar Watts is for on Grid**

A. The system waits to turn on the smart load until enough PV power is produced (when on the grid)

**AC Coupling Settings ("For AC Coupled Input to Gen")**

A. To use the Gen input terminal as an AC coupled input, check the "For AC Coupled Input to Gen" box (this feature will also work with three-phase "Grid-Tied" Inverters)

B. In this mode, the meaning of "Smart Load OFF Batt" and "Smart Load ON Batt" change.

**Smart Load OFF Batt:** The SOC % or V at which the AC coupled inverter(s) are shut down when in off-grid mode.
***NOTE:*** 90% recommended

Smart Load ON Batt: The SOC % or V at which the AC coupled inverter(s) are turned on when in off-grid mode.
***NOTE:*** 60%-80% recommended

When On-Grid, the AC-coupled Inverter is always on, selling any extra power back to the grid.

**Ensure you can (are allowed) sell power to your utility provider when using AC Coupled PV Arrays on-grid.**

To use the LOAD terminal for AC coupling grid-tied Inverter (s)

A. You must select "AC couple on load side"

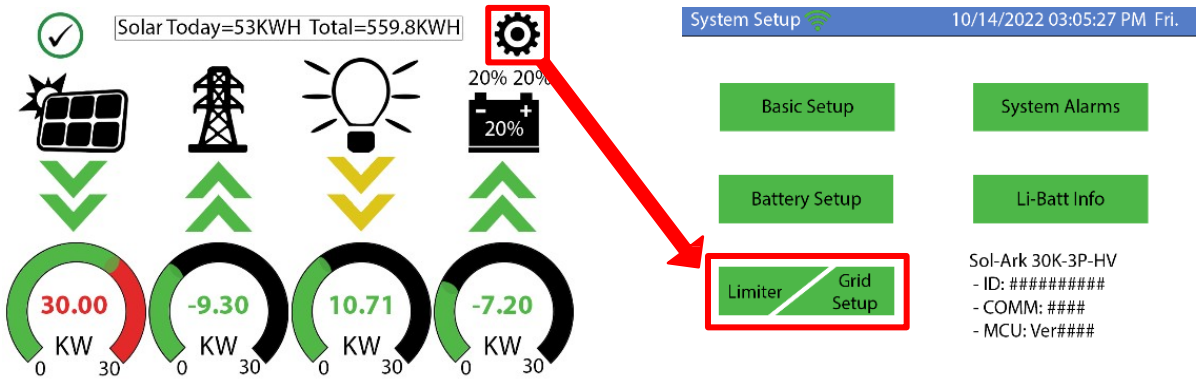
B. The Gen terminals are not used (even though the GEN terminals are not physically being used for this mode, AC coupling on the LOAD side prevents the use of the GEN terminals)

C. Wire as shown in the preceding example diagram labeled "Load side AC coupling example"

Some load-side AC coupling installations require a line-side tap instead of landing on a service panel.

***NOTE:*** Some load-side AC coupling installations require a line-side tap instead of landing on a service panel.

5. Limiter Tab / Grid Setup




## Limiter Tab / Other Tab

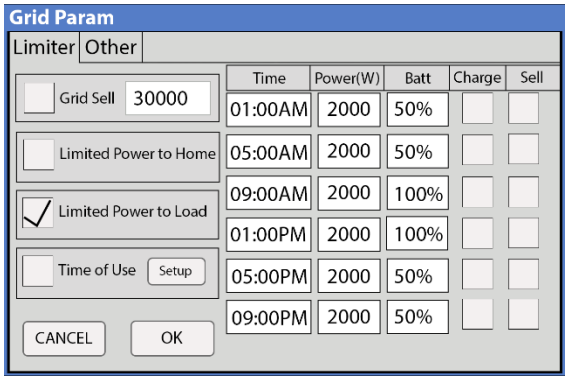
**Grid Sell:** maximum watts sold to the grid.

**Limited Power to Home:** Limits power produced by the system to match the demand of the Home (CTs Required)

**Limited Power to Load:** Limits power produced by the system to match the demand of connected loads.

**Time of Use:** Use the batteries while the grid is ON

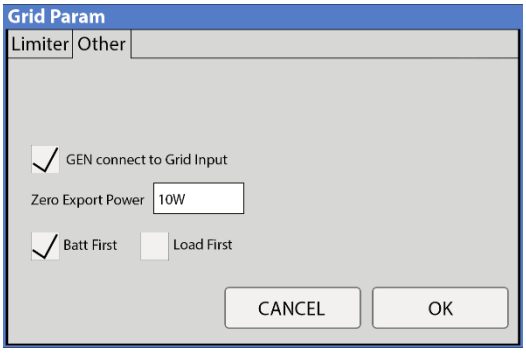
**Time:** When the System will sell batt/PV power to the Grid or Home



**Power(W):** Max watts called from the battery only at each time slot.

**Batt:** The battery voltage or % at which the system will limit selling to the Grid or Home from the battery. The system will drain the battery until reaching that percent/voltage.

**Charge:** Enables grid/gen charging up to the voltage or percentage specified on the line during a selected period. PV will always charge 100%.




If using a generator, select the charge box for the times that may need the generator, and the Gen will charge the battery to the voltage of the percentage specified in the "Batt" column.

**Sell:** The sell check box allows us to discharge the battery for grid sell-back for that time slot.

**GEN connect to Grid Input:** Enable if Generator connects to the AC Grid Terminals.

**Zero Export Power:** Power that is always drawn from the grid.

**Batt First vs. Load First:** Internal Use, Select "Batt First".

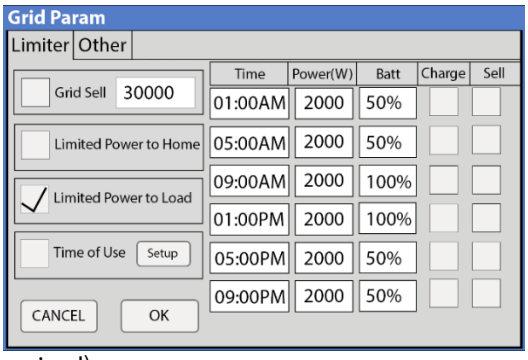
***NOTE:*** If you need the batteries to never charge from the grid, uncheck the "Grid Charge" box under the charge tab of the battery menu. See Charge Tab under Batt Setup

## Selecting Power Mode (Limiter Tab Details)

Sol-Ark 30K-3P will simultaneously use various power sources available to meet the load demand. The following power modes allow the user to determine the power sources available to the Sol-Ark 30K-3P-208V.

### Limited Power to Load / Self Consumption

A. Sol-Ark will only power loads connected to the load output
B. It will not produce more power than what the connected loads require
C. This mode will NOT sell back to the Home nor Grid (Grid Terminal)




### Limited Power to Home (Zero-Metering)

Main Menu → System Settings → Grid Setup → Limiter → Limited Power to Home

A. Pushes power to the whole Home WITHOUT selling back any excess to the grid (no net metering agreement required).
B. This mode requires the use of limiter sensors .
C. Power source priority is the same as Grid Sell Back.

### Grid Sell

Main Menu → System Settings → Grid Setup → Limiter → Grid Sell

A. This mode allows Sol-Ark 30K-3P-208V to SELL BACK any excess power the solar panels produce to the grid.

**Power source priority:**

1. Solar Panels | 2. Grid | 3. Generator (Manual) | 4. Batteries (until reaching programmable % discharge)

Simultaneously select Grid Sell and Limited Power to Home

Load (light bulb) icon on the home screen now includes both the load output power and the home's consumption.

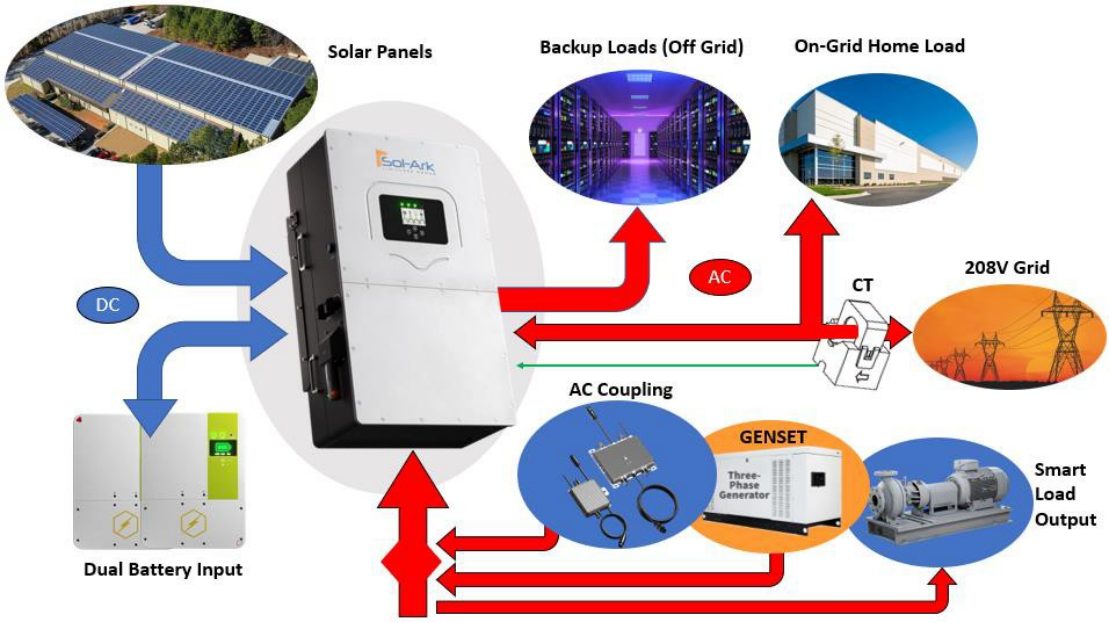
### Time of Use (using batteries during peak power times)

Main Menu → System Settings → Grid Setup → Limiter → Time of Use

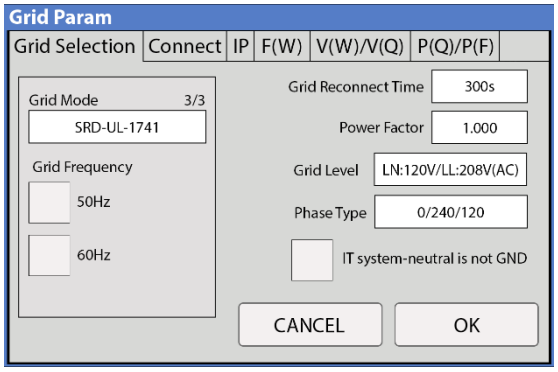
A. Use the batteries to reduce power consumption from the grid during a user-programmable peak pricing time

**Power source priority:**

1. Solar Panels | 2. Batteries (programmable % discharge) | 3. Grid (control when Grid charges) | 4. Generator




## Grid Selection Tab




**General Standard:** uses Protect Parameters in table.

**UL 1741 & IEEE1547:** Enables sell compliant functionality UL1741SA: Enables wider Freq, Voltage, and Power Factor

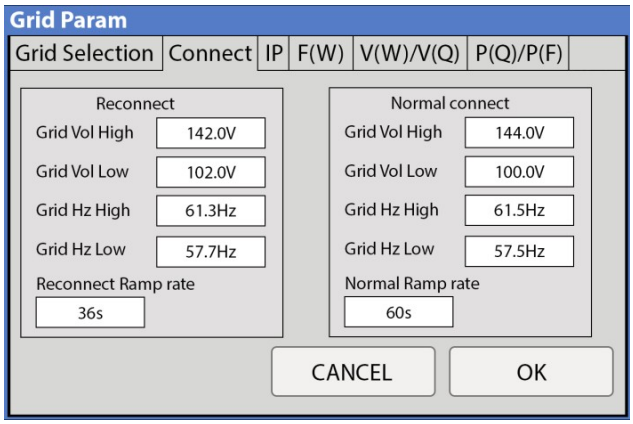
**Grid Frequency:** Select the Grid Frequency connection.

**Grid Reconnect Time:** Time to reconnect to the grid after grid loss.

**Grid Level:** Several voltage levels for the inverter output voltage when in off-grid mode. LN:120VAC LL:208VAC, LN:115VAC LL:200VAC, LN:133VAC LL:220VAC

***NOTE:*** Each time the input/output voltage changes, the inverter(s) require a power cycle

## Connect Tab




**Reconnect:** The voltage and frequency range the Inverter uses to reconnect to the grid after a grid loss

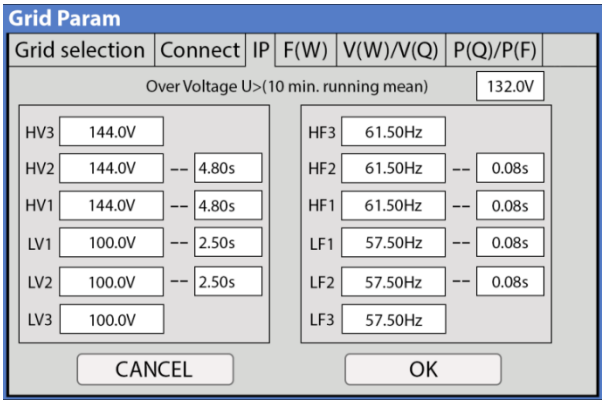
**Reconnect Ramp Rate:** The reconnection power ramp

**Normal Connect:** The voltage and frequency range the Inverter uses when connecting to the grid for the FIRST time.

**Normal Ramp Rate:** The startup power ramp

***NOTE:*** We recommend widening the frequency range when connecting a generator to the grid terminal (55-65Hz).

### IP Tab




**HV1/HV2/HV3:** Overvoltage protection point

- **4.8s trip time**

**LV1/LV2/LV3:** Undervoltage protection point

- **2.5s trip time**

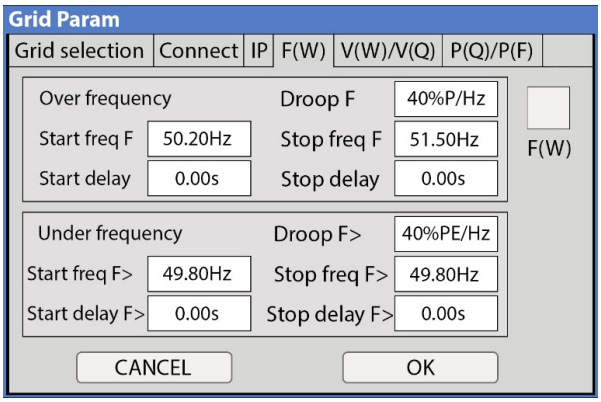
**HF1/HF2/HF3:** Over frequency protection point

- **4.8s trip time**

**LF1/LF2/LF3:** Under frequency protection point

- **2.5s trip time**

### F(W) Tab




The Sol-Ark 30K-3P-208V can adjust the inverter output power according to the grid frequency.

**Droop F:** The percentage of nominal power per Hertz (Hz).

**Example:**

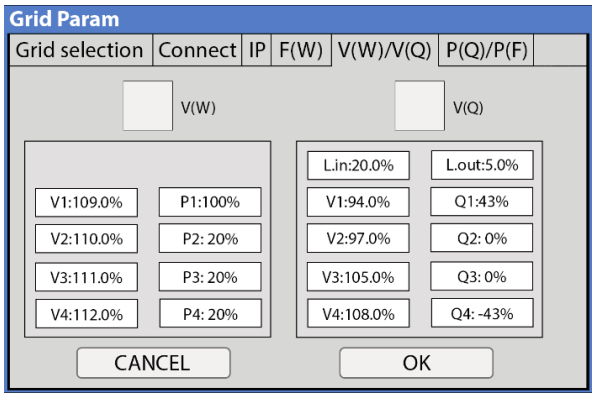
**Start freq F > 50.2Hz | Stop freq F < 51.5Hz**

**Droop F =40%P/HZ**

If the grid frequency reaches 50.2Hz, the Inverter will decrease its active power at Droop F of 40%. The Inverter will stop decreasing output power when the grid frequency is less than 51.5Hz.

Please follow the local grid code.

### V(W) / V(Q) Tab




These functions are used to adjust the Inverter's output power (both active power and reactive power) when there are changes in grid voltage.

**V(W):** Will be used to adjust the Inverter's active power according to the set grid voltage.

**V(Q):** Will be used to adjust the Inverter's reactive power according to the set grid voltage.

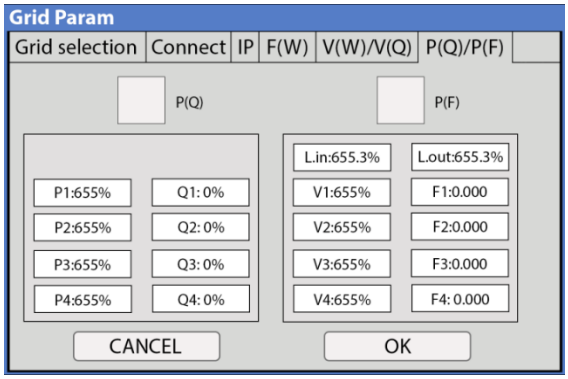
**Example:**

**V2 = 110.0% | P2 = 20%** When the grid voltage reaches 110% of the rated grid voltage, the Inverter will reduce its output power (active output power) to 20% rated power

**Example:**

**V1 = 93% | Q1 = 43%** When the grid voltage reaches 93% of the rated grid voltage, the Inverter will output 43% reactive output power.

### P(Q) / P(F) Tab




**P(Q):** Will be used to adjust the Inverter's reactive power according to the set active power.

**P(F):** Will be used to adjust the Inverter's PF (power factor) according to the set active power Please follow the local grid code.

## 3.2.8 Limiter Sensors (CT Sensors)

CT Sensors enable Limited Power to Home mode (meter zero) and Peak Shaving mode. CT sensors also allow the system to calculate loads powered upstream of the Grid Input in the "home." We recommend CT installation if using multiple inverters or a critical loads panel.

1. CT Sensor Install Location

- Install the CT sensors on L1 and L2, and L3 upstream of everything in the home except for a Generator

Transfer Switch, Knife Blade Disconnect, or Bypass Transfer Switch (upstream of Main Service Panel and Line-Side Tap). – see Diagrams Section Pgs. 8-17

2. CT Sensor Size

- Each Inverter includes three (3) x 1 3/8" CT sensors (fits up to 4/0 AWG service wires and busbars)
- We have 2" (> 4/0 AWG or Metal Busbars) sensors available for purchase if needed.
- Dimensions refer only to CT sensor hole size; contact Sales at (972) 575-8875 Ext 1 to purchase larger sensors

3. CT Sensor Extension Example

4. CT Sensor Wiring

- Wire CT sensor on L1 to pins 1 (white +) and 2 (black -)
- Wire CT sensor on L2 to pins 3 (white +) and 4 (black -)
- Wire CT sensor on L3 to pins 5 (white +) and 6 (black -).
- Twist the black and white wires for each sensor along the length of the run,
- If needed, you may extend the range using Shielded Cat 6 (use two twisted pair wires per sensor),
- Use two shielded Cat 6 cables for sensor extensions.

5. CT Sensor Direction

- The arrow embossed on the CT sensor housing helps determine the direction.
- Install CT sensors with the arrow pointing toward the Inverter.

6. Peak Shaving Mode

- Grid Peak Shaving is available with the CT sensors in the location described above and the correct arrow direction

7. CT Ratio

Set the CT ratio; the default value is 2000/1. DO NOT change this value unless you speak with technical support; 3rd Party CT sensors require our permission not to void the warranty.

8. Parallel 120VAC/208VAC Three-Phase Note*

Please contact Sol-Ark technical support for parallel operation details.

### Limiter Sensor Automatic Setup

**Requires Batteries and AC coupled panels must be off while detecting. If you do not have batteries: verify CT sensor placement manually.**

A. Install limiter sensors as previously described (shown in all diagrams). We require a battery and grid connection before starting auto-setup.

B. Navigate to the "Advanced" Tab of the Basic Setup screen (follow the directions below to get there).

A. Touch the gear icon → Touch the Basic Setup button → Select the Advanced tab

C. Select "Auto detect Home Limit Sensors" and press "OK".

D. Wait for the Sol-Ark to finish its learning process (Sol-Ark will alternate sell-back magnitude between legs, automatically determining the correct settings for the sensors).

E. Verify sensors were correctly configured (see Fig. D). If they are not correct, repeat the learn function.

**Fig.**

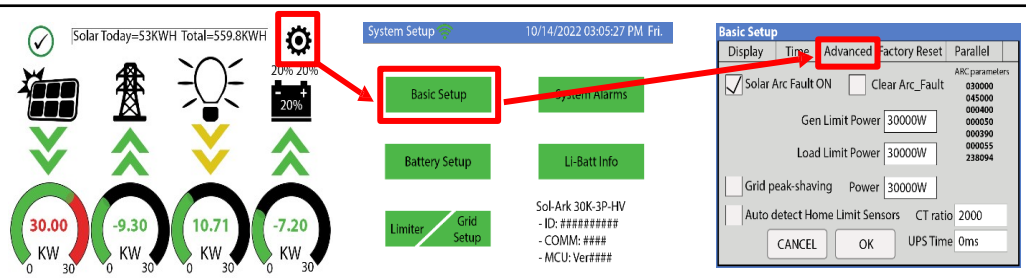
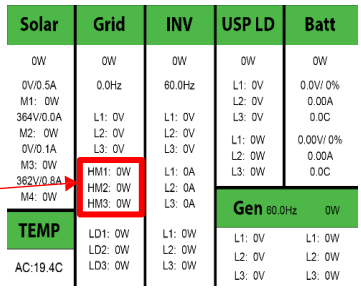



**Fig.**

In Limited Power to Home Mode HM values will be close to zero. HM values should never be negative. If negative, the Limiter Sensors are not installed properly.




Possible Limiter Sensor issues: Sensors are facing wrong direction Sensors are on the wrong wire(s) / input(s) Sensors are not fully closed on wire(s) Sensor Polarity is wrong (White = + |BLK = -).

**Verifying proper sensor direction**:

- Any loads in the home will show a positive HM (+) value in Watts.
- Turning on solar panels and enabling Grid Sell should show a negative HM (-) in Watts if you are producing more power than the loads are consuming.
- If you turn on Limited Power to Home mode, then HM: ~0 Watts to zero the meter (system matches the loads to within 99%).

## 3.2.9 Installation Tips

If you installed limiter sensors (CTs) for Limited Power to Home selling mode, verifying the proper sensor placement and direction is critical. Remove one sensor from the main L1 connection, and the power should drop to 0W.

### 3.2.9.1 Off-Grid Installation Tips

Sol-Ark 30K-3P-208V will automatically operate in Off-Grid Mode without the grid (under the same power priority as TOU)

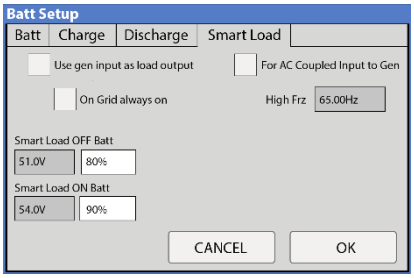
A. Limiter Sensors are not required for completely Off-Grid installs unless you use Grid Peak Shaving with a Gen connected to the Grid input terminal.

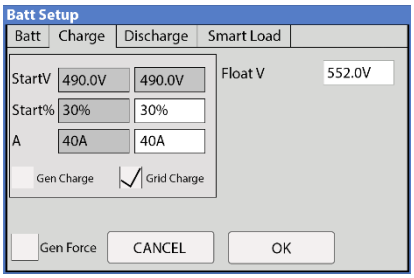
B. The Grid input Terminal Block on the Sol-Ark should be used as the Generator input (up to 54kW generators) so that you may maintain Smart Load output capability when off-grid. Therefore, you will use Grid Charge (default) in the Battery Setup/Charge menu to enable the generator's ability to charge the batteries. Enable "GEN connect to Grid Input," as shown on the right.

