PV Based Rapid Electric Vehicle Charging Station with Energy Storage at PLUS Ayer Keroh R&R Jejantas (South Bound)

Final Report and As Built Drawings

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Project Overview

This is a project on the installation of PV-based electric vehicle charging station with energy storage system in Malaysia, funded by United Nation Industrial Development Organisation (UNIDO) under the project entitled “Energy Efficient Low Carbon Transport” in Malaysia.

Background

In line with the need for more sustainable and greener transportation, the electrification of transport is an inevitable trend. It is anticipated that electric drive train will soon replace conventional internal combustion engine (ICE) as the main propulsion system in automobiles. As a matter of fact, several major car makers have announced their commitments towards the development of hybrid and full electric vehicles in replacement of their gasoline and diesel models. Volvo, for instance, has announced that they will only make electric vehicles from 2019 onwards. In terms of governments, Norwegian government has decided that the new cars sold from 2025 onwards shall be only electric or hybrid cars, while the French and the British government have pledged to ban the sale of new gasoline and diesel cars by 2040.

One of the key hurdler to the increase penetration of electric vehicles is undoubtedly the charging infrastructure. Given the limitation of the existing battery technology, electric vehicles nowadays still possesses limited driving mileage that generate “mileage anxiety” among electrical car users. To alleviate this issue and encourage electric vehicle ownership, a high proliferation of electric car chargers as well as the use of fast charging technology are of paramount importance. Currently, there are three levels of EV charging: Level 1,

It is worth highlighting that the use of electric vehicle itself is neither green, nor contribute to carbon footprint reduction, if the energy used to charge the vehicle is still derived from conventional power grid dominated by fossil fuel power plants. Instead of being so-called “zero emission” vehicles, electric cars in such scenario are at best “else-where emission” vehicles. In this light of this fact, the use of electric vehicle should be coupled with the use of renewable energy resources, such as solar, wind, biomass etc., such that overall carbon emission can be reduced.

Under the National Electric Mobility Blueprint (NEMB), Malaysia government is aspired to drive the number of electric vehicles to 100,000 electric cars, 100,000 electric two-wheelers and 2,000 electric buses, as well as to increase the number of charging stations to 125,000 by the year 2020. In accordance to this, the Energy Efficient Low Carbon Transport program is formulated to support the NEMB through policy and regulatory framework improvement as well as the development and demonstration of EV infrastructure and local EV manufacturing capacity. As part of the Energy Efficient Low Carbon Transport program, this project serves as a demonstration project for DC fast charger technology with integrated energy storage system (lithium battery) powered by solar energy. By extracting the solar energy through photovoltaic panels and storing it in lithium battery, the implemented system ensures that the power used for EV charging is green and clean.

Aim of the Project

The immediate target of this project is to have a working PV-Battery based Rapid EV Charger at R&R Ayer Keroh, Melaka (KM210 North-south Highway, Southbound; 2°23’52.9’’N + 102°13’19.9’’E)

This set up is a flagship set-up whereby aesthetic value, quality and corporate identity have to be in-line to the overall project objectives. This unit establishment is expected to be operational by end October. Future locations will be configured similarly or with minor modification upon completion of this first flagship site and incorporating key learning points from this site.

Installed System

Overview

The overview of the installed system is shown in Fig. xx

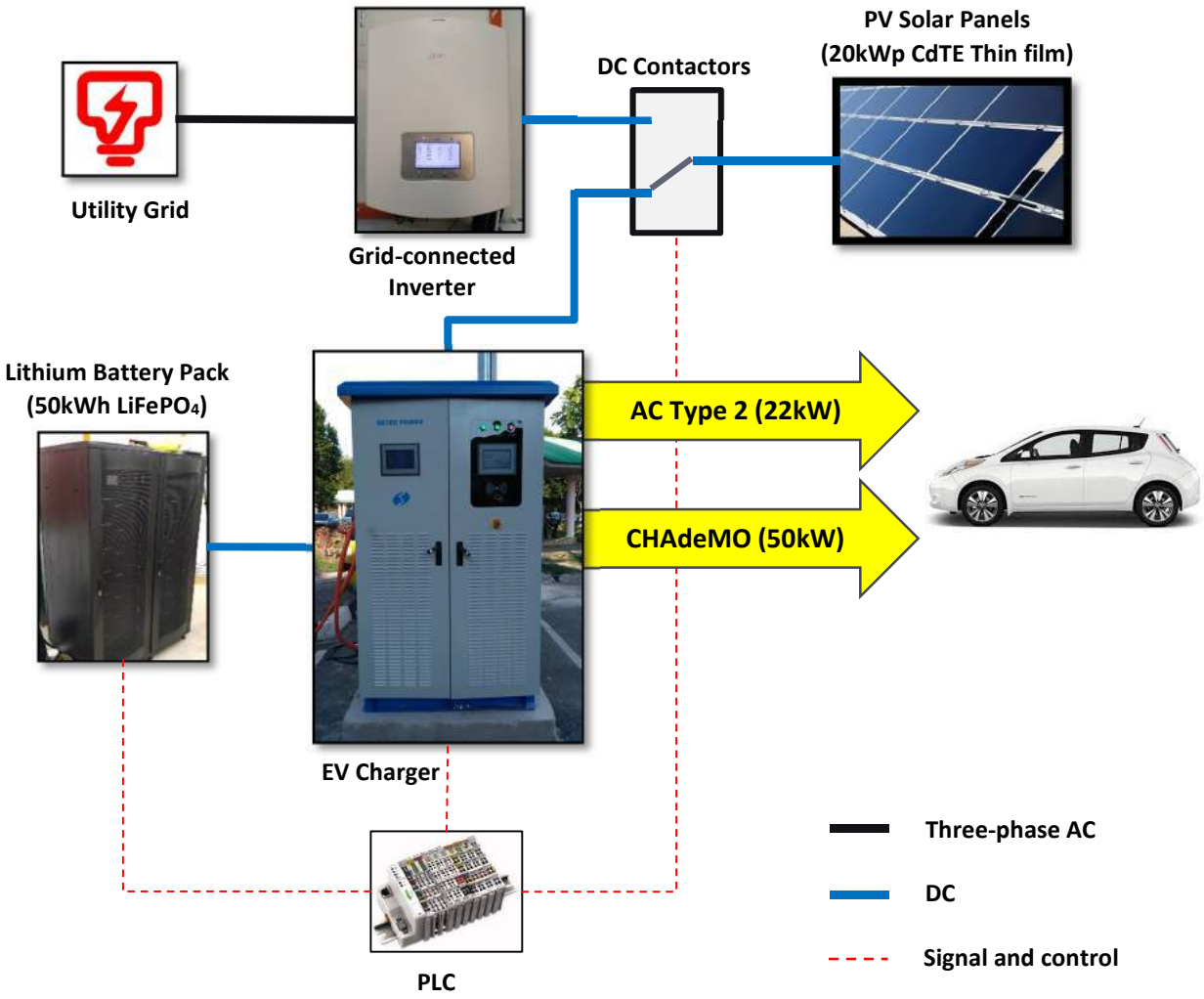

Figure 1 Overview of the components in the installed PV-based EV charger with energy storage system

The implemented EV Charger System consist of the following features:

1) **Integrated System**
   with PV panels, energy storage system (Lithium battery pack) and AC grid power supply.
   Able to operate in both standalone (primary) mode and grid-connected (secondary) mode.
   Intgerated with Energy Management System (EMS) and allows online realtime monitoring of the system parameters.

2) **Dual Charger outputs**
   Provides EV two charging outputs:
   (1) AC type 2 (22kW) charger
   (2) CHAdeMo (50kW) DC fast charger

3) **Fully Standalone Mode**
   In standalone mode of operation, EV charger draws power from the battery which is charged using the PV panels (with maximum power point tracking, MPPT charger). The system operates in fully standalone mode, i.e. without the need for grid power supply, such that it will be able to operate in the absence of grid supply.

4) **Maximized PV Power Usage**
   When battery is almost full, the power from PV panels will be injected to the grid via a PV grid-tied inverter.
   This will help to reduce power consumption of the R&R facility from TNB.

5) **Backup Grid-connected Mode**
   If the battery is almost depleted, the system will transit into grid-connect mode, such that EV charger draws power from the grid.
   This will avoid extreme discharging of the battery, prolonging battery life.

Main System Components

PV Solar Panels

A total of 176 pieces of CdTE Thin film PV panels from First Solar are installed with a total power of 20,240W or 20.24kWp. Each of the PV panel has a Wp of 115W. The panel technology and type is chosen as per stated in the TOR.

The detailed specifications of the PV panel is attached in the appendix:

The panels are divided into three strings: the first string contains 8 parallel substrings with 8 series connected panels in each substring, while the second and third strings contain 8 parallel substring with 7 series connected panels in each substring.

When connected to the EV charger, the three strings are connected in parallel; when operating with the grid-connected inverter, each string is connected to separate DC input of the inverter to maximize power extraction.

Grid-connected Inverter

In the installed system, Solis 20kW inverter is used as the grid-connected inverter. It has 4 MPPT inputs of 18A each. The detailed specifications of the inverter is in the appendix:

Under default mode of operation, i.e. in Standalone Mode, the PV panels are not connected to the Solis inverter, and the inverter is not in operation. When the battery is almost fully charged, the PLC will control the DC contactors to disconnect the PV panels from the EV charger, and redirect the PV panels to the Solis inverter. The inverter will then inject power to the grid to reduce net energy consumed by the R&R facilities from the utility grid.

Figure 2: Solis grid-connected inverter (right), DC contactors box (bottom left) and PV combiner box (top left) installed in the main switch board room at R&R Ayer Keroh.

EV Charger

The EV charger is customized version of the SETEC SET450-50kW charging station. The charger includes two charger ports: a 22kW AC type 2 charger and a 50kW CHAdeMO DC fast charger. By default, the EV charger will draw power from battery to charge the EVs. However, when the battery capacity is almost depleted, the EV charger can transit into grid-connected mode, where power will be drawn from utility grid instead of the battery for EV charging. While in this mode, the battery will continue to be charged by solar panel to replenish its capacity.

Figure 3 SETEC EV Charger

Lithium Battery Pack

In this project, Sichuan Changhong Lithium Iron Phosphate (LiFePO4) battery pack is used as the energy storage device to store energy from PV panel and then used for EV charging.

The specifications of the battery pack are as follows:

Ambient Temperature = - 30 deg C to 60 deg C
Relative Humidity (RH) = 5% - 95%
Nominal Voltage = 425.6V
Rated Capacity = 120Ah
Total Energy = 51.072kWh
Communication Mode = CAN2.0B

Figure 4 Lithium Iron Phosphate (LiFESO4) 50kWh battery pack.

Energy Management System (EMS)

An energy management system has been integrated into the installed EV charger system to allow online monitoring and recording of the system parameters.

The EMS consists of:

1. Two RDM digital power meter
   To measure the electrical parameters, particularly power consumed from the utility grid (during grid-connected operation of the EV charger) and the power injected to the grid by the Solis inverter.
2. Wago 750-837 controller module (PLC)
   To perform control to the EV charger system based on the battery SOC.
   To extract system parameters from Solis inverter, battery pack, and EV charger, and send to Data Manager for online monitoring and recording.
   Powered by uninterruptible power supply (UPS) to ensure continuity of operation during power outages.
3. One RDM Data Manager
   To read data from digital power meters and Wago controller module and process them for online monitoring and recording.
   To provide storage of data up to 6-12 months.
   Powered by uninterruptible power supply (UPS) to ensure continuity of operation during power outages.

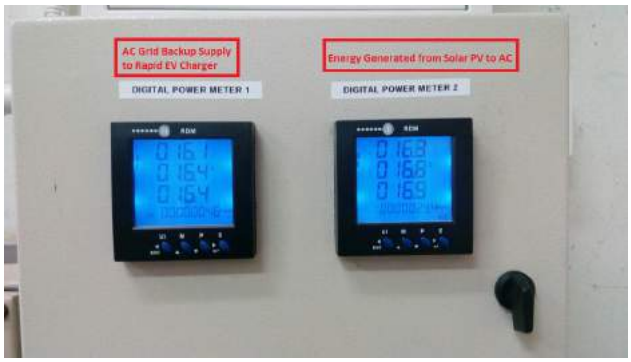

Figure 5 RDM digital power meters.

Figure 6 Wago controller module with power supplies.

Figure 7 RDM Data Manager.

Modes of Operation

A Programmable Logic Controller (PLC) is used to control the transition between different modes of operation., as shown in the Table 1 below:

Table 1: Modes of operation

Modes		Operation	Remarks
1	Standalone (default)	• Solar PV charges battery • Battery charges EVs	• Fully standalone • Solar energy is used for EV charging
2	Excess Solar Power	• Battery is almost full • Solar PV inject power to grid	• EV charger standalone • Excess power from PV reduces TNB bill for R&R
3	Grid-connected	• Battery is almost depleted • Grid power charges EVs	• Protects battery life • Allow EV charger to continue operate

The PLC reads the state of charger (SOC) of the battery pack and provide corresponding control signals to the EV charger unit and DC contactors to switch between different modes of operation

To avoid chattering effect, hysteresis switching is used. By default, the system will transit from Mode 1 (Standalone) to Mode 2 (Excess Solar Power) when the battery SOC rise above 95%. The system will stay in Mode 2 until the SOC drops below 85%, where it will transit back to Mode 1.

On the other hand, once the battery SOC drops below 5%, the system will transit from Mode 1 to Mode 3. The system will only return back to Mode 1, once the SOC rises above 30%.

Lesson Learned

Throughout the design and implementation of the PV-based EV charging station with energy storage system, there are some valuable lessons learned by the project team. It is hoped that by detailing these experiences and insights acquired from this project, future implementation of similar projects can be improved.

Solar Panels

For the 20kWp solar photovoltaic system, the project team used 115W solar thin firm panel manufactured by First Solar with a total of 176pcs equivalent to 20,240W or 20.24kWp. The panels required more care especially in handling and during installation compare to poly and mono crystalline panels because it is more fragile. During the installation, some of installers experienced slight electrocution while wiring up the plug and sockets of the panels.

During the wiring of the DC cables from the panels all the way to the electrical room, labelling of the positive and negative cables are essential. The solar panel array was designed in such a way that the open circuit voltage Voc and maximum power point voltage Vmp is around 500V-700V respectively. Furthermore, the panels were designed with 3 MPPT strings to the inverter. Each string consists of 7-8 panels. As built drawings and single line drawing of the PV system is enclosed in the appendix. Within this range, the solar charge controller in the charger is able to detect the range and charge the lithium ion battery. Furthermore, the DC protection devices can only withstand DC voltage up to 1000V. The designed and installation are done by SEDA qualified person assisted by certified wireman based on our Malaysia local standard and requirement. Based on 3 peak sun hours (PSH) daily, the 20kWp can produce around 60kWh electricity to the battery and also the AC grid.

EV Charger – DC Fast Charger

Designing the 50kW fast charger is another challenge faced by the project team. The charger consists of 2 charger ports: One is 50kW DC charger output using a CHAdeMO plug while the other output is a 22kW AC charger using a Type 2 socket. Since there different EVs in the market are using different AC charger, the choice of a suitable charger type is important.

The project team decided to use a Type 2 socket instead of a Type 2 nozzle plug to provide a universal socket not only for the Type 2 plug cars but it can also use to charge cars which are Type 1 socket. All owners need to bring their own T2-T1 or T2-T2 cables as practice and implemented in our local environment.

Energy Storage System

The battery installed in the electrical room is a 50kWh lithium Ion battery. The type of lithium ion used is Lithium iron phosphate (LiFePO4). If the battery is full, the charger will only take supply from the battery until the battery drops to 5%, it will switch to the AC grid. The reason, 5% capacity is selected is to increase the life span of the battery. Discharging the battery till zero will only reduce the lifespan. Once the battery charges the level back above 95%, the DC contactors will switch to AC grid mode where the excess energy will be channel to the common grid. Four units of ABB DC contactors were used for switching between the battery charging to the grid connected. The DC contactors withstand

up to 1000Vdc and 125A rating. The signal is connected through electrical 230V AC signal. A UPS is provided for signal power backup. The contactors are secured by mechanical and electrical interlock to prevent the both from switching on/off.

Integration with Existing Electrical Installation

To allow the EV charger to continue operating even when the battery is almost depleted, the EV charger was designed to operate in back-up grid-connected mode where it draws power from the existing electrical grid for EV charging. During the electrical installation, the project team found that the incoming isolator, which supplies power to the EV charger as well as other F&B outlets within the R&R facilities, is only rated at 160A. Since at full power, the charger is expected to draw 50kW power, equivalent to 126A, it was important to ensure that there is no risk of overcurrent.

For this, the energy logging for 2 days at the electrical room incoming supply was done, where the project team noticed each current phase usage varies from 80-180A. Therefore, the project team has decided to install a circuit breaker of 40A to limit drawing more than 40A current from the AC grid and for single phase charging, it will draw current from the yellow phase which is under utilisied. This is to prevent circuit breaker/isolator from overload tripping which will affect electrical supply to the F&B stalls. The project team recognised that this setting will limit the capability of the charger to deliver full power during back-up mode. For the time being, the AC grid back up mode is turn off to prevent unnecessary overload and power outage. We recommend client to do phase balancing for the time being and for future upgrade of the isolator, proper sizing of the cables should be made to mitigate this issue.

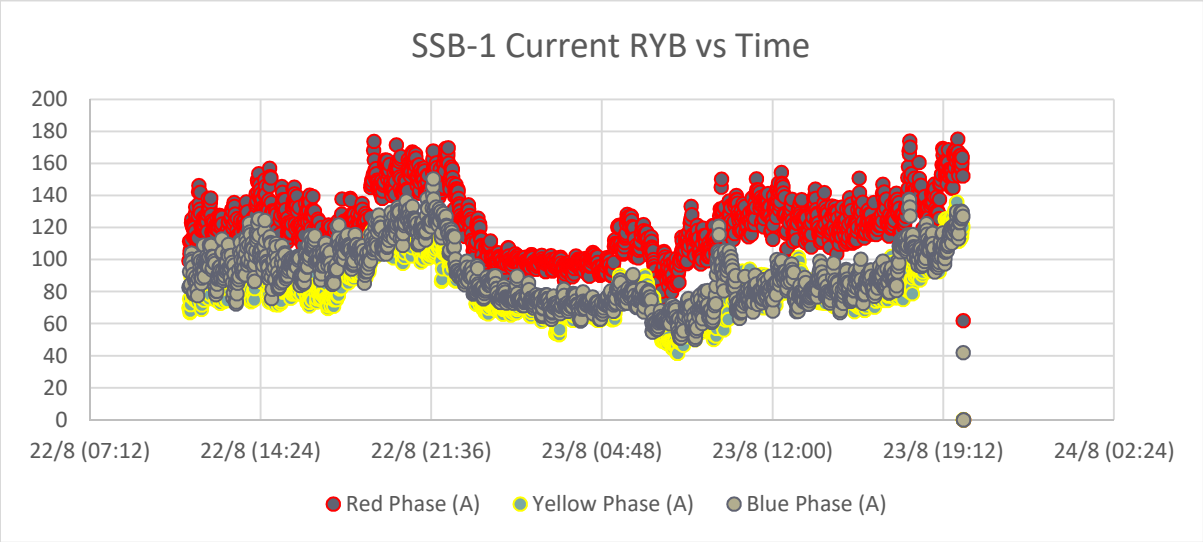

Figure 8 Logged three-phase current at SSB-1.

Digital Power Meter and Energy Management System (EMS)

Digital Power Meter (DPM) are installed for the Solar PV system supply (DPM 2) to the grid and also the AC grid supply to the charger (DPM 1). This is to enable PLUS to monitor the energy generated and use from the system installed. The DPM is connected to a Data Manager where the information is log and saved in the memory. The Data Manager is equipped with wireless sim module for internet connectivity and online monitoring of the parameters from the DPM, Battery Pack, EV charger and grid-connected inverter. The link is below

http://plusayerkeroh.sites.rdmsite.com/cgi-bin/cgi.cgi?Layout

Operation & Maintenance (O&M) Manual

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EV Charger System
Operation and Maintenance Manual

Prepared by
Light and Energy Solutions
September 2017

1. Safety Instructions

2. This manual contains important instructions for EV Charger that shall be followed during installation, operation and maintenance of the unit.

3. Read instructions carefully and become familiar with the equipment before attempting to install, operate, or maintain it. The following special messages may appear throughout this document or on the equipment to warn of potential hazards or to call attention to information that explains a procedure.

LOOK FOR THIS SYMBOL TO POINT OUT SAFETY PRECAUTIONS. IT MEANS: *BE ALERT—*

***YOUR SAFETY IS INVOLVED.* IF YOU DO NOT FOLLOW THESE SAFETY INSTRUCTIONS,**

INJURY OR PROPERTY DAMAGE CAN OCCUR.

READ FIRST: There is important safety information throughout this document.

Read this manual in its entirety before attempting any owner maintenance or trouble shooting.

QUALIFIED PERSONNEL: EV chargers must be installed, uninstalled and serviced by a qualified electrician in full compliance with all local and regional electric authorities.

This manual and its content do not in any way, relieve the reader of responsibility to follow local safety codes and standards.

ELECTRIC SHOCK! : EV chargers are fed by more than one 240VAC circuit breaker. The potential for lethal electrical shock exists. Service to internal parts of a charger may only be performed by a qualified technician.

DO NOT MODIFY: This charger should not be modified in any way. This will void the warranty, compromise protection and could result in a possible shock or fire hazard.

DANGER : To reduce the risk of fire or electric shock, carefully read and follow these important safety and operating instructions before installing or operating the charger.

DANGER: Risk of electric shock. Disconnect charger from EV and ac power before servicing. Turning off the charger does not reduce this risk.

DANGER: Do not touch un-insulated parts of the output connector.

A possibility of serious electrical shock exists.

DANGER: Do not operate the charger with damaged cable, including cables with exposed conductors or damaged connectors. Replace damaged cables before operation.

DANGER: Case of rain, must refrain from the use of a charger.

This a risk of electrical shock.

DANGER: Do not disassemble the charger. Have the charger examined by your dealer's qualified service technician. Incorrect re-assembly of the charger may result in an explosion, electric shock, or fire.

DANGER: Inlet area of vehicle and the charger connector in the wet state, the charger should not be used.

DANGER: Disconnect both AC and DC power from the charger before opening the case.

Contact with live components within the charger could cause electrical shock, serious injury, or death

DANGER: Install and ground the charger in accordance with the national electric code and your local electric code. Failure to properly ground the charger could result in a fatal electric shock.

WARNING: Do not leave the charger unattended while charging.

WARNING: Do not allow water, moisture or foreign objects into the charger.

WARNING: Do not place the charger on or near a flammable object while in use. Keep away from carpets, cluttered workbenches, etc.

WARNING: Do not cover the air intake holes on the charger as this could cause the charger to overheat.

WARNING: Young children should be supervised to ensure that they do not play with the appliance.

WARNING: The user is responsible for conforming to all local and national electrical codes and standards applicable in the jurisdiction this equipment is installed in to.

WARNING: Do not connect or disconnect the plug while the charger on. Doing so will cause arching and burning of the connector resulting in charger damage or battery explosion.

WARNING: Do not operate the charger with the door open or with any panels removed.

WARNING: Do not operate the charger if it has been dropped, received a sharp blow, or otherwise damaged in any way. Call your service representative.

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WARNING:- Dusty environments may require more frequent maintenance to obtain maximum life and optimum performance.

NOTE

Keep the charging station in its original packaging during storage or transport to the installation site.

· Store in a clean, dry, enclosed area.

· Only unpack the charging station once it has been delivered to the installation site.

· **Do not install charging station in locations where it may be exposed to direct sunlight and inclement weather. Sheltered install is recommended.**

If the charging station is to be stored, keep it in its original packaging in an appropriate place:

· On dry base ground

· Sheltered from dust, inclement weather, and sunlight;

· storage temperature: -30°C to 70°C

· Humidity: 5–95%

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2. About the EV Charger

Thank you for purchasing this 50KW dual charger. We are sure you will be pleased with its performance and features. In order to ensure that you obtain the maximum from its operation, please read the following instructions carefully.

This EV charger system is a customised version of the SETEC SET450-50kW charging station and includes the following features:

i) Integrated operation with PV panels, energy storage system (battery) and AC grid power supply. Able to operate in both standalone (primary) mode and grid-connected (secondary) mode.
ii) Provides two charging outputs: one via the AC type 2 (22kW) charger and one via the CHAdeMo (50kW) DC Fast charger.
iii) In standalone mode of operation, EV charger draws power from the battery which is charged using the PV panels (with maximum power point tracking, MPPT charger).
iv) The system will transit into grid-connected mode once the battery has been depleted below a threshold state of charge (SOC) to protect the battery. EV charger will be able to continue operating but drawing power from the grid instead.
v) Transition between different modes of operation is done using control signals from PLC.

Please note that this charger has been designed to be used solely with electric vehicles. It should not be used for charging other types batteries.

3. RECEIVING THE CHARGER

Unpack the charger and examine it for shipping damage. In the event that shipping damage is found, report it as a claim with the freight company.

Check the charger nameplate against packing lists and purchase orders to verify receipt of proper equipment. If there are any discrepancies notify the shipper immediately.

All shipments leaving manufacturing have been carefully inspected. If a shipment arrives with the crating or packing damaged, have the carrier note the condition on the receipt. Check as soon as possible for concealed damage. If damage has occurred, notify and file a claim with the carrier at once. Do not return the unit to the shipper. Failure to follow this procedure may result in refusal by the carrier to honor any claims.

4. STORAGE

When the charger is stored prior to being installed and powered up, it must be stored indoors-in a clean and dry environment where the temperatures will remain within the range of 40 °C to 50 °C. The charger should be stored upright in the shipping wooden & carton that it was shipped in. This will help protect the charger from dust and abrasion. It should be stored in an area where it is not likely to be damaged. Do not stack anything on top of the charger.

5. GENERAL SPECIFICATIONS

Item		Specifications	Remark
AC Input	Rated voltage	400VAC	
	Voltage fluctuation range	400V +/- 10%	
	Number of phases	Three-phase + PE (4 cables)	
	Rated frequency	50 or 60 Hz	
	Frequency fluctuation range	+/- 5%	
	Input power factor	0.95 or more	In rated operation
	Input power	60kw or less	In rated operation
	Grounding detection	30mA	
	Harmonic current	Total 5% or less	
DC Output	Rated Output Capacity	50kw	
	Voltage variable range	50 to 500VDC	
	Output current	100ADC	
	Current variable range	0 to 100A	
	Ripple current	6.0Ap-p or less	
Structure	Degree of Protection IP	IP54	
	Ambient temperature	-20 ℃ ~ 50℃	
	Storage temperature	-30℃ ~ 70 ℃	
	Cubicle dimensions LxWxH	1730*600*660mm	
	Weight in kg	400KG	Include module/connector
OTHERS	Certification	CE/IEC 61851	
	Safety	Emergency stop	
	Vehicle connector	CHAdeMo/Combo2	
	Battery communication protocol	CAN / PLC	
	Management system	OCPP (optional)	

Mechanical

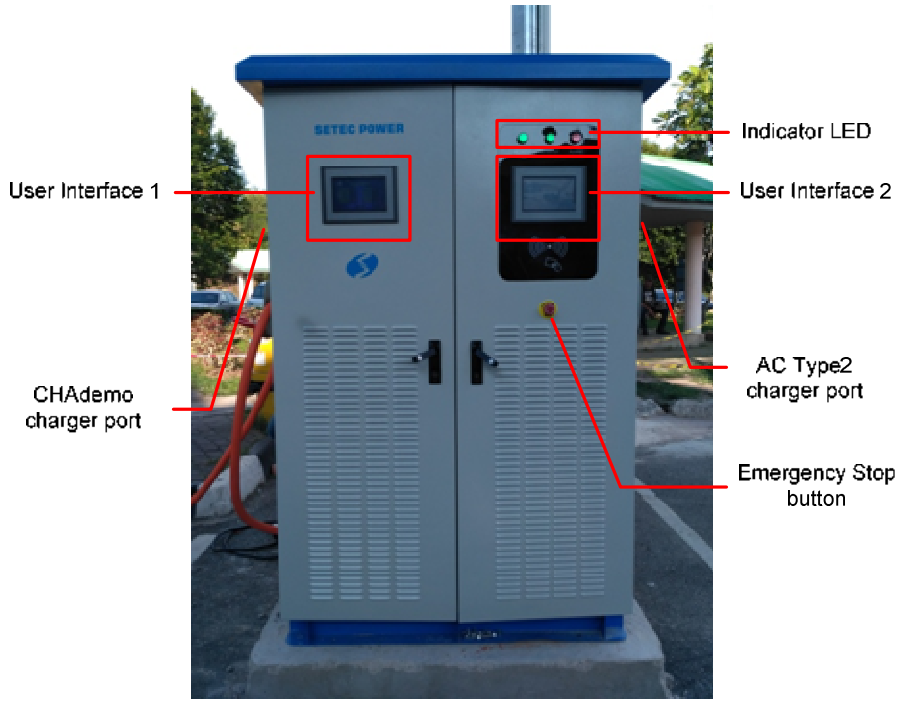


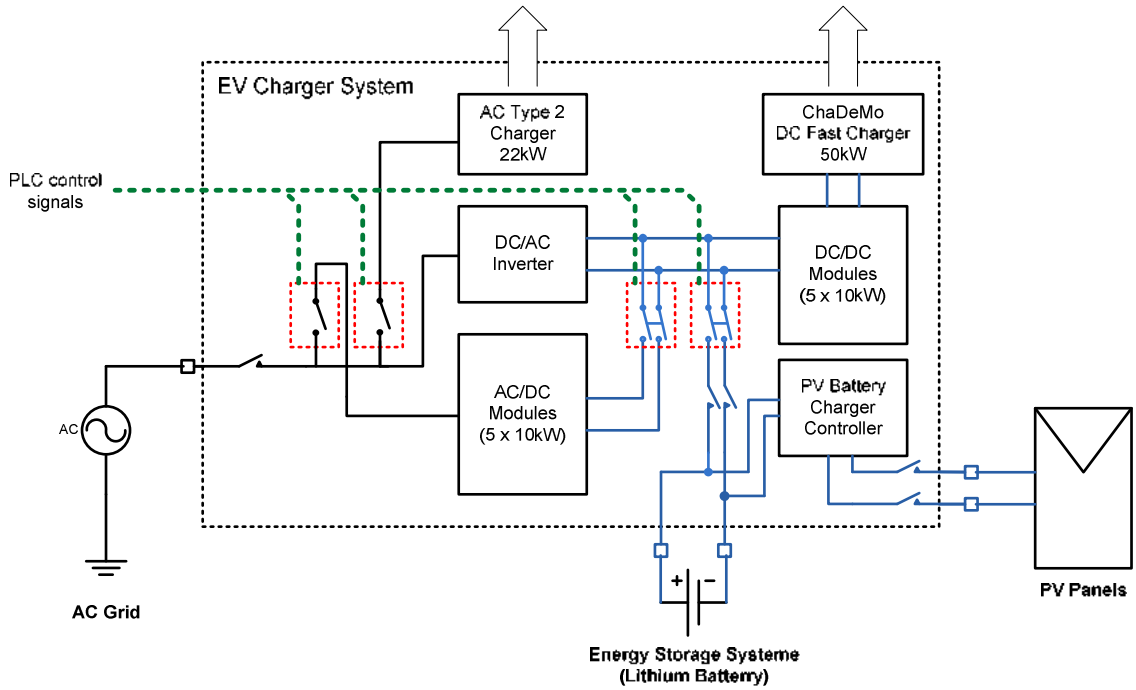
Figure above shows the front view of the EV charger system. The components and their functions are given in the table below:

Component	Function
User Interface 1	Touch screen user interface for controlling the supply power to the charger when operating in grid-connected mode
User Interface 2	Touch screen user interface for controlling the DC and AC EV charger outputs
Indicator LED	Indicate the operation of the charger system Left: AC on Middle: DC Charging Right: Fault
Emergency Stop Button	Press to stop the operation of the charger if there is any emergency
CHAdeMo charger port	Charger port for CHAdeMo (with charging cable and charging gun)
AC Type 2 charger port	Charger port for AC Type 2 (without charging cable and charging gun)

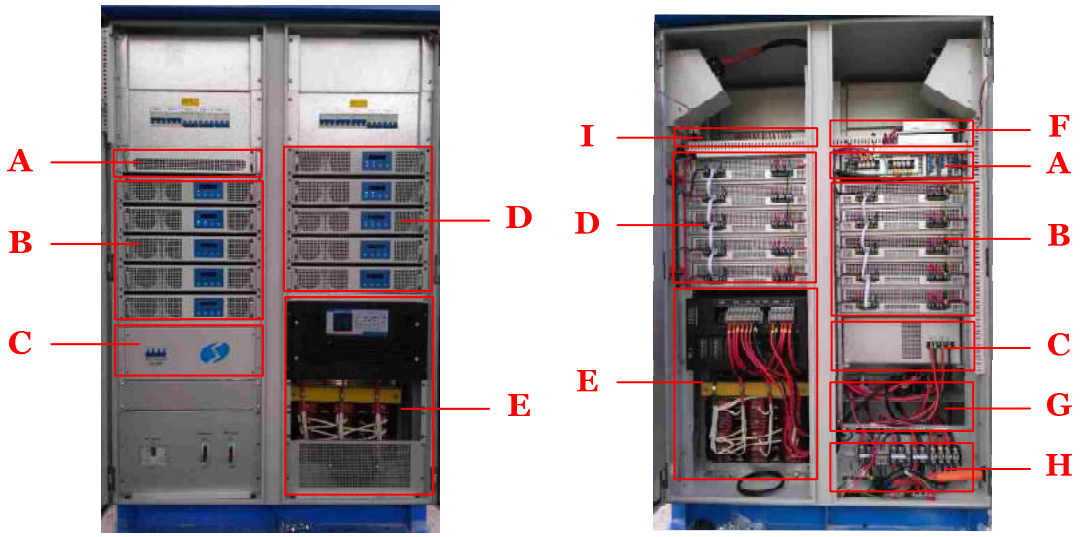
The charging ports are located on the two sides of the charger. When viewed from the front, the CHAdemo charger port is positioned on the left while the AC Type2 charger port is located on the right, as shown in the figure below.

Note that the charging cable for AC Type2 charger port is not provided with the charger.

Electrical - Subcomponents

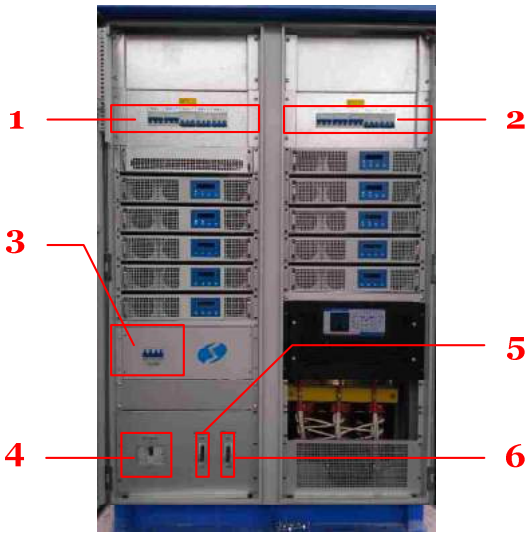


The EV Charger System consists of several main subcomponents as shown in the figure above. The AC (three-phase four wires) connections are given in black, DC connections are given in blue and the control signals (from PLC) are given in green.



