Operation and Installation Manual

Soleaf

DASSTECH Photovoltaic Grid-Connected Inverter

[Grid connected type Photovoltaic Inverter]

DASS 100i

[DSP-33100E-OD-HV]

Version 1.0

DASS Tech

Table of Contents

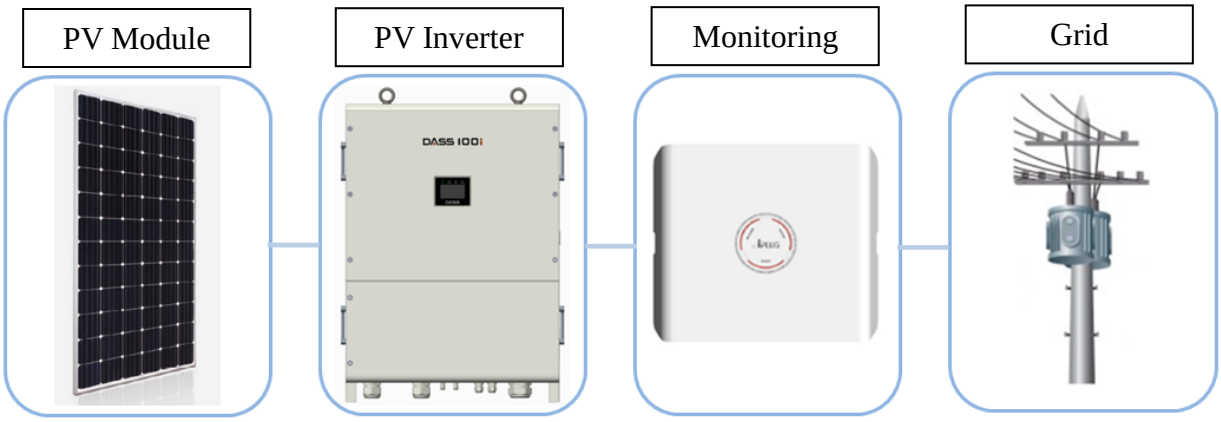
1. Precautions for Safety

- **Precautions for safety aim for safe and correct operation of the products by preventing accidents or hazards in advance, so you must follow them at all times.**

- **In order to properly and safely use the functions of DSP inverter series, read the manual carefully.**

- **After reading the operation and installation manual, please store it in a place where all users can easily find and read it.**

- **DSP series inverter is a grid-connected PV inverter that transforms direct current of PV generator into alternate current and connects to the system.**



※ The DSP series inverter must only be operated with PV arrays of protection class II in accordance with IEC 61730, application class A. DSP series inverter shouldn't be connected to any energy source other than PV module

Danger

Deadly risk due to the high voltage of the inverter

When the photovoltaic generator array is exposed to the light, dangerous DC voltage on the DC conductor or the conductive parts of the inverter can be generated. If you are contact on the DC conductor or the conductive parts, you may be deadly shocked by electricity.

Use caution not to be contacted on the DC conductor.

Use caution not to be contacted on the live conductive parts of the inverter.

Separate the inverter from all power sources before you carry out any work on the inverter.

1.1 Symbols Used in the Manual

- The meaning of the symbols used in the manual is as follows:

 **Danger** indicates a hazardous situation which, if not avoided, will result in death or serious injury
 **Warning** indicates a hazardous situation which, if not avoided, can result in death or serious injury
 **Caution** indicates a hazardous situation which, if not avoided, can result in minor or moderate injury

1.2 Symbols Used in the Inverter

- The meaning of the symbols used in the inverter is as follows:

Symbol	Description
	Do not lift up or move the product alone.
	Keep the connection requirements of secondary protective conductor. Refer to Ground Connection in page 26.
	The product can be heated during the inverter's operation. Do not touch the inverter enclosure during operation. Before carrying out any work, you should wait for the product cooled down completely. Wear safety gloves and personal protective equipment.
	The product is worked on a high pressure. All works related with the inverter must be performed by a professional electric engineer.
	The capacitor of the inverter may charged with very high voltage. Se[arate the inverter from all power sources and wait for 10 minutes or longer before your work in order for the capacitor to be discharged.
	Follow the local electronic waste regulations when disposing the inverter.
	Transport the product by 2 persons or more or use dedicated equipment.
	Follow the instructions in the manual provided with the inverter.
	This product is complied with the corresponding CE requirements.

1.3 Precautions while Operating

- **Do not operate the product when the front cover is opened.**
  It can cause electric shock as the high-voltage terminals or live parts can be exposed.

- **Do not operate the switch with wet hands.**
  It can cause electric shock.

- **Do not open the cover when power is already on or during operation.**
  It can cause electric shock.

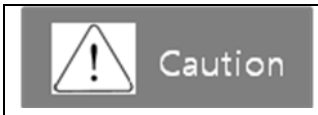
- **Even if power is not on, do not open the front cover except for regular inspection time.**
  Even under off-power, voltage can be charged in the internal capacitor of the inverter, which can cause electric shock.

- **Check if the DC voltage of the inverter is discharged by using a measurement tool such as volt-ohm-milliampere (VOM) after 10 min or longer from power off when wiring work or regular inspection is performed.**
  Since high voltage can be charged in the internal capacitor of the inverter, it can cause electric shock.

- **Do not use the product if the sheath of the cable is damaged.**
  It can cause electric shock.

- **Do not place a heavy object that gives excessive stress on the cable while using.**
  It can cause electric shock due to the damage on the sheath of the cable.

- **Do not supply power even if the installation is complete when part of the inverter is damaged.**
  It can cause electric shock.



- **Do not install the product near any flammable materials.**
  If the product is installed with flammable materials or attached near flammable substance, it can cause a fire.

- **Disconnect the input power (solar cells) and output power (AC system power) in the inverter during inverter failure.**
  If the power is not disconnected, it can cause a fire due to the secondary accident.

- **Do not touch the front or upper surface of the inverter enclosure during inverter operation.**
  The front or upper surface of the enclosure can be hot, which can cause a burn.

- **Do not touch the inverter while power is connected or within 30 min after power is disconnected.**
  Since the product is on a high-temperature, it can cause a burn when the product is contacted with human body.

- **Do not supply power even if the installation is complete when the inverter is damaged.**
  It can cause electric shock and additional part damage.

- **Do not have foreign substances such as screws, metal parts, water or oil get into the inside of the inverter.**
  It can cause a fire.

- **Keep the distance of at least 30 cm from the inverter.**
  It can risk health due to the emission effect.

2. Product Overview

2.1 Basics

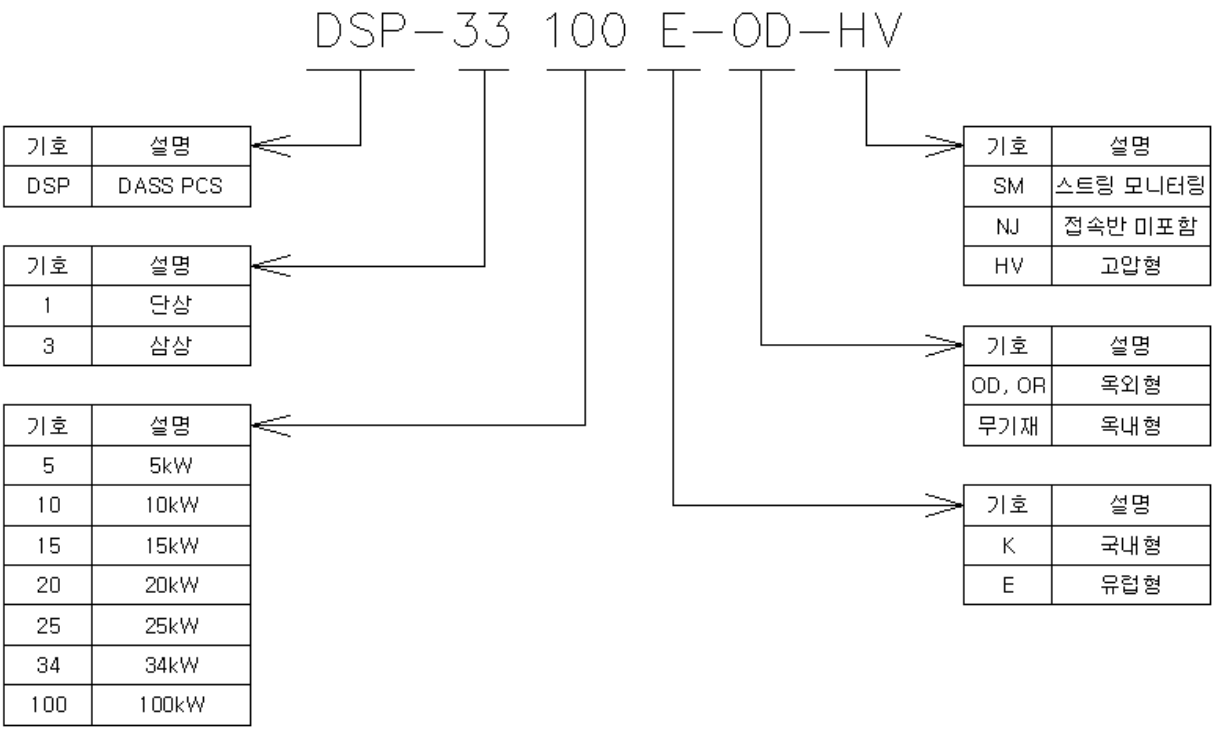
If the inverter is operated incorrectly, it can prevent normal operation or reduce a lifespan of the product. In the worst case, the inverter can be broken or incur fatal damage to human bodies. Therefore, please read carefully and understand thoroughly the operation and installation manual prior to the use.

2.2 Appearance of the Product

2.3 Verification of the Product

Please check the name plate at the side of the main product body whether inverter type and rated output are matched with the ordered product details once the inverter is taken out of the packaging box. In addition, check whether there is any damage during transportation.

- **Inverter TYPE**

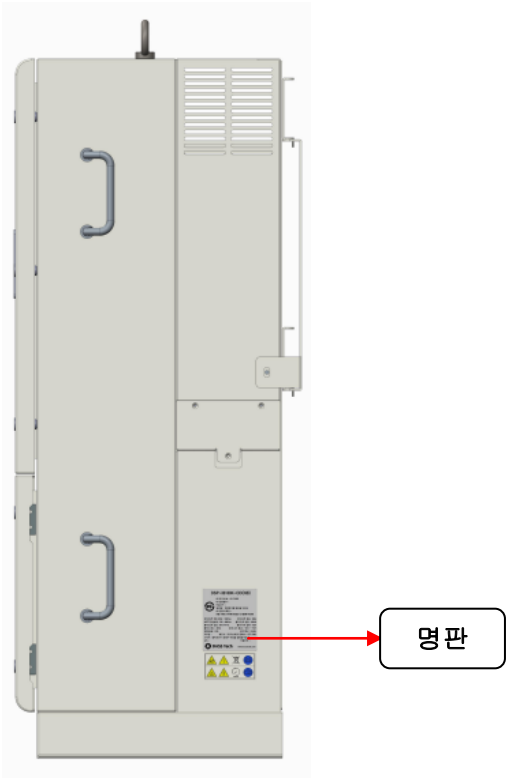


- **Accessories/tools**
  - Please contact the office if there are some missing accessories such as the operation and installation manual, fixed bracket, bracket fixing bolts and hexagon wrench or if the product is damaged.
  - Depending on the operation field, necessary tools can be different and should be prepared well. (e.g: Multi-tester to check voltage and wiring, power tools to install fixed brackets etc.)