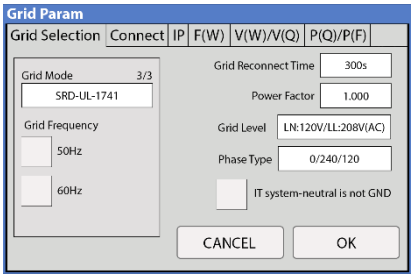
C. When off-grid, there is no need for a transfer switch: connect the load output of the Sol-Ark to the whole home/building

D. Do not use Grid Sell or Limited Power to Home Modes Off-Grid. Only Limited power to load (default)

E. The Auto Generator start functions as a 2-wire switch (closes the circuit when needing charging)



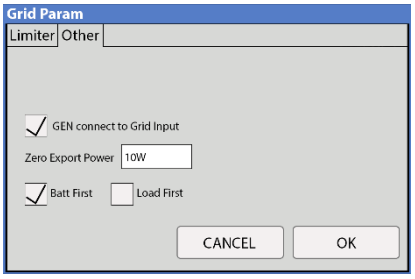
i. Auto Gen-start will be triggered when the battery voltage or percent reaches the level programmed in the Battery Setup menu. Then, the generator will continue to charge the batteries until they are about 95% full (this percentage is not programmable) before turning the generator off.

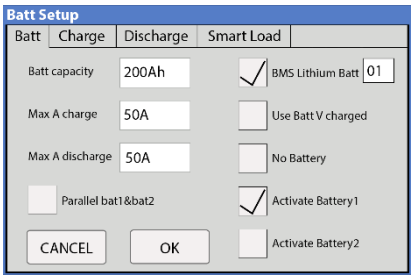
F. We recommend changing the "Grid Reconnect Time" under the Grid Selection tab of the grid setup menu to 30 seconds; otherwise, the Sol-Ark will not charge from the generator until it has been on for at least 5 minutes per the default value of 300 seconds

G. Under setup for Limiter: Other, select "GEN connect to Grid Input." And General Standard in the Grid Selection tab. Then, ensure to widen the input frequency range to 55-65Hz to work with any frequency generator.

H. If you want to use a wind turbine with the Sol-Ark 30K-3P-208V, the turbine must have a 400V charge controller with a dump load to prevent overcharging the batteries. Connect the charge controller on the turbine to the battery bank the Sol-Ark uses, and the turbine will help charge the batteries.

I. Don't forget to set the Battery capacity and reasonable charge/discharge rates



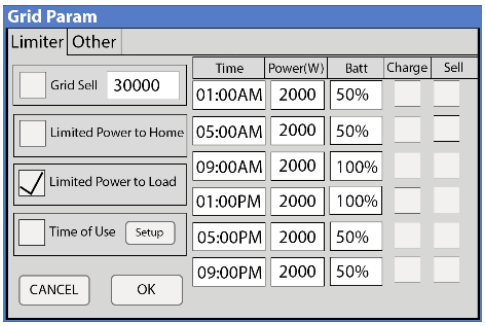

### 3.2.9.2 Grid-Tie / No Battery Install Tips

A. Under Battery setup, select no Battery & disable Activate Battery (or the system will beep)

B. Note: a whole system power cycle is required when changing the battery to no battery settings

C. Under the Limiter Setup, select Grid Sell

D. Touch the Battery Icon to see the Detailed Volts View to verify your inputs & outputs.



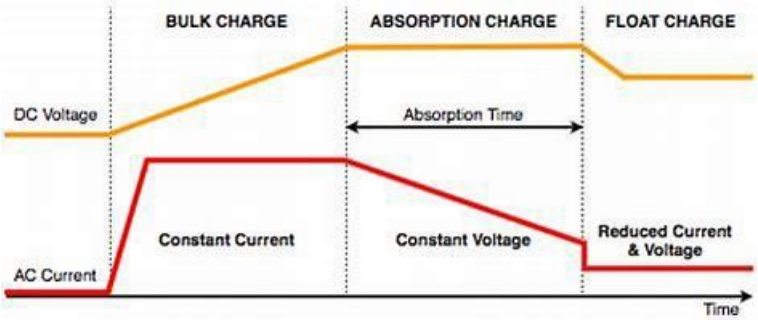

### 3.2.10 Batteries Charging Information

**3- Stage Charging**

The MPPT has a 3-stage battery charging algorithm for rapid, efficient, and safe battery charging. The figure below shows the stage sequence.

**Bulk Charge Stage**

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




**Absorption Stage**

When the battery has reached the absorption voltage setpoint, we use constant-voltage regulation to maintain battery voltage at the absorption setpoint, preventing heating and excessive battery gassing. The battery can come to a full state of charge at the absorption voltage setpoint. Absorption lasts until batteries charge at 2% of the programmed Ah size.

**Float Stage**

After the Absorption stage charges the battery fully, the MPPT reduces the battery voltage to the float voltage setpoint. If batts have 100% charge, there can be no more chemical reactions, and all the charging current turns into heat and gassing. The float stage provides a meager rate of maintenance charging while reducing the heating and gassing of a fully charged battery. The purpose of float is to protect the battery from long-term overcharge.

***NOTE:*** Find our full list of currently supported battery communications
www.sol-ark.com/battery-partners

## 3.3 Installation and Operation of the Battery System

### 3.3.1 Preparing tools and safety gear

**Danger:** It is recommended to wear the following safety gear when dealing with the battery pack.

**Danger:** Il est recommandé de porter l'équipement de sécurité suivant lors de l'opération de la batterie.

The following tools and instrument are required to install the battery system:

<table>
<tr><th>Type</th><th colspan="3">Tools and Instruments</th></tr>
<tr><td rowspan="3">Installation</td><td>  <br>Wire Cutter</td><td>  <br>Crimping Modular Plier</td><td>  <br>Cable Ties</td></tr>
<tr><td>  <br>Screwdriver Set</td><td>  <br>Electric Screwdriver</td><td>  <br>1000VDC Multimeter</td></tr>
<tr><td>  <br>Adjustable Wrench</td><td colspan="2">  <br>Isolated Nut Drivers 1500V</td></tr>
<tr><td>Personal protective equipment (PPE)</td><td>  <br>Anti-arc flash suit</td><td>  <br>Safety goggles</td><td>  <br>Safety shoes</td></tr>
</table>

**NOTE**

Use properly insulated tools to prevent accidental electric shock or short circuits.

If insulated tools are not available, cover the entire exposed metal surfaces of the available tools, except theirtips, with electrical tape.

### 3.3.2 System Working Environments Checking

#### 3.3.2.1 Cleaning

**Danger:** The battery system has high voltage connectors. The clean condition benefits the isolation characteristic of the system.

**Danger:** *Le système de batterie a des connecteurs à haute tension. La condition de nettoyage entraînera lacaractéristique d'isolation dusystème.*

Before installation and system working, the dust and iron scurf must be clean to ensure the environments cleaning. And the environment must have certain anti-dust ability.

*Avant l'installation et le fonctionnement du système, vous devez éliminer la poussière et le copeaude fer pour maintenir l'environnement propre. Et l'environnement doit avoir une certaine capacitéanti-poussière.*

The system after long term running must check if the humidity and dust cover or not. If heavy dust cover with high humidity on the system, stop the system running and make clean specially for the high voltage connectors.

*Après une longue période de fonctionnement, le système doit vérifier l'humidité et le pare-poussière ou non. En cas de forte couverture de poussière avec une humidité élevée sur le système, celui-ci doit être arrêté et doit être nettoyé spécialement pour les connecteurs à haute tension.*

**Danger:** the power cables and plugs still have high voltage DC power from serial connected battery modules (battery module can't be turned off), be careful to handle the Power Plugs.

**Danger:** *Les câbles d'alimentation et les fiches sont toujours alimentés en courant continu à haute tension par les modules de batterie connectés en série (le module de batterie ne peut pas être désactivé), vous devez donc manipuler les fiches avec précaution.*

#### 3.3.2.2 Temperature

PowerCube-M1-C system working temperature range: 10°C ~ 40°C; Optimum temperature: 18°C ~ 28°C.

*Plage de température de fonctionnement du système PowerCube-M1-C: 10°C-40°C; température optimale:18°C-28°C.*

**Caution:** Out of the working temperature range may cause the battery reduces the cycle of life even trigger the battery system over / low temperature alarm or protection.

***Attention,*** *En dehors de la plage de température de fonctionnement, la batterie risque de réduire sa durée de vie et même de déclencher une alarme ou une protection contre les températures trop élevée ou trop basses.*

#### 3.3.2.3 Cooling System

The room must be equipped with cooling system.

*La salle doit être équipée d'un système de refroidissement.*

**Caution:** Out of the working temperature range may cause reduction of the cycle of life of the battery even trigger the battery system over / low temperature alarm or protection.

***Attention:*** *En dehors de la plage de température de fonctionnement, la batterie risque de réduire sa durée de vie et même de déclencher une alarme ou une protection contre les températures trop élevées ou trop basses.*

#### 3.3.2.4 Heating System

The room must be equipped with heating system. If the environment is lower than 0°C, the heating system at first must be turned on.

*La salle doit être équipée d'un système de chauffage. Si la température ambiante est inférieure à 0°C, vous devez d'abord allumer le système de chauffage.*

**Caution:** Out of the working temperature range may cause reduction of the cycle of life of the battery even trigger the battery system over / low temperature alarm or protection.

***Attention:*** En dehors de la plage de température de fonctionnement, la batterie risque de réduire sa durée de vie, voire de déclencher une alarme ou une protection contre les températures trop élevées ou trop basses du système de batterie.

#### 3.3.2.5 Fire-extinguisher System

**Danger:** The room must be equipped with fire-extinguisher system for lithium-ion battery.
La salle doit être équipée d'un système d'extinction d'incendie pour batterie lithium-ion.
The fire system needs to be regularly checked to be in normal condition. Refer to the using and maintenance requirements of local fire equipment relevant.

**Danger:** Le système d'incendie doit être vérifié régulièrement pour être en état normal. Reportez-vous aux exigences d'utilisation et de maintenance des équipements anti-incendie locaux

#### 3.3.2.6 Grounding System

**Danger:** Before the battery installation be sure the grounding point of the basement is stable and reliable.If the battery system is installed in an independent equipment cabin (e.g. container), make surethe grounding of the cabin is stable and reliable.

**Danger:** Avant l'installation de la batterie, vous devez vous assurer que le point de mise à la terre du sous-solsoit stable et fiable. Si le système de batterie est installé dans une cabine d'équipement indépendante (conteneur, par exemple), vous devez vous assurer que la mise à la terre de la cabine soit stable et fiable.

The resistance of the grounding system must be ≤100 mΩ

La résistance du système de mise à la terre doit être ≤100 mΩ.

### 3.3.3 Cables Connection

**Danger:** The battery system is high voltage DC system. Make sure the grounding of the rack is stable and reliable.
**Danger:** *Le système de batterie est un système CC à haute tension. Vous devez vous assurer que la mise à la terre du rack soit stable et fiable.*

**Danger:** All the plugs and sockets of the power cables must be orange to orange and black to black. Otherwise it will cause personal injury.
**Danger:***Toutes les fiches et prises des câbles d'alimentation doivent être orange à orange et noir à noir. Sinon, cela causera des blessures.*

**Danger:** Isolation breakers or switches for each battery string must be installed for maintenance.
**Danger:** *Un disjoncteur d 'isolement ou un commutateur doivent être installés pour chaque batterie.*

**Danger:** No short circuit or reserved connection of the battery system's anode and cathode.
**Danger:***Toutes les fiches et prises des câbles d'alimentation doivent être orange à orange et noir à noir. Sinon, cela causera des blessures.*

**Caution:** Wrong communication cables connection will cause the battery system failure.
***Attention,*** *Une mauvaise connexion des câbles de communication entrainera une défaillance du système de batterie.*

### 3.3.4.1 Grounding

Danger: The PowerCube-M1-C modules' grounding is based on metal directly touch between the module's surface and rack's surface. So it needn't grounding cables at all. If uses normal rack, remove the paint at the corresponding place.

**Danger:** *La mise à la terre des modules PowerCube-M1-C repose sur le contact direct des métaux entre la surface de module et celle du rack. Il n'est donc pas nécessaire de mettre les câbles à la terre. Si vous utilisez un rack normal, il est possible d'enlever la peinture aux positions correspondantes.*

The fix hole of the fix frame can be fixed directly with the metal frame of the cabinet. Then through the grounding of the cabinet to ensure reliable grounding.

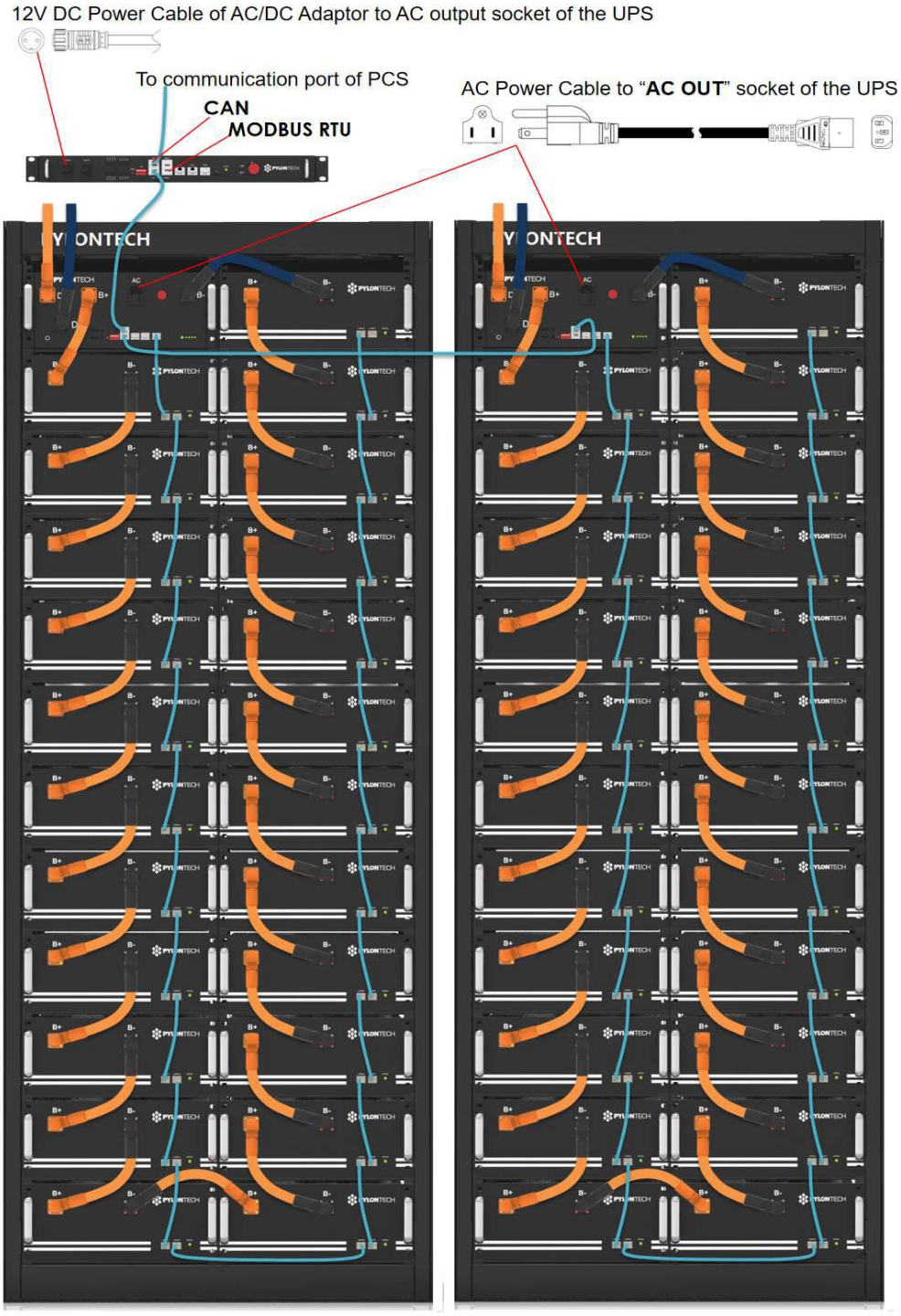
The cable shall be copper with yellow-green color.
The ground cable can also be connected from the M8 grounding bolt on the frame base. Grounding cable must be≥6AWG.

### 3.3.4.2 Cables Connection

***NOTE:*** Power cable uses water-proofed connectors. It must keep pressing this Lock Button during pulling out the power plug.

I. CAN Communication Mode between MBMS and BMS (battery string qty. ≤6 set)

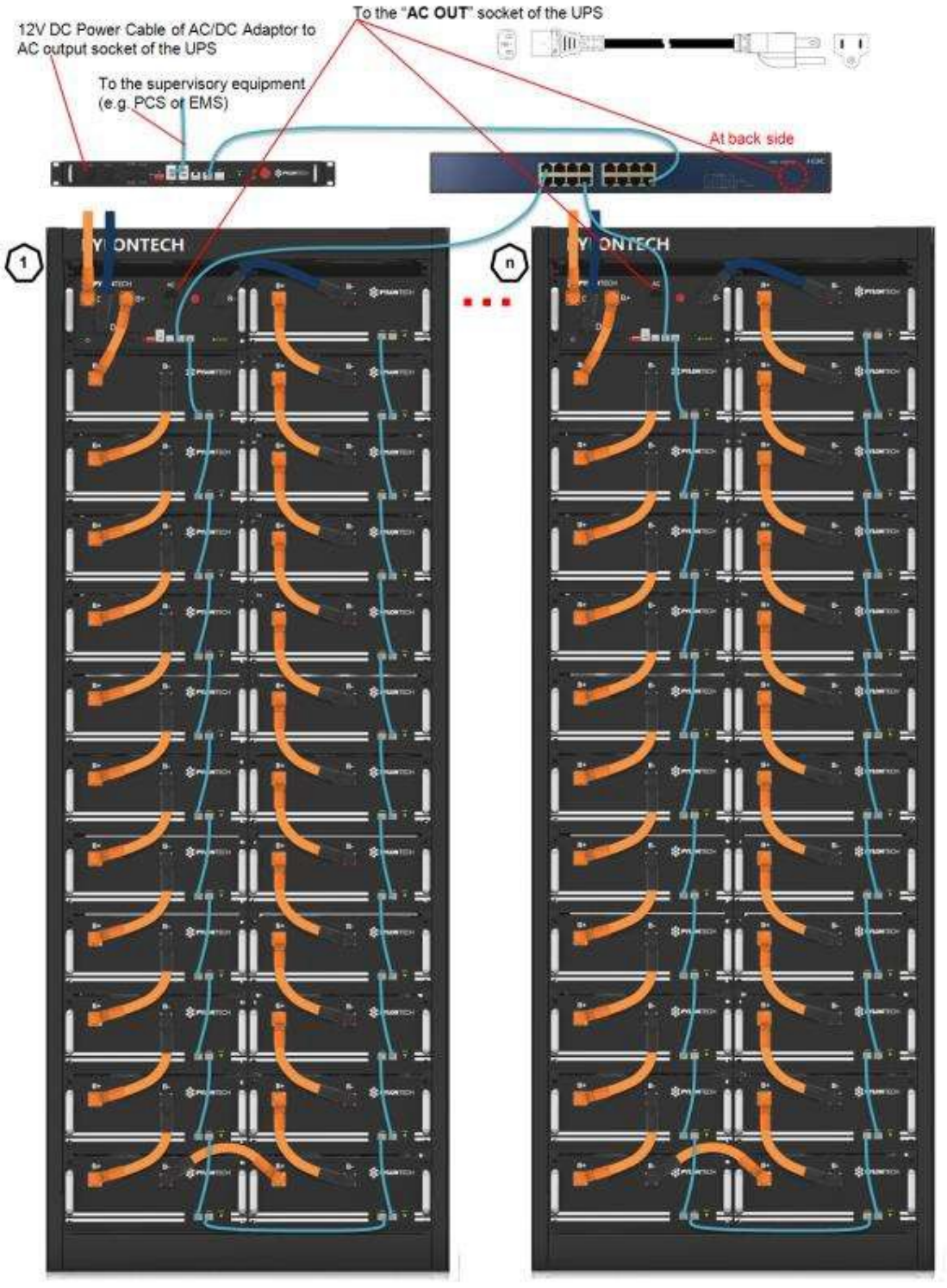
When system configured PowerCube-M1-C ≤6 set. The communication between PowerCube-M1-C uses CAN communication mode. The communication between the MBMS and the BMS of 1st PowerCube-M1-C uses CAN communication mode.




***NOTE:*** The 1st PowerCube-M1-C should be installed nearest by the MBMS.

II. Ethernet communication between MBMS and BMS (battery string qty. ≤32 set).

A. When system configured PowerCube-M1-C ≤32set. The communication between PowerCube-M1-Cs andMBMS uses Ethernet Switch by LAN communication.




B. Relation of MBMS and battery strings (PowerCube-M1-Cs) in the ports of Ethernet Switch

Both ends of BMS to MBMS communication cables must be marked with labels.

*Les deux côtés du câble de communication de BMS à MBMS doivent être marqués avec des étiquettes.*

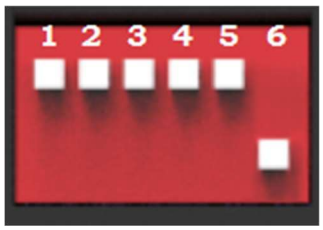
**Caution:** The last port of Ethernet Switch is for the MBMS.

**Attention:** Les deux côtés du câble de communication de BMS à MBMS doivent être marqués avec desétiquettes.

**Caution:** From the 1st port to the nth port are for the corresponding battery string (PowerCube-M1-C). So we can fastest find out the corresponding battery string on the Ethernet Switch.

**Attention:** *Du 1er port au nème port correspondent à la chaîne de batterie correspondante (PowerCube-M1). Ainsi, nous pouvons trouver rapidement la chaîne de batterie correspondante sur le commutateur Ethernet.*

III. ADD Switch Setting (Address Assignment)

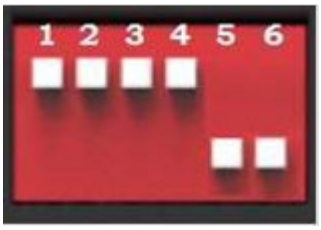



ADD Switch - Battery Controller is a 6-bit dial switches to manually distribute the communication address of the battery system. Down position is OFF, means "0". Up position is ON, means "1". 1st bit to 5th bit is for address, and the 6th bit dial switch support a 120Ω resistance (Terminal Resistance).

ADD Switch - MBMS is a 6-bit dial switches to manually distribute the communication address of the battery system. Down position is OFF, means "0". Up position is ON, means "1". 1st bit to 4th bit is for address, the 5th and the 6th bit dial switch support a 120Ω resistance (Terminal Resistance).

A. Under communication for single BMS (battery string qty. 1 set)

The BMS's first five bits must set in below <BMS's Address Configure Table >. The last BMS's terminal resistance must set in "1" (X=1);

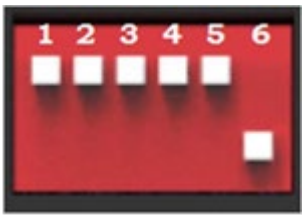



The address is configured following ASCII code: ("X" is terminal resistance).

BMS's Address Configure Table:

| CAN | Modbus | Address dial bit |
|---|---|---|
| 0 | 1 | 00000X |
| 1 | 1 | 10000X |
| 2 | 2 | 01000X |
| 3 | 3 | 11000X |
| 4 | 4 | 00100X |
| 5 | 5 | 10100X |
| 6 | 6 | 01100X |

B. Under CAN Communication Mode between MBMS and BMS (battery string qty. s6 set) The BMS's first five bits must set in below <BMS's Address Configure Table >. The last BMS's terminal resistance must set in "1" (X=1), and other BMS's terminal resistance must set in "0".