The front and rear interior views of the EV charger are shown in figure above. The subcomponents of the charger and their functions are given in the table below:

Subsystem	Part	Function
A	AC Type2 Charger 22 kW	To provide charging for AC Type 2 charger
B	DC/DC Modules	To provide and control DC power for CHAdemo charger using DC power from battery
C	PV Battery Charger Controller	To charger the battery using PV panel (with maximum power point tracking MPPT)
D	AC/DC Modules	To provide and control DC power for CHAdemo charger using AC power from grid
E	DC/AC Inverter	To supply 220V AC power to the whole EV charger system
F	Auxiliary power supply	To take 220V AC power from E and supply 5V and 15V dc power supply to the whole EV charger
G	DC and AC contactors	To switch between different modes of operation
H	Wiring Terminal	To provide connections to the external components of the system (i.e. AC grid, PV panels, batteries and PLC)
I	Controller	To control the EV charger system and the user interface

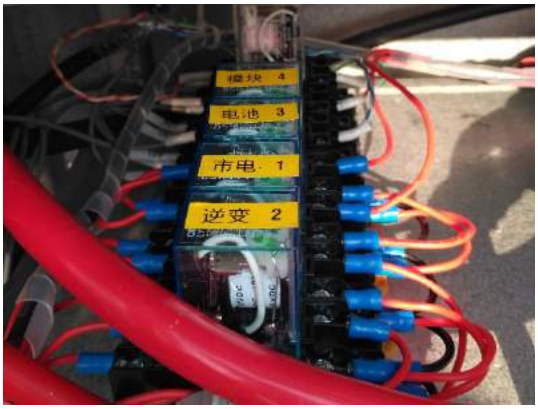


Several circuit breakers (MCCB) are used to connect/disconnect the external components to the charger system, and to provide/disconnect power supply to the subcomponents in the system. The functions of the circuit breakers are as follows:

MCCB	Function
1	Connect/disconnect the power supply to DC/DC Modules 1
2	Connect/disconnect the power supply to DC/DC Modules 2
3	Connect/disconnect the power supply to the PV Battery Charger
4	Connect/disconnect the AC grid to the charger system
5	Connect/disconnect the PV to the EV charger system
6	Connect/disconnect the Battery to the EV charger system

Operation between two modes

The EV charger system allows switching between standalone (battery powered) mode and grid-connected mode. This is done using 2 control signals from the PLC, used to drive 4 relays as shown in the figure:



Relay 1 and 2 each control a three-phase AC contactor, while relays 3 and 4 each control two DC contactors (for positive and negative rails). Relay 2 and Relay 3 are driven by PLC control signal 1 which is enabled during standalone mode; while Relay 1 and 4 are driven by PLC control signal 2, which is enabled during grid-connected mode.

By default, i.e. standalone mode, Relay 3 will drive the DC contactors to connect the battery to the DC bus supplying the DC/AC Inverter (E) and DC/DC Modules (B). At the same time, Relay 2 will connect the output of the DC/AC Inverter (E) to the AC Type 2 Charger (A).

In the event of low battery SOC, Relay 1 will connect the grid to the AC Type 2 Charger (A) directly. Relay 4 will drive the DC contactors to connect DC/DC Modules (D) to the DC bus to supply the DC/AC Inverter (E) and DC/DC Modules (B).

It is important that only one from each set of DC and AC contactors is switched on at any time. As protection, the Relays are wired in such a way that electrical interlock exists between Relay 1 & Relay 2, as well as between Relay 3 & Relay 4.

INSTALLATION

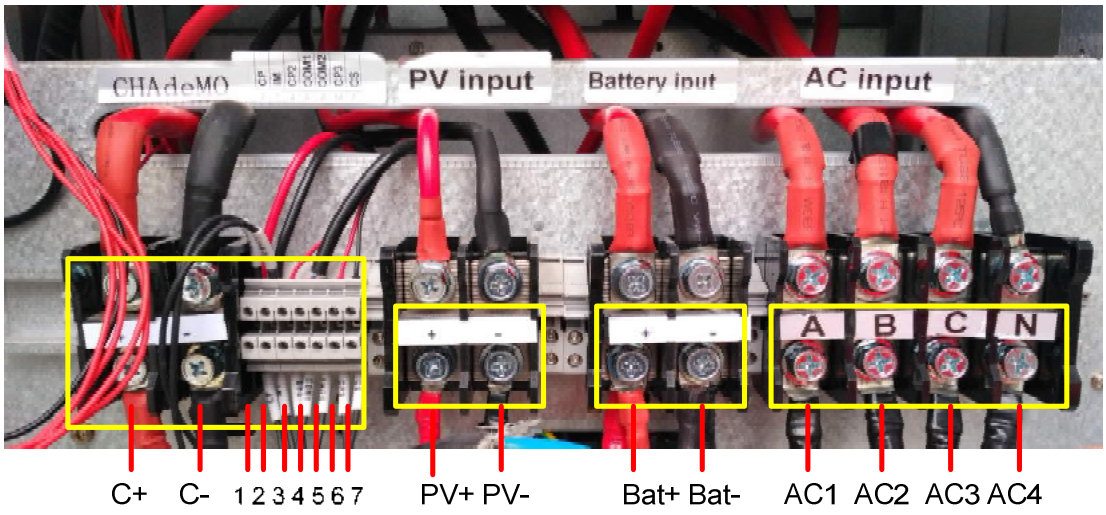
Location

① For the best operating conditions and longest life, take care in selecting an installation site.
② Operating life and performance will be influenced by charger location.
③ Select a dry and well-ventilated location.
④ Do not install charging station in locations where it may be exposed to direct sunlight and bad weather. It is recommended to install the charging station under shelter.
⑤ The front and the back of the charger must remain unobstructed for serviceability.

Installation Procedure

1 The cabinet must be fixed on a concrete base.
2 DC and AC input wiring on the base through the cabinet.

Wiring Instructions.



AC input: Three-phase four wires 400V/230V, 50Hz

Terminal	Connection
AC1	Phase 1
AC2	Phase 2
AC3	Phase 3
AC4	Neutral

CHAdeMo

Terminal	Connection
C+	CHAdeMo DC output (positive)
C-	CHAdeMo DC output (negative)
1	IM, grounding wire
2	CP, charger sequence signal 1
3	CP3, charger sequence signal 2
4	COM1, CAN-H EL-, Electromagnet & LED (negative)
5	COM2, CAN-L EL+, Electromagnet & LED (positive)
6	CP2, Vehicle charge permission
7	CS, Connector proximity detection

Battery Input

Terminal	Connection
Bat+	Battery positive terminal
Bat-	Battery negative terminal

PV Input

Terminal	Connection
PV+	PV positive terminal
PV-	PV negative terminal

Charging operation

⚠ TO PREVENT ELECTRICAL SHOCK, DO NOT TOUCH UNINSULATED PARTS OF THE CHARGER DC OUTPUTCONNECTOR, BATTERY CONNECTOR, OR BATTERY TERMINALS.MAKE SURE ALL ELECTRICAL CONNECTORS ARE IN GOOD WORKING CONDITION.

DO NOT USE CONNECTORS THAT ARE CRACKED, CORRODED, OR DO NOT MAKE ADEQUATE ELECTRICAL CONTACT. USE OF A DAMAGED OR DEFECTIVE CONNECTORMAY RESULT IN A RISK OF OVERHEATING OR ELECTRIC SHOCK.

Preparation

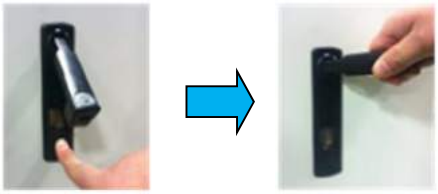
Make sure the charger has been installed according to the directions in this manual.

Failure to do so could result in personal injury and damage to the equipment.

Operation

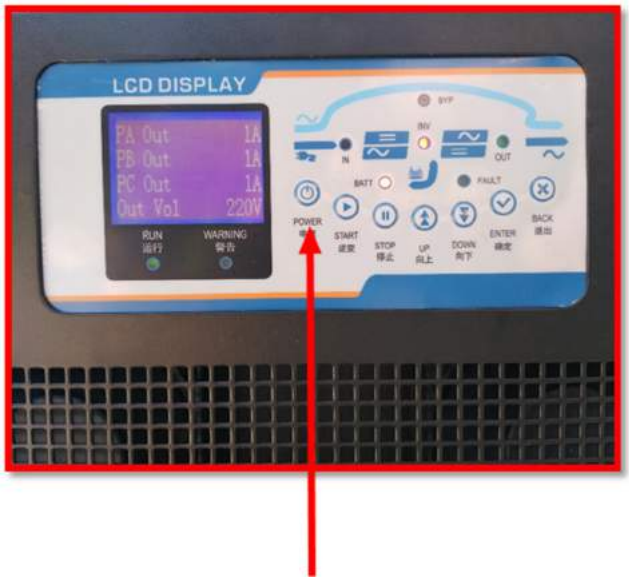
Before Charging

1. Open the front door
   - Unlock the door handle using key
   - Press button under handle and turn handle clockwise to open the door



2. Switch ON the main circuit breakers (MCCB 1 to 6)

3. Turn on the Inverter



- check whether the status LED for AC power is ON.
- check module status
- check screen is functioning

4. Close the door
   - If the above process is completed, make sure to close and lock the door before charging for safety.

Start charging

Step 1: Connect Charging Cable to the EV Charger

For EV charging using AC Type 2 charger, user need to use his/her own charger cable. Ensure that the charging cable is connected to the AC charger port of the EV charger.

NOTE: For EV Charging using CHAdeMo port, skip this step

Step 2: Connect Charging Gun to the EV

Connect the other end of the charger gun to the charging port on the vehicle

NOTE: location of charging port may differ for different vehicle.

Step 3: Select the charging connector

Select the connector (CHAdeMO or AC1) on the display accordingly.

Step 4: Start charging

Press the start button to start charging.

Screen and display information will change depending on the type of charger used.

Step 5: Stop charging

Charging will stop automatically once battery is full.

Press the “Stop” button if wish to stop charging before the battery is full.

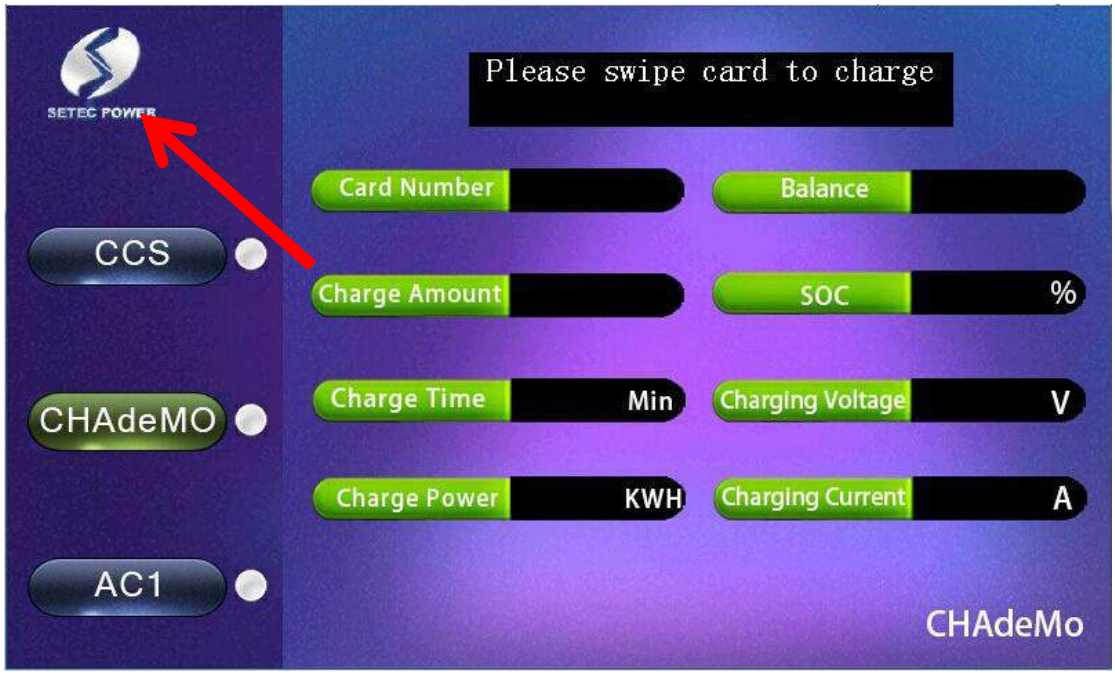
Setting

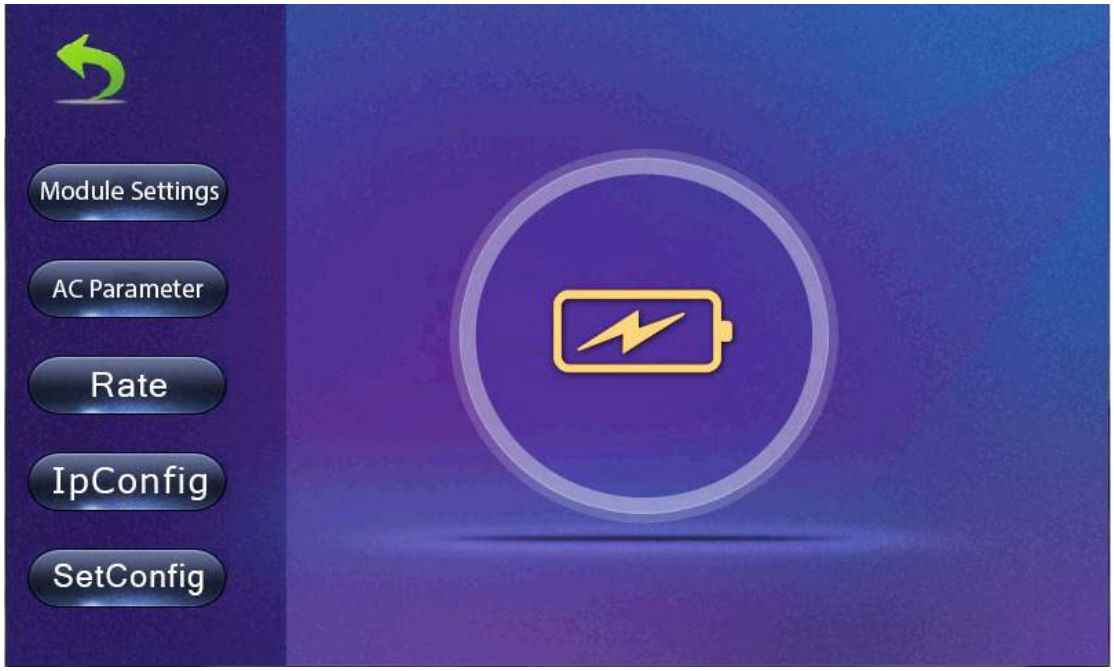
Operator can make settings to the EV charger which include: module settings, AC settings, rates, passwords and languages.

Setting interface

To access the setting menu, click on the SETEC POWER logo on the upper left corner of the user interface.

Enter the password (default is “123”) to enter the setting menu.





Module Settings

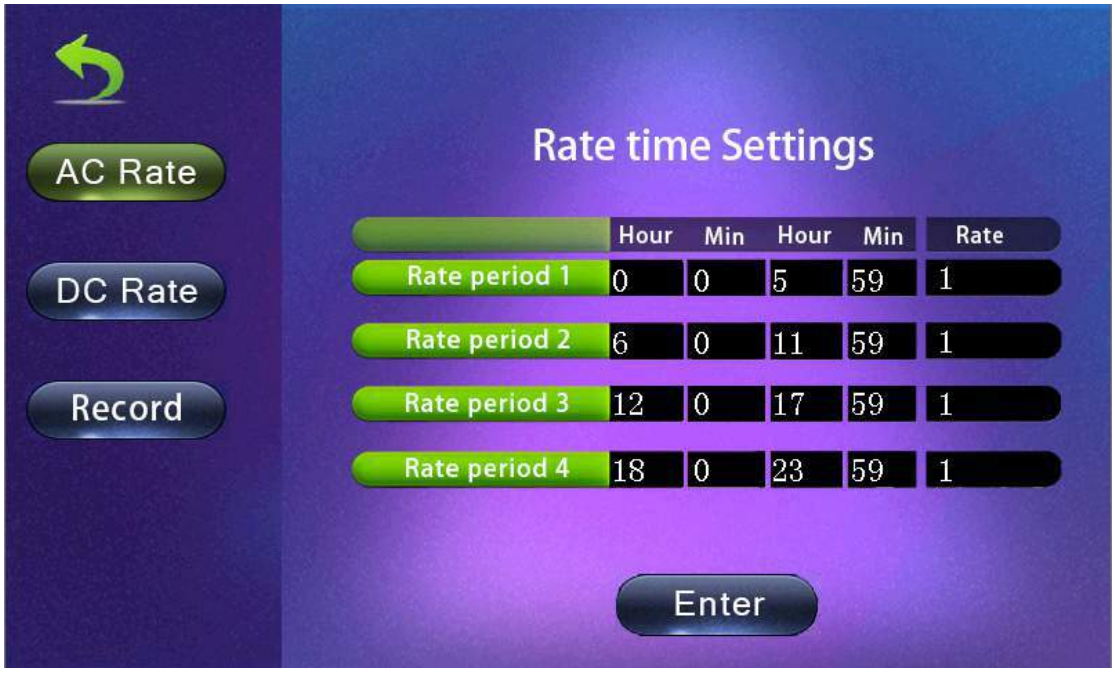
This provide settings for the DC/DC modules. Operator can set Max voltage, Min voltage, Max current and Number of modules.

Noted: Number of modules refers to the amount of modules which are switched on in the cabinet. Default value is 5.

Fig.4 AC Setting(50KW charger/AC charger optionoal)

Charging Rate (for Operator only)

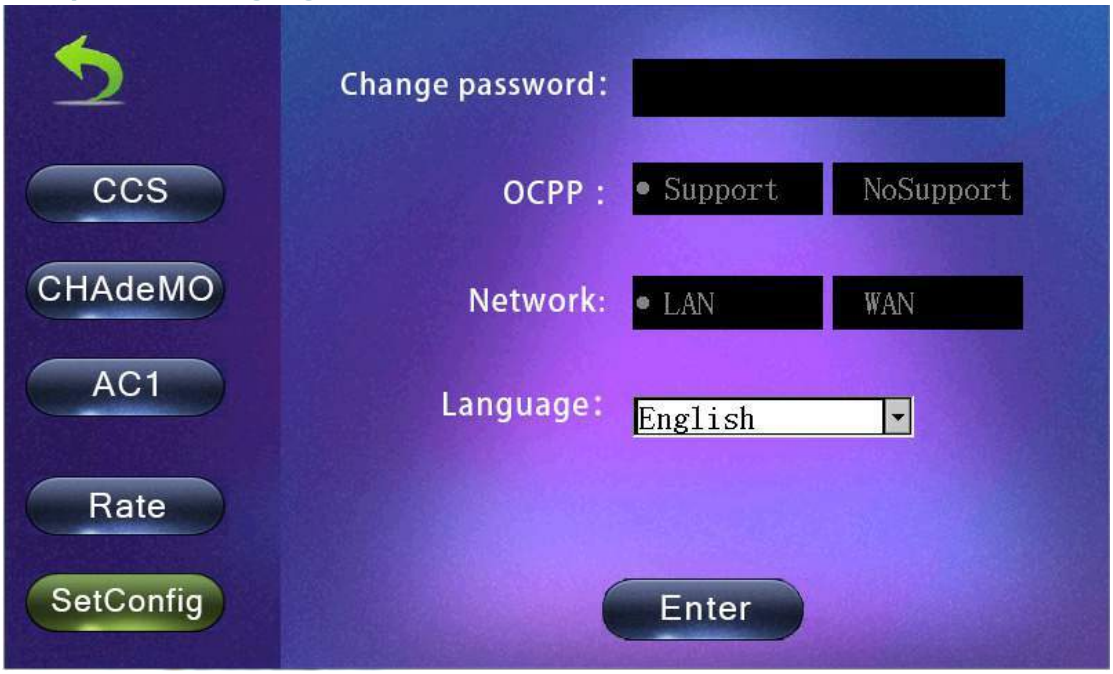
Click "Rate" button, different rates can be set for different time. (0 ~ 5:59) (6:00 ~ 11:59) (12:00 ~ 17:59) (18:00 ~ 23:59)



Record History

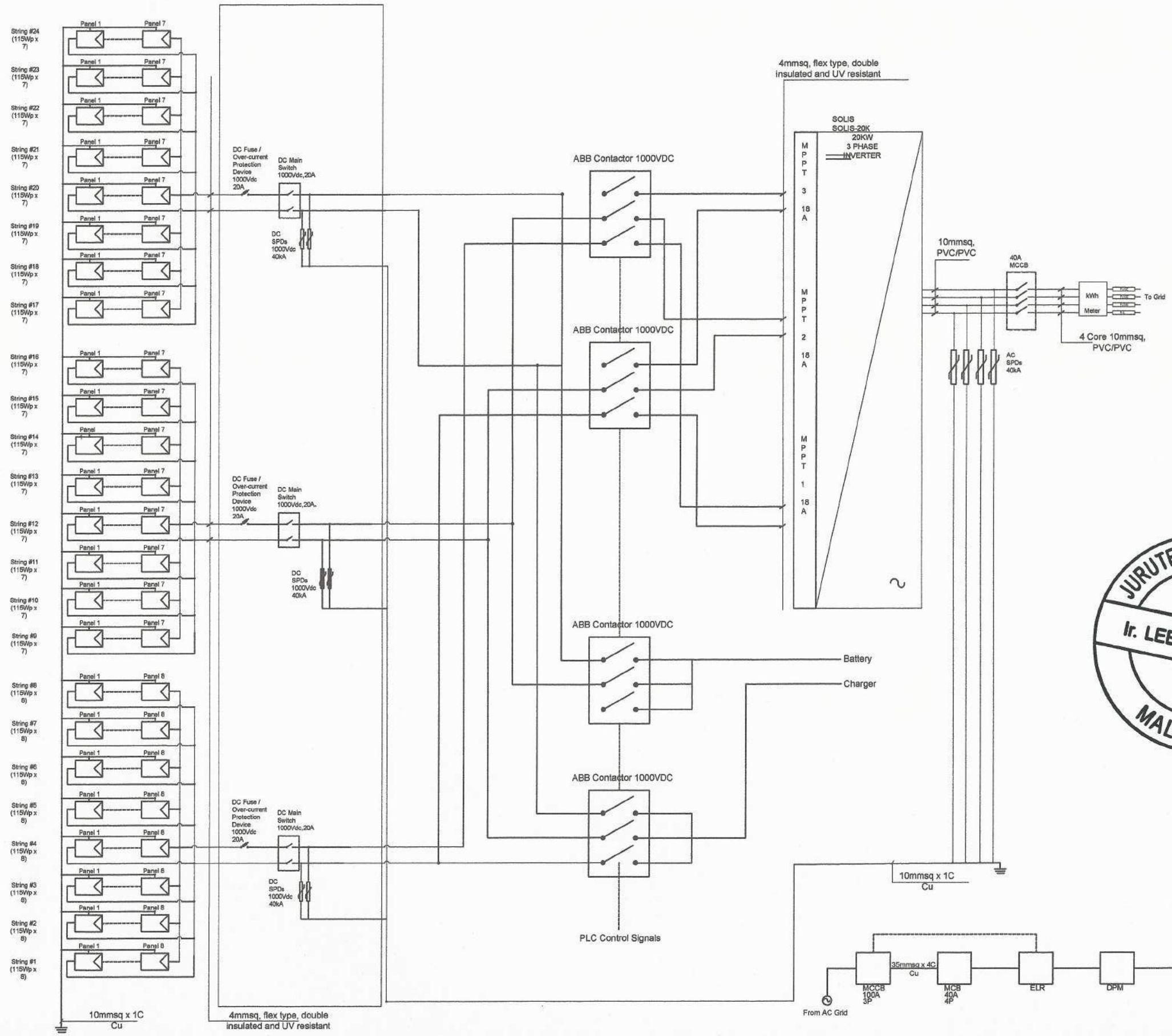
Noted: Maximum 4000 records. If the record is full, it will automatically delete 1000 records. It can export history file as CSV format.

Passport and Language



Electrical As Built and Shop Drawings with PE Endorsement

20KWP SINGLE LINE DIAGRAM FOR SOLAR PV SYSTEM



NOTE :

DATE	REVISION

LOCATION OF SITE/ INSTALLATION

PLUS R&R Jejantas Ayer Keroh, Melaka (KM210 Southbound)

EV SOLUTION PROVIDER

JURUTERA PROFESIONAL
ELEKTRIK
Ir. LEE YUEN HOW
16775
MALAYSIA

LIGHT AND ENERGY SOLUTION
Address: UNIT B716, BLOCK B, KELANA SQUARE
NO.17, JALAN SS7/26, KELANA JAYA
47301, PETALING JAYA, SELANGOR
TEL : 03-78872912
E-mail : derrickchin620@gmail.com

SCALE	DATE	DRAWN BY : DERRICK
N.T.S	SEP 2017	CHECKED BY : SYED
		APPROVED BY : Ir. LEE

DRAWING TITLE

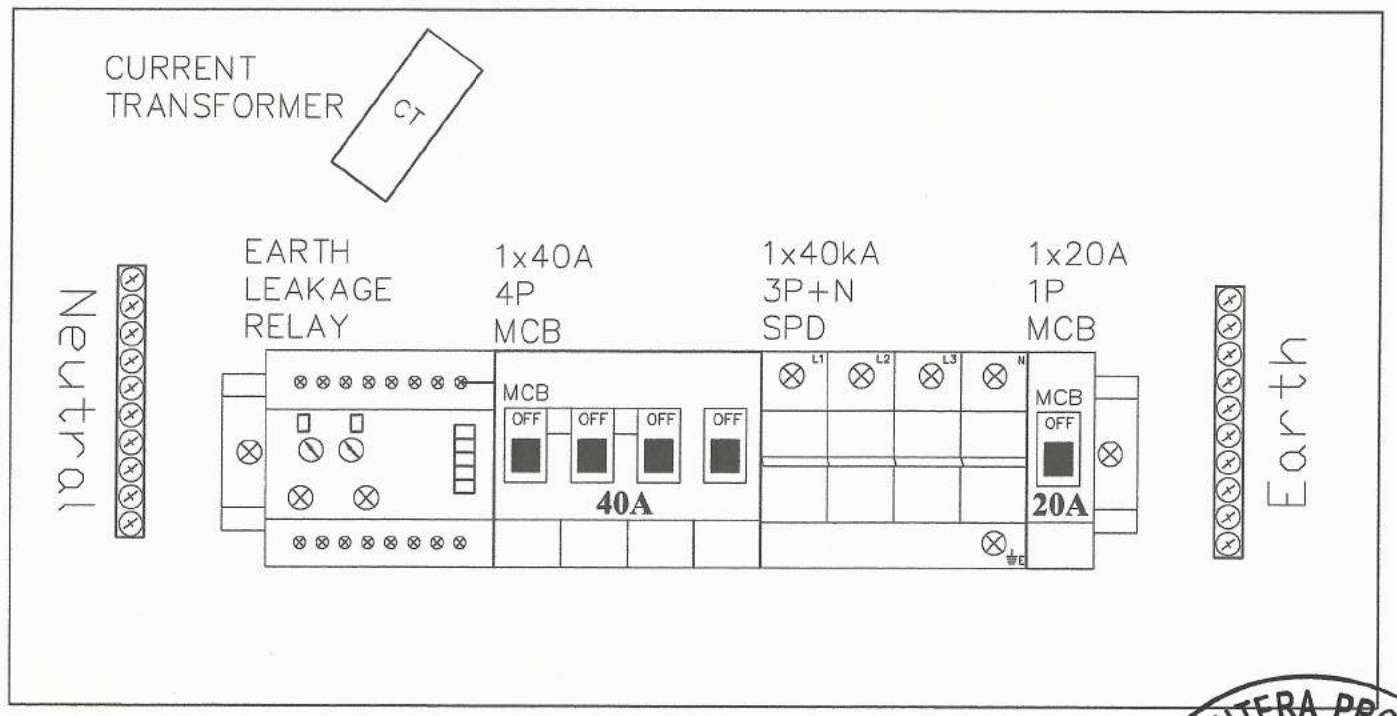
Installation of EV Charging Station
Energy Storage System and
Energy Management System integration.

DRAWING NO

L&ES/XEV/UNIDO/0003

SCALE DRAWING

DB Shop Drawing (DC CONTACTOR PANEL)



INTERNAL VIEW

NOTE :

DATE	REVISION

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PROJEK LEBUHRAYA USAHASAMA BHD
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KM 210 SOUTHBOUND,
MELAKA.

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E-MAIL : volve@lightandenergy.com.my

SCALE	DATE	DRAWN BY : ZAHRUDDIN
N.T.S	SEPT 2019	CHECKED BY : SHAMIR
		APPROVED BY : Ir. LEE

DRAWING TITLE
ELECTRICAL SYSTEM
PROJEK LEBUHRAYA USAHASAMA BHD
GROUND FLOOR PLAN
-ELECTRICAL LAYOUT PLAN
-SHOP DIAGRAM

DRAWING NO
L&ES/XEV/PLUSBHD/0004

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ELEKTRIK
Ir. LEE YUEN HOW
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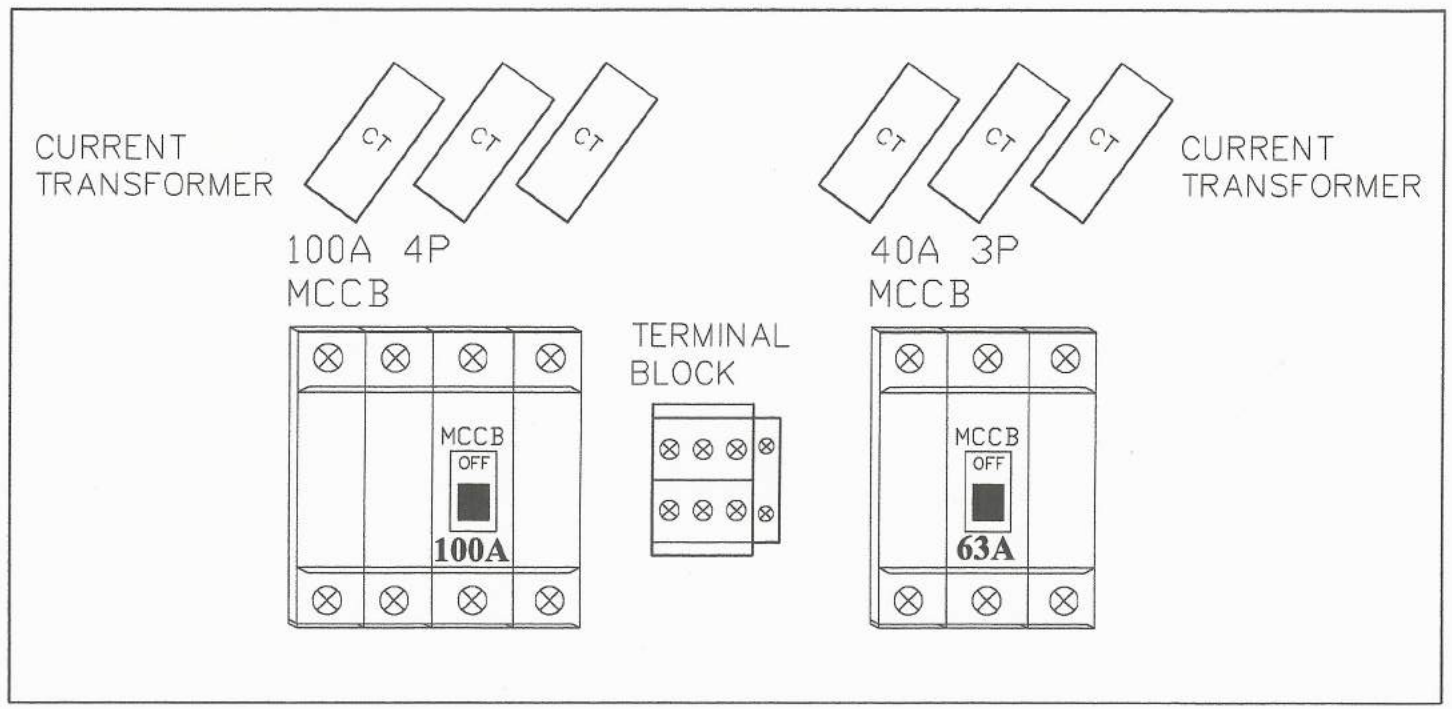
AS BUILT DRAWING

DB Shop Drawing (DB PANEL 1 (Internal View))



INTERNAL VIEW

NOTE :

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N.T.S	SEPT2019	CHECKED BY : SHAMIR
		APPROVED BY : Ir. LEE

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ELECTRICAL SYSTEM
PROJEK LEBUHRAYA USAHASAMA BHD
GROUND FLOOR PLAN
-ELECTRICAL LAYOUT PLAN
-SHOP DIAGRAM

DRAWING NO
L&ES/XEV/PLUSBHD/0003

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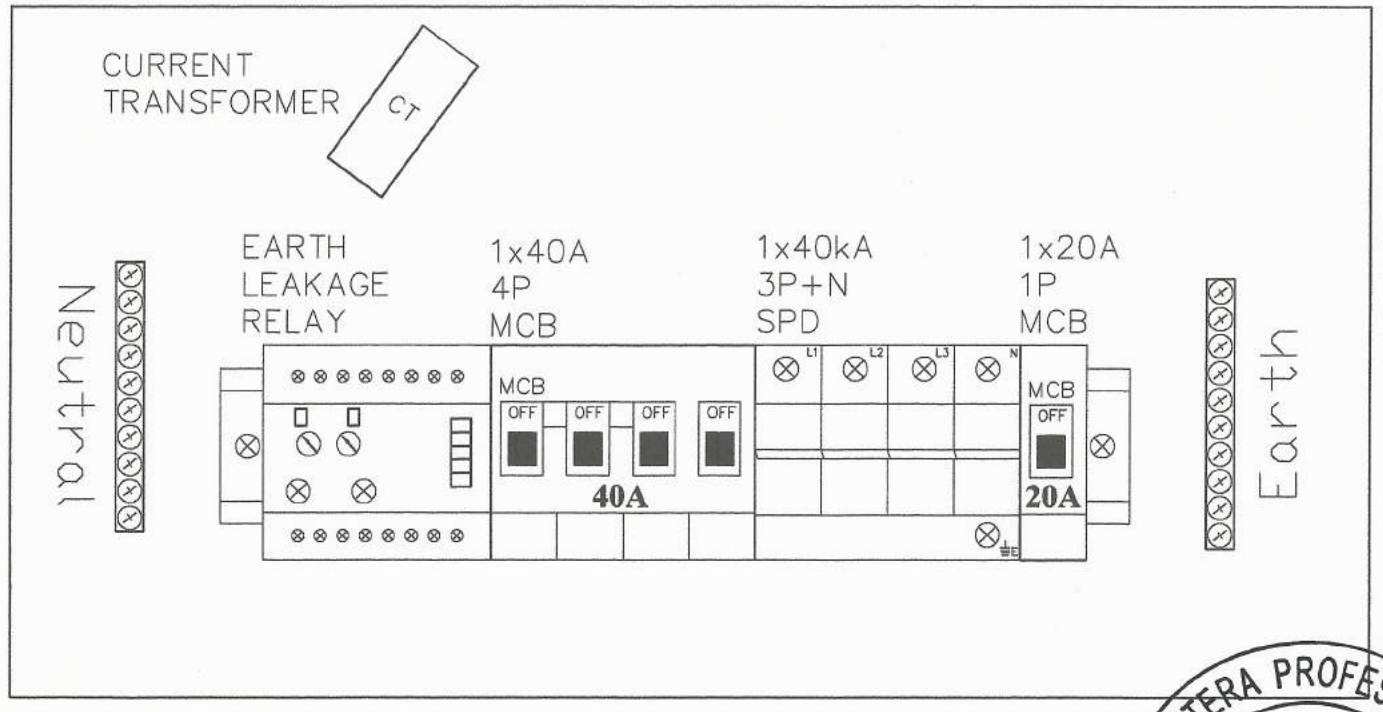
AS BUILT DRAWING