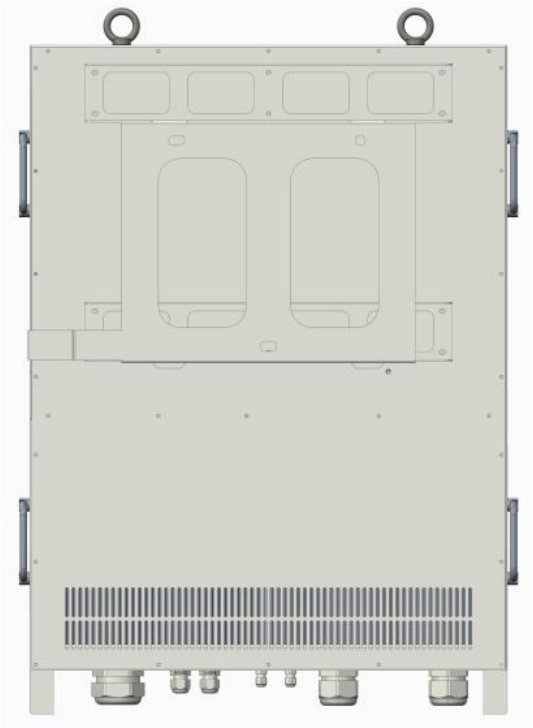
2.4 Configuration of the Product

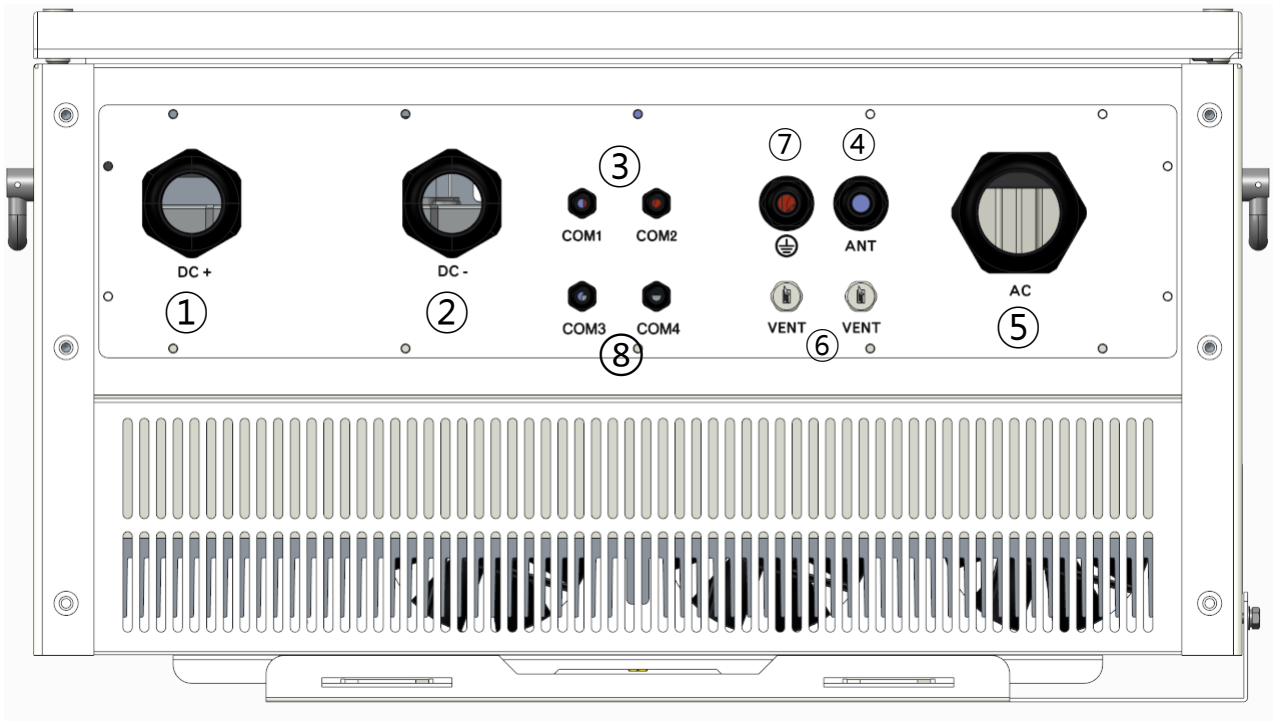
- **Front view**

- **Side view**



- **Rear view**

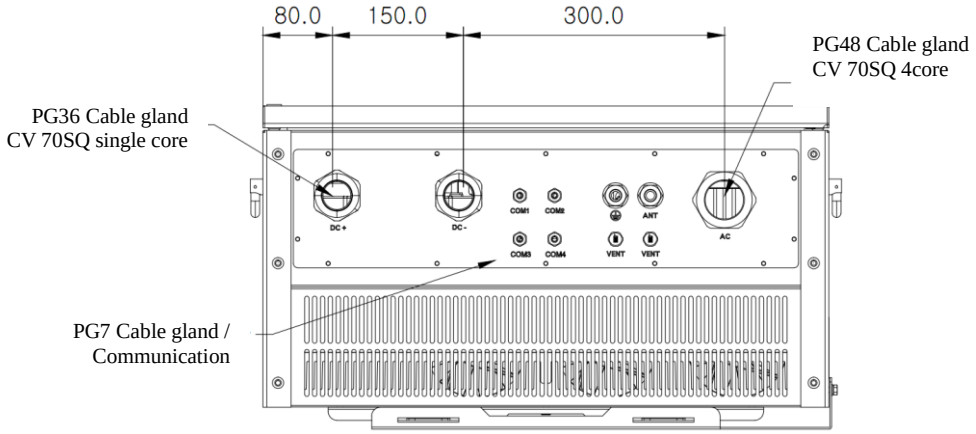


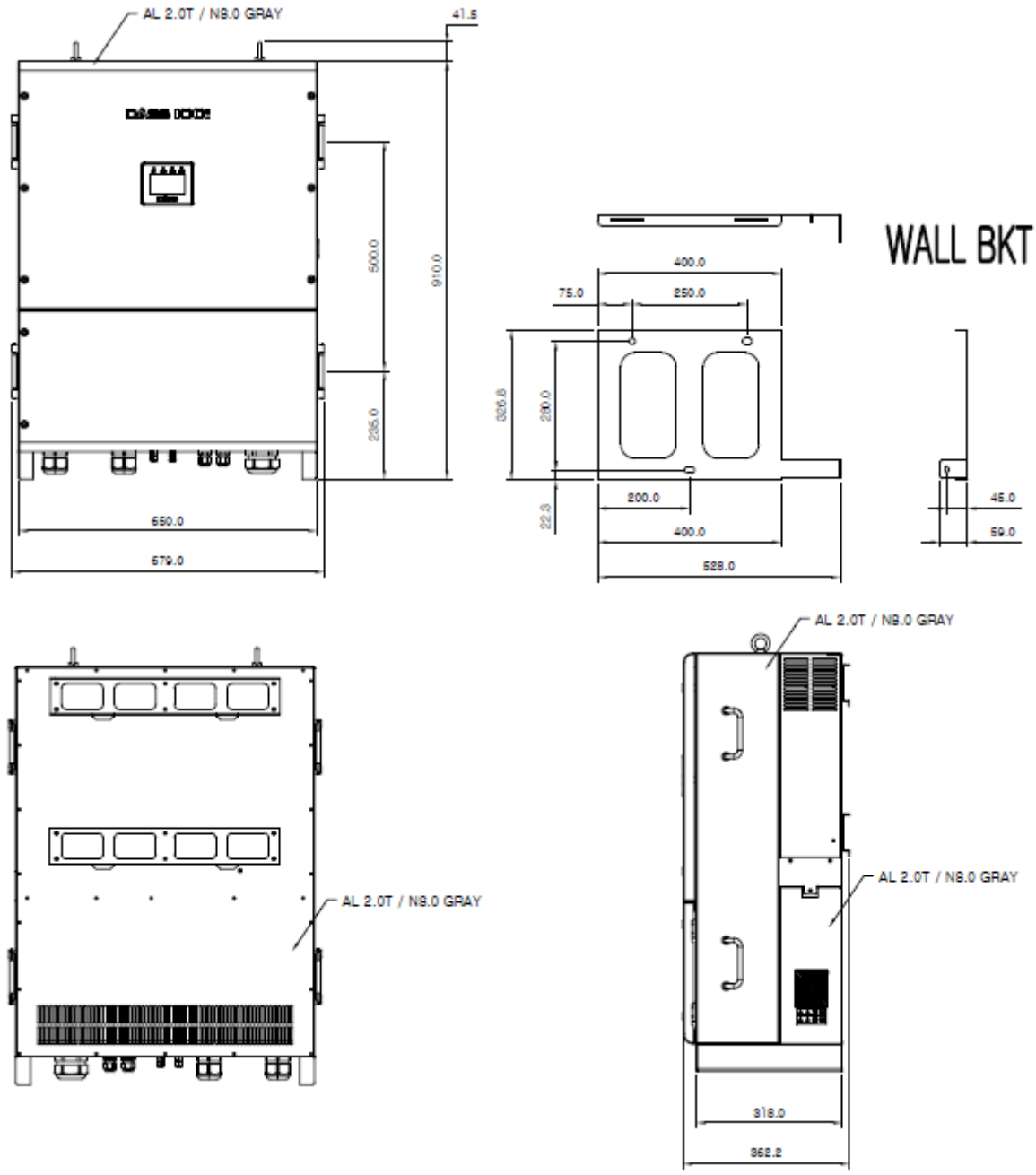


- **Bottom view**

Item	Name	Description
①	PV(+) Input Port	Input PV(+) cable gland
②	PV(-) Input Port	Input PV(-) cable gland
③	COM1, COM2	485 communication (IN, OUT)
④	ANT	Wifi cable (option)
⑤	AC Output Port	Output AC cable gland
⑥	Protective Vent	Pressure balance Vent
⑦	F.G	Grounding connection terminal
⑧	COM3, COM4	Active voltage control communication (IN,OUT)

2.5 Dimensions of the Product





2.6 Configuration of the Photovoltaic System

With arranging necessary equipment correctly, the inverter shall be connected well.

With the wrong system configuration and connection, it can cause abnormal operation or reduce a lifespan of the product seriously.

In the worst case, the inverter can be damaged, so please use the product well according to the contents and precautions in the manual.

