

Elementa 2 Pro

TSMG5015B2-2H
User Manual



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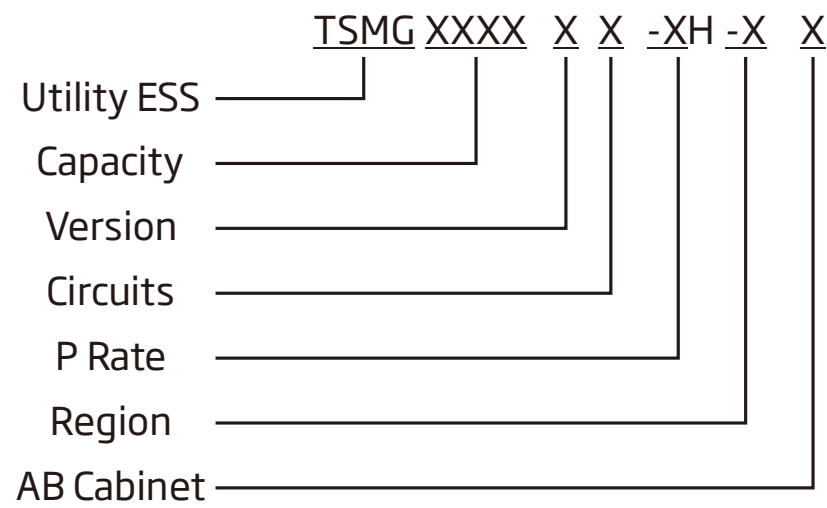
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Product Model Definition



Example:

TSMG5015B2-2H-UA indicates Trina Storage Elementa 2 Pro equipped with two circuits, which is A cabinet with UL configuration.

About this Document

Purpose

This manual contains the basic operational and maintenance information of the Elementa highlighting common problems and solutions. Please follow the instructions in the manual as stated with any deviations being discussed with Trina Storage in the first instance.

Version List and Corresponding Models

EN: For TSMG5015B2-2H-E/TSMG5015B2-2H-A/ TSMG5015B2-2H-P

UL: For TSMG5015B2-2H-U

Intended Audience

This manual is for operators and service personnel of the associated Power Plant, as well as any applicable qualified technical personnel. The Elementa should only be operated by professional technicians who meet the following requirements.

- Have been trained and approved by Trina Storage.
- Have read this manual thoroughly and understood the safety instructions related to operations.
- Are familiar with local standards and relevant safety regulations of electrical systems and batteries.

Symbol Conventions

The symbols that may be found in this document are defined as follows.

Symbol	Description
 DANGER	Indicates a hazard with a medium or high level of risk which, if not avoided, will result in death or serious injury.
 WARNING	Indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
 CAUTION	Indicates a potentially hazardous situation which, if not avoided, could result in equipment damage, data loss, performance deterioration or unanticipated results.
 NOTE	Supplements the important information in the main text. NOTE is used to address information not related to personal injury, equipment damage and environment deterioration.

Change History

Changes between document issues are cumulative. The latest document issue contains all updates made in previous issues.

Version 260113

Version	Change Content	Reviser
260113	The first version release.	AEP

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1 Information

To provide customers with the best user experience, the products and product manuals are continually improved and upgraded and If the manual received is inconsistent with the product on site, then please consult Trina Storage to confirm the information being received is the latest and is applicable.

Table 1-1 Region information

Region		E-mail Address
APAC	AUS	BESSservice.au@trinasolar.com
	JPN	BESSservice.jp@trinasolar.com
	Rest of APAC	BESSservice.APAC@trinasolar.com
LAC	CL	BESSservice.cl@trinasolar.com
	Rest of LAC	BESSservice.LAC@trinasolar.com
MEA		BESSservice.MEA@trinasolar.com
EU	UK	BESSserviceUK@trinasolar.com
	Rest of EU	BESSserviceEurope@trinasolar.com

2 Acronym List

Table 2-1 Acronym List

Acronym	Description
BAU	Battery Array Unit
BCU	Battery Cluster Unit
BCP	Battery Collection Panel
BESS	Battery Energy Storage System
BMS	Battery Management System
BMU	Battery Module Unit
BOM	Bill of Materials
CAN	Controller Area Network
DC	Direct Current
EMS	Energy Management System
(B)ESS	(Battery) Energy Storage System
FACP	Fire Alarm Control Panel
FAT	Factory Acceptance Test
FSS	Fire Suppression System
HV	High Voltage
HVB	High Voltage Box
LED	Light Emitting Device
LFP	Lithium Iron Phosphate
IP	Ingress Protection
iso SPI	Isolated Serial Peripheral Interface
LOTO	Lockout Tagout
LVP	Low Voltage Panel
MSD	Manual Service Disconnect
MV	Medium Voltage
OCV	Open Circuit Voltage
PCS	Power Conversion System

POI	Point of Interconnect
PPC	Power Plant Controller
PPE	Personal Protective Equipment
PV	Photovoltaic
SAT	Site Acceptance Test
SCADA	Supervisory Control and Data Acquisition
SLC	Signaling Line Circuit
SOC	State of Charge
SOE	State of Energy
SOH	State of Health
SOP	State of Power
SPD	Surge Protection Device
STP	Shielded Twisted Pair
TN-S	Terra Neutral Separate
TMS	Thermal Management System
UPS	Uninterruptable Power Supply

3 Safety

Throughout this manual, the below labels indicating NOTICE, WARNING, and CAUTION are used to convey hazards and risks associated with specific tasks and procedures. These safety alerts do not represent all hazards present when performing a given task. Installers and operators of TS products shall adhere to industry safety best practices, site-specific Environment, Health and Safety (EHS) plans, as well as local safety requirements and regulations. Only properly trained and qualified personnel should be permitted to complete the installation procedures identified in this manual.

Note: The Emission characteristics of the system make it suitable for use in industrial areas that means Class A electromagnetic environment. If it is used in a residential environment (Class B is normally required) this equipment might not offer adequate protection to radio-frequency communication services. The user might need to take mitigation measures, such as relocating or re-orienting the equipment.

3.1 Symbols

This outlines a list of symbols used throughout. Each symbol has a corresponding description the reader must consider when reading through this document's contents.

Table 3-1 Symbol illustration

Symbol	Description
	CAUTION: High Voltage. Risk of electric shock.
	CAUTION: Lifting heavy objects may lead to injury. Use lifting aids and proper lifting techniques when moving.
	CAUTION: Risk of Explosion.
	CAUTION: Risk of Chemical Hazard.
	Do not dispose of this product as household waste.
	Keep products away from fire.
	Personal Protective Equipment.
	Miscellaneous Dangerous Goods.

3.2 General Safety

DANGER

- Do not touch both pole terminals of ESS.
 - Be sure to disconnect, LOTO, and verify zero voltage at the corresponding power inputs (DC and AC) before performing any work on the ESS.
 - Use insulated tools with any electrical equipment rated for voltage exposure.
 - Wear appropriate PPE per the local authority at any time when approaching and working with ESS. Do not wear metal jewelry such as watches.
 - When cleaning the ESS, it is forbidden to wash any electrical equipment including connectors.
 - It is forbidden to perform any physical action that shall damage the ESS like hit, crush, pierce, or burn batteries.
-

WARNING

- Stepping on the top of the Elementa is prohibited at any time.
-

CAUTION

- If you have any questions, please contact the ESS supplier. Operation without authorization is forbidden.
 - The installation and Commissioning workers must be required to hold the Trina Storage authorization certificate to carry out installation and commissioning work.
 - Use of Elementa in series or parallel with other types of battery products is prohibited.
-

3.3 Cleaning Safety

DANGER

- Do not use cleaning solvents to clean Elementa or expose Elementa to flammable or harsh chemicals or vapors.
-

WARNING

- To clean Elementa use a soft, lint-free cloth. If needed, the cloth can be dampened with soapy water only.
-

CAUTION

- Keep the sides of Elementa clear of debris (leaves, snow, etc.) to maintain optimal airflow.
-

4 Product Overview

4.1 Main Features

The Elementa has several key features that make it a high performing product in the market including.

- A compliant state-of-the-art fire detection and suppression system that includes:
 - Fire Alarm Control Panel (FACP)
 - Dry pipe sprinklers
 - Aerosol-based fire extinguishing system,
 - Audible and Visual Alarms
 - Heat, smoke and combustible gas detectors
 - Signaling Line Circuit (SLC) supporting provisions for Customer external communication from every Elementa.
 - Explosion control system utilizing key sensors and the active ventilation intake, and exhaust fan.
- All-in-one three level Battery Management System (BMS) capable of:
 - Enabling dual-way communication with an external controller(s), such as Power Plant Controllers (PPC), Energy Management System (EMS), etc.
 - Handling a wide variety of battery operating parameters, such as battery cells/rack voltages, battery rack current, battery cells temperature, SOC and SOH estimation, operating status, and battery limits to enhance better asset utilization and to operate it in its appropriate operational ranges.
 - Receiving critical information from both the Fire Alarm Control Panel and the combustible gas sensor.
 - Interfacing with main Elementa, such as liquid cooling unit, dehumidifiers, UPS, etc.
- State-of-Art TMS that maintains an efficient temperature distribution across the entire cabinet.
- DC arc flash hazard mitigation. Every rack includes positive and negative pole fuses while every module includes Manual Service Disconnect (MSD) and a fuse to mitigate arc flash hazards to enhance safety when authorized operators service the Elementa
- Insulation Monitoring Detection. Every rack has an insulation monitoring detection function that detects when a rack is disconnected from the main DC bus.
- High Ingress Protection rating. The Elementa enclosure has an IP55 rating, and the modules are IP67 rated.

Disclaimer: The Elementa IP55 rating is not met where the onboard Chiller unit is installed.

- The Elementa is factory assembled before shipping, reducing onsite installation costs.

- The Elementa cabinets are supplied with:
- Main connections including DC power cables, auxiliary power cables, and communication cables between Elementas are provided to the Trina Storage.

4.2 Product Data Sheet

Table 4-1 Cell specification

Item	Specification
Cell Chemistry	Lithium Iron Phosphate (LFP)
Cell Model	TS71173204-314B
Dimensions (D*W*H)	(71.8±1.5)mm*(174.7±1.5)mm*(207.5±2)mm
Weight	5.52±0.4 kg
Nominal Capacity	314 Ah
Nominal Energy	1004.8 Wh
Nominal Voltage	3.2 V
Operating Voltage Range	T>0°, 2.5V~3.65V T≤0°C, 2.0V~3.65V
Standard Charge Method	25±2°C, 0.5P CP to 3.65 V
Standard Discharge Method	25±2°C, 0.5P DP to 2.5 V
Operational Temperature Range	Charging: 0°C~60°C Discharging: -30°C~60°C

Table 4-2 Module specification

Item	Specification
Module Format	1P104S
Nominal Capacity	314 Ah
Nominal Voltage	332.8 VDC
Maximum Operating Voltage Range	261~377.5 VDC
Nominal Energy	104.49kWh
Nominal Charging & Discharging Power	52.24 kW/52.24 kW
Nominal Charge/Discharge Method	0.5CP
Nominal Charge/Discharge Current	157 A

Maximum Charge/Discharge Current	200 A
Storage temperature	-30℃ ~ 60℃
Humidity range	0~95% RH
Operating Altitude	≤4000 m
Dimensions	W810±3*D2200±3*H243±3mm
Weight	650±25 kg
Power Cable Connection Method	Quick Plug
Communication Harness Connection Method	Quick Plug

Table 4-3 Rack specification

Item	Specification
Cell Chemistry	LFP
Rack Format	1P416S
Nominal Capacity	314 Ah
Nominal Voltage	1331.2 VDC
Maximum Operating Voltage Range	1123.2V~1497.6 V
Nominal Energy	417.92 kWh
Nominal Charge/Discharge Current	157A
Maximum Continuous Charge/Discharge Current	186 A
Nominal Charge/Discharge Power	208.96kW
Storage Temperature	-30~60℃
Operating Altitude	≤4000 m
Dimensions(W*D*H)	(826 ± 3) mm * (2206 ± 3) mm * (1225 ± 3) mm
Weight	2950 ± 60 kg
Communication	CAN/Modbus TCP