The address is configured following ASCII code: ("X" is terminal resistance).

BMS's Address Configure Table:

| Battery String | Address Bit |
|---|---|
| 1 | 10000X |
| 2 | 01000X |
| 3 | 11000X |
| 4 | 00100X |
| 5 | 10100X |
| 6 | 01100X |

### 3.3.4 Battery System Power On

**Warning:** Double check all the power cables and communication cables. Make sure the voltage of the INVERTER is same level with the battery system. Check all the power switch of every battery system is OFF.

Vérifiez deux fois tous les câbles d'alimentation et les câbles de communication. Assurez-vous que la tension du INVERTER est identique à celle du système de batterie. Vérifiez que l'interrupteur de chaque système de batterie soit éteint.

**Warning:** The external switch or breaker between INVERTER and battery string must be off before the battery system power on.

Un interrupteur ou disjoncteur externe entre le PC et la chaîne de batterie doit être désactivé avant que le système de batterie ne soit alimenté.

#### 3.2.4.1 Battery System Power On Steps:

1. Check the UPS (if has) is turned on. And the UPS is power supplying.

2. Switch the external power or INVERTER on, make sure all the power equipment can work normally.

3. Turn on all the BMS (Battery Control Modules) as following step:

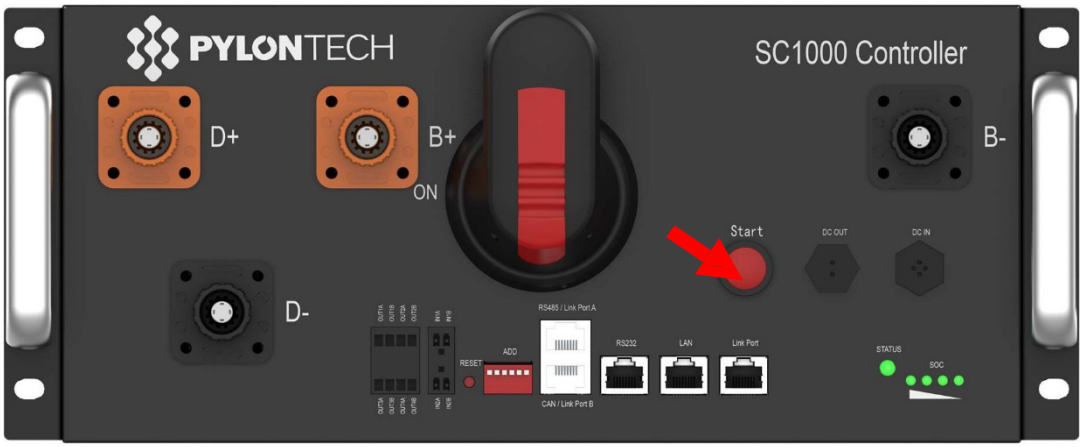
(1) Turn on the 1st BMS (Battery Control Modules) of battery string.

(2) The second BMS must be operated after success the first battery string's self-check. From 1st BMS to the last BMS turn on the battery strings on one by one.

*Instruction of step 3 in the following conditions (internal power supply):

① Turn on the "Isolating Switch":


② Press the "Start Button":



Press and hold the Start Button for more than 5 seconds until the buzzer rings, the LED indicator on front panel will light on if the start-up is successful.

***NOTE:*** Do not keep pressing the start button more than 30 seconds, or it will go into "BLACK- START" mode.


**System start process:**

The battery string's system will check itself. If power on successfully the battery string system will enter self-check mode automatically.

If the BMS and all battery modules are working normally, every status LED will be lighting green, that's mean self-check are passed. Self-check will be finished within 10 seconds.

**Black-start function:**

If long press (>10 seconds) the start button 30 seconds AFTER power on. The "STATUS" lamp will become green if the black start function is enabled. If "STATUS" lamp remains red, the black start function is failed to active, it needs long press start button again. System will close relay and output for 10 minutes.

**Warning:** if the black-start function is enabled, the terminal of D+ and D- will be electricity dangerous with high DC voltage output.
Les bornes D+ et D- présentent une tension de sortie en courant continu élevée et présentent un risque de mise sous tension si la fonction de démarrage en noir d'activation est activée.

**Caution***:* If the BMS can't receive communication from upper equipment because of the communication is off, the "STATUS" lamp will light red after 30sec. That doesn't mean failure existed, it means this battery string is OK while the external communication is off.
**Attention:** Si le BMS ne peut pas recevoir de communication de haut niveau parce que la communication est hors service, La lampe «d'état» sera rouge après 30sec. Ça veut dire que la batterie est OK pendant que la communication externe est coupée.

**Warning:** If there is failure during the self-check, must debug the failure then can start next step.
En cas d'échec lors de l'auto-contrôle, vous devez déboguer l'échec pour pouvoir commencer à l'étape suivante.

If the "STATUS" lamp on BMS/battery shows red from beginning, it means there is some failure in the battery string, the Power Relays in BMS will open, and it must be debugged at first.
Si le voyant "STATUS" est rouge depuis le début, cela signifie qu'il y a une défaillance de la chaîne de batterie, les relais de puissance dans le BMS s'activent et il faut déboguer en premier.

***NOTE:*** The LED lamp will be off in 20sec without any operation.
La lampe à LED sera éteinte dans 20 secondes sans aucune opération.

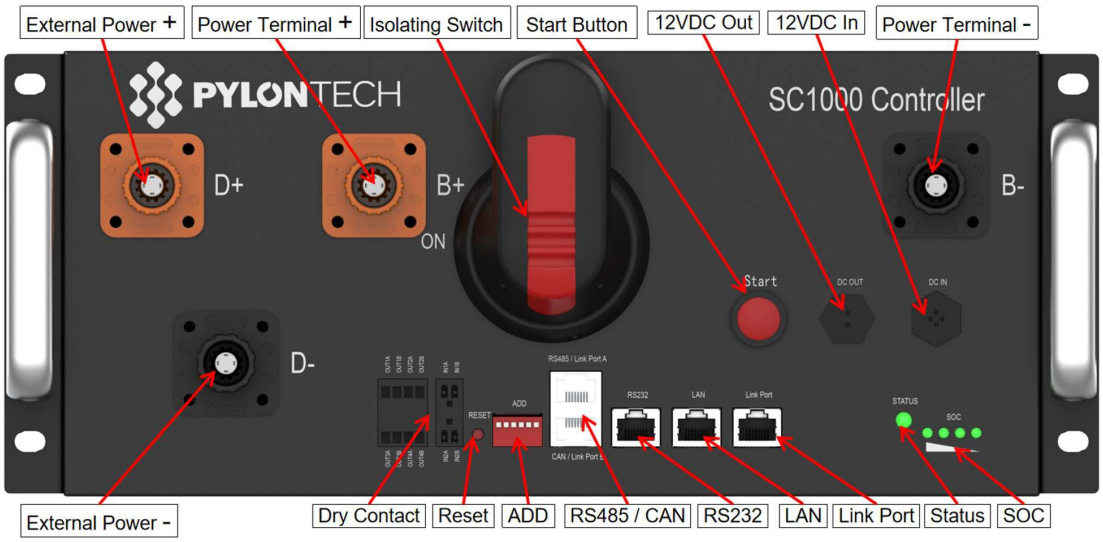
4. Turn on the external switches or breakers all after all the BMS turn on successful:

When the voltage distance is smaller than the parameter, the battery string will do the parallel operation.

**Caution:** The whole Battery Energy Storage System (BESS), after installation or restart the system when long time not in using, should be charged to full at first.
**Attention:** Pour l'ensemble du système de stockage d'énergie de batterie (BESS) après l'installation ou le redémarrage du système après une longue période d'inactivité, il faut le charger complètement au début.

### 3.3.5 Battery System Power Off

During maintenance or long-term storage, be sure to turn off the battery system.

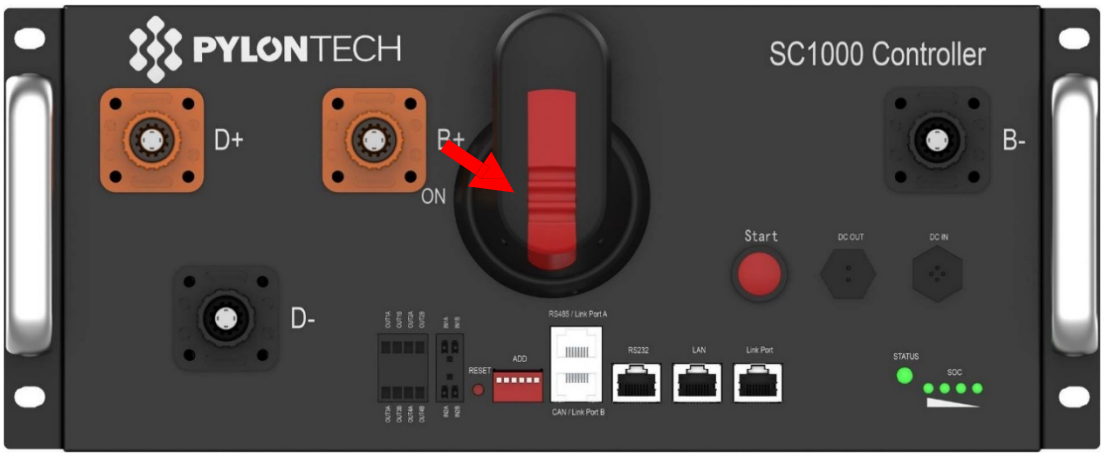



1. Turn off the power switch of INVERTER, to make sure no current through this battery string.
2. Turn off all the external switches or breaker between INVERTER and each battery strings.
3. Turn off the "Isolating Switch" of the BMS.
4. Turn off the "Power Switch" of the MBMS. If the ESS configures only single battery without MBMS, so needn't this operation step.
5. Turn off the UPS.

**Warning:** The UPS can turn on if have equipment must keep running can't turn off. Otherwise must turn off the UPS to save its power.
L'UPS peut s'allumer si l'équipement doit continuer à fonctionner et ne peut pas s'éteindre. Sinon, vous devez éteindre l'UPS pour économiser son énergie.

**Caution:** Before changing the battery module for service, be sure charge/discharge the replaced battery same voltage to the other in system battery modules. Otherwise, the system needs long time to do the balance for this replaced battery module.
**Attention:**Avant de remplacer le module de batterie pour le service, vous devez charger/décharger la batterie remplacée à la même tension dans les modules de batterie du système. Sinon, le système a besoin d'une longue durée pour équilibrer ce module de batterie remplacé.

**Warning:** Do not turn off the "Isolating Switch" during normal running condition. Otherwise will cause this battery string current surge by another battery strings. If the "Isolating Switch" is turned off in normal running condition, the INVERTER must be turned off firstly.
N'éteignez pas l'interrupteur d'isolation en fonctionnement normal. Dans le cas contraire, cela provoquera une surtension de la chaîne de batterie par une autre chaîne de batterie. Si le "commutateur d'isolation" est éteint en fonctionnement normal, il doit d'abord éteindre le INVERTER.




***NOTE:*** After installation, do not forget to register online for full warranty:
www.pylontech.com.cn/service/support.

## 3.4 Operation of the Outdoor Battery Cabinet System

### 3.4.1 Outdoor battery cabinet system power on

1. Connect INVERTER external AC 480V power supply.
2. Connect external auxiliary power supply of AC277 V. And the transformer output is AC 220V.
3. Turn on the air-conditioning circuit breaker and air-conditioning starts working after self-check is completed.
4. Turn on the UPS circuit breaker and ensure that there is no alarm when UPS starts up.
5. Turn on the INVERTER inlet circuit breaker and the INVERTER enters self-check mode.
6. Turn on the battery system, following the steps in *section 3.3.3*.
7. INVERTER communicates with BMS. BMS relay closes and outputs direct current to INVERTER. And the whole system is normal without failure.
8. Turn on the switch of the INVERTER load side.

### 3.4.2 Black start

1. For single battery string, manually long press and hold the BMS star button (>10 seconds). BMS closes the relay according to the logic and performs black start.
2. For multi battery string, turn on the BMS to complete self-check, then switch on the MBMS. And communication is normal, then the BMS closes the relay, outputting DC power to the INVERTER.

### 3.4.3 Outdoor battery cabinet system power off

1. Ensure that the INVERTER is already in the shutdown state and there is no load output.
2. Disconnect the INVERTER load switch.
3. Disconnect the switch of MBMS or BMS.
4. Disconnect the INVERTER AC side switch.
5. Disconnect the auxiliary power switch.

### 3.4.4 Power off in emergencies

1. Tap the emergency stop button to stop the inverter.
2. Tap the emergency stop button to trigger the shunt trip and turn off the main circuit breaker.

# 4 System Debug and Maintenance

**Danger:** The maintenance of the system must be done by qualified and authorized person only.

**Danger**: La maintenance de la batterie doit être effectuée uniquement par le personnel qualifié et autorisé.

## 4.2 Personal Safety

Be sure to observe the following when working with the system:

- Use personal protective equipment (PPE) appropriately, including insulating gloves and shoes, and wear the corresponding level of anti-arc flashover clothing.
- Make sure that there're more than 2 people on site.

## 4.3 Safety Precautions

When performing maintenance or repair of the energy storage system, observe the following safety requirements to ensure the safety of the operator:

- Check the grounding wire for proper functioning; if abnormalities are found, make the necessary grounding connections.
- All external connections to the energy storage system and to the internal power supply must be disconnected during maintenance.
- Ensure that the energy storage system is not accidentally energized or switched-on during maintenance.
- Measure with a multimeter to ensure that the internal AC and DC sides of the energy storage system are both completely unpowered.
- Maintenance tools used must be carefully insulated and protected.
- Do not dismantle the internal original components privately.
- At the end of the maintenance, count the tools and do not leave them in the cabinet.

If you have any questions, please do not hesitate to contact PylonTech.

## 4.4 Maintenance Intervals

| Recommended Schedule of Routine | | |
|---|---|---|
| **Inspection Content** | **Inspection method** | **Maintenance Intervals** |
| System operation status and environment | (1) Observe the appearance of the energy storage system for damage or deformation.<br>(2) Check whether there is any abnormal sound in the operation of the energy storage system.<br>(3) Check whether the parameters are correct during system operation.<br>(4) Check whether the main devices are normal.<br>(5) Check whether the heat generated by the shell of the energy storage system is normal, and monitor the heat generated by the system using a thermal imaging camera, etc.<br>(6) Check whether the humidity and dust in the environment around the energy storage system, and all air inlet filters are functioning properly.<br>(7) Check the ventilation of the air inlet and outlet, the degree of blockage of the filter.<br>*NOTE*: Open the cabinet door gently to prevent dust of the filter cotton from lifting up, which may cause the smoke detector alarm. | Every 6 months. |
| System cleanliness | (1) Check the cleanliness of the components.<br>(2) If necessary, a compressed air machine must be used to clean the | Every 6 months to 1 year (depending on the dust |

| | | |
|---|---|---|
| | system.<br>***NOTE:*** The system must be powered off when cleaning dust. | content of the environment in which it is used). |
| Power circuit connection check | (1) Check power cable connections for looseness and retighten to the torque specified above.<br>(2) Check power cables and control cables for damage, especially cut marks on the skin in contact with metal surfaces.<br>(3) Check that the insulating wraps of the power cable terminals are not detached. | Officially run for six months, then every six months to one year thereafter. |
| Terminal and wiring connection check | (1) Check whether the control terminal screws are loose and tighten them with a screwdriver.<br>(2) Check whether there is any color change in the wiring copper or screws.<br>(3) Visually inspect the connections such as equipment terminals and the distribution of wiring.<br>(4) Check the main circuit terminals for poor contact and screw locations for signs of overheating. | Officially run for six months, then every six months to one year thereafter. |
| Circuit breaker maintenance | (1) Routine inspection of all metal components for corrosion.<br>(2) Annual inspection of contactors (auxiliary switches and micro-switches) to ensure that they are in good mechanical working order.<br>(3) Check the operating parameters (especially voltage and insulation). | Officially run for six months, then every six months to one year thereafter. |
| SPD check | (1) Annual inspection of cable connection to ensure that they are in good mechanical working order.<br>(2) Check the operating parameters (especially voltage and insulation). | Every 6 months to 1 year |
| Fuse check | (1) Annual inspection of cable connection to ensure that they are in good mechanical working order.<br>(2) Check the operating parameters (especially voltage and insulation). | Every 6 months to 1 year |
| Battery maintenance | (1) Perform normal charging and discharging operations on the battery system to check whether there are any abnormalities in the operating status of the battery, and to check whether the battery system indicator status is normal.<br>(2) It is recommended that the battery be fully charged and equalized on a regular basis. | Every 6 months to 1 year |
| Aerosol fire extinguisher inspection | When the fire extinguishing equipment is in normal working condition, it is necessary to check the starting device (JR10 starter box, etc.) to make sure that the line is normal.<br>The fire extinguishing equipment is maintenance-free for its own validity period. | Officially run for six months, then every six months to one year thereafter. |
| Air conditioner maintenance | (1) Check whether the temperature of the air outlet is close to the cooling setting value, ±2℃.<br>(2) Check the degree of dust at the air inlet and outlet. And use a compressed air machine to clean and treat the dust at the air conditioner inlet and outlet. | Ranges from quarterly, semi-annually or once a year (depending on the dust content of the environment in which it is used). |
| Display maintenance | (1) Check the display for water ingress and see if the display shows normally without color change.<br>(2) Test the display to see if it responds normally to switching and selecting content. | Every 6 months to 1 year |

| | | |
|---|---|---|
| Safety Functions | (1) Check the stop function of the emergency stop button.<br>(2) Simulate a shutdown and check shutdown signal communication.<br>(3) Check the body warning signs and other equipment markings and replace them if they are found to be blurred or damaged. | Officially run for six months, then every year thereafter. |

## 4.5Inverter System Troubleshooting

### 4.4.1 Inverter System Troubleshooting Guide

**LCD is not powering on.**

- Check all connections- at least one of the following power sources is required: PV/Grid/Battery.
- Try pressing the power button, touchscreen, or navigation buttons

**Panels are connected, but DC Light is not on**

- PV voltage must be 170V-500V | It's night

**Panels are not producing.**

- Check for proper wiring on all solar panel connections
- Turn PV disconnect "ON"
- Check that the PV input voltage is not greater than 500V
- If the system says PV = 0V, check the PV polarity

**Panels are not producing much power.**

- PV Wire Strip Length: 5/8". Your batteries are charged; you can test Grid Sell to verify.

**The system does not keep batteries charged.**

- Check the charge setting in the Charge Menu

**Auto Gen-Start is not working.**

- Check to make sure your generator is compatible with Auto Start
- Make sure that the Auto Gen Start wire is adequately connected to the Sol-Ark and the generator
- Ensure the generator connected is a three-phase gen and that its phasing is correct

**Normal LED isn't on**

- Sol-Ark is in pass-through-only mode, with only a Grid connection
- Sol-Ark is not working correctly (Call us)

**The alarm light is on**

- Check the system alarms menu to identify the alarm

**Grid HM value is negative when it should be positive (only applies in limited home mode)**

- Limiter Sensors are backward, or L1/L2/L3 sensors are swapped or incorrectly wired. Try Auto Learn

**AC Overload Fault or Bus Unbalance Fault**

- Check Transfer Switch/Subpanel wiring
- Check for large loads that consume more than the inverter rating

**The system connects to the grid and quickly disconnects.**

- With a digital multimeter, verify your Neutral wire connection (should be 0 Vac referenced to GND)
- Check your Freq is set to 60Hz, and that the 30K-3P measures 120V on L1 / L2 / L3 vs. N
- If overloading: verify 120/208V grid input and load output wires are not swapped
- The L1, L2, and L3 are phase specific. So, you may have to swap Grid L1 / L2 / L3 for 208V applications.

### DC Overload Fault

- Check PV voltage
- Make sure you have not wired more than two (2) solar strings in parallel

### System is beeping.

- Check the system alarms menu to see which alarm has been triggered. Most alarms will self-reset
- There is no battery connected. If not using a battery, select “no battery” and disable “activate batt” in Batt menu.
- Turn off the center button, remove AC Grid and PV Power for the 30s (the screen is dead), and then power up to fully reset the system

### Battery cable sparks when connected.

- Put the external battery disconnect in the off position before connecting or disconnecting the batteries

The battery symbol on the home screen is red.

- The battery is under-Voltage or over-Voltage

### The battery symbol on the home screen is yellow.

The battery is low, or the charge/discharge current is close to the programmed limit (which is ok)

### The grid symbol on the home screen is yellow.

- Grid parameters are out of specified range, or the grid is down

### System has restarted.

- It happens if the system is overloaded, the battery voltage is greater than 500V, or the Software update

### Batteries were connected backward.

- It can cause SEVERE damage! Check the voltage before turning the system on

### Why is the LCD screen still on when the power button is off?

- If PV or Grid power, LCD stays on, but the Inverter and loads are off

### The Batt % meter is not reaching 100%

- The system needs to go through a small discharge/charge cycle first to calibrate the battery

### The generator setup is reading 0Hz.

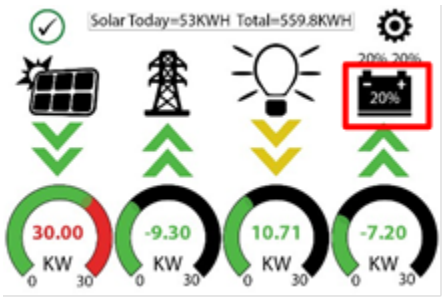
- Select "General Standard" instead of UL1741. Then widen the frequency range to 55Hz-65Hz.

### Color Touchscreen is Frozen

- Press and hold the escape button for 7-10 seconds

### Constant F18 Faults while powering loads within specification.

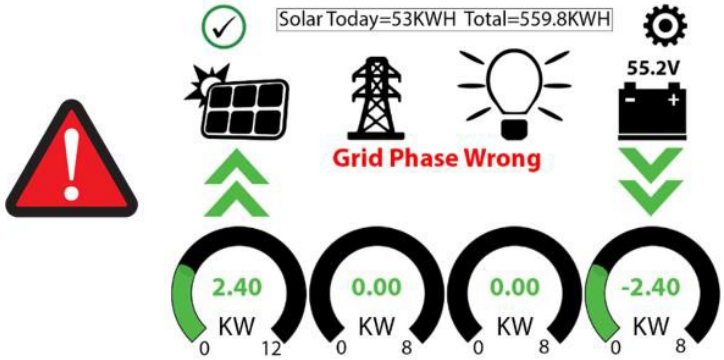
- Click the battery icon on the front of the Inverter and look to see what the AC Output voltage is:




| Solar | Grid | INV | USP LD | Batt |
|---|---|---|---|---|
| 0W | 0W | 0W | 0W | 0W |
| 0V/0.5A<br>M1: 0W<br>364V/0.0A<br>M2: 0W<br>0V/0.1A<br>M3: 0W<br>362V/0.8A<br>M4: 0W | 0.0Hz<br><br>L1: 0V<br>L2: 0V<br>L3: 0V<br><br>HM1: 0W<br>HM2: 0W<br>HM3: 0W | 60.0Hz<br><br>L1: 0V<br>L2: 0V<br>L3: 0V<br><br>L1: 0A<br>L2: 0A<br>L3: 0A | L1: 0V<br>L2: 0V<br>L3: 0V<br><br>L1: 0W<br>L2: 0W<br>L3: 0W | 0.0V/ 0%<br>0.00A<br>0.0C<br><br>0.00V/ 0%<br>0.00A<br>0.0C |
| TEMP | | | Gen 60.0Hz | 0W |
| AC:19.4C | LD1: 0W<br>LD2: 0W<br>LD3: 0W | L1: 0W<br>L2: 0W<br>L3: 0W | L1: 0V<br>L2: 0V<br>L3: 0V | L1: 0W<br>L2: 0W<br>L3: 0W |

- If the AC Output Voltage is ~120V per leg (this is Wye configuration) and you have more than one Inverter in parallel, contact engineering support for further assistance.