In case of using non-grounded PV module, the module should comply with IEC 61730 Class A.

PV array should not be grounded.

2.7 Features of the Product

- **High-efficiency power conversion**

  PWM method with IGBT semi-conductor device is applied and the high-efficiency of 98% or higher can be achieved at the rated power.

- **Digital control**

  The system is controlled efficiently through the high-performance digital control and it can be checked through LCD keypad to monitor and display the operation of the inverter including input/output status, also fault conditions to terminate the operation.

  Also, by detecting a voltage in the solar module, the inverter is operated or terminated automatically.

- **Transformer-less inverter**

  As this outdoor type inverter is a transformer-less type, it is suitable for distributed power systems designed for a commercial scale generation.

- **Distributed power system and economic feasibility**

  The photovoltaic system can be installed anywhere where the sunlight is available. Thus, distributed power can be constructed at a level of building, house, or solar power plant, which can be used economically.

- **Maximum Power Point Tracking (MPPT)**

  Since the output characteristic of the solar cell is to generate, not uniform DC depending on temperature, humidity, climate, environment, and insolation, the inverter controls the solar cell module to maintain the maximum power point through the Maximum Power Point Tracking (MPPT) control.

- **Easy parallel operation**

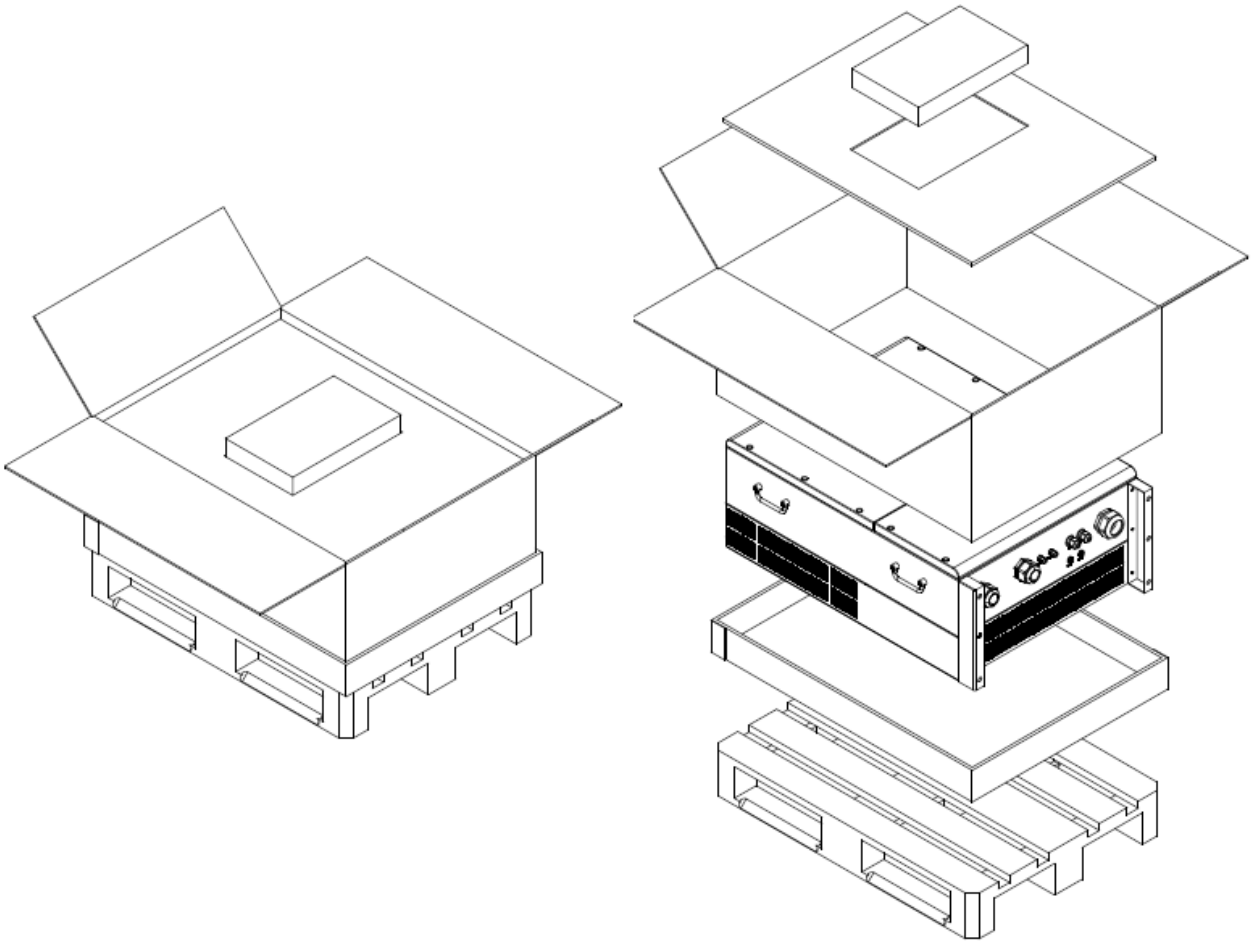
  Once the capacity of the solar cell module is increased, the inverter can be added without additional equipment via parallel connection easily.

- **Simplicity of operation**

  The inverter is designed to display the status in real time through the front LCD screen.

3. Installation

3.1 Transportation



- Please transport the product correctly according to the weight of the product.
- Do not stack the product beyond the restricted limit.
- Move the unit by 4 persons or more or with the lifting device because the weights of the inverter and packaging box are 85kg and 10kg.
- Do not open the front cover during transportation of the product.

- Please check the outer appearance of the product whether there are no fault appearances found.
- Do not drag or throw the inverter.
- Since the inverter is a precise apparatus, do not drop the inverter or give any strong impact.

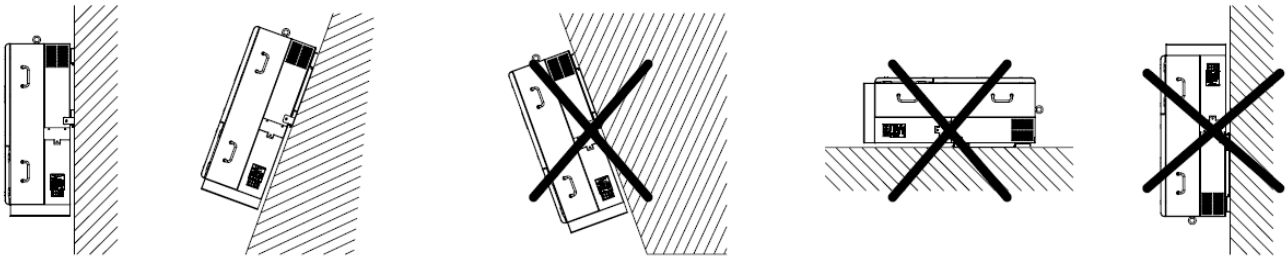
3.2 Installation Place

⚠ Caution

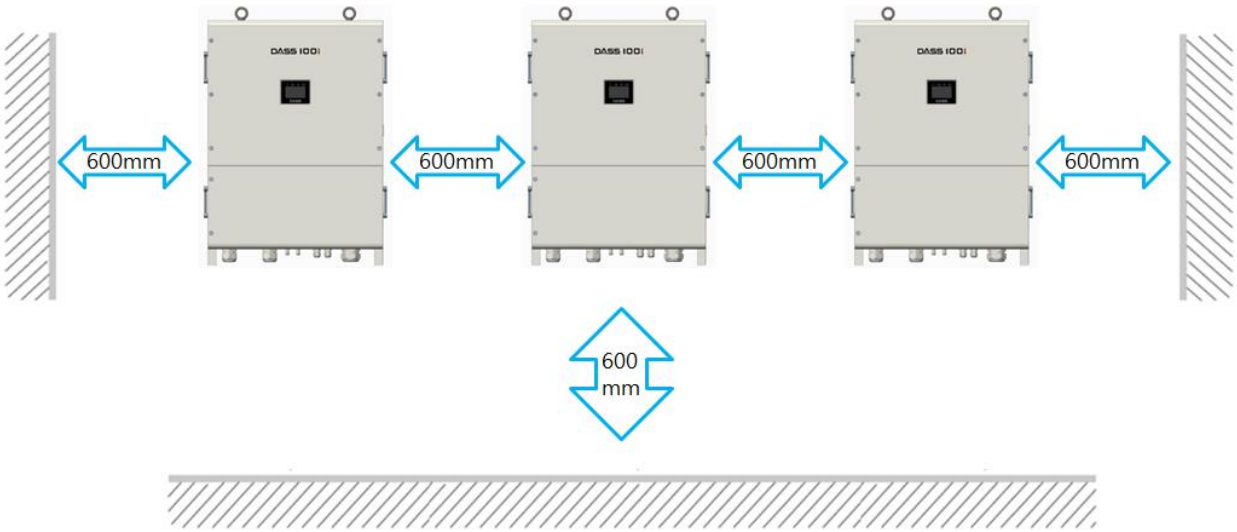
Please install the product at a place where the following conditions are met.

- The inverter should be installed at a place where there is no direct sun light considering installation direction or surrounding space to prevent reduction in lifespan or performance degradation.
- The product can be installed at indoor or outdoor place.
- The inverter should be installed at a well-ventilated place if it is installed indoor.
- Do not install the product at a vibrated place.
- Do not install the product at the concrete wall as much as possible.
- A lifespan of the inverter can be affected by an ambient temperature. Please make sure the ambient temperature at the installed place does not exceed an allowable storage temperature (-25 ~ 50℃).
- Please avoid a place with high temperature and humidity (relative humidity is 90% or less and no dew formation).
- Since the inverter is high-temperature heating element, please install the inverter on the surface of fire retardant material.
- Please make sure facilitating heat dissipation by ensuring a space around the inverter.
- Please avoid the place where there are oil mist, flammable gas, fiber dust, dust, and moisture.
- Please install the product sturdily with the bolts.
- Please install the product at a place without salinity. (In particular, if the product is installed near the coastal area, product corrosion can occur. Thus, contact with salinity should be avoided using additional methods such as installing an additional enclosure and indoor installation.)