Table 4-4 Cabinet specification

Item	Specification
Cabinet Model	TSMG5015B2-2H
Cabinet Format	12P416S

Nominal Voltage		1331.2 VDC
Maximum Operating Voltage Range		1123.2V~1497.6 V
Nominal Energy		5015 kWh
Nominal Sustained Charge/Discharge Power		2507.5kW
Nominal Charge/Discharge Current		1884 A
Maximum Continuous Charge/ Discharge Current		2232 A
Cooling Mode		Liquid cooling
Operating Temperature		-30~55°C (50~55°C derating)
Operating Humidity		≤100% RH (Non-condensing)
Storage Humidity		≤95% RH (Non-condensing)
Power supply range		400V±10%(IEC) 480V±10%(UL)
Dimensions (W*D*H)		6058*2438*2896 mm
Weight		40.5±2T
Communication		CAN/Modbus TCP
IP Level		IP55
Certification	UL	UL9540
		UL1973
		UL9540A
	IEC	IEC62619
		IEC 62477-1
		IEC63056
		IEC62933-5-2
		EN61000-6-2/4 (EMC)
		CE
	Transportation	UN38.3/UN3536

4.3 General System Layout

Figure 4-1 Elementa View

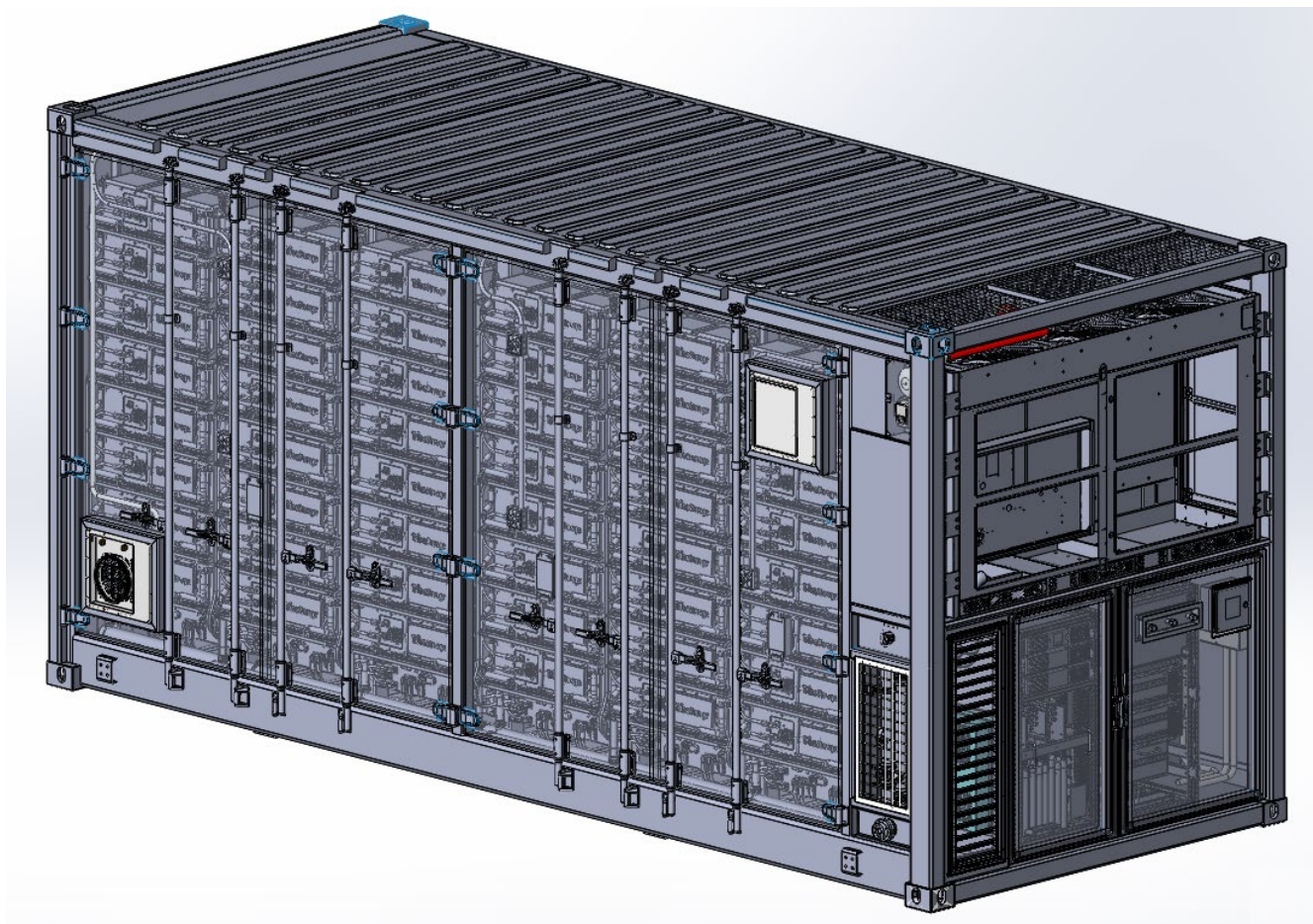
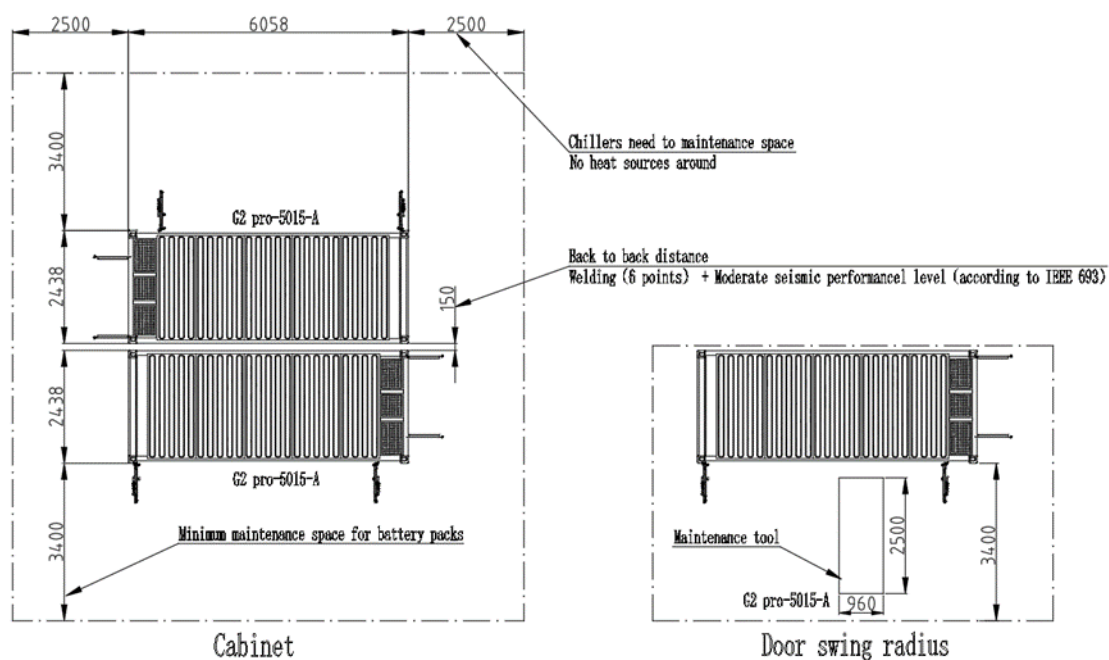


Figure 4-2 Elementa View



Note: The specific layout will differ according to project therefore this is for guidance only.

5 Operation Instruction

5.1 States of Operation

OFF

OFF is a state where the auxiliary power is disconnected from Elementa attached to a DC Bus. In this state, the DC contactors are open and the BAU is not functioning. OFF state allows operators to perform LOTO and is the state where maintenance can be conducted.

START-UP

START-UP is a transition state from either SHUTDOWN or OFF to one of the operational states that can occur if the BAU is not in FAULT. This transition state has auxiliary power connected and the DC bus is becoming energized.

NORMAL

NORMAL is an operational state where the BAU is in either Normal, Charge Prohibited, Discharge Prohibited, or Standby sub-states. The auxiliary and DC buses are energized. NORMAL is the state when the system is operating within the defined parameters outlined in section 4.2 of this document.

SHUTDOWN

The transition to a SHUTDOWN state occurs when the operator issues a shutdown command, or the system is ready to start. The SHUTDOWN state does not power off the whole system. In the SHUTDOWN state, the auxiliary power remains connected, but the HVB DC contactors are disconnected. The BAU is powered and not in a FAULT state.

SHUTDOWN is a state that allows operators to perform LOTO and where maintenance may be conducted.

FAULT

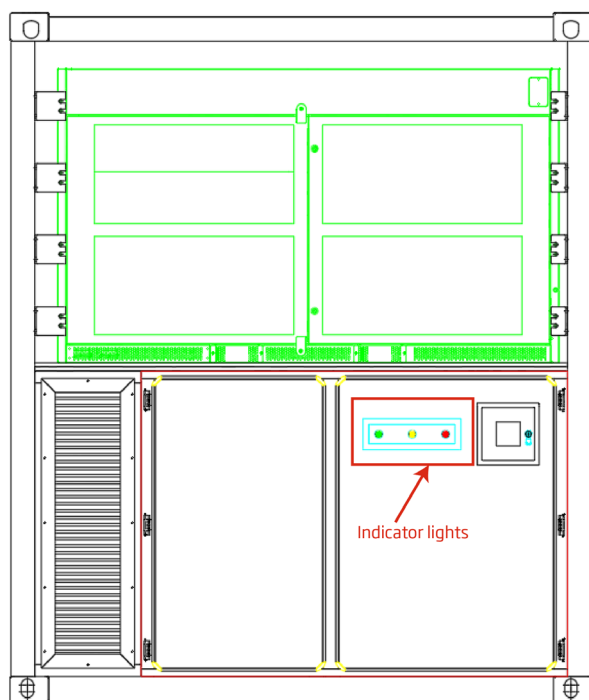
The FAULT state is triggered by an abnormal operation and results in Elementa disconnecting from the DC bus. The auxiliary bus remains energized.

FAULT - SAFETY RELATED

FAULT - A SAFETY RELATED state is a FAULT sub-state caused by either a FACP, combustible gas, or level three high cell temperature event. If the system enters a FAULT-SAFETY RELATED mode, personnel should follow the site-specific emergency response plan based on the emergency response plan identified in section 13 of this document.

5.2 List of Indicator Light Status

Figure 5-1 Location of indicator lights



The indicator light reflects the status of the cabinet, which represents the aggregated status of all racks. When all racks are operating normally, the cabinet indicator displays a green light. If any abnormalities, the cabinet indicator will correspondingly illuminate a yellow or red light.

Table 5-1 Indicator status

Indicator Light	Indicator Status
Run indicator light ●	The system is operating normally without any faults.
Fault indicator Light ●	System level 3/2 alert*
Alarm indicator light ●	System level 1 alert*

* If the red or yellow light is on, please confirm the specific situation and fault.

Table 5-2 List of indicator light status

System state	Run indicator light ●	Fault indicator light ●	Alarm indicator light ●
Power OFF	Green light is OFF	Red light is OFF	Yellow light is OFF
Failure	Green light is OFF	Red light is ON	Yellow light is OFF
Power ON	Green light is ON	Red light is OFF	Yellow light is OFF
Power up of Primary Circuit	Green light is ON	Red light is OFF	Yellow light is OFF
Charge/Discharge	Green light is ON	Red light is OFF	Yellow light is OFF

5.3 Auxiliary Power on Sequence (EN)

EN: Applicable for TSMG5015B2-2H-E/TSMG5015B2-2H-A/ TSMG5015B2-2H-P



DANGER

As a first step before initiating any procedure confirm the DC 1500V circuits are fully isolated. Before initiating any power-on operations, ensure that the busbar isolation plate has been properly installed. Prior to disassembling the isolation plate, confirm that the system has been fully powered down.



CAUTION

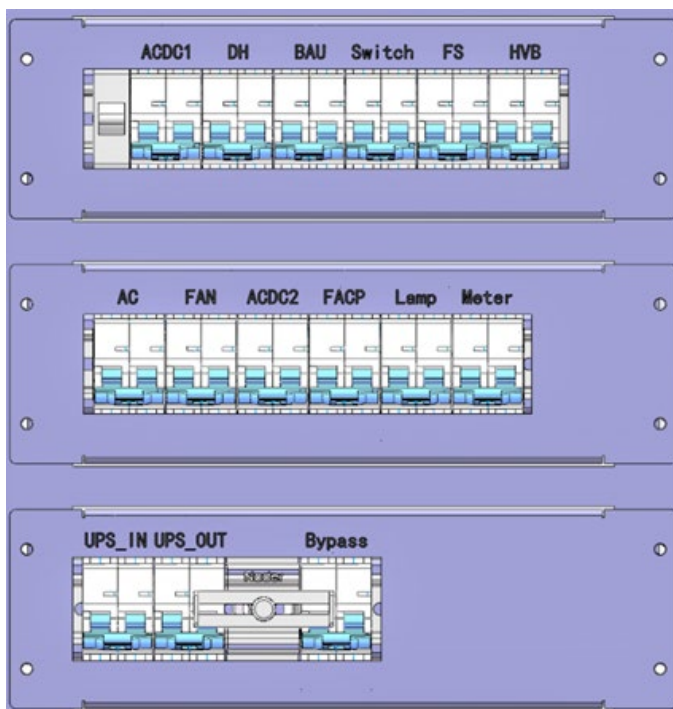
To avoid damage please follow the steps below.

