



INSTALLATION, COMMISSIONING & OPERATING MANUAL

SOLVA

Intelligent • Integrated • In Control

Static Transfer Switch Cabinet for the SOLVA AC261 Energy Storage Range



SOLVA STS 2IN • SOLVA STS 4IN • SOLVA STS 6IN

Larger STS solutions are available on special request - contact Freedom Won

This manual covers installation, commissioning, operation and maintenance of the SOLVA STS cabinet range.
For a comprehensive overview of the wider SOLVA range, visit www.freedomwon.co.za

SOLVA STS Range

Installation, Commissioning & Operating Manual

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About this manual

This manual applies to the Freedom Won SOLVA STS 2IN, 4IN and 6IN cabinets. Any differences between the variants are noted at the relevant point in the text; where no note is given, the information applies to all three. Larger STS configurations can be engineered on special request - please contact Freedom Won to discuss your requirements.

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1. Preface

1.1. Overview

This document describes the installation, electrical connection, commissioning and maintenance of the Freedom Won SOLVA STS static transfer switch cabinets. Please read it carefully before installing or operating the system, so that you understand the safety requirements and become familiar with its functions and features.

The SOLVA STS is a static transfer switch (STS) cabinet that enables a near-seamless transfer of the SOLVA AC261 power conversion system (PCS) cabinets between grid-connected (on-grid) and island (off-grid) operation in the event of a grid failure or outage. The cabinet houses one or two STS modules, together with the protection, metering and communication equipment needed to integrate the energy storage system with the grid and with the site load.

This manual applies to all three variants of the SOLVA STS range. Any differences between the variants are noted at the relevant point in the text; where no note is given, the information applies to all three.

Note

This product is for use with the [SOLVA AC261](#).

1.2. About this Manual

Read this manual in full and make sure you understand the equipment before installing, operating or maintaining it. The content is updated periodically, and minor differences may exist between this manual and the delivered product; always refer to the physical product you have purchased and obtain the latest revision from Freedom Won or an authorised channel.

1.3. Symbol Usage

The following signal words are used throughout this manual to highlight information that protects personal and property safety. Only suitably trained and qualified personnel may carry out the procedures described.

Table 1-1 Signal words used in this manual

Signal word	Meaning
DANGER	An imminently hazardous situation that, if not avoided, will result in death or serious injury.
WARNING	A hazardous situation that, if not avoided, could result in death or serious injury.
CAUTION	A hazardous situation that, if not avoided, may result in minor or moderate injury, or property damage.
ATTENTION	A potential risk that, if not avoided, may lead to equipment malfunction or property damage.

2. Safety Precautions

2.1. Personnel Requirements

The lifting, transport, installation, wiring, operation and maintenance of the SOLVA STS cabinet must be carried out only by professional electrical technicians who comply with local regulations. Operators must:

- Have a sound understanding of electronics, electrical wiring and mechanics, and be able to read electrical and mechanical schematics;
- Be thoroughly familiar with the construction and operating principles of the cabinet and its associated upstream and downstream equipment;
- Have completed professional training in the installation and commissioning of electrical systems;
- Be able to manage emergencies and unexpected situations that may arise during installation or commissioning;
- Be knowledgeable about the standards and regulations applicable in the country or region of the installation.

2.2. Electrical Safety

DANGER - lethal voltage

Touching points or terminals connected to the grid or to internal equipment can cause a fatal electric shock. Both the battery and grid sides can carry voltage. Always confirm the absence of voltage with a calibrated voltmeter before making contact.

- Lethal high voltage is present inside the cabinet. Observe and follow the warning labels on the product.
- A damaged internal component may cause electric shock or fire.
- Comply with the safety precautions in this manual and in any other relevant documentation for the equipment.
- Observe the protective requirements and precautions specific to the battery system.
- All lifting, transport, installation, wiring, operation and maintenance activities must comply with the regulations applicable in the project area.

2.3. Operation and Maintenance Safety

- Wear appropriate personal protective equipment for all maintenance, inspection and related tasks - safety goggles, helmet, insulated footwear, gloves and other protective apparel.
- Only personnel authorised by Freedom Won are permitted to remove, replace or otherwise handle the cabinet.
- Do not carry out any maintenance procedure that is not described in this manual, to avoid the risk of electric shock.
- For repairs, contact the Freedom Won after-sales service team.
- Do not apply any substance to internal or external components.
- Do not clean the equipment with solvents or harsh chemicals.

2.4. Storage

If the cabinet is not to be installed soon after delivery, store it in accordance with the following requirements:

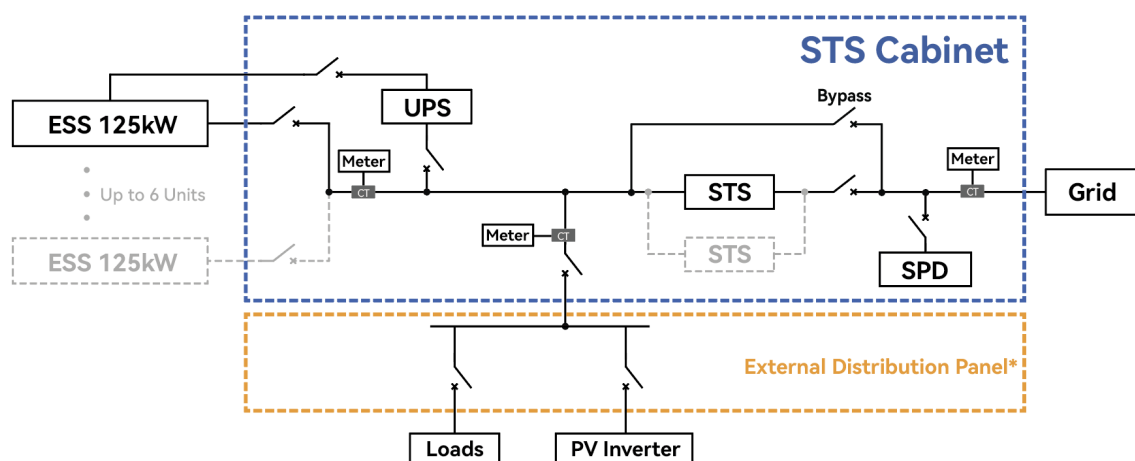
- Storage temperature: -20°C to 55°C ; relative humidity: 0-95 %, non-condensing. Keep the cabinet at least 2 m from any heat source and at least 50 cm from walls, windows or air intakes.
- The storage floor must be flat and strong enough to bear the weight of the cabinet. The storage area must be free of corrosive, combustible or explosive materials and gases.
- Inspect the packaging at least weekly for damage, including damage caused by rodents. Repair or replace damaged packaging immediately.

3. Product Introduction

3.1. System Introduction

The SOLVA STS is a static transfer switch cabinet used to connect the SOLVA AC261 energy storage system (ESS) cabinets to the grid, giving an on-grid/off-grid transfer time of less than 20 ms. The cabinet houses one or two Static Transfer Switch (STS) modules, an Uninterruptible Power Supply (UPS), a Surge Protective Device (SPD), metering with current transformers of 0.5S accuracy class, and the associated circuit breakers.

A simplified single-line diagram of the cabinet is shown in Figure 3-1.



*Note: Distribution panel is not included in STS cabinet.

Figure 3-1 Simplified single-line diagram of the SOLVA STS cabinet

The SOLVA STS cabinet reserves circuit breakers for a PV inverter and for site loads, allowing a PV inverter and its loads to continue operating normally even while the system is off-grid. The Energy Management System (EMS) integrated in the cabinet communicates with the SOLVA AC261 cabinets and meters the grid- and load-side voltage and current; it can in turn communicate with a higher-level plant controller, or operate independently as a microgrid controller.

Load power and battery charging while on-grid

While the SOLVA STS is connected to the grid, the loads (site loads and any PV inverter) should draw no more than 70 % of the rated ESS power connected to the cabinet. This margin is deliberate: it is the headroom the system needs to complete the transfer to island (off-grid) mode within 20 ms without any interruption to the load, at the moment a grid failure is detected. The remaining 30 % of rated power is not forfeited - it can be used to charge the batteries in the SOLVA AC261 cabinets while the system is grid-connected. In other words, load sizing and battery charging share the same power budget: keeping site load within the 70 % limit is what makes a seamless grid-to-island transfer possible. This is explained further, with the supporting figures, in Section 3.5 (Specification).

Freedom Won offers the SOLVA STS in three standard variants, differentiated by the number of SOLVA AC261 cabinets that can be connected: 2, 4 or 6 inputs. Unused inputs can be left unpopulated for future expansion.

Larger systems

Configurations larger than SOLVA STS 6IN are available on special request. Please contact Freedom Won to discuss larger or bespoke requirements.

Figure 3-2 shows the appearance of the three standard variants, from smallest to largest: SOLVA STS 2IN, SOLVA STS 4IN and SOLVA STS 6IN.



Figure 3-2 Appearance of the SOLVA STS 2IN, 4IN and 6IN cabinets

3.2. Naming Convention

Every SOLVA STS model follows the naming convention SOLVA STS [Inputs], where [Inputs] is the number of SOLVA AC261 cabinets that can be connected to the STS cabinet:

- SOLVA STS 2IN - up to 2 SOLVA AC261 cabinets
- SOLVA STS 4IN - up to 4 SOLVA AC261 cabinets
- SOLVA STS 6IN - up to 6 SOLVA AC261 cabinets

3.3. Dimensions

3.3.1. SOLVA STS 2IN

Cabinet dimensions (W × D × H): 800 × 1200 × 1800 mm; weight: 550 kg.

Packaging dimensions: 880 × 1350 × 1950 mm; weight: 580 kg.

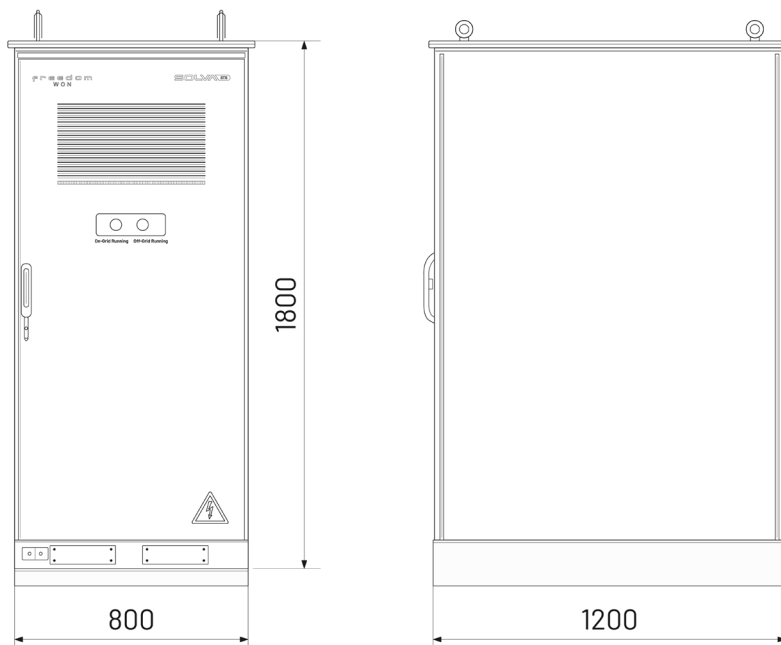


Figure 3-3 Dimensions of the SOLVA STS 2IN cabinet

3.3.2. SOLVA STS 4IN

Cabinet dimensions (W × D × H): 1000 × 1200 × 1800 mm; weight: 800 kg.