3.3 Cautions While Installation



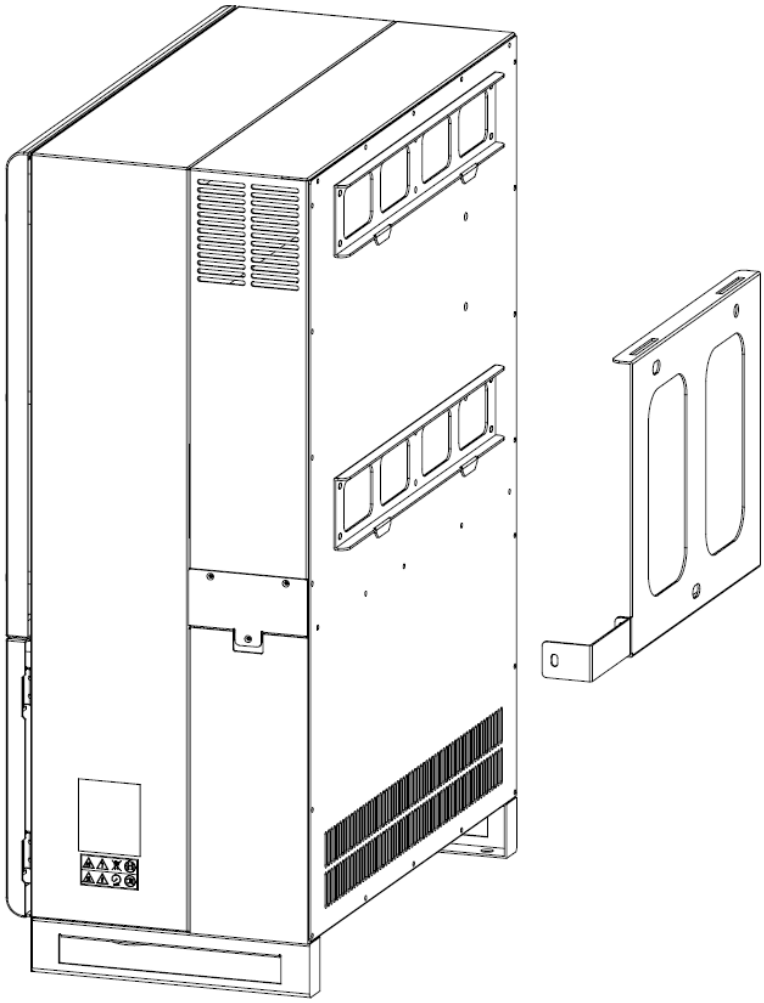
- Please install the product according to the contents in the manual.
- The installation place should be clean at all times and can be accessed safely without using auxiliary means such as lifting platform or foothold. Otherwise, service work may be limited.
- The connecting part (bottom surface of the inverter) should be directed to the below.
- Do not install the product at a tilted condition.
- Do not install the product horizontally.
- Please install the product at a place without high humidity and dust as well as direct sunlight, and the product should not be close to high-temperature heat-generating part. Generated power can be reduced due to overheating.
- The installation work must be done by professional technician.
- Do not place a heavy object on the product.
- Do not spray or place flammable substances near the product.
- The installation direction must be followed in accordance in the information in the operation manual.
- Since the inverter is a precise apparatus, do not drop the inverter or give any strong impact.
- The inverter requires grounding work of 3-type(200V grade) or special 3-type (400 V grade).
- Do not use other electronic appliances near the product. Failure or noise in the electronic appliances may occur.



- Be sure to use the exclusive bracket, and use caution due to the sharp part.
- Prior to installing the inverter, DC switch installed at the lower end of the inverter should be OFF. If it is ON, it can be a cause of a failure during installation. Upon installation completion, the inverter should be ON, and then make the inverter operated.
- At least 60cm of space at the upper part as well as left and right side of the inverter should be secured when the product is installed in the indoor.
- At least 60cm of space should be secured from the ground when the product is installed in the indoor or outdoor.
- 60cm or more of space between inverters should be secured when the product is installed in parallel.

3.4 Installation Method

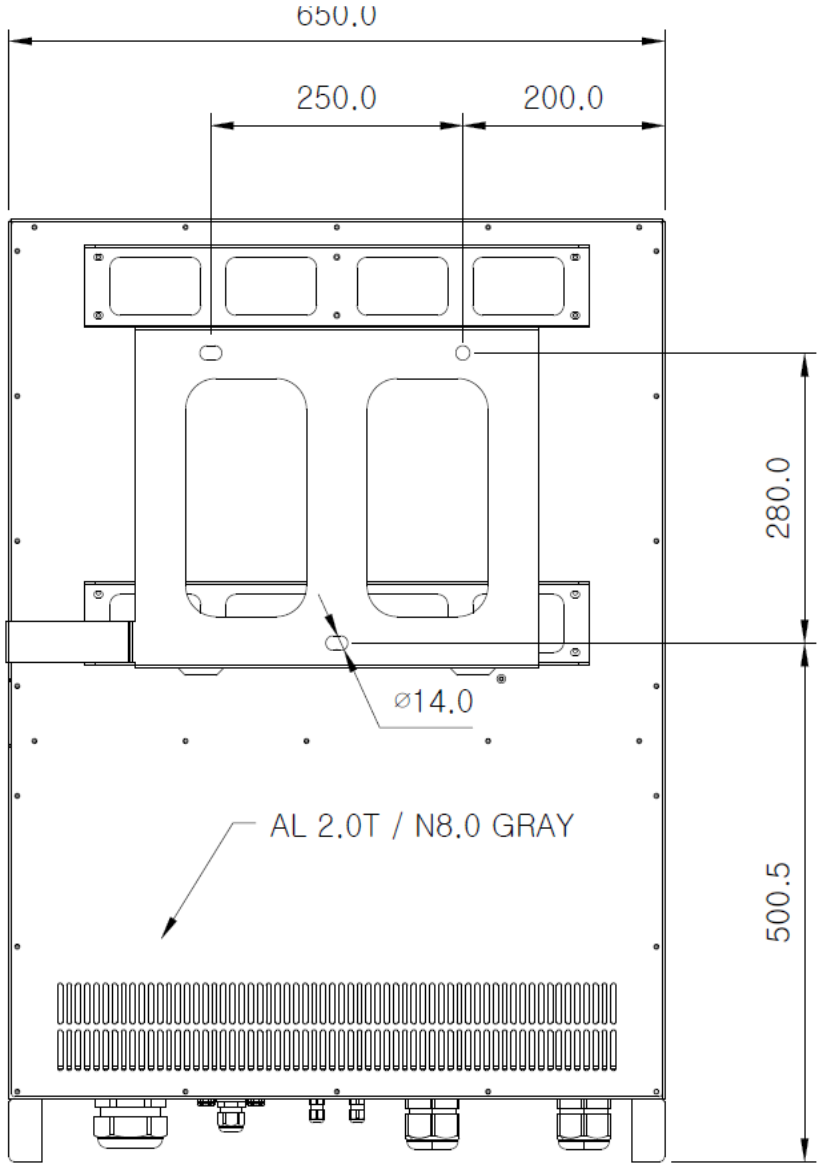
- Please refer to the below photo for the installation method.
- After the fixing bracket is installed, the inverter is placed on the bracket and fastened by the bolts.



⚠ Caution

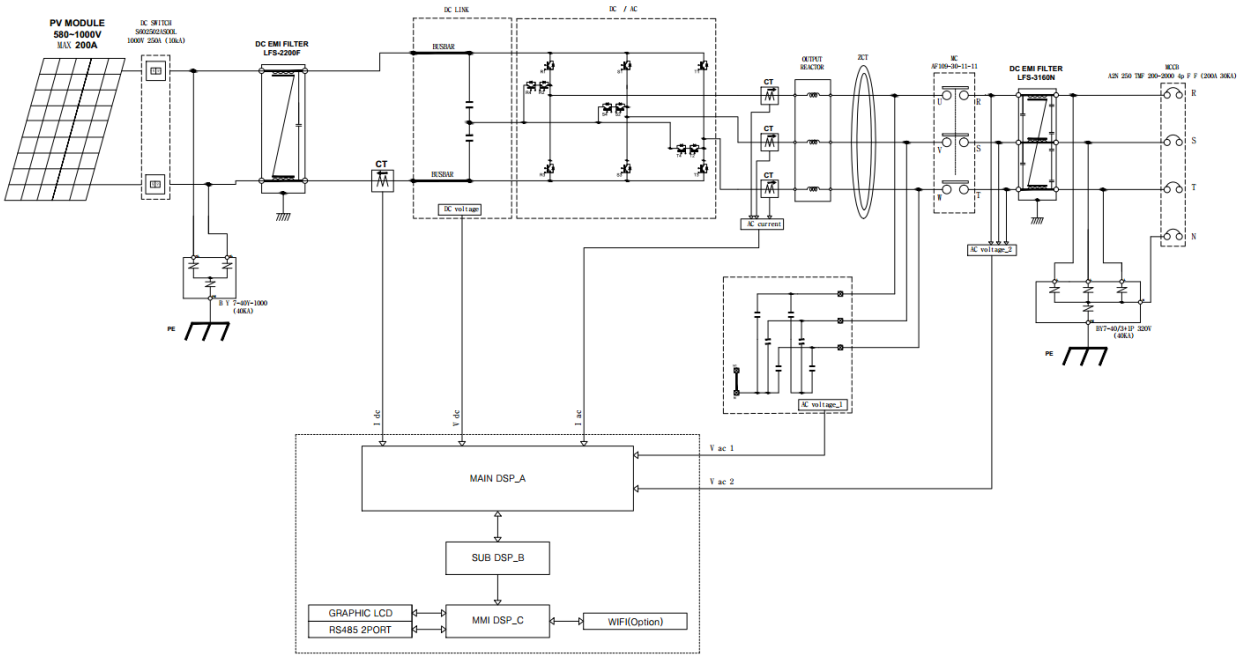
At least 4 or more persons must install the inverter during lifting or fixing it to the bracket.
Because the product is heavy, pls. install the product by a lift or crane possibly.
Since a weight of the inverter is 85kg, deal with it carefully, not to drop the inverter.

- Mark the locations of drill holes by using a fixing bracket (inner wall bracket) and bracket drawings provided along with the inverter.
- Please refer to the drawing as below to make holes (3 points) on the location for fixing a bracket.



- Fix the bracket by using bolts and nuts.
- After lifting the inverter, hang the inverter to the back of the bracket accurately.
- Fix the inverter and bracket (1 point).