DB Shop Drawing (DC CONTACTOR PANEL)



INTERNAL VIEW

NOTE :

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		APPROVED BY : Ir. LEE

DRAWING TITLE
ELECTRICAL SYSTEM
PROJEK LEBUHRAYA USAHASAMA BHD
GROUND FLOOR PLAN
-ELECTRICAL LAYOUT PLAN
-SHOP DIAGRAM

DRAWING NO
L&ES/XEV/PLUSBHD/0004

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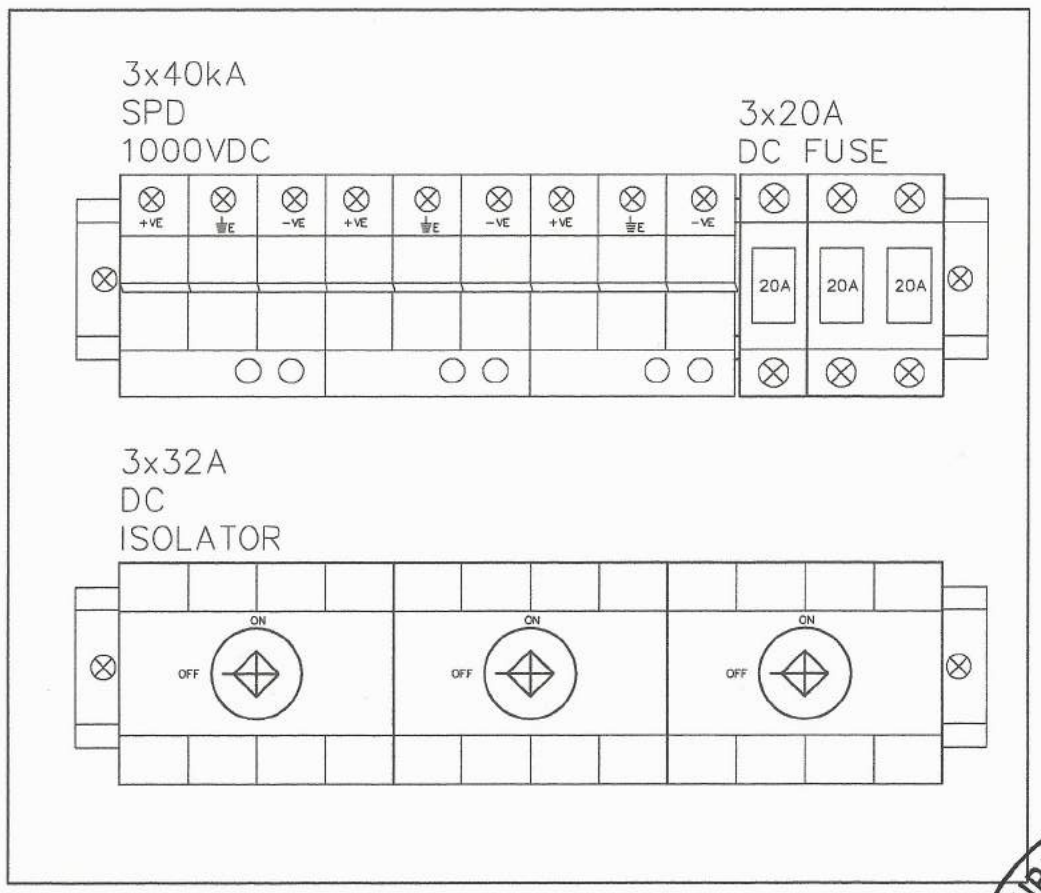
AS BUILT DRAWING

DB Shop Drawing (DC COMBINER PANEL)



INTERNAL VIEW

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SCALE	DATE	DRAWN BY : ZAHRUDDIN
N.T.S	SEPT 2019	CHECKED BY : SHAHIR
		APPROVED BY : Ir. LEE

DRAWING TITLE
ELECTRICAL SYSTEM
PROJEK LEBUHRAYA USAHASAMA BHD

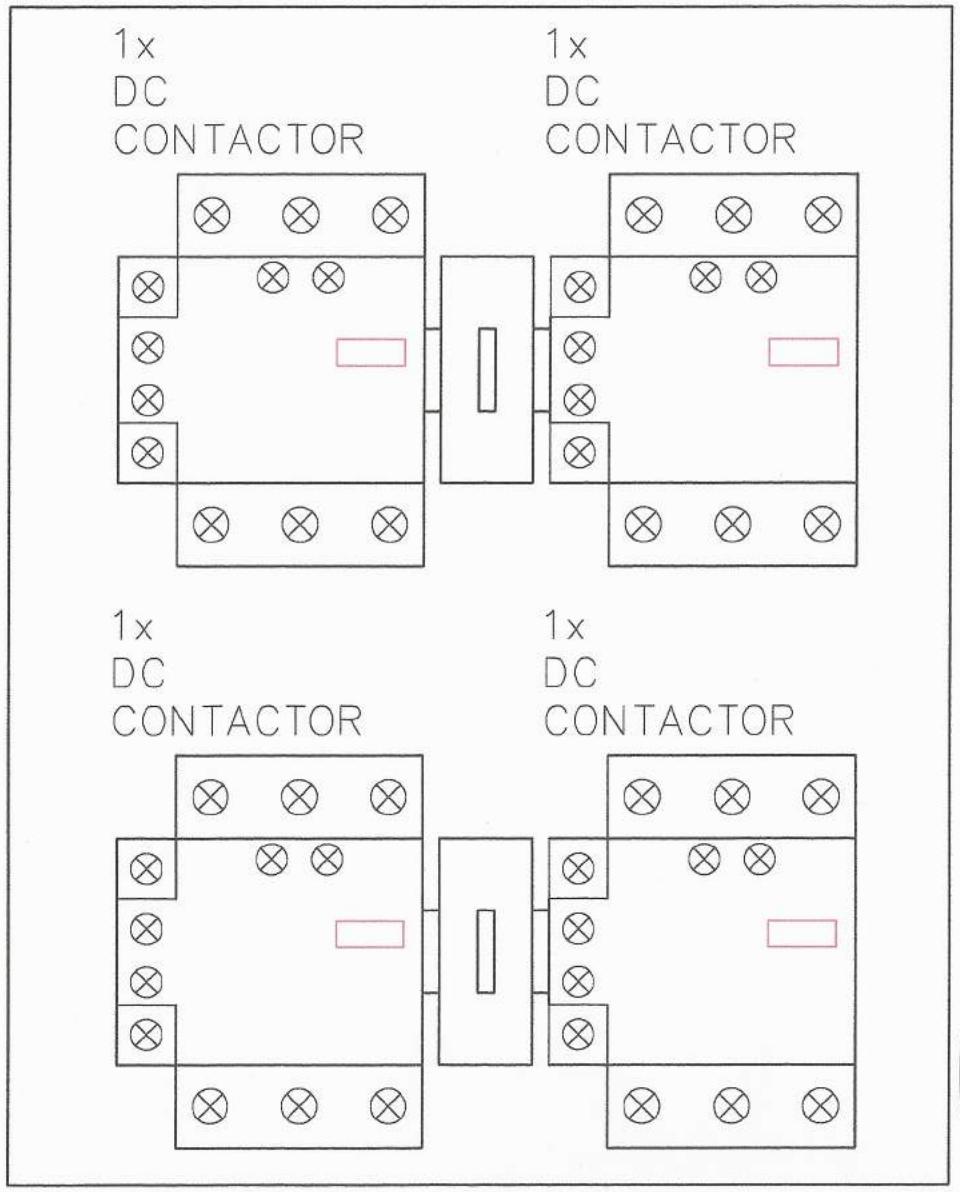
GROUND FLOOR PLAN

-ELECTRICAL LAYOUT PLAN
-SHOP DIAGRAM

DRAWING NO
L&ES/XEV/PLUSBHD/0005

AS BUILT DRAWING

DB Shop Drawing (DC CONTACTOR PANEL)



INTERNAL VIEW

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SCALE	DATE	DRAWN BY : ZAHRUDDIN
N.T.S	SEPT2019	CHECKED BY : SHAMIR
		APPROVED BY : Ir. LEE

DRAWING TITLE
ELECTRICAL SYSTEM
PROJEK LEBUHRAYA USAHASAMA BHD
DC CONTACTOR PANEL
-ELECTRICAL LAYOUT PLAN
-SHOP DIAGRAM

DRAWING NO
L&ES/XEV/PLUSBHD/0006

AS BUILT DRAWING

Structure Design Calculation and Drawing with PE Endorsement

AYER KEROH R&R
MELAKA

	CONTRACTOR: LIGHT & ENERGY SOLUTION SDN BHD

DESIGN OF MS STRUCTURE FOR SOLAR PANELS

BY : QCH	DATE : 7 JAN 2017	

Document no:					Rev	Stage
LES	AYER KEROH	SOLAR ST	17	002	00	C

Rev	Date	Revision Description

1.0 DESIGN CRITERIA

1.1 DESIGN STANDARDS

BS8110 : DESIGN OF REINFORCED CONCRETE STRUCTURES

ALUMINIUM ALLOY : FACTORED DESIGN TO BS8118

STRUCTURAL STEELWORK : DESIGN TO BS 5950: 2000

BS 6399 : PT 1 : CODE OF PRACTICE FOR DEAD AND IMPOSED LOADS

CP3: CHAPTER V: PART 2: WINDLOADS

MS1553: 2002 : WINDLOADS

1.2 LOADING

1.2.1 DESIGN WIND PRESSURE : LG ± 0.65 KN/M2

1.2.3 DEADLOADS :

RC BEAM:	24 KN/M3
STEELWORK:	78 KN/M3
ALUMINIUM:	27 KN/M3

1.3 ALLOWABLE DEFLECTION

MS / ALUMINIUM FRAME : L/100

1.4 MATERIAL PROPERTIES :

1.4.2 AUMINIUM ALLOY : AA6063-T5

MODULUS OF ELASTICITY Es	:	70 KN/M2
CO-EFFICIENT OF THERMAL EXPANSION α	:	23*10-6 / ° C
BM/TENSION CAPACITY FY	:	110 N/MM2
SHEAR CAPACITY PV	:	65 N/MM2
BEARING CAPACITY pbs	:	130 N/MM2

1.4.3 STEEL GRADE : S275

MODULUS OF ELASTICITY Es	:	205 KN/M2
CO-EFFICIENT OF THERMAL EXPANSION α	:	12*10-6 / ° C
DESIGN STRENGTH py	:	275 N/MM2
BEARING STRENGTH pbs	:	460 N/MM2

1.4.4 STEEL FASTENERS

BOLT STAINLESS STEEL GRADE A4-50	:	$f_{0.2}$ = 210 N/MM2
	:	fu = 500 N/MM2
LIMITING STRESS pf = 0.5($f_{0.2}$ + fu) OR 1.2$f_{0.2}$	:	pf = 252 N/MM2

1.4.5 STEEL FASTENERS

BOLT STAINLESS STEEL GRADE 8.8

TENSION CAPACITY ft	:	560 N/MM2
SHEAR CAPACITY fs	:	375 N/MM2
BEARING CAPACITY fbt	:	560 N/MM2

1.5 WELDING

DESIGN STRENGTH OF FILLET WELD pw = (E35 ELECTRODE)	:	220 N/MM2

1.6 ANCHOR BOLTS

REFER FISCHER CHEMICAL CATALOGUE OR EQUAL

AYER KEROH R&R
INSTALLATION OF SOLAR PANELS AT ROOF STRUCTURE
MS STRUCTURE
REFER DRWG NO: ATT

REV:	0
DATE:	05/01/17
DOCREF	AYER
PAGE:	1

1.0 DESIGN WIND PRESSURE

LOCATION: AYERR KEROH, MELAKA

BASIC WIND SPEED V = 33.50 M/S

TOTAL HEIGHT FROM GL TO ROOF = 10.00 M

DESIGN WIND SPEED Vs = V x S1 x S2 x S3

WHERE

S1 = 1.00 (TOPOLOGY)
S2 = 0.78 (CLADDING CATEGORY 3)
S3 = 1.00 (FOR DESIGN LIFE OF 50 YEARS)

THEREFORE

Vs = 26.13 M/S

CHRACTERISTIC WIND PRESSURE CWP

CWP = 0.613 x (Vs)^2 / 1000 = 0.42 KN/M2

MAX. TOTAL PRESSURE COEFFIENT Cp = Cpe - Cpi = 1.20

DESIGN WIND PRESSURE DWP = CWP X Cp = 0.50 KN/M2

ADOPT DESIGN WIND PRESSURE OF: **0.65** KN/M2

REFERENCES

1.0 BS CP3 : CH V : PT 2 WINDLOADS

2.0 DESIGNER'S MANUAL : RJ REYNOLDS

3.0 MS1553 : 2002 : WIND LOADING

REV:	0
DATE:	05/01/17
DOCREF:	AYER
PAGE:	2

AYER KEROH R&R
INSTALLATION OF SOLAR PANELS AT ROOF STRUCTURE
MS STRUCTURE
REFER DRWG NO: ATT

2.0 ROOF DIMENSIONS

L	W	H MAX	H MIN	CHANNEL PURLINS SPAN	C/C1	TRUSS C/C2	TRUSS SPAN
9700	14700	7905	7000	4900	1170	4900	9700

TRUSS MEMBERS

a SOLAR ROOF PURLINS 50X125X4MMTHK RHS

b SHS TRUSS TOP/BOTTOM CHORDS 100X100X4MMTHK SHS

c TRUSS WEB 50X50X2.3MMTHK SHS

d UC COLUMNS 203X203X60KG/M UC

2.1 LOADING @ 1.17 M C/C

DESIGN WIND PRESSURE AT ROOF TOP WP = 0.65 KN/M2

WL PER TRUSS = WP/2 X C/C = 0.38 KN/M

DEADLOADS

ii) SOLAR PANEL (12 KG/PANEL) 0.15 X C/C = 0.35

iii) SW MEMBERS STAAD

0.73

WL FROM SIDE WP X 1.7/2 = 0.56 KN/M

2.2 LOAD CASES/COMBINATIONS

LC1 1.0DL +1.0WL
LC3 1.4DL + 1.4WL

2.3 CARRY OUT FEM ANALYSIS ON STAADPRO

FROM STAAD ANALYSIS RESULTS FILE : LIGHT AYER KEROH SOLAR

MAX DY (MM) =		27.14	<=	L/175 55	**OK**
MAX DX (MM) =	N109	71.43	<=	H/100 79.1	**OK**

FROM DESIGN TO BS5950, ALL MEMBERS PASSED, MAX PASS RATIO =

a	SOLAR ROOF PURLINS	0.65	<	1.00	**OK**
b	SHS TRUSS TOP/BOTTOM CHORDS	0.81	<	1.00	**OK**
c	TRUSS WEB	0.20	<	1.00	**OK**
d	UC COLUMNS	0.50	<	1.00	**OK**

3.1 REACTIONS AT UC COLUMN BASES

FACTORED LOADS

NODE	LC	KN	FX	FY	FZ	REM
117 118	2		6.00	41.00	0.80	
119 120	2		6.60	57.00	2.20	

MAX FX =	6.60	KNM		
FY =	57.00	KN		
MAX RES SHEAR IN 8M20 G8.8 CHEMICAL RS =	7.17	KN		
SHEAR CAP. Ps = 375 X 0.7πd^2 / 4000 =	82.43	>	7.17	**OK**
BEARING CAP IN 25MMTHK BASEPLATE Pbp =	230.00	>	7.17	**OK**

REACTIONS AT UC COLUMN BASES **OK**

AYER KEROH R&R
INSTALLATION OF SOLAR PANELS AT ROOF STRUCTURE
UC RC STUMP & FOOTING C1
REFER DRWG NO: ATT

REV:	0
DATE:	07/01/17
DOCREF:	AYER
PAGE:	4

1.0 UC RC STUMP & FOOTING C1

LOADING FACTORED

FROM UC					57.00		
STUMP	1.4 X 24 X 0.45 X 0.45 X 1.0 =				6.80		
TOTAL N =					63.80		
10% RC FOOTING					**92.60**		
		L	B	D	SW		
CONSIDER FOOTING SIZE		2.0	2.0	0.3	28.8		
BEARING P (KN/M2) =					16.54	< 100	**OK**

STUMP REINF'T

h	b	d	d/h	CONCRETE GRADE
450	450	368	0.82	30

N/bh =			0.32		
M/bh^2 =			0.00		
N =	0.35fcu.Ac + 0.67Asc.fy =				
THEREFORE, Asc =			-23	MM2	
MIN. Asc =	0.4bh / 100 =		810		
PROVIDE :	8T20	Ascp =	2511	> -23	**OK**
LINKS :	T12		200	< 240	**OK**

AYER KEROH R&R
INSTALLATION OF SOLAR PANELS AT ROOF STRUCTURE
RC FOOTING
REFER DRWG NO: ATT

REV:	0
DATE:	07/01/17
DOCREF:	AYER
PAGE:	5

RC FOOTING	P	H MIN.	L	L1	B	D1	D2	d
	23 KN/M2	1400 MM	2000	775	2000	300	300	230

PUNCHING SHEAR

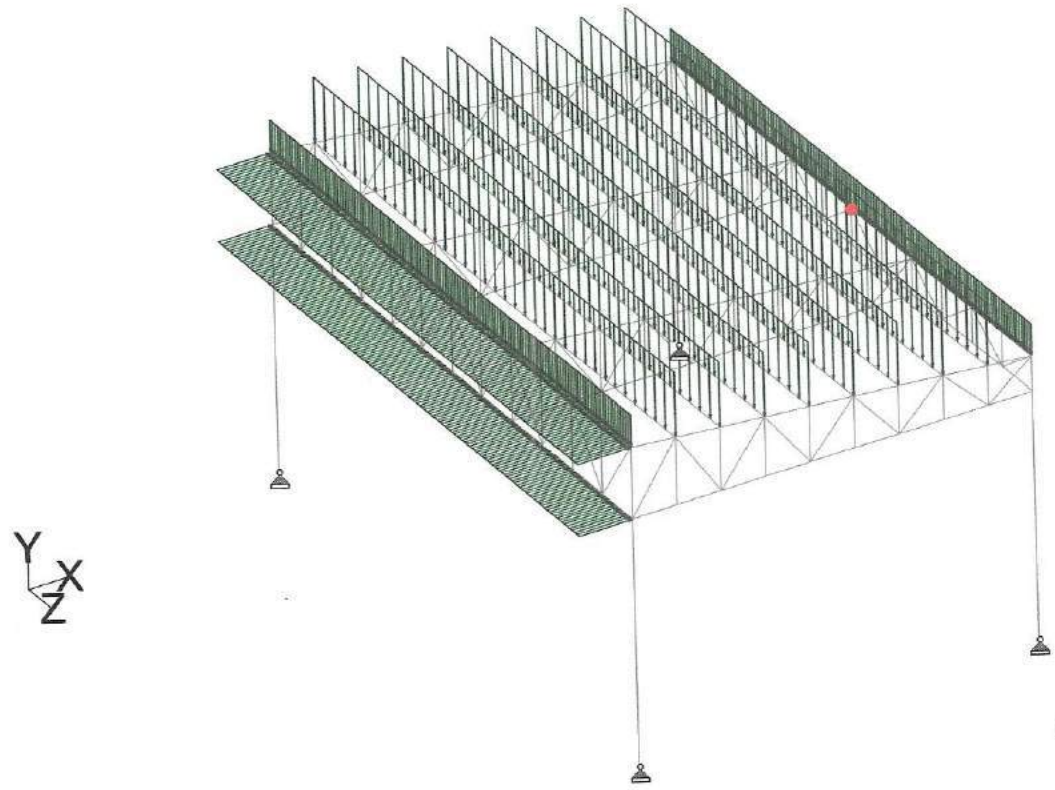
CRITICAL P =	COL P + 8 X 1.5d =	4560	MM			
A WITHIN P =	$(h + 3d)^2$ =	1.30	M2			
AREA OUTSIDE P =		2.70				
PUNCHING SHEAR STRESS v =		0.06				
vc MIN. = TABLE 3.8 BS8110		0.34	>	0.06		**OK**

BENDING

FORCE ON SHADED AREA =		36	KN			
BM AT COL FACE =	F X L1 / 2 =	14	KNM			
M/Bd^2fcu =		0.004				
la =		0.95				
As REQ. PER M WIDTH =		80	MM2/M			
PROVIDE :	T20 200 Ascp =	1000	>	80		**OK**
MIN. Asc =	0.13bh / 100 =	390	<	1000		**OK**
100Ascp / bh =		0.33	<	0.30		**OK**
MAX C/C SPACING (MM) =		750	CL. 3.12.11.2.7			
vc =		0.42	>	0.06		**OK**
MAX SHEAR @ COLUMN FACE vmax ==		0.15	<	4.38 (0.8SQRT(30))		**OK**
FORCE @ 1.0D FROM COL FACE =		25	KN			
SHEAR STRESS @ CRITICAL SECTION =		0.05	<	0.42		**OK**

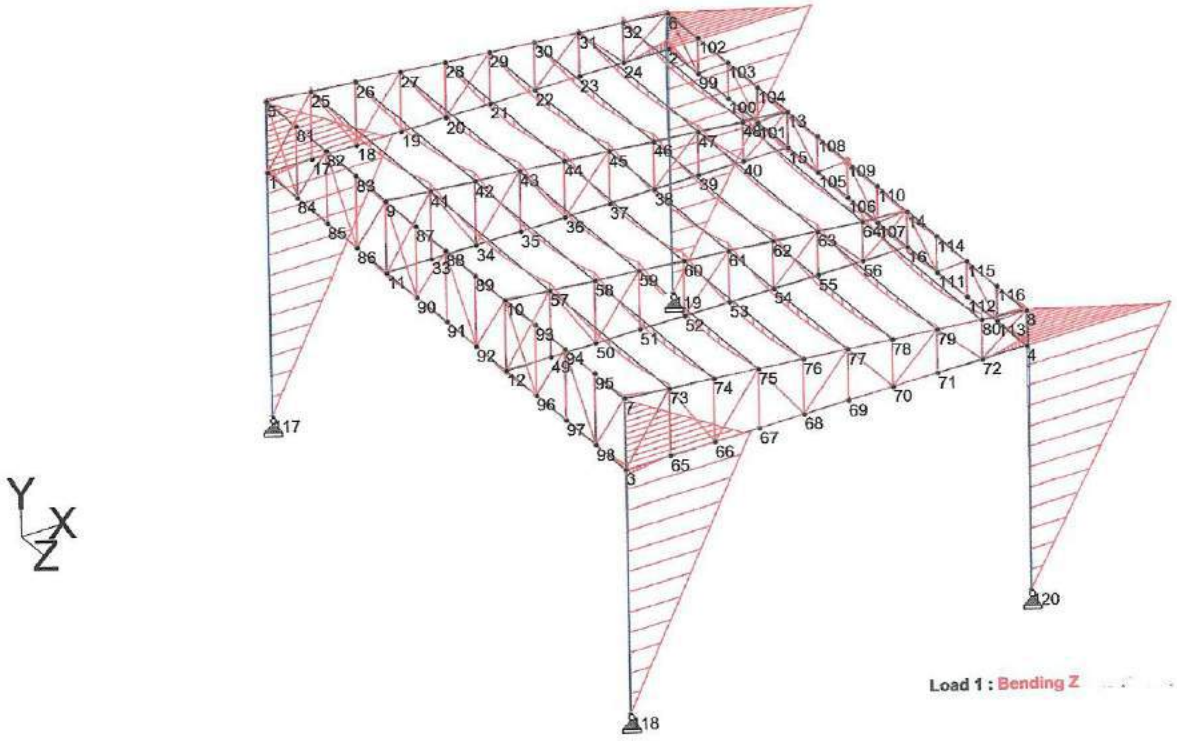
RC FOOTING **OK**

Software licensed to Snow Panther [LZ0]	Job No ms structure f	Sheet No 1	Rev
	Part ms frame		
Job Title ayer keroh mr	Ref R 0.0		
	By qch	Date 6jan17	Chd
Client lns	File light ayer keroh solar.std	Date/Time 05-Jan-2017 12:18	

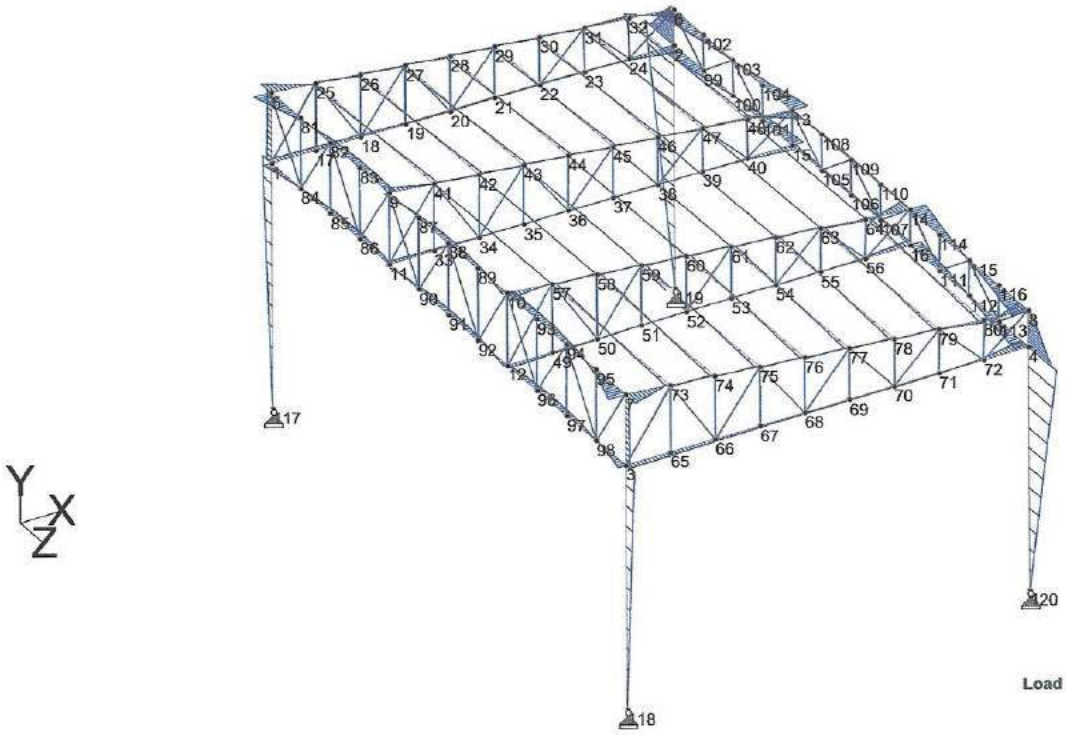


Load 1 (SELF Y)

6

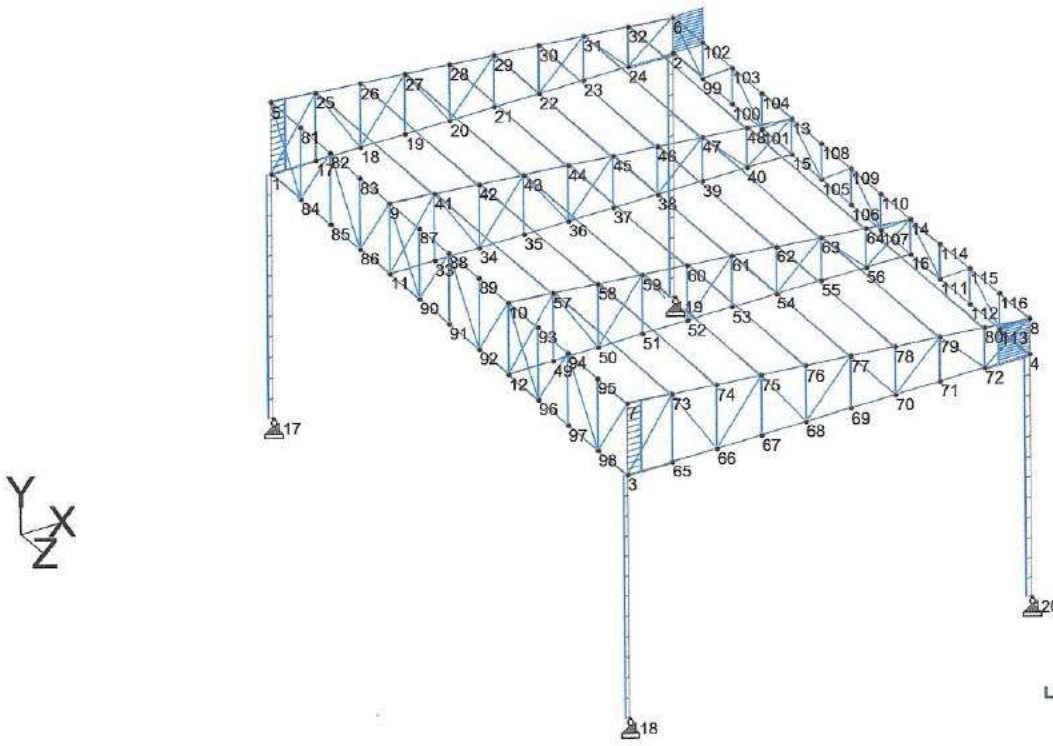

Y
X
Z
17
18
19
20
Load 1 : Bending Z

Software licensed to Snow Panther [LZ0]	Job No ms structure f	Sheet No 1	Rev
	Part ms frame		
Job Title ayer keroh mr	Ref R 0.0		
	By qch	Date 6jan17	Chd
Client lns	File light ayer keroh solar.std	Date/Time 05-Jan-2017 12:18	

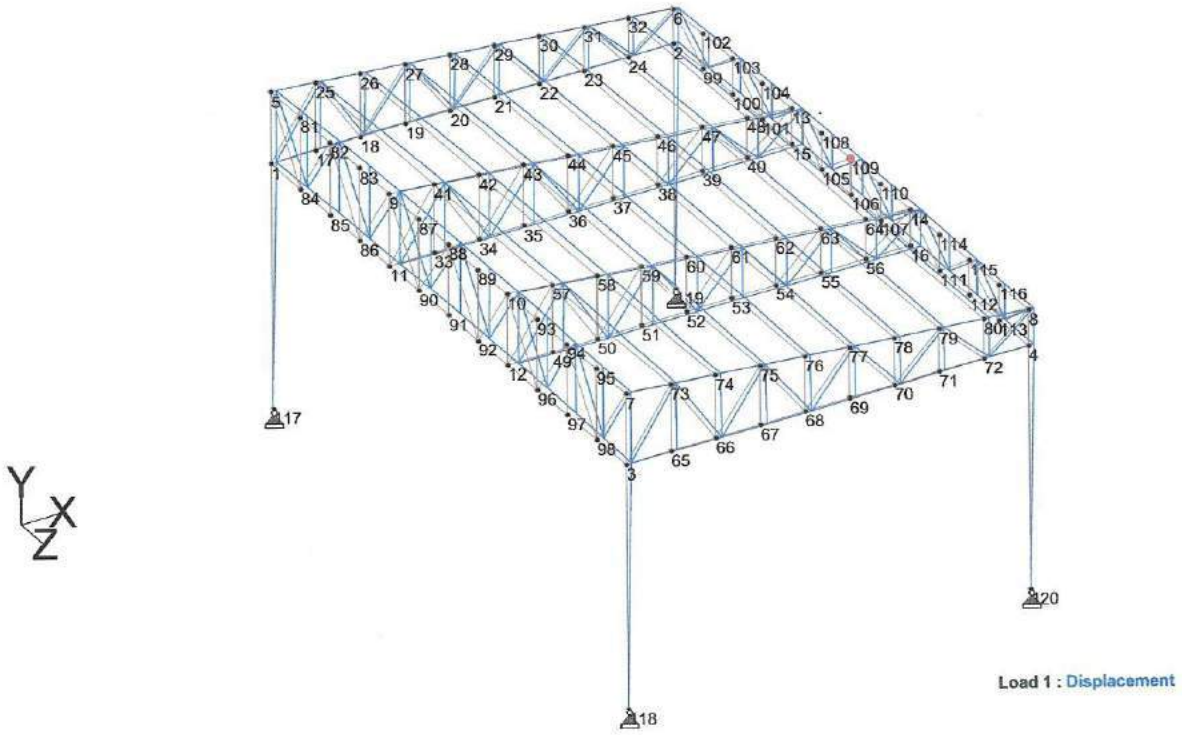


8

Software licensed to Snow Panther [LZ0]	Job No ms structure f	Sheet No 1	Rev
	Part ms frame		
Job Title ayer keroh rnr	Ref R 0.0		
	By qch Date 6jan17	Chd	
Client lns	File light ayer keroh solar.std	Date/Time 05-Jan-2017 12:18	



Software licensed to Snow Panther [LZ0]	Job No ms structure f	Sheet No 1	Rev
	Part ms frame		
Job Title ayer keroh rnr	Ref R 0.0		
	By qch Date 6jan17	Chd	
Client Ins	File light ayer keroh solar.std	Date/Time 05-Jan-2017 12:18	