Packaging dimensions: 1080 × 1350 × 1950 mm; weight: 840 kg.

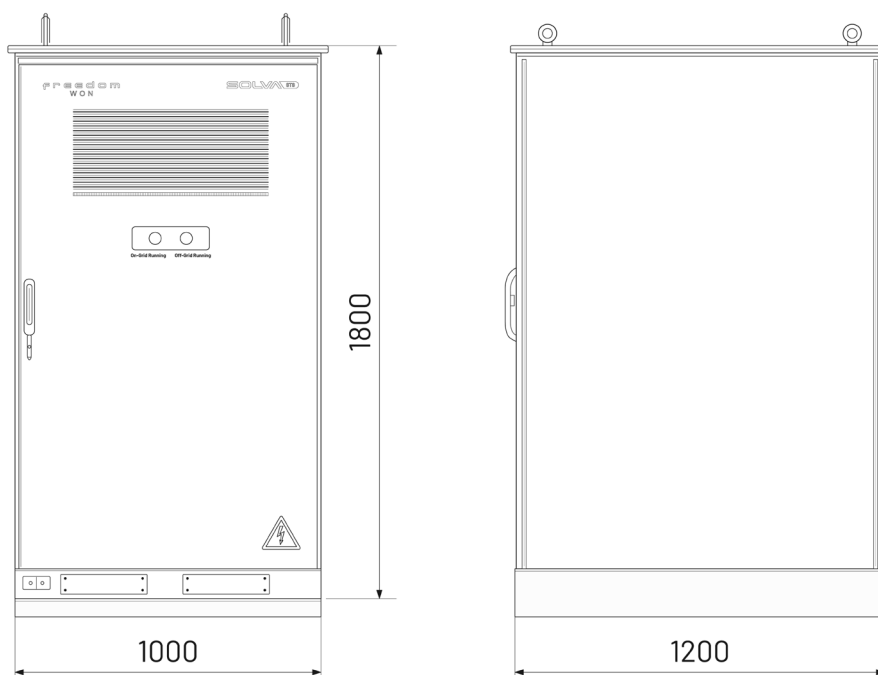


Figure 3-4 Dimensions of the SOLVA STS 4IN cabinet

3.3.3. SOLVA STS 6IN

Cabinet dimensions (W × D × H): 1200 × 1200 × 2200 mm; weight: 950 kg.

Packaging dimensions: 1280 × 1350 × 2250 mm; weight: 990 kg.

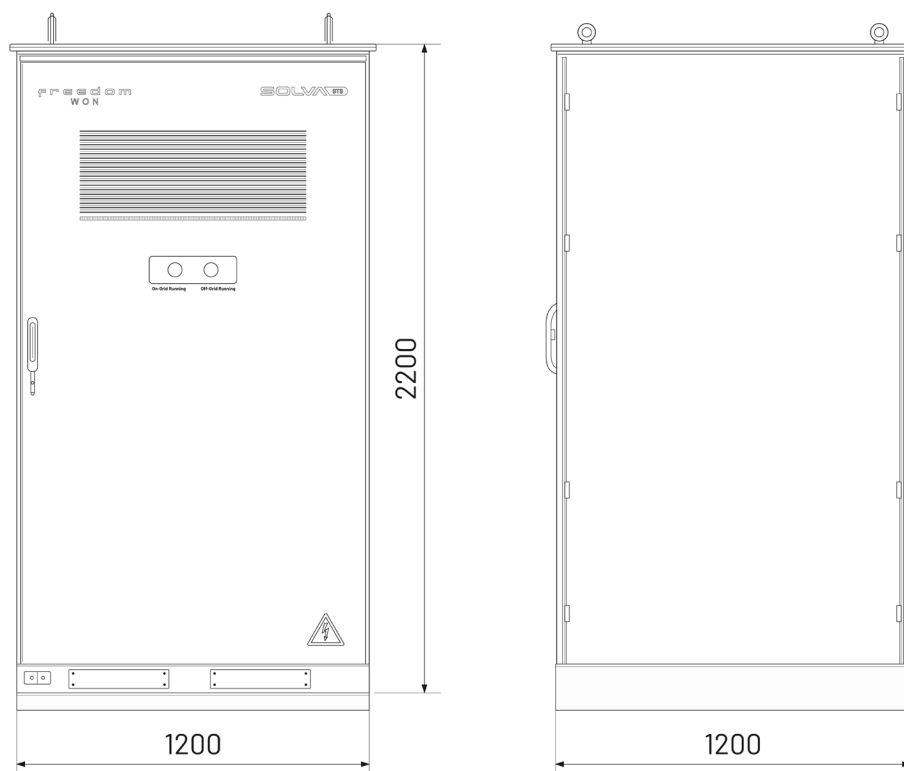


Figure 3-5 Dimensions of the SOLVA STS 6IN cabinet

3.4. External Indicators

Green and red indicator lights are fitted to the front door of the STS cabinet. The relevant indicator illuminates according to the operating mode of the STS:

Table 3-1 External Indicator Definitions

Indicator	Definition
Green	On-grid operation status
Red	Off-grid operation status



Figure 3-6 External indicators on the SOLVA STS front door

3.5. Specification

Table 3-2 SOLVA STS Specification Summary

	SOLVA STS 2IN	SOLVA STS 4IN	SOLVA STS 6IN
ESS-side parameters			
Max. number of SOLVA AC261 connection points	2 units	4 units	6 units
Max. current to SOLVA AC261 PCSs	2 × 250 A	4 × 250 A	6 × 250 A
Rated total power to SOLVA AC261 PCSs	2 × 125 kW	4 × 125 kW	6 × 125 kW
Grid-side parameters			
Number of grid connection ports	1		
Max. grid current	500 A	800 A	1600 A
Rated voltage	400 V		
Grid voltage range	400 V ± 15 %		
Grid type	3W + N + PE		

Rated frequency	50/60 Hz		
On/off-grid switching time	< 20 ms		
PV and load requirements			
Max. PV & load connection current	250 A	630 A	800 A
Recommended max. PV inverter power	170 kW	430 kW	550 kW
Recommended max. load power *	70% × rated combined SOLVA AC261 PCS power		
Auxiliary equipment parameters			
UPS	Dual Conversion Integrated Battery		
Maintenance socket	16 A for small power (PC etc.)		
Surge protection	AC Type II		
Meter accuracy	0.5S		
General parameters			
Dimensions (W × D × H)	800 × 1200 × 1800 mm	1000 × 1200 × 1800 mm	1200 × 1200 × 2200 mm
Altitude	3000 m		
Ambient temperature	-15 °C to 45 °C		
Humidity	0-95 % RH, non-condensing		
Cooling method	Air cooling		
IP rating	IP54		
Communication	RS485, Modbus TCP/IP		

* The recommended maximum load power is based on a power factor of 0.7, and reflects the 70% on-grid load limit explained in Section 3.1. Where the load includes motors or other high-inrush loads soft starters or VSD's are required. The 70% limit may need reducing if the load is dominated by inductive loads and VSD's. Contact Freedom Won for technical support before placing an order.

3.6. Electrical & Communication Diagram

Figure 3-7 shows the electrical and communication architecture of the SOLVA STS 2IN cabinet; the SOLVA STS 4IN and 6IN cabinets follow the same architecture, scaled up to the additional ESS connections, meters and breakers.