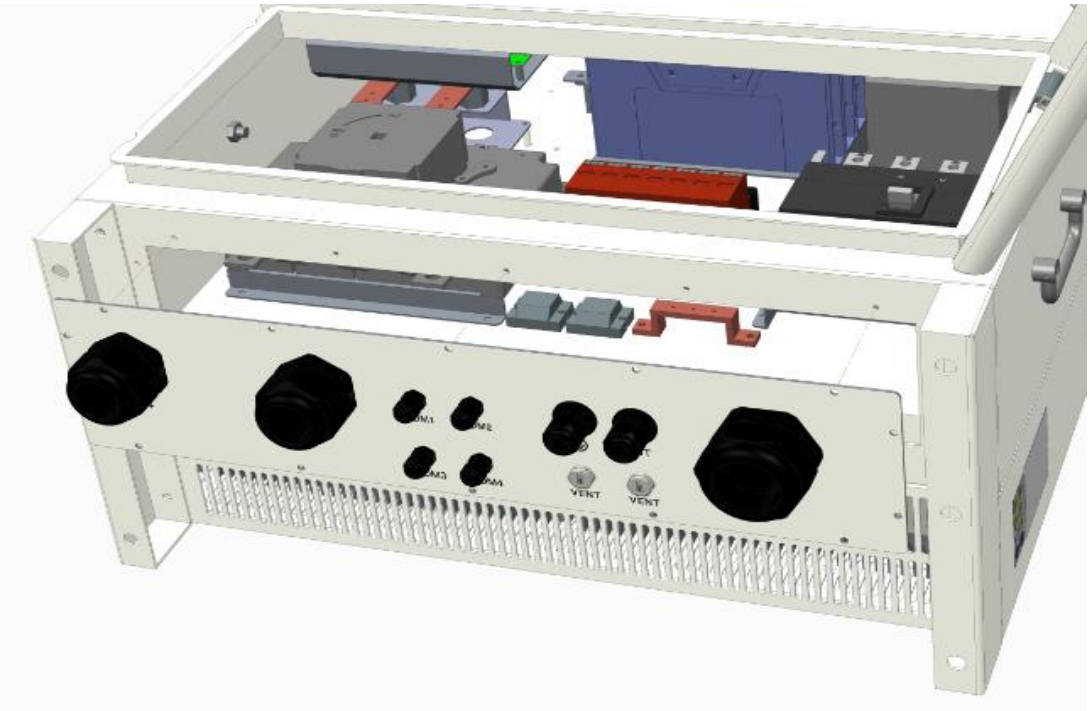
3.5 Block Diagram



<DSP-33100E-OD-HV Block Diagram>

3.6 Precautions during Wiring

- Incorrect terminal connection can cause damage to the inverter.
- Please be careful for polarity (+/-) during DC connection.
- Distinguish carefully grounding and power lines during connecting AC connectors.
- The wiring work or inspection should be done by professional technician.
- Wiring work should be done after installing the main body of the inverter.
- Cables are not provided separately.
- If wiring is changed as a result of inappropriate events, check whether the LCD display of the keypad is turned off prior to wiring work. It is dangerous immediately after power is disconnected since high voltage is charged in the internal capacitor of the inverter.



- Separate the bottom bracket from the body as above.
- For wiring, pls. work according to the following procedures

1. Put the wire to be used through a cable gland
2. Put the wire through the bottom bracket.
3. Wiring the wire to applicable components(DC breaker, AC breaker, Grounding wire and etc.)
4. After finishing wiring, assemble the bracket to the body.

- The inverter must be grounded with special 3-type (grounding resistance is 10 Ω or less) to prevent electric shock.

- Fasten the grounding of the inverter to the internal grounding connection terminal

- For grounding wires, dedicated grounding wires should be used. The grounding points should be connected to the inverter as close as possible. A thickness of the wire should be more than the dimension in the below and wiring should be short as much as possible.

- Pls. use the copper wire As the grounding wire,

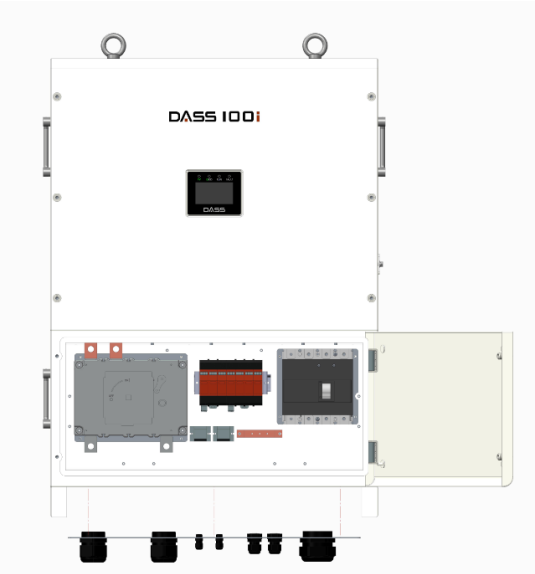
Capacity	Grounding wire dimension(mm²)
1.5 ~ 3 kW	4.0
5 kW or higher	6.0
100 kW or higher	25.0

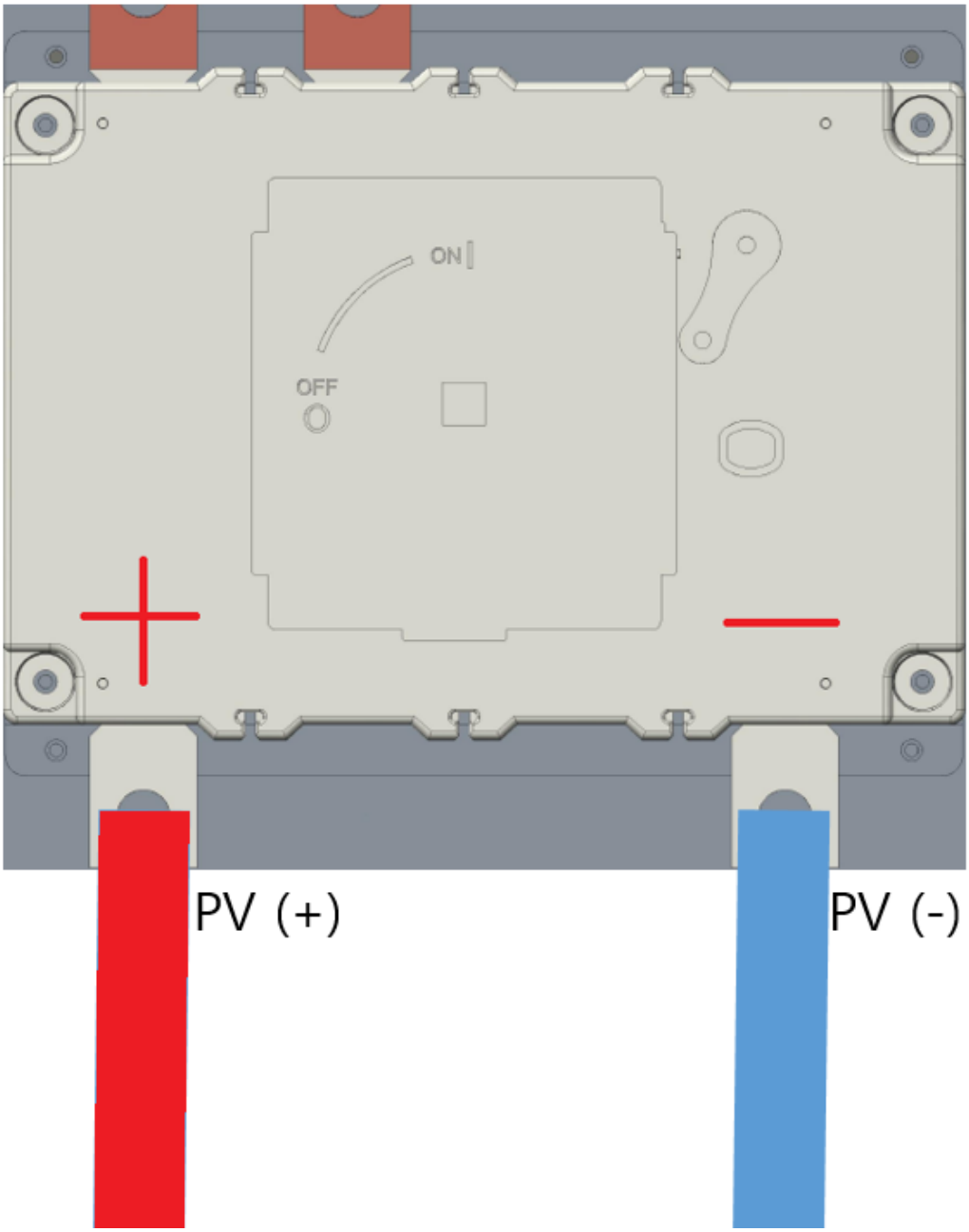
- Please check the maximum input voltage of the inverter and output voltage of the solar cell array. If the output voltage of the solar cell array exceeds the maximum input voltage of the inverter, critical damage can occur in the inverter.

- The output voltage must be set in consideration of temperature coefficient during wiring of the solar cell module. If the output voltage of the solar cell array is set without consideration of temperature coefficient, input over-voltage or low-voltage in the inverter can occur according to an ambient temperature.

3.7 DC Connection

① Open the cover by loosening 2 bolts in the bottom part.
② Connect PV (+) to the left part of DC breaker and PV (-) to the right part of DC breaker as below
③ For DC wiring, pls. use 70SQ wire (pls. change the wire thickness depending on wiring length)
④ Wire and terminal lug should be designed according to 95℃ at least and tightening torque should be 18 [N•m].





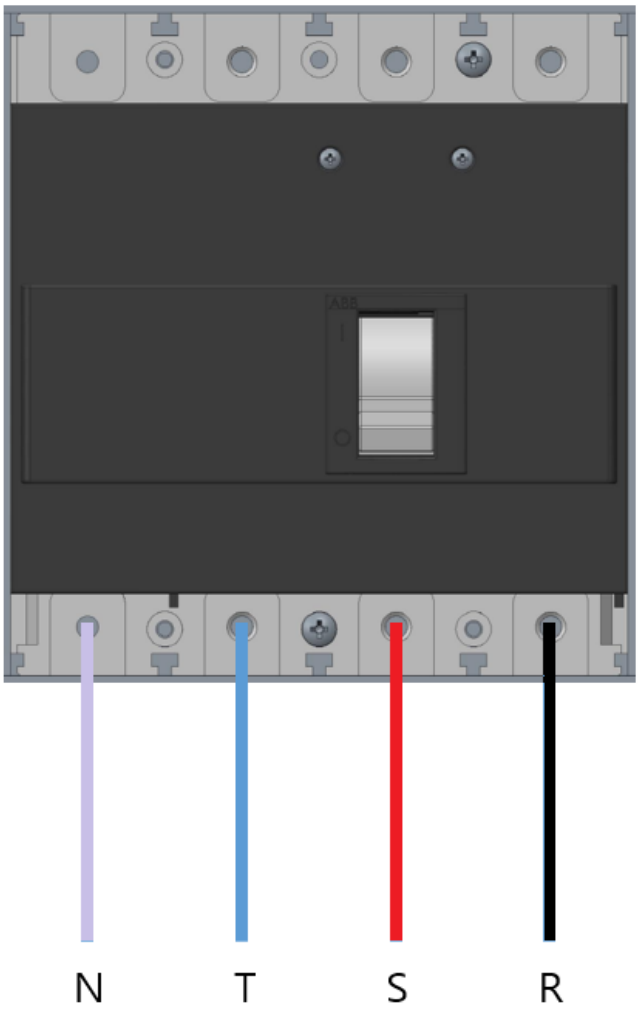
3.8 AC Connection and Grounding Connection

- **AC Connection**

⑤ Cover can be opened by loosening 2 bolts in the bottom part.

⑥ AC circuit breaker can be found by opening the cover as above.

⑦ Please use a wire of 70SQ for AC wiring (pls. change the wire thickness depending on wiring length).



⑧ An order of AC circuit breaker is R, S, T and N form the left side.