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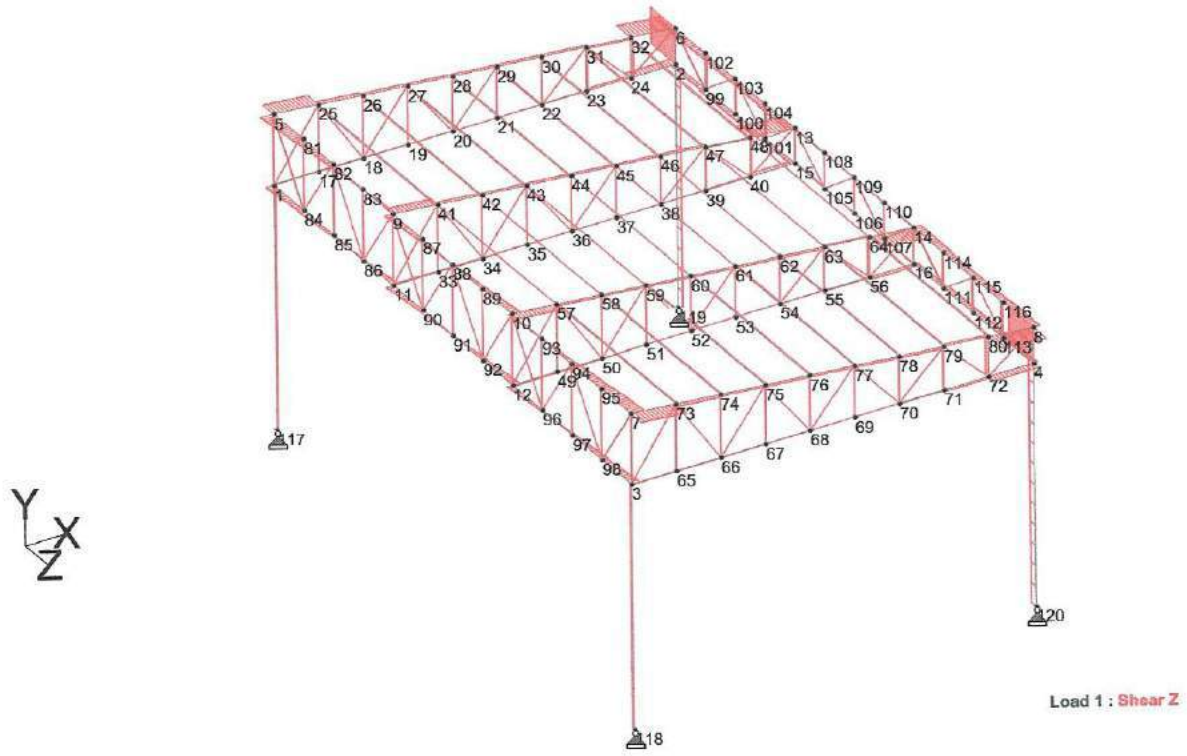
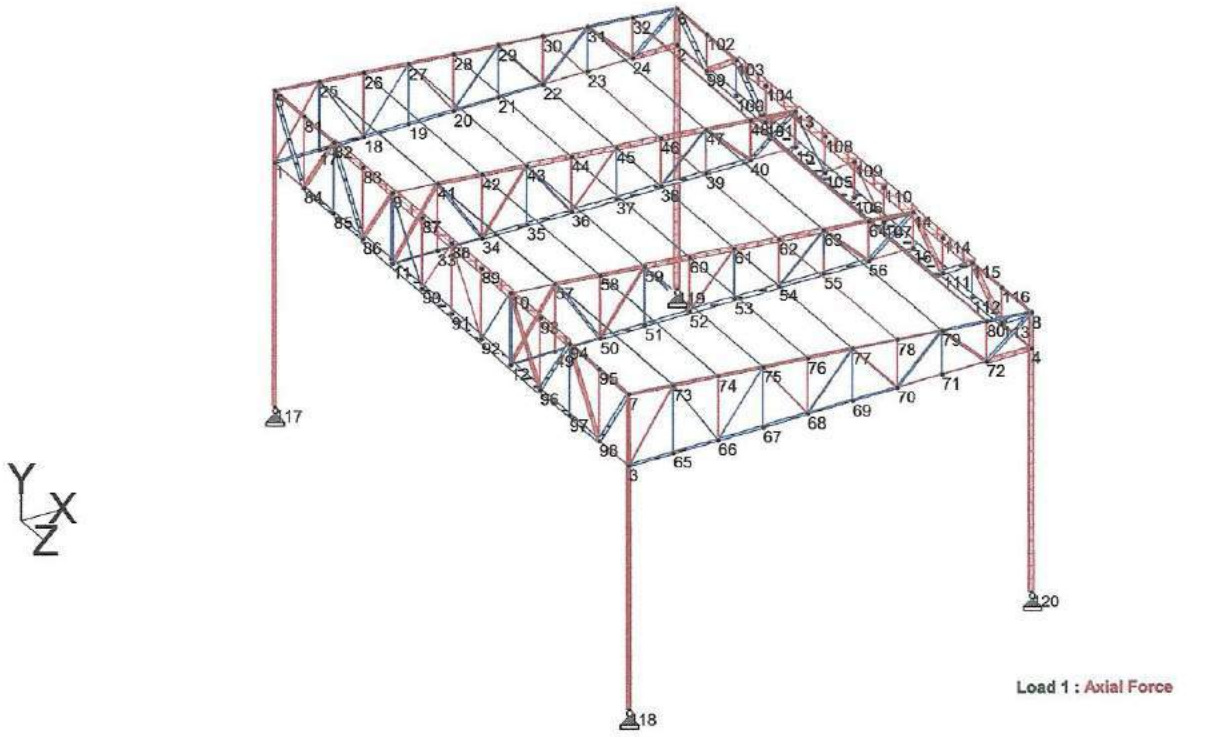
Software licensed to Snow Panther [LZ0]	Job No ms structure f	Sheet No 1	Rev
	Part ms frame		
Job Title ayer keroh rnr	Ref R 0.0		
	By qch Date 6jan17	Chd	
Client lns	File light ayer keroh solar.std	Date/Time 05-Jan-2017 12:18	

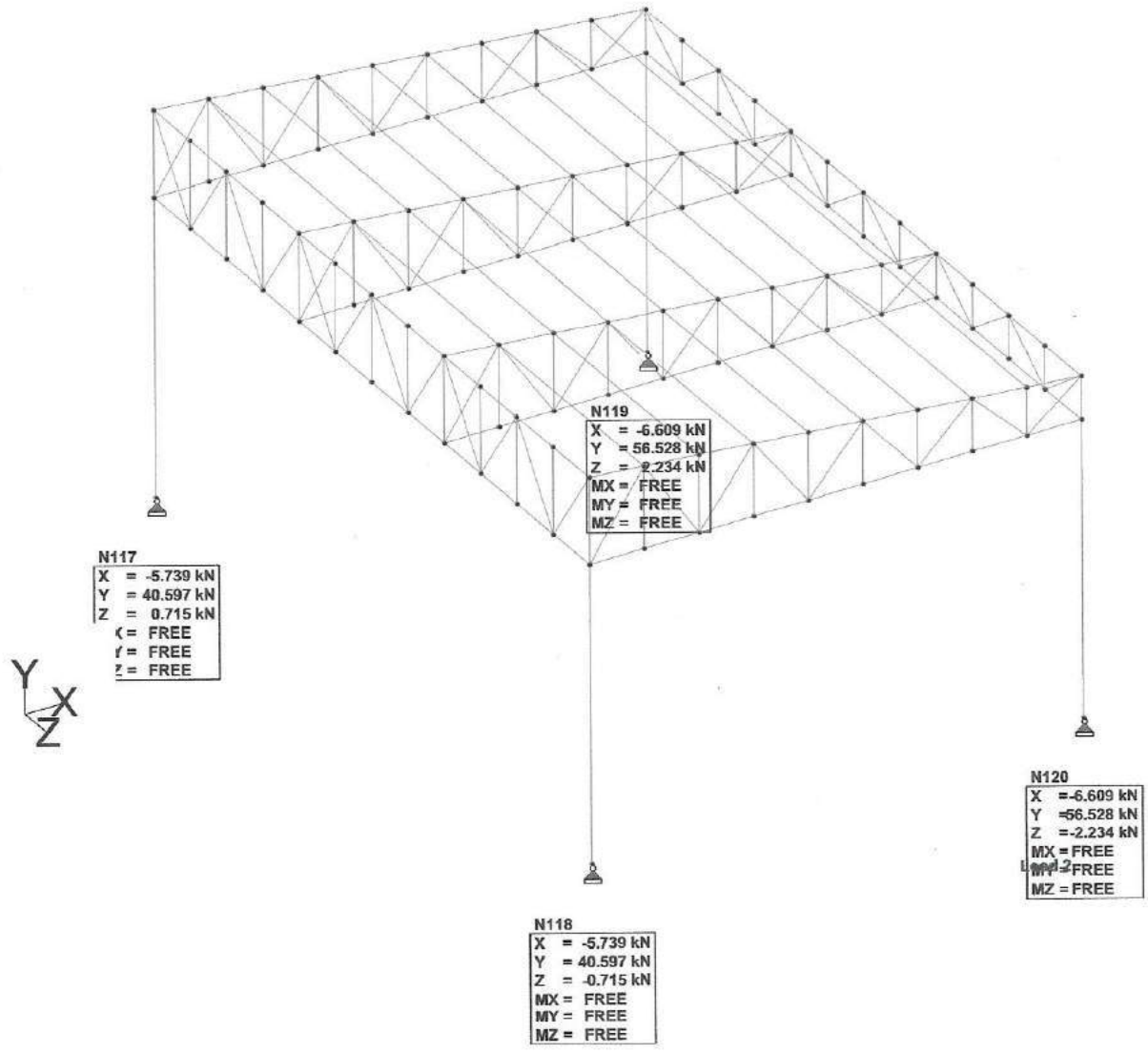


Software licensed to Snow Panther [LZ0]	Job No ms structure f	Sheet No 1	Rev
	Part ms frame		
Job Title ayer keroh mr	Ref R 0.0		
	By qch	Date 6jan17	Chd
Client Ins	File light ayer keroh solar.std	Date/Time 05-Jan-2017 12:18	



Node Displacement Summary

	Node	L/C	X (mm)	Y (mm)	Z (mm)	Resultant (mm)	rX (rad)	rY (rad)	rZ (rad)
Max X	88	2:	**108.105**	-14.084	-0.000	109.018	-0.000	0.000	-0.003
Min X	117	1:DL+WL	**0.000**	0.000	0.000	0.000	-0.001	0.008	-0.007
Max Y	117	1:DL+WL	0.000	**0.000**	0.000	0.000	-0.001	0.008	-0.007
Min Y	109	2:	100.317	**-37.467**	-0.000	107.086	-0.000	0.000	0.000
Max Z	67	2:	45.819	-2.227	**17.607**	49.136	-0.010	-0.001	-0.000
Min Z	19	2:	45.819	-2.227	**-17.607**	49.136	0.010	0.001	-0.000
Max rX	29	2:	46.055	-2.280	-0.002	46.111	**0.015**	-0.001	0.000
Min rX	77	2:	46.055	-2.280	0.002	46.111	**-0.015**	0.001	0.000
Max rY	81	2:	60.936	-3.745	1.764	61.076	0.003	**0.015**	-0.000
Min rY	95	2:	60.936	-3.745	-1.764	61.076	-0.003	**-0.015**	-0.000
Max rZ	24	2:	46.078	-0.665	-4.589	46.311	0.005	-0.004	**0.001**
Min rZ	119	2:	0.000	0.000	0.000	0.000	-0.004	0.002	**-0.011**
Max Rst	88	2:	108.105	-14.084	-0.000	**109.018**	-0.000	0.000	-0.003


N119
X = -6.609 kN
Y = 56.528 kN
Z = 2.234 kN
MX = FREE
MY = FREE
MZ = FREE
N117
X = -5.739 kN
Y = 40.597 kN
Z = 0.715 kN
= FREE
= FREE
= FREE
Y
X
Z
N120
X = -6.609 kN
Y = 56.528 kN
Z = -2.234 kN
MX = FREE
MY = FREE
MZ = FREE
N118
X = -5.739 kN
Y = 40.597 kN
Z = -0.715 kN
MX = FREE
MY = FREE
MZ = FREE

ALL UNITS ARE - KN METE (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
3	ST TUB E	PASS	BS-4.8.2.2	0.373	2
		26.09 T	-1.82	1.58	0.00
4	ST TUB E	PASS	ANNEX I.1	0.295	2
		1.23 C	2.05	1.38	-
5	ST TUB E	PASS	ANNEX I.1	0.485	2
		10.88 C	3.39	2.19	-
6	ST TUB E	PASS	BS-4.8.2.2	0.373	2
		26.09 T	1.82	1.58	0.00
7	ST UC2 03X203X60	PASS	ANNEX I.1	0.203	2
		30.50 C	2.07	31.94	-
8	ST TUB E	PASS	ANNEX I.1	0.487	2
		22.61 C	4.76	0.80	-
9	ST UC2 03X203X60	PASS	ANNEX I.1	0.203	2
		30.50 C	2.07	31.94	-
10	ST TUB E	PASS	ANNEX I.1	0.487	2
		22.61 C	4.76	0.80	-
11	ST UC2 03X203X60	PASS	ANNEX I.1	0.336	2
		46.41 C	11.06	36.48	-
12	ST TUB E	PASS	ANNEX I.1	0.460	2
		25.35 C	4.57	0.63	-
13	ST UC2 03X203X60	PASS	ANNEX I.1	0.336	2
		46.41 C	11.06	36.48	-
14	ST TUB E	PASS	ANNEX I.1	0.456	2
		20.60 C	4.30	0.88	-
15	ST TUB E	PASS	BS-4.7 (C)	0.295	2
		91.41 C	1.24	0.19	0.00
16	ST TUB E	PASS	ANNEX I.1	0.231	2
		67.75 C	1.84	0.56	-
17	ST TUB E	PASS	BS-4.8.2.2	0.422	2
		80.04 T	1.01	0.99	0.00
18	ST TUB E	PASS	BS-4.8.2.2	0.404	2
		80.59 T	1.47	0.31	1.22
19	ST TUB E	PASS	BS-4.7 (C)	0.434	2
		134.82 C	-0.11	0.61	0.00
20	ST TUB E	PASS	ANNEX I.1	0.592	2
		102.55 C	4.21	1.35	-
21	ST TUB E	PASS	BS-4.8.2.2	0.595	2
		145.82 T	-0.85	0.77	0.00
22	ST TUB E	PASS	BS-4.8.2.2	0.818	2
		144.35 T	-2.93	1.35	0.00
23	ST TUB E	PASS	ANNEX I.1	0.268	2
		3.14 C	2.67	0.45	-
24	ST TUB E	PASS	ANNEX I.1	0.268	2
		3.14 C	2.67	0.45	-
25	ST TUB E	PASS	BS-4.8.2.2	0.179	2
		12.55 T	-1.27	-0.36	0.00
26	ST TUB E	PASS	BS-4.8.2.2	0.179	2
		12.55 T	1.27	-0.36	0.00

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ALL UNITS ARE - KN METE (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
27	ST TUB E	PASS	BS-4.8.2.2	0.240	2
		22.63 T	0.04	0.07	1.72
28	ST TUB E	PASS	BS-4.8.3.3.3	0.105	2
		0.68 C	0.07	0.16	-
29	ST TUB E	PASS	BS-4.8.2.2	0.240	2
		22.63 T	-0.04	0.07	1.72
30	ST TUB E	PASS	BS-4.8.3.3.3	0.105	2
		0.68 C	0.07	0.16	-
31	ST TUB E	PASS	BS-4.8.2.2	0.225	2
		26.09 T	-1.42	-0.25	0.00
32	ST TUB E	PASS	BS-4.8.2.2	0.168	2
		26.95 T	-0.87	0.11	0.00
33	ST TUB E	PASS	BS-4.8.2.2	0.143	2
		26.94 T	-0.60	0.08	0.00
34	ST TUB E	PASS	BS-4.8.2.2	0.103	2
		18.79 T	-0.42	0.09	0.18
35	ST TUB E	PASS	BS-4.8.2.2	0.102	2
		18.73 T	-0.39	0.12	0.00
36	ST TUB E	PASS	ANNEX I.1	0.055	2
		3.43 C	0.55	0.09	-
37	ST TUB E	PASS	ANNEX I.1	0.077	2
		3.59 C	0.64	0.25	-
38	ST TUB E	PASS	ANNEX I.1	0.519	2
		46.71 C	3.33	2.38	-
39	ST TUB E	PASS	ANNEX I.1	0.091	2
		27.99 C	0.82	0.21	-
40	ST TUB E	PASS	BS-4.7 (C)	0.091	2
		28.41 C	-0.55	-0.01	1.08
41	ST TUB E	PASS	BS-4.7 (C)	0.082	2
		25.66 C	-0.54	-0.09	1.08
42	ST TUB E	PASS	BS-4.7 (C)	0.083	2
		26.07 C	-0.49	0.01	1.08
43	ST TUB E	PASS	ANNEX I.1	0.055	2
		12.13 C	0.54	0.09	-
44	ST TUB E	PASS	ANNEX I.1	0.051	2
		12.44 C	0.47	0.12	-
45	ST TUB E	PASS	BS-4.8.2.2	0.166	2
		20.28 T	1.15	0.05	1.08
46	ST TUB E	PASS	BS-4.8.2.2	0.522	2
		20.15 T	-4.47	0.87	1.08
47	ST TUB E	PASS	BS-4.8.2.2	0.101	2
		12.68 T	-0.68	0.03	0.00
48	ST TUB E	PASS	BS-4.8.2.2	0.145	2
		38.55 T	-0.20	0.09	0.00
49	ST TUB E	PASS	BS-4.8.2.2	0.148	2
		38.62 T	-0.10	-0.22	1.08

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ALL UNITS ARE - KN METE (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
50	ST TUB E	PASS	BS-4.8.2.2	0.178	2
		50.45 T	0.04	0.20	0.63
51	ST TUB E	PASS	BS-4.8.2.2	0.176	2
		50.46 T	0.01	0.20	0.18
52	ST TUB E	PASS	BS-4.8.2.2	0.154	2
		41.34 T	-0.08	0.21	0.00
53	ST TUB E	PASS	BS-4.8.2.2	0.177	2
		41.22 T	-0.48	-0.08	1.08
54	ST TUB E	PASS	ANNEX I.1	0.198	2
		0.84 C	2.03	0.27	-
55	ST TUB E	PASS	BS-4.7 (C)	0.105	2
		33.01 C	-0.54	-0.31	1.08
56	ST TUB E	PASS	BS-4.7 (C)	0.104	2
		32.71 C	-0.46	-0.03	1.08
57	ST TUB E	PASS	BS-4.7 (C)	0.165	2
		51.74 C	-0.49	-0.38	1.08
58	ST TUB E	PASS	BS-4.7 (C)	0.164	2
		51.43 C	-0.47	-0.07	1.08
59	ST TUB E	PASS	BS-4.7 (C)	0.171	2
		53.58 C	-0.47	-0.32	1.08
60	ST TUB E	PASS	BS-4.7 (C)	0.170	2
		53.18 C	-0.59	-0.07	1.08
61	ST TUB E	PASS	BS-4.7 (C)	0.092	2
		28.93 C	0.82	-0.22	1.08
62	ST TUB E	PASS	ANNEX I.1	0.425	2
		28.24 C	4.47	0.34	-
63	ST TUB E	PASS	BS-4.8.2.2	0.101	2
		12.68 T	0.68	0.03	0.00
64	ST TUB E	PASS	BS-4.8.2.2	0.145	2
		38.55 T	0.20	0.09	0.00
65	ST TUB E	PASS	BS-4.8.2.2	0.148	2
		38.62 T	0.10	-0.22	1.08
66	ST TUB E	PASS	BS-4.8.2.2	0.178	2
		50.45 T	-0.04	0.20	0.63
67	ST TUB E	PASS	BS-4.8.2.2	0.176	2
		50.46 T	-0.01	0.20	0.18
68	ST TUB E	PASS	BS-4.8.2.2	0.154	2
		41.34 T	0.08	0.21	0.00
69	ST TUB E	PASS	BS-4.8.2.2	0.177	2
		41.22 T	0.48	-0.08	1.08
70	ST TUB E	PASS	ANNEX I.1	0.198	2
		0.84 C	2.03	0.27	-
71	ST TUB E	PASS	BS-4.7 (C)	0.105	2
		33.01 C	0.54	-0.31	1.08
72	ST TUB E	PASS	BS-4.7 (C)	0.104	2
		32.71 C	0.46	-0.03	1.08

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ALL UNITS ARE - KN METE (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
73	ST TUB E	PASS	BS-4.7 (C)	0.165	2
		51.74 C	0.49	-0.38	1.08
74	ST TUB E	PASS	BS-4.7 (C)	0.164	2
		51.43 C	0.47	-0.07	1.08
75	ST TUB E	PASS	BS-4.7 (C)	0.171	2
		53.58 C	0.47	-0.32	1.08
76	ST TUB E	PASS	BS-4.7 (C)	0.170	2
		53.18 C	0.59	-0.07	1.08
77	ST TUB E	PASS	BS-4.7 (C)	0.092	2
		28.93 C	-0.82	-0.22	1.08
78	ST TUB E	PASS	ANNEX I.1	0.425	2
		28.24 C	4.47	0.34	-
79	ST TUB E	PASS	BS-4.8.2.2	0.225	2
		26.09 T	1.42	-0.25	0.00
80	ST TUB E	PASS	BS-4.8.2.2	0.168	2
		26.95 T	0.87	0.11	0.00
81	ST TUB E	PASS	BS-4.8.2.2	0.143	2
		26.94 T	0.60	0.08	0.00
82	ST TUB E	PASS	BS-4.8.2.2	0.103	2
		18.79 T	0.42	0.09	0.18
83	ST TUB E	PASS	BS-4.8.2.2	0.102	2
		18.73 T	0.39	0.12	0.00
84	ST TUB E	PASS	ANNEX I.1	0.055	2
		3.43 C	0.55	0.09	-
85	ST TUB E	PASS	ANNEX I.1	0.077	2
		3.59 C	0.64	0.25	-
86	ST TUB E	PASS	ANNEX I.1	0.519	2
		46.71 C	3.33	2.38	-
87	ST TUB E	PASS	ANNEX I.1	0.091	2
		27.99 C	0.82	0.21	-
88	ST TUB E	PASS	BS-4.7 (C)	0.091	2
		28.41 C	0.55	-0.01	1.08
89	ST TUB E	PASS	BS-4.7 (C)	0.082	2
		25.66 C	0.54	-0.09	1.08
90	ST TUB E	PASS	BS-4.7 (C)	0.083	2
		26.07 C	0.49	0.01	1.08
91	ST TUB E	PASS	ANNEX I.1	0.055	2
		12.13 C	0.54	0.09	-
92	ST TUB E	PASS	ANNEX I.1	0.051	2
		12.44 C	0.47	0.12	-
93	ST TUB E	PASS	BS-4.8.2.2	0.166	2
		20.28 T	-1.15	0.05	1.08
94	ST TUB E	PASS	BS-4.8.2.2	0.522	2
		20.15 T	4.47	0.87	1.08
95	ST TUB E	PASS	ANNEX I.1	0.125	2
		25.50 C	1.25	0.17	-

ALL UNITS ARE - KN METE (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
96	ST TUB E	PASS	BS-4.7 (C)	0.218	2
		67.61 C	-1.11	-0.12	0.00
97	ST TUB E	PASS	ANNEX I.1	0.231	2
		67.75 C	1.84	0.56	-
98	ST TUB E	PASS	BS-4.8.2.2	0.247	2
		41.04 T	1.27	-0.11	1.23
99	ST TUB E	PASS	BS-4.8.2.2	0.259	2
		41.15 T	-1.51	-0.02	0.82
100	ST TUB E	PASS	BS-4.8.2.2	0.404	2
		80.59 T	-1.47	-0.31	0.00
101	ST TUB E	PASS	BS-4.7 (C)	0.294	2
		91.39 C	-0.71	0.12	0.00
102	ST TUB E	PASS	BS-4.7 (C)	0.294	2
		91.39 C	-1.37	0.04	0.00
103	ST TUB E	PASS	BS-4.7 (C)	0.295	2
		91.41 C	-0.72	0.11	0.00
104	ST TUB E	PASS	BS-4.8.2.2	0.395	2
		82.13 T	1.34	-0.28	1.23
105	ST TUB E	PASS	BS-4.8.2.2	0.395	2
		82.13 T	-1.34	0.28	0.00
106	ST TUB E	PASS	BS-4.8.2.2	0.422	2
		80.04 T	-1.01	-0.99	1.23
107	ST TUB E	PASS	BS-4.7 (C)	0.218	2
		67.61 C	-1.86	0.06	0.00
108	ST TUB E	PASS	ANNEX I.1	0.125	2
		25.50 C	1.25	0.17	-
109	ST TUB E	PASS	ANNEX I.1	0.460	2
		25.35 C	4.57	0.63	-
110	ST TUB E	PASS	BS-4.8.2.2	0.259	2
		41.15 T	-1.51	-0.02	0.41
111	ST TUB E	PASS	BS-4.8.2.2	0.247	2
		41.04 T	-1.27	0.11	0.00
112	ST TUB E	PASS	ANNEX I.1	0.295	2
		1.23 C	2.05	1.38	-
113	ST TUB E	PASS	BS-4.8.2.2	0.406	2
		68.76 T	1.96	0.27	0.00
114	ST TUB E	PASS	BS-4.8.2.2	0.397	2
		69.33 T	1.69	-0.41	1.23
115	ST TUB E	PASS	BS-4.8.2.2	0.818	2
		144.35 T	2.93	-1.35	1.23
116	ST TUB E	PASS	ANNEX I.1	0.215	2
		21.37 C	2.06	0.38	-
117	ST TUB E	PASS	BS-4.7 (C)	0.328	2
		101.88 C	0.18	0.05	0.00
118	ST TUB E	PASS	ANNEX I.1	0.592	2
		102.55 C	4.21	1.35	-

ALL UNITS ARE - KN METE (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
119	ST TUB E	PASS	BS-4.8.2.2	0.558	2
		149.15 T	0.47	-0.59	1.23
120	ST TUB E	PASS	BS-4.8.2.2	0.558	2
		149.15 T	-0.47	0.59	0.00
121	ST TUB E	PASS	BS-4.8.2.2	0.595	2
		145.82 T	0.85	-0.77	1.23
122	ST TUB E	PASS	BS-4.7 (C)	0.434	2
		134.83 C	-0.36	0.38	0.00
123	ST TUB E	PASS	BS-4.7 (C)	0.434	2
		134.83 C	-0.46	0.51	0.00
124	ST TUB E	PASS	BS-4.7 (C)	0.434	2
		134.82 C	-0.35	0.39	0.00
125	ST TUB E	PASS	BS-4.8.2.2	0.397	2
		69.33 T	-1.69	0.41	0.00
126	ST TUB E	PASS	BS-4.8.2.2	0.406	2
		68.76 T	-1.96	-0.27	1.23
127	ST TUB E	PASS	ANNEX I.1	0.485	2
		10.88 C	3.39	2.19	-
128	ST TUB E	PASS	BS-4.7 (C)	0.328	2
		101.88 C	-1.82	0.31	0.00
129	ST TUB E	PASS	ANNEX I.1	0.215	2
		21.37 C	2.06	0.38	-
130	ST TUB E	PASS	ANNEX I.1	0.456	2
		20.60 C	4.30	0.88	-
131	ST TUB E	PASS	BS-4.8.2.2	0.080	2
		2.28 T	0.12	0.01	1.62
132	ST TUB E	PASS	ANNEX I.1	0.053	2
		2.54 C	0.10	0.01	-
133	ST TUB E	PASS	BS-4.8.2.2	0.074	2
		0.13 T	-0.15	-0.01	0.00
134	ST TUB E	PASS	ANNEX I.1	0.069	2
		2.30 C	0.13	0.02	-
135	ST TUB E	PASS	BS-4.8.2.2	0.083	2
		0.02 T	-0.14	-0.04	0.00
136	ST TUB E	PASS	ANNEX I.1	0.156	2
		2.48 C	0.27	0.06	-
137	ST TUB E	PASS	BS-4.8.2.2	0.280	2
		0.51 T	0.51	-0.09	1.05
138	ST TUB E	PASS	ANNEX I.1	0.500	2
		2.09 C	0.86	0.20	-
139	ST TUB E	PASS	ANNEX I.1	0.095	2
		0.14 C	0.09	0.11	-
140	ST TUB E	PASS	ANNEX I.1	0.107	2
		5.67 C	0.15	0.07	-
141	ST TUB E	PASS	BS-4.8.2.2	0.078	2
		0.27 T	-0.11	0.05	1.43

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ALL UNITS ARE - KN METE (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
142	ST TUB E	PASS	ANNEX I.1	0.056	2
		5.37 C	0.08	0.04	-
143	ST TUB E	PASS	BS-4.8.2.2	0.015	2
		0.14 T	-0.02	0.01	1.24
144	ST TUB E	PASS	BS-4.8.3.3.3	0.078	2
		5.43 C	0.05	0.02	-
145	ST TUB E	PASS	ANNEX I.1	0.118	2
		0.02 C	0.19	0.07	-
146	ST TUB E	PASS	ANNEX I.1	0.239	2
		5.01 C	0.37	0.13	-
147	ST TUB E	PASS	ANNEX I.1	0.095	2
		0.14 C	0.09	0.11	-
148	ST TUB E	PASS	ANNEX I.1	0.107	2
		5.67 C	0.15	0.07	-
149	ST TUB E	PASS	BS-4.8.2.2	0.078	2
		0.27 T	0.11	0.05	1.43
150	ST TUB E	PASS	ANNEX I.1	0.056	2
		5.37 C	0.08	0.04	-
151	ST TUB E	PASS	BS-4.8.2.2	0.015	2
		0.14 T	0.02	0.01	1.24
152	ST TUB E	PASS	BS-4.8.3.3.3	0.078	2
		5.43 C	0.05	0.02	-
153	ST TUB E	PASS	ANNEX I.1	0.118	2
		0.02 C	0.19	0.07	-
154	ST TUB E	PASS	ANNEX I.1	0.239	2
		5.01 C	0.37	0.13	-
155	ST TUB E	PASS	BS-4.8.2.2	0.080	2
		2.28 T	-0.12	0.01	1.62
156	ST TUB E	PASS	ANNEX I.1	0.053	2
		2.54 C	0.10	0.01	-
157	ST TUB E	PASS	BS-4.8.2.2	0.074	2
		0.13 T	0.15	-0.01	0.00
158	ST TUB E	PASS	ANNEX I.1	0.069	2
		2.30 C	0.13	0.02	-
159	ST TUB E	PASS	BS-4.8.2.2	0.083	2
		0.02 T	0.14	-0.04	0.00
160	ST TUB E	PASS	ANNEX I.1	0.156	2
		2.48 C	0.27	0.06	-
161	ST TUB E	PASS	BS-4.8.2.2	0.280	2
		0.51 T	-0.51	-0.09	1.05
162	ST TUB E	PASS	ANNEX I.1	0.500	2
		2.09 C	0.86	0.20	-
163	ST TUB E	PASS	BS-4.8.3.3.3	0.127	2
		0.31 C	0.13	0.15	-
164	ST TUB E	PASS	BS-4.8.2.2	0.073	2
		0.16 T	-0.09	0.07	0.00

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ALL UNITS ARE - KN METE (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
165	ST TUB E	PASS	BS-4.8.3.3.3	0.072	2
		1.22 C	0.12	0.00	-
166	ST TUB E	PASS	BS-4.8.3.3.3	0.035	2
		0.86 C	0.02	0.04	-
167	ST TUB E	PASS	BS-4.8.3.3.3	0.022	2
		0.59 C	0.00	0.03	-
168	ST TUB E	PASS	BS-4.8.3.3.3	0.035	2
		0.86 C	0.02	0.04	-
169	ST TUB E	PASS	BS-4.8.3.3.3	0.072	2
		1.22 C	0.12	0.00	-
170	ST TUB E	PASS	BS-4.8.2.2	0.073	2
		0.16 T	0.09	0.07	0.00
171	ST TUB E	PASS	BS-4.8.3.3.3	0.127	2
		0.31 C	0.13	0.15	-
172	ST TUB E	PASS	ANNEX I.1	0.214	2
		0.29 C	0.34	0.12	-
173	ST TUB E	PASS	BS-4.8.2.2	0.127	2
		0.41 T	0.25	-0.02	0.86
174	ST TUB E	PASS	BS-4.8.3.3.3	0.202	2
		1.70 C	0.29	0.14	-
175	ST TUB E	PASS	BS-4.8.3.3.3	0.034	2
		1.11 C	0.00	0.05	-
176	ST TUB E	PASS	BS-4.8.3.3.3	0.025	2
		0.14 C	0.00	0.05	-
177	ST TUB E	PASS	BS-4.8.3.3.3	0.034	2
		1.11 C	0.00	0.05	-
178	ST TUB E	PASS	BS-4.8.3.3.3	0.202	2
		1.70 C	0.29	0.14	-
179	ST TUB E	PASS	BS-4.8.2.2	0.127	2
		0.41 T	-0.25	-0.02	0.86
180	ST TUB E	PASS	ANNEX I.1	0.214	2
		0.29 C	0.34	0.12	-
181	ST TUB E	PASS	ANNEX I.1	0.212	2
		6.40 C	0.29	0.11	-
182	ST TUB E	PASS	BS-4.8.2.2	0.049	2
		2.26 T	0.05	0.01	0.00
183	ST TUB E	PASS	BS-4.8.2.2	0.094	2
		0.62 T	-0.19	0.00	0.00
184	ST TUB E	PASS	BS-4.8.3.3.3	0.102	2
		4.51 C	0.08	0.01	-
185	ST TUB E	PASS	BS-4.8.2.2	0.116	2
		8.17 T	-0.09	-0.01	0.00
186	ST TUB E	PASS	BS-4.7 (C)	0.159	2
		13.51 C	0.14	-0.01	1.64
187	ST TUB E	PASS	BS-4.8.2.2	0.216	2
		18.46 T	0.11	-0.02	1.51

ALL UNITS ARE - KN METE (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
188	ST TUB E	PASS	ANNEX I.1	0.341	2
		27.36 C	0.43	0.05	-
189	ST TUB E	PASS	BS-4.8.2.2	0.297	2
		29.54 T	-0.10	0.01	1.38
190	ST TUB E	PASS	BS-4.7 (C)	0.415	2
		28.64 C	-0.08	0.03	0.00
191	ST TUB E	PASS	BS-4.8.2.2	0.265	2
		25.52 T	0.06	0.05	0.00
192	ST TUB E	PASS	BS-4.7 (C)	0.251	2
		19.38 C	-0.03	0.03	0.00
193	ST TUB E	PASS	BS-4.8.2.2	0.133	2
		12.81 T	0.04	0.02	0.00
194	ST TUB E	PASS	BS-4.7 (C)	0.074	2
		6.25 C	0.02	0.01	0.00
195	ST TUB E	PASS	BS-4.8.3.3.3	0.037	2
		2.26 C	0.01	0.02	-
196	ST TUB E	PASS	BS-4.8.2.2	0.117	2
		10.60 T	0.04	-0.02	1.51
197	ST TUB E	PASS	BS-4.7 (C)	0.243	2
		22.37 C	-0.16	-0.03	1.51
198	ST TUB E	PASS	BS-4.8.2.2	0.296	2
		32.91 T	-0.02	-0.03	0.00
199	ST TUB E	PASS	BS-4.7 (C)	0.415	2
		28.64 C	0.08	0.03	0.00
200	ST TUB E	PASS	BS-4.8.2.2	0.265	2
		25.52 T	-0.06	0.05	0.00
201	ST TUB E	PASS	BS-4.7 (C)	0.251	2
		19.38 C	0.03	0.03	0.00
202	ST TUB E	PASS	BS-4.8.2.2	0.133	2
		12.81 T	-0.04	0.02	0.00
203	ST TUB E	PASS	BS-4.7 (C)	0.074	2
		6.25 C	-0.02	0.01	0.00
204	ST TUB E	PASS	BS-4.8.3.3.3	0.037	2
		2.26 C	0.01	0.02	-
205	ST TUB E	PASS	BS-4.8.2.2	0.117	2
		10.60 T	-0.04	-0.02	1.51
206	ST TUB E	PASS	BS-4.7 (C)	0.243	2
		22.37 C	0.16	-0.03	1.51
207	ST TUB E	PASS	BS-4.8.2.2	0.296	2
		32.91 T	0.02	-0.03	0.00
208	ST TUB E	PASS	ANNEX I.1	0.212	2
		6.40 C	0.29	0.11	-
209	ST TUB E	PASS	BS-4.8.2.2	0.049	2
		2.26 T	-0.05	0.01	0.00
210	ST TUB E	PASS	BS-4.8.2.2	0.094	2
		0.62 T	0.19	0.00	0.00