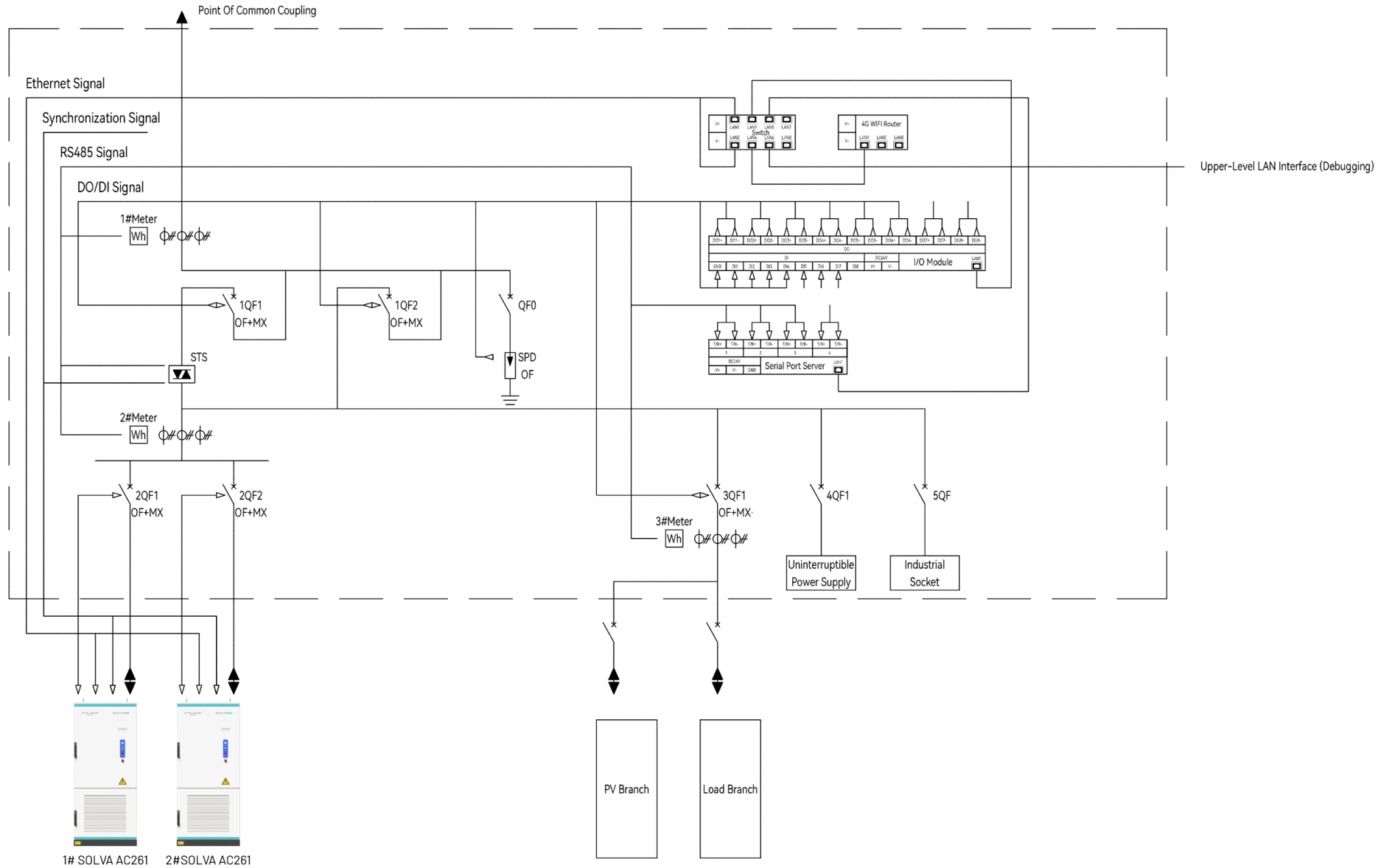


Figure 3-7 Electrical and Communication Architecture - SOLVA STS 2IN

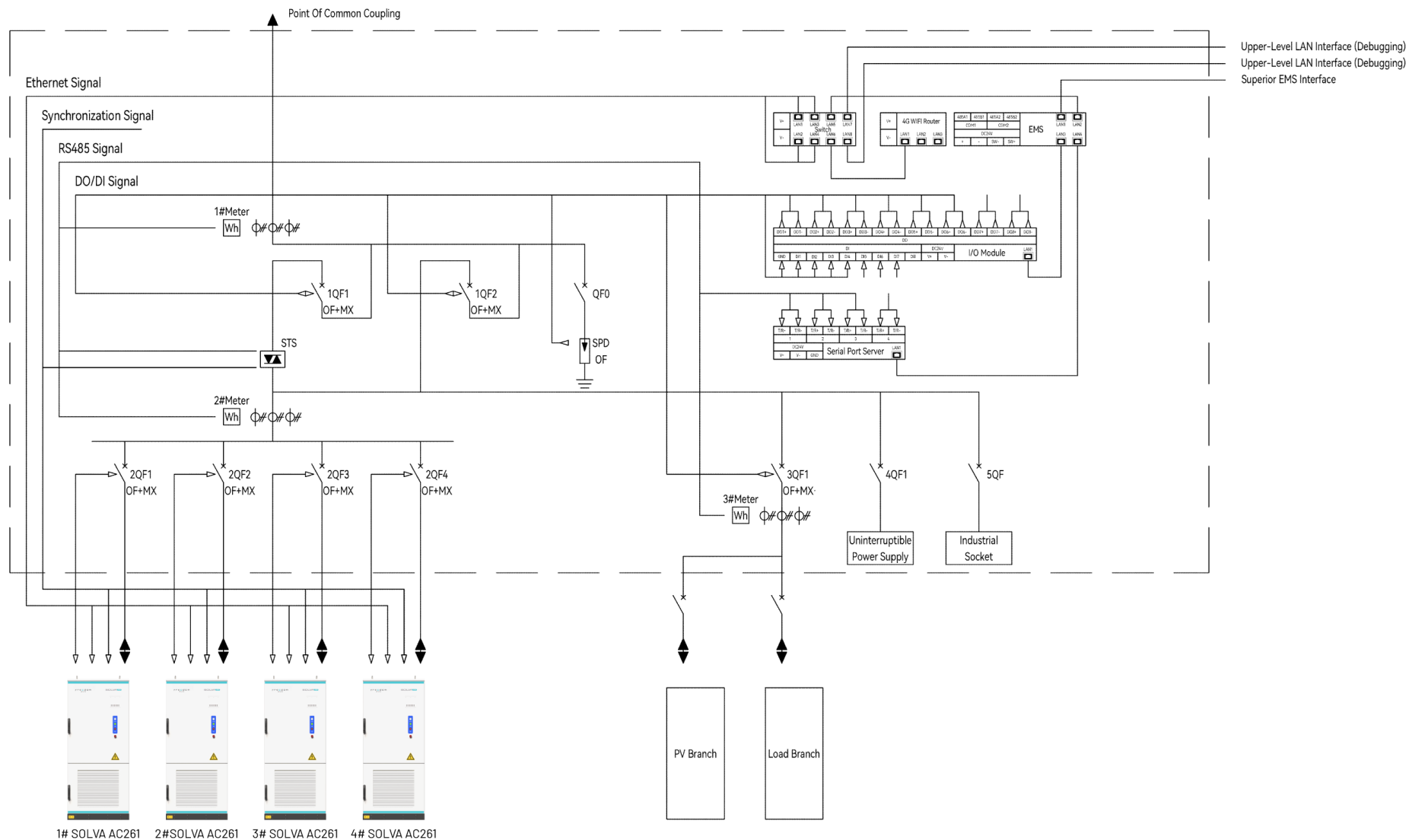


Figure 3-8 Electrical and Communication Architecture - SOLVA STS 4IN

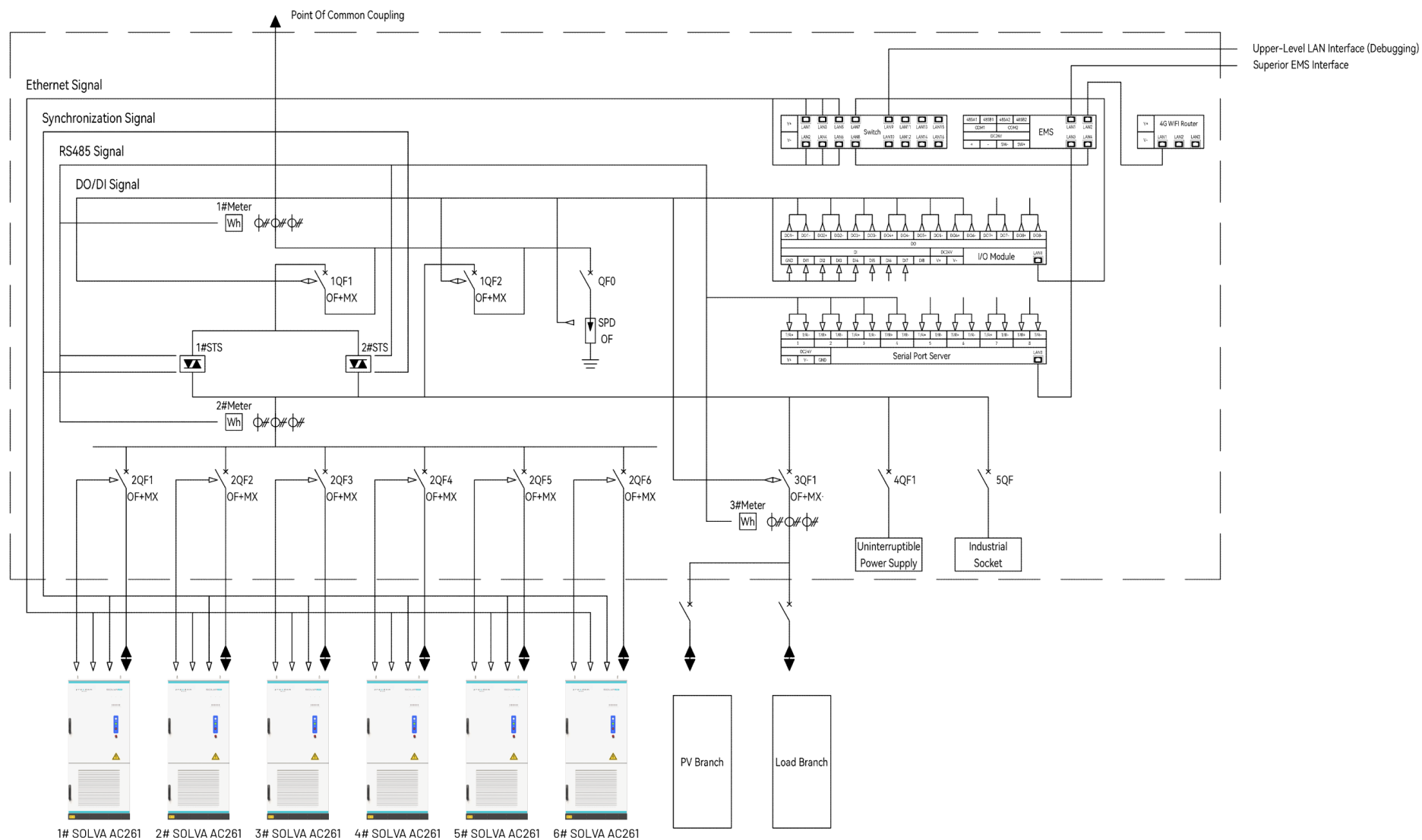


Figure 3-9 Electrical and Communication Architecture - SOLVA STS 6IN

3.7. Components

3.7.1. Schematic of Internal Components

The internal layout of each SOLVA STS variant is shown in Figures 3-10 to 3-12 and described in the accompanying tables.

3.7.1.1. SOLVA STS 2IN

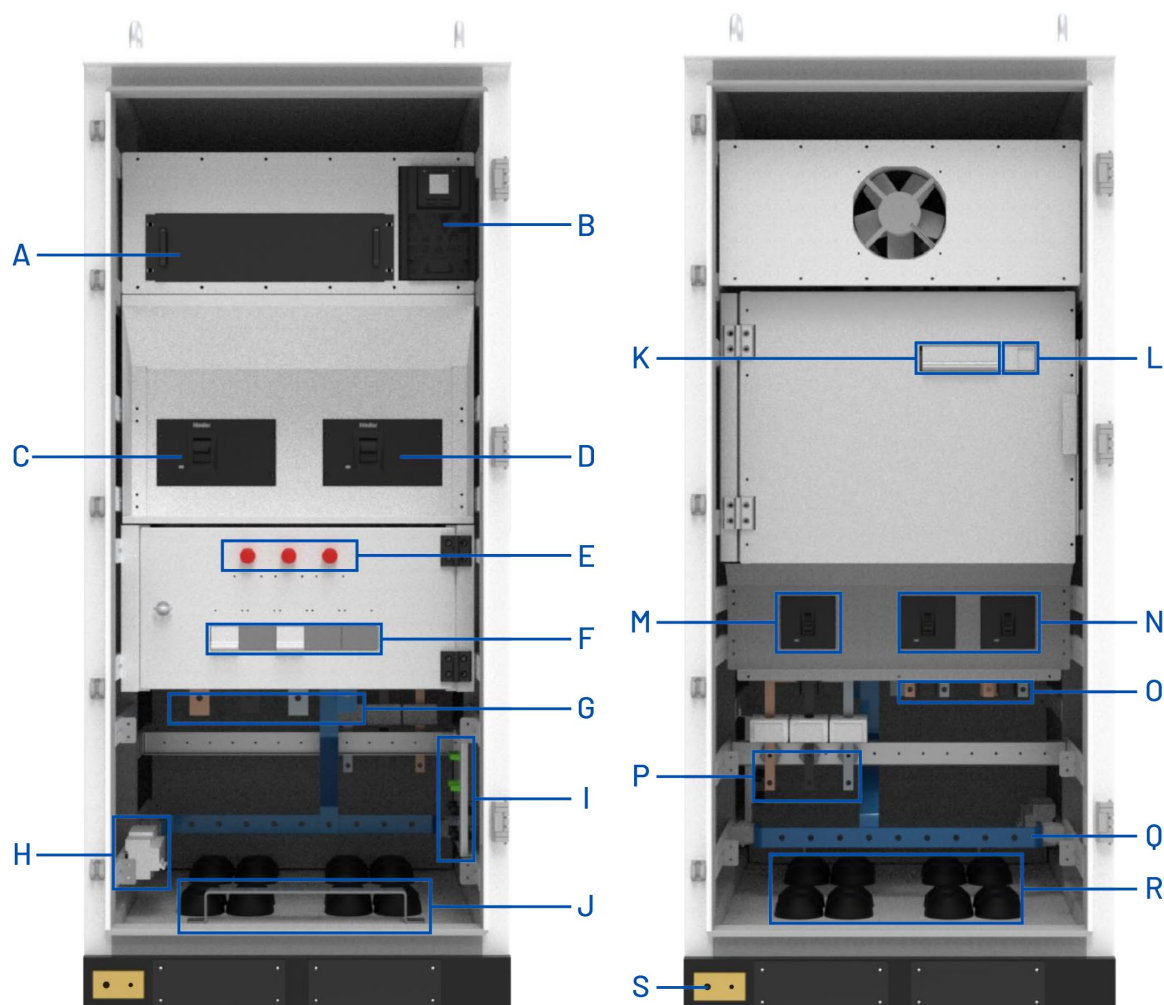


Figure 3-10 Internal components of the SOLVA STS 2IN cabinet

Table 3-3 Component key for Figure 3-10 (SOLVA STS 2IN)