Table 5-3 EN breakers list

NO	Item	Load Description
1	QF1	Main Breaker
2	QF2	Chiller
3	QF3	UPS
4	QF4	UPS OUT
5	QF5	UPS Bypass
6	QF6	FSS-Fan
7	QF7	ACDC1
8	QF8	Air Conditioner
9	QF9	ACDC2
10	QF10	Dehumidifier
11	QF11	FACP
12	QF12	Lamp (Optional)
13	QF13	BAU
14	QF14	Flood Sensor (Optional)
15	QF15	HVB
16	QF16	Switch
17	QF17	Meter (Optional)

1. Close the circuit breaker "Main" (QF1) to power the Elementa auxiliary power supply main circuit.
2. Close the circuit breaker "Chiller" (QF2) to power the chiller supply circuit.

3. Close the circuit breaker "UPS" (QF3) to power the UPS.
 4. Close the circuit breaker "UPS OUT" (QF4) to power the UPS OUT.
 5. Open the circuit breaker "Bypass" (QF5) to open the UPS bypass (QF4 and QF5 cannot be opened simultaneously).
 6. Close the circuit breaker "FAN" (QF6) to power the FSS intake and exhaust fans.
 7. Close the circuit breaker "ACDC1" (QF7) to power the switch power supply 1.
 8. Close the circuit breaker "AC" (QF8) to power the air conditioner.
 9. Close the circuit breaker "ACDC2" (QF9) to power the switch power supply 2.
 10. Close the circuit breaker "DH" (QF10) to power the dehumidifiers.
 11. Close the circuit breaker "FACP" (QF11) to power the FACP.
 12. Close the circuit breaker "Lamp" (QF12) to power the lamps (Optional).
 13. Close the circuit breaker "BAU" (QF13) to power the BAU.
 14. Close the circuit breaker "FS" (QF14) to power the flood sensor (Optional).
 15. Close the circuit breaker "HVB" (QF15) to power the HVB.
 16. Close the circuit breaker "Switch" (QF16) to power the switch.
 17. Close the circuit breaker "Meter" (QF17) to power the Meter (Optional).
- Figure 5-2 LVP breakers



5.4 Auxiliary Power Down Sequence (EN)

EN: Applicable for TSMG5015B2-2H-E/TSMG5015B2-2H-A/ TSMG5015B2-2H-P

Elementa

1. Open circuit breaker "Meter" (QF17), the meter power circuit (Optional).
2. Open circuit breaker "Switch" (QF16), the switch power circuit.
3. Open circuit breaker "HVB" (QF15), the HVBS power circuit.
4. Open circuit breaker "FS" (QF14), the flood sensor power circuit (Optional).
5. Open circuit breaker "BAU" (QF13), the BAU power circuit.
6. Open circuit breaker "Lamp" (QF12), the lamp power circuit (Optional).
7. Open circuit breaker "FACP" (QF11), the Fan power circuit.

 NOTE

The FSS cabinet has its own power supply, power down need to pay attention to the order of fire-related power down.

8. Open circuit breaker "DH" (QF10), the Dehumidifiers power circuit.
9. Open circuit breaker "ACDC2" (QF9), the switch power supply 2 power circuit.
10. Open circuit breaker "AC" (QF8), the air conditioner power circuit.
11. Open circuit breaker "ACDC1" (QF7), the switch power supply 1 power circuit.

 CAUTION

Before disconnecting this circuit breaker, please confirm that the 6 HVBS have been successfully powered down.

-
12. Open circuit breaker "FAN" (QF6), the FSS intake and exhaust fans power circuit.
 13. Open circuit breaker "Bypass" (QF5), the UPS bypass power circuit.
 14. Open circuit breaker "UPS OUT" (QF4), the UPS out power circuit.
 15. Open circuit breaker "UPS" (QF3), the UPS power circuit.
 16. Open circuit breaker "Chiller" (QF2), the chiller power circuit.
 17. Open circuit breaker "Main" (QF1), the Elementa main power circuit.

5.5 Auxiliary Power on Sequence (UL)

UL: Applicable for TSMG5015B2-2H-U

 DANGER

As a first step before initiating any procedure confirm the DC 1500V circuits are fully isolated. Before initiating any power-on operations, ensure that the busbar isolation plate has been properly installed. Prior to disassembling the isolation plate, confirm that the system has been fully powered down.

 CAUTION

To avoid damage please follow the steps below.

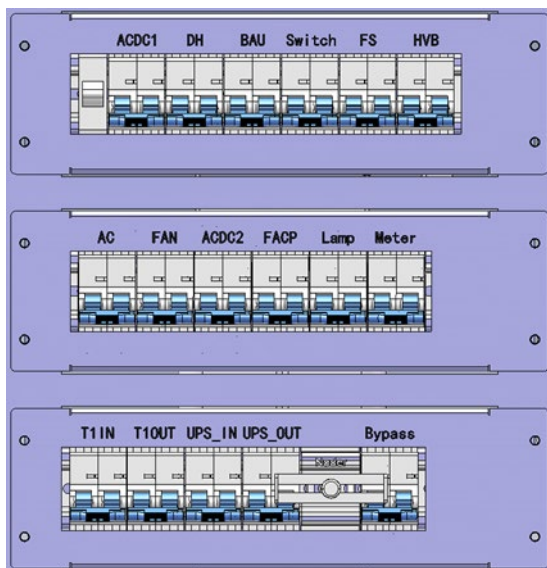
Table 5-4 UL breakers list

NO	Item	Load Description
1	QF1	Main Breaker
2	QF2	Chiller
3	QF3	UPS
4	QF4	UPS OUT
5	QF5	UPS Bypass
6	QF6	FSS-Fan
7	QF7	ACDC1
8	QF8	Air Conditioner
9	QF9	ACDC2
10	QF10	Dehumidifier
11	QF11	FACP
12	QF12	Lamp (Optional)
13	QF13	BAU
14	QF14	Flood Sensor (Optional)
15	QF15	HVB
16	QF16	Switch
17	QF17	Transformer input
18	QF18	Transformer output
19	QF19	Meter (Optional)

1. Close the circuit breaker "Main" (QF1) to power the Elementa auxiliary power supply main circuit.
2. Close the circuit breaker "Chiller" (QF2) to power the chiller supply circuit.
3. Close the circuit breaker "UPS" (QF3) to power the UPS.
4. Close the circuit breaker "UPS OUT" (QF4) to power the UPS OUT.
5. Open the circuit breaker "Bypass" (QF5) to open the UPS bypass (QF4 and QF5 cannot be opened simultaneously).
6. Close the circuit breaker "FAN" (QF6) to power the FSS intake and exhaust fans.
7. Close the circuit breaker "ACDC1" (QF7) to power the switch power supply 1.
8. Close the circuit breaker "AC" (QF8) to power the air conditioner.

9. Close the circuit breaker "ACDC2" (QF9) to power the switch power supply 2.
10. Close the circuit breaker "DH" (QF10) to power the dehumidifiers.
11. Close the circuit breaker "FACP" (QF11) to power the FACP.
12. Close the circuit breaker "Lamp" (QF12) to power the lamps (Optional).
13. Close the circuit breaker "BAU" (QF13) to power the BAU.
14. Close the circuit breaker "FS" (QF14) to power the flood sensor (Optional).
15. Close the circuit breaker "HVB" (QF15) to power the HVB.
16. Close the circuit breaker "Switch" (QF16) to power the switch.
17. Close the circuit breaker "T1 IN" (QF17) to power the transformer input.
18. Close the circuit breaker "T1 OUT" (QF18) to power the transformer output.
19. Close the circuit breaker "Meter" (QF19) to power the Meter (Optional).

- Figure 5-3 LVP breakers



5.6 Auxiliary Power Down Sequence (UL)

UL: Applicable for TSMG5015B2-2H-U

Elementa

1. Open circuit breaker "Meter" (QF19), the meter power circuit (Optional).
2. Open circuit breaker "Switch" (QF16), the switch power circuit.
3. Open circuit breaker "HVB" (QF15), the HVBS power circuit.
4. Open circuit breaker "FS" (QF14), the flood sensor power circuit (Optional).
5. Open circuit breaker "BAU" (QF13), the BAU power circuit.
6. Open circuit breaker "Lamp" (QF12), the lamp power circuit (Optional).
7. Open circuit breaker "FACP" (QF11), the Fan power circuit.

 NOTE

The FSS cabinet has its own power supply, power down need to pay attention to the order of fire-related power down.

8. Open circuit breaker "DH" (QF10), the Dehumidifiers power circuit.
9. Open circuit breaker "ACDC2" (QF9), the switch power supply 2 power circuit.
10. Open circuit breaker "AC" (QF8), the air conditioner power circuit.
11. Open circuit breaker "ACDC1" (QF7), the switch power supply 1 power circuit.

 CAUTION

Before disconnecting this circuit breaker, please confirm that the 6 HVBS have been successfully powered down.

-
12. Open circuit breaker "FAN" (QF6), the FSS intake and exhaust fans power circuit.
 13. Open circuit breaker "Bypass" (QF5), the UPS bypass power circuit.
 14. Open circuit breaker "UPS OUT" (QF4), the UPS out power circuit.
 15. Open circuit breaker "UPS" (QF3), the UPS power circuit.
 16. Open circuit breaker "T1 OUT" (QF18), the transformer output power circuit.
 17. Open circuit breaker "T1 IN" (QF17), the transformer input power circuit.
 18. Open circuit breaker "Chiller" (QF2), the chiller power circuit.
 19. Open circuit breaker "Main" (QF1), the Elementa main power circuit.

5.7 Chiller Start-up/ Shutdown

 CAUTION

- Please refer to the chiller user manual for other modes of operation
- Do not cut off the power when the chiller is shut down to ensure that the compressor heater is continuously heated.

After the chiller is powered on, if the compressor does not start, the heating belt will automatically start heating. When the chiller is powered on for the first time, it is necessary to ensure that the heating time of the compressor heating belt is not less than 4 hours before starting up the chiller.

When the ambient temperature is too low, it may cause the lubricating oil in the compressor to solidify. Therefore, when the chiller is powered on for the first time in a low temperature environment, it is necessary to perform a 4-hour live standby treatment on the unit to ensure that the compressor heating belt is preheated for a sufficient period of time.

Chiller Start-up

Each time the chiller ON/OFF button is used, the system switches the current working state of the chiller.

After starting, the chiller HMI status will be updated from the shutdown state to the running state. In case there is no keyboard operation for a while, the HMI will automatically return to the home page

interface.

Chiller shutdown

After shutting down, the chiller HMI will be updated from running status to shutdown status. The chiller has nonvolatile memory and supports power-off memory. If the system is power-off and then power-on, the chiller will automatically enter the state before power-off. (i.e. If the chiller is on before system power-off, the chiller will automatically start up and enter the normal operation interface when system power-on.)

5.8 Chiller Commissioning

1. Check water tank levels.
2. Open all valves and the nipples in the chiller cabinet and in each rack.
3. Confirm voltage measurements and phase rotation on aux. Supply within chiller cabinet.
4. Close the aux. supply breaker within the Chiller cabinet.
5. Check the HMI and ensure that the mode is in LOCAL and the chiller is in OFF status.
6. Leave it in this state for 4 hours for pre-heating.
7. OPTIONAL: Use a thermal camera to check the temperatures on the compressor.
8. Put the chiller in ON state.
9. OPTIONAL TEST: Exhaust mode to remove all air.
10. In the maintenance tab, start the pump at 50% in manual mode.
11. If there is an inlet low pressure alarm or water tank low level alarm, fill the header tank.
12. If above pressure is below 0.5 bar then the aux. pump injects coolant from aux. tank automatically. If above 0.5 bar, then we need to manually inject from maintenance tab --> Auto Add W Pump (ON) and monitor the inlet pressure.
13. Set the pump on 80% speed and ensure that the inlet pressure is 0.8 to 1bar.
14. Set Pump back to auto mode.
15. Check the refrigeration pressure on the Advanced status page (Suction pressure and Discharge pressure values --> depends on the ambient temp).
16. Check and confirm project specific cooling and heating setting point (SP) (Default from Envicool 20°C and 18°C). It should be noted that this setpoint is the value for the fully automatic mode when the unit is not connected to communications. Once communication is established, the system will operate according to Trina's thermal management control strategy.
17. Ensure control temperature is in "Outlet".
18. Ensure "out water HP SP" is 2-2.5 bar and "in water LP SP" is 0.8-1.2 bar.
19. Switch chiller to remote mode and check communication status in both Chillers and Elementa HMI.