ALL UNITS ARE - KN METE (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
211	ST TUB E	PASS	BS-4.8.3.3.3	0.102	2
		4.51 C	0.08	0.01	-
212	ST TUB E	PASS	BS-4.8.2.2	0.116	2
		8.17 T	0.09	-0.01	0.00
213	ST TUB E	PASS	BS-4.7 (C)	0.159	2
		13.51 C	-0.14	-0.01	1.64
214	ST TUB E	PASS	BS-4.8.2.2	0.216	2
		18.46 T	-0.11	-0.02	1.51
215	ST TUB E	PASS	ANNEX I.1	0.341	2
		27.36 C	0.43	0.05	-
216	ST TUB E	PASS	BS-4.8.2.2	0.297	2
		29.54 T	0.10	0.01	1.38
217	ST TUB E	PASS	BS-4.8.2.2	0.408	2
		35.64 T	0.22	0.02	0.00
218	ST TUB E	PASS	BS-4.7 (C)	0.601	2
		36.92 C	-0.07	0.06	0.00
219	ST TUB E	PASS	BS-4.8.2.2	0.367	2
		35.34 T	0.09	0.07	2.11
220	ST TUB E	PASS	BS-4.8.3.3.3	0.559	2
		32.28 C	0.02	0.05	-
221	ST TUB E	PASS	BS-4.8.2.2	0.066	2
		3.40 T	0.08	0.00	0.00
222	ST TUB E	PASS	ANNEX I.1	0.025	2
		0.35 C	0.03	0.02	-
223	ST TUB E	PASS	ANNEX I.1	0.025	2
		0.27 C	0.03	0.02	-
224	ST TUB E	PASS	BS-4.8.2.2	0.066	2
		3.40 T	-0.08	0.00	2.11
225	ST TUB E	PASS	BS-4.8.3.3.3	0.559	2
		32.20 C	0.02	0.05	-
226	ST TUB E	PASS	BS-4.8.2.2	0.367	2
		35.34 T	-0.09	-0.07	0.00
227	ST TUB E	PASS	BS-4.7 (C)	0.601	2
		36.92 C	0.07	-0.06	2.11
228	ST TUB E	PASS	BS-4.8.2.2	0.408	2
		35.64 T	-0.22	-0.02	2.11
229	ST TUB E	PASS	BS-4.8.2.2	0.531	2
		46.55 T	0.31	-0.01	0.00
230	ST TUB E	PASS	BS-4.7 (C)	0.540	2
		49.79 C	0.10	0.07	0.00
231	ST TUB E	PASS	BS-4.8.2.2	0.450	2
		47.80 T	0.09	0.03	1.50
232	ST TUB E	PASS	BS-4.7 (C)	0.466	2
		43.03 C	-0.02	0.04	0.00
233	ST TUB E	PASS	BS-4.8.2.2	0.063	2
		3.61 T	0.02	0.05	0.00

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ALL UNITS ARE - KN METE (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
234	ST TUB E	PASS	ANNEX I.1	0.046	2
		0.49 C	0.05	0.04	-
235	ST TUB E	PASS	ANNEX I.1	0.046	2
		0.49 C	0.05	0.04	-
236	ST TUB E	PASS	BS-4.8.2.2	0.063	2
		3.61 T	-0.02	-0.05	1.50
237	ST TUB E	PASS	BS-4.7 (C)	0.466	2
		43.03 C	0.02	-0.04	1.50
238	ST TUB E	PASS	BS-4.8.2.2	0.450	2
		47.80 T	-0.09	-0.03	0.00
239	ST TUB E	PASS	BS-4.7 (C)	0.540	2
		49.79 C	-0.10	-0.07	1.50
240	ST TUB E	PASS	BS-4.8.2.2	0.531	2
		46.55 T	-0.31	0.01	1.50
241	ST TUB E	PASS	BS-4.8.2.2	0.649	2
		3.48 T	1.00	2.24	4.90
242	ST TUB E	PASS	BS-4.8.2.2	0.279	2
		5.60 T	0.00	2.13	0.00
243	ST TUB E	PASS	BS-4.8.2.2	0.649	2
		3.48 T	-1.00	-2.24	0.00
244	ST TUB E	PASS	BS-4.9	0.658	2
		0.00 T	1.04	2.33	0.00
245	ST TUB E	PASS	BS-4.8.2.2	0.263	2
		0.80 T	-0.01	-2.18	4.90
246	ST TUB E	PASS	BS-4.9	0.658	2
		0.00 T	1.04	2.33	0.00
247	ST TUB E	PASS	BS-4.9	0.655	2
		0.00 T	1.03	2.33	0.00
248	ST TUB E	PASS	BS-4.8.2.2	0.260	2
		0.23 T	0.01	2.18	0.00
249	ST TUB E	PASS	BS-4.9	0.655	2
		0.00 T	1.03	2.33	0.00
250	ST TUB E	PASS	BS-4.9	0.640	2
		0.00 T	1.03	2.22	0.00
251	ST TUB E	PASS	BS-4.8.2.2	0.260	2
		0.21 T	0.01	2.18	0.00
252	ST TUB E	PASS	BS-4.9	0.640	2
		0.00 T	1.03	2.22	0.00
253	ST TUB E	PASS	BS-4.9	0.624	2
		0.00 T	1.03	2.12	0.00
254	ST TUB E	PASS	BS-4.8.2.2	0.256	2
		0.06 T	0.01	2.15	0.00
255	ST TUB E	PASS	BS-4.9	0.624	2
		0.00 T	1.03	2.12	0.00
256	ST TUB E	PASS	BS-4.8.3.3.3	0.610	2
		0.07 C	1.02	2.04	-

ALL UNITS ARE - KN METE (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
257	ST TUB E	PASS	ANNEX I.1	0.252	2
		0.27 C	0.01	2.11	-
258	ST TUB E	PASS	BS-4.8.3.3.3	0.610	2
		0.07 C	1.02	2.04	-
259	ST TUB E	PASS	BS-4.9	0.583	2
		0.00 T	1.00	1.90	0.00
260	ST TUB E	PASS	BS-4.8.2.2	0.254	2
		1.60 T	0.01	2.07	0.00
261	ST TUB E	PASS	BS-4.9	0.583	2
		0.00 T	1.00	1.90	0.00
262	ST TUB E	PASS	BS-4.8.3.3.3	0.861	2
		8.47 C	1.16	1.72	-
263	ST TUB E	PASS	BS-4.8.3.3.3	0.713	2
		15.69 C	0.04	1.97	-
264	ST TUB E	PASS	BS-4.8.3.3.3	0.861	2
		8.47 C	1.16	1.72	-
265	ST UC2 03X203X60	PASS	ANNEX I.1	0.308	2
		40.19 C	4.22	33.86	-
266	ST UC2 03X203X60	PASS	ANNEX I.1	0.481	2
		56.12 C	13.18	38.99	-
267	ST UC2 03X203X60	PASS	ANNEX I.1	0.481	2
		56.12 C	13.18	38.99	-
268	ST UC2 03X203X60	PASS	ANNEX I.1	0.308	2
		40.19 C	4.22	33.86	-

********** END OF TABULATED RESULT OF DESIGN **********

122. FINISH

********** END OF THE STAAD.Pro RUN **********

**** DATE= JAN 6,2017 TIME= 22:10:58 ****


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*   For questions on STAAD.Pro,                            *
*   Please contact : Research Engineers Ltd.               *
*   E2/4,Block GP, Sector-V,Salt Lake, KOLKATA - 700 091   *
*   India : TEL:(033)2357-3575      FAX:(033)2357-3467     *
*   email : support@calcutta.reiusa.com                    *
*   US    : Ph-(714) 974-2500, Fax-(714) 921-0683          *
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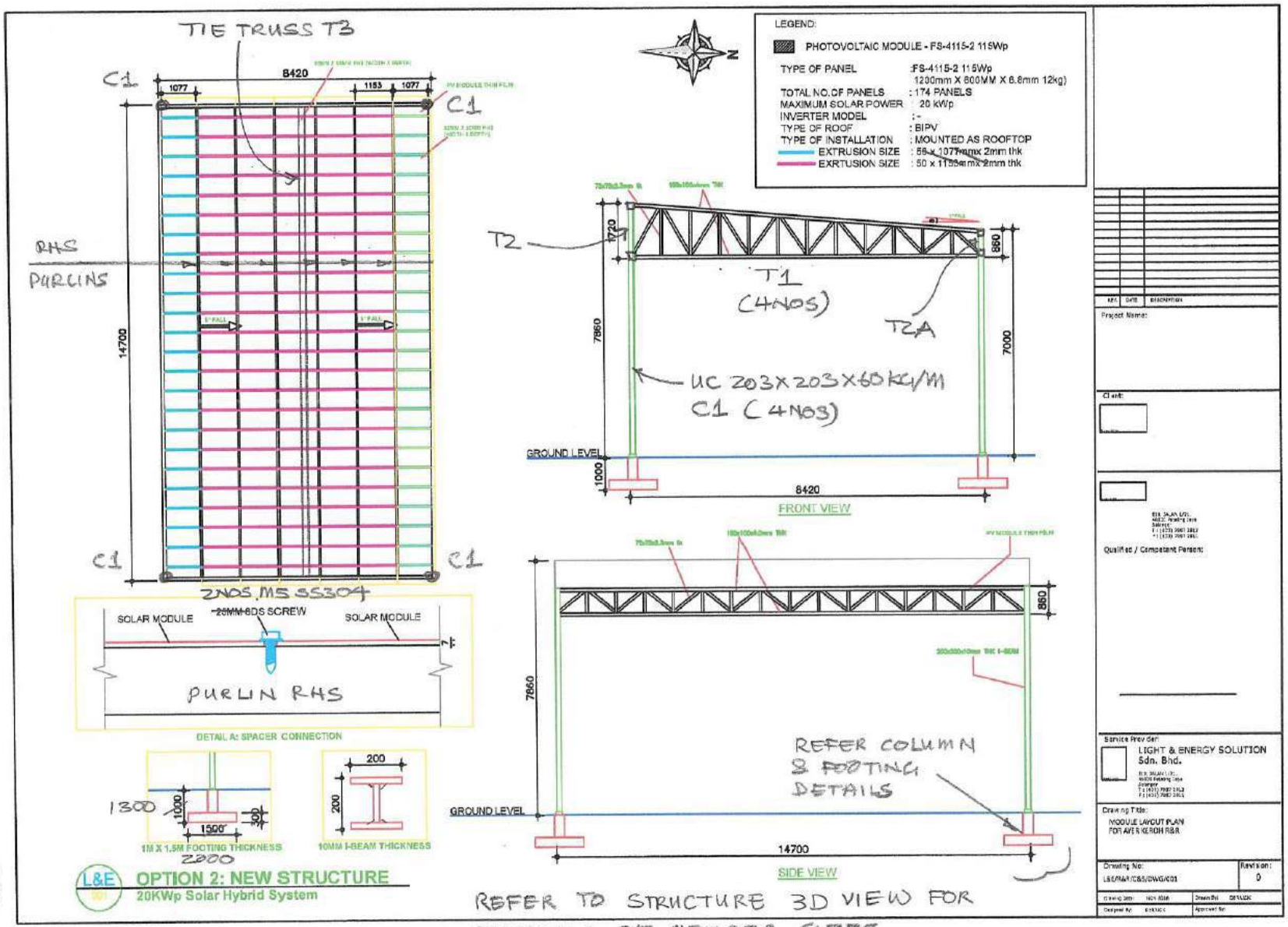
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C1
8420
1077
1153
1077
C1
RHS
PURLINS
14700
C1
C1
2NOS M5 SS304
SOLAR MODULE
26MM BDS SCREW
SOLAR MODULE
PURLIN RHS
DETAIL A: SPACER CONNECTION
1300
1000
1500
2200
1M X 1.5M FOOTING THICKNESS
200
200
10MM I-BEAM THICKNESS
LEGEND:
PHOTOVOLTAIC MODULE - FS-4115-2 115Wp
TYPE OF PANEL :FS-4115-2 115Wp
1200mm X 600MM X 6.8mm 12kg)
TOTAL NO.OF PANELS : 174 PANELS
MAXIMUM SOLAR POWER : 20 kWp
INVERTER MODEL :-
TYPE OF ROOF : BIPV
TYPE OF INSTALLATION : MOUNTED AS ROOFTOP
EXTRUSION SIZE : 58 x 1077mmx 2mm thk
EXRTUSION SIZE : 50 x 1153mmx 2mm thk
T2
1720
860
T1
(4NOS)
T2A
7860
7000
UC 203X203X60 KG/M
C1 (4NOS)
GROUND LEVEL
1000
8420
FRONT VIEW
860
7860
REFER COLUMN
& FOOTING
DETAILS
GROUND LEVEL
14700
SIDE VIEW
REFER TO STRUCTURE 3D VIEW FOR
DETAILS OF MEMBER SIZES
L&E
OPTION 2: NEW STRUCTURE
20KWp Solar Hybrid System
Project Name:
Client:
Qualified / Competent Person:
Service Provider:
LIGHT & ENERGY SOLUTION
Sdn. Bhd.
Drawing Title:
MODULE LAYOUT PLAN
FOR AYER KEROH R&R
Drawing No:
L&E/RAY/CES/DWG/001
Revision:
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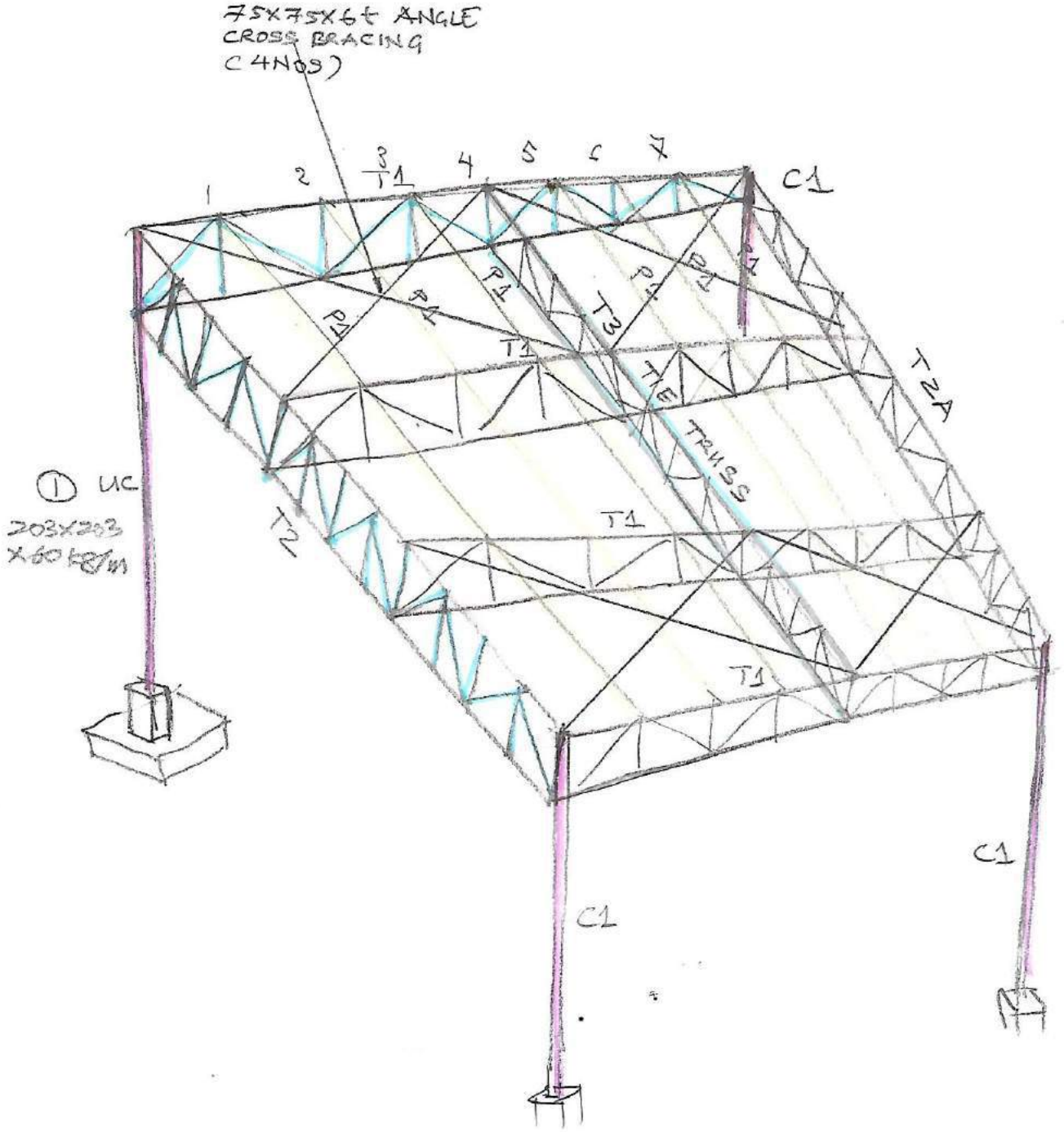


Noted

① UC 203X203X60 kg/m

② — 100X100X4t SHS

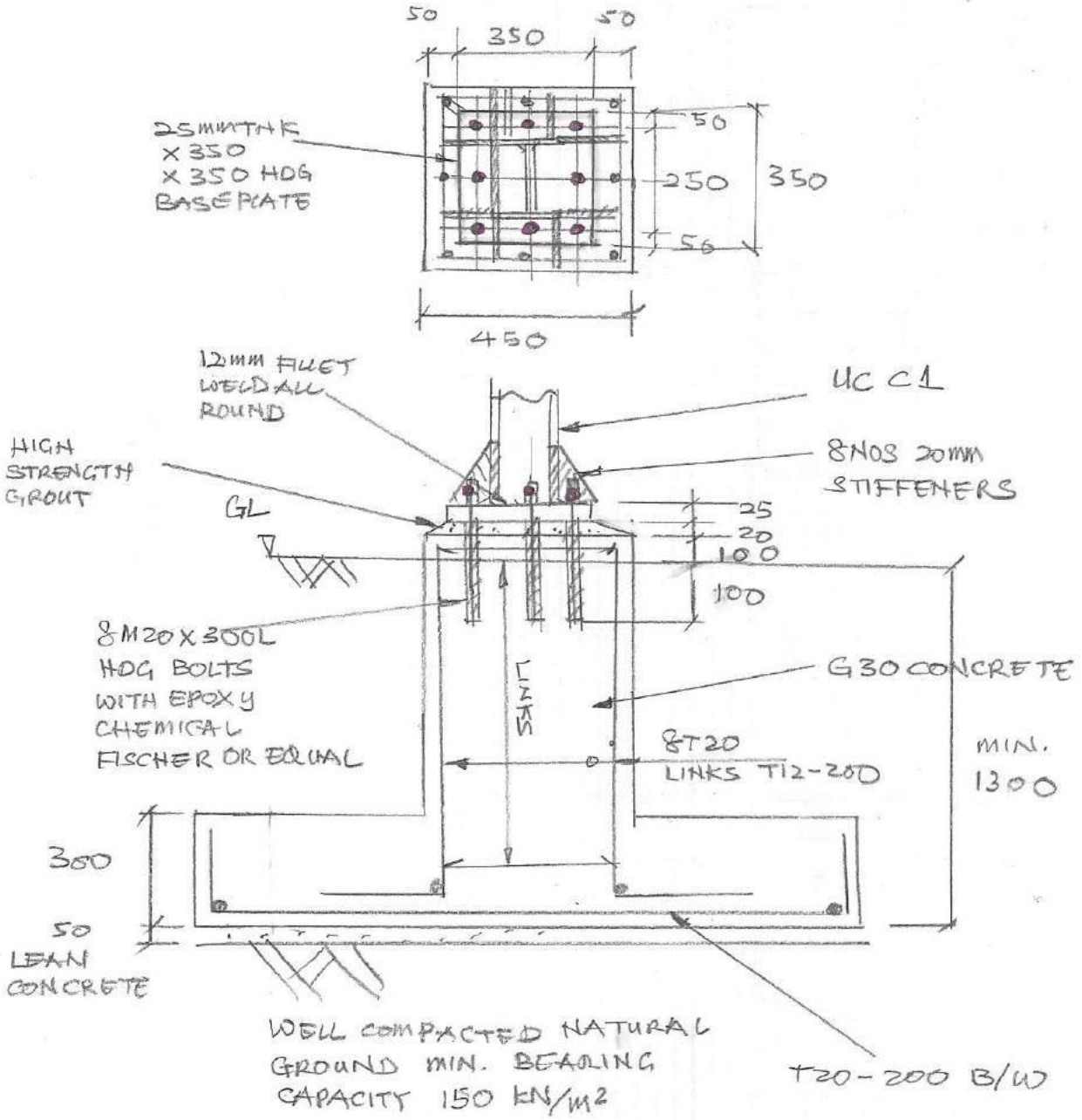
③ — 50X50X2.3tt SHS

④ — Purlins 50X125X4t RHS

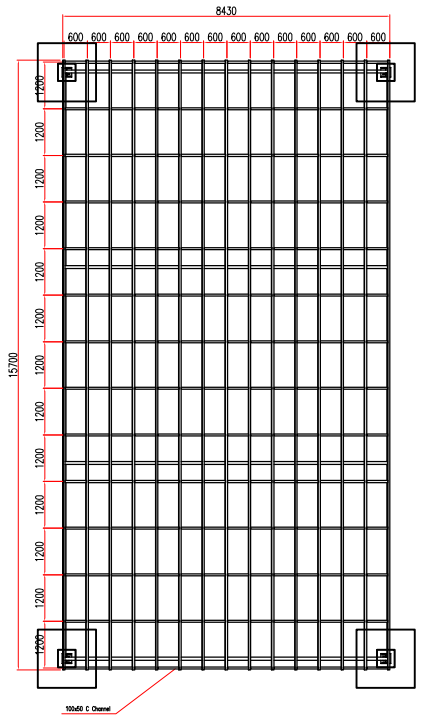
AYER KEROH – 3D ELEVATION

AYER KEROH SOLAR STRUCTURE

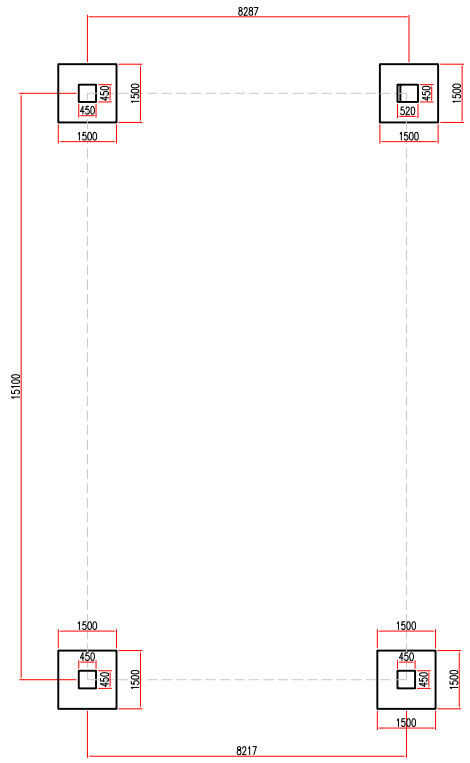
1.0 UC COLUMN & FOOTING



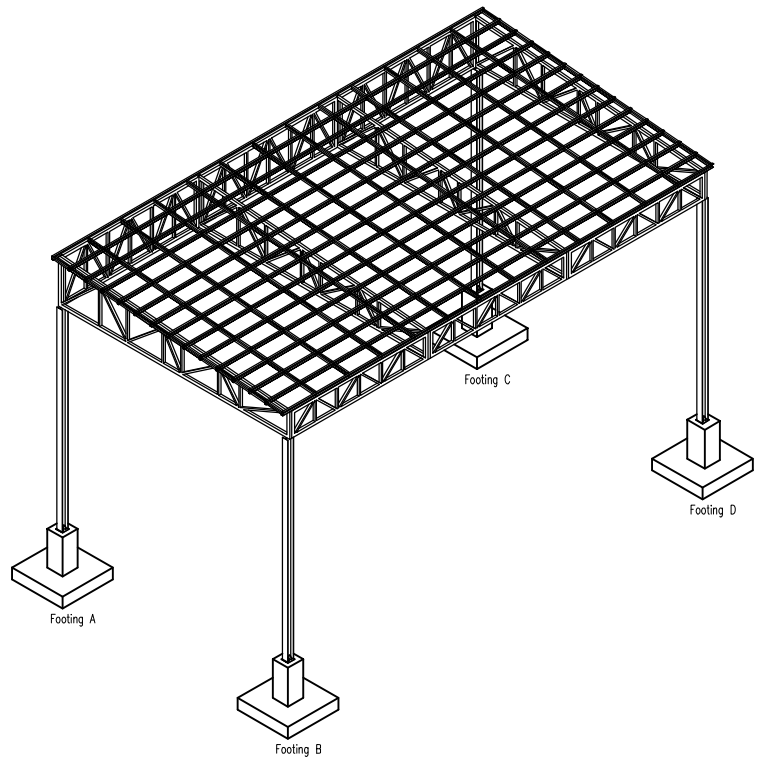
Structure Mitigation Plan Drawing with PE Endorsement



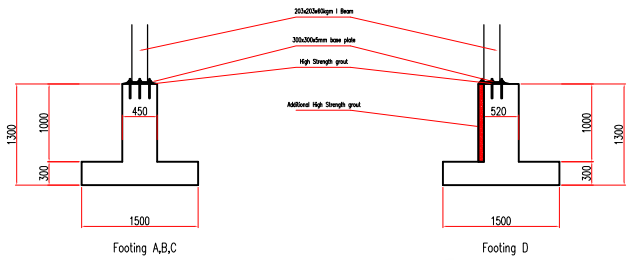
TOP VIEW (WITH SOLAR PURLIN)

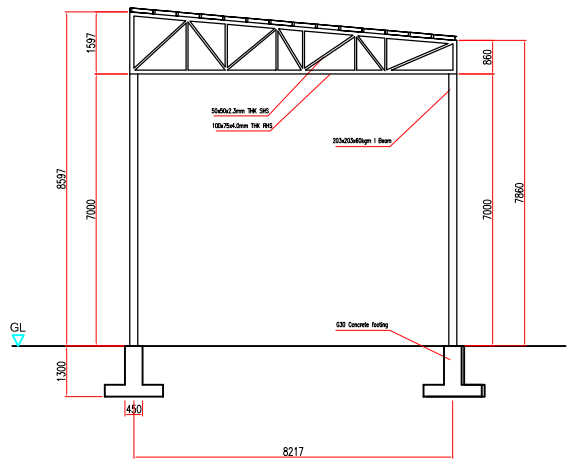


Footing Layout

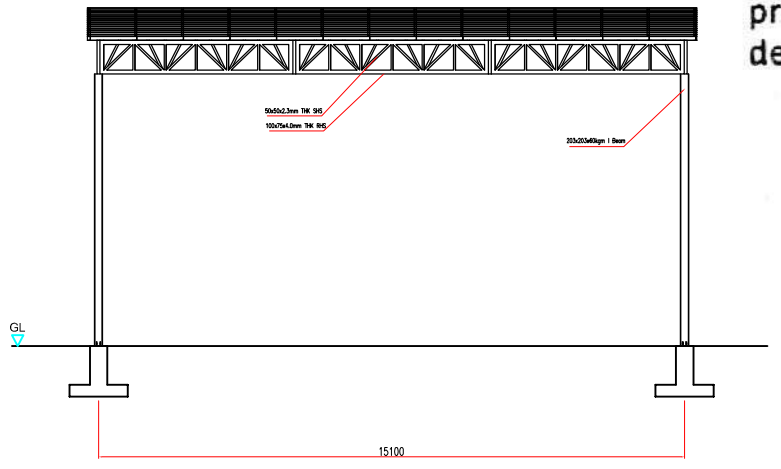


ISOMETRIC VIEW (WITH SOLAR PURLIN)





SIDE VIEW (WITH SOLAR PURLIN)



FRONT VIEW (WITH SOLAR PURLIN)

I hereby certify that this work has been designed by me in accordance with sound engineering practice and that I take full responsibility for the design and proper performance of the same.

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PROMOUNT ENGINEERING SDN. BHD.
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CONSULTANT:

PROJECT TITLE :

Ayer Keroh R&R 20kwp Structure

PV MODULE USED :

DRAWING TITLE :

SCALE	:	NTS
DATE	:	8 Sept 2017
REVISED BY	:	
DRAWN BY	:	Low KL
CHECKED BY	:	Low KL
NO. LUKISAN	:	
REVISION	:	Rev 1

Technical Data Sheet and Product Manual

First Solar Photovoltaic (PV) Data Sheet

First Solar Series 4™ PV Module

ADVANCED THIN FILM SOLAR TECHNOLOGY

117.5 WATT MODULE EFFICIENCY OF 16.3%

INDUSTRY BENCHMARK SOLAR MODULES

As a global leader in PV energy, First Solar's advanced thin film solar modules have set the industry benchmark with over 10 gigawatts (GW) installed worldwide and a proven performance advantage over conventional crystalline silicon solar modules. Generating more energy than competing modules with the same power rating, First Solar's Series 4™ and Series 4A™ PV Modules deliver superior performance and reliability to our customers.

PROVEN ENERGY YIELD ADVANTAGE

- Generates more energy than conventional crystalline silicon solar modules with the same power
- Superior temperature coefficient resulting in greater energy yield in typical field operating temperatures
- Superior spectral response resulting in a proven energy yield advantage in humid environments
- Anti-reflective coated glass (Series 4A™) enhances energy production

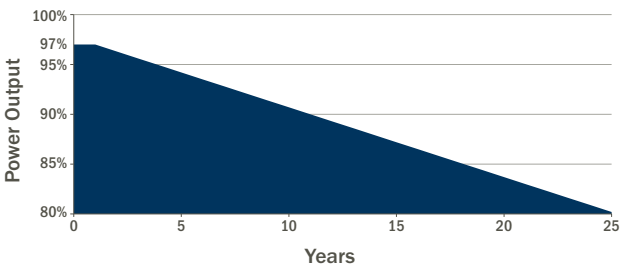
ADVANCED PERFORMANCE & RELIABILITY

- Long-term power-output warranted for 25 years
- Compatible with advanced 1500V plant architectures
- Highly predictable energy in all climates and applications
- Independently certified for reliable performance in high temperature, high humidity, extreme desert and coastal environments based on accelerated life and stress tests

CERTIFICATIONS & TESTS

- PID-Free, Thresher Test, Long-Term Sequential Test, and ATLAS 25+[1]
- IEC 61646 1500V, IEC 61730 1500V, CE
- IEC 61701 Salt Mist Corrosion, IEC 60068-2-68 Dust and Sand Resistance
- ISO 9001:2008 and ISO 14001:2004
- UL 1703 and ULC 1703 Listed Class B Fire Rating (Class A Spread of Flame)
- CSI Eligible (CA-USA), FSEC (FL-USA), MCS (UK), CEC Listed (Australia), JET (Japan)[2], SII (Israel), InMetro (Brazil)[2]

MODULE WARRANTY[3]



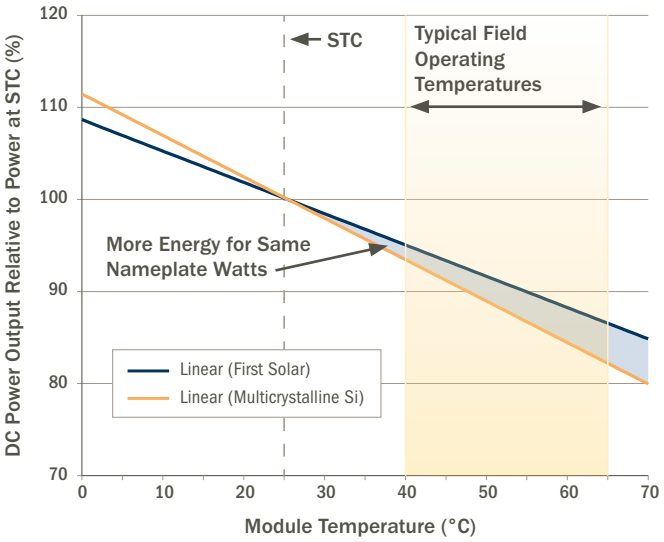
- 25-Year Linear Performance Warranty[4]
- 10-Year Limited Product Warranty

FIRST SOLAR SERIES 4™ PV MODULE

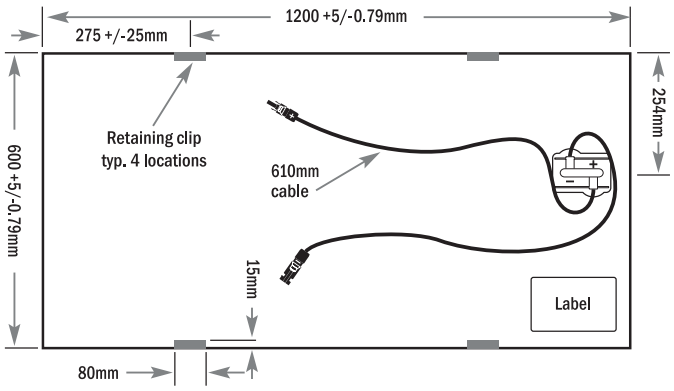
MECHANICAL DESCRIPTION	
Length	1200mm
Width	600mm
Weight	12kg
Thickness	6.8mm
Area	0.72m^2
Leadwire	2.5mm^2, 610mm
Connectors	MC4[9]
Bypass Diode	None
Cell Type	Thin-film CdTe semiconductor, up to 216 cells
Frame Material	None
Front Glass	3.2mm heat strengthened Series 4A™ includes anti-reflective coating
Back Glass	3.2mm tempered
Encapsulation	Laminate material with edge seal
Load Rating	2400Pa[10]

MODULE NUMBERS AND RATINGS AT STC[5,6]							
NOMINAL VALUES		FS-4105-2 FS-4105A-2	FS-4107-2 FS-4107A-2	FS-4110-2 FS-4110A-2	FS-4112-2 FS-4112A-2	FS-4115-2 FS-4115A-2	FS-4117-2 FS-4117A-2
Nominal Power (± 5%)	P_{MPP} (W)	105.0	107.5	110.0	112.5	115.0	117.5
Voltage at P_{MAX}	V_{MPP} (V)	67.8	68.6	69.4	70.2	70.5	71.2
Current at P_{MAX}	I_{MPP} (A)	1.55	1.57	1.59	1.60	1.63	1.65
Open Circuit Voltage	V_{OC} (V)	86.0	86.6	87.2	87.7	87.8	88.2
Short Circuit Current	I_{SC} (A)	1.74	1.75	1.75	1.75	1.78	1.79
Module Efficiency	%	14.6	14.9	15.3	15.6	16.0	16.3
Maximum System Voltage	V_{SYS} (V)	1500 [7]					
Limiting Reverse Current	I_R (A)	4.0					
Maximum Series Fuse	I_{CF} (A)	4.0					
MODULE NUMBERS AND RATINGS AT 800W/m^2, NOCT[8] 45°C, AM 1.5 [6]							
Nominal Power (± 5%)	P_{MPP} (W)	78.3	80.1	82.0	83.9	85.8	87.6
Voltage at P_{MAX}	V_{MPP} (V)	62.6	63.1	64.1	65.0	65.5	65.9
Current at P_{MAX}	I_{MPP} (A)	1.25	1.27	1.28	1.29	1.31	1.33
Open Circuit Voltage	V_{OC} (V)	81.0	81.6	82.1	82.6	82.7	83.1
Short Circuit Current	I_{SC} (A)	1.40	1.41	1.41	1.41	1.44	1.44
TEMPERATURE CHARACTERISTICS							
Module Operating Temperature Range	(°C)	-40 to +85					
Temperature Coefficient of P_{MPP}	T_K (P_{MPP})	-0.34%/°C					
Temperature Coefficient of V_{OC}	T_K (V_{OC})	-0.29%/°C					
Temperature Coefficient of I_{SC}	T_K (I_{SC})	+0.04%/°C					

SUPERIOR TEMPERATURE COEFFICIENT



MECHANICAL DRAWING



END-OF-LIFE RECYCLING

- Recycling services available through First Solar's industry-leading recycling program or customer-selected third party.