No.	Item	Qty	Description
A	Static Transfer Switch (STS)	1	250 kW STS
B	Uninterruptible Power Supply (UPS)	1	1 kVA UPS
C	Main switch	1	500 A, 4P MCCB
D	Bypass switch	1	500 A, 4P MCCB
E	Indicators	3	Main switch, bypass switch and PV/load breaker closing indicators
F	Monitoring area	-	Meter supply breakers and Meters 1-3
G	Grid-side AC connector	4	L1 - brown, L2 - black, L3 - grey, N - blue
H	SPD	1	385 V, 40 kA, 3P+N
I	External communication area	1	-
J	Internal PE bar	1	-
K	Auxiliary breakers	4	UPS, AC 230 V, DC 24 V and maintenance-socket supplies
L	Maintenance socket	1	63 A
M	PV & load branch breaker	1	250 A MCCB
N	ESS breaker	2	250 A MCCB
O	ESS connector	6	For ESS 1 and 2 - L1 brown, L2 black, L3 grey
P	PV & load branch connector	3	L1 - brown, L2 - black, L3 - grey
Q	N-phase bar	1	-
R	Cable inlet/outlet	1	-
S	Main earth bar	1	-

3.7.1.2. SOLVA STS 4IN

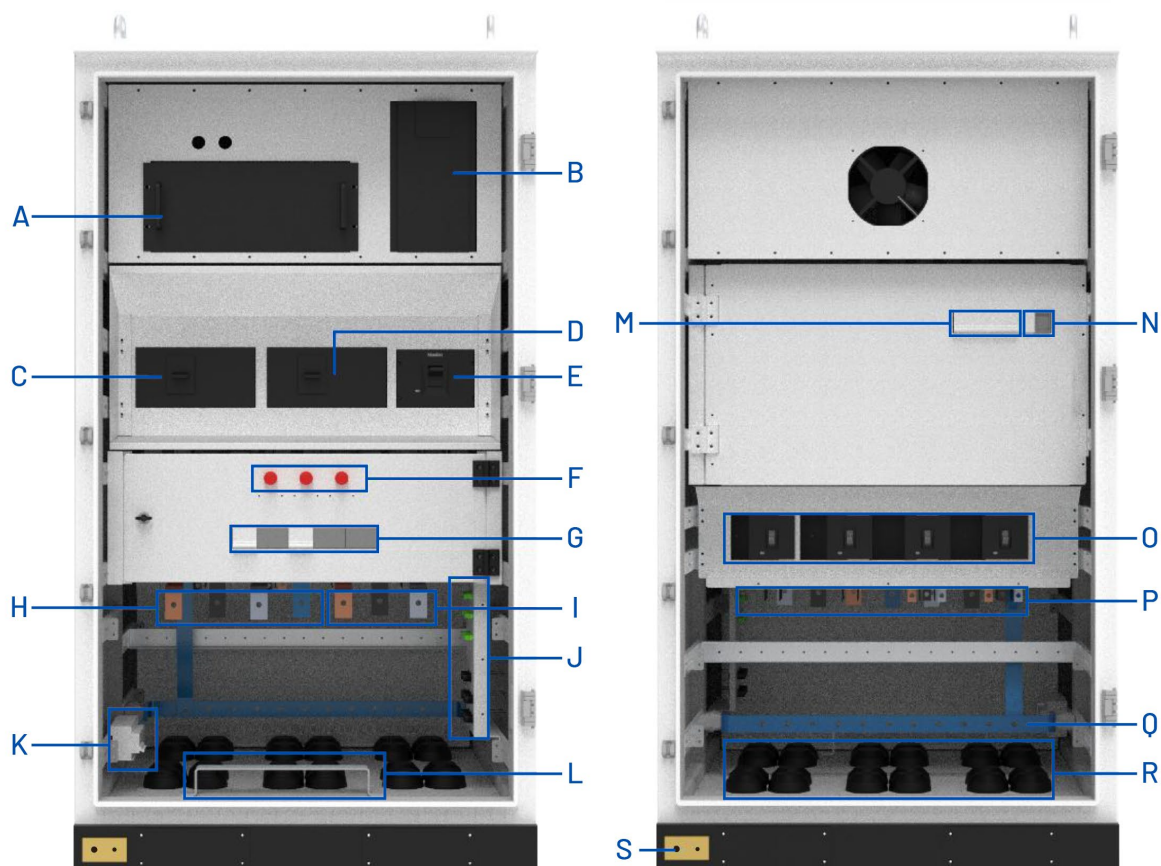


Figure 3-11 Internal components of the SOLVA STS 4IN cabinet

Table 3-4 Component key for Figure 3-11(SOLVA STS 4IN)

No.	Item	Qty	Description
A	Static Transfer Switch (STS)	1	500 kW STS
B	Uninterruptible Power Supply (UPS)	1	3 kVA UPS
C	Main switch	1	800 A, 4P MCCB
D	Bypass switch	1	800 A, 4P MCCB
E	PV & load branch breaker	1	630 A MCCB
F	Indicators	3	Main switch, bypass switch and PV/load breaker closing indicators
G	Monitoring area	-	Meter supply breakers and Meters 1-3
H	Grid-side AC connector	4	L1 - brown, L2 - black, L3 - grey, N - blue
I	PV & load branch connector	3	L1 - brown, L2 - black, L3 - grey
J	External communication area	1	-
K	SPD	1	385 V, 40 kA, 3P+N
L	Internal PE bar	1	-

M	Auxiliary breakers	4	UPS, AC 230 V, DC 24 V and maintenance-socket supplies
N	Maintenance socket	1	63 A
O	ESS breaker	4	250 A MCCB
P	ESS connector	12	For ESS 1-4 - L1 brown, L2 black, L3 grey
Q	N-phase bar	1	-
R	Cable inlet/outlet	1	-
S	Main earth bar	1	-

3.7.1.3. SOLVA STS 6IN

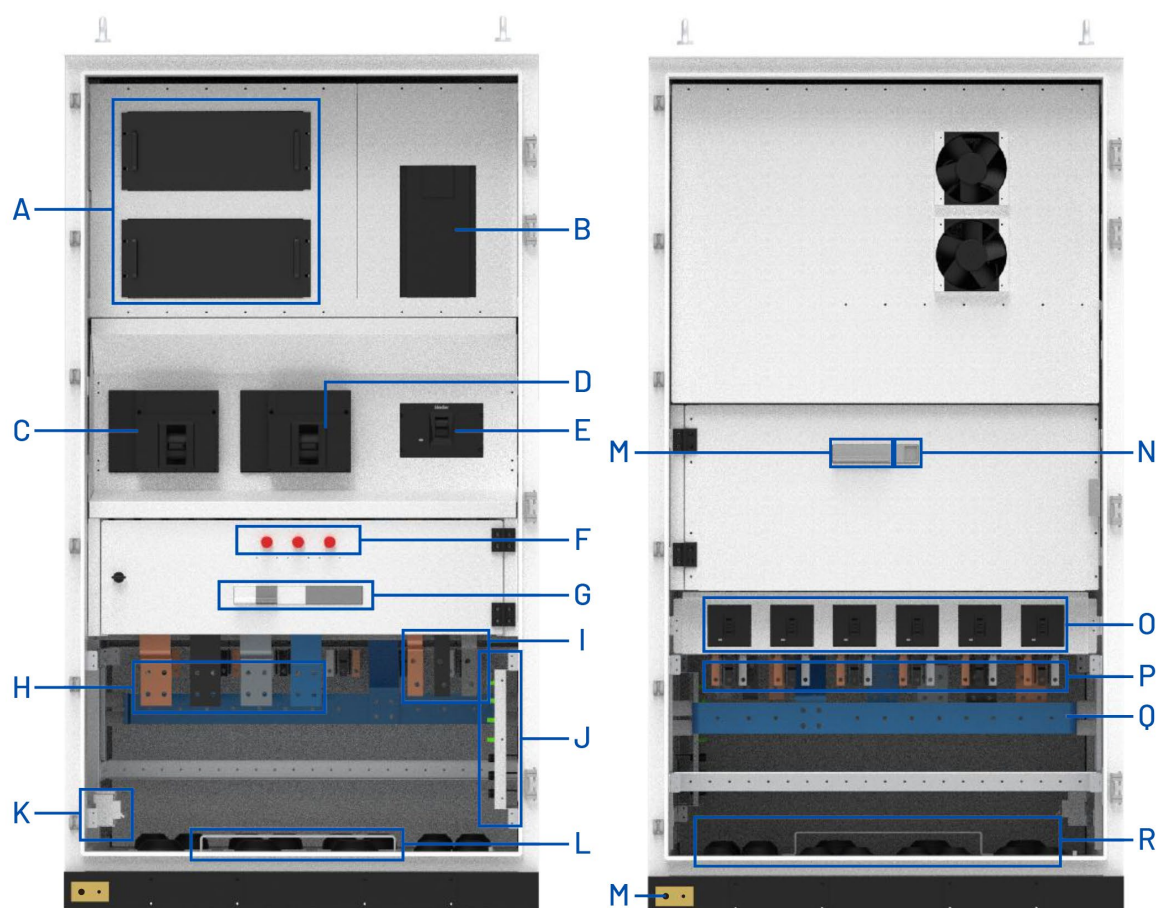


Figure 3-12 Internal components of the SOLVA STS 6IN cabinet

Table 3-5 Component key for Figure 3-12 (SOLVA STS 6IN)

No.	Item	Qty	Description
A	Static Transfer Switch (STS)	2	500 kW STS × 2
B	Uninterruptible Power Supply (UPS)	1	3 kVA UPS
C	Main switch	1	1600 A, 4P MCCB
D	Bypass switch	1	1600 A, 4P MCCB
E	PV & load branch breaker	1	800 A, 3P MCCB
F	Indicators	3	Main switch, bypass switch and PV/load breaker closing indicators
G	Monitoring area	-	Meter supply breakers and Meters 1-3
H	Grid-side AC connector	4	L1 - brown, L2 - black, L3 - grey, N - blue
I	PV & load branch connector	3	L1 - brown, L2 - black, L3 - grey
J	External communication area	1	-
K	SPD	1	385 V, 40 kA, 3P+N
L	Internal PE bar	1	-
M	Auxiliary breakers	4	UPS, AC 230 V, DC 24 V and maintenance-socket supplies
N	Maintenance socket	1	63 A
O	ESS breaker	6	250 A MCCB
P	ESS connector	18	For ESS 1-6 - L1 brown, L2 black, L3 grey
Q	N-phase bar	1	-
R	Cable inlet/outlet	1	-
S	Main earth bar	1	-

3.7.2. Static Transfer Switch (STS)

The Static Transfer Switch module is designed to meet the needs of the energy storage system for supplying power to critical loads during a grid outage or grid failure. It offers intelligent switching, a fast response, redundant design and straightforward maintenance.



Figure 3-13 The STS module

The operating principle of the STS module is shown in Figure 3-14.