5.9 Air Conditioner and Dehumidifier Settings

5.9.1 Air Conditioner

The air conditioner's cooling and heating functions both rely on the return air temperature on the indoor side (condensing side) to determine operation. Setting the return air temperature at 30°C will activate cooling, with a differential of 10°C, meaning that cooling will stop when the return air temperature reaches 20°C. Similarly, heating starts when the return air temperature falls below 5°C, with the same differential of 10°C, and stops when the return air temperature rises above 15°C.

5.9.2 Dehumidifier

Set the dehumidification mode activation value to 60% RH with a hysteresis of 10% RH. When there is no hysteresis set value, the dehumidification mode stop value can also be directly set to 50% RH.

5.10 BMS Interface Definition

Table 5-5 Interface definition

Topic	Definition	Remarks
Interface	CAN	3 channels (Segregation, 250k/500kbps)
	RS485	9 channels (Segregation, 9600bps~57600bps)
	DI	18 channels. 7 channels high-active digital signal inputs and 11 channels low-active digital signal inputs
	Dry Contact Output	16 channels, maximum voltage 32V, maximum current 500mA
	High Side Output	4 channels, maximum voltage 24V, maximum current 500mA
	Ethernet	2 channels (100M/1000M) and 2 channels (10M/100M)
	TYPE-C	1
	USB	3 channels, read / write rate is related to the USB flash drive used, typical value is 5MB/s
	TF	1 TF slot, read/write rate depends on the TF card used, typical value 3MB/s
	HDMI	1
Environment	Power Supply	DC 12V-32V
	Power Consumption	< 10W
	Operating Temperature	-30°C~65°C

	Storage Temperature	-40°C~85°C
	Relative Humidity	5%RH~95%RH, non-condensing
	Altitude	< 4000m

The BAU bottom interface diagram is shown below.

Figure 5-4 BAU bottom interface diagram

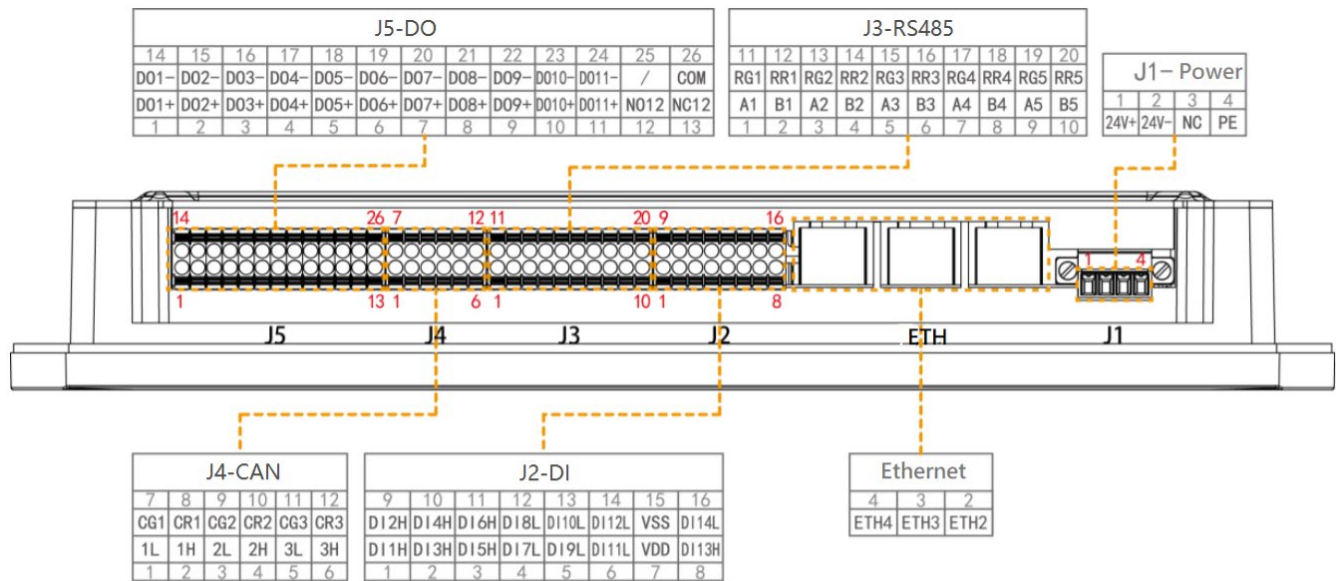


Table 5-6 Bottom interface definition

Interface	Pin NO.	PIN Definition	Function	Note
J1-Power	1	24V+	Power supply input positive	BAU power supply
	2	24V-	Power supply input negative	
	3	NC	No connection	
	4	PE	Grounding	Must be grounded
J2-DI	1	DI1H	1st high-active digital signal input	
	9	DI2H	2nd high-active digital signal input	
	2	DI3H	3rd high-active digital signal input	
	10	DI4H	4th high-active digital signal input	
	3	DI5H	5th high-active digital signal input	

	11	DI6H	6th high-active digital signal input	
	4	DI7L	7th low-active digital signal input	
	12	DI8L	8th low-active digital signal input	
	5	DI9L	9th low-active digital signal input	
	13	DI10L	10th low-active digital signal input	
	6	DI11L	11th low-active digital signal input	
	14	DI12L	12th low-active digital signal input	
	8	DI13H	13th low-active digital signal input	
	16	DI14L	14th low-active digital signal input	
	7	VDD	DI Isolated Power Supply Input Positive	
	15	VSS	DI isolated power supply input negative	
J3-RS485	1/2	A1/B1	1st RS485 communication	If the RR interface is not short circuited, the RS485 interface does not have a 120 Ω terminal resistor. If the RR interface is short circuited to B interface, the RS485 interface will have a 120 Ω terminal resistor.
	11	RG1	1st RS485 isolated ground	
	12	RR1	1st RS485 termination resistor	
	3/4	A2/B2	2nd RS485 communication	
	13	RG2	2nd RS485 isolated ground	
	14	RR2	2nd RS485 termination resistor	
	5/6	A3/B3	3rd RS485 communication	
	15	RG3	3rd RS485 isolated ground	
	16	RR3	3rd RS485 termination resistor	
	7/8	A4/B4	4th RS485 communication	
	17	RG4	4th RS485 isolated ground	
	18	RR4	4th RS485 termination resistor	
	9/10	A5/B5	5th RS485 communication	

	19	RG5	5th RS485 isolated ground	
	20	RR5	5th RS485 termination resistor	
J4-CAN	1/2	1L/1H	1st CAN communication	If the CR interface is not short circuited, the CAN interface does not have a 120 Ω terminal resistor. If the CR interface is short circuited to L interface, the CAN interface will have a 120 Ω terminal resistor.
	7	CG1	1st CAN isolated ground	
	8	CR1	1st CAN termination resistor	
	3/4	2L/2H	2nd CAN communication	
	9	CG2	2nd CAN isolated ground	
	10	CR2	2nd CAN termination resistor	
	5/6	3L/3H	3rd CAN communication	
	11	CG3	3rd CAN isolated ground	
	12	CR3	3rd CAN termination resistor	
J5-DO	1/14	DO1+/DO1-	1st normally open dry contact output	
	2/15	DO2+/DO2-	2nd normally open dry contact output	
	3/16	DO3+/DO3-	3rd normally open dry contact output	
	4/17	DO4+/DO4-	4th normally open dry contact output	
	5/18	DO5+/DO5-	5th normally open dry contact output	
	6/19	DO6+/DO6-	6th normally open dry contact output	
	7/20	DO7+/DO7-	7th normally open dry contact output	
	8/21	DO8+/DO8-	8th normally open dry contact output	
	9/22	DO9+/DO9-	9th normally open dry contact output	
	10/23	DO10+/DO10-	10th normally open dry contact output	
	11/24	DO11+/DO11-	11th normally open dry contact output	

	12/26	N012/COM	12th normally open dry contact output	
	13/26	NC12/COM	12th normally close dry contact output	
	25	/	No connection	
ETHERNET	2	ETH2	100M/1000M Ethernet	Default protocol communication interface
	3	ETH3	100M/1000M Ethernet	
	4	ETH4	10M/100M Ethernet	Default BAU and BCU communication interface

The BAU top interface diagram is shown below.

Figure 5-5 BAU top interface diagram

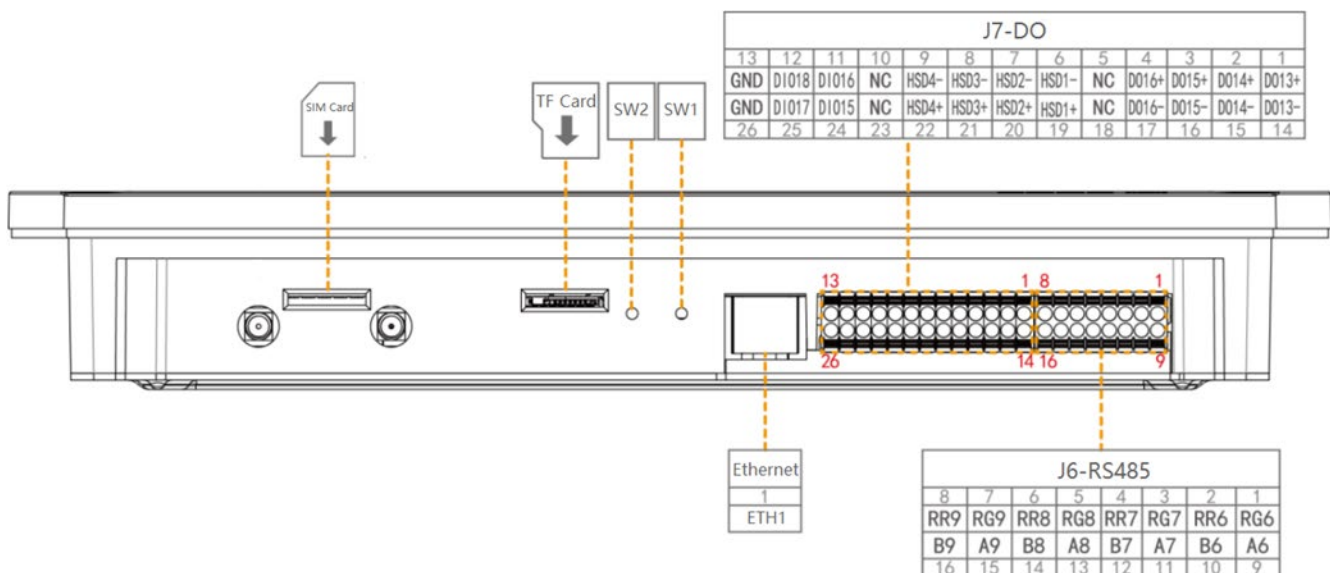


Table 5-7 Top interface definition

Interface	Pin NO.	PIN Definition	Function	Note
J6-RS485 (reserved)	9/10	A6/B6	6th RS485 communication	If the RR interface is not short circuited, the RS485 interface does not have a 120 Ω terminal resistor.
	1	RG6	6th RS485 isolated ground	
	2	RR6	6th RS485 termination resistor	
	11/12	A7/B7	7th RS485 communication	
	3	RG7	7th RS485 isolated ground	If the RR interface is short circuited to B interface, the RS485 interface will have a 120 Ω terminal resistor.
	4	RR7	7th RS485 termination resistor	
	13/14	A8/B8	8th RS485 communication	
	5	RG8	8th RS485 isolated ground	

	6	RR8	8th RS485 termination resistor	
	15/16	A9/B9	9th RS485 communication	
	7	RG9	9th RS485 isolated ground	
	8	RR9	9th RS485 termination resistor	
J7-D0 (reserved)	13	GND	Non-isolated power supply ground	
	26	GND	Non-isolated power supply ground	
	12	DIO18	18th digital signal input	
	25	DIO17	17th digital signal input	
	11	DIO16	16th digital signal input	
	24	DIO15	15th digital signal input	
	10	NC	No connection	
	23	NC	No connection	
	9/22	HSD4-/HSD4+	4th high side output	
	8/21	HSD3-/HSD3+	3rd high side output	
	7/20	HSD2-/HSD2+	2nd high side output	
	6/19	HSD1-/HSD1+	1st high side output	
	5	NC	No connection	
	18	NC	No connection	
	4/17	DO16+/DO16-	16th normally open dry contact output	
	3/16	DO15+/DO15-	15th normally open dry contact output	
	2/15	DO14+/DO14-	14th normally open dry contact output	
	1/14	DO13+/DO13-	13th normally open dry contact output	
ETHERNET	1	ETH1	10M/100M Ethernet	Reserved

The BAU left interface diagram is shown below.