1 Device package meets ATLAS 25+.
2 Testing Certifications/Listings pending.
3 Limited power output and product warranties subject to warranty terms and conditions.
4 Ensures 97% rated power in first year, -0.7%/year through year 25.
5 Standard Test Conditions (STC) 1000W/m^2, AM 1.5, 25°C
6 All ratings ±10%, unless specified otherwise. Specifications are subject to change.
7 Application Class A for 1000V (class II), Application Class B for 1500V (class 0)
8 Nominal Operating Cell Temperature: Module operation temperature at 800W/m^2 irradiance, 20°C air temperature, 1m/s wind speed.
9 Multi-Contact MC4 (PV-KST4/PV-KBT4)
10 Higher load ratings can be met with additional clips or wider clips, subject to testing

Disclaimer
The information included in this Module Datasheet is subject to change without notice and is provided for informational purposes only. No contractual rights are established or should be inferred because of user's reliance on the information contained in this Module Datasheet. Please refer to the appropriate Module User Guide and Module Product Specification document for more detailed technical information regarding module performance, installation and use.

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20kW Solis Inverter Data Sheet and Manual

Solis Three Phase Inverter

solis-20K inverter

Leading Features

- Three phase output
- Over 98.4% Max.efficiency
- 200V-800V input voltage range
- 7.0" LCD color screen display(optional)
- Four MPPT design with precise MPPT algorithm
- Compact and light design, easy installation
- IP65, visually pleasing for domestic environment
- RS 485, WiFi/GPRS (optional) interface
- Numerous protection functions
- WiFi and monitoring app available
- 5 years standard warranty, 10 years optional upgrade

Model	Solis-20K
Input Side (DC)	
Max. input power	24kW
Max. input voltage	1000V
Start-up input voltage	350V
MPPT voltage range	200-800V
Max. input current	18A+18A+18A+18A
MPPT number/Max. input strings number	4/8
Output Side (AC)	
Rated output power	20kW
Rated grid voltage	380/400V
Grid voltage range	304~460V(adjustable)
Rated grid frequency	50/60Hz
Operating phase	Three
Rated output current	28.7A
Power factor	>0.99
Total harmonic distortion (THDi)	<3%
DC injection current	<50mA
Grid frequency range	47-52Hz or 57-62Hz(adjustable)
Efficiency	
Max. efficiency	98.4%
EU efficiency	97.6%
MPPT efficiency	99.9%
Protection	
DC reverse-polarity protection	Yes
Short circuit protection	Yes
Output over current protection	Yes
Output over voltage protection	Yes
Insulation resistance monitoring	Yes
Residual current detection	Yes
Surge protection	Yes
Grid monitoring	Yes
Islanding protection	Yes
Temperature protection	Yes
Integrated DC switch	Optional
General Data	
Dimensions	530W*688H*356.5D(mm)
Weight	48kg
Topology	Transformerless
Self consumption	<1W(Night)
Operating ambient temperature range	-25°C~60°C
Ingress protection	IP65
Noise emission(typical)	<50 dBA
Cooling concept	Natural convection
Max. operation altitude	2000m
Designed lifetime	>20 years
Grid connection standard	CQC, G59/3, AS4777, VDE0126-1-1, NB/T32004
Relative humidity	0~95%
Safety/EMC standard	EN61000-6-1:2007; EN61000-6-3:2007 IEC62109-1/2; AS3100;NB/T 32004
Features	
DC connection	MC-4 mateable
AC connection	Terminal connectors
Display	7.0" LCD color screen display(optional)
Interface	RS 485, WiFi/GPRS (optional)
Warranty	5~10 Years

PV Grid Tie Inverter

Solis Three Phase Inverter

Installation and Operation Manual

Ningbo Ginlong Technologies Co., Ltd.
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Xiangshan, Ningbo, Zhejiang, 315712, P.R.China
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Fax: +86 (0)574 6578 1606
Email: info@ginlong.com
Web: www.ginlong.com

Please record the serial number of your inverter and quote this when you contact us.

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Ver 2.6

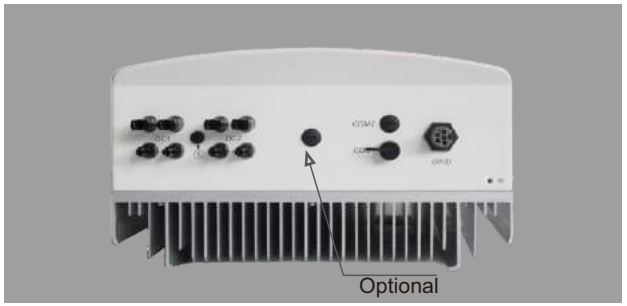
Contents

Contents

1. Introduction

Solis three phase series PV inverters could transfer DC power from PV panels into AC power and feed into grid. There are 6 models for Solis three phase inverter.
Solis-6K, Solis-10K, Solis-15K are used for 380/400V three phase grid system,
Solis-20K-HV is used for 480V three phase grid system.
Solis-6K-LV, Solis-10K-LV are use for 208/220/240V three phase grid system.
All 6 models are transformerless topology grid tie PV inverter.

▲ Figure 1.1 Front side view



▲ Figure 1.2 Bottom side view

1. Introduction

1.2 Packaging

When you receive the inverter, please check if all the parts listed below are included:

1

2

3

4

5

6

Part NO.	Description	Number
1	PV grid tie inverter	1
2	Wall mounting bracket	1
3	Locking screws	2
5	AC connector	1
6	DC connectors	4 pairs(2 for Solis-6K)
7	Manual	1

▲ Table 1.1 Material list

2.Safety Instructions

Improper use may result in potential electric shock hazards or burns. This manual contains important instructions that should be followed during installation and maintenance. Please read these instructions carefully before use and keep them for future reference.

2.1 Safety Symbols

Safety symbols used in this manual, which highlight potential safety risks and important safety information, are listed as follows:

WARNING:
WARNING symbol indicates important safety instructions, which if not correctly followed, could result in serious injury or death.

NOTE:
NOTE symbol indicates important safety instructions, which if not correctly followed, could result in some damage or the destruction of the inverter.

CAUTION:
CAUTION, RISK OF ELECTRIC SHOCK symbol indicates important safety instructions, which if not correctly followed, could result in electric shock.

CAUTION:
CAUTION, HOT SURFACE symbol indicates safety instructions, which if not correctly followed, could result in burns.

2.2 General Safety Instructions

WARNING:
Please don't connect PV array positive(+) or negative(-) to the ground, it could cause serious damage to the inverter.

WARNING:
Electrical installations must be done in accordance with the local and national electrical safety standards

2.Safety Instructions

WARNING:
To reduce the risk of fire, branch-circuit over-current protective devices (OCPD) are required for circuits connected to the Inverter.
The recommend rated trip current for AC breaker should be 25A for Solis-6K inverter, 32A for Solis-10K, Solis-15K, Solis-20K-HV inverter.

CAUTION:
Risk of electric shock. Do not remove cover. There is no user serviceable parts inside. Refer servicing to qualified and accredited service technician.

CAUTION:
The PV array (Solar panels) supplies a DC voltage when it is exposed to light.

CAUTION:
Risk of electric shock from energy stored in capacitors of the Inverter. Do not remove cover until 5 minutes after disconnecting all sources of supply. Service technician only. Warranty may be voided if any unauthorized removal of cover.

CAUTION:
The surface temperature of the inverter can reach up to 75℃ (167 F).
To avoid risk of burns, do not touch the surface when inverter is operating.
Inverter must be installed out the reach of children.

2.3 Notice For Use

The inverter has been constructed according to the applicable safety and technical guidelines. Use the inverter in installations that meet the following sepcification ONLY:

1.Permanent installation is required.

2.The inverter must be connected to a separate grounded AC group, to which no other electrical equipment is connected.

3.The electrical installation must meet all the applicable regulations and standards.

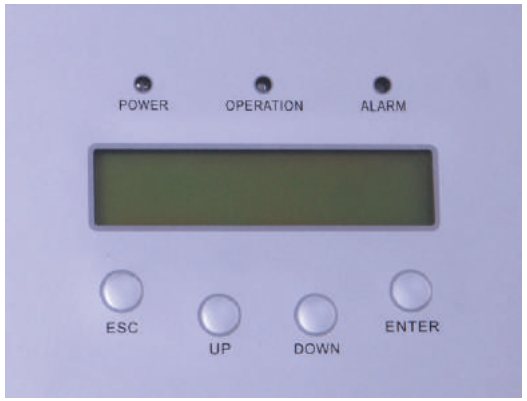
4.The inverter must be installed according to the instructions stated in this manual.

5.The inverter must be installed according to the correct technical specifications.

6.To startup the inverter, the Grid Supply Main Switch (AC) must be switched on, before the solar panel's DC isolator shall be switched on. To stop the inverter, the Grid Supply Main Switch (AC) must be switched off before the solar panel's DC isolator shall be switched off.

3. Overview

3.1 Front Panel Display



▲ Figure 3.1 Front Panel Display

3.2 LED Status Indicator Lights

There are three LED status indicator lights in the front panel of the inverter. Left LED: POWER LED (red) indicates the power status of the inverter. Middle LED: OPERATION LED (green) indicates the operation status. Right LED: ALARM LED (yellow) indicates the alarm status. Please see Table 3.1 for details

Light	Status	Description
POWER	ON	The inverter can detect DC power
	OFF	No DC power or low DC power
OPERATION	ON	The inverter is operating properly.
	OFF	The inverter has stopped to supply power.
	FLASHING	The inverter is initializing.
ALARM	ON	Alarm or fault condition is detected.
	OFF	The inverter is operating properly.

▲ Table 3.1 Status Indicator Lights

3. Overview

3.3 Keypad

There are four keys in the front panel of the Inverter(from left to right):
ESC, UP, DOWN and ENTER keys. The keypad is used for:

- Scrolling through the displayed options (the UP and DOWN keys);
- Access to modify the adjustable settings (the ESC and ENTER keys).

3.4 LCD

The two-line Liquid Crystal Display (LCD) is located at the front panel of the Inverter, which shows the following information:

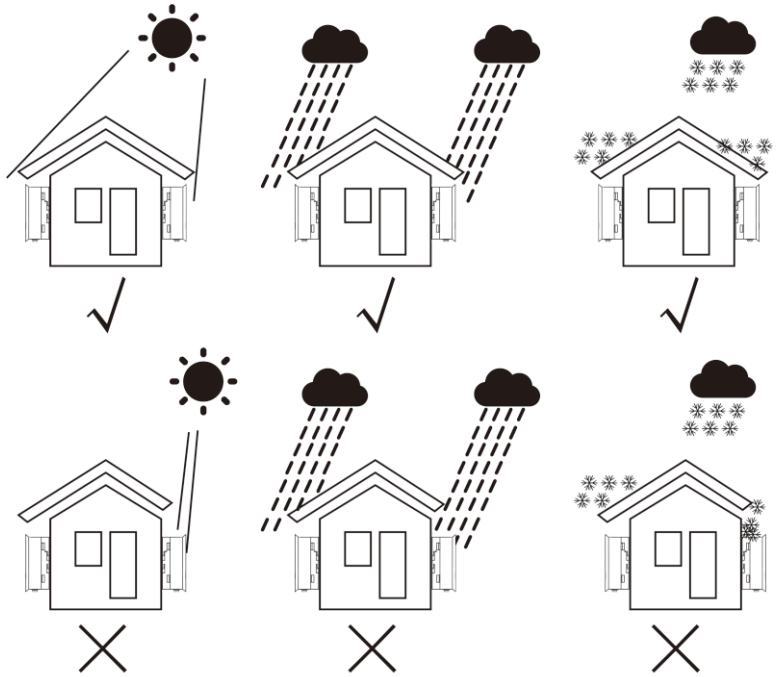
- Inverter operation status and data;
- Service messages for operator;
- Alarm messages and fault indications.

4. Installation

4.1 Select a Location for the Inverter

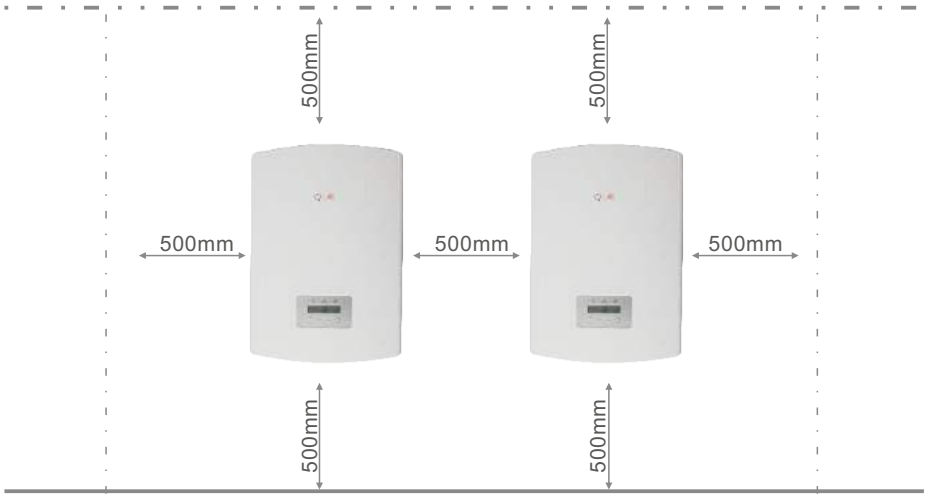
To select a location for the inverter, the following criteria should be considered:

- Do not install in small closed spaces where air cannot circulate freely. To avoid overheating, always make sure the flow of air around the inverter is not blocked.
- Exposure to direct sunlight will increase the operational temperature of the inverter and may cause output power limiting. Ginlong recommend inverter installed to avoid direct sunlight or raining.
- To avoid over heating ambient air temperature MUST be considered when choosing the inverter installation location. Ginlong recommend using a sun shade minimizing direct sunlight when the ambient air temperature around the unit exceeds 40°C.



▲ Figure 4.1 Recommend Installation place

- Install on a wall or strong structure capable of bearing the weight.
- Install vertically with a maximum incline of +/- 5° . If the mounted inverter is tilted to an angle greater than the maximum noted, heat dissipation can be inhibited, and may result in less than expected output power.
- For 1 or more inverter installed, a minimum 12in clearance should be kept between each inverter or other object. The bottom of the inverter should be 20in clearance to the ground.



▲ Figure 4.2 Inverter Mounting clearance

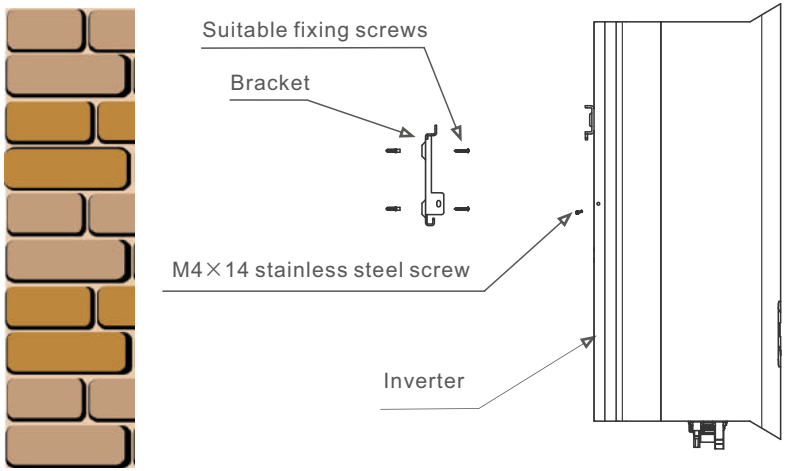
- Visibility of the LED status indicator lights and the LCD located at the front panel of the inverter should be considered.
- Adequate ventilation must be provided if the inverter is to be installed in a confined space.

NOTE:
Nothing should be stored on or placed against the inverter.

4. Installation

4.2 Mounting the Inverter

Please use suitable fixings for wall type (e.g. use dynabolts for brick, masonry, etc).



▲ Figure 4.3 Inverter Mounting

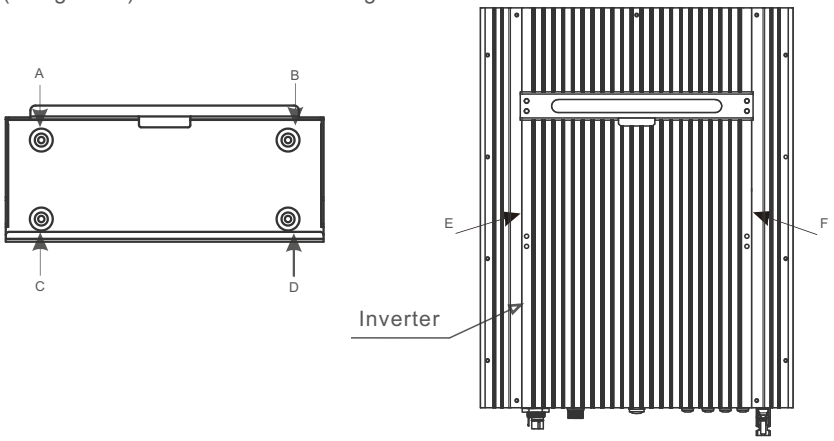
Inverter should be mounted in a vertical position as shown in Figure 4.3. The steps to mount the inverter on the wall are given as follows:

1. Locate the wall studs in the desired location and align the wall mount bracket over the studs. Mark the mounting holes. For masonry walls, the mounting holes should be for a suitable dynabolt type mounting system.

2. MAKE SURE BRACKET IS horizontal. Ensure that the A, B, C, and D mounting holes (in Figure 4.3) are aligned with the wall's most secure points (e.g. wall studs in case of clad building materials).

WARNING:
Bracket must be mounted vertically on a vertical wall surface.

3. Carefully hang the inverter on the upper part of the wall mount bracket by fitting the hooks into the slot of the bracket. Use M4×14 stainless steel screws at holes E and F (in Figure 4.) to secure the mounting hooks to the rear of the inverter.



▲ Figure 4.4 Wall Mount Bracket

4.3 Electrical Connections

The Inverter is designed for electrical connection without removing the cover. The meaning of the symbols located at the bottom of the inverter are listed in Table 4.1.All electrical installations must be in accordance with all local and national electrical codes .

+	Positive DC input terminal
-	Negative DC input terminal
DC 1	Positive or negative DC 1 input terminal
DC 2	Positive or negative DC 2 input terminal
DC SWITCH	Switch of DC input terminals(optional)
COM	Communication connection equipment terminal (Optional)
GRID	Grid wires connection equipment terminal

▲ Table 4.1 Terminals

The electrical connection of the inverter must follow the steps listed below:

1. Switch the Grid Supply Main Switch (AC) OFF.
2. Switch the DC Switch OFF.
3. Assemble PV input connector of the Inverter.

Before connecting inverter, please make sure the PV array open circuit voltage is within the limit of the inverter

Maximum 1000Voc for

Solis-6K Solis-10K Solis-15K Solis-20K-HV

Maximum 600Voc for

Solis-6K-LV Solis-10K-LV

Please don't connect PV array positive or negative pole to the ground, it could cause serious damages to the inverter

Before connection, please make sure the polarity of the output voltage of PV array matches the "DC+" and "DC-" symbols.

▲ Figure 4.5 DC+ Connector

▲ Figure 4.6 DC- Connector

Please use qualified DC cable for PV system.

The steps to assemble the DC connectors are listed as follows:

I) Strip off the DC wire for about 7mm, Disassemble the connector cap nut (see Figure 4.7).

▲ Figure 4.7 Disassemble the Connector Cap nut

ii) Insert the wire into the connector cap nut and contact pin as shown in Figure 4.8.

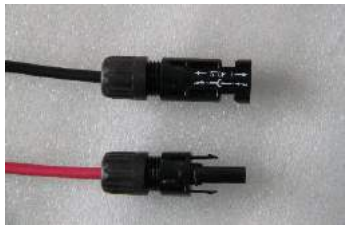
▲ Figure 4.8 Insert the Wire into the Connector Cap nut and contact pin

iii) Crimp the contact pin to the wire using a proper wire crimper as shown in Figure 4.9

▲ Figure 4.9 Crimp the contact pin to the wire

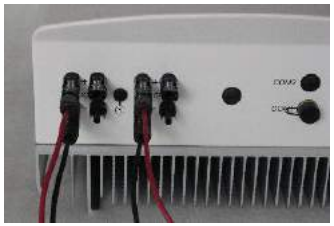
iv) Insert the contact pin to the top part of the connector and screw up the cap nut to the top part of the connector (as shown in Figure 4.10).

4. Installation



▲ Figure 4.10 Connector with Cap nut Screwed on

v) Then connect the DC connectors to the inverter. Small click will confirm connection (as shown in Figure 4.11).



▲ Figure 4.11 Connect the DC Connectors to the Inverter

4. Assemble the grid side connector of the Inverter.

For all AC connections, 2.5- 6mm^2 105 ℃ cable is required to be used. Please make sure the resistance of cable is lower than 1.5 ohm. If the wire is longer than 20m, it's recommended to use 6mm^2 cable.

WARNING:

There are “L” “1” “2” “N” “⏚” symbols marked inside the connector (see Figure4.12), the Line wire of grid must be connected to “L” “1” “2” terminal; the Earth wire of grid must be connected to “⏚” ; it is recommended that the Neutral wire of grid is connected to “N” terminal (not required)

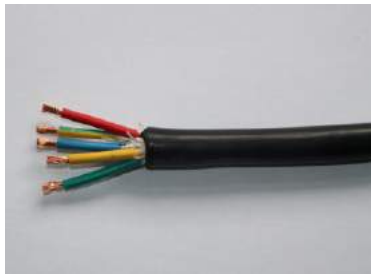
Each Solis three phase inverter is supplied with an AC grid terminal connector, which is in Figure 4.12.

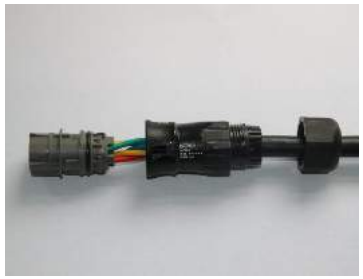
▲ Figure 4.12 AC Grid Terminal Connector

▲ Figure 4.13 AC Grid Terminal Connector Inside

The steps to assemble the AC grid terminal connectors are listed as follows:

a) Strip the end of AC wire about 8mm, Insert the cable through the jacket and cap nut of connector, then insert the wires to the grid terminal and tighten the screws on the connector (as shown in Figure 4.13). Please try to pull out the wire to make sure it is well connected.





▲ Figure 4.14 Connect Wires to the Grid Terminal

b) Assemble the connector and tighten up cap on the terminal (as shown in Figure 4.14).

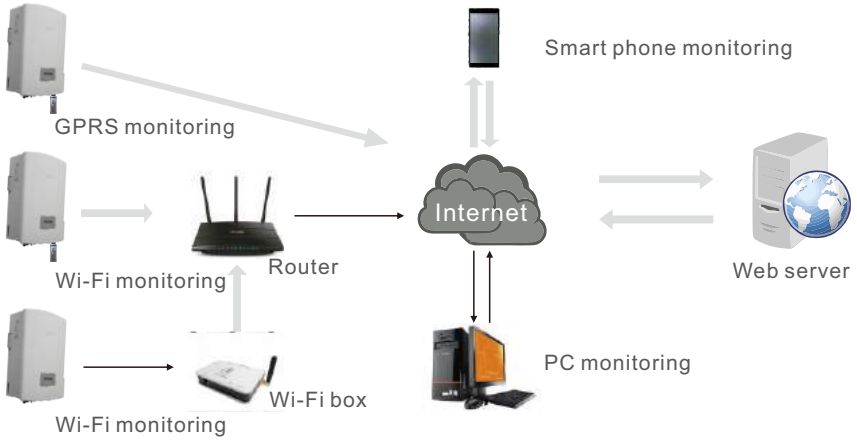
▲ Figure 4.15 Tighten up the cap on the terminal

c) Connect the AC grid terminal connector to the inverter. Small click will confirm connection (as shown in Figure 4.16).

▲ Figure 4.16 Connect AC Terminal Connector to the inverter

5. Inverter monitoring Connection.

The inverter can be monitored by Wi-Fi or GPRS functions. All the communication functions are optional (Figure 4.17), please refer to communication connection instructions.



▲ Figure 4.17 Wi-Fi communication function

5.1 Start the Inverter

To start up the Inverter, it is important that the following steps are strictly followed:

1. Switch the Supply Main Switch (AC) ON first.

2. Switch the DC Isolator ON. If the voltage of PV arrays are higher than start up voltage, the inverter will turn on. The red LED power will light, and the LCD shows the company's name and the inverter model.

▲ Figure 5.1 Company Name and Inverter Model on LCD

3. When both the DC and the AC grid sides supply to the inverter, it will be ready to generate power. Initially, the inverter will check both its internal parameters and the parameters of the AC grid, to ensure that they are within the acceptable limits. At the same time, the green LED will flash and the LCD displays the information of INITIALIZING.

4. After 30-180 seconds (depending on local requirement), the inverter will start to generate power. The green LED will be on continually and the LCD displays GENERATING.

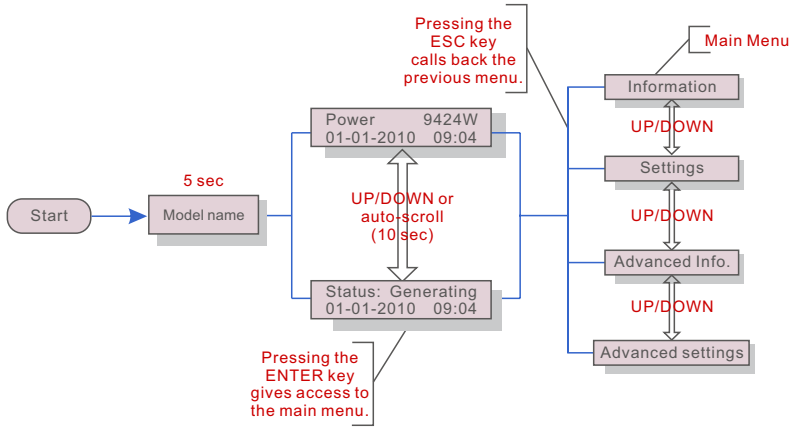
WARNING:
Do not touch the surface when the inverter is operating. It may be hot and cause burns.

5.2 Stop the Inverter

To stop the Inverter, the following steps must be strictly followed:

1. Switch the Grid Supply Main Switch (AC) OFF.
2. Wait 30 seconds. Switch off the DC switch or pull out the DC input cable. All the LEDs of the inverter will be off in a minute.

During normal operation, the display shows the power and the operation status alternately with each screen lasting for 10 seconds (see Figure 6.1). Screens can also be scrolled manually by pressing the UP and DOWN keys. Pressing the ENTER key gives access to Main Menu.



▲ Figure 6.1 Operation Overview

6.1 Main Menu

There are four submenus in the Main Menu (see Figure 6.1):

1. Information
2. Settings
3. Advanced Info.
4. Advanced Settings

6.2 Information

The Solis three phase PV inverter main menu provides access to operational data and information. The information is displayed by selecting "Information" from the menu and then by scrolling up or down.

Display	Duration	Description
V_DC1 350.8V I_DC1 5.1A	10 sec	V_DC1: Shows input 01 voltage value. I_DC1: Shows input 01 current value.
V_DC2 350.8V I_DC2 5.1A	10 sec	V_DC2: Shows input 02 voltage value. I_DC2: Shows input 02 current value.
V_Grid 400.4V I_Grid 8.1A	10 sec	V_Grid: Shows grid voltage value. I_Grid: Shows grid current value.
Status: generating Power: 1488W	10 sec	Status: Shows status of the inverter. Power: Shows output power value.
Grid Frequency F_Grid 50.06Hz	10 sec	F_Grid: Shows frequency of grid value.
Total Energy 0258458 kwh	10 sec	Total energy output value (since the last time energy was cleared).
This Month: 0123kwh Last Month: 0123kwh	10 sec	This Month: Total energy generated this month. Last Month: Total energy generated last month.
Today: 02kwh Yesterday: 01kwh	10 sec	Today: Total energy generated during this Day. Yesterday: Total energy generated last Day.

▲ Table 6.1 Information Indicator

Pressing the ESC key returns to the Main Menu. Pressing the ENTER key to lock (Figure 6.2(a)) or unlock (Figure 6.2 (b)) the screen.

(a) (b)

▲ Figure 6.2 Lock and Unlock the Screen of LCD

6.3 Settings

The following submenus are displayed when the Settings menu is selected:

1.Set Time

2.Set Address

6.3.1 Setting Time

This function allows time and date setting. When this function is selected, the LCD will display a screen as shown in Figure 6.3.

▲ Figure 6.3 Set Time

Press the UP/DOWN keys to set time and data. Press the ENTER key to move from one digit to the next (from left to right). Press the ESC key to save the settings and return to the previous menu.

6.3.2 Setting Address

This function is used to set the address of an inverter connected to PC for communication purpose. The address number can be assigned from “01” to “99” (see Figure 6.4). The default address number of Solis three phase inverter is “01”.

▲ Figure 6.4 Set Address

Press the UP/DOWN keys to set the address. Press the ENTER key to save the settings. Press the ESC key to cancel the change and return to the previous menu.

6. Operation

6.4 Advanced Info - Technicians Only

NOTE:
To access to this area is for fully qualified and accredited technicians only.

Select “Advanced Info.” from the Main Menu to display a screen and be able to access to the following information.

1.Alarm Message

2.Temperature

3.Standard No.

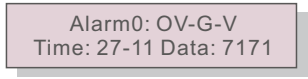
4.Version

5.Communication Data

The screen can be scrolled manually by pressing the UP/DOWN keys. Pressing the ENTER key gives access to a submenu. Press the ESC key to return to the Main Menu.

6.4.1 Alarm Message

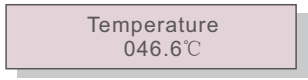
The display shows the 10 latest alarm messages (see Figure 6.5). Screens can be scrolled manually by pressing the UP/ DOWN keys. Press the ESC key to return to the previous menu.



▲ Figure 6.5 Alarm Message

6.4.2 Temperature

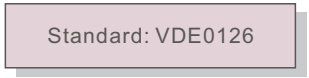
The screen shows the temperature inside the inverter (see Figure 6.6).



▲ Figure 6.6 Temperature inside the Inverter

6.4.3 Standard No.

The screen shows the reference standard of the Inverter (see Figure 6.7).



▲ Figure 6.7 Example of Standard of the Inverter

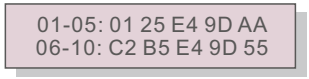
6.4.4 Version

The screen shows the model version and the software version of the Inverter (see Figure 6.8).

▲ Figure 6.8 Model Version and Software Version

6.4.5 Communication Data

The screen shows the internal data of the Inverter (see Figure 6.13), which is for service technicians only.



▲ Figure 6.9 Communication Data

6.5 Advanced Settings - Technicians Only

NOTE:
To access to this area is for fully qualified and accredited technicians only.
For technicians only.

Select Advanced Settings from the Main Menu to access the following options:

1.Select Standard

2.Grid ON/OFF

3.Calibrate Energy

6. Operation

6.5.1 Selecting Standard

NOTE:
The inverter is customized according to the local standard before shipping to the customer. The " User-Def" function can be only used by the service engineer and must to be allowed by the local energy supplier.

NOTE:
Before to using this function, please set "GRID OFF" to stop inverter (refer to Section 6.5.2).

NOTE:
This function is for technicians use only.

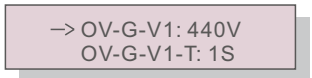
This function is used to select the grid's reference standard (see Figure 6.10).

▲ Figure 6.10

Press the UP/DOWN keys to select the standard (AS4777, AS4777_NQ, AUS-Q-0.9, AUS-Q-0.8, VDE4105, VDE0126, UL-240V, UL-208V, MEX-CFE, G83/2, G59/3, EN50438 DK, EN50438 IE, EN50438 NL, EN50438L, EN50438T and “User-Def” function).

Press the ENTER key to confirm the setting. Press the ESC key to cancel changes and returns to previous menu.

Selecting the User-Def sub menu will access to the following submenu (see Figure 6.11): Below is the setting range for User-Def. Use this function can change the limits manually.



▲ Figure 6.11

IMPORTANT NOTE for installation in Australia:

The standard AUS-Q-0.9 and AUS-Q-0.8 mean fixed the inverter output power factor to 0.9 and 0.8. They are for Australia Energex and Ergon standard, please make sure the setting is suitable for local requirement. Otherwise it could reduce the power generated.

The default setting for Australia is standard AS4777.

Below is the voltage and frequency protection limits range for Solis three phase PV inverter:

For Solis-6K/Solis-10K/Solis-15K/Solis-20K-HV

OV-G-V1: 410---530V	OV-G-F1: 50.2-53Hz(60.2-63Hz)
OV-G-V1-T: 0.1---9S	OV-G-F1-T: 0.1---9S
OV-G-V2: 430---580V	OV-G-F2: 51-53Hz(61-63Hz)
OV-G-V2-T: 0.1---1S	OV-G-F2-T: 0.1---9S
UN-G-V1: 300---360V	UN-G-F1: 47-49.5Hz(57-59.5Hz)
UN-G-V1-T: 0.1---9S	UN-G-F1-T: 0.1---9S
UN-G-V2: 230---330V	UN-G-F2: 47-49Hz(57-59Hz)
UN-G-V2-T: 0.1---1S	UN-G-F2-T: 0.1---9S

For Solis-6K-LV/Solis-10K-LV

OV-G-V1: 220---288V	OV-G-F1: 50.2-53Hz(60.2-63Hz)
OV-G-V1-T: 0.1---9S	OV-G-F1-T: 0.1-9S
OV-G-V2: 220---288V	OV-G-F2: 51-53Hz(61-63Hz)
OV-G-V2-T: 0.1---1S	OV-G-F2-T: 0.1-9S
UN-G-V1: 160---210V	UN-G-F1: 47-49.5Hz(57-59.5Hz)
UN-G-V1-T: 0.1---9S	UN-G-F1-T: 0.1-9S
UN-G-V2: 160---210V	UN-G-F2: 47-49Hz(57-59Hz)
UN-G-V2-T: 0.1---1S	UN-G-F2-T: 0.1-9S

NOTE:
There are two stage for voltage and frequency limits in User-Def, please make sure limit 1 is in the scope of limit 2, otherwise the set will be failed. The initial values of the User-Def standard are some reference values. They are not indicating the values of the standard you are currently using.