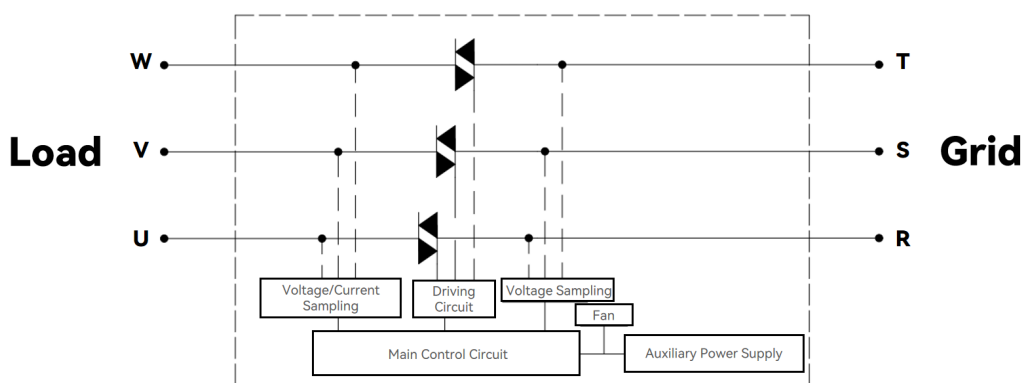


Figure 3-14 STS module operating principle

Table 3-6 STS module technical parameters

Parameter	STS250 Module	STS500 Module
Applied to	SOLVA STS 2IN	SOLVA STS 4IN, 6IN
Grid port power	250 kW	500 kW
Max. grid port current	361 A	722 A
ESS & load side port power	250 kW	500 kW
Rated voltage	400 Vac	400 Vac
Grid-side voltage range	400 Vac $\pm$ 15 %	400 Vac $\pm$ 15 %
Rated frequency	50/60 Hz	50/60 Hz
On/off-grid switching time	< 20 ms	< 20 ms
Efficiency	> 99.5 %	> 99.5 %
Power consumption	60 W	60 W
Dimensions (W $\times$ H $\times$ D)	440 $\times$ 130 $\times$ 520 mm	440 $\times$ 232 $\times$ 500 mm
Weight	22 kg	40.5 kg

Operating temperature	-25 °C to 55 °C (derated above 45 °C)	-25 °C to 55 °C (derated above 45 °C)
Relative humidity	0-95 % RH, non-condensing	0-95 % RH, non-condensing
Cooling method	Intelligent air cooling	Intelligent air cooling
Power ports	RST - grid side; UVW - ESS & load side	RST - grid side; UVW - ESS & load side

3.7.3. Uninterruptible Power Supply (UPS)

The UPS provides continuous, reliable power to the cabinet control electronics by operating in dual conversion mode: incoming AC power is first converted to DC and then inverted back to AC. This isolates the cabinet control electronics from sags, surges and frequency fluctuations on the incoming supply and allows operation of the control and communications when both the grid and the PCSs are offline.



Figure 3-15 Uninterruptible power supply (UPS)

Table 3-7 UPS specification

Parameter	SPM1K	SPM3K
Applied to	SOLVA STS 2IN	SOLVA STS 4IN, 6IN
Max. output power	0.8 kW / 1 kVA	2.4 kW / 3 kVA
Output frequency	50/60 Hz $\pm$ 3 Hz	50/60 Hz $\pm$ 3 Hz
Output configuration	L+N+PE	L+N+PE
Input frequency	40-70 Hz	40-70 Hz
Input voltage range	160-280 V	160-280 V
Input configuration	L+N+PE	L+N+PE
Operating temperature	0-40 °C	0-40 °C
Relative humidity	0-95 % RH, non-condensing	0-95 % RH, non-condensing
Noise	< 50 dB @ 1 m	< 50 dB @ 1 m
Dimensions (D × W × H)	233 × 145 × 288 mm	336 × 190 × 425 mm

3.7.4. Meter & CT

The cabinet uses four meters of 0.5S accuracy class, installed at key points to measure the energy storage cabinets, the PV inverter, the load, and the system as a whole. Together they provide a complete view of energy flow and system efficiency.



Figure 3-16 Energy meter

Each meter is paired with current transformers (CTs) selected to match the current rating of the circuit being measured, since current levels differ across the four measurement points.



Figure 3-17 Current transformer (CT)

Table 3-8 Meter and CT specification

Parameter	Value
Working temperature	-25 °C to +70 °C
Relative humidity	5-95 % RH, non-condensing
Working altitude	≤ 2000 m, CAT III
Pollution level	2
Auxiliary power	AC/DC 100-270 V, ≤ 5 VA
Rated voltage input	AC 3 × 230/400 V
Rated current input	1 A or 5 A
Digital inputs	4 channels, dry contact, built-in DC 24 V
RS485 communication	1 channel, 1.2-115.2 kbps, Modbus-RTU
Real-time clock drift	≤ 0.5 s/day

4. Installation

4.1. Environment Requirements

Beyond the general requirements elsewhere in this manual, choose the installation site in accordance with the following requirements, to ensure the installation meets applicable safety, fire-protection and regulatory requirements.

4.1.1. General Requirements

The installation site must fully comply with local laws, regulations and relevant industry standards.

- **Permitted locations:** outdoors; inside a dedicated energy-storage building; or inside a building fitted with fire-prevention and ventilation measures.
- **Prohibited locations:** residential units, lift shafts, stairwells, refuge floors, and other critical passages or escape routes.
- **Accessibility:** the site must be easily accessible for transport, installation and maintenance.
- **Future expansion:** reserve adequate space for possible capacity expansion or additional cabinets in parallel.

4.1.2. Fire Safety

- Keep the site and its surroundings free of vegetation within 3 m, to avoid the risk of fire from summer heat.
- Install fire extinguishers in accordance with local fire codes, and provide a nearby connection point for a water-based fire-suppression system.
- The safety distance between the cabinet and residential areas, populated centres or production buildings must meet local fire-safety standards; where the required distance cannot be met, construct a fire-rated firewall in accordance with local regulations.
- Reserve sufficient space for transport, installation and maintenance.

Table 4-1 Minimum safe distance from other buildings

Building classification	Typical Minimum safe distance
Residential housing	≥ 12 m
Schools, hospitals or other population centres	≥ 30.5 m
Class A industrial buildings	≥ 12 m
Class B industrial buildings	≥ 10 m
Class C & D industrial buildings (Class I/II fire resistance)	≥ 10 m
Industrial buildings (Class III fire resistance)	≥ 12 m
Adjacent buildings with fire-resistant walls, no openings	(3 – 25 % × 3) m, per calculation

4.1.3. Flood and Water Protection

- Avoid low-lying or flood-prone areas. The site must be at least 300 mm above the historical maximum water level.
- For sites near rivers, lakes or the sea, the foundation must be at least 0.6 m above the historical maximum wave height.
- Fit drainage where large volumes of water may pass through the site, and waterproofing (barriers, drainage or a raised foundation) where water may accumulate.
- Keep the site away from any area where liquids may be generated or may leak, to prevent equipment failure.

4.1.4. Geological and Surrounding Environment

- Avoid soils that are prone to deformation or settlement.
- Keep the site away from salt-laden or polluted areas that could corrode the cabinet - see Table 4-2 for minimum distances.

Table 4-2 Minimum distance from pollution sources

Environmental source	Minimum safety distance
Coastal areas (C5 corrosion upgrade available for closer location to the coast)	> 2000 m
Heavy pollution sources (e.g. smelters, coal mines, thermal power plants)	> 1500 m
Moderate pollution sources (e.g. chemical plants, rubber plants, electroplating)	> 1000 m
Light pollution sources (e.g. food processing, tanneries, landfill, sewage works)	> 500 m

4.1.5. Security

Enclose the installation area with a lockable fence or wall, and restrict access to authorised personnel only.

4.2. Cable Requirements

4.2.1. Power Cable - ESS Cabinet to STS Cabinet

Table 4-3 Recommended cable and fastener specification - ESS to STS (all models)

Conductor	Connection	Cable	Fastener	DT terminal
AC L1	ESS breaker	Flexible copper, 70-95 mm ²	M10	DT70/95-10
AC L2	ESS breaker	Flexible copper, 70-95 mm ²	M10	DT70/95-10
AC L3	ESS breaker	Flexible copper, 70-95 mm ²	M10	DT70/95-10
AC N	ESS breaker	Flexible copper, 70-95 mm ²	M10	DT70/95-10

4.2.2. Power Cable - STS Cabinet to Grid

Table 4-4 Recommended cable and fastener specification - STS to grid (SOLVA STS 2IN)

Conductor	Cable	Fastener	DT terminal
L1 (black busbar)	Flexible copper, 240 mm ²	M12	DT240-12
L2 (brown busbar)	Flexible copper, 240 mm ²	M12	DT240-12
L3 (grey busbar)	Flexible copper, 240 mm ²	M12	DT240-12
N (blue busbar)	Flexible copper, 240 mm ²	M12	DT240-12
PE (grounding plate)	Flexible copper, 120 mm ²	M10	DT120-10

Table 4-5 Recommended cable and fastener specification - STS to grid (SOLVA STS 4IN)

Conductor	Cable	Fastener	DT terminal
L1 (black busbar)	Flexible copper, 2 × 185 mm ²	M12	2 × DT185-12
L2 (brown busbar)	Flexible copper, 2 × 185 mm ²	M12	2 × DT185-12
L3 (grey busbar)	Flexible copper, 2 × 185 mm ²	M12	2 × DT185-12
N (blue busbar)	Flexible copper, 2 × 185 mm ²	M12	2 × DT185-12
PE (grounding plate)	Flexible copper, 185 mm ²	M10	DT185-M10

Table 4-6 Recommended cable and fastener specification - STS to grid (SOLVA STS 6IN)

Conductor	Cable	Fastener	DT terminal
L1 (black busbar)	Flexible copper, 4 × 185 mm ²	M12	4 × DT185-12
L2 (brown busbar)	Flexible copper, 4 × 185 mm ²	M12	4 × DT185-12
L3 (grey busbar)	Flexible copper, 4 × 185 mm ²	M12	4 × DT185-12
N (blue busbar)	Flexible copper, 4 × 185 mm ²	M12	4 × DT185-12
PE (grounding plate)	Flexible copper, 2 × 185 mm ²	M10	2 × DT185-10

4.2.3. Power Cable - STS Cabinet to PV Inverter & Load Distribution Box

Table 4-7 Recommended cable and fastener specification - STS to PV inverter/load (SOLVA STS 2IN)

Conductor	Cable	Fastener	DT terminal
AC L1	Flexible copper, 95 mm ²	M10	DT95-10
AC L2	Flexible copper, 95 mm ²	M10	DT95-10
AC L3	Flexible copper, 95 mm ²	M10	DT95-10
AC N	Flexible copper, 95 mm ²	M10	DT95-10

Table 4-8 Recommended cable and fastener specification - STS to PV inverter/load (SOLVA STS 4IN)

Conductor	Cable	Fastener	DT terminal
AC L1	Flexible copper, 2 × 150 mm ²	M12	2 × DT150-12
AC L2	Flexible copper, 2 × 150 mm ²	M12	2 × DT150-12
AC L3	Flexible copper, 2 × 150 mm ²	M12	2 × DT150-12
AC N	Flexible copper, 2 × 150 mm ²	M10	2 × DT150-10

Table 4-9 Recommended cable and fastener specification - STS to PV inverter/load (SOLVA STS 6IN)

Conductor	Cable	Fastener	DT terminal
AC L1	Flexible copper, 2 × 185 mm ²	M12	2 × DT185-12
AC L2	Flexible copper, 2 × 185 mm ²	M12	2 × DT185-12
AC L3	Flexible copper, 2 × 185 mm ²	M12	2 × DT185-12
AC N	Flexible copper, 2 × 185 mm ²	M10	2 × DT185-10

4.2.4. Communication Cable

Communication cables between the STS cabinet and the ESS cabinets, and between the ESS cabinets themselves, are shipped with the STS cabinet (Category 6 cable for COM2/PARA connections; 1 mm² shielded cable for the reserved JX1 terminal). The correspondence between STS-cabinet terminals and ESS-cabinet terminals scales directly with the number of inputs - each additional ESS cabinet adds one JX terminal pair and one COM2 connection, as shown for the SOLVA STS 6IN in Table 4-10.