Figure 5-6 BAU left interface diagram

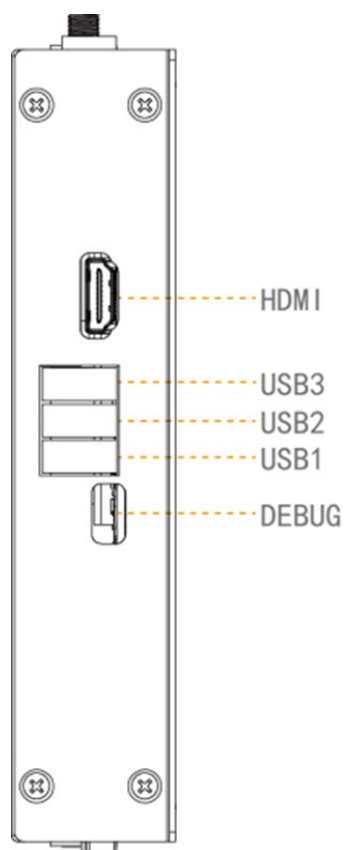


Table 5-8 Left interface definition

Interface	Pin NO.	PIN Definition
HDMI	HDMI Interface	Reserved interface, for internal use
USB3	USB Interface	USB_2.0, reserved interface, for internal use
USB2		USB_3.0, for program loading, for internal use
USB1		USB_3.0, for connecting a USB stick, upgrading programs and reading historical data
DEBUG	Debug Interface	TPYE-C, for internal use

5.11 System Communication

The below presents the communication mode between the Elementa BMS, PCS, and EMS.

Figure 5-7 Communication Topology

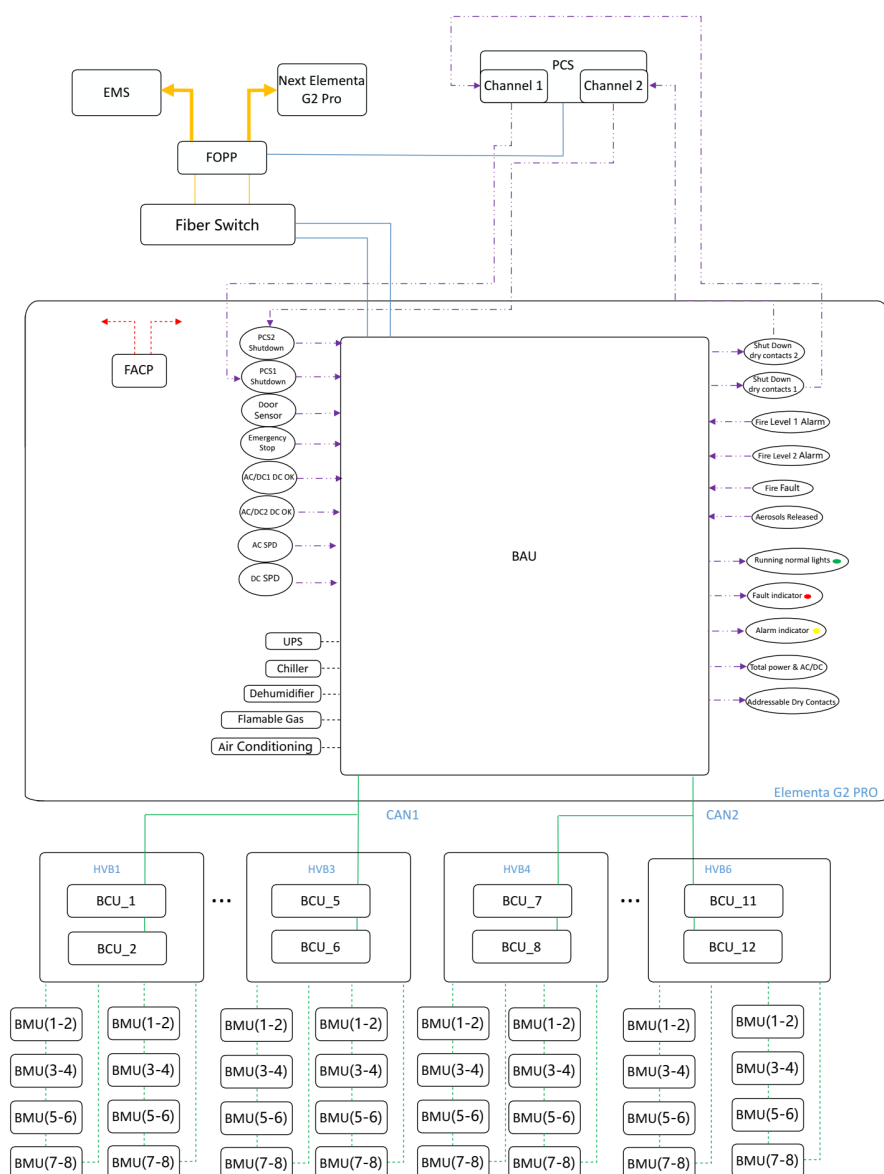


Table 5-9 Communication protocol description

Module	Port	Function Description	Communication Protocol
Internal Communication	CAN1	BMS internal communication	Internal communication protocol between BAU and BCU
External Communication	CAN2	Communication between BMS and PCS	Communication protocol between PCS and BMS
USB2	LAN2	Communication between BMS and EMS (Internet A)	IEC 61850/IEC104
USB1	LAN3	Communication between BMS and EMS (Internet B)	IEC 61850/IEC104

5.12 UPS

5.12.1 Introduction of UPS

Uninterruptible Power Supply is a type of power supply that contains an energy storage device. It is mainly used to provide uninterrupted power for equipment that has high requirements for power stability.

When the input from the main power supply is normal, the UPS stabilizes the voltage and supplies it to the load. At this time, the UPS plays a role as an AC voltage stabilizer and simultaneously charges the internal battery. When the mains power supply is interrupted (due to an accident), the UPS immediately converts the DC power from the battery into 230V AC power through an inverter switch to continue supplying power to the loads, ensuring the normal working and protecting the software and hardware of loads from damage. UPS can protect against both excessively high and low voltages.

5.12.2 Interface and Function of UPS

The interface of UPS is shown in the figure below:

Figure 5-8 UPS Illustration

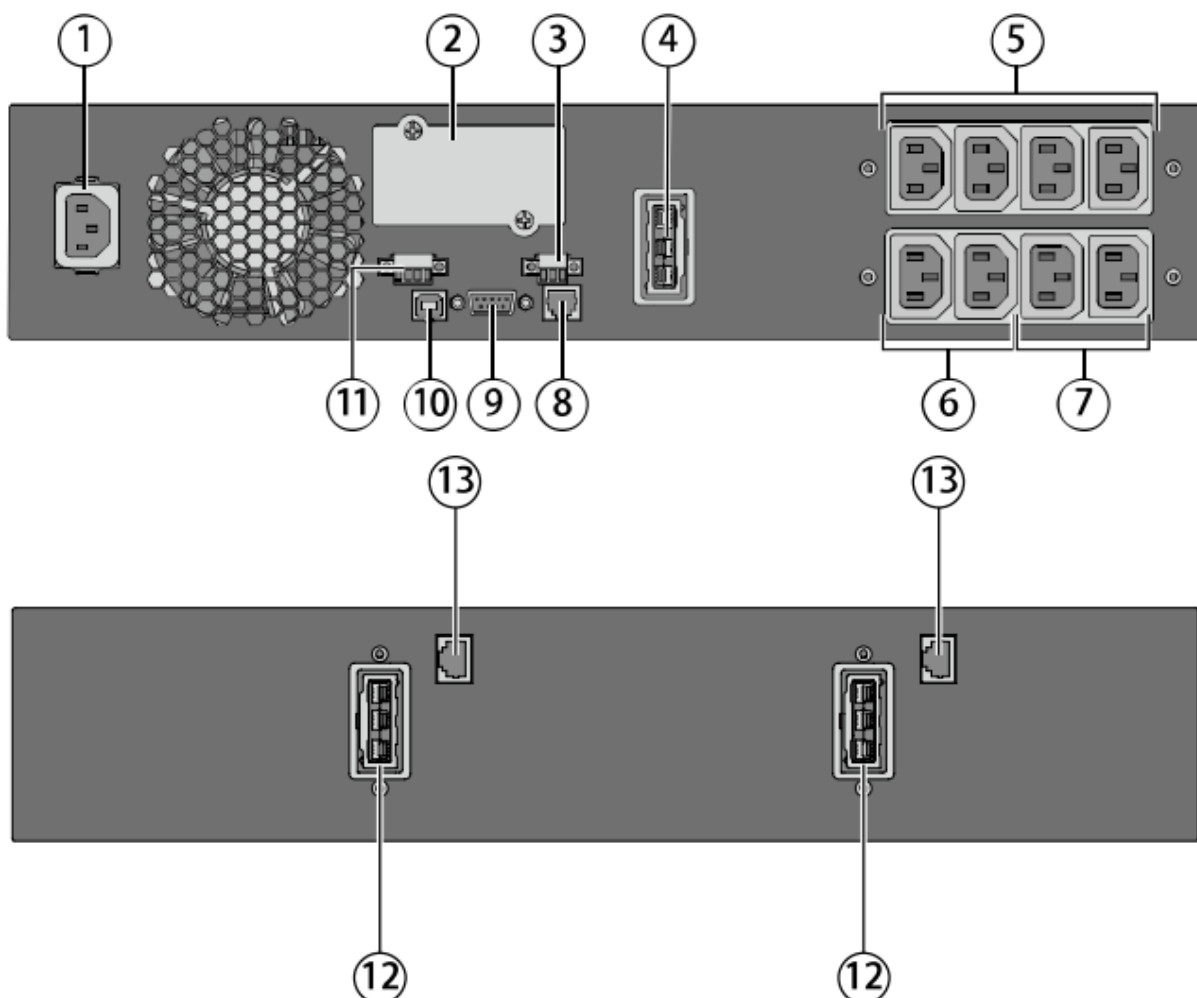


Table 5-10 UPS interface

Function Description	Communication Protocol
1	Socket for connection to AC power source
2	Slot for optional communication card
3	Relay output contact
4	Connector for additional battery module
5	Primary group: outlets for connection of critical equipment
6	Group 2: programmable outlets for connection of equipment
7	Group 1: programmable outlets for connection of equipment
8	Connector for automatic recognition of an additional battery module
9	RS232 communication port
10	USB communication port
11	Connector for ROO (Remote On/Off) control and RPO (Remote Power Off)
12	Connectors for battery modules (to the UPS or to the other battery modules)
13	Connectors for automatic recognition of battery modules

6 Maintenance Procedures

6.1 PPE and Arc Flash

Every piece of equipment that requires an arc flash label and PPE has its unique requirements.

Every label should be read carefully to understand the proper safety protocol.

Personnel approaching any part of the Elementa, for any reason, shall follow the guidelines of all labels before operation, maintenance, or servicing is performed.

An example of an arc flash label and its associated PPE requirements is shown below:

Figure 6-1 Arc flash label example

 WARNING	
Arc Flash and Shock Hazard Appropriate PPE Required	
_____	Arc Flash Boundary
_____	Incident Energy at 18 inches (cal/cm ²)
_____	PPE Level, _____

_____	Shock Hazard (Nominal System Voltage)
_____	Limited Approach
_____	Restricted Approach - Glove Class _____
Equipment Name: _____ Date: _____	

6.2 Precautions before Maintenance



- Ensure there is no precipitation or wind while performing work.
- Multiple energy sources exist inside and outside of the Elementa which may require control based upon the work being performed.
- Follow the LOTO guidance.



To avoid additional risks, do not perform any other maintenance operation beyond this manual.



NOTE

If necessary, contact Trina Storage support for maintenance.