⑨ Pls. use only dedicated screw connected to AC circuit breaker

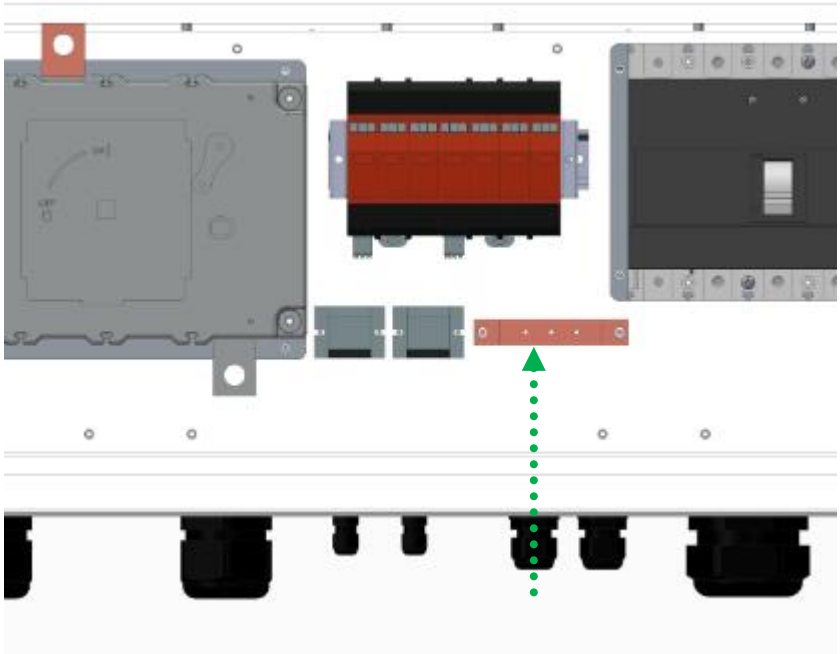
⑩ When the cable is connected to AC circuit breaker, care should be taken that the cable and terminal do not have a phase-to-phase short-circuit among R, S, T, and N.

⑪ Wires and terminal lug should be desigend for 95℃ at least and Tightening torque should be 5 [N•m]

⚠ Caution

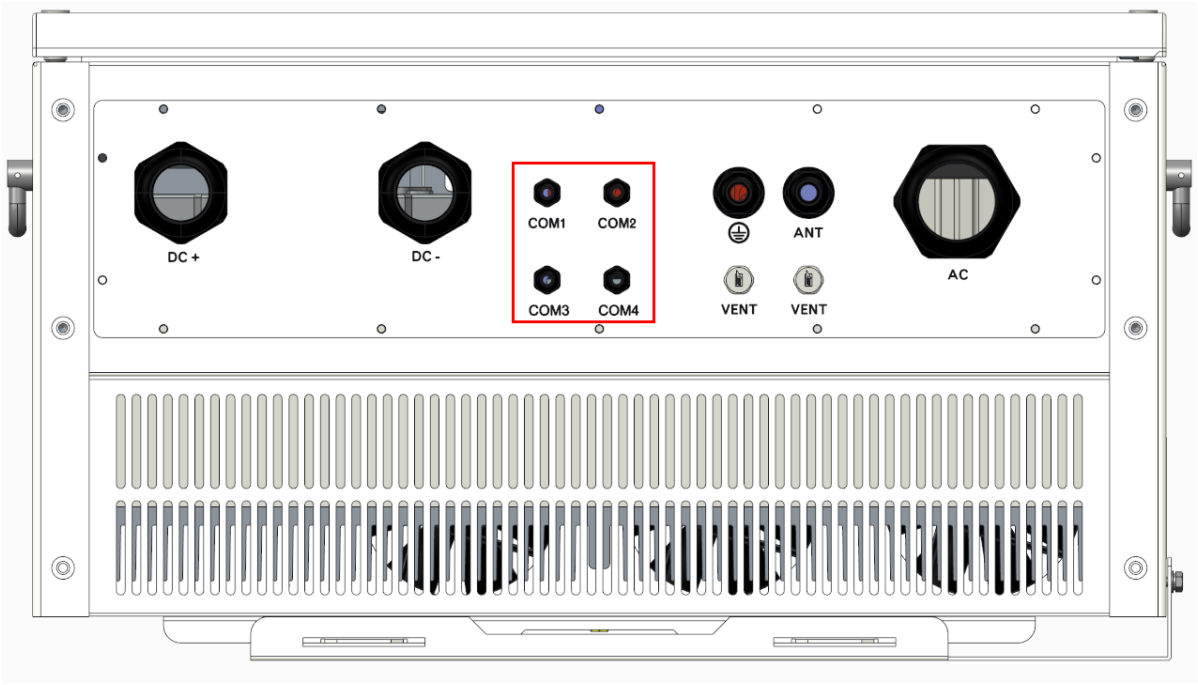
In case of negative phase, a certain letter regarding phase reverse, appears at the right upper end of the LCD in the keypad when PV power and AC power are applied and it is not counted.
For safety reasons, disconnect all powers and re-wire the AC cables.

- **Grounding connection**



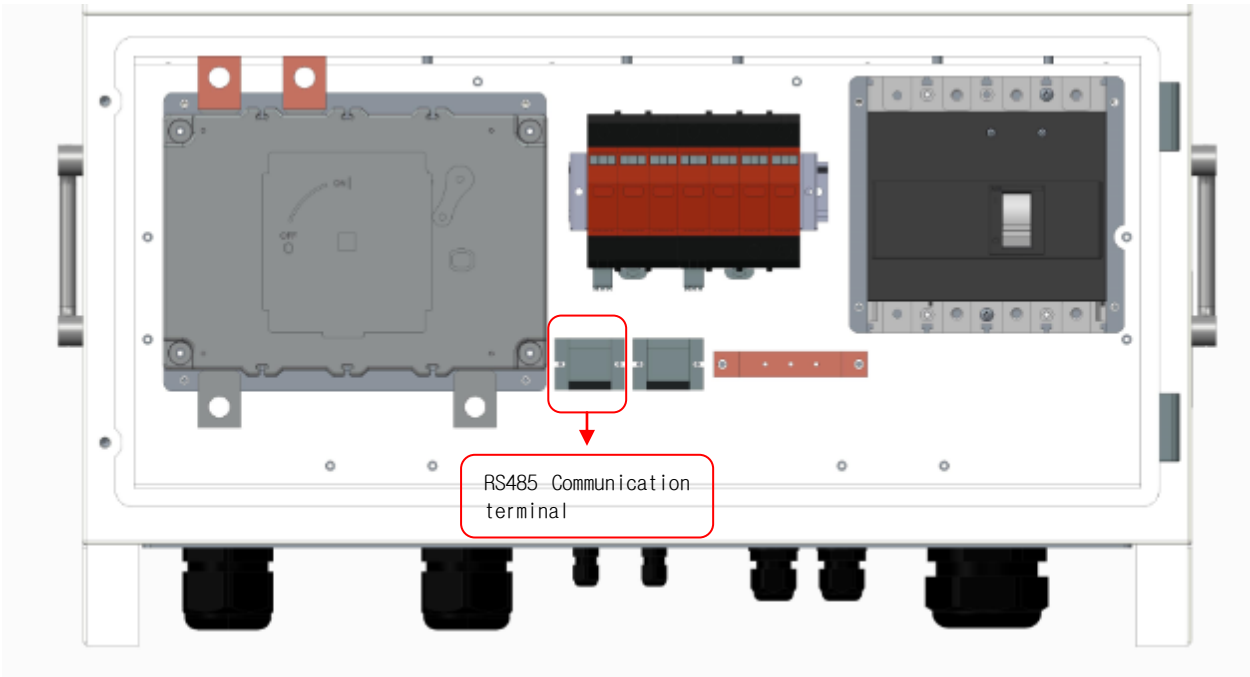
① Please use dedicated grounding wires when grounding wire is done.
② Use copper wire for grounding cable.
③ A thickness of grounding wire should be 25SQ or thicker.
④ Please press a terminal against the grounding wire and connect the wire to grounding bus bar in the bottom part of the inverter.
⑤ A rated dimension of the terminal is 5Ø.
⑥ The grounding points should be connected to the inverter as close as possible.
⑦ The inverter must be grounded with special 3-type (grounding resistance is 10 Ω or less) to prevent electric shock.

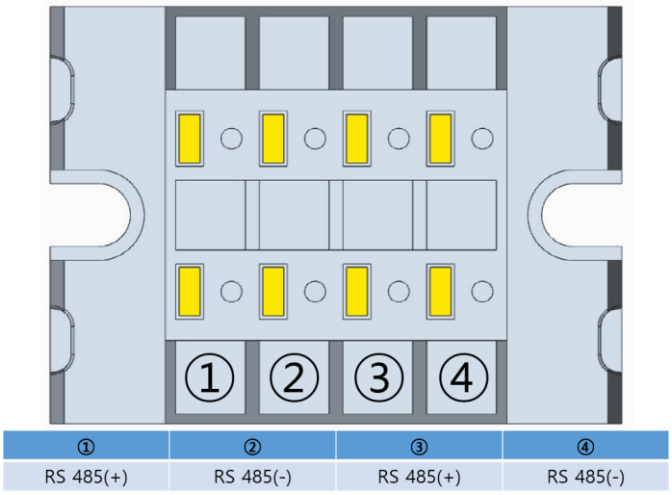
3.9 RS485 Communication Connection

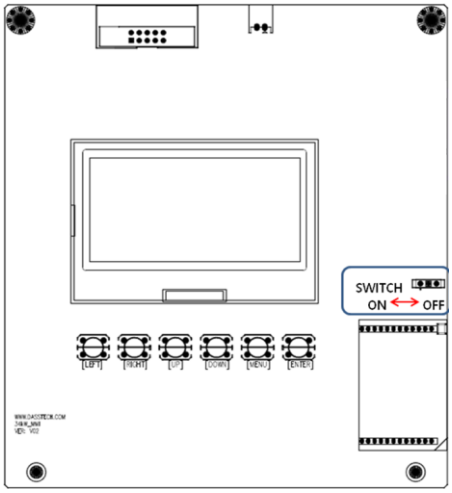


① In case of parallel connection, pls. use two cable glands for communication.

② Open the cover in the bottom part of the inverter.







③ Pass the communication power wire (3~6.5mm) through the cable gland and connect the communication line [+] to BUS+ of RS485 connector, the communication line [-] to BUS-, respectively.

④ In case of parallel connection, implement parallel connection for 485communication by using 485 IN, OUT.