Table 4-10 Communication cable correspondence - SOLVA STS 6IN

STS cabinet terminal	ESS cabinet terminal
JX1	1#ESS - XT1 & XT2
JX2	2#ESS - XT1 & XT2
JX3	3#ESS - XT1 & XT2
JX4	4#ESS - XT1 & XT2
JX5	5#ESS - XT1 & XT2
JX6	6#ESS - XT1 & XT2
1#ESS / 2#ESS / ... / 6#ESS	Corresponding ESS - COM2
PARA	1#ESS - PARA1

Note

2IN and 4IN follow the same pattern for their number of inputs

4.2.5. Cable Torque Requirements

Attention

A loose connection between a cable and a copper lug may cause overheating or fire. Tighten copper-lug screws and bolts to the torque values in Table 4-11.

Table 4-11 Recommended tightening torque by bolt size

Bolt size	Torque (N.m)
M3	0.7 - 1
M4	1.8 - 2.4
M5	4 - 4.8
M6	7 - 8
M8	17 - 20
M10	34 - 40
M12	60 - 70
M16	119 - 140

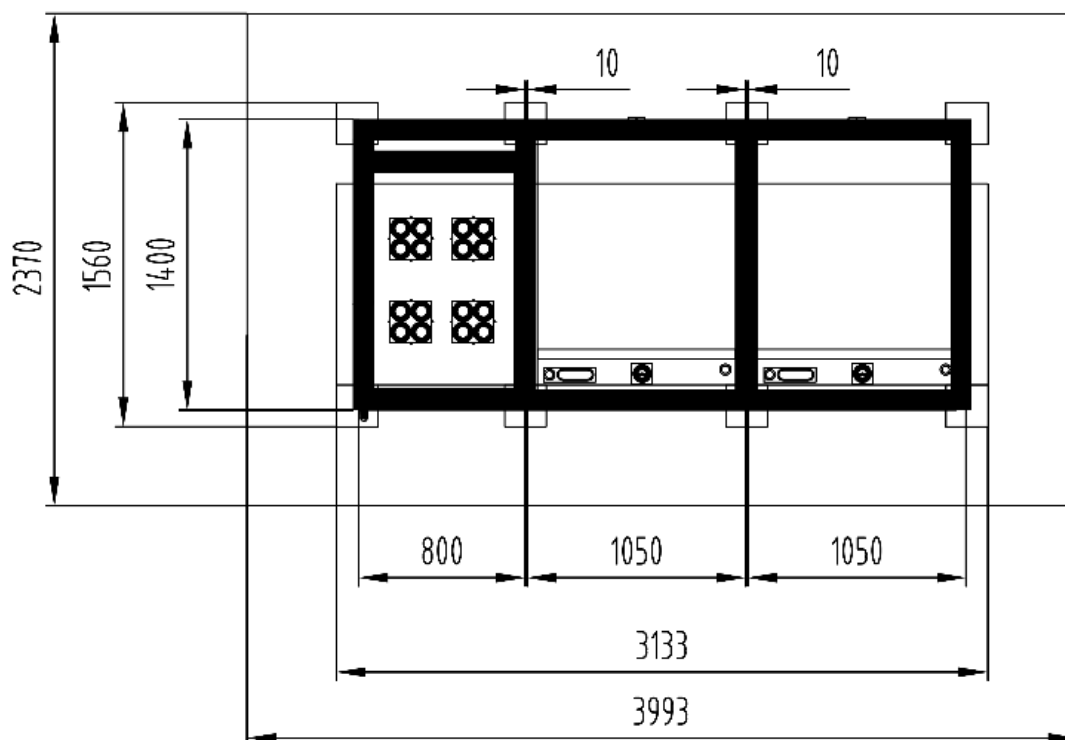
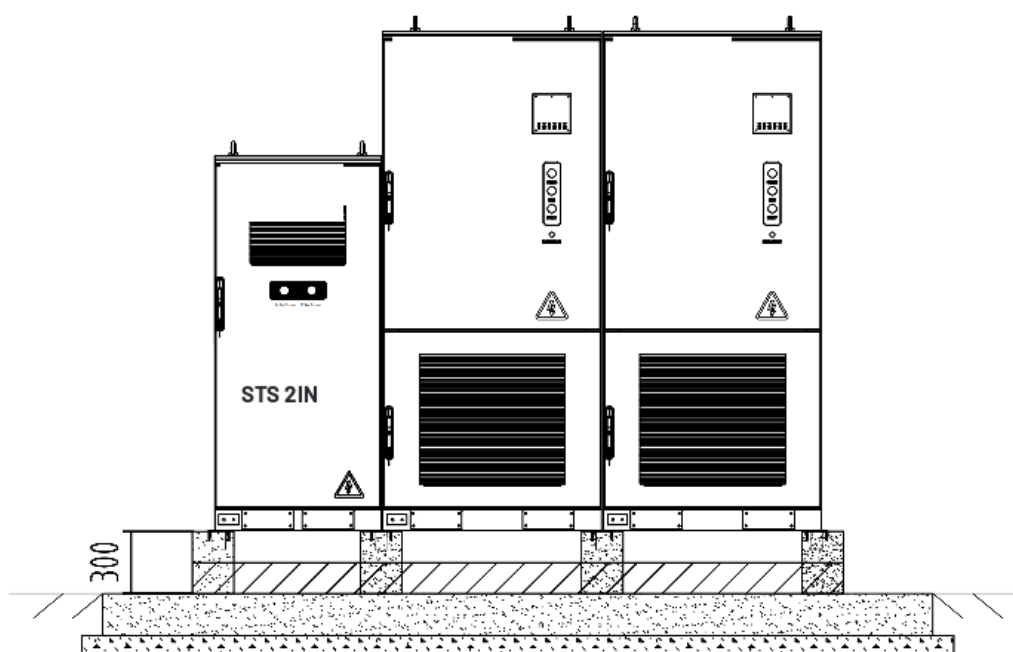


Figure 4-2 Foundation arrangement - SOLVA STS 2IN with associated SOLVA AC261 cabinets

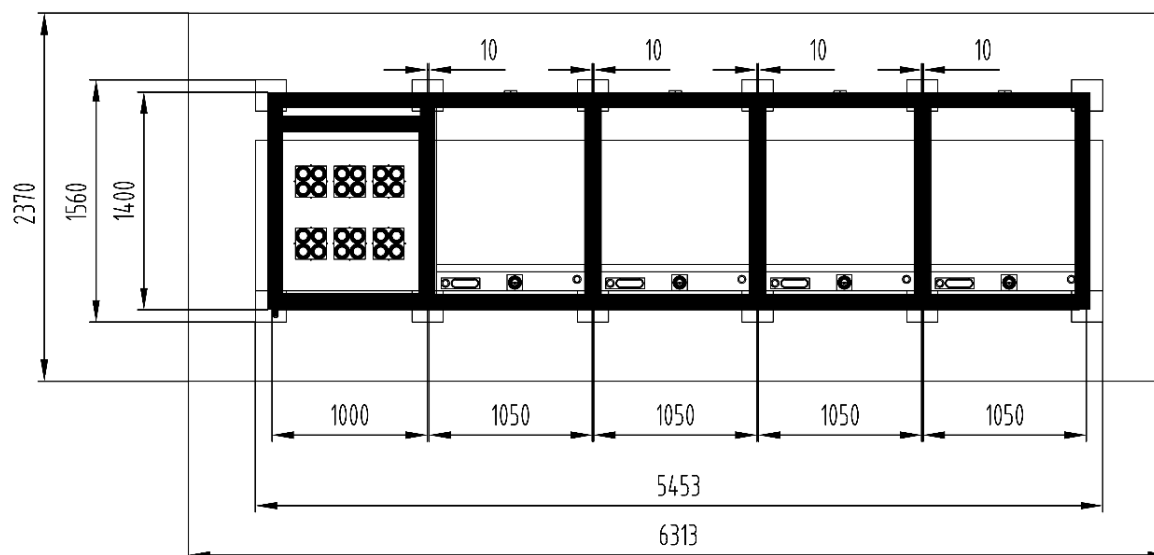
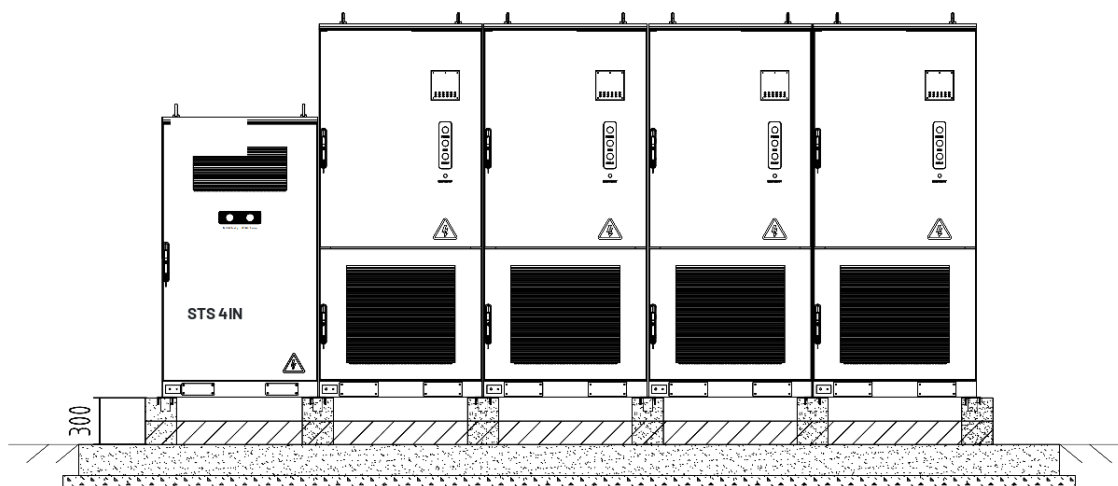


Figure 4-3 Foundation arrangement - SOLVA STS 4IN with associated SOLVA AC261 cabinets