6.3 LOTO & Points of Isolation

DANGER

- De-energization is to be completed by qualified operators.
- Multiple energy sources exist inside and outside of the Elementa which may require control based upon the work being performed.



Voltage is present, risk of electric shock.



Read and follow all arc flash labels on the equipment.



Always wear the proper PPE until all LOTO steps are complete and a zero-energy condition is verified.

6.3.1 LOTO Definitions

Lockout/Tagout (LOTO) is a safety procedure used to ensure that equipment is properly isolated and hazards are controlled before maintenance or work is started. LOTO is done by physically locking and/or tagging the equipment to prevent it from being turned on accidentally and to ensure that only authorized personnel performing work can remove their physical control.

Local government agencies provide guidelines for electrical safety in the workplace, including requirements for LOTO procedures that apply within its jurisdiction. Therefore, a project-specific LOTO procedure capturing the most up-to-date local requirements and site design must be followed.

There are three types of LOTO devices typically used for Elementa. These or other suitable LOTO devices may be implemented for specific project requirements.

Figure 6-2 Typical LOTO devices for Elementa



1. Padlocks: These are the most common type of lockout device and come in various sizes and

strengths. They are used to physically lock out a machine or equipment by attaching the lock to an energy isolation point.

2. Hasps: These are supplementary and used with padlocks to create a lockout point. They are typically used to allow multiple operators to conduct work at one time.
3. Electrical lockout devices: These are designed specifically for electrical equipment and are used to lock out circuit breakers and other electrical controls.

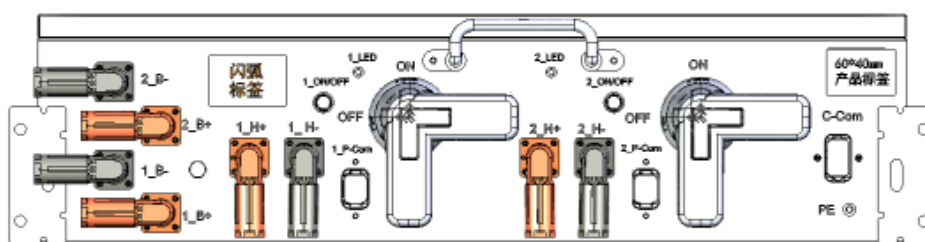
6.3.2 Elementa Points of Isolation

Elementa offers flexible means to establish a safe operating boundary during maintenance. This section describes the points of isolation of the Elementa including the energy control steps to de-energize each sub-system.

6.3.3 Elementa HVB Points of Isolation

The HVB offers means for the disconnect between the battery rack (composed of four Modules in series) and the rest of the system that is connected to the common DC bus. The HVB manual disconnect switch is as shown in below figure.

Figure 6-3 HVB manual disconnect switch



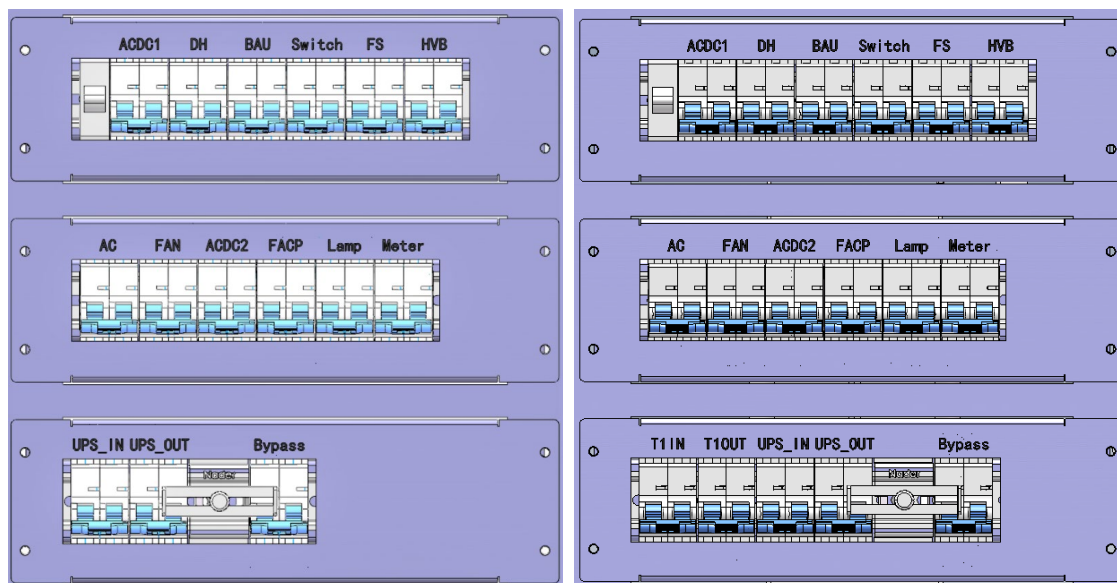
DANGER

- Placing the manual disconnect switch in the “OFF” position does not mean there is no voltage present. There could still be rack voltage on either side of the manual disconnect switch.

6.3.3.1 Elementa Distribution Box AC Circuit Isolation Point

The breakers to de-energize internal loads are located on the front side of the Distribution Box as shown below:

Figure 6-4 AC distribution switch



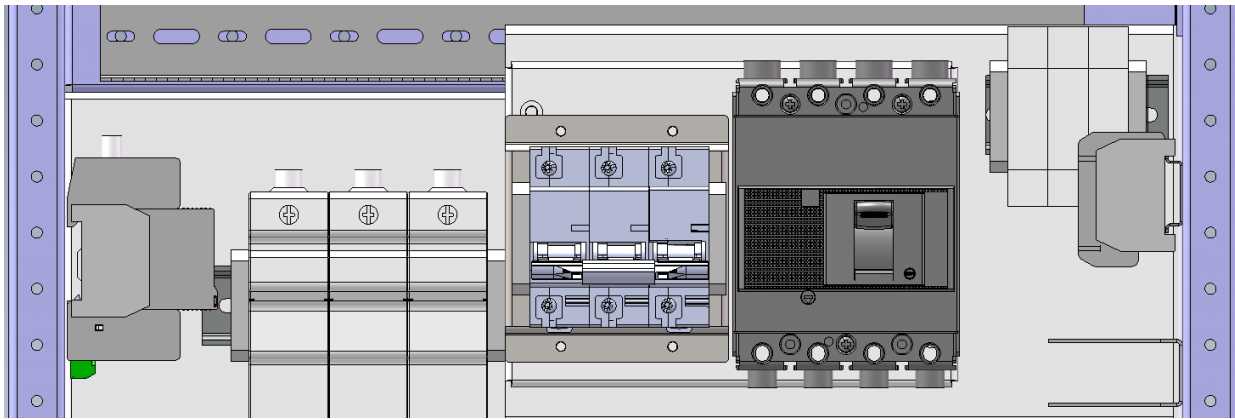
The main circuit breaker Main (QF1) is equipped with a padlock as shown below:

Figure 6-5 Padlock of QF1



As shown in the figure the main circuit breaker Main (QF1) outgoing side of the distribution cabinet is equipped with F1/F2/F3 fuse protection.

Figure 6-6 Fuse location



The AC UPS (1500VA - 230Vac) supplies power to the air inlet and exhaust fan, BMS, Switch, etc. It is located in the LVP, inside the Elementa. UPS can be manually controlled.

6.3.4 Example LOTO Procedure

LOTO procedures can become complex and need to consider all the work occurring at a site and within overlapping safety boundaries. In this section, sample LOTO procedures for common tasks are provided as a basis for a site-level Energy Control Plan to be developed and deployed for the specific activities of the day.

6.3.4.1 Module LOTO Procedure

Figure 6-7 Rack illustration



1. Isolate the DC power of the Elementa to service a single Module:
2. Issue a shutdown command to the PCS to remove all loads from/to the Elementa and electrically isolate the PCS from the common DC bus.
3. Issue a shutdown command to all Elementa BAUs on the common DC bus.
4. Disconnect the BIC and Distribution Box isolation switch.

5. Apply LOTO to the HVB manual disconnect in the target rack.
6. Confirm isolation of the HVB using a properly rated multimeter, and verify there is zero voltage between the positive and negative copper busbar of the DC circuit of the BIC and Distribution Box.
7. De-energize the dehumidifier circuit breaker labeled "Humidifier" (QF11) in the Elementa LVP.
8. Remove the MSDs for each battery Module above, below, and including the target Module to be serviced, and carefully store them to be reused.
9. Service the target Module.

6.3.4.2 Chiller LOTO Procedure

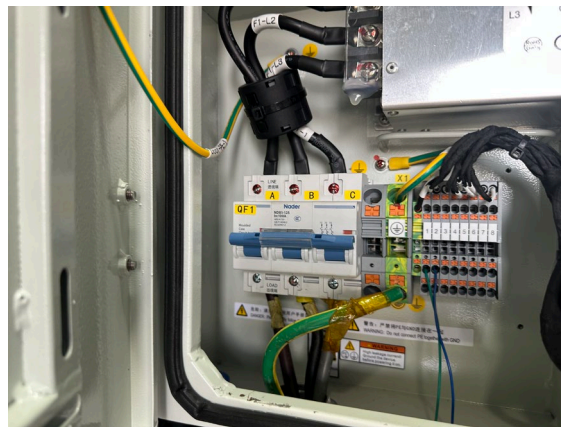


WARNING

Only properly trained and authorized personnel shall perform work on the chiller.

1. Refer to the chiller user manual provided by the manufacturer and follow the detailed instructions on shutting down the chiller using the UI.
2. De-energize and LOTO the chiller (QF2 Chiller) circuit breaker in the Elementa LVP.
3. Verify the absence of voltage on the AC terminals with proper tool (i.e. proximity sensor or multimeter)
4. Conduct service on the chiller following the chiller user manual.

Figure 6-8 Chiller auxiliary panel



6.4 Elementa General Maintenance



Wear proper PPE during the maintenance procedures, per the equipment's arc flash labels.



Before opening any door of the Elementa, ensure safe condition inside using either the manual gas sampling port or the onboard combustible gas sensor.

6.4.1 Electrical Inspection

Electrical maintenance consists of visual and electrical test measurements inside the Elementa. LOTO attention requirements of each section shall be listed before performing any activity or checks.

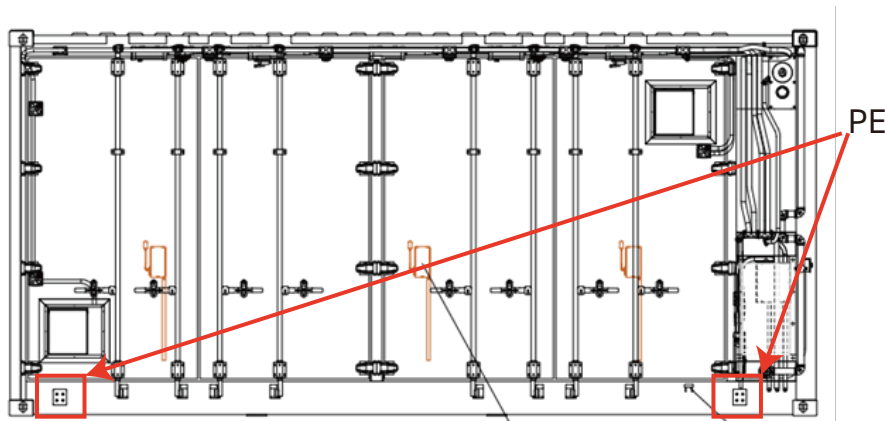
6.4.2 Visual Inspection



- Battery Modules, LVP and other electrical equipment within the Elementa may represent an Electrical Shock Hazard.
- Ensure there is no precipitation or wind while performing work inside Elementa.

1. Visually verify the external grounding point is in place and secure, and check for signs of corrosion with the metal frame.

Figure 6-9 Grounding illustration



2. After establishing a safe working condition, open each battery Elementa door individually.
3. Visually inspect all grounding and bonding wires for proper placement and check the connection to the Elementa metal frame for signs of corrosion.
 - Doors bonding.
 - Module bonding.
 - HVB bonding.
4. Visually inspect all cables and connectors for signs of damage or water ingress.
5. Visually inspect the DC connectors on the battery Module and HVB to ensure that all connections are secure and free of corrosion.
6. Visually inspect the Module MSD are firmly installed and the black handle is locked.
7. In case of abnormalities:
 - Record the location of the abnormality.
 - Cut off the AC and DC power from the system as described in Section 6.3 of this manual and perform all appropriate LOTO procedures to create safe working conditions.