### 4.4.2 Troubleshooting Phasing Issues.




If the Sol-Ark screen shows Grid Phase Wrong, there is a phasing issue with your wiring, and it may cause overload faults (F18, F26, F34) and WILL CAUSE DAMAGE if left unchecked.
Single Sol-Ark: To locate the improperly wired phases, measure L1 to L1 (Top Screws) between the Grid and Load terminals; you should see 0V AC. Repeat for L2 to L2 and L3 to L3 between the Grid and Load terminals. Attempt to correct the wiring until you only read 0V AC between L1 to L1 | L2 to L2 | L3 to L3
Parallel inverters: measure L1 of the Grid Terminal to L1 of another unit's Grid terminal L1; you should see 0V AC. If in 208V parallel, measure the lines of the same wire color between sol-arks to see if you read 0V AC.
Make sure to correct both the Grid and Load wiring; they both need to be correct.
If the error persists, you will need to check your AC wiring beyond the Inverter and may also need to verify that the phases are properly labeled coming from your meter.

### 4.4.3 Sol-Ark Inverter Error Codes

| Fault | Instruction | Common Cause/Remedy |
|---|---|---|
| F1 | DC Inversed Failure | If you have parallel systems and turn one system off, you with get this notification. **NOT** a fault. |
| F8 | GFDI_Relay_Failure | Current Leakage from inverter AC output to Ground, check Ground and neutral are connected at the main panel. |
| F13 | Grid_Mode_change | It can happen when not using batteries or if Grid Input settings are changed. This is a notification, **NOT** a fault. If you switch from No Batt to Battery mode, power the system down completely to restart. |
| F15 | AC_OverCurr_Failure | It is usually caused by Loads too large for the Inverter. If off-grid, the battery discharge amps are programmed too low. Overloads can result in F15, F18, F20, or F26. |

| | | |
|---|---|---|
| F16 | GFCI_Failure | Ground fault. Check PV+ or PV- wiring (which must be ungrounded). Exposed PV conductors + rain can also cause. Check that the neutral line and Ground are not double-bonded (common with portable generators). |
| F18 | Tz_Ac_OverCurr_Fault | Overloaded the Load Output (reduce loads) or overloaded a generator (see the inverter separate manual for details). Wiring Short on the AC Side can also cause this error. Overloads can result in F15, F18, F20, or F26. |
| F20 | Tz_Dc_OverCurr_Fault | It is typically caused by DC current from the battery that is too large (ex: 4 Ton AC Unit) or too much PV current (3 or more strings in parallel). Overloads can result in F15, F18, F20, or F26. |
| F22 | Tz_EmergStop_Fault | Initiated Emergency Stop; see sensor pinout table. |
| F23 | Tz_GFCI_OC_Fault | PV Ground fault. Check PV+ or PV- wiring (which must be ungrounded, or damage can occur). Typically caused by pinched PV wire grounding.<br>the PV+ or PV-. Grounded PV wire can cause F20, F23, or F26. |
| F24 | DC_Insulation_Fault | An exposed PV conductor combined with moisture is faulting (can cause F16, F24, F26). |
| F25 | AC_Active_Batt_Fault | No battery connection to the Inverter and Activate Battery is enabled. Disable Activate Battery in settings while no battery is connected. |
| F26 | BusUnbalance_Fault | Too much load on one leg (L1 or L2) Vs. the other leg or DC loads on the AC output when off-grid. Grounded PV +/- wire can cause F20, F23, or F26. |
| F29 | Parallel_CANBus_Fault | Usually, a communication error for parallel systems, check cables, and MODBUS addresses. |
| F30 | AC_MainContactor_Fault | Contact Sol-Ark.com |
| F31 | Soft_Start_Failed | The soft start of a large motor failed. |
| F34 | AC Overload Fault | AC Overload or load shorted. Reduce heavy loads. |
| F35 | AC_NoUtility_Fault | Grid connection lost |
| F37 | DCLLC_Soft_Over_Cur | Software DC overcurrent |
| F39 | DCLLC_Over_Current | Hardware DC overcurrent |
| F40 | Batt_Over_Current | Batteries exceeded their current discharge limit. |
| F41 | Parallel_System_Stop | If one system faults in parallel, this normal fault will register on the other units as they disconnect from grid. |
| F45 | AC_UV_OverVolt_Fault | Grid under-voltage causes a disconnect. This will self-reset when the grid stabilizes. |
| F46 | Parallel_Aux_Fault | Cannot communicate with other parallel systems. Check Master = 1, and Slaves are 2-9, ethernet cables are connected. |
| F47 | AC_OverFreq_Fault | Grid over Frequency (common in power outages) causes a disconnect. Will self-reset when grid stabilizes. |
| F48 | AC_UnderFreq_Fault | Grid under Frequency (common in power outages) causes a disconnect. Will self-reset when grid stabilizes. |

| | | |
|---|---|---|
| F55 | DC_VoltHigh_Fault | PV may be higher than 500V. Battery voltage should not be above 500V (depending on the model). |
| F56 | DC_VoltLow_Fault | Batteries are overly discharged, the Inverter is off-grid and exceeds programmed batt discharge current by 20%, or Lithium BMS has shut down. If battery settings are incorrect, this can also happen. |
| F58 | BMS communication fault | Sol-Ark is programmed to BMS Lithium Battery Mode but cannot communicate with a BMS. |
| F60 | Gen_Volt_or_Fre_Fault | Generator Voltage or Frequency went outside the allowable range. |
| F61 | Button_Manual_OFF | The parallel Slave system turned off without turning off the Master. |
| F63 | ARC_Fault | It can be a poor PV connector/connection. And sometimes a false alarm due to powerful lightning storms. |
| F64 | Heatsink_HighTemp_Fault | Check that the built-in fans are running; the ambient temp may be too high. Ensure proper clearance. |

## 4.6 Battery System Debug and Maintenance

4.5.1 Battery System Debug

This system debug is for BESS system (Battery Energy Storage System). BESS system can't debug alone. It must operate with configured UPS, INVERTER and EMS system together.

| Debug Step | Content |
|---|---|
| Preparation for debug. | Turn on the BESS system, referring to section 3. Before turning on the whole BESS system, starting up of the load is not allowed!<br>Remark: Besides the BESS, if other equipment has its own system starting up step, be sure to follow its own system operation menu. |
| System function test. | Each component system debug:<br>Power supply from the External Power Suppler (e.g. UPS) is working normally.<br>Communication Test: Check if the communication between the BESS system and communicated devices normal or not, alarm equipped or not.<br>Power Conversion System Test: Before conjoint test be sure test the Inverter System starting up progress at first. And check if the parameters meet BESS requirement or not.<br>BESS Test: Charge/Discharge test; Stop test when charging, stop discharging, current limiting functions, etc.<br>Caution: Before turning on the BESS system, be sure setup all the parameters of the INVERTER and EMS at first. |
| Monitor function test. (If configured.) | Check if the data of the BESS system is showing on the monitor system normally. |
| EMS monitoring test (If configured.) | If the EMS system has been configured, check the information uniformity and command functionality following the BMS protocol. |
| Trial operation test. | After the system debugged, run the system a period as test (testing with low load), to test if the high voltage DC system is fit for the contract. |

4.5.2 Trouble Shooting

**Danger:** The PowerCube-M1-C is a high voltage DC system, operated by qualified and authorizedperson only.

***Dange:*** *PowerCube-M1-C est un système à courant continu à haute tension, opéré uniquement par le personnel qualifié et autorisé.*

**Danger:** Before checking the failure, be sure check all the cables connection and the BESS systemcan turn on normally or not.

***Dange:*** *Avant le contrôle de panne, il faut contrôler toutes les connexions des câbles et si le systèmeBESS peut s'allumer normalement ou non.*

Section A Before starting up.

| Failure Mode | Possible Reason | Solution |
|---|---|---|
| Battery system doesn't start up after correct wiring connection and start up procedure. | Power cable issue. | 1.Check the wiring connection and connectivity of the power cables. |
| | Internal cable issue. | 2. Open BMS case, check the connectivity and reliability of the internal power supply cable. |
| | PMU issue. | 3. Open BMS case, use multimeter check PMU 12Vdc output and CMU LEDs. If neither is on, please swap the PMU. |
| | Other error. | 4. If problem remain, contact Pylontech service engineer. |

Section B During operation：

(1) Error Code checked from BMS (Modbus protocol Appendix IV or CAN ID 0*4250&0*4290):

*The 'Failure Definition' and 'Failure Mode' column is reference from Pylontech Modbus protocol AppendixIV Error code 1 bit to present.

| Failure Type | Failure Definition | Possible Reason | Solution |
|---|---|---|---|
| External | Input RV Err (Bit4) | D+ D- reversely connected. | Check the external power cables of the polarity and connection. |
| External | DC OVER input over voltage error (Bit3) | D+ D- voltage extremely higher than battery system voltage. | Check external inverter`s voltage whether match with the battery system or not. |
| External | Emergency stop (Bit13) | Command by external device via dry contactor. | Command by external device, not an error actively report by Battery system. |
| Current Leakage | Current Leakage Error (Bit21) | Current Leakage >25mA. | 1.With insulation glove, disconnect the battery system and contact Pylontech service engineer. |
| Self-test | Self-test moduleInitial Error (Bit16) | Self-test failed. | 1. Restart.<br>2. If problem remain, contact Pylontech service engineer. |
| Self-test | Self-test module coulomb error (Bit15) | Self-test failed. | Contact Pylontech service engineer. |
| Self-test | Self-test module detecting amount error. (Bit14) | Self-test failed. | Contact Pylontech service engineer. |
| Self-test | Safety check failure (Bit11) | Chip self-test failed. | 1.Restart.<br>2.If problem remain, contact Pylontech service engineer. |
| Self-test | Self-test volt error (Bit10) | Battery cell voltage measurement mismatchwith DCBUS voltage measurement. | Restart.<br>2. Check the connectivity and reliability of the power and comm. cable by reconnection.<br>3. Swap the current measurement board or BMS.<br>4.If problem remain, contact Pylontech |
| Battery cell | Battery damage error (Bit6) | Battery cell voltage measured at < 2.0V | 1. Restart.<br>2. Swap out the RED LEDmodule.<br>3. Use multimeter to measure the battery module power terminal voltage, if is the same as the BMS reading value, then it`s a true cell damage. Otherwise please swap the BMU of the module. |

| | | | |
|---|---|---|---|
| Comm. and hardware | BMIC error (Bit8) | Sensor chip error. | 1. Restart.<br>2. If you observe a module LED is off, try to bypass the module on both comm. and power side and see whether rest modules` LED could be on and green. If so, then please change the BMU of the bypassed module. If not, further bypass the next LED off module and repeat the process.<br>If problem remains, contact Pylontech service engineer. |
| Comm. and hardware | Internal Comm. ERR (Bit2) | Communication offline between module and BMS. | 1. Check the connectivity and reliability of the comm. cable between BMS and battery modules.<br>Restart.<br>2. If problem remain, contact Pylontech service engineer. |
| Comm. and hardware | BMU Internal bus error (Bit18) | BMU internal error | 1. Change the BMU of the RED LED module.<br>If problem remain, contact Pylontech service engineer. |
| Comm. and hardware | BMS Internal bus error (Bit9) | CMU internal error or I2C issue | 1. Restart.<br>2. Change the current measurement board<br>3. Change the CMU or BMS.<br>4. If problem remains, contact Pylontech service engineer. |
| Hardware | Shutdown circuit error (Bit7) | Cannot completely switch off the system during self-protection. | 1. Change PMU<br>If problem remain, contact Pylontech service engineer. |
| Hardware | Relay Error (Bit5) | 1. Start-up procedure problem.<br>2. Relay adhesion.<br>Relay damage. | 1. Completely switch off inverter and battery system. Make sure DCBUS has no voltage.<br>2. Switch on each BMS first before switch on the MBMS. After the battery system finish self-test (require ~3mins), switch on the inverter.<br>3. Change the relay or BMS.<br>If problem remain, contact Pylontech service engineer. |
| Hardware | Temperature sensor error (Bit1) | 1. Sensor cable issue.<br>Sensor connection issue. | 1. Change the RED LED module`s BMU.<br>2. Check the temp. sensor cable connect between BMU and battery pack of the connectivity.<br>3. Change the RED LED module.<br>If problem remain, contact Pylontech service engineer. |
| Hardware | voltage sensor error (Bit 0) | 1. Sensor cable issue.<br>2. Sensor connection issue<br>BMU issue | 1. Change the RED LED module`s BMU.<br>2. Check the voltage sensor cable connect between BMU and battery pack of the connectivity.<br>3. Change the RED LED module.<br>4. If problem remain, contact Pylontech service engineer. |

4.5.3 Replacement of main component

If the customer requires maintenance services, PylonTech may provide paid repair services as determined by the PylonTech's service organizations. When you need to repair or replace the main components of the product, please contact PylonTech in advance.

**Danger:** The PowerCube-M1-C is a high voltage DC system, operated by qualified and authorized person only.

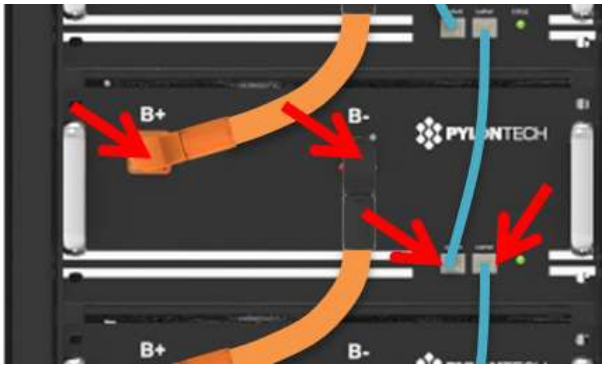
**Danger:** PowerCube-M1-C est un système à courant continu à haute tension, opéré uniquement par lepersonnel qualifié et autorisé.

***NOTE:*** Before replacing the main component, shut off the maintenance battery string's power. Confirm the D+ and D- terminal are without power. The turn off progress refer to *section 3.6.5.*

4.5.3.1 **Replacement of Battery Module**

A new battery module can be added onto an existing system at any time. Make sure the new battery modulehas an equivalent voltage level (OCV) compared to existing modules. In a serial connection system, the newmodule, even with a higher SOH, will follow the system worst SOH condition module to perform.

1. Make sure the new battery module has an equivalent voltage level (OCV) compared to existing modules.
2. Shut off the whole battery string's power. Be sure to confirm the D+ and D- terminal are without power. The turning off progress refer to section 3.6.5.
3. Pull out the Plug of Power Cable +/-. Pull out the plug of communication cable.

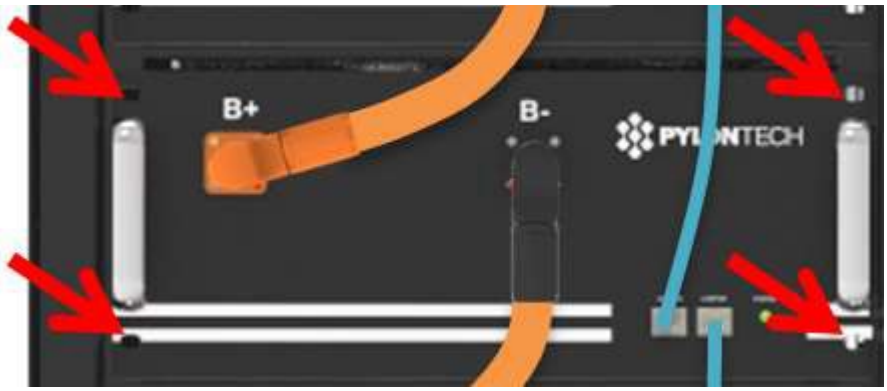




**Danger:** the power cables and plugs still have high voltage DC power from serial connected battery modules (battery module can't be turned off), be careful to handle the Power plugs.

**Danger:** Les câbles d'alimentation et les fiches sont toujours alimentés en courant continu à haute tensionpar les modules de batterie connectés en série (le module de batterie ne peut pas être éteint), vo us devez donc manipuler les fiches avec précaution.

4. Dismantle the 4 screws of the battery module's front face.




5. Handle the battery module out of the rack and put it to the appoint place.

**Warning:** Single battery module weights 43kg. If without handling tools it must be handled bymore than 3 personnel. If installed in high place of the rack it must has more than 4 personnel.

**Avertissement:** Un module de batterie pèse 55 kg. Sans outils de manipulation, il est nécessaire de plus de 3hommes pour manipuler avec lui. Si vous l'installez en hauteur, il faut plus de 4

1. Install the new battery module (see the above of 5.2.1.1). And connect the normal cables. Refer to section 3.5.
2. Turn on this battery string. Refer to *section 3.6.*
3. Make a fully charge of the system before normal operation.

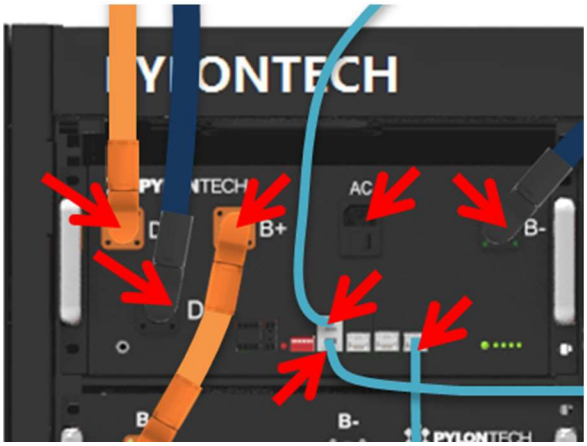
## Capacity expansion

A new battery module can be added onto an existing system at any time. Please make sure the existing system is being fully charged before added on a new module. In a serial connection system, the new module, even with a higher SOH, shall follow the system worst SOH condition module to perform.

4.5.3.2 Replacement of Control Module (BMS)

1. Shut off the whole battery string's power. Be sure to confirm the D+ and D- terminal without power. Operate turning off progress referring to *section 3.6.5*.

2. Pull out the plugs of Power Cables and the communication plugs.



**Danger:** the power cables still have high voltage DC power from another battery module, becareful to handle the Power plugs.

**Danger:** Les câbles d'alimentation sont toujours alimentés en CC à haute tension par d'autres modules debatterie; vous devez manipuler les fiches d'alimentation avec soin.

3. Dismantle the 4 screws of the battery module's front face.


4. Install the new control module (BMS). And reconnect all the cables. Refer to section 3.5.

5. Turn on this battery string. Refer to section 3.6.

**Caution:**Before pulling out the communication cables be sure to mark the cable number, avoiding cable wrong sequence.

**Attention:** Avant de débrancher les câbles de communication, vous devez marquer leurs numéros afin d'éviter toute séquence incorrect.

### 4.5.4 Battery Maintenance

**Danger:** The maintenance of battery must be done by qualified and authorized person only.

**Danger:** La maintenance de la batterie doit être effectuée uniquement par le personnel qualifié et autorisé.

**Danger:** Some maintenance items must shut off at first.

**Danger:** Certains items de maintenance doivent être arrêtés en premier.

1. Voltage Inspection:

[Periodical Maintenance] Check the voltage of battery system through the monitor system. Check if thesystem voltage abnormal or not. For example: Single cell's voltage is abnormal high or low.

2. SOC Inspection:

[Periodical Maintenance] Check the SOC of battery system through the monitor system. Check the batterystring SOC abnormal ornot.

3. Cables Inspection:

[Periodical Maintenance] Visual inspect all the cables of battery system. Check if the cables broken, aging,getting loose or not.

4. Balancing:

[Periodical Maintenance] The battery strings will become unbalanced if not being full charged for long time.Proposal: every 3 months do the balancing maintenance (charge to full).

5.Output Relay Inspection:

[Periodical Maintenance] Under low load condition (low current), control the output relay OFF and ON tohear the relay has click voice, which means this relay can off and on normally.

6. History Inspection:

[Periodical Maintenance] Analyze the history record to check if there is an accident (alarm and protection)or not and analyze the reason.

7. Shutdown and Maintenance:

[Periodical Maintenance] Some battery function must be restarted then can ESS start the maintenance. So, it must do once every 6 months at least.

8. Recycle

**NOTE**

Damaged batteries may leak electrolyte or produce flammable gas.

When a damaged battery needs recycling, follow the local recycling regulation (i.e. Regulation (EC) №1013/2006 among European Union) to process and using the best available techniques to achieve a relevantrecyclingefficiency.

## 4.7 Emergency Disposal

### 4.7.1 EPO (Emergency Power Off Switch)

In case of fire or any situation beyond the control of anyone, please immediately snap the EPO button (as shown in the picture) to stop the system. DO NOT touch the EPO during normal operation. To restore the system, firstly rotate the EPO button in the operating direction on the panel to make the button pop up, and then power on the system according to the power on steps.

### 4.7.2 Firefighting Equipment

In the event of fire, the fire system will operate automatically. The firefighting device is shown in the picture below.


View of the Front Door


View of the Rear Door

# 5. Shipment and Storage

## 5.1 Shipment

The outdoor battery cabinet is handled by forklift or hoisting.

- The outdoor battery cabinet is transported with battery. Therefore, ALWAYS avoid violent impact during handling.
- It should be fixed firmly during transportation, and no displacement is allowed in the carriage.
- During transportation, it should be placed and transported in strict accordance with the vertical direction, the tilt angle ≤ 15°, and it cannot be transported horizontally or sideways, so as to avoid device vibration.
- It is not allowed to be loaded with flammable, explosive, and corrosive items during transportation.
- It shall not be stored in an open warehouse during transit.
- The equipment is not allowed to be exposed to rain, snow or liquid substances and mechanical damage.

Single cell's SOC shall remain around 55% according to customer requirement before shipment. The remaining of battery level, after shipment and before charging, is determined by the storage time and condition.

1. The battery modules should meet the UN38.3 certificate standard.
2. In particular, special rules for the carriage of goods on the road and the current dangerous goods law, specifically ADR (European Convention on the International Carriage of Dangerous Goods by Road), as amended, should be observed.

## 5.2 Storage

For long-term storage, e.g. if it needs to be stored for a long time (more than 3 months), the battery cells shouldbe stored in the temperature range for 5~45°C, relative humidity <65% and corrosive-gas-freed environment.
The battery should be shelfed in 5~45°C, dry, clean and well-ventilated environment. Before storage the battery should be charged to 50~55% SOC.
It is recommended to discharge and charge the battery every 3 months, and the longest discharge and charge interval shall not exceed 6 months.