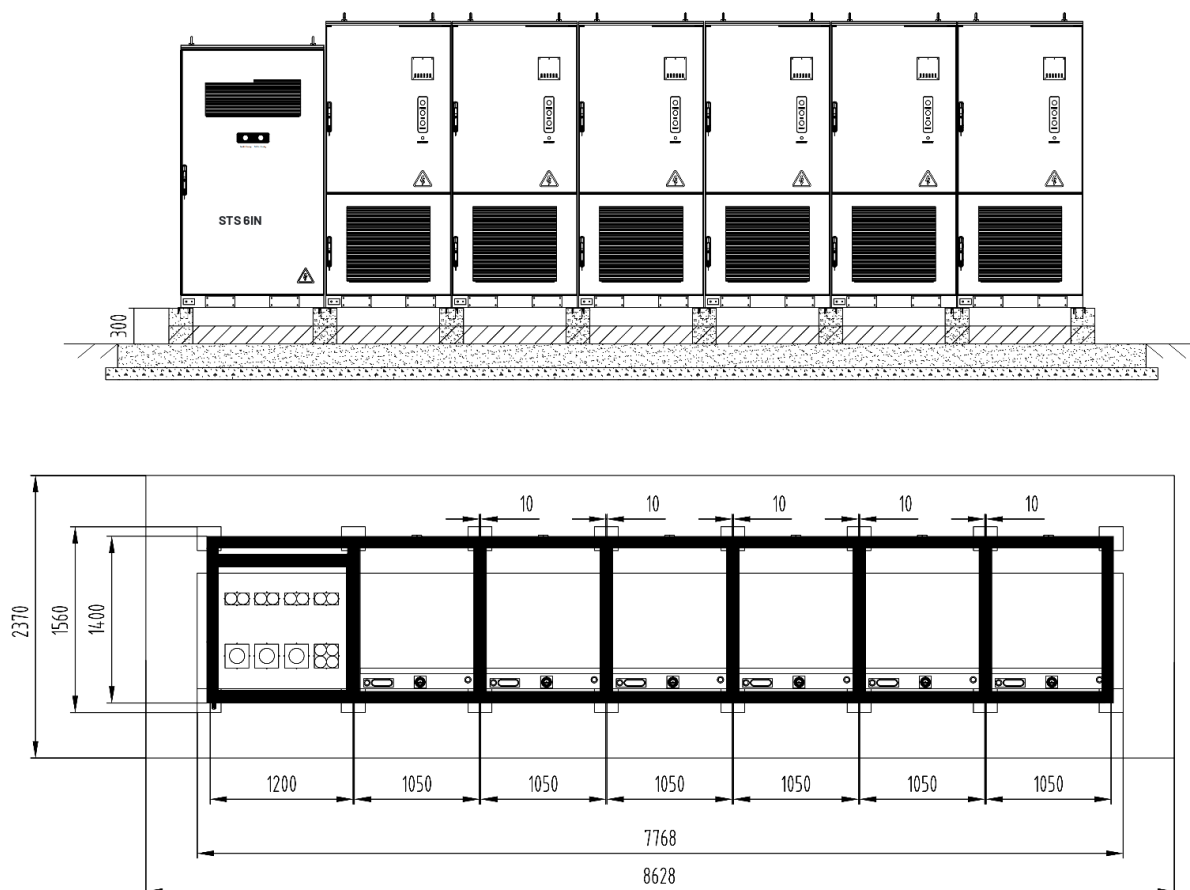


Figure 4-4 Foundation arrangement - SOLVA STS 6IN with associated SOLVA AC261 cabinets

4.4. Cable Connection

4.4.1. Safety Requirements

To protect personnel and equipment during electrical installation, follow all safety instructions in this manual – especially in this chapter – together with local safety regulations for the destination country or region. During electrical connection and any other work on the cabinets, always follow these five safety rules:

- Disconnect all external connections to the STS cabinet, and all connections to the internal power supply.
- Make sure the ESS and STS cabinets cannot be re-energised by any means.
- Use a multimeter to confirm that the inside of the STS cabinet is completely de-energised.
- Carry out the necessary earthing and short-circuit connections.
- Cover any potentially live parts near the work area with insulating covers.

4.4.2. Tool Preparation

Before starting work, prepare the following tools and personal protective equipment:

- Stripping pliers, torque wrench, wire crimper, hydraulic pliers, multimeter, electric screwdriver, heat gun
- Insulating gloves, an anti-arc-flash suit, safety shoes, ear protection and safety goggles

4.4.3. Overview of Wiring Area

The SOLVA STS cabinet is substantially pre-wired at the factory. On-site installation only requires wiring in these areas:

- AC cable connection – grid
- AC cable connection – ESS, PV inverter and load distribution box
- External communication terminal connections
- PE (earthing) connection

Attention

All neutral (N) conductors must be securely connected to the N-phase busbar inside the cabinet. Ensure the correct tightening torque and reliable contact, to prevent overheating or a poor electrical connection.

4.4.4. DT Terminal Manufacture & Connection

Before wiring the AC side, open the panel in front of the wiring terminals, then proceed as follows:

- **Step 1** – Strip the cable using stripping pliers, exposing the copper core to a length equal to the copper-lug barrel depth plus 5 mm.
- **Step 2** – Choose heat-shrink tubing to match the cable size, at least 20 mm longer than the copper-lug barrel. Slide the tubing and the DT terminal onto the cable in sequence.
- **Step 3** – Insert the exposed copper core into the copper-lug barrel and crimp with a wire crimper, compressing at least twice.
- **Step 4** – Slide the heat-shrink tubing fully over the copper lug and shrink it with a heat gun.
- **Step 5** – Connect the power cable to its terminal.
- **Step 6** – Check that the connection is securely fixed.

Where the load includes motors, frequency converters or other switching loads, size the circuit according to Table 4-12.

Table 4-12 On/off-grid switching load capacity by load type

Load type	Switching load capacity	Typical loads
Pure resistive load	$\leq 100\%$ (recommended $\leq 80\%$); switching (~ 10 ms) is imperceptible	Electric furnace elements, incandescent and other lighting, resistive heating
Direct-start motor / soft starter load	$\leq 25\%$ of PCS rated power; inrush current 5-8×	Three-phase/single-phase induction motors, pumps, electric drills, fixed-speed air conditioners, compressors, frequency converters
Variable-frequency converter load	$\leq 50\%$ of PCS rated power; switching current surge	VF motors, VF air conditioners, VF oil-pump motors, VF air compressors
PFC load (consumption)	$\leq 70\%$ of PCS rated power; transient over-current risk	AC charging points, PFC power supplies, PFC charging equipment

Please advise Freedom Won of the load types to be connected at the time of ordering, so that preliminary testing and commissioning can be carried out in advance.