- Firmly re-secure or replace the grounding cable and the associated hardware if necessary.
 - Perform continuity ground check to verify $< 0.1 \text{ m}\Omega$ of resistance.
 - Restore the system to normal operation.
- Figure 6-10 Module MSD latched



8. Paint maintenance:

- Regular cleaning of the surface for removing dirt and impurities on the surface, preventing them from damaging the paintwork. Use mild detergent and soft bristle brush and avoid using rough materials or brushes scratching the paintwork.
- Repair scratches and breaks in time in that scratches and broken paint surfaces are susceptible to rust and corrosion. If you find scratches or breakage, repair them in time to prevent rust from spreading. Use a suitable paint refinishing pen or seek professional paint repair services.
- Prevent the paintwork from exposure to chemicals, such as gasoline, alcohol, detergents, and so on. These may damage the protective layer of the paintwork, leading to corrosion and fading.

6.4.3 Connections Inspection



- De-energization is to be completed by qualified operators.
- Multiple energy sources exist inside and outside of the Elementa which may require control based upon the work being performed.



Read and follow all arc flash labels on the equipment.



Voltage is present, risk of electric shock.

1. Establishing a safe working condition to access the Elementa internal components.
2. Check that there is no damage to the DC cables.
3. Verify the DC power wire terminal lug to DC bus bar torque using a torque wrench. Refer to the standard torque table.

Figure 6-11 Elementa bus bar DC power connection



4. Check that the Ethernet cable is properly connected and not damaged.
5. Check that there is no water infiltration.
6. In case of abnormalities:
 - Document the abnormality and its location.
 - Replace any damaged components.
 - Bring the system back to regular operation.

6.5 Distribution Box Inspection



Voltage is present, risk of electric shock.

1. After establishing a safe working condition, open the Elementa LVP door, which is the last door on the right side of the Elementa.
2. Visually check for water stagnation, dirt, and corrosion on components.
3. Use the trigger button to activate all the mini-breakers from the load to the main LVP circuit breaker.



Before the cycle, all mini-breakers properly shut down the chiller and BMS.

4. In case of abnormalities:

- Record the location of the abnormality.
- Cut off the AC and DC power from the system as described in the installation manual and perform all appropriate LOTO procedures to create safe working conditions.
- Replace any damaged components.
- Remove and clean any debris within the LVP with a cloth suitable for electrical equipment
- Bring the system back online.

6.6 Mechanical enclosure inspection

6.6.1 Exterior Visual Inspection

1. Inspect the outside of the enclosure for damage, corrosion, debris, or other aspects that may impede the proper functioning of the Elementa.
2. Carefully clean and prepare the surface to be coated using an adequate locally acquired color-matched paint to protect the damaged area.

6.6.2 Interior Visual Inspection

Inspect the interior of the enclosure for leaks, pest intrusion, condensation, or dust and debris.

6.6.3 Door Function Check

1. Check the doors can open and close properly.
2. Check the door seals are intact and show no signs of leakage. If the seals show signs of leakage, replace them with an adequate outdoor-rated weatherproofing seal.
3. Check the lock and handle mechanisms work properly. If the lock or handle device is rusted or has mechanical friction, apply a small amount of lubricant to the affected area.
4. Check the door grounding strap is intact.

6.7 FSS Inspection



- Testing of the Fire Suppression System and ventilation system must be done with appropriate isolation measures in place to ensure that accidental discharge of the extinguishing agent is avoided.
- In preparation for performing any maintenance work on the FSS and ventilation, follow the de-energization procedures before allowing trained personnel to approach the equipment.



- Voltage is present when accessing the LVP and/or battery compartment, risk of electric shock.

The service provider shall verify by signature on the inspection form that the below inspection result has been collected and that the Elementa plant has not changed from that identified in the design record file.

Deficiencies found during inspections shall be recorded and remediated as soon as possible.

6.7.1 Fire Alarm Control Panel and Aerosol Canisters

The Fire Alarm Control Panel is the main logic controller for the Fire Suppression and Ventilation System located behind the last door of the Elementa.

Refer to the Fire Alarm Control Panel (FACP) and the Aerosol Canister Manuals provided by the manufacturers for detailed instructions on disarmament, tests, and maintenance procedures.

6.7.1.1 FACP

Annual Inspections

The manufacturer recommended annual maintenance of the FACP is limited to the following.

- Cleaning the external cabinet and door - Clean the FACP enclosure and door with a damp cloth, do not use detergents or solvents to clean these surfaces, and ensure that no water enters the cabinet during cleaning.
- Release system - Test the release system periodically to verify its operation. Tests should be performed with proper containment to prevent accidental release. Testing of the release system must be performed by trained personnel.

The battery backup is checked annually to determine if its connection to the FACP is intact. The FACP contains sealed lead-acid batteries to provide backup power in the event of a power failure. If the battery backup fails, the following steps should be followed to replace the battery backup:

- Disconnect the jumper cables between the backup batteries.
- Disconnect the red wire from the positive terminal of one backup battery.
- Disconnect the black wire from the negative terminal of the other battery backup.
- Remove the backup battery from the bottom of the FACP cabinet.
- Recycle the backup battery according to the manufacturer's instructions.
- When the Elementa Cabinets needs to be stored for an extended period (exceeding 5 days) in an ambient temperature below -20°C, the FACP and UPS batteries (lead-acid) must be removed and stored separately. The storage ambient temperature should be maintained above 0°C. The batteries should be reinstalled when the Elementa Cabinets is powered on for debugging.

6.7.1.2 Aerosol

Monthly inspection:

- Check all electrical connections to ensure that the Aerosol Fire Extinguishing Device will function properly in the event of a fire.

- Perform a complete visual inspection of all Aerosol Fire Suppression Units for damaged or missing parts.
- Ensure that the Aerosol Fire Fighting Device is not obstructed and meets the required spacing.

Annual Inspection:

- Conduct a general visual inspection of all aerosol fire extinguishing devices for damage or missing parts.
- Ensure that access to hazardous areas, exits, and disconnect switches are unobstructed and that there are no obstructions to the proper operation of the extinguishing device or to the distribution of aerosols in the event of a fire.
- Inspect the aerosol fire extinguishing device for physical damage such as cracks, dents, deformation or corrosion.
- Inspect the mounting bracket and associated hardware for loose, damaged, or broken parts. Replace damaged parts and tighten any loose hardware.
- Inspect disconnect switches outside of protected area for damage, cracks, dirt, or distortion. Replace as necessary.
- Check all electrical connections and test for electrical continuity with an ohmmeter. Repair and replace as necessary.
- Ensure that the generator is not obstructed and that the required clearances are met.

6.7.2 Smoke and Heat Detectors

Bi-Annual Inspection:

Check and confirm the smoke and heat detector LEDs are flashing.

Annual Inspection:

- Verify that the detectors are functioning properly by using a smoke gun and temperature gun in accordance with the smoke detector and temperature detector manuals.
- If smoke is not above the preset alarm value, the indicator light flashes; if smoke is above the preset alarm value, the indicator light stays on and the fire alarm controller generates an alarm and triggers the alarm.
- If the temperature is not above the preset alarm value, the indicator light flashes. If the temperature is above the preset alarm value, the indicator light will be on continuously and the fire alarm controller will generate an alarm and trigger the alarm.

6.7.3 Ventilation and Gas Detector

Bi-Annual Inspection of the ventilation system is necessary and shall be conducted if the Elementa plant has not changed since the last inspection (i.e. more batteries added, the ventilation system has changed, sensors have been added, etc.) and the ventilation system remains installed following this manual.

The following steps need to be followed.

- Check the ventilation components (including installation layout) are free of corrosion, tampering, paint/coating (or other means of blocking) or mechanical damage.
- Check the ventilation system has not been falsely activated.
- Check the ventilation control unit circuit monitoring system should have no grounding fault and be in the "normal state".
- Test the combustible gas sensor using standard gases according to the Combustible Gas Sensor manual and calibrate the sensor if necessary.
- System interlocks, notifications, and sequence of operation are verified for functioning following the FSS Design Drawings with the AC auxiliary power removed from the FSS (QF11).
- Check the ventilation component serial numbers are verified as the same as those recorded during the last inspection.
- If the staff member on-site confirms the fire risks and need for aerosol release, they can press the 'Release' button on FACP and the aerosol release will enter the pre-release phase directly.

6.8 Chiller



- When preparing for the maintenance of the chiller, the power-off procedure should be followed.
- The capacitors in the chiller will continue to discharge after the power is removed. To ensure personal safety, wait at least ten (10) minutes after the unit is powered off before performing maintenance operations.



Voltage may be present when accessing the chiller.

For specific instructions on performing maintenance operations, refer to the liquid Chiller user manual.

6.8.1 HMI Check

Check the Chiller's HMI manual controller for any alarms or fault indications. If there are specific reported alarms or faults, please refer to the chiller user manual promptly.

6.8.2 Fan Inspection

Before turning off the chiller, listen for abnormal fan noise.

Perform the relevant maintenance according to Section 6.3.1 of the chiller user manual.

Inspect the fan and coil for dust and debris. Clean with a brush and spray with mild soap and water if necessary. Tighten any loose fasteners that are found during inspection.

6.8.3 Breakers, Power Cables, and Terminals

Cycle all mini breakers of the chiller panel once.

Use the HMI to shut down the chiller as described in the chiller unit user manual, and perform the relevant maintenance according to Section 6.3.2.

Visually inspect the power cables and terminal wiring for dust, dirt, and debris.

Clean with a dry brush and compressed air.

Visually inspect the power cables and terminal wiring for damage or signs of abnormal heating.

Replace any damaged cables.

Visually inspect the power cables and terminal wiring for any loose connections. Tighten any loose connections that are found during inspection.

6.8.4 Condenser

Use the HMI to shut down the chiller as described in the chiller unit user manual, and perform the relevant maintenance according to Section 6.3.5.

Visually inspect that the condenser coil is free from dust, debris, or foreign matter. To clean the coil, use compressed air to carefully remove the dust and debris. Optionally, a liquid cleaner specifically designed for HVAC coils may be used.

Visually inspect that the condenser coil fins are not damaged or deformed.

6.8.5 Expansion Tank

Check the coolant to verify the PH value is within the permitted specifications.

Check the coolant to verify the concentration is within the permitted specifications.

Verify that the coolant level is within the operation range. If the coolant is low, add the proper mixture as specified in the chiller User Manual

Drain extra coolant if it has fallen out of the permitted specifications.

To replace the coolant:

1. Shut down the chiller unit by using the HMI as described in the chiller user manual and power off the chiller.
2. Open the drain valve to drain the coolant and close the valve when complete.



DANGER

Do not allow coolant to drain onto the ground.

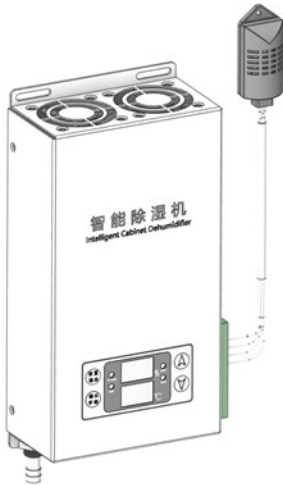
-
3. Remove and replace the Y-type filter for cleaning and replacement
 4. Refill the coolant to 190 liters. Check the PH, concentration, and coolant level.
 5. Restart the chiller
 6. Follow local requirements for disposal of the waste coolant.

6.8.6 Dehumidifier

Visually inspect condensate drain tubes to verify the tubes are free and clear of any dust, dirt, or debris. If the tubes are blocked, clear them with compressed air.

Clean all debris out of the outlet drain of each Elementa. Mild soap and water may be used. Ensure free drainage.

Figure 6-12 Dehumidifier drain



6.8.7 Thermal Imaging



Proper PPE should be applied before and during thermal scan.

Thermal imaging should be performed every five (5) years, on the connections listed in the table below, immediately following the annual capacity test.

Scan each Elementa and report any temperature condition that is outside the average values.

Ensure a safe working environment before performing the thermal scan.

Table 6-1 Thermal imaging connection list

Item
Battery module
HVB
DC connectors
Elementa internal DC bus bar terminal lug connections

6.9 Notification

Special attention should be paid to the following quality risks if the product is not powered on for a long time or maintenance is not carried out according to the user manual:

Cabinet Structure:

If dehumidifiers and the air conditioner are not activated inside the cabinet, condensation may form in the cabinet, posing a threat of corrosion to auxiliary materials, fasteners, and the cabinet floor.