Press the UP/DOWN keys to scroll through items. Press the ENTER key to edit the highlighted item. Press the UP/DOWN keys again to change the setting. Press the ENTER key to save the setting. Press the ESC key to cancel the change and return to the previous menu.

NOTE:
It must set Grid ON (refer to Section 6.5.2) before the new standard can be used.

6. Operation

6.5.2 Grid ON/OFF

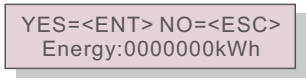
This function is used to start or stop the generation of Solis three phase inverter (see Figure 6.12).

▲ Figure 6.12 Set Grid ON/OFF

Screens can be scrolled manually by pressing the UP/DOWN keys. Press the ENTER key to execute the setting. Press the ESC key to return to the previous menu.

6.5.3 Calibrate Energy

Maintenance or replacement could clear or cause a different value of total energy. Use this function could allow user to revise the value of total energy to the same value as before. If the monitoring website is used the data will be synchronous with this setting automatically. (see Figure 6.13).



▲ Figure 6.13 Calibrate energy

Press the DOWN key to move the cursor, Press the UP key to revise the value. Press the ENTER key to execute the setting. Press the ESC key to return to the previous menu.

7. Maintenance

Solis three phase inverter does not require any regular maintenance. However, clean the heat-sink will help inverter dissipating heat and increase the life time of inverter.
The dirt on the inverter can be cleaned with a soft brush.

CAUTION:
Do not touch the surface when the inverter is operating. Some parts may be hot and cause burns. Turn OFF your inverter (refer to Section 5.2) and let it cool down before you do any maintenance or cleaning of inverter.

The LCD and the LED status indicator lights can be cleaned with cloth if they are too dirty to be read.

NOTE:
Never use any solvents, abrasives or corrosive materials to clean the inverter.

8. Trouble Shooting

The inverter is designed in accordance with the most important international grid-tied standards and safety and electromagnetic compatibility requirements. Before delivering to the customer, the inverter has been subjected to several tests to ensure its optimal operation and reliability.

In case of failure, the LCD screen will display an alarm message. In this case, the inverter may stop feeding into the grid. The failure descriptions and their corresponding alarm messages are listed in Table 8.1:

8. Trouble Shooting

Alarm Message	Failure description
OV-G-V	Over grid voltage
UN-G-V	Under grid voltage
OV-G-F	Over grid frequency
UN-G-F	Under grid frequency
G-IMP	High grid impedance
NO-GRID	No grid voltage
OV-DC	Over DC voltage
OV-BUS	Over DC bus voltage
UN-BUS	Under DC bus voltage
GRID-INTF.	Grid interference
INI-FAULT	Initialization system fault
OV-TEM	Over Temperature
GROUND-FAULT	Ground fault
ILeak-FAULT	High Grid leakage current
Relay-FAULT	Relay check fault
DCinj-FAULT	High DC injection current

▲ Table 8.1 Fault message and description

NOTE:
If the inverter displays any alarm message as listed in Table 8.1; please turn off the inverter (refer to Section 5.2 to stop your inverter) and wait for 5 minutes before restarting it (refer to Section 5.1 to start your inverter). If the failure persists, please contact your local distributor or the service center. Please keep ready with you the following information before contacting us.

1. Serial number of the Inverter;
2. The distributor/dealer of the Inverter (if available);
3. Installation date.
4. The description of problem (i.e. the alarm message displayed on the LCD and the status of the LED status indicator lights. Other readings obtained from the Information submenu (refer to Section 6.2) will also be helpful.);
5. PV array's configuration (e.g. number of panels, capacity of panels, number of strings, etc.);
6. Your contact details.

9. Specifications

Model	Solis-6K	Solis-10K
The max DC input voltage	1000Vdc	
MPPT operation range	200～800Vdc	
The max dc input current	15+15Adc	18+18Adc
Number of MPPT/strings per MPPT	2/1	2/2
Rated output power	6kW	10kW
The max. transient power	6.6kW	11kW
Rated grid voltage	400Vac	
The grid voltage range	313～470Vac(adjustable)	
Operation phase	Three phase	
Rated grid output current	8.7Aac	14.5Aac
Output power factor	>0.99	
Grid current THD	<4%(Total THD)	
The dc injection current	<20mA	
Rated grid frequency	50/60Hz	
Max. Efficiency	>97.5%	
Protection	DC reverse-polarity protection; AC short circuit protection; islanding protection; temperature protection. Etc.	
Size(mm)	430W*600H*220Dmm	
Weight	27kg	
Topology	Transformerless	
Internal consumption	<6W(Night)	
Running temperature	-25～60℃	
Ingress protection	IP65	
Interface	Rs485 WIFI GPRS(Optional)	
Design lifetime	>20years	
Operating Range Utility Frequency	47-52 or 57-62Hz(adjustable)	
Utility Monitoring	Islanding protection V_{AC} F_{AC} in accordance with UL 1741, G59/3, AS4777,VDE 0126-1-1, VDE 4105, CEI 0-21,CQC	
Operation Surroundings Humidity	0～95%	
EMC	EN61000-6-1:2007 EN61000-6-3:2007	

9. Specifications

Model	Solis-15K	Solis-20K-HV
The max DC input voltage	1000Vdc	
MPPT operation range	200～800Vdc	
The max dc input current	18+18Adc	
Number of MPPT/strings per MPPT	2/2	
Rated output power	15kW	20kW
The max. transient power	15kW	20kW
Rated grid voltage	400Vac	480Vac
The grid voltage range	313～470Vac(adjustable)	427～523Vac(adjustable)
Operation phase	Three phase	
Rated grid output current	21.7Aac	24Aac
Output power factor	>0.99	
Grid current THD	<4%(Total THD)	
The dc injection current	<20mA	
Rated grid frequency	50/60Hz	
Max. Efficiency	>97.5%	
Protection	DC reverse-polarity protection; AC short circuit protection; islanding protection; temperature protection. Etc.	
Size(mm)	430W*600H*220Dmm	
Weight	30kg	
Topology	Transformerless	
Internal consumption	<6W(Night)	
Running temperature	-25～60℃	
Ingress protection	IP65	
Interface	RS485 WIFI GPRS(Optional)	
Design lifetime	>20years	
Operating Range Utility Frequency	47-52 or 57-62Hz(adjustable)	
Utility Monitoring	Islanding protection V_{AC} F_{AC} in accordance with UL 1741, G59/3, AS4777,VDE 0126-1-1, VDE 4105, CEI 0-21,CQC	
Operation Surroundings Humidity	0～95%	
EMC	EN61000-6-1:2007 EN61000-6-3:2007	

9. Specifications

Model	Solis-6K-LV	Solis-10K-LV
The max DC input voltage	600Vdc	
MPPT operation range	150～500Vdc	
The max dc input current	15+15Adc	18+18Adc
Number of MPPT/strings per MPPT	2/2	
Rated output power	6kW	10kW
The transient max power	6.6kW	10kW
Rated grid voltage	208/220/240Vac	
The grid voltage range	180～270Vac(adjustable)	
Operation phase	Three phase	
Rating grid output current	16.6/15.7/14.4Aac	25/25/24Aac
Output power factor	>0.99	
Grid current THD	<4%(Total THD)	
The dc injection current	<20mA	
Rated grid frequency	50/60Hz	
Max. Efficiency	>97.2%	
Protection	DC reverse-polarity protection; AC short circuit protection; islanding protection; temperature protection. Etc.	
Size(mm)	430W*600H*220Dmm	
Weight	27kG	
Topology	Transformerless	
Internal consumption	<6W(Night)	
Running temperature	-25～60℃	
Ingress protection	IP65	
Interface	RS485 WIFI GPRS(Optional)	
Design lifetime	>20years	
Operating Range Utility Frequency	47-52 or 57-62Hz(adjustable)	
Utility Monitoring	Islanding protection V_{AC} F_{AC} in accordance with UL 1741, G59/3, AS4777,VDE 0126-1-1, VDE 4105, CEI 0-21,CQC	
Operation Surroundings Humidity	0～95%	
EMC	EN61000-6-1:2007 EN61000-6-3:2007	

RDM Data Manager and Energy Management System (EMS) Data Sheet and Manual

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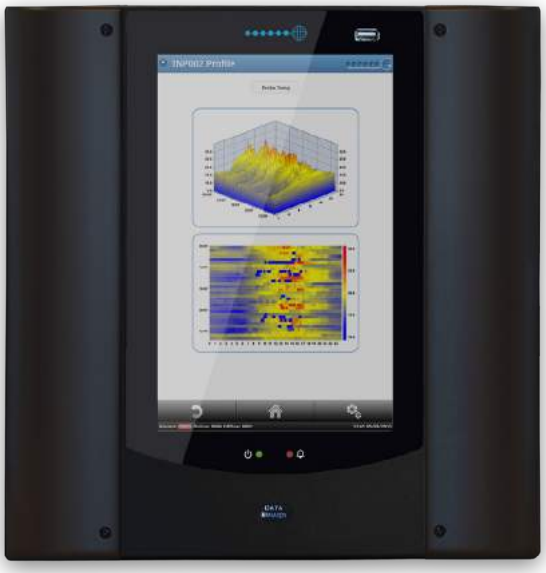
DMTouch

Future proof front-end control and monitoring solution

DMTouch is the ultimate platform to interface with a number of standard and proprietary HVACR (heating, ventilation, air conditioning and refrigeration) devices.

Unlike competing products, the DMTouch is based on an open protocol platform and, after appropriate activation, will communicate with multiple protocols (e.g. CAT 5 Ethernet IP, BACnet, and Modbus®).



Built to your requirements...

DMTouch is available with a range of software activations, accessories and expansion modules to match the unique requirements of your control and monitoring projects.

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We supply a range of DMTouch accessories to enhance the connectivity, security, and presence of the device.

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With three expansion board slots, the DMTouch can accomodate additional inputs and outputs as required by your project.

Energy Features

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Networking

DMTouch can communicate with a variety of networking protocols, meaning our customers are free to use their current control equipment.

More Information?

More information on the DMTouch, including complete user guide documentation, can be found within Resource Data Management's online download portal: resourcedm.com/support/documents

Technical Specifications

Feature	Specification
Onboard Storage	8GB Solid State Disk (Approx 25MB reserved for Application)
Inputs	12 Inputs Individually configurable as analogue temperature inputs or digital inputs. Probe types supported (PT1000 (default), 470R, 700R, 2K, 2K25, 3K, 5K, 6K, 10K, 10K(2), 100K) Range: -99°C to +350°C for PT1000 Digital Input: Normally Open or Normally Closed input (Volt Free) with alarm delay.
Outputs	4 Relay Outputs: 7.5A resistive load 250Vac, 5A inductive load 250Vac COSΘ=0.4
Onboard Expansion / Interfaces	3 x Expansions Card Slots 5 x USB A Ports 1 x RS485 Interface (Option to enable) 3 or 4 x Ethernet RJ45 Alarm Sounder
Power	Supply Voltage Range: 100 - 240 Vac ±10% Supply Frequency: 50 - 60 Hz Maximum supply current: 1A Typical supply current: 0.4A
Environmental	Operating temperature: -10°C to 60°C (14°F to 140°F) Operating humidity: 10% to 80% (non condensing)
Dimensions	(HxWxD) 330 x 310 x 96mm (12.9 x 12.2 x 3.7in)
International Support	Flexible language support (English, English (US), French, German and Swedish) Improved language support for The Data Builder (TDB) network communications, including an extended range of characters The DMTouch has a Switch Mode Power Supply (SMPS) allowing for worldwide operation
Certifications	CE, RCM, UL

Features

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On Site User Guide

PR05XX

General Note: Icons or images may not be exactly as depicted in this document or in the same location depending on user configuration and the DMTouch software version.

Hardware images shown represent the current version of DMTouch.

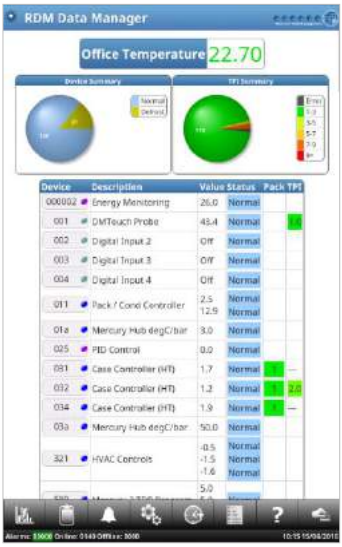
The space provided below is available for site specific notes.

Contents

On Site Guide

Operations from the 'Home' Screen

From the 'Home' screen of the DMTouch, the following options can be accessed:



Reports

Alarm Log

Service

GP Run-On

Key Legend

Help

Energy Monitoring

Swipe

The Key Legend tells the user the type of network the devices are logged on to (i.e. IP, Genus) and will also show split controllers, if it's a TDB program, system created device or any hidden devices.

By pressing on the help button the user will be shown the DMTouch user guide.

Home – Press to return to the 'home' screen
Back – Press to return to the previous page

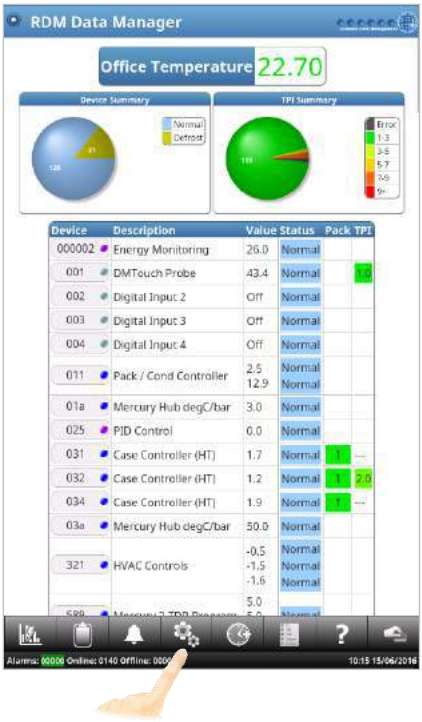
If there is a layout present on the DMTouch then the above buttons will be available to allow a user to toggle between the Device List and the Layout screen. The left hand icon will provide the Device List and the right hand side will provide the Layout screen.

Interacting with the Touchscreen

The DMTouch display has no physical buttons or switches, all user interactions are carried out by pressing areas on the touchscreen similar to a mobile phone or tablet PC. The DMTouch utilises a capacitive display technology and therefore objects such as pen nibs or screwdriver tips will not operate the display. Either a finger or a dedicated tool, such as a capacitive stylus pen, should be used when interacting with the DMTouch to provide the correct operation. Care should be taken not to apply excessive force as it could lead to damage.

Each press of the display is accompanied by a click from the sounder. On some pages where lines of text are shown, such as the parameter list, the user can scroll down the page by running their finger from the bottom to the top of the list in the same manner as with a touchscreen enabled mobile telephone. During this motion your finger should remain in contact with the touch screen.

Using the Onscreen Keyboard

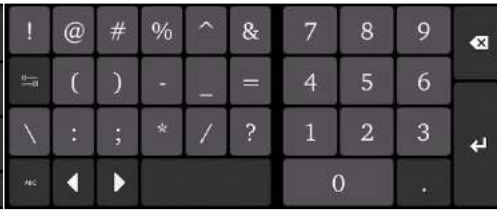


When entering information into the DMTouch an alphabetical or numerical keyboard will be displayed. For example, click on the 'Service' option as shown on the left. A login screen will appear prompting the user to enter valid user credentials as seen below.

The user can configure the log in screen to accept a username/password or a pin number. This option is configurable through the 'Site Setup' page.

If setup for user name and password, then, when the user touches the screen to enter their details the alphabetical keyboard will be shown, and if set up for a pin then the numerical keyboard will be displayed. The keyboard will appear beneath allowing them to type in their log in details. The user can toggle between the two keyboards using the 'ABC' and '123' button at the bottom left of the keyboard.

Alphabetical Keyboard



Numerical Keyboard

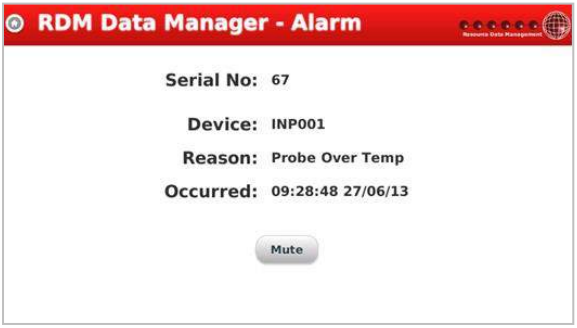
Accepting Alarms

When alarm(s) occur(s), the DMTouch will display the alarm on the screen. The alarm buzzer will sound and the light at the bottom of the touchscreen with the Bell icon will flash red.

To accept the alarm(s), enter an appropriate PIN or username/password and press Enter (press "Mute" if the system has been configured for no PIN). If the appropriate hardware is fitted a swipe card or user fingerprint can be used to accept the alarm instead. Further alarms can be accepted by pressing "Mute". If the "Mute" key has not been pressed for 10 seconds, a PIN or username/password will be required to accept further alarms.

Once all of the current alarms have been accepted, the alarm sounder will stop, the indicator will display static red and the screen will revert to the screen prior to the alarm. Once all alarms are clear, the indicator will display static green.

Typical alarm screen when using a PIN or swipe card to acknowledge and accept.



Typical alarm screen when not using a PIN or swipe card.

Alarm Log

Alarms are shown in tabular form, with their serial number, device, alarm and occurred time.

When viewing the alarm log the user can press on the screen and drag up or down to view the different alarms. Both current alarms and historic alarm information is viewable on this page.

Each alarm generated is assigned a unique 'Serial' number.

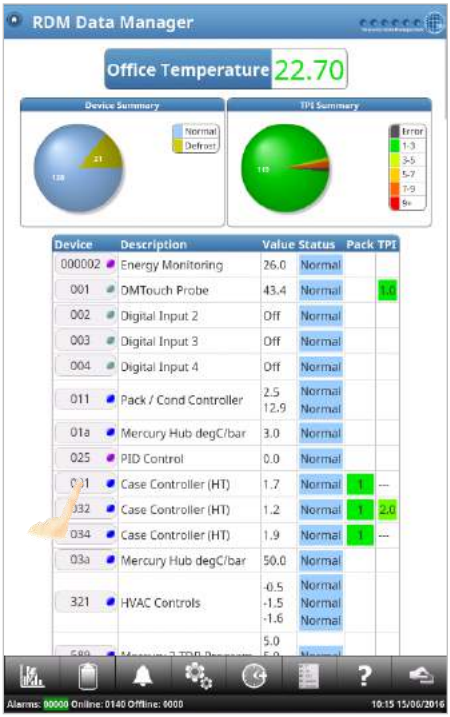
There is a filter drop down box at the top of the page that will allow the user to filter between All, Current and Old alarms.

Alarm Detail

Touching a given serial number will result in additional information being displayed for the alarm selected.

Viewing Data

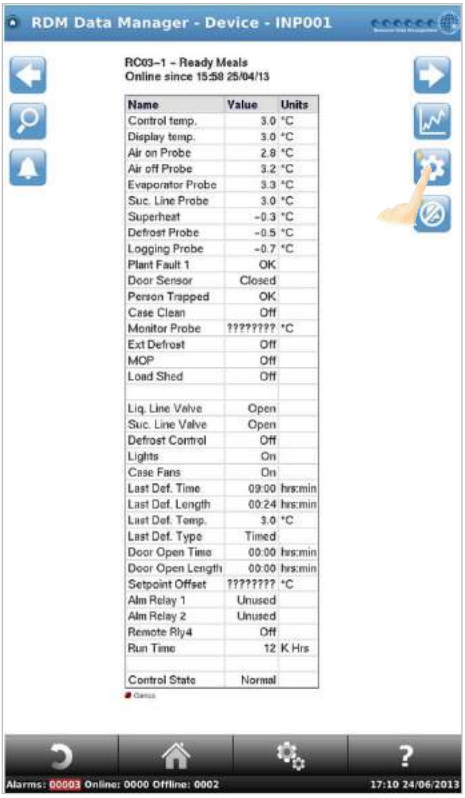
From the "Home" screen.



From the 'Home Screen' the user can press on any of the devices on the 'Device List'

Pressing on the desired 'Device' name will show more detailed information from the device.

Device Information



The device information is shown in tabular form on this screen. Use the navigation buttons on the left and right hand side to see more detail.

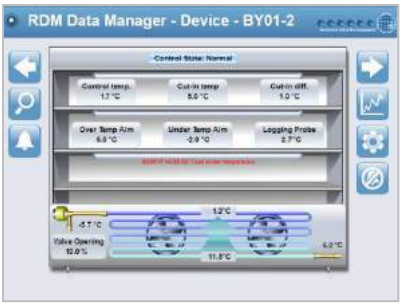
Using the navigation buttons allows the user to review data or interact with the device. Some examples are as follows. The user can view Alarms relating to the device, set Parameters for the device, view the device Data Logs and Inhibit the device.

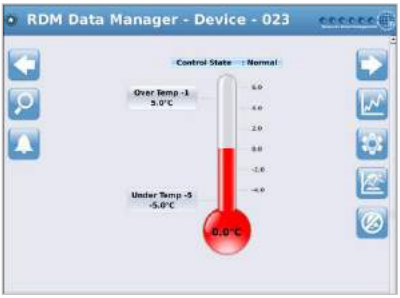
Please see next page for more information on the function of the buttons.

Navigation Buttons

	Next	This takes the user to the next device
	Graph	This will show the 'Graph' screen and allow viewing of historical data
	Set	The user is prompted for a log in and taken to a screen that allows set points to be altered
	Efficiency Graph	If set up in the 'Energy' section, this shows how the case has been performing
	Inhibit	Will show the options for putting the device into inhibit
	Previous	This takes the user to the 'Previous' device
	Settings	Will show the current settings of the device
	Alarms	Current and previous alarms
	Manual Defrost	Forces the device into a defrost
	Manual Override	Allows the user to override key functions on HVAC and BMS equipment on a BACnet interface
	COP	Generates a graph of the Coefficient of Performance for that case
	Defrost Terminate	Terminates the device's defrost cycle

Mimic Drawing





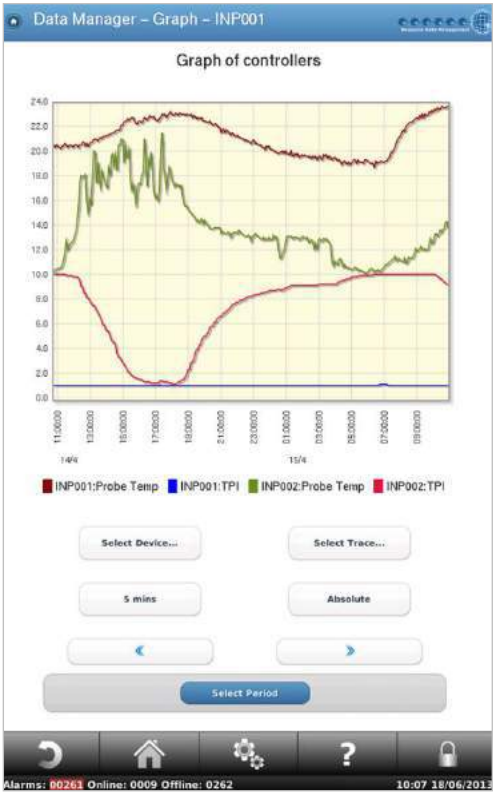
These are mimic diagrams that can be set up on the DMTouch by an engineer that will show the user a simulation of how the case is performing.

There are four that can be configured and shown. They are Case, Coldroom, Probe and Energy Meter.

If they are setup, they will appear at the top of the page when checking the device values.

These are used show a quick overview of how the device is performing. The user will be able to see over/under temperature alarm set point and what the current value is.

Viewing Graph Data



Press "Graph" to view the data.

In this example probe temperatures for two devices in the last 24 hours is shown.

The user can change the trace that is required and the interval time. They can also add devices to superimpose different traces over the top.

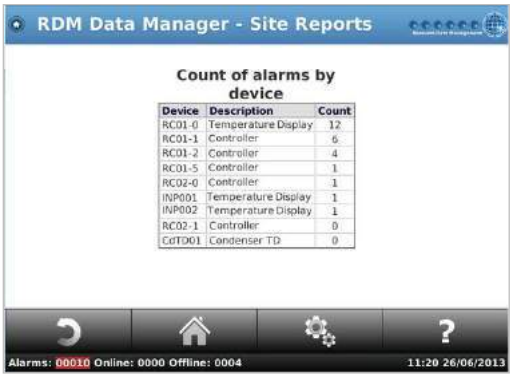
Using the arrows will allow the user to move forward or back 24 hours.

Reports

From the 'Home Page' page select Reports.

Press "Report" to view the data.

As shown in this example the number of alarms generated in the past 24 hours by each device is highlighted.



Press down on "Report Type" and select the type of report to be created.

Select "Period" and define the required period from the possible options listed (24 hours, 1 week, 2 weeks or 1 month). It is also possible to select a specific period out with these options from which the data is gathered.

GP Timer Run-On

This feature allows General Purpose timer channels to have run-on hours added. From the home screen, press more, then Run-On

Press "Set" and key in the desired Run-On period; the new finish time will be displayed.

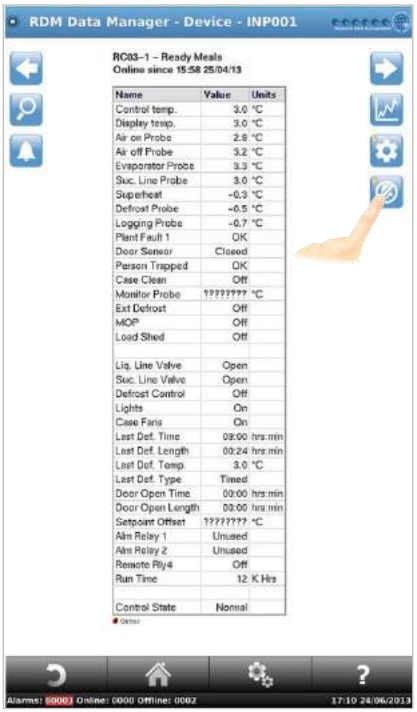
Inhibits

Inhibits are used to prevent alarms from devices that are intentionally switched off for a duration. Inhibits can be set to:

- Short
- Long
- Online

The defined periods for short and long inhibits are setup during commissioning.

Online keeps the device in inhibit until the next time it is switched on and comes online.



Select the desired Device from the list of devices, now press the Inhibit button.

(Swipe card or enter "PIN" to access this feature)

Select either Short, Long or Online.

If Short or Long is selected, the status will change to "Inhibit".

If Online is selected, the mode will come on as "Pending" until that device goes offline. Then the mode indicates "Inhibit" until the device comes back online.

Note. If the case is not switched off before the Offline delay has elapsed, this online inhibit action will be cancelled.

Accessing the DMTouch via a PC

Using a Web Browser to View the DMTouch

The DMTouch can be accessed using a PC connected to the IP network connection. Doing so provides a visually similar layout to physically being at/using the DMTouch.

If the PC is directly connected to the DMTouch a standard straight through patch cable or cross-over Cat 5 cable can be used.

Navigation

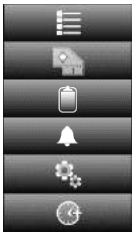
With the PC attached to the DMTouch start a web browser session, the Home screen will be found at http://10.1.2.75 (certain configurations may differ). Example web browsers are Internet Explorer or Google Chrome.

For consistent results, use the application navigation buttons rather than the standard browser buttons.

Home Screen

There are two types of screen that will appear at the home page, a device list or a site layout. In both cases a menu tab will appear at the bottom of the page, as shown below.

Depending on the features enabled and the screen you are currently in, then the list of icons below will be displayed.



Device List
Layout
Reports
Alarm Log
Service
GP Run-On

Key
Help
Maintenance
Logout
Back
Energy Monitoring

Clicking on the appropriate menu will select the required page.

Device List

Shown below is the Device List from the DMTouch home screen, this is shown if no layout diagram has been uploaded to the DMTouch:

The columns shown are as follows:

Device	Device Name
Description	Device Alias
Value	Current Value (if used)
Status	Current State
Pack	Pack Optimisation Performance Indicator*
TPI	Case Temperature Performance Indicator*

*Only available when the requisite energy features have been enabled. Refer to DMTouch commissioning guide for full details.

The status field is colour coded to indicate the different states:

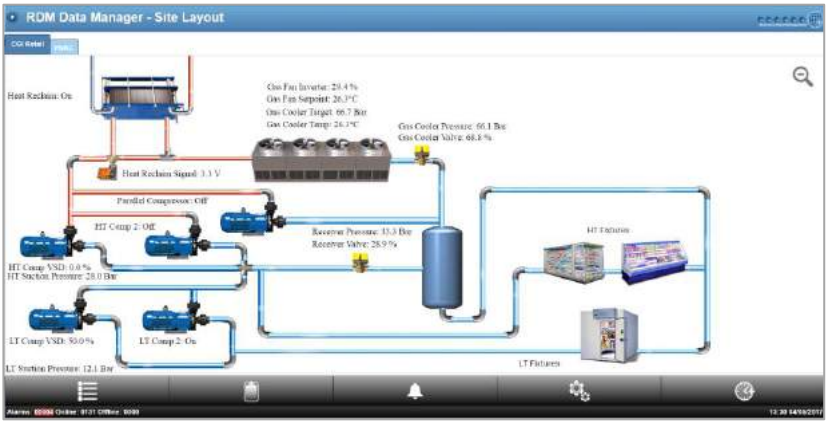
	Red	Alarm
	Blue	Normal
	Yellow	Defrost
	Green	Case Off
	Orange	Alarm Inhibit

Further information on each device can be viewed by clicking on the desired device from the list. There is an indication of the system's current status at the lower left hand side of the screen:

- Time and date
- Number of current alarms
- On/Off line status.

Layout

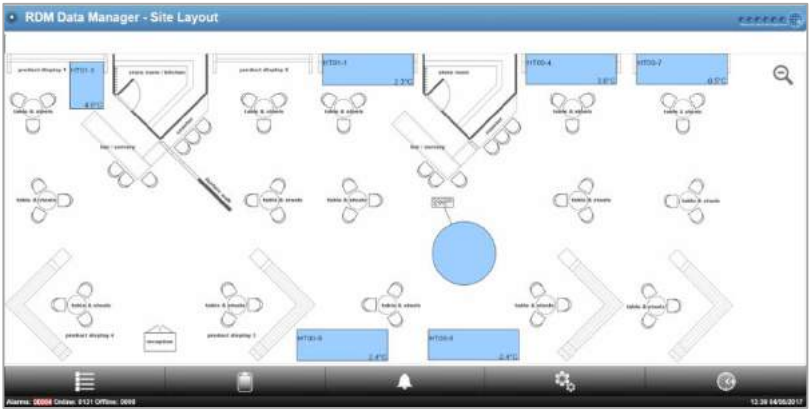
If a layout diagram has been loaded during commissioning, then a screen similar to the one below will appear as the home page.



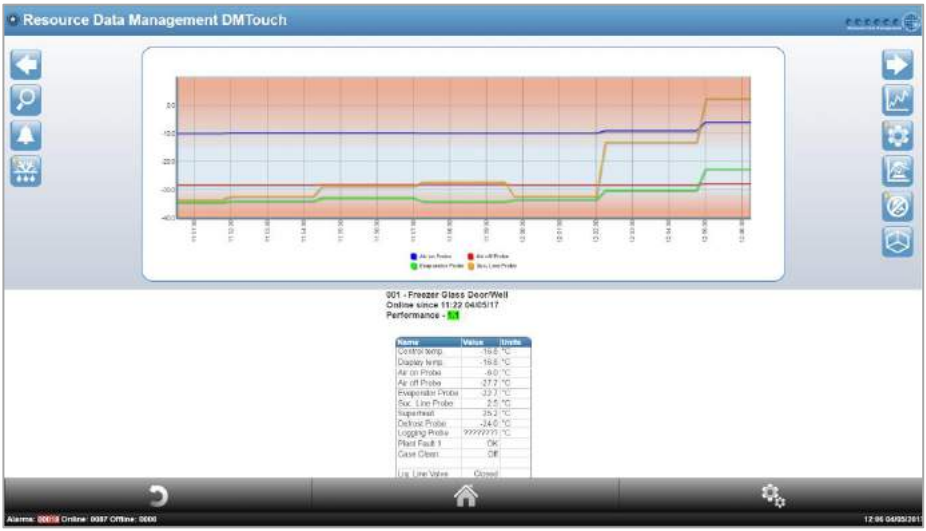
The layout screen gives an over-view of the site layout. The individual devices are colour coded to show their respective states (see example below).

Colours used to define status:

	Red	Alarm
	Blue	Normal
	Yellow	Defrost
	Green	Case Off
	Orange	Alarm Inhibit



Clicking on a device or bay will auto-zoom in to that specific area. As with the device list, further clicking on the device will display the device values and/or alarm status, as shown below.



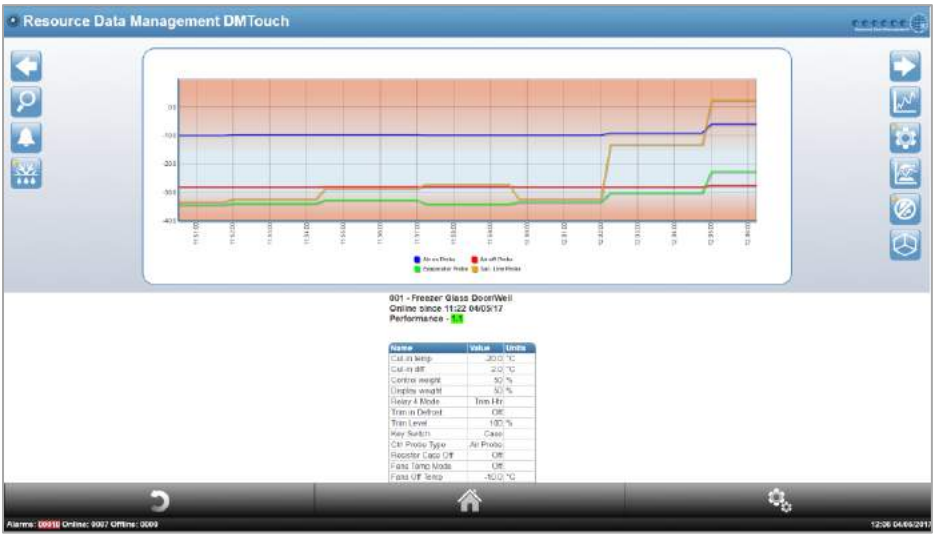
The data on this screen will vary according to which device is being viewed.