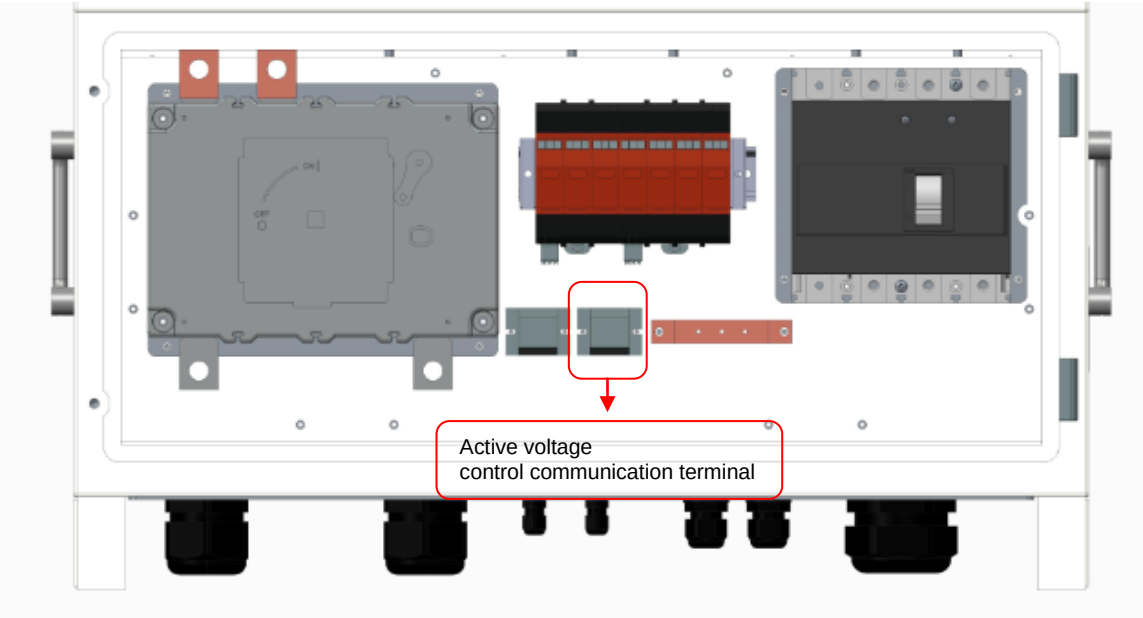
⑤ Please turn ON the switch (in the above pic.) only in the inverter at the far end of RS485 communication when parallel operation of the inverter and monitoring on the inverter are connected.

⑥ System ID Number should be set according to the below method during the communication use. When ID is not assigned, the value is set to 0 by default.

(Menu button – ETC Set – System ID Number – assigning the preferred ID Number to be used)

⑦ Once the communication setup is complete, fasten the plug of the communication gland.

3.10 Active Voltage Control Setting



- (Using KEPCO KDN device(DER-AVM))

① System ID Number should be set according to the below method during the communication use. When ID is not assigned, the value is set to 0 by default.

(Menu button – ETC Set – System ID Number – assigning the preferred ID Number to be used)

② Connect DER-AVM to a PORT for inverter active voltage control.

- In case of using independently

① Assign communication ID as above

② Set 'Active Voltage Control Mode'

(Menu button – Factory Setting – AVR Control {Reactive Power Mode or Power Factor Mode})

I. Reactive Power Mode : Set AVR Control V1/ V2/ V3/ V4/ TIME/ Q(+)/ Q(-)

II. Power Factor Mode : Set Power Factor Ref.

Menu	parameter	설정범위	default	설명 및 비고
Factory Setting	AVR Control	Normal /Power Factor / Reactive Power	Normal	능동전압제어 mode 설정
	AVR Control : V1	100~110%	102 [%]	전압상승시 무효전력 조정 시작 전압 (%)
	AVR Control : V2	90~100%	98 [%]	전압강하시 무효전력 조정 시작 전압 (%)
	AVR Control : V3	100~110%	104 [%]	전압상승시 무효전력 조정 최대 전압 (%)
	AVR Control : V4	90~100%	96 [%]	전압상승시 무효전력 조정 최소 전압 (%)
	AVR Control :Time	0~60sec	60 [sec]	무효전력이 최대 출력까지 변동하는 응답시간 (s)
	AVR Control :Q(+)	0~48.4%	48.4 [%]	지상 무효전력 최대값 (%)
	AVR Control :Q(-)	-48.4~0%	-48.4 [%]	진상 무효전력 최대값 (%)
	Power Factor Ref.	-90.00~90.00%	100 [%]	역률 기준값 설정
	Reactive Power Ref.	-100.0~100.0%	0 [%]	무효전력 기준값 (%)
	Active Power Ref.	0.0~100.0%	100 [%]	유효전력 기준값 (%)
Operation Setting	Rated Line Voltage	200.0~480.0V	380 [V]	인버터 출력단자 정격전압 (V)

4. High voltage transformer design guide for a central inverter

For new energy, the warranty is only applied to high-voltage transformers installed in accordance with the guideline provided with the application note.

The photovoltaic inverter is classified into two types: transformer and non-transformer types.
Since a non-transformer type inverter has no transformer in the inside in contrast with transformer-type inverter, a medium voltage (MV) transformer should be designed in accordance with the guideline when it is connected to the external high-voltage transformer.

4.1 Technical properties

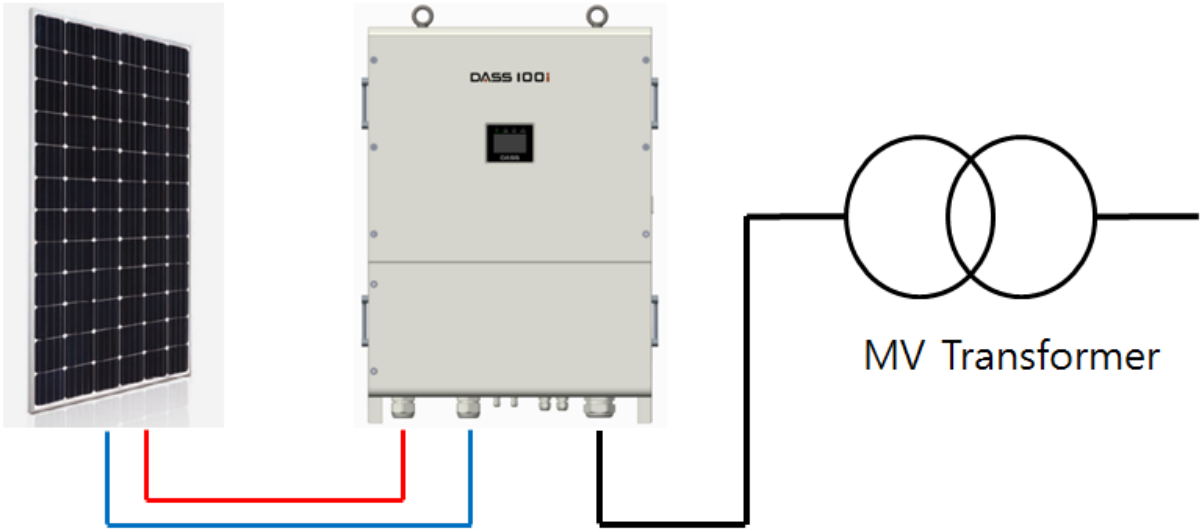
The MV transformer that is connected to the photovoltaic inverter without transformer shall comply with the following technical specifications.

1. The transformer shall be suitable for the pulse width modulation (PWM) inverter. The transformer shall be designed to prevent magnetic flux from saturating even if 1% of the direct current (DC) flows in the low-voltage winding. The transformer shall be designed and tested in accordance with the ANSI / IEEE, NEMA, IEC and Department of Energy standards.
2. The transformer shall be designed considering voltage generated during the inverter's pulse operation. The voltages can reach a magnitude of maximum ± 1400 V reference to the ground. The effective value of voltage reference with regard to grounding is up to 700V.

3. The low-voltage winding of the transformer shall be designed for voltage that can produce a voltage gradient dV / dt of up to 500V / μs reference to the ground. The line-to-line voltage waveform is a sine wave.
4. A shield winding that is grounded to the tank is needed between the low-voltage and high-voltage windings. This shield plate shall be designed to protect the heat due to eddy current caused by the flux of the low-voltage and high-voltage windings. This plays a role in additional dV /dt filtering.
5. The transformer shall have 110% of current load capacity at the ambient temperature of up to 50°C.
6. The load curve and surrounding conditions at each installation site shall be considered during thermal rating.
7. It is recommended to adjust a voltage level in the mid-voltage grid using the transformer which has a tap changer at the high-voltage side.
8. The grid frequency by country shall be considered.
9. Effective standards by country shall be considered.
10. The current of the sine wave filter capacitor is measured during commissioning, and if needed, the authority that can optimize the overall system is owned.

4.2 Requirements of the mid-voltage power transformer connected to the (single) central inverter

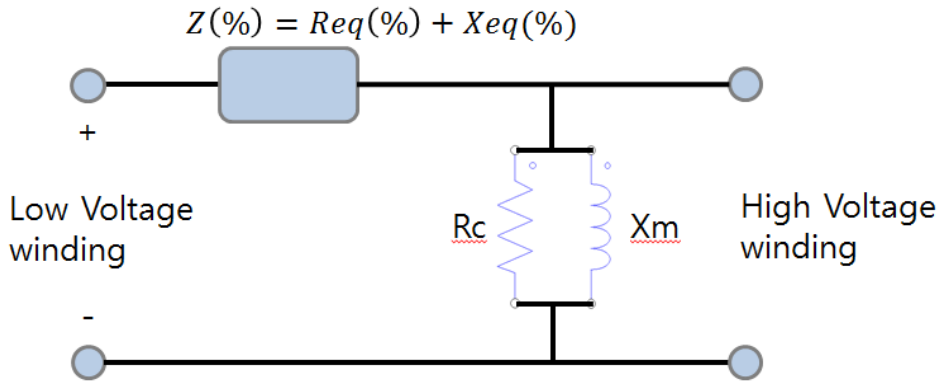
The low-voltage side is connected to the central inverter whose rated output voltage is 380V, and the high-voltage side is for the connection to the high voltage (20KV) systems in Europe. However, other high voltages can also be used: 10 kV, 15 kV, 22 kV, 25 kV, 27 kV, 30 kV, 34.5 kV or 35 kV etc.



This transformer shall comply with the following technical specifications.

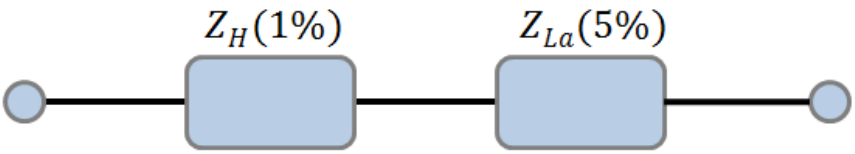
- Equivalent series impedance between low-voltage and high-voltage windings:

The equivalent series impedance Z(%) of the transformer shall be 6%. The impedance voltage allowable criteria of 5.4% to 6.6% shall be maintained. This value can be determined when the voltage in other low-voltage winding increases until the high-voltage winding is short-circuited and a nominal current flows.