Thermal Management System:

Liquid cooling chiller: The electrical performance of components such as the compressor and water

pump may be affected by long-term power disconnection.

Air conditioner: The electrical performance of components such as the compressor and motor may be affected by long-term power disconnection.

Dehumidifier: The drainage pipe is prone to clogging due to long-term disconnection, while the fan is susceptible to dust accumulation and fouling. Internal pipelines may also experience corrosion due to the high temperature and humidity of the project site.

FSS:

FACP supported by the standby power for a long time will affect the life span of the backup battery.

Cell:

When the cabinet is in disconnection for a long time, the main risk comes from the self-discharge of the cell. In order to ensure the safety and performance of the cabinet, the following measures should be taken:

Before the cabinet is in disconnection for a long time, ensure that the SOC of the cabinet remains above 25%.

Regular access to auxiliary power supply (recommended once a month), and check the voltage status of cells inside the cabinet through BMS.

Electric:

The UPS battery needs to be recharged, and the life span will be affected by the low temperature.

The SPD will fail due to long-term power disconnection.

Electrical parts may experience corrosion due to the high temperature and humidity of the project site.

BMS:

If the BMS is not used for a long time, the SOC calculation will be inaccurate due to the cell self-discharge voltage shift. Later, circulating current and voltage difference will exist while charge and discharge.

In the high temperature and humidity project sites, if the dehumidifier isn't activated, BMS connector harness interface will experience corrosion. In this way, it may cause voltage sampling failure, temperature sampling failure and sudden change faults.

7 System Balancing and SOC Calibration

7.1 System Balancing

Battery cells will vary slightly in internal resistance and self-discharge based on several factors. These include manufacturing variability, aging, temperature distribution, etc.

This leads to a situation where cells within a rack could operate at slightly different voltages and this matters because one of the protection functions of cells in a system is to prevent overcharge above a given cell voltage.

If a single cell within a rack is slightly higher, it will prevent charging of the remaining cells, thus limiting capacity in the rack or system of racks. A similar situation exists for undervoltage where a cell voltage is below the other cells.

Cell balancing will correct this phenomenon using circuits that connect a parasitic load to an individual cell to correct for these imbalances.

Balancing is triggered automatically when the following conditions are met.

1. The average cell voltage reported in a rack is greater than 3.3V
2. the difference between the lowest cell voltage and highest cell voltage within a rack is $> 30\text{mV}$.
3. There are no reported faults in the system.

Attention

System balancing will also be evaluated and managed during regular service intervals by the O&M service Partner if this is not Trina Storage.

7.2 SOC Calibration

Due to the flatness of the LFP cell OCV curve, calibration can only be implemented under certain conditions where the cell voltages can be measured most accurately. This typically limits the operational areas for calibration to either the top of charge or bottom of the discharge where the cell voltages have clearer granularity.

The calculation result of SoC during the operation of the battery system is correlated with the depth of charge/discharge, the ambient temperature, humidity, number of cycles, and SoH of the cells

Generally, the calibration should trigger automatically when the system gets to the extreme SoC regions (i.e. top and bottom of charge), but because of the shallow charging or discharging of the Elementa in real project applications, this will not always activate. Therefore, to avoid significant deviation of the voltage reading during the operation of the Elementa, it is recommended to carry out manual SOC calibration periodically (defined according to specific project application).

The detailed steps are as follows:

1. Each rack should be discharged at full power until the cell voltage reaches level 1 step discharge voltage and BMS limits the discharge power to 80% of rated power.

2. Continue to discharge at 80% of rated power until the cell voltage reaches level 2 step discharge voltage, and BMS limits the discharge power to 50% of rated power.
3. Continue to discharge at 50% of rated power until the cell voltage reaches the cut-off voltage, and BMS limits the discharge power to 0, at which point BMS automatically recalibrates SOC.
4. Then, each rack should be charged at full power, until the cell voltage reaches level 1 step charge voltage and BMS limits the charge power to 80% of rated power.
5. Continue to charge at 80% of rated power until the cell voltage reaches the level 2 step charge voltage, and BMS limits the charge power to 50% of rated power.
6. Continue to discharge at 50% of rated power until the cell voltage reaches the cut-off voltage, and BMS limits the charge power to 0, at which point BMS automatically recalibrates SOC.

Attention:

- The above Level 1 and Level 2 alarm thresholds are fine-tuned according to the specific project application.
- The regular calibration interval will also be adjusted according to the operation of the site with the general recommendation being once a month.

8 Equipment Troubleshooting



Before opening any door of the Elementa, ensure safe condition inside using either the manual gas sampling port or the onboard combustible gas sensor.



Wear proper PPE during the troubleshooting procedures, per the equipment's arc flash labels.



In preparation for performing any troubleshooting work, identify the zone the work will be performed in, identify the proper LOTO provisions, and follow the de-energization procedures.



Opening any battery Module or HVB will void its warranty and is not part of any troubleshooting procedure.

8.1 Module Troubleshooting

If a module is suspected of malfunctioning for whatever reason, including abnormal operational parameters being reported by the BMS or a short circuit situation, follow the de-energization process before accessing the Elementa then follow the below steps:

1. Disconnect the DC wire between each module in a particular rack.
2. Using a digital multimeter (DMM), measure the resistance value of each DC wire. Verify the value of each DC jumper is " $< 0.1 \text{ m}\Omega$ ".
3. If a DC wire is outside the allowable value, replace the defective DC wire, begin a system restart procedure, and document the actions.
4. If all the DC wires are found to be in good condition, then contact Trina Storage for further investigation and troubleshooting.

8.2 High Voltage Box Troubleshooting

If one HVB is suspected of malfunctioning for whatever reason, including abnormal operational parameters being reported by the BMS or a short circuit situation, follow the de-energization process before accessing the Elementa then follow the below steps:

1. Disconnect both DC jumpers.
2. Using a digital multimeter (DMM), measure the resistance value of each DC jumper. Verify the

value of each DC jumper is " $< 0.1 \text{ m}\Omega$ ".

3. If a DC jumper is outside the allowable value, replace the defective DC jumper, begin a system restart procedure, and document the actions.
4. If the DC jumpers are found to be in good condition, then contact Trina Storage for further investigation and troubleshooting.

9 Emergency Response Plan



DANGER

- Do not attempt to approach the equipment at any time in the event of a hazardous condition.
- The specific site-level Emergency Response Plan must be followed in all situations. Below is only a general guideline.

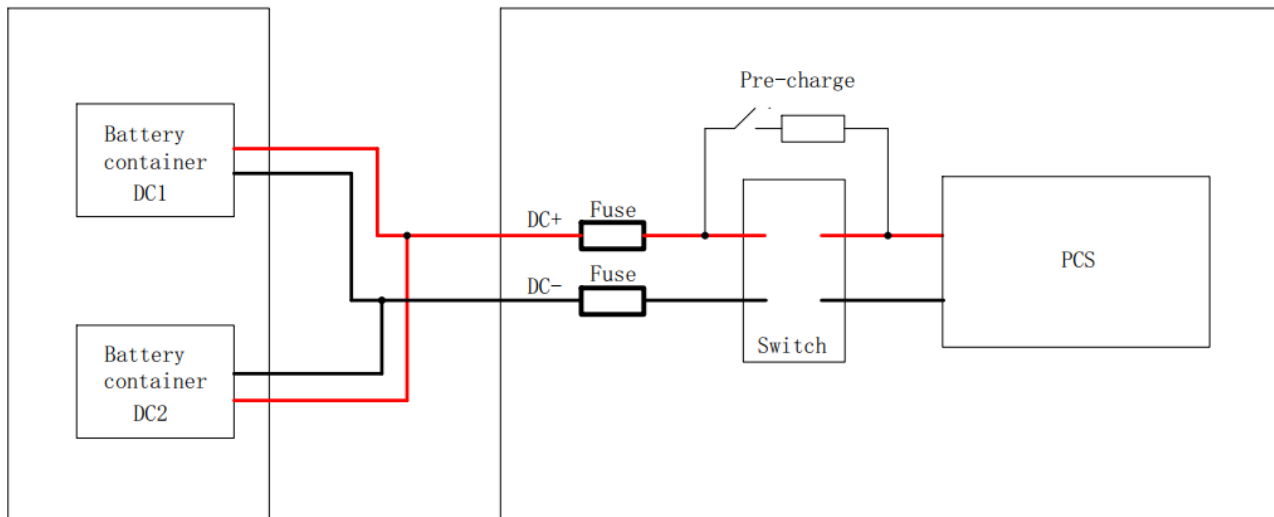
In the event of smoke, fire, activated alarms, explosions, or other hazardous situations, contact the local emergency authorities and Trina Storage AFTER evacuating the site.

If there is smoke or a burning smell coming from the equipment during the operation, maintenance or troubleshooting, back away from the equipment immediately and notify the local emergency authority and Trina Storage.

If any part of the system interior has become accessible (i.e., door open) and you do not see LOTO equipment, back away from the equipment and notify the site leader.

10 PCS Requirements

Figure 10-1 PCS matching



If DC1 and DC2 are connected to different PCS, please ensure that the two PCS run synchronously.

Please make sure to use one single copper busbar for two parallel battery cabinets cable connection for positive or negative pole in PCS side.

Please make sure to use fuse(F) for DC circuit in PCS. The fuse breaking time in PCS should be less than the breaking time of fuse in battery cabinet when short circuit occurs.

Please make sure PCS have pre-charge circuit.

Please make sure the PCS has a main circuit switch on the DC side .

One PCS can match up to 3 battery cabinets.

PCS should have insulation monitor device. BMS monitor the insulation of DC bus before battery DC relay is closed. PCS monitor the insulation of DC bus after battery DC relay is closed.

PCS should have residual current device to monitor the leakage current on AC side.

When the cell is in a low SOC state after discharge, the grid cannot charge the cell in time and needs short-term storage. In this scenario, it is necessary to ensure that PCS is disconnected from the cell to prevent the cell from being over discharged.

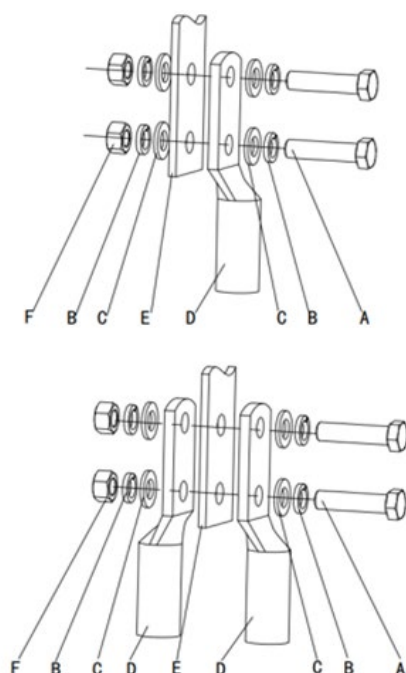
11 Appendix

11.1 Standard Torque Table

Table 11-1 Standard torque table

NO.	Name	Thread diameter	pitch	Performance grade torque value (N-M)8.8
1	Bolts	M3	0.7	0.8 to 1.2
2		M4	0.7	2 to 3
3		M5	0.8	5 to 6
4		M6	1	8 to 9
5	Nuts	M8	1.25	21 to 25
6	Screws	M10	1.5	34 to 36
7		M12	1.75	73 to 89
8		M14	2	100 to 105

Figure 11-1 Typical fastener assembly for compression lugs



A	hex head bolt
B	spring washer
C	flat washer
D	Terminal
E	Busbar
F	nut

11.2 Tool List

Table 11-2 Tool list

Type	Item
General tools	Electrical Insulated Torque Wrenches with a range of 0.8 to 105 N-M
	Electrical Insulated Ratchet Wrenches
	Electrical Insulated Sockets 8mm thru 22mm
	Electrical Insulated Philips Screw Drivers
	Electrical Insulated Flat Head Screw Drivers
	Multi Meter (Rated up 2000VDC)
	LOTO Locks
Special tools	Gas Sensor calibration and bump test gases
	SOC-24V test magnet
	Fire Test Gun
	Electronic Encoder
Chiller tools	Ethylene Glycol Ph Meter
	Ethylene Glycol Refractometer
	Filling Kit
	HVAC Condenser coil cleaning solution
	Compressor and air nozzle
	Diagonal Pliers
	For other installation tools, see section 3.1.1 of the chiller user manual.
	For other debugging tools, see section 4.1 of the chiller user manual.
Module	Field Module Disassembly and Assembly Tool (Optional)

This tool list is for reference only, and installation tools will be provided by EPC.