**Caution:** If not following the above instructions for long term storage of the battery, the cycle life will decrease relative heavily.
**Attention:** Si vous ne suivez pas les instructions ci-dessus pour stocker la batterie à long terme, cela

## Annex 1: Diagrams of 30K-3P-208V Inverter

***¤Diagram 1***

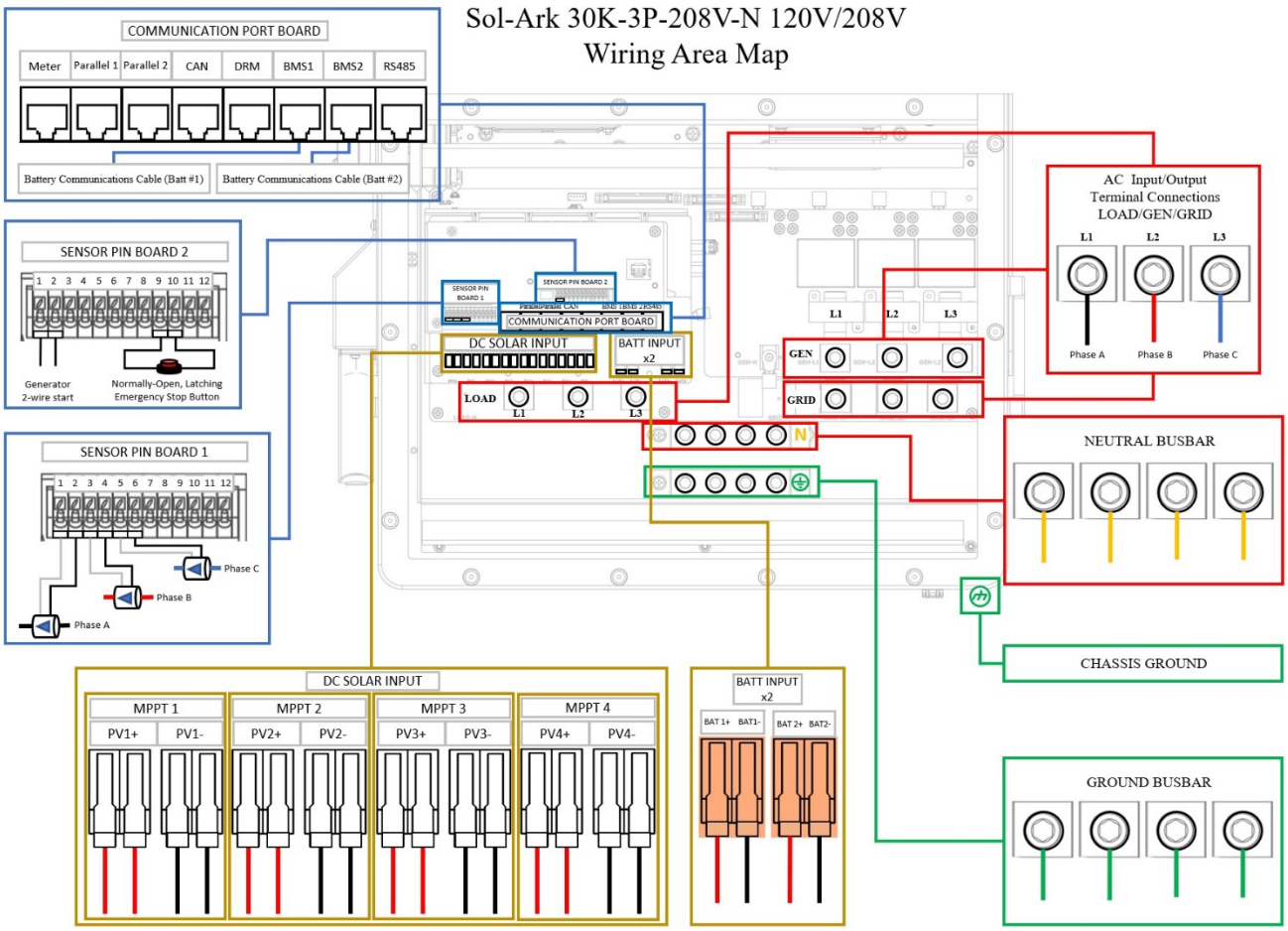


***Diagram 2***

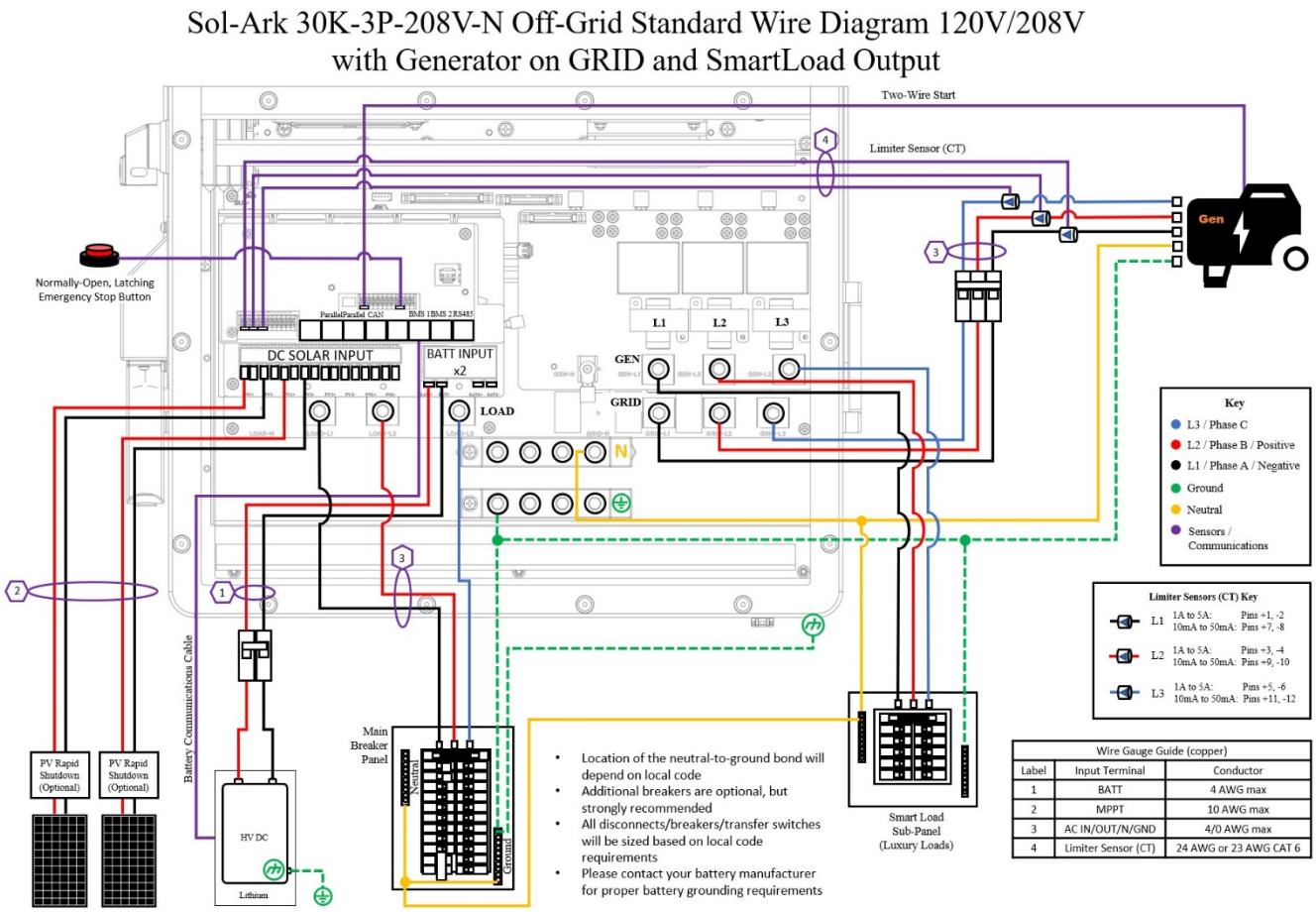

Sol-Ark 30K-3P-208V-N Off-Grid Standard Wire Diagram 120V/208V
with Generator on GRID and SmartLoad Output
Two-Wire Start
Limiter Sensor (CT)
Gen
Normally-Open, Latching
Emergency Stop Button
DC SOLAR INPUT
BATT INPUT
x2
LOAD
GEN
GRID
L1
L2
L3
N
Key
L3 / Phase C
L2 / Phase B / Positive
L1 / Phase A / Negative
Ground
Neutral
Sensors / Communications
Limiter Sensors (CT) Key
L1 1A to 5A: Pins +1, -2 10mA to 50mA: Pins +7, -8
L2 1A to 5A: Pins +3, -4 10mA to 50mA: Pins +9, -10
L3 1A to 5A: Pins +5, -6 10mA to 50mA: Pins +11, -12
PV Rapid Shutdown (Optional)
PV Rapid Shutdown (Optional)
Battery Communications Cable
HV DC
Lithium
Main Breaker Panel
Neutral
Ground
Smart Load Sub-Panel (Luxury Loads)
• Location of the neutral-to-ground bond will depend on local code
• Additional breakers are optional, but strongly recommended
• All disconnects/breakers/transfer switches will be sized based on local code requirements
• Please contact your battery manufacturer for proper battery grounding requirements
Wire Gauge Guide (copper)
Label | Input Terminal | Conductor
1 | BATT | 4 AWG max
2 | MPPT | 10 AWG max
3 | AC IN/OUT/N/GND | 4/0 AWG max
4 | Limiter Sensor (CT) | 24 AWG or 23 AWG CAT 6

***Diagram 3***

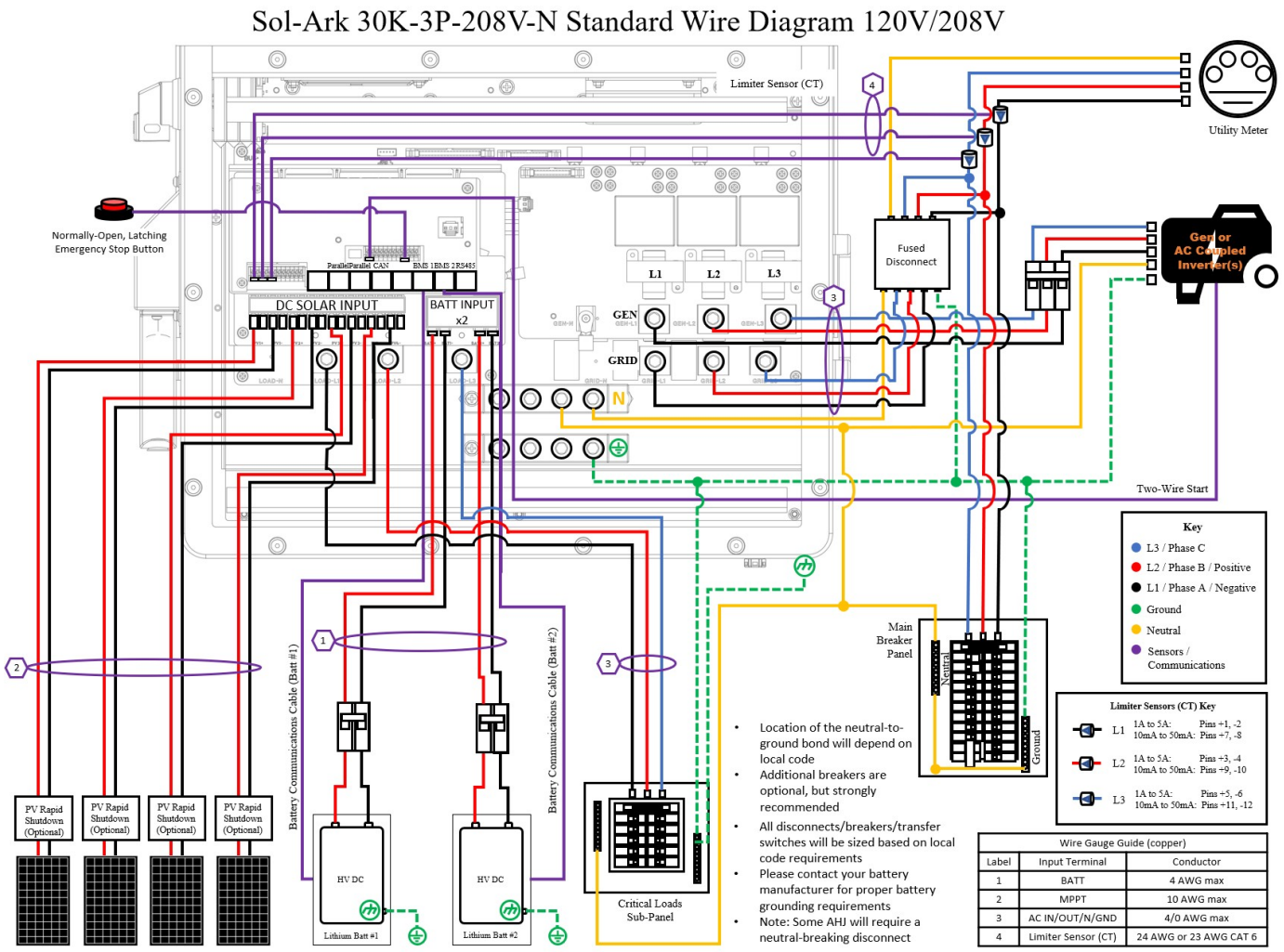
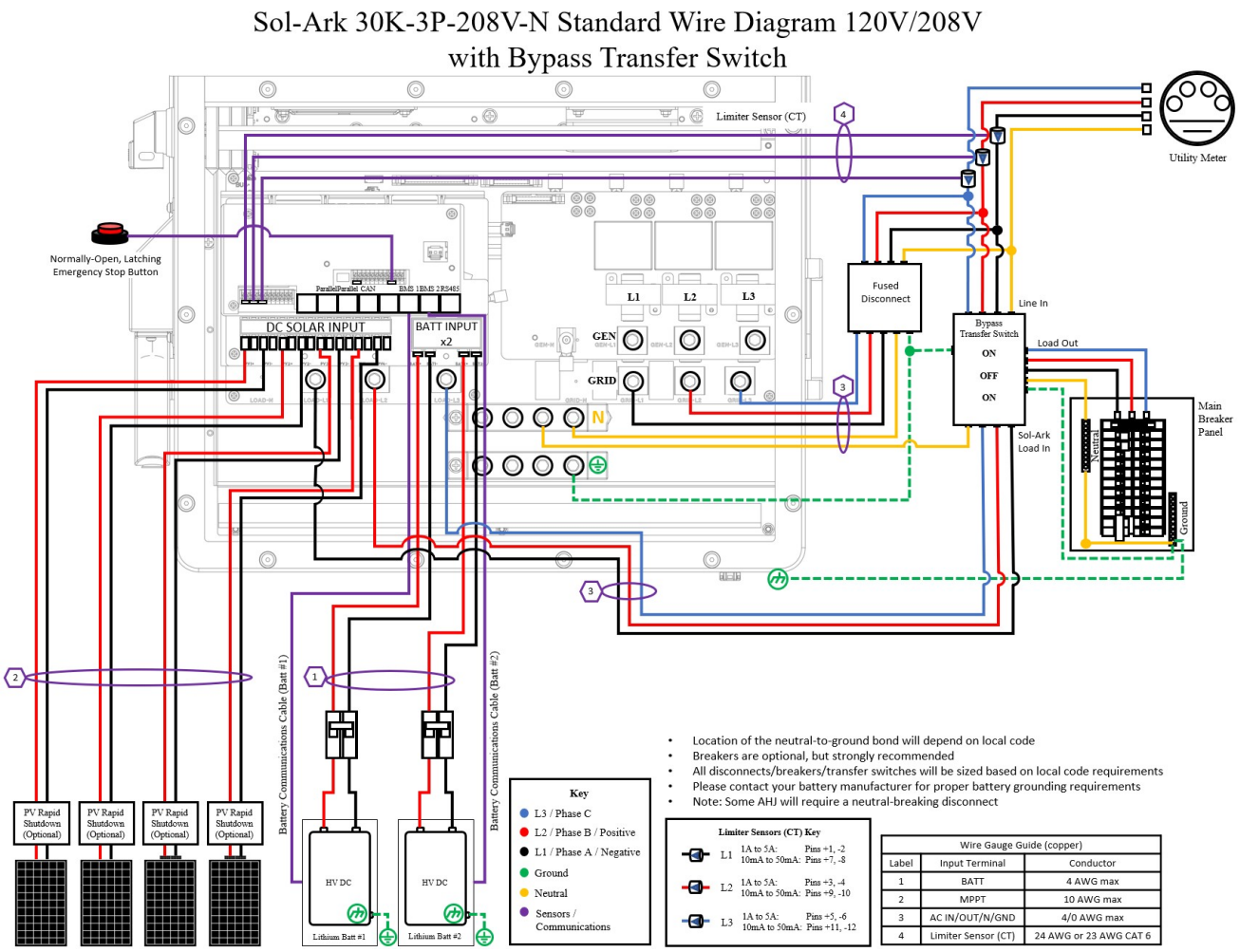

Sol-Ark 30K-3P-208V-N Standard Wire Diagram 120V/208V
Limiter Sensor (CT)
Utility Meter
Normally-Open, Latching Emergency Stop Button
Fused Disconnect
Gen or AC Coupled Inverter(s)
DC SOLAR INPUT
BATT INPUT x2
GEN
GRID
L1
L2
L3
N
Two-Wire Start
Key
L3 / Phase C
L2 / Phase B / Positive
L1 / Phase A / Negative
Ground
Neutral
Sensors / Communications
Main Breaker Panel
Neutral
Ground
Limiter Sensors (CT) Key
L1 1A to 5A: Pins +1, -2 10mA to 50mA: Pins +7, -8
L2 1A to 5A: Pins +3, -4 10mA to 50mA: Pins +9, -10
L3 1A to 5A: Pins +5, -6 10mA to 50mA: Pins +11, -12
PV Rapid Shutdown (Optional)
PV Rapid Shutdown (Optional)
PV Rapid Shutdown (Optional)
PV Rapid Shutdown (Optional)
Battery Communications Cable (Batt #1)
Battery Communications Cable (Batt #2)
HV DC
HV DC
Lithium Batt #1
Lithium Batt #2
Critical Loads Sub-Panel
Location of the neutral-to-ground bond will depend on local code
Additional breakers are optional, but strongly recommended
All disconnects/breakers/transfer switches will be sized based on local code requirements
Please contact your battery manufacturer for proper battery grounding requirements
Note: Some AHJ will require a neutral-breaking disconnect
Wire Gauge Guide (copper)
Label | Input Terminal | Conductor
1 | BATT | 4 AWG max
2 | MPPT | 10 AWG max
3 | AC IN/OUT/N/GND | 4/0 AWG max
4 | Limiter Sensor (CT) | 24 AWG or 23 AWG CAT 6

***Diagram 4***




- Location of the neutral-to-ground bond will depend on local code
- Breakers are optional, but strongly recommended
- All disconnects/breakers/transfer switches will be sized based on local code requirements
- Please contact your battery manufacturer for proper battery grounding requirements
- Note: Some AHJ will require a neutral-breaking disconnect

| Wire Gauge Guide (copper) | | |
|---|---|---|
| Label | Input Terminal | Conductor |
| 1 | BATT | 4 AWG max |
| 2 | MPPT | 10 AWG max |
| 3 | AC IN/OUT/N/GND | 4/0 AWG max |
| 4 | Limiter Sensor (CT) | 24 AWG or 23 AWG CAT 6 |