4.4.5. AC Cable Connection - ESS, PV Inverter and Load Distribution Box

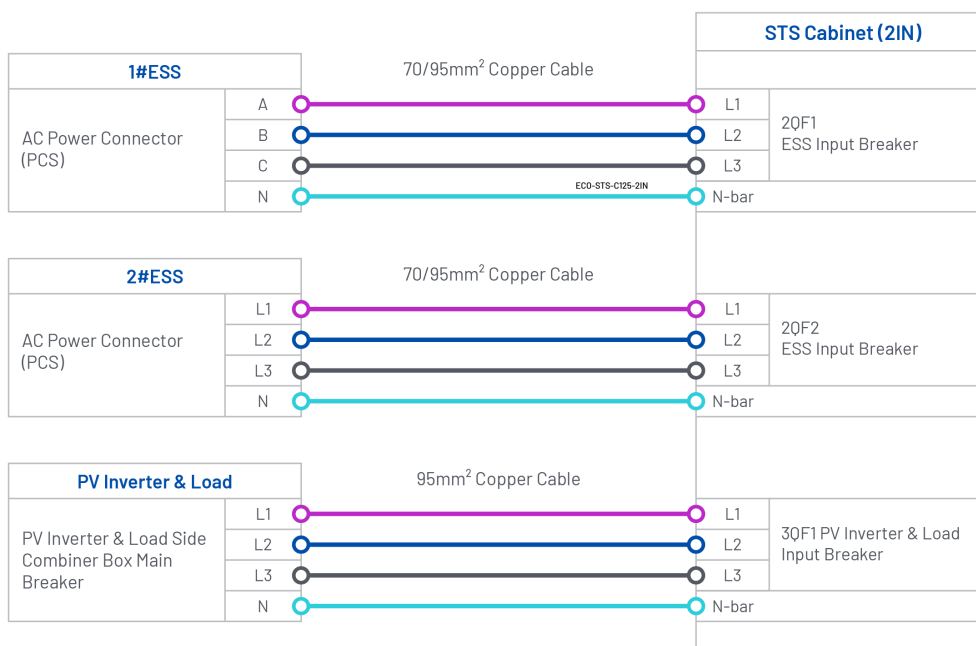


Figure 4-5 AC and communication cable correspondence - SOLVA STS 2IN

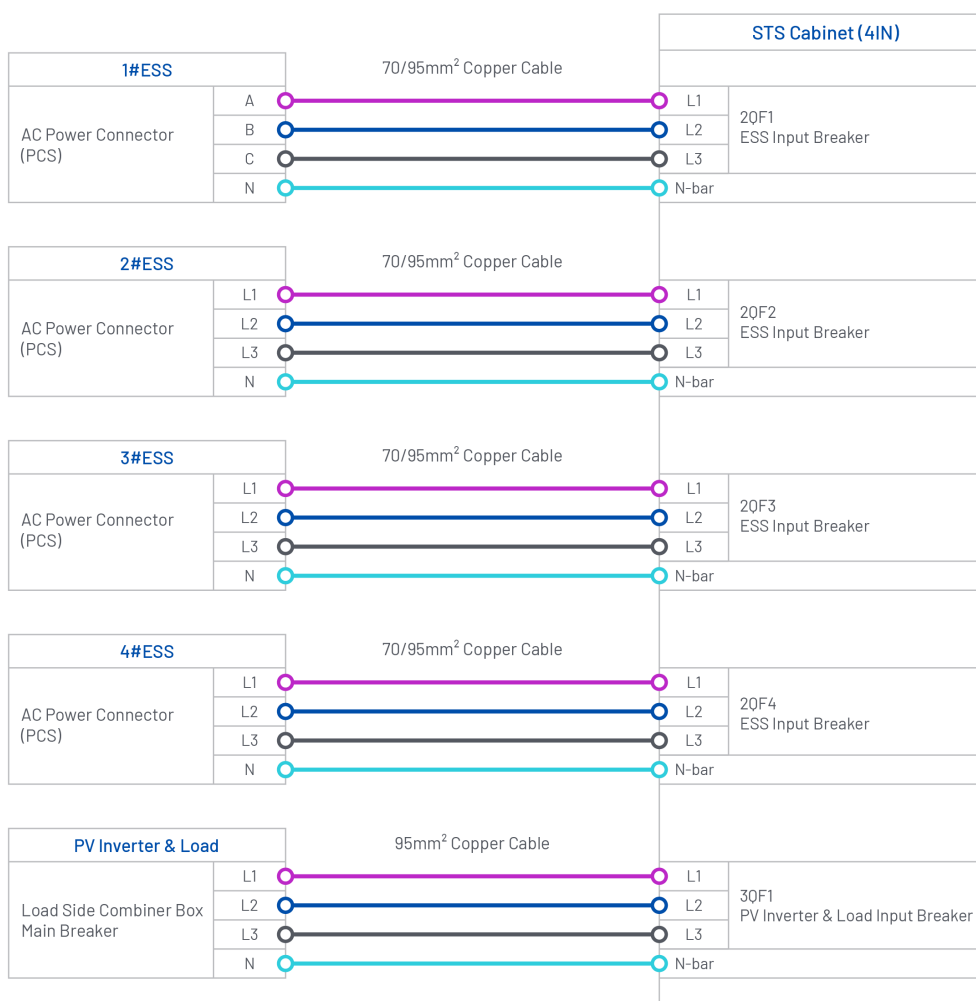


Figure 4-6 AC and communication cable correspondence - SOLVA STS 4IN

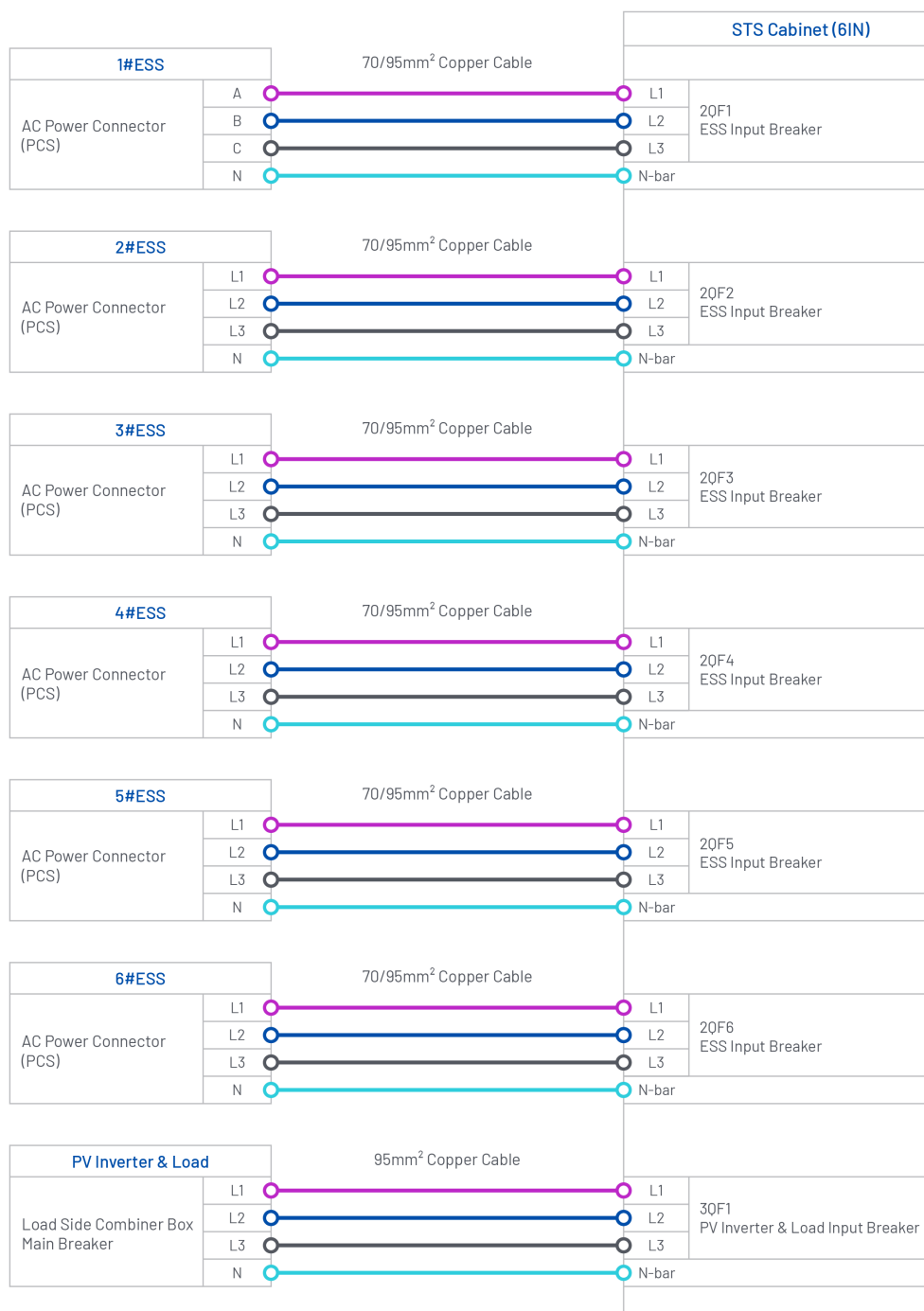


Figure 4-7 AC and communication cable correspondence - SOLVA STS 6IN

4.4.6. Grounding Connection

The PE conductor from the grid, and the earthing conductor from each ESS cabinet, must be connected to the dedicated earthing terminal block provided in the STS cabinet.

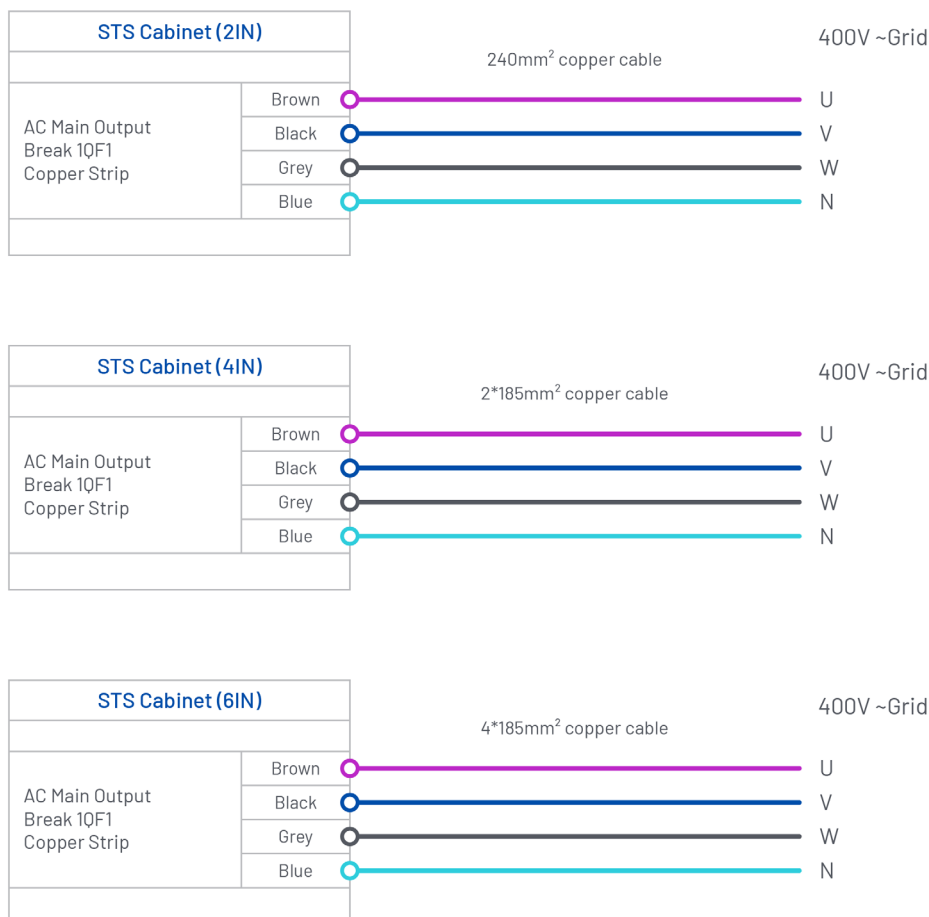


Figure 4-8 Grounding-plate connection

Every cabinet, including the STS cabinet, requires its own earthing connection. Grounding must comply with the following:

- The grounding connection must comply with the grounding standards and codes of the country or region in which the project is located.
- The connection between the equipment and the earth electrode must be tight and reliable.
- Once grounding is complete, measure the earthing resistance - it must not exceed 10 Ω .

WARNING

If the earthing conductors are not properly connected: a fault may pose a fatal electric-shock hazard to operators; a lightning strike may damage the equipment; and the equipment may malfunction. Wire strictly in accordance with the markings inside the equipment.

4.4.7. Communication Wiring

The communication interface on the STS cabinet is shown in Figure 4-9.

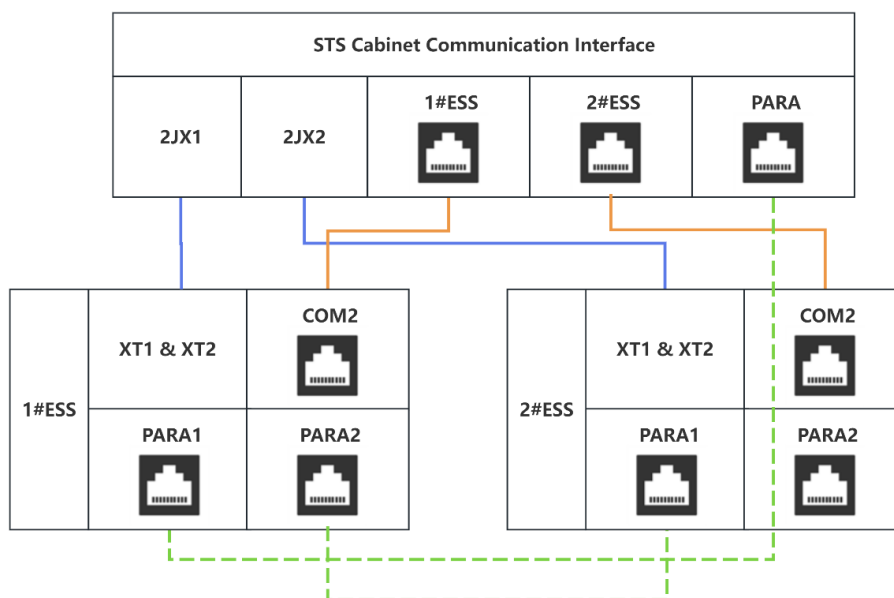


Figure 4-9 STS cabinet communication interface

The reserved JX1 terminal provides DI, DO and RS485 communication, for use where a PV inverter with a pre-matched communication protocol is connected: link the 1JX1 terminal inside the STS cabinet to the RS485 communication port of the PV inverter.

Table 4-13 JX1 terminal pin definition (reserved)

Pin	Definition	Pin	Definition
1	DI 1	9	RS485 A1
2	DI 1: COM	10	RS485 B1
3	DI 2	11	RS485 A2
4	DI 2: COM	12	RS485 B2
5	DO 1+	13	RS485 A3
6	DO 1-	14	RS485 B3
7	DO 2+	15	RS485 A4
8	DO 2-	16	RS485 B4

5. Power On & Off

This section describes the general power-on and power-off sequence for a SOLVA STS cabinet installed with SOLVA AC261 ESS cabinets. If the STS cabinet is used with other ESS equipment, contact Freedom Won in advance for the specific power-on and power-off procedure.

5.1. Power-on Procedure

- **Step 1** – Switch on the UPS, then close 4QF2 and 4QF3 in sequence.
- **Step 2** – Close the STS cabinet main switch 1QF1, then close 2QF1 to 2QF6 in sequence.
- **Step 3** – Close Q1 and QF4 on each ESS cabinet in sequence – the PCS begins operating – then close QF, followed by QF2 and QF3, on each ESS cabinet.
- **Step 4** – Close 3QF1 (if a PV inverter or loads are connected), then 4QF1, then 5QF, then QF0 on the STS cabinet, in sequence.
- **Step 5** – Monitor the operation of each ESS cabinet and the STS cabinet. If there are no fault alarms, power-on is complete.

5.2. Power-off Procedure

- **Step 1** – Open QF4, then QF3, then QF2, then QF1, then QF on each ESS cabinet, in sequence.
- **Step 2** – Open 2QF1 to 2QF6 on the STS cabinet.
- **Step 3** – Open 5QF, then 4QF3, then 4QF1, then 3QF1 (if a PV inverter or loads are connected) on the STS cabinet, in sequence.
- **Step 4** – Open 4QF2 and 1QF1, then switch off the UPS.

6. Warranty Statement

Refer to the applicable document for the warranty terms and conditions for the SOLVA STS range.

7. After-sales Service

For project enquiries, technical guidance, spare parts or service, contact Freedom Won.

Table 7-1 Freedom Won contact details

Company	Freedom Won (Pty) Ltd
Website	www.freedomwon.co.za
Product range	SOLVA STS (2IN, 4IN, 6IN)

7.1. Disclaimer

The images featured in this manual are for illustrative purposes only. Although we have taken care to ensure all information is accurate at the time of publication, we cannot be held responsible for any errors, omissions or changes that may occur. For the most up-to-date information, please contact Freedom Won directly.