There are a further 10 device-associated screens, which can be accessed by clicking the icons on this screen (top to bottom, left to right):

	Previous	Moves back to the previous device
	Settings	Shows the device's parameter settings
	Alarms	Shows the device alarm log
	Defrost	Performs an immediate defrost
	Next	Moves to the next device on the list
	Graph	Shows the device history in graphical format
	Set	Allows the user to change device parameters
	Efficiency	Shows graphical reviews of case valve performance
	Inhibit	Inhibits all alarms from the device
	Profile	Shows graphical performance profile

Settings

Click the Settings icon to view the device settings:

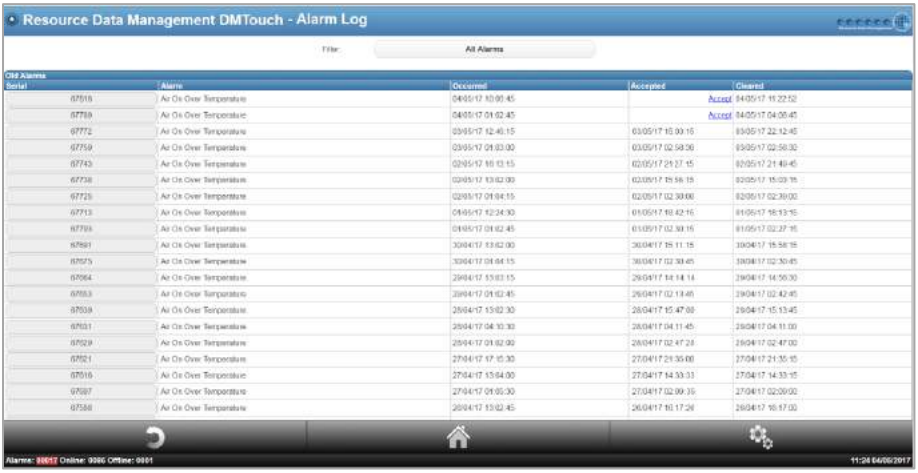


The data on this screen is read only and will vary according to which device is being accessed.

Press the "Values" icon or the back button to revert to the device values.

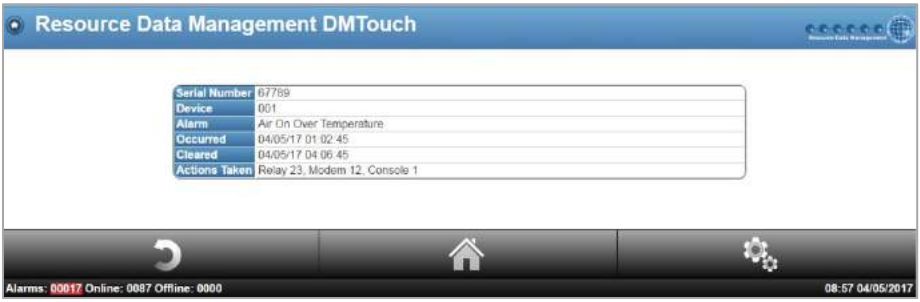
Alarms

Click the alarms icon to access the device alarm page:



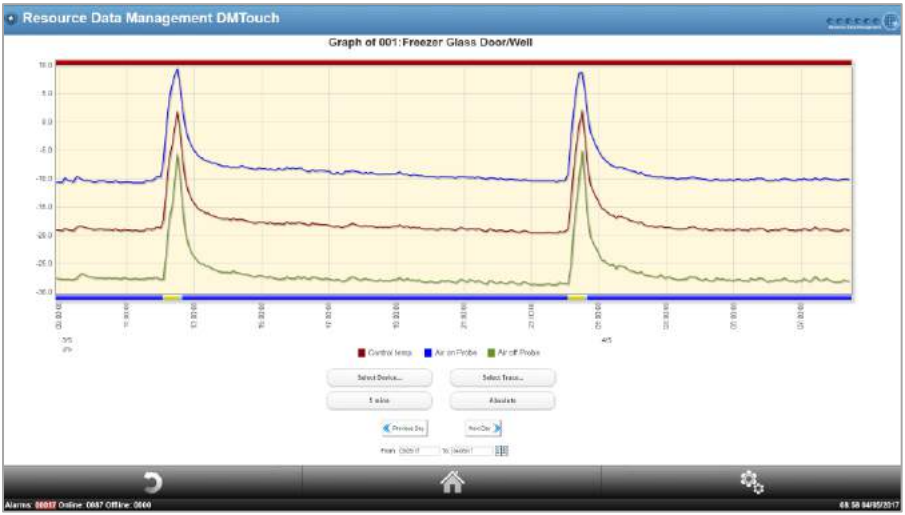
Data and values on this view only screen will vary according to the device being viewed.

Clicking on the alarm serial number can expand individual alarms, giving this view:



Graph

Click the graph icon to view the device history graphically:



Traces seen on the graph can be added or deleted by selecting/de-selecting using the Select Trace button.

Previous day values can be seen by clicking the 'Previous Day' icon and to go forward a day click the 'Next Day' button.

Selected days can be seen by using the 'From' and 'To' buttons and entering the required dates.

More devices can be added to the graph by selecting them using the 'Select 'Device' button.

Sample frequency varies according to the type of DMTouch. The SSD version (PR0510) will allow for sample frequencies as low as 15 seconds.

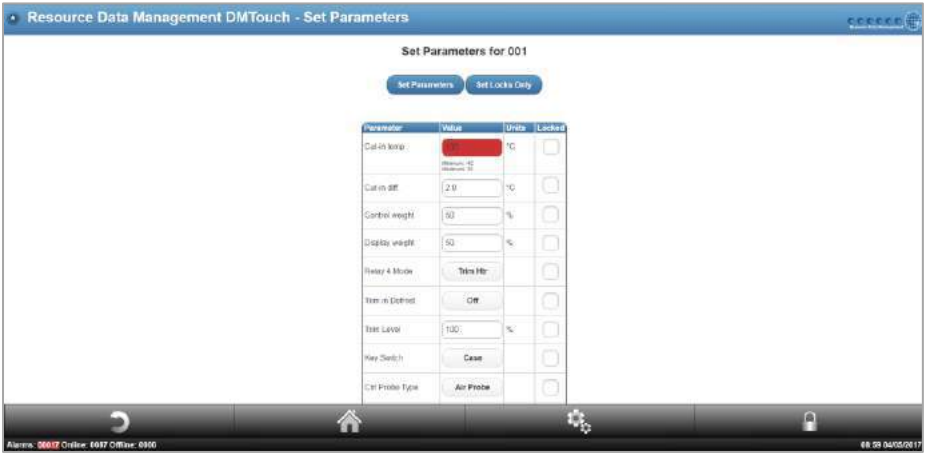
Zoom

The trace(s) can be zoomed by clicking and holding the left mouse button and dragging across the time and date at the bottom of the graph, then releasing the left mouse button.

Set

(Access to this screen requires a service or install level user)

Click the set icon to view and/or change the device parameters:



Type in the required values in the appropriate fields and click "Set Parameters". The parameters will be saved in the device's memory.

Parameters can be "locked" preventing further changes to be made (unless by an authorised user).

Check the "Locked" tick box against each parameter you require to lock and then press "Set Parameters".

The DMTouch will highlight values entered into a parameter field which are out with a parameters valid range. When this occurs the parameter is highlighted in Red, enter a valid value from the range shown and press "Set Parameters" to continue.

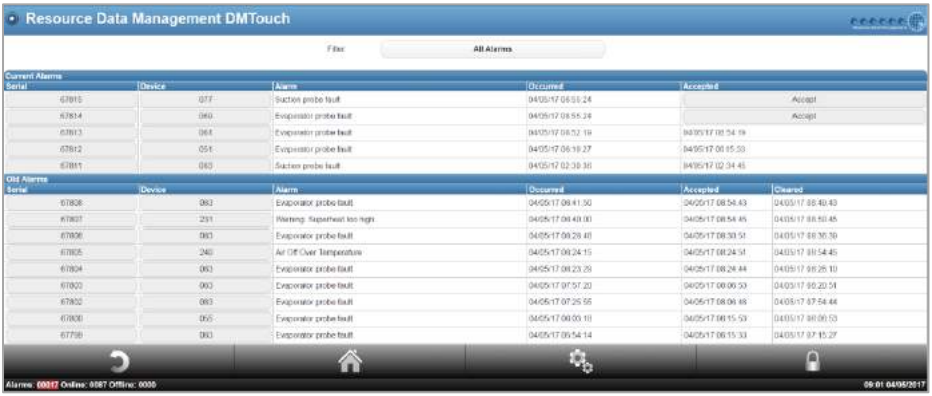
Efficiency

Click the efficiency icon to view the device valve performance.

The efficiency screen displays the percentage valve opening against time.

Alarm Log

Click Alarm Log Icon the menu to view alarm data:



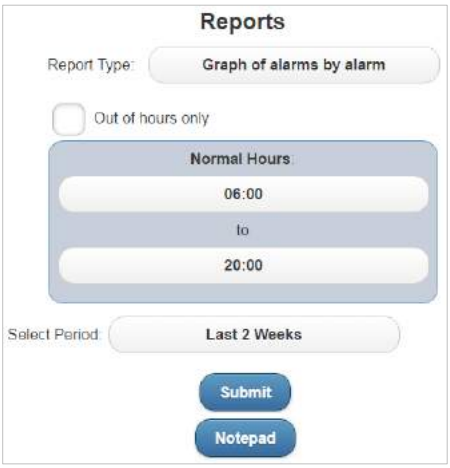
Accepting Alarms Using the PC

To accept alarms through the PC, then navigate to the Alarm Log page. Any alarm that needs to be accepted will show an "Accept" button in right hand side column, beside each configured alarm.

Clicking on the button will prompt the user to login, at this point the alarm will be acknowledged. Repeat to accept further alarms.

Reports

From the menu tab click on reports.

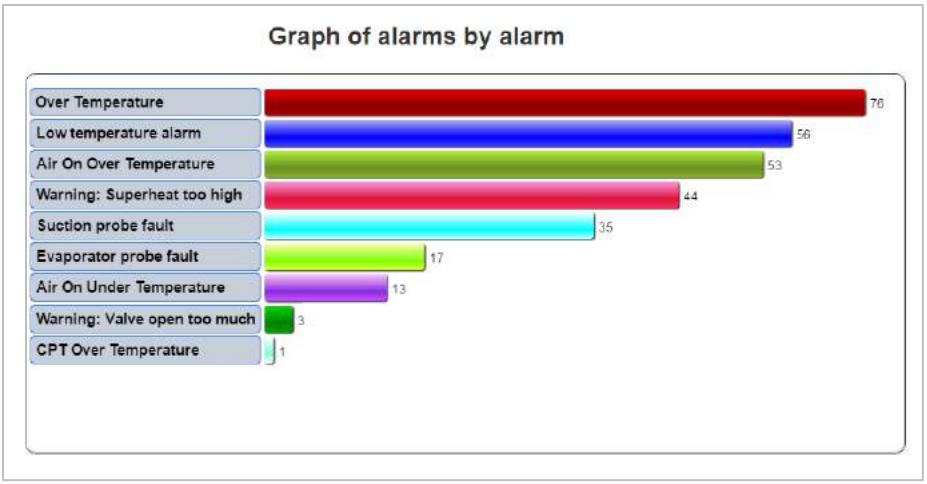


Select the type of report to be created.

Select whether the report generated is used with data gathered out with "Normal Hours".

From the drop down menu select appropriate times to define "Normal Hours"

Define the period from which data is gathered.



Shown above is an example graph of "alarms by alarm". By selecting "Count of alarms by alarm" It is possible to view this data in tabular format.

GP Timer Run-On

From the menu tab click on GP Run-On.

Type in the desired run-on duration and click the "Set" button. The page will update showing the new finish time.

The clear button will also be displayed; click this button to cancel a run-on.

Front Panel

Note: Refer to Installation Manual for details of connections. The removal of wings/covers and connections made inside the covers should only be carried by a competent installation/service engineer who has had training in the installation and maintenance of the DMTouch.

Notes

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Resource
Data Management

50kWh Lithium-Ion Battery Data Sheet and Manual

LIFEPO4 BATTERY SYSTEM INSTRUCTION

MODEL：CH480V/50KWH LIFEPO4 BATTERY SYSTEM

Registered	
Checked	
Approved	

Customer Approve

CH480V/50KWH LIFEPO4 BATTERY SYSTEM INSTRUCTION

This specification CH480V/50KWH lithium iron phosphate battery system working conditions, main performance indexes, instructions and the transportation and storage requirements, the specification is only suitable for the production of CH480V/50KWH lithium iron phosphate battery system (hereinafter referred to as the "battery system") manufactured by Sichuan Changhong Battery Co., Ltd..

2

2.1 Products：Lithium iron phosphate battery system.。

2.2 MODEL：CH480V/50KWH。

3 Environment condition

The working conditions of the battery system are shown in Table 1

Table 1 working conditions

No.	Item	Parameter
1	Altitude	≤4500m
2	Ambient temperature	-30℃～60℃
3	Relative humidity	5%～95%

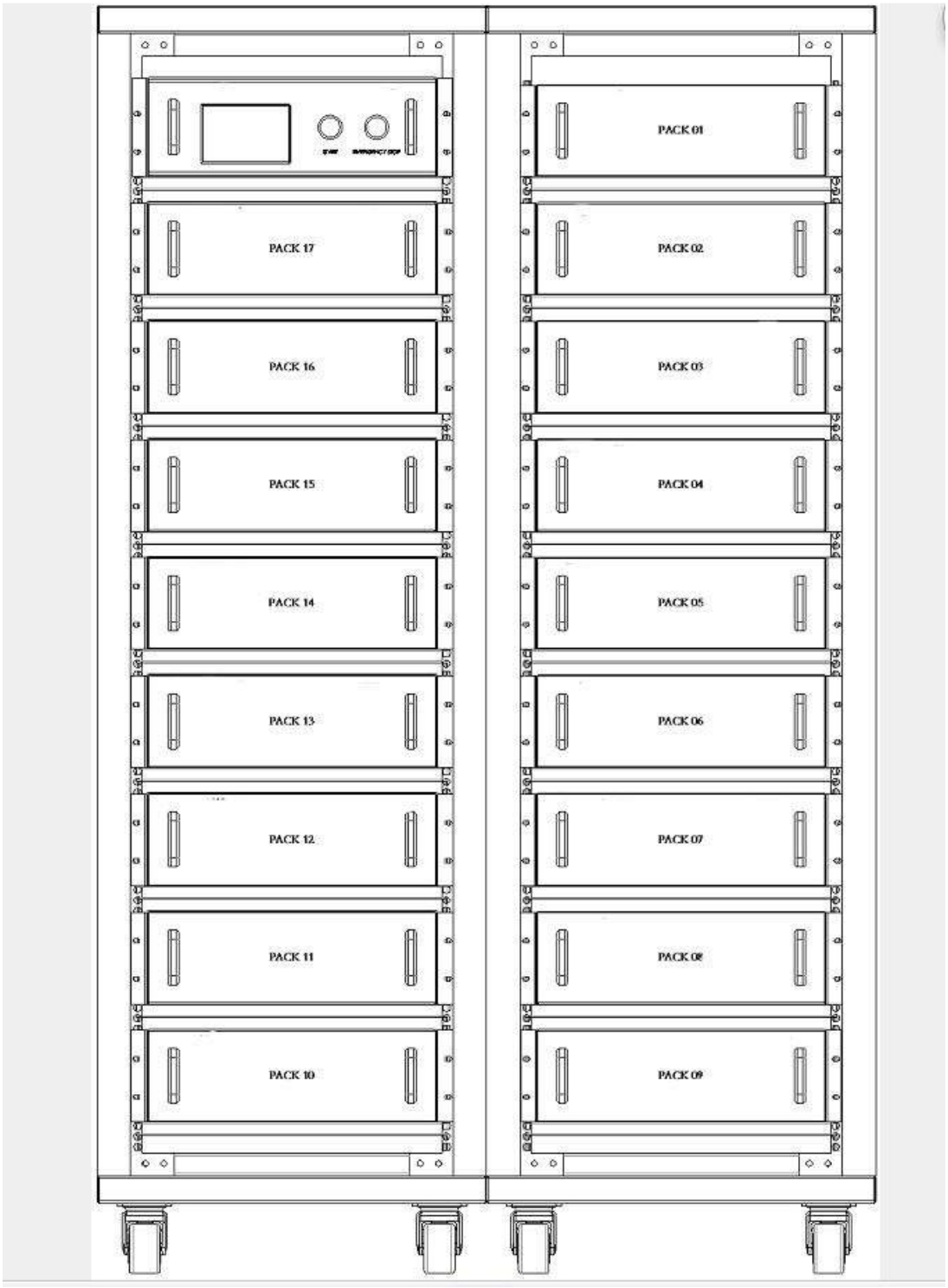
4 Performance Index

4.1 battery system components

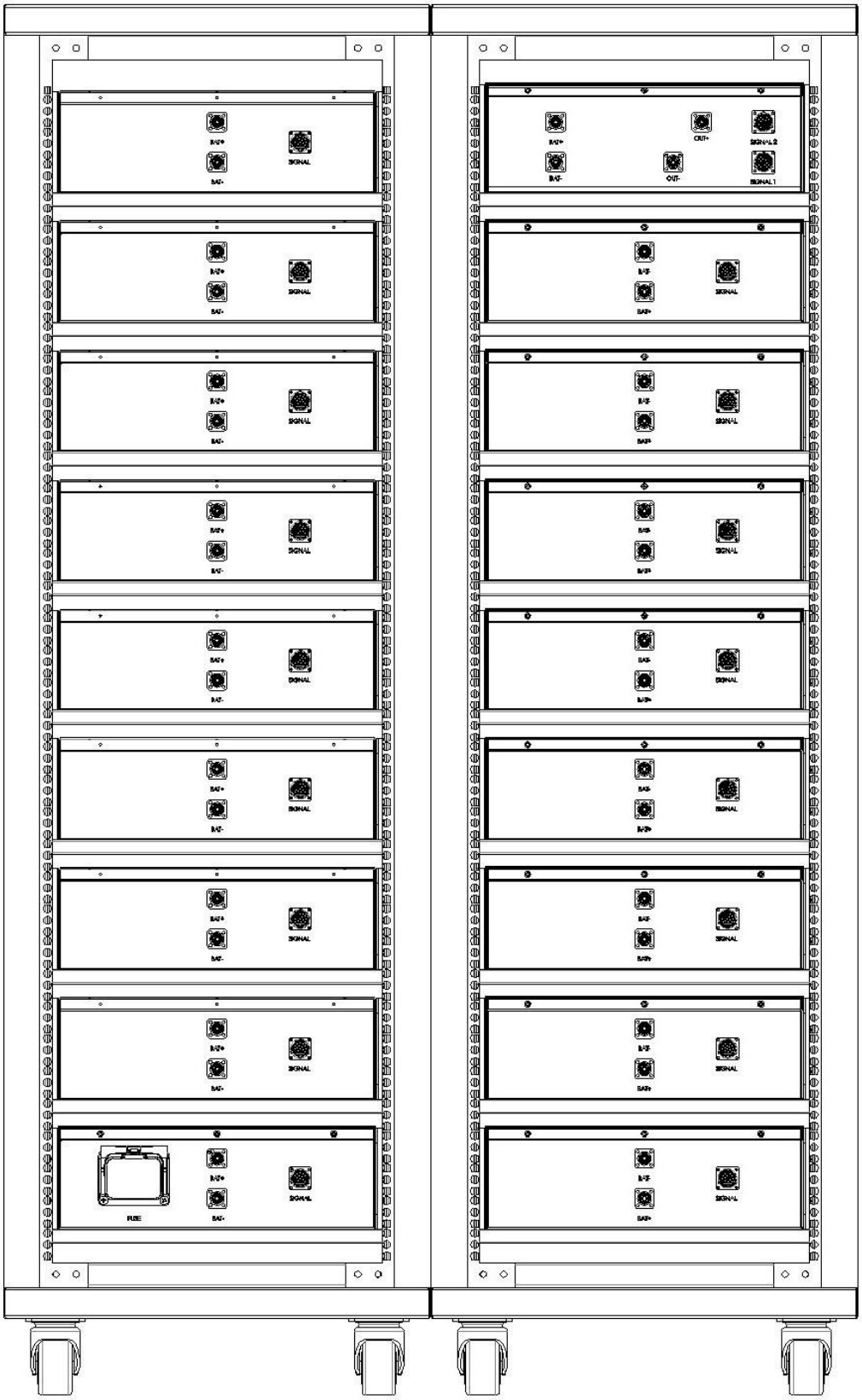
The battery system is composed of 17 battery boxes and 1 main control boxes, which are integrated in the two standard cabinets. The battery box includes a battery module, a battery management system Auxiliary control module, power socket, signal socket and maintenance switch; the main control box mainly includes the main control module of battery management system, DC/DC power supply, power socket, signal socket, control relay, shunt, fuse, switch and display etc.

4.2 Appearance

The cabinet appearance is bright black, smooth surface, no scratches, dirt and scratches, deformation, uniform coating layer, no blistering, cracking, peeling and wear, the chassis with screen printing company Logo, product type, chassis serial number and interface definition, as refer to Figure 1, figure 2.



cabinet front view



cabinet rear view

4.3 Main parameter

Battery System Technical Specification

NO.	ITEM	PARAMETER
1	Model	CH480V/50KWH
2	Nominal voltage	425.6V
3	Rated capacity	120Ah
4	Charging ceiling voltage	478V
5	Discharge end voltage	332V
6	Total energy	51.072kwh
7	Cooling mode	Fan
8	Communication mode	CAN2.0B
9	Single battery voltage acquisition accuracy	±5mV
10	Battery temperature acquisition accuracy	±1℃
11	Current acquisition accuracy	±1%
12	SOC estimation accuracy	±10%

Battery System Protection Parameter

No	ITEM	Parameter
1	Battery voltage upper limit alarm value	3550mV
2	Voltage protection value of single cell battery	3600mV
3	Alarm value of lower limit of single battery voltage	2700mV
4	Low voltage protection value of single cell battery	2500mV
5	Temperature alarm value	-25℃、50℃
6	Temperature protection value	-30℃、60℃
7	Battery temperature difference alarm	45℃

	value	
8	Total voltage alarm value	472V
9	Excess voltage protection alarm value	478V
10	Total voltage low protection value	359V
11	Total voltage low protection value	332V
12	Steady charging and discharging over current alarm value	180A
13	Steady charging and discharging overcurrent protection value	200A
14	Leakage alarm value	8mA
15	Leakage protection value	10mA

5 Instruction

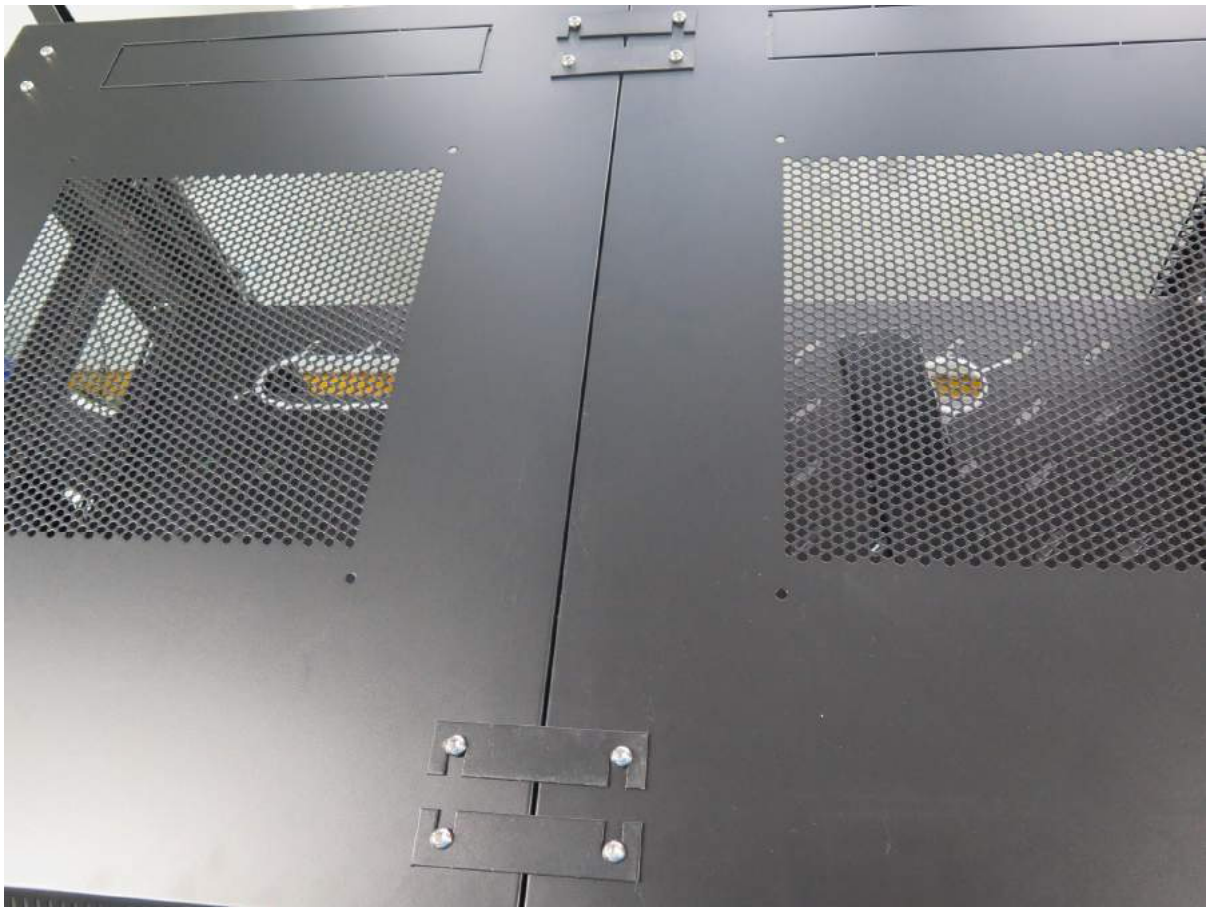
5.1 Check

After the product is out of the box, according to the appendix list of quantity inventory, to ensure that the quantity is complete, at the same time, check the appearance of the product is in line with the requirements of 4.2, to ensure that no abnormal, can be the next step.

5.2 Installation and connection

5.2.1 Fixed cabinet

The two cabinet placed close to the parallel, the rear space to guarantee the normal open the cabinet door, numbered "1" cabinet placed on the left, numbered "2" cabinet placed on the right, Take off the inner side door of the two cabinet then the cabinet connecting bar is installed at the corresponding position at the top of the cabinet. The status of the connection of the cabinet is shown in figure 3.



Cabinet top connection bar installation diagram

5.2.2 Fix main control box and battery box

The cabinet 1 from top to bottom placed the main control box and battery box PACK17 ~ PACK10. Cabinet 2 from top to bottom placed PACK1~PACK9, Then screw main control box and the 4 mounting holes on the battery box, pay attention to ensure gently in the whole process. Fixed status after completion see figure 4.

Front view after installation

5.2.2 Wiring

According to the design requirements, the PACK1 BAT+ is the total positive electrode of the battery system, and the PACK17 BAT- is the total negative electrode of the battery system. Connecting wire process is as the following steps and requirements:

1) All the battery box is connected in series and connected to the main control box with power cable, the connection is beginning from the total positive down to, between PACK1 BAT+ and the main control box BAT+ using labeled power cable JU651.001,002.

PACK1 BAT- connecting with PACK2 BAT+, and so on like this. Among them, PACK1 ~ PACK9, PACK10 ~ PACK17 using the power cable labeled JU651.001.001, between PACK9 and PACK10 using the power cable labeled JU651.001.003.

Between PACK17 BAT- and the main control box BAT- connected by power cable JU651.001.004, pay attention to ensure that the red plug to red socket, black plug to black socket.

2） Connect the internal signal plug to the battery box corresponding socket and the socket on the main control box. Each internal signal cable plug are marked with number. The connection order of the battery box is from PACK1 to turn down, finally connected to the main control box Signal1. When connecting, each plug pin is defined as "A" on the top, aligning the socket, tightening the fastening button for reliable connection.

3) To ensure that all cables are connected reliably, plug in the manual switch plug and lock the buckle. Manually switch socket is on the PACK9.

The overall effect of the connection is shown in figure 5.

The back view after connection

5.3 Power on detection

First press the "EMERGENCY STOP" button to closed state, and then press the "START" button to keep about 5S time, battery system on power, display light, release the button, observe the display information is complete or not, if the state is normal, Use the multimeter or voltage meter to measure the voltage between OUT+ and OUT- on main control box. If the voltage is in the required range, it means the battery system can meet the normal working conditions. After the detection is completed, press the "EMERGENCY STOP" button again, the battery system is power off. To ensure safety, remove the manual maintenance switch.

5.4 Connection with electrical equipment

After power detection completed, Use the power cable labled JU651.001.005 to connected OUT+ on the main control box of, the other end is connected with the positive input load. Use the power cable labeled JU651.001.006 to connect to OUT- on the main control box, the other end is connected with the input negative end of the load, plug manual maintenance switch, press the "EMERGENCY STOP" button

to a closed state, and then press the "START" button to keep about 5S time, battery system is on power, display light, release the button, the normal operation of the battery system. To stop the battery system running, press the "EMERGENCY STOP" button again.

5.5 Disconnect

If you need to disconnect the battery system from the electrical equipment, follow these steps:

1) Press the emergency stop button on the panel

5.6 Signal communication

The battery system in the main control box have a signal socket 2, and is equipped with a plug with a wire (corresponding to the external signal cable, identified as "Signal2"), the computer can read the battery system through CAN communication information, communication port is CAN2. The definition of the signal socket 2 is shown in Appendix F. The communication protocol is recorded in the optical disk.

6 Matters needing attention

It is recommended to participate in the installation, use, training and maintenance of the battery system under the correct guidance of the engineering and technical personnel with the electrical, electronic and electrical knowledge.

61 Safety instructions

Please read the following carefully to ensure proper use of the battery system.

● The voltage at the two ends of the battery system has exceeded the safety voltage of the human body. For the sake of safety, the body is not allowed to touch the two ends of the battery system at the same time. In the process of use, insulation treatment is necessary to the battery system positive and negative ends and the exposed parts of the metal conductor,

to prevent any possible short-circuit occurs, and do a good job of security related work.

● The battery system installation, debugging, testing, related personnel should do protective measures of high voltage, wear insulated gloves, wearing rubber soled shoes, equipped with fire safety facilities.

● Prohibit the use of wire or other metal objects directly to the battery system positive and negative short circuit; the conductive object is not allowed to fall into the battery system, in order to avoid short circuit.

● Do not place the battery system into fire or heating battery system, if the ambition temperature is very hot the battery system cannot be used, otherwise, the battery system will be overheated, thus affect performance, shorten the service life.

● No impact, or throw the battery system. And the battery system need to avoid violent vibration.

Do not use a nail or other sharp objects to pierce the battery.

Without the manufacturer's authorization to prohibit the removal of battery systems.

If the battery emits an odor, fever, deformation, abnormal sound or any other anomalies can not be used, if the battery or charging system is in use, should be immediately from the charging equipment or remove and stop using the appliance, please send it to the factory authorized units or relevant organizations to properly handle it.

When an accident occurs, it is not permitted to use carbon dioxide to extinguish the fire, but the use of carbon tetrachloride fire extinguishing equipment or sand.

The use of the battery system is strictly prohibited smoking or ignition, in order to avoid danger.

The positive and the negative cannot reverse during the use or maintenance of the battery system.

Users are not allowed to replace the battery, the battery should be replaced by the supply side or by the authorized unit or individual authorized to replace.

The battery system should be kept clean, dry, bright and ventilated.

When the battery system is insufficient, it should be charged in time, which will be beneficial to prolong the battery life. If the battery is not charged in time, it will affect the service life of the battery system in the low charge state.

The best working temperature of the battery system is 15℃ to 35 ℃, if out of this temperature range, the battery system performance may change, it could be the battery capacity changes, or the equipment running time changes, this is a normal phenomenon.

Batteries are consumables, battery life is limited. Please replace the battery when the battery capacity is less than 80% of the rated capacity.

It is strictly prohibited to separately connect a wire from the battery

box of the battery system to the power supply to other equipment, in order to avoid the whole battery consistency is artificially destroyed.

62 Battery system installation

Use a voltmeter or a multimeter to determine the polarity of positive and negative electrode of each battery box before installation, if found its polar and polar label +/- does not match, please immediately stop using the battery, and contact the supplier technical service department to check and replace or obtain other treatment.

Each battery pack is placed in a numbered sequence and fixed on the rack to ensure that the battery system is in a tight state during transit.

When the battery box is connected in series, the battery box with the maintenance switch needs to remove the maintenance switch, After the whole battery box is connected in series, plug the maintenance switch back

7 Transport

The battery system has been charged about 50% of electricity. The battery system is packed in wooden cases for transportation, and shall not be subjected to violent mechanical collision, exposure, rain, and no inversion during transportation. In the process of loading and unloading, the battery system should be handled gently, to prevent falling, tumbling, weight pressure.

8.Storage period

The battery system should be stored in a dry, ventilated, clean the warehouse, should avoid contact with corrosive substances, away from fire and heat source; storage temperature of 5 to 40 DEG C, relative humidity of not more than 75%, the storage period for 1 years; should the battery in about 50% of the state of charge storage.

9 Product Liability

Please carefully read the product instructions before using the battery system, and use the battery system in strict accordance with the product specifications. The company shall not be liable for any accident caused by improper use of the operating instructions as specified in the instructions.

Appendix A

Packing box 1 packing list

No.	Name	Quantity
1	Packing list	1
2	Quality Certificate	1
3	Cabinet 1	1
4	Internal signal cable	1
5	External signal cable	1

6	Cabinet number identification	1
7	Signal cable identification	1
8	Power cable JU651.001.001	15
9	Power cable JU651.001.002	1
10	Power cable JU651.001.003	1
11	Power cable JU651.001.004	1
12	Power cable JU651.001.005	1
13	Power cable JU651.001.006	1
14	Manual maintenance switch plug	1
15	Cabinet connecting strip	4
16	Screw accessories	Included
17	Tools + keys	3

Appendix B

Packing box 2 packing list

No.	Name	Quantity
1	**Packing list**	1
2	**Cabinet 2**	1
3	**An instruction manual**	1
4	**Key**	1
5	**CD**	1

Appendix C

Packing box 3 packing list

No.	Name	Quantity
1	**Packing list**	1

2	**Main control box**	1
3	**Battery box 17**	1
4	**Battery box 16**	1
5	**Battery box 15**	1
6	**Battery box 14**	1
7	**Battery box 13**	1

Appendix D

Packing box 3 packing list

No.	Name	Quantity
1	Packing list	1
2	**Battery box 12**	1
3	**Battery box 11**	1
4	**Battery box 10**	1
5	**Battery box 09**	1
6	**Battery box 08**	1
7	**Battery box 07**	1

Appendix E

Packing box 5 packing list

No.	Name	Quantity
1	Packing list	1
2	**Battery box 06**	1
3	**Battery box 05**	1
4	**Battery box 04**	1
5	**Battery box 03**	1

6	**Battery box 02**	1
7	**Battery box 01**	1

Appendix F

Pin definition of signal socket 2

Pin No.	Definition
M	24V+
L	24V-
A	CAN3H
U	CAN3L
N	CAN3LR
P	CAN2H
B	CAN2L
C	CAN2LR