***Diagram 5***

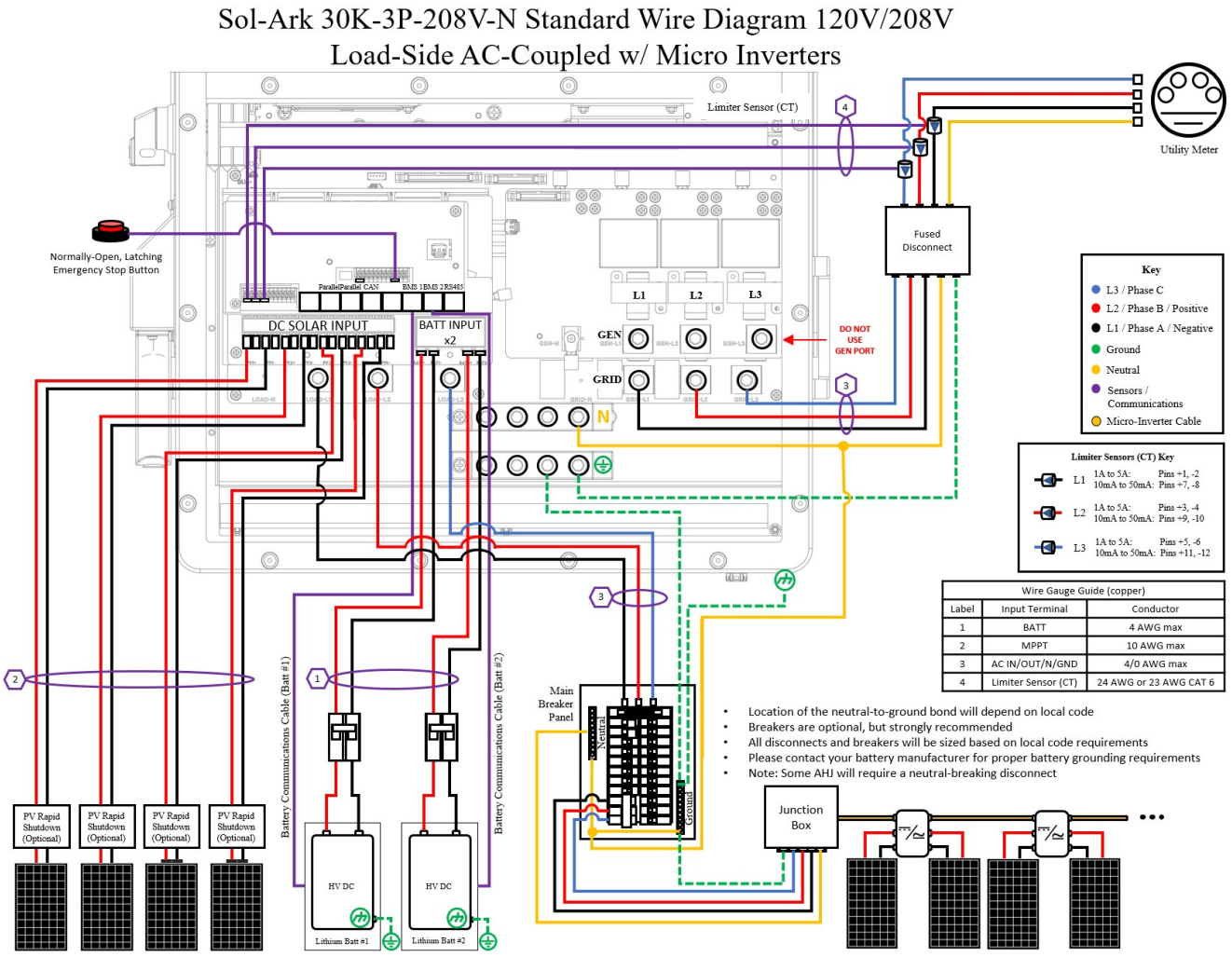
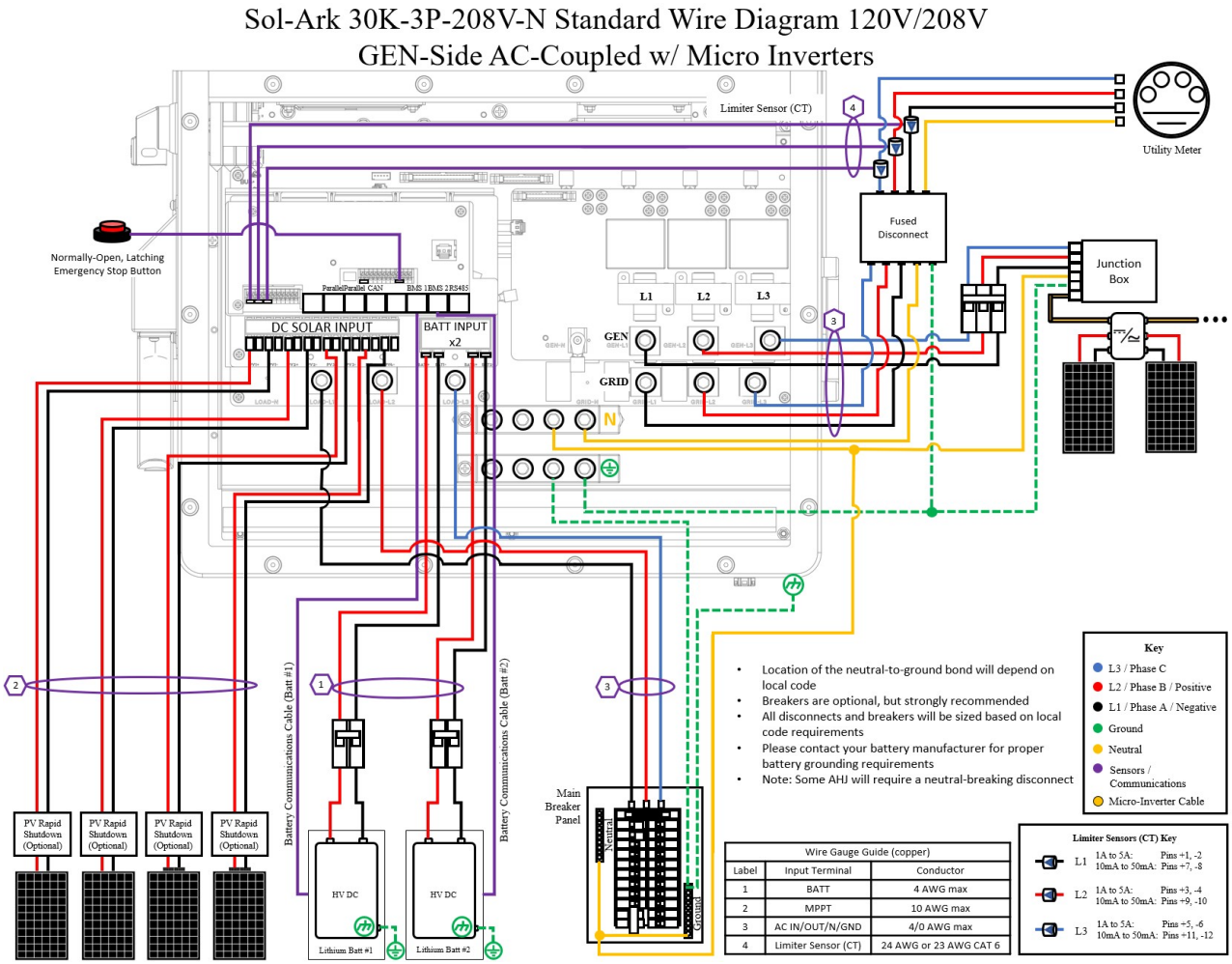
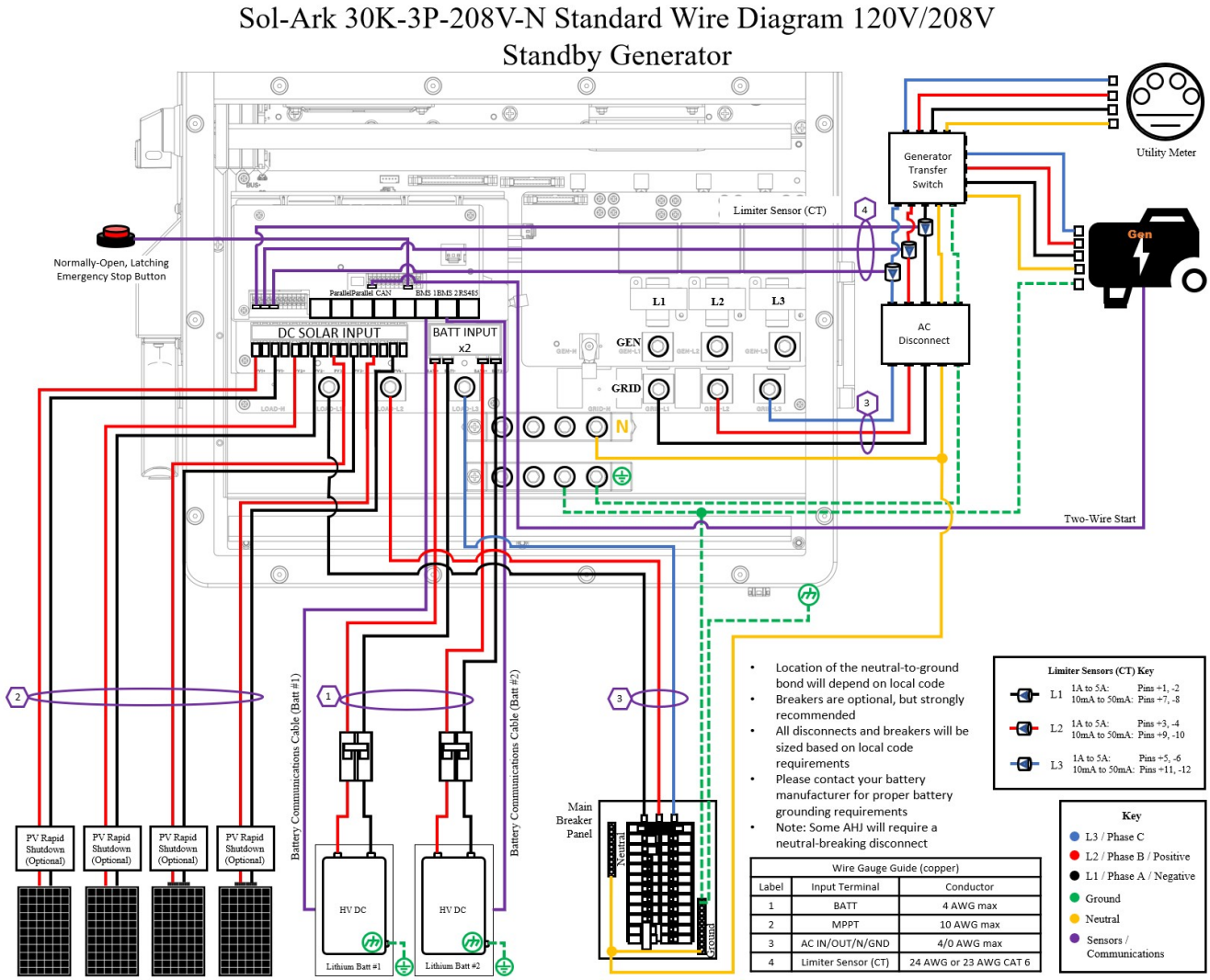

Sol-Ark 30K-3P-208V-N Standard Wire Diagram 120V/208V
Load-Side AC-Coupled w/ Micro Inverters
Limiter Sensor (CT)
Utility Meter
Fused Disconnect
Normally-Open, Latching Emergency Stop Button
DC SOLAR INPUT
BATT INPUT x2
GEN
GRID
L1
L2
L3
N
DO NOT USE GEN PORT
Key
L3 / Phase C
L2 / Phase B / Positive
L1 / Phase A / Negative
Ground
Neutral
Sensors / Communications
Micro-Inverter Cable
Limiter Sensors (CT) Key
L1 1A to 5A: Pins +1, -2 10mA to 50mA: Pins +7, -8
L2 1A to 5A: Pins +3, -4 10mA to 50mA: Pins +9, -10
L3 1A to 5A: Pins +5, -6 10mA to 50mA: Pins +11, -12
Wire Gauge Guide (copper)
Label | Input Terminal | Conductor
1 | BATT | 4 AWG max
2 | MPPT | 10 AWG max
3 | AC IN/OUT/N/GND | 4/0 AWG max
4 | Limiter Sensor (CT) | 24 AWG or 23 AWG CAT 6
PV Rapid Shutdown (Optional)
Battery Communications Cable (Batt #1)
Battery Communications Cable (Batt #2)
HV DC
Lithium Batt #1
Lithium Batt #2
Main Breaker Panel
Neutral
Ground
Junction Box
Location of the neutral-to-ground bond will depend on local code
Breakers are optional, but strongly recommended
All disconnects and breakers will be sized based on local code requirements
Please contact your battery manufacturer for proper battery grounding requirements
Note: Some AHJ will require a neutral-breaking disconnect

***Diagram 6¤***



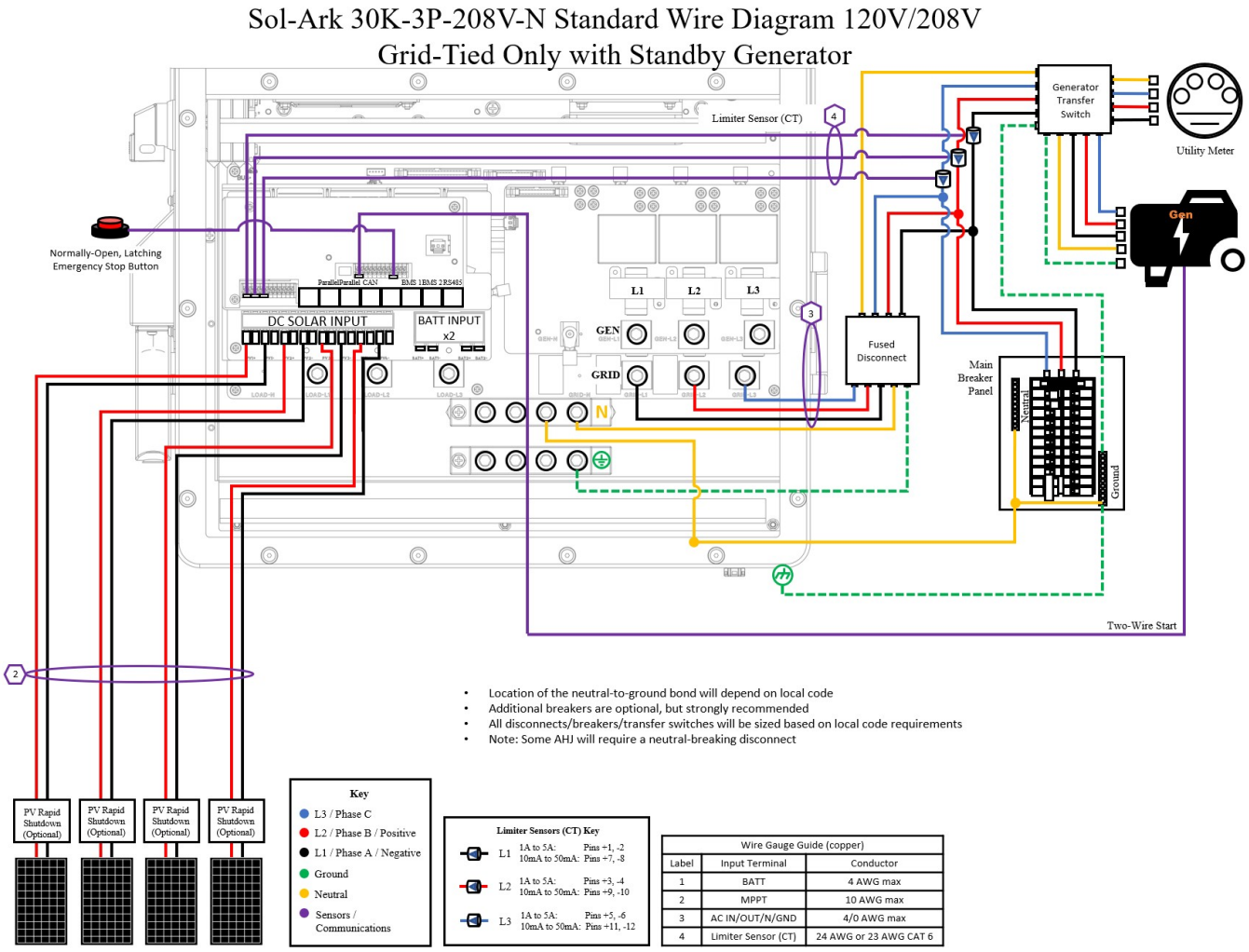

Note: PV fuses are only required for >2 strings per MPPT

***Diagram 7***




| Wire Gauge Guide (copper) | | |
|---|---|---|
| Label | Input Terminal | Conductor |
| 1 | BATT | 4 AWG max |
| 2 | MPPT | 10 AWG max |
| 3 | AC IN/OUT/N/GND | 4/0 AWG max |
| 4 | Limiter Sensor (CT) | 24 AWG or 23 AWG CAT 6 |

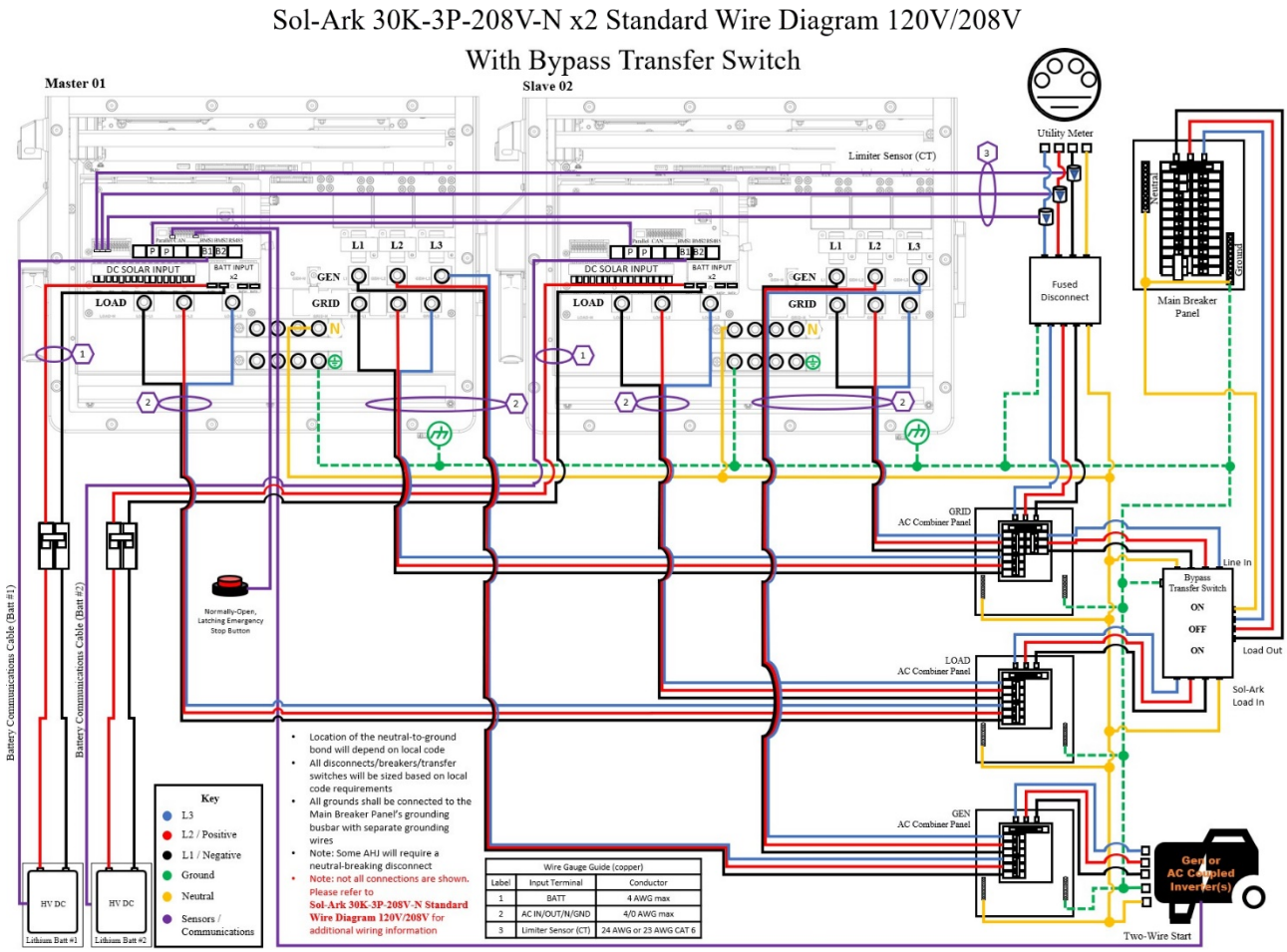
***Diagram 8***




- Location of the neutral-to-ground bond will depend on local code
- Additional breakers are optional, but strongly recommended
- All disconnects/breakers/transfer switches will be sized based on local code requirements
- Note: Some AHJ will require a neutral-breaking disconnect

| Wire Gauge Guide (copper) | | |
|---|---|---|
| Label | Input Terminal | Conductor |
| 1 | BATT | 4 AWG max |
| 2 | MPPT | 10 AWG max |
| 3 | AC IN/OUT/N/GND | 4/0 AWG max |
| 4 | Limiter Sensor (CT) | 24 AWG or 23 AWG CAT 6 |

***Diagram 9***




Note: Before powering up Parallel System installs, please see the inverter separate manual for details.

# Annex 2: Diagrams of 60K-3P-480V Inverter

***Diagram 1***

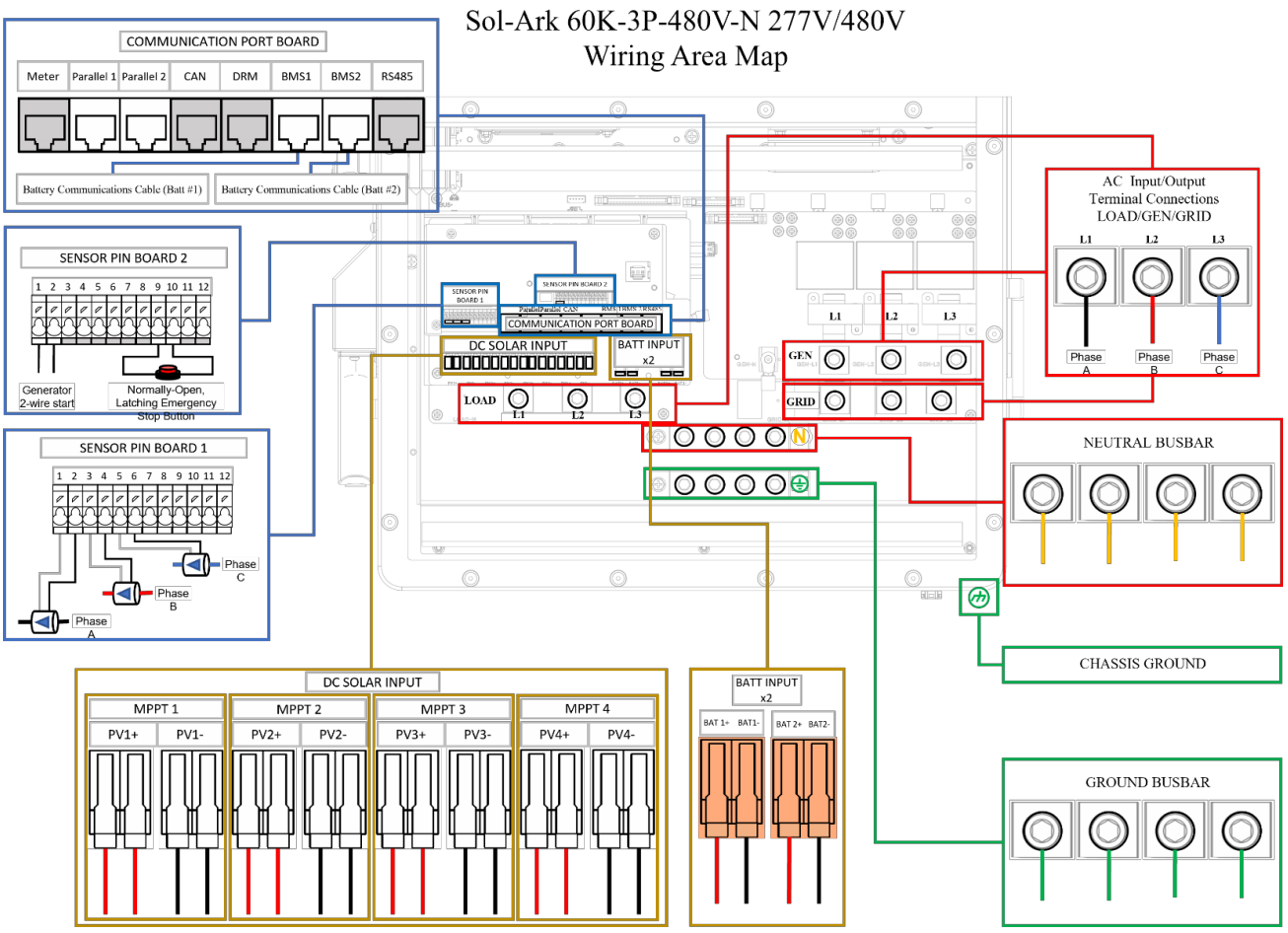
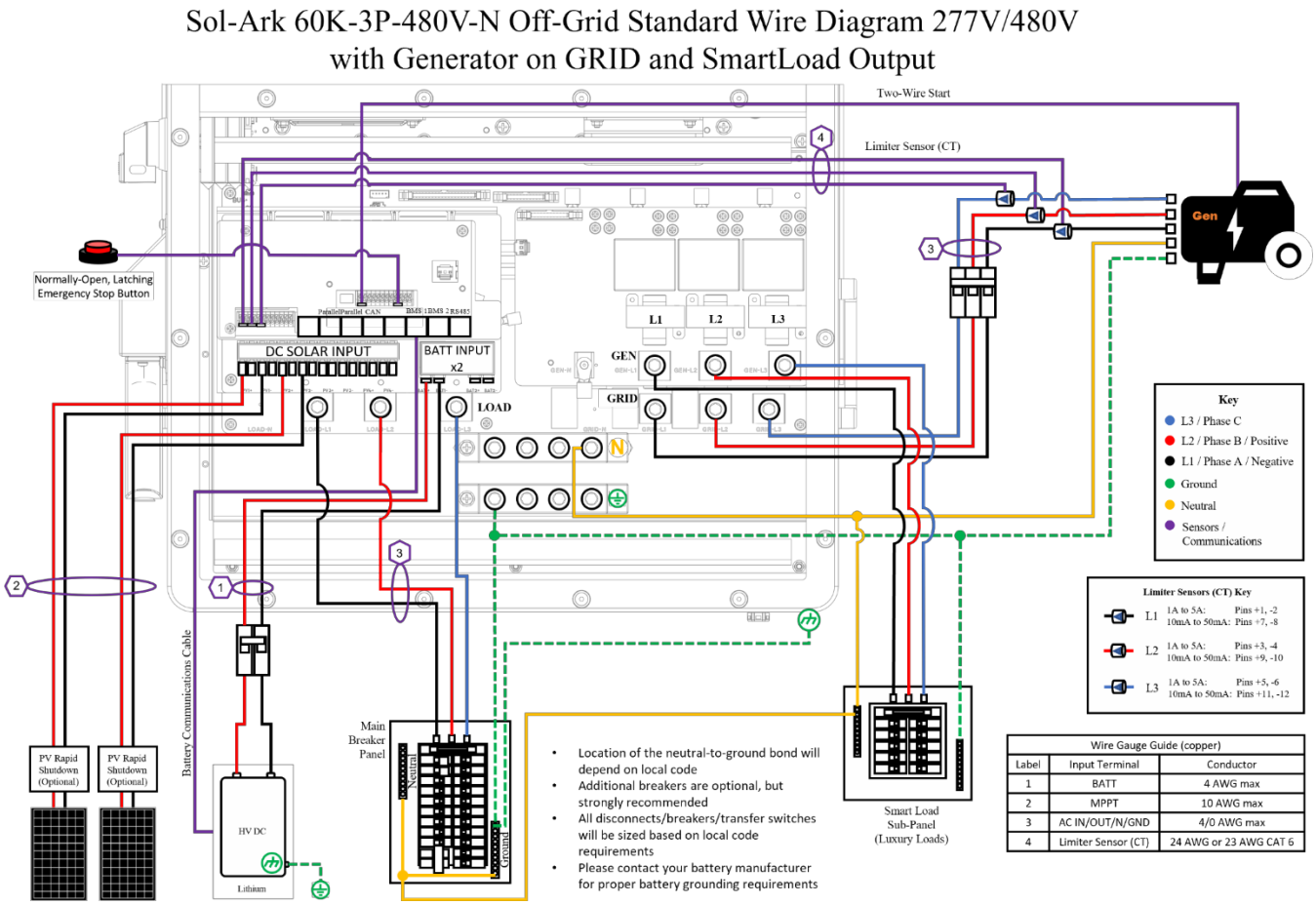


***Diagram 2***




CT Sensors are optional but necessary to enable Peak Shaving.

(See the inverter separate manual for details.)

***Diagram 3***

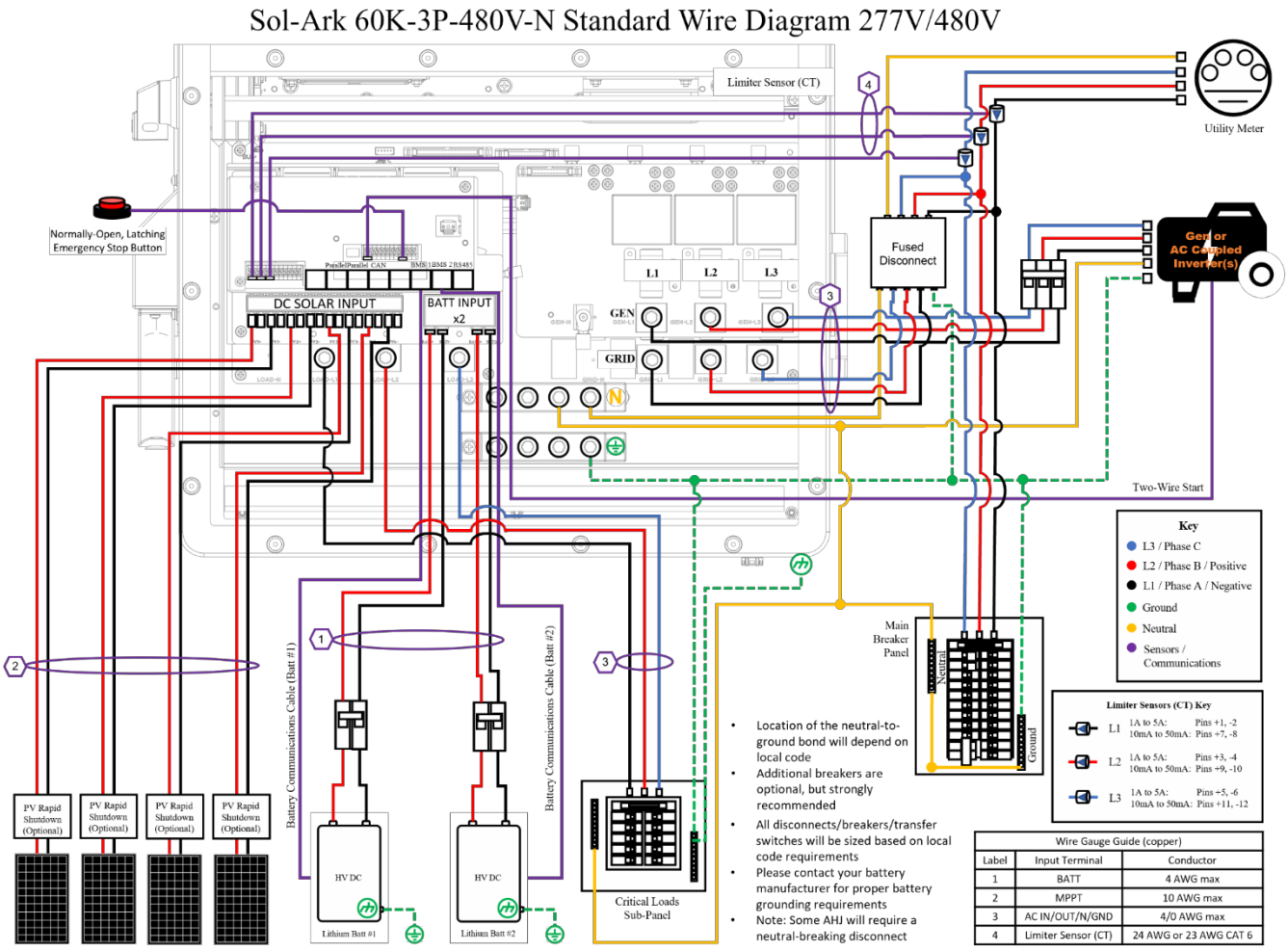
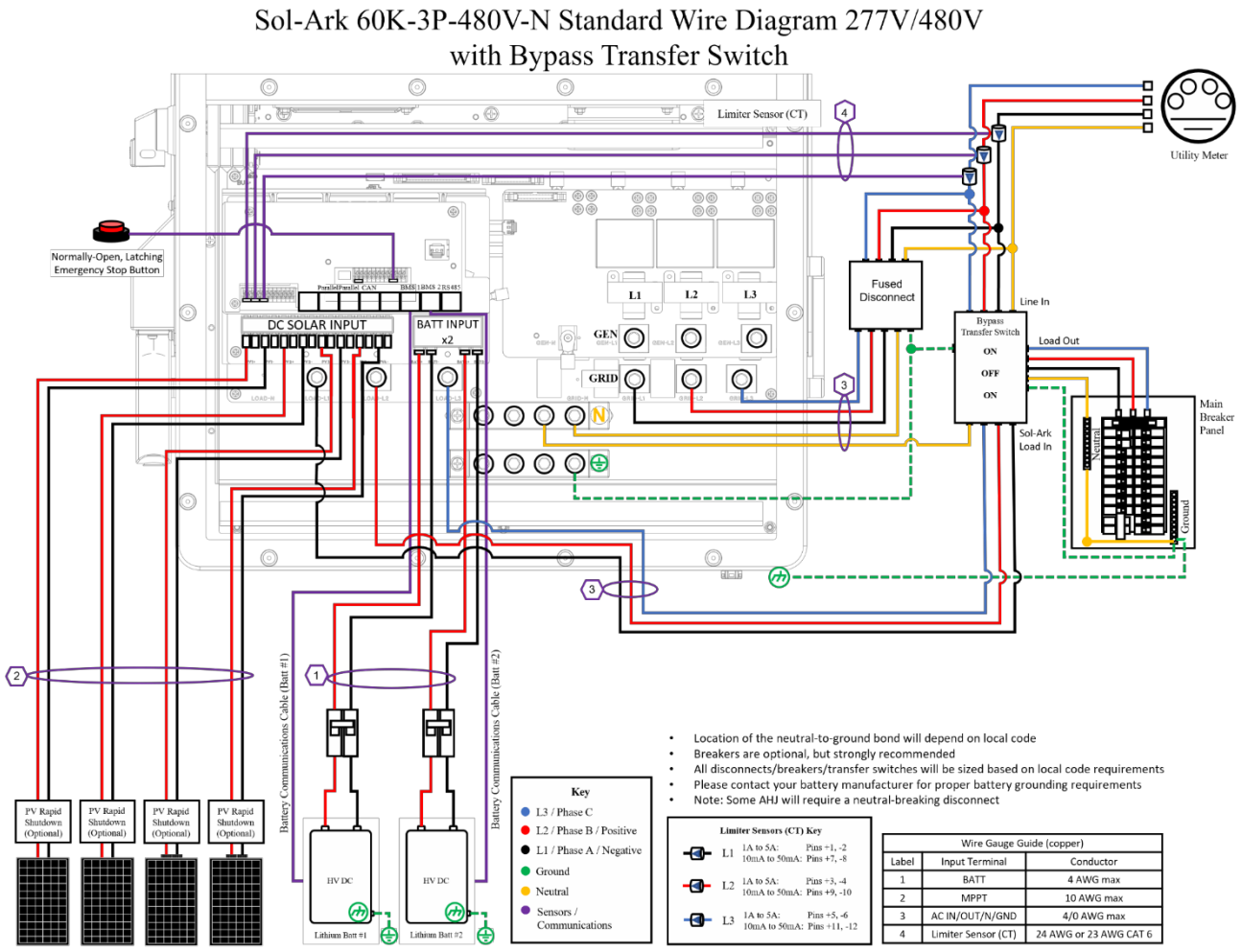

Sol-Ark 60K-3P-480V-N Standard Wire Diagram 277V/480V
Limiter Sensor (CT)
Utility Meter
Normally-Open, Latching Emergency Stop Button
Fused Disconnect
Gen or AC Coupled Inverter(s)
DC SOLAR INPUT
BATT INPUT x2
L1
L2
L3
GEN
GRID
N
Two-Wire Start
Key
L3 / Phase C
L2 / Phase B / Positive
L1 / Phase A / Negative
Ground
Neutral
Sensors / Communications
Main Breaker Panel
Neutral
Ground
Limiter Sensors (CT) Key
L1 1A to 5A: Pins +1, -2 10mA to 50mA: Pins +7, -8
L2 1A to 5A: Pins +3, -4 10mA to 50mA: Pins +9, -10
L3 1A to 5A: Pins +5, -6 10mA to 50mA: Pins +11, -12
PV Rapid Shutdown (Optional)
PV Rapid Shutdown (Optional)
PV Rapid Shutdown (Optional)
PV Rapid Shutdown (Optional)
Battery Communications Cable (Batt #1)
Battery Communications Cable (Batt #2)
HV DC
HV DC
Lithium Batt #1
Lithium Batt #2
Critical Loads Sub-Panel
Location of the neutral-to-ground bond will depend on local code
Additional breakers are optional, but strongly recommended
All disconnects/breakers/transfer switches will be sized based on local code requirements
Please contact your battery manufacturer for proper battery grounding requirements
Note: Some AHJ will require a neutral-breaking disconnect
Wire Gauge Guide (copper)
Label | Input Terminal | Conductor
1 | BATT | 4 AWG max
2 | MPPT | 10 AWG max
3 | AC IN/OUT/N/GND | 4/0 AWG max
4 | Limiter Sensor (CT) | 24 AWG or 23 AWG CAT 6

***Diagram 4***




| Wire Gauge Guide (copper) | | |
|---|---|---|
| Label | Input Terminal | Conductor |
| 1 | BATT | 4 AWG max |
| 2 | MPPT | 10 AWG max |
| 3 | AC IN/OUT/N/GND | 4/0 AWG max |
| 4 | Limiter Sensor (CT) | 24 AWG or 23 AWG CAT 6 |

***Diagram 5***

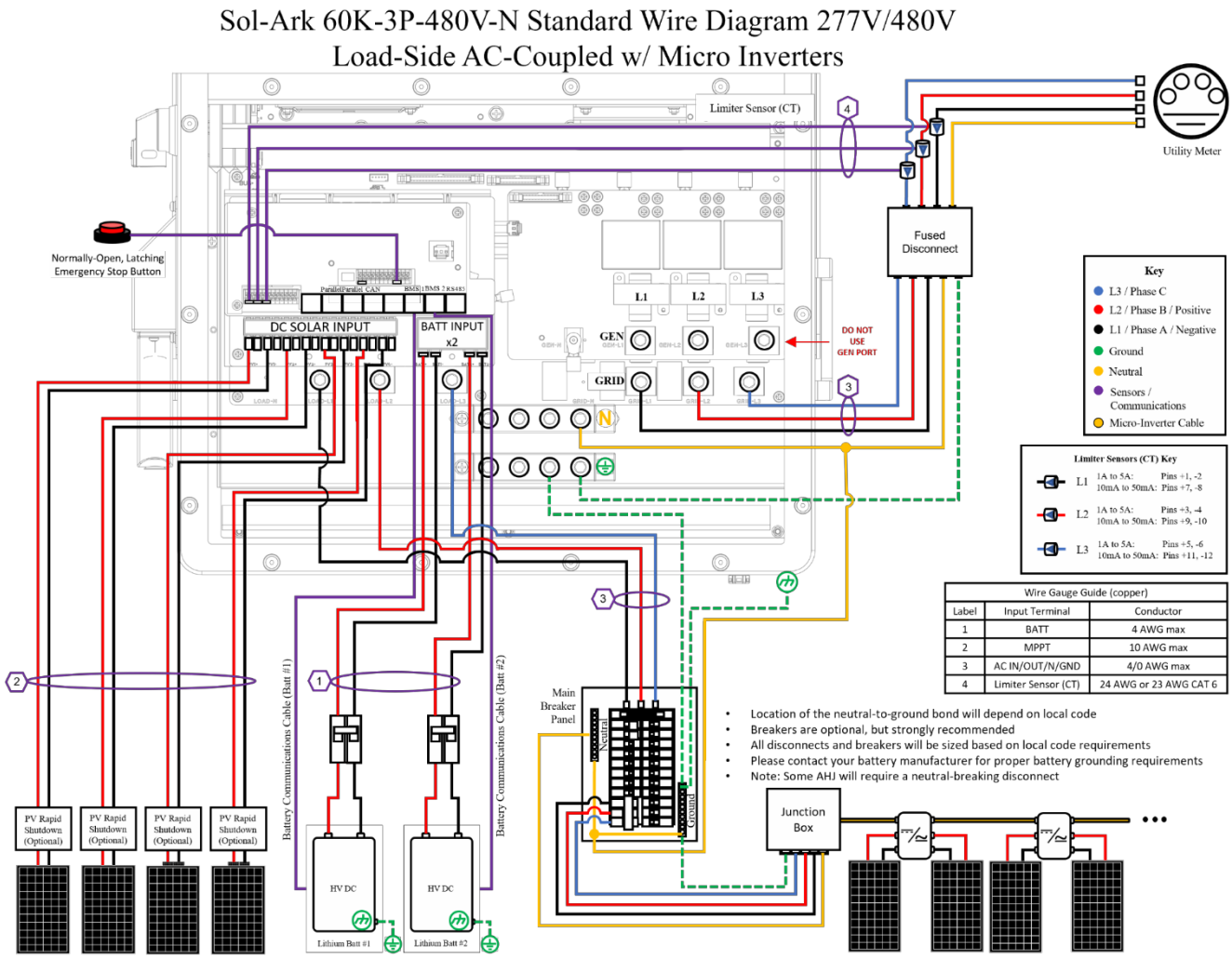

Sol-Ark 60K-3P-480V-N Standard Wire Diagram 277V/480V
Load-Side AC-Coupled w/ Micro Inverters
Limiter Sensor (CT)
Utility Meter
Fused Disconnect
Normally-Open, Latching Emergency Stop Button
DC SOLAR INPUT
BATT INPUT x2
GEN
GRID
L1
L2
L3
DO NOT USE GEN PORT
Key
L3 / Phase C
L2 / Phase B / Positive
L1 / Phase A / Negative
Ground
Neutral
Sensors / Communications
Micro-Inverter Cable
Limiter Sensors (CT) Key
L1 1A to 5A: Pins +1, -2 10mA to 50mA: Pins +7, -8
L2 1A to 5A: Pins +3, -4 10mA to 50mA: Pins +9, -10
L3 1A to 5A: Pins +5, -6 10mA to 50mA: Pins +11, -12
Wire Gauge Guide (copper)
Label | Input Terminal | Conductor
1 | BATT | 4 AWG max
2 | MPPT | 10 AWG max
3 | AC IN/OUT/N/GND | 4/0 AWG max
4 | Limiter Sensor (CT) | 24 AWG or 23 AWG CAT 6
PV Rapid Shutdown (Optional)
Battery Communications Cable (Batt #1)
Battery Communications Cable (Batt #2)
HV DC
Lithium Batt #1
Lithium Batt #2
Main Breaker Panel
Neutral
Ground
Junction Box
Location of the neutral-to-ground bond will depend on local code
Breakers are optional, but strongly recommended
All disconnects and breakers will be sized based on local code requirements
Please contact your battery manufacturer for proper battery grounding requirements
Note: Some AHJ will require a neutral-breaking disconnect

***Diagram 6***

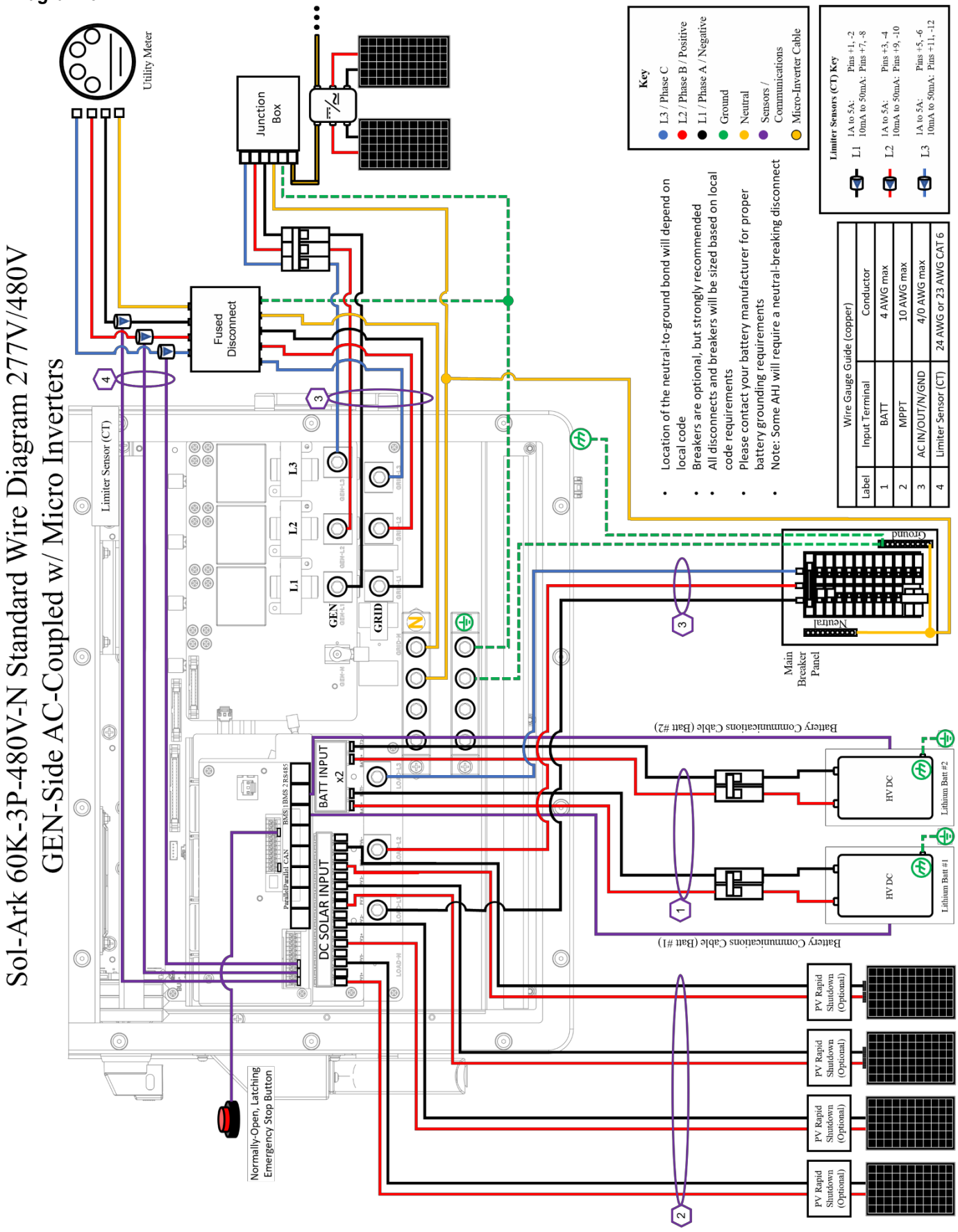
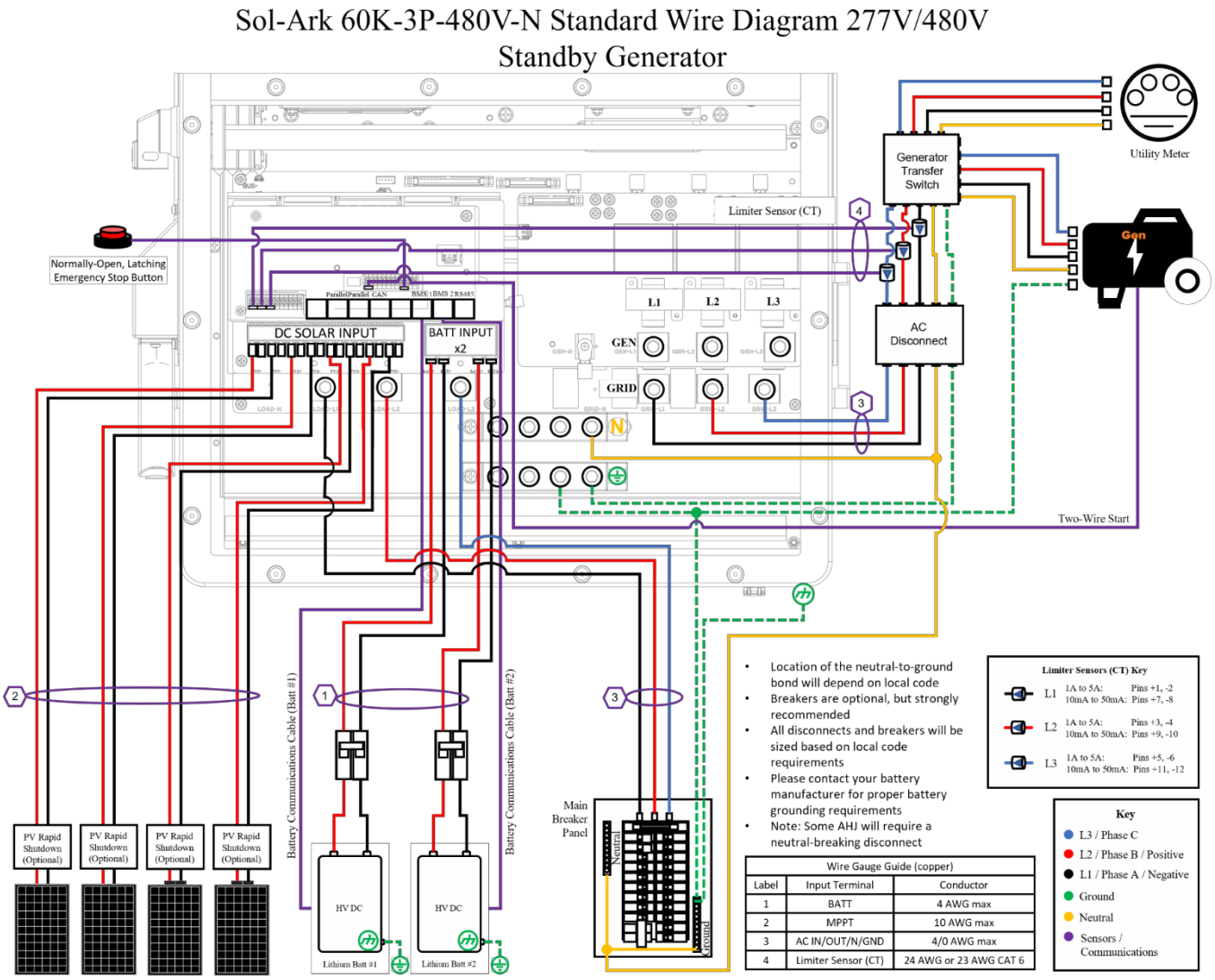
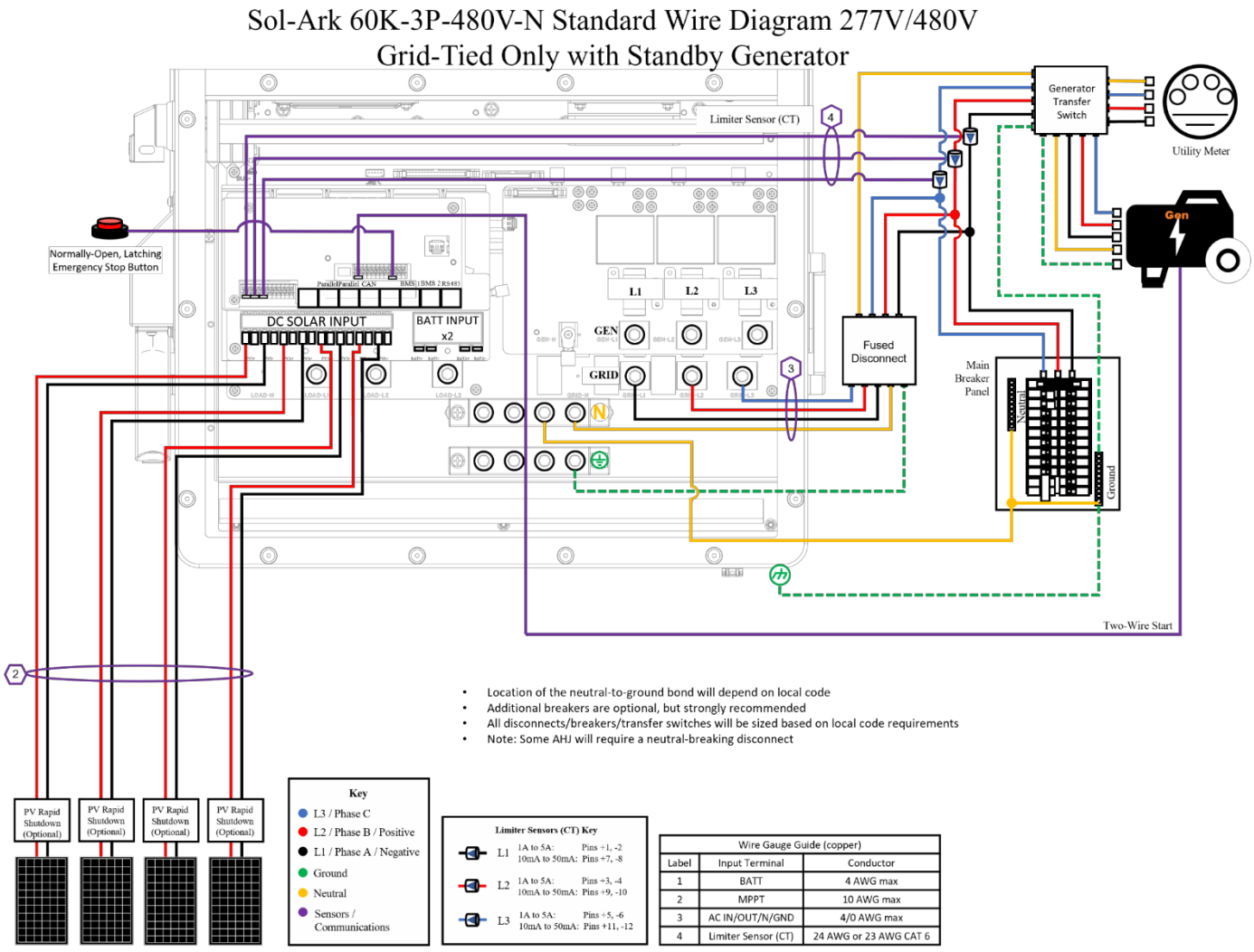

Sol-Ark 60K-3P-480V-N Standard Wire Diagram 277V/480V
GEN-Side AC-Coupled w/ Micro Inverters
Utility Meter
Junction Box
Fused Disconnect
Limiter Sensor (CT)
L3
L2
L1
GEN
GRID
BATT INPUT x2
DC SOLAR INPUT
BMS 1 BMS 2 RS485
Parallel
Parallel CAN
Normally-Open, Latching Emergency Stop Button
PV Rapid Shutdown (Optional)
HV DC
Lithium Batt #1
Lithium Batt #2
Battery Communications Cable (Batt #1)
Battery Communications Cable (Batt #2)
Main Breaker Panel
Neutral
Ground
Key
L3 / Phase C
L2 / Phase B / Positive
L1 / Phase A / Negative
Ground
Neutral
Sensors / Communications
Micro-Inverter Cable
Limiter Sensors (CT) Key
L1 1A to 5A: Pins +1, -2
10mA to 50mA: Pins +7, -8
L2 1A to 5A: Pins +3, -4
10mA to 50mA: Pins +9, -10
L3 1A to 5A: Pins +5, -6
10mA to 50mA: Pins +11, -12
Location of the neutral-to-ground bond will depend on local code
Breakers are optional, but strongly recommended
All disconnects and breakers will be sized based on local code requirements
Please contact your battery manufacturer for proper battery grounding requirements
Note: Some AHJ will require a neutral-breaking disconnect
Wire Gauge Guide (copper)
Label | Input Terminal | Conductor
1 | BATT | 4 AWG max
2 | MPPT | 10 AWG max
3 | AC IN/OUT/N/GND | 4/0 AWG max
4 | Limiter Sensor (CT) | 24 AWG or 23 AWG CAT 6

***Diagram 7***




| Wire Gauge Guide (copper) | | |
|---|---|---|
| Label | Input Terminal | Conductor |
| 1 | BATT | 4 AWG max |
| 2 | MPPT | 10 AWG max |
| 3 | AC IN/OUT/N/GND | 4/0 AWG max |
| 4 | Limiter Sensor (CT) | 24 AWG or 23 AWG CAT 6 |

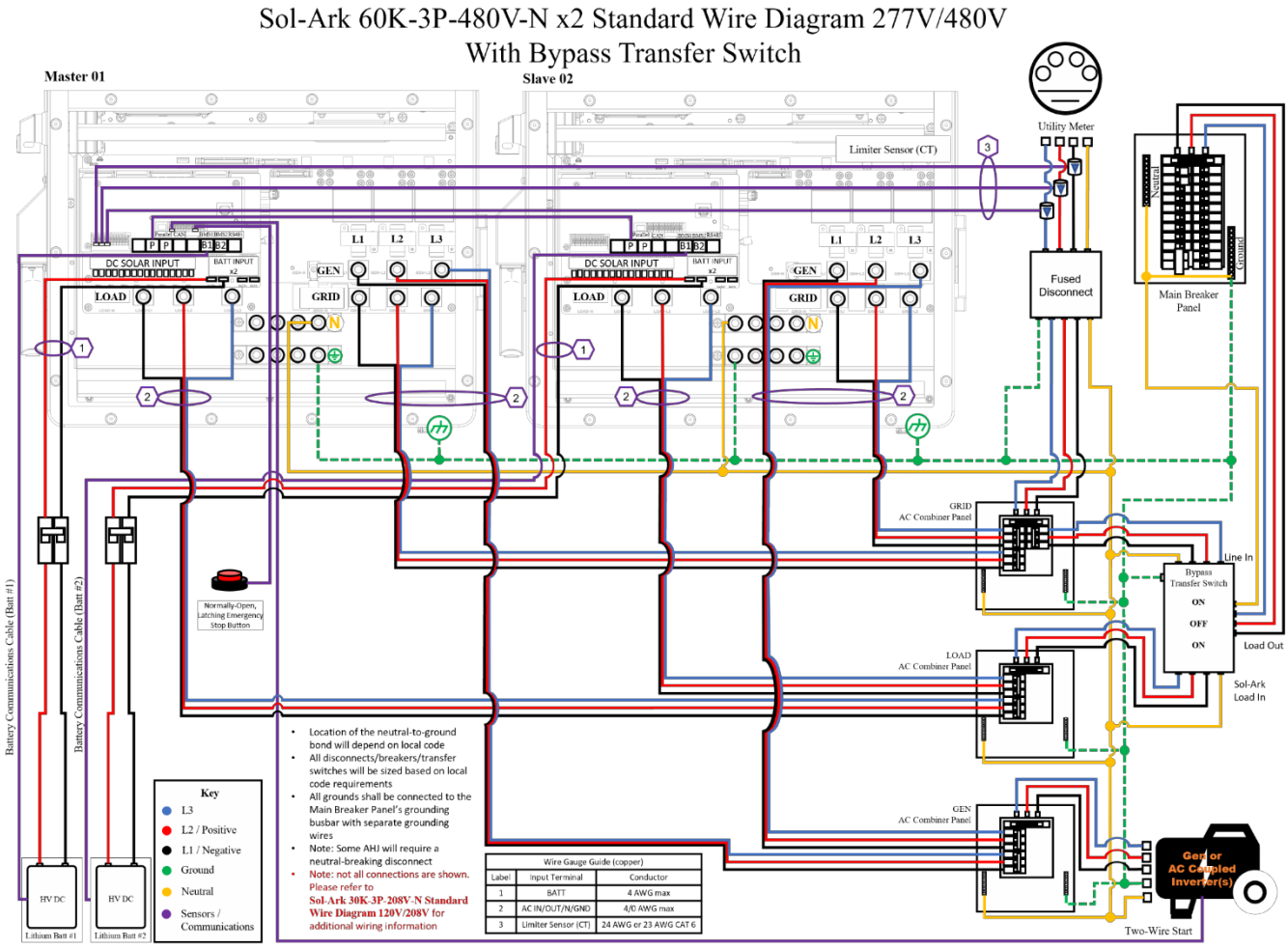
***Diagram 8***



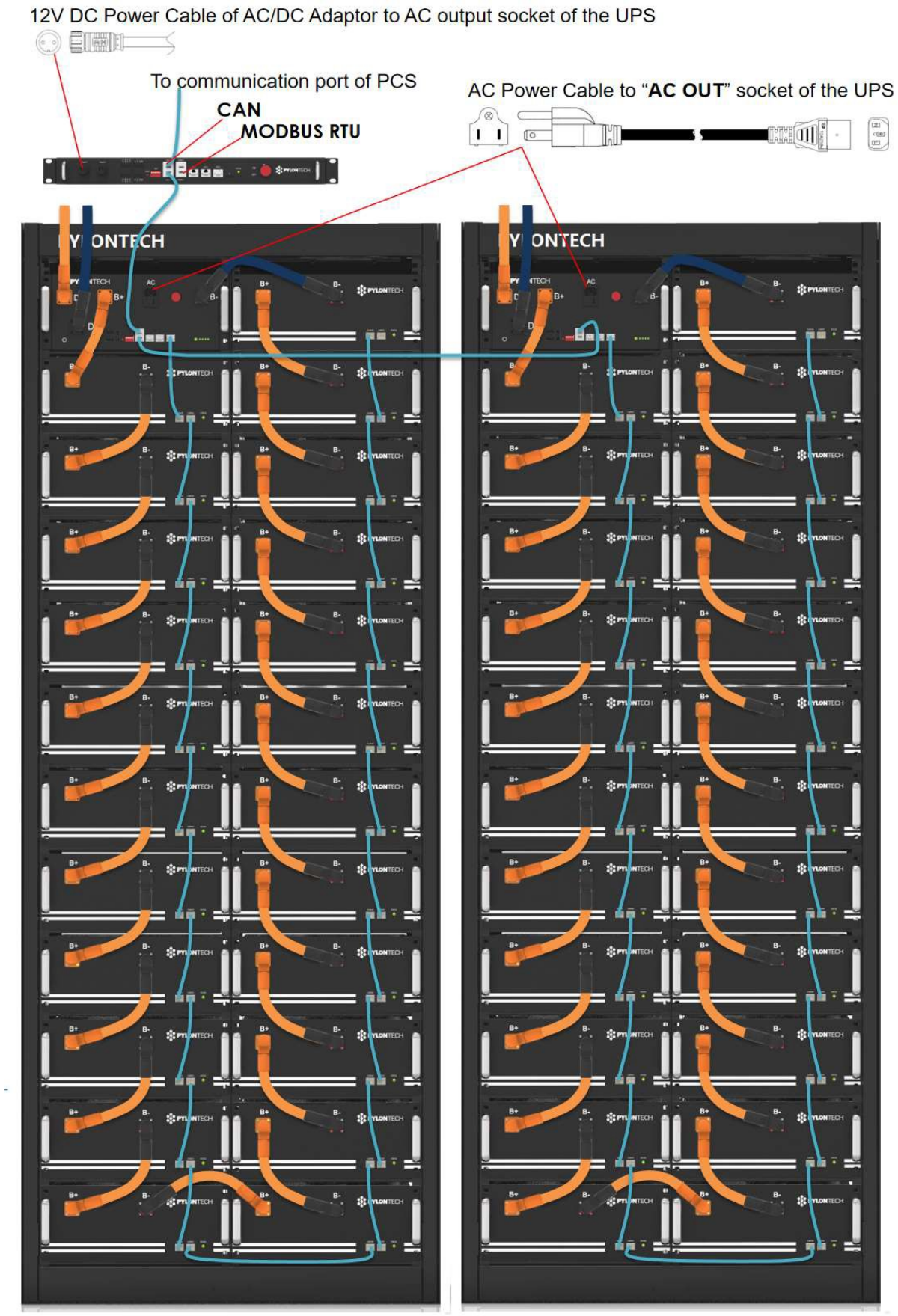

- Location of the neutral-to-ground bond will depend on local code
- Additional breakers are optional, but strongly recommended
- All disconnects/breakers/transfer switches will be sized based on local code requirements
- Note: Some AHJ will require a neutral-breaking disconnect

| Wire Gauge Guide (copper) | | |
|---|---|---|
| Label | Input Terminal | Conductor |
| 1 | BATT | 4 AWG max |
| 2 | MPPT | 10 AWG max |
| 3 | AC IN/OUT/N/GND | 4/0 AWG max |
| 4 | Limiter Sensor (CT) | 24 AWG or 23 AWG CAT 6 |

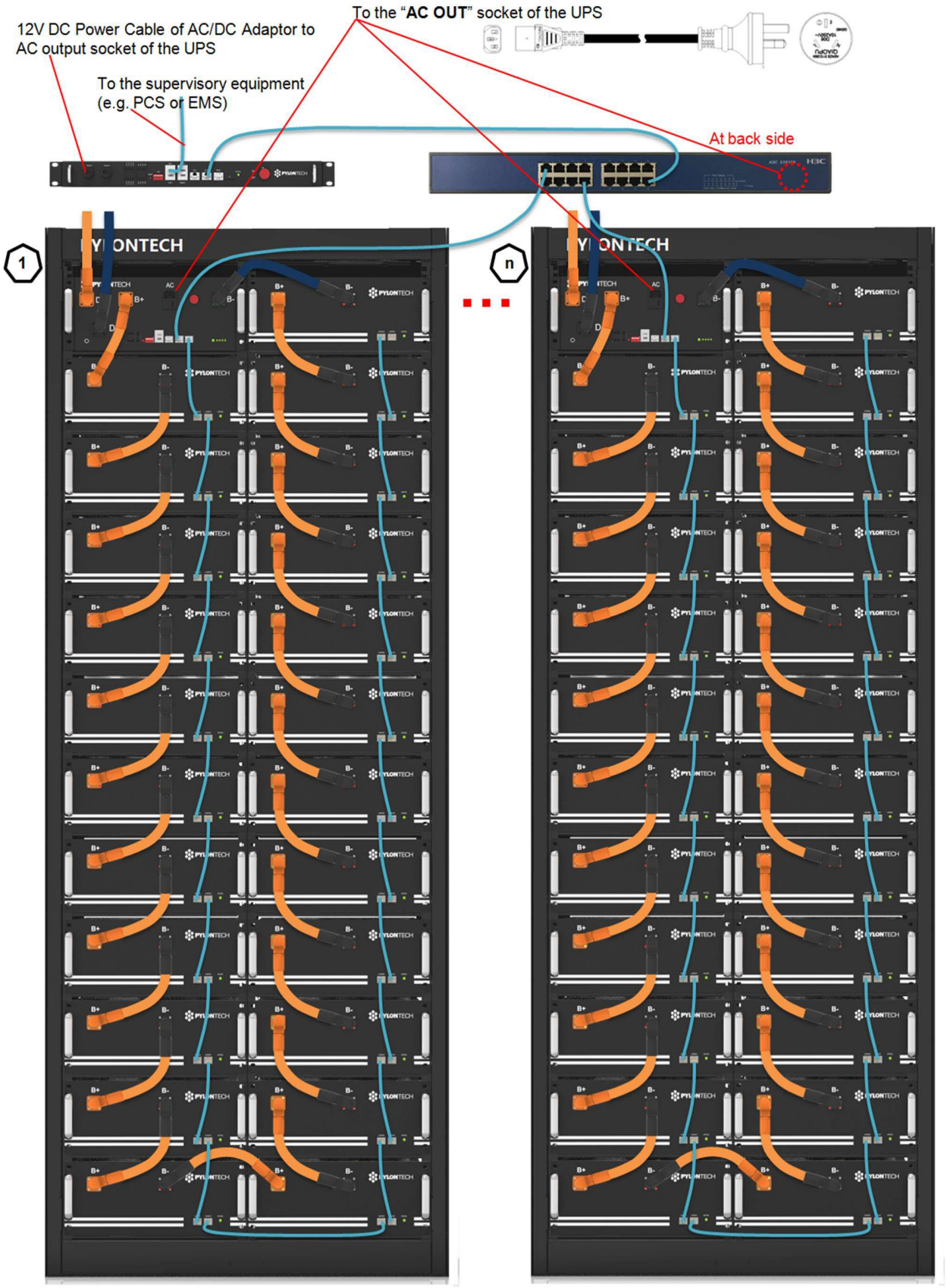
***Diagram 9***


Sol-Ark 60K-3P-480V-N x2 Standard Wire Diagram 277V/480V
With Bypass Transfer Switch
Master 01
Slave 02
Utility Meter
Limiter Sensor (CT)
Fused Disconnect
Main Breaker Panel
Neutral
Ground
DC SOLAR INPUT
BATT INPUT
LOAD
GRID
GEN
L1
L2
L3
GRID AC Combiner Panel
LOAD AC Combiner Panel
GEN AC Combiner Panel
Bypass Transfer Switch
ON
OFF
ON
Line In
Load Out
Sol-Ark Load In
Gen or AC Coupled Inverter(s)
Two-Wire Start
Normally-Open, Latching Emergency Stop Button
Battery Communications Cable (Batt #1)
Battery Communications Cable (Batt #2)
HV DC
Lithium Batt #1
Lithium Batt #2
Key
L3
L2 / Positive
L1 / Negative
Ground
Neutral
Sensors / Communications
Location of the neutral-to-ground bond will depend on local code
All disconnects/breakers/transfer switches will be sized based on local code requirements
All grounds shall be connected to the Main Breaker Panel's grounding busbar with separate grounding wires
Note: Some AHJ will require a neutral-breaking disconnect
Note: not all connections are shown. Please refer to Sol-Ark 30K-3P-208V-N Standard Wire Diagram 120V/208V for additional wiring information
Wire Gauge Guide (copper)
Label
Input Terminal
Conductor
1
BATT
4 AWG max
2
AC IN/OUT/N/GND
4/0 AWG max
3
Limiter Sensor (CT)
24 AWG or 23 AWG CAT 6

## Annex 3: Cable connection diagram (CAN ≤6 set)



## Annex 4: Cable connection diagram (Ethernet)



## Annex 5: Installation and System Turn ON Process List

| Tick after completion | No. | Item | Remark |
|---|---|---|---|
| ☐ | 1 | The environment is meeting all technical requirements.<br>3.3.1 Cleaning<br>3.3.2 Temperature<br>3.3.3 Radiating System<br>3.3.4 Heating System<br>3.3.5 Fire-extinguisher System<br>3.3.6 Grounding System | Refer to section 3.3 |
| ☐ | 2 | Battery rack is installed following the technical requirements. | Refer to *section 3.5.3.* |
| ☐ | 3 | Control Module (BMS) and Battery Module are installed well.<br>And install the rack metal strip. | Refer to *section 3.5.4.* |
| ☐ | 4 | The MBMS are installed well. (If configured.) | Refer to *section 3.5.5.* |
| ☐ | 5 | The Ethernet Switch is installed well. (If configured.) | Refer to *section 3.5.6.* |
| ☐ | 6 | Connect the AC power cables from BMS, MBMS and Ethernet Switch to the AC "OUTPUT" socket of the UPS. (If configured.) | Refer to *section 3.6.2.1 or 3.6.2.2.* |
| ☐ | 7 | Connect External Power Cable +/- between each BMS to the INVERTER or confluence cabinet. | Refer to *section 3.6.2.1 or 3.6.2.2.* |
| ☐ | 8 | Connect power cables of each battery string. | Refer to *section 3.6.2.1 or 3.6.2.2.* |
| ☐ | 9 | Connect communication cables of each battery string. | Refer to *section 3.6.2.1 or 3.6.2.2.* |
| ☐ | 10 | Set up ADD switch of every BMS and the MBMS ( Address Assignment). | Refer to *section 3.6.3.* |
| ☐ | 11 | Connect external communication cables from BMS to Ethernet Switch, MBMS or another. | Refer to *section 3.6.2.1 or 3.6.2.2.* |
| ☐ | 13 | Connect the communication cable from MBMS to the INVERTER. | Refer to *section 3.6.2.1 or 3.6.2.2.* |

| | | | |
|---|---|---|---|
| ☐ | 14 | Double check every power cable, communication cables are installed well. And ADD Switches are setting right. | Refer to *section 3.6.2.1 or 3.6.2.2 and 3.6.3.* |
| ☐ | 15 | Check whether the UPS is turned on. And the UPS is power supplying. | Refer to *section* 3.6.4. |
| ☐ | 16 | Switch the external power or INVERTER on, be sure all the power equipment working normally. | Refer to *section* 3.6.4. |
| ☐ | 17 | Turn the BMS (Battery Control Modules) of each battery string on (from 1st BMS to the last, one by one)<br>□ Turn on the "POWER OUTPUT SWITCH":<br>□ Turn on the "PowerSwitch":<br>□ The battery string's system will check itself if work normal the battery string system will go into self-check mode.<br>If has failure during the self-check, be sure to debug. the failure then can start next step. | Refer to *section* 3.6.4. |
| ☐ | 18 | If every battery string is working normally.<br>Then switch the MBMS on. The MBMS will self-check and check each battery string one by one. | Refer to *section* 3.6.4. |
| ☐ | 19 | The first installation should do full charging progress. After MBMS communicating with each BMS, it will run parallel operation. It will start up from lowest voltage battery string to do the parallel operation during the charging.<br>If the status LED of BMS turns to green, it means this battery string is in parallel operation. | The first installation should do full charging progress. |

## Annex 6: System Turn OFF Process List

| Tick after completion | No. | Item | Remark |
|---|---|---|---|
| ☐ | 1 | Turn off the switch between INVERTER and this battery string(PowerCube-M1-C), or turn off the power switch of INVERTER, to make sure no current through this battery string. | Refer to *section 3.6.4.* |
| ☐ | 2 | Turn off the "Power Output Switch" of the BMS. | Refer to *section 3.6.5.* |
| ☐ | 3 | Turn off the "Power Switch" of the BMS. | Refer to *section 3.6.5.* |
| ☐ | 4 | Turn off the "Power Switch" of the MBMS. | Refer to *section 3.6.5.* |
| ☐ | 5 | Turn off the UPS.<br>The UPS can be turned on to check the equipment (INVERTERor battery system etc.). Otherwise, be sure to turn off the UPS to save its power. | Refer to *section 3.6.5.* |

**Pylon Technologies Co., Ltd.**

5/F, No.71-72, Lane 887, ZuChongzhi Road, China (Shanghai) Pilot Free Trade Zone

Pudong, Shanghai 201203, China

**T**+86-21-51317699 | **F** +86-21-51317698

**E** service@pylontech.com.cn

**W** www.pylontech.com.cn