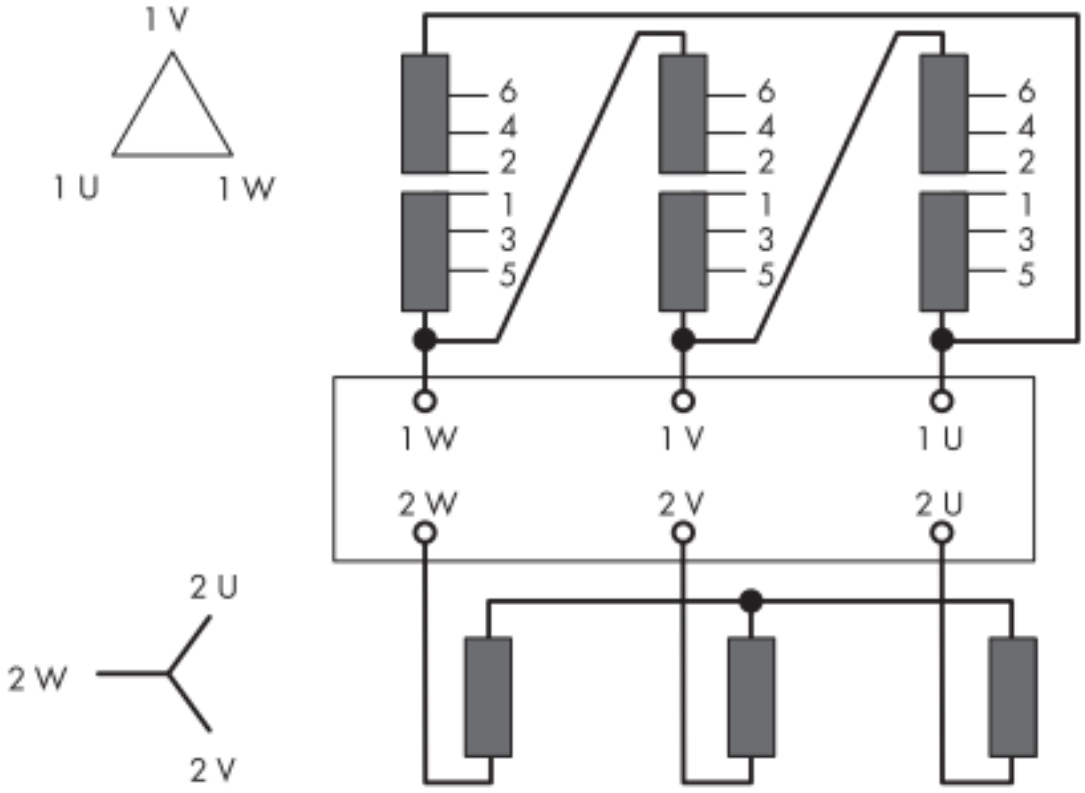
- The equivalent series impedance Z(%) of the two-winding transformer:

The contents of Article 2 can be summarized that the equivalent series impedance Z(%) of the two-winding transformer can be expressed as follows: ZL refers to the equivalent series impedance of the low-voltage winding, and ZL refers to the equivalent series impedance of the high-voltage winding.



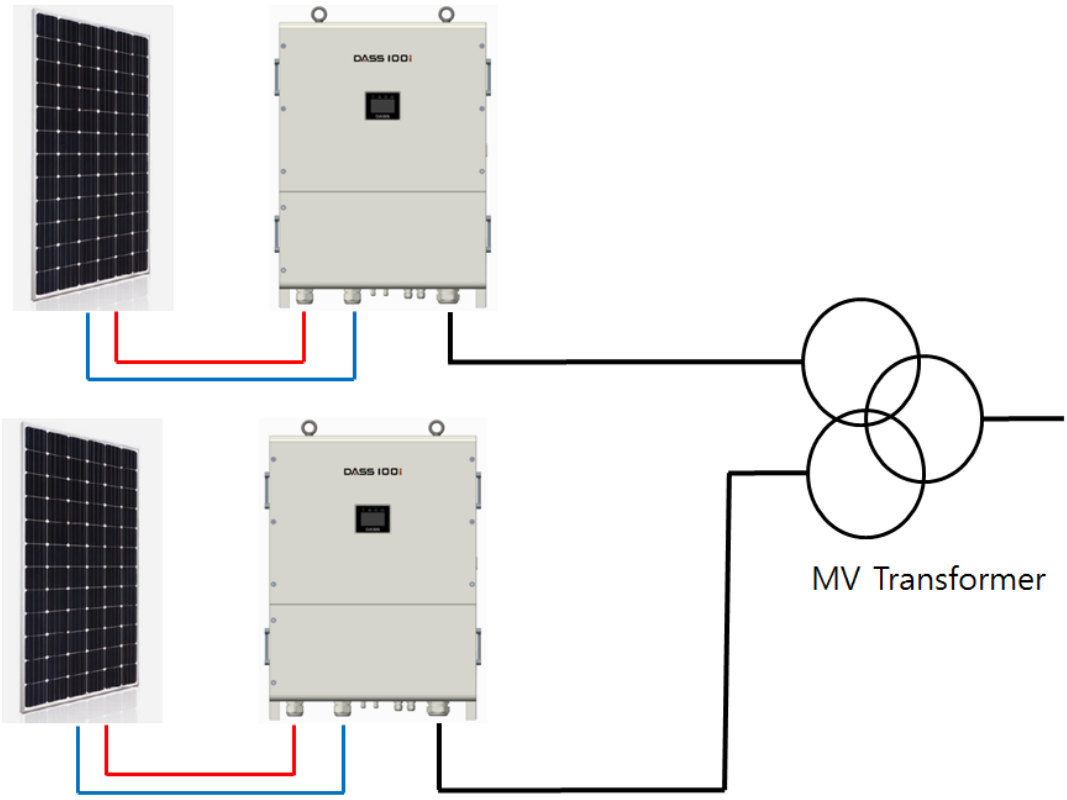
- A neutral point is not needed in the low-voltage side. Nonetheless, if a neutral point appears in the low-voltage side, this neutral point shall not be connected or grounded.
- A two-winding transformer where winding changes in each of the high-voltage and low-voltage sides can be used.

For example, YNd11, YNd5, YNd1 or Dy11, Dy5, Dy1 has a non-grounding neutral point in the low-voltage side.



4.3 Requirements of the mid-voltage power transformer connected to the (double) central inverters

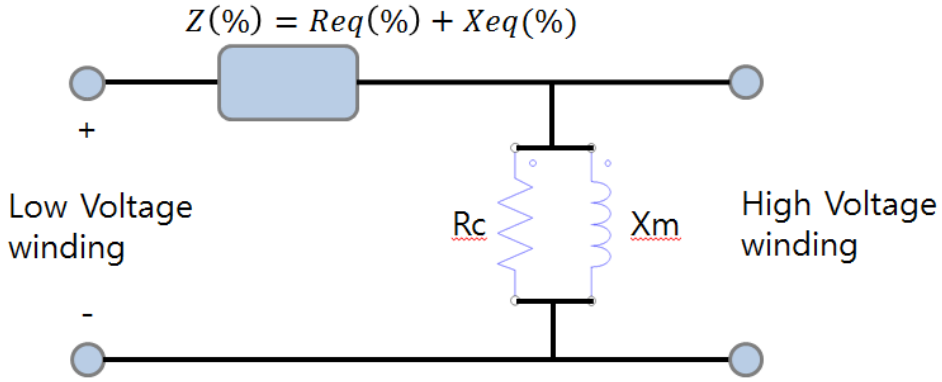
The transformer in the figure allows only a double stack (four-winding) transformer and a three-winding transformer with LHL winding. In such MV transformer, a high-voltage winding is placed between two low-voltage windings.



This transformer shall comply with the following technical specifications.

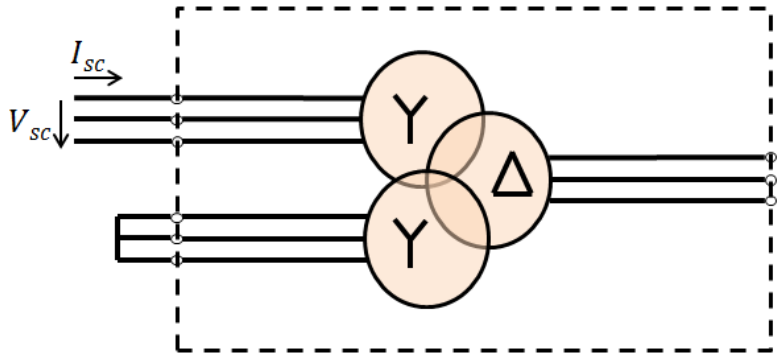
- Equivalent series impedance between low-voltage and high-voltage windings:

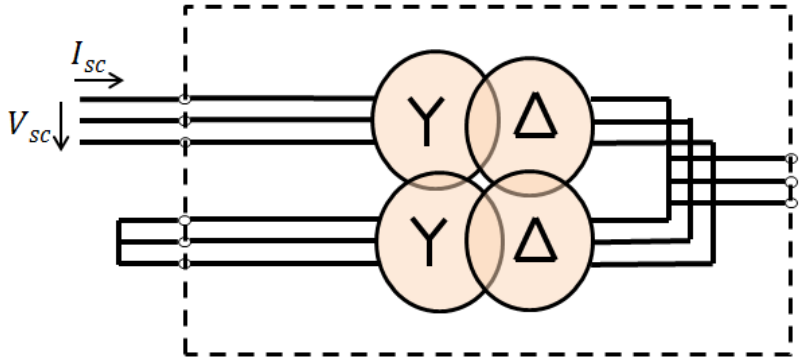
The equivalent series impedance Z(%) of the transformer shall be 6% in every instance for each inverter. The impedance voltage allowable criteria of 5.4% to 6.6% shall be maintained. This value can be determined when the voltage in other low-voltage winding increases until the high-voltage winding is short-circuited and a nominal current flows. Simultaneously, other low-voltage winding is in the idle state.



- Equivalent series impedance between low-voltage windings:

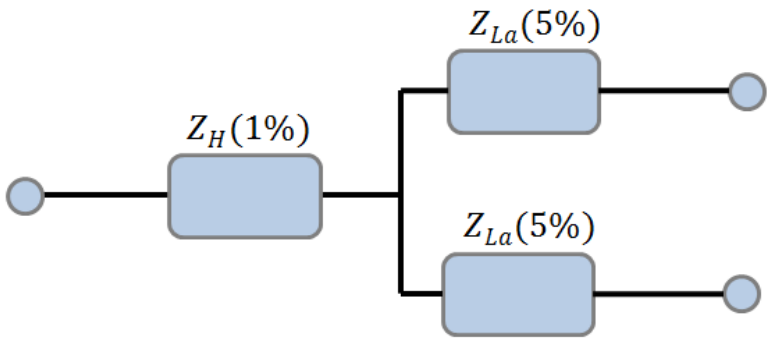
The equivalent series impedance Z(%) of two low-voltage windings shall be 10%. The allowable error limit of the impedance voltage shall maintain 9% to 11%. This value can be determined when the voltage in other low-voltage winding increases until one of the low-voltage windings is short-circuited and a nominal current flows. Simultaneously, high voltage winding is in the no-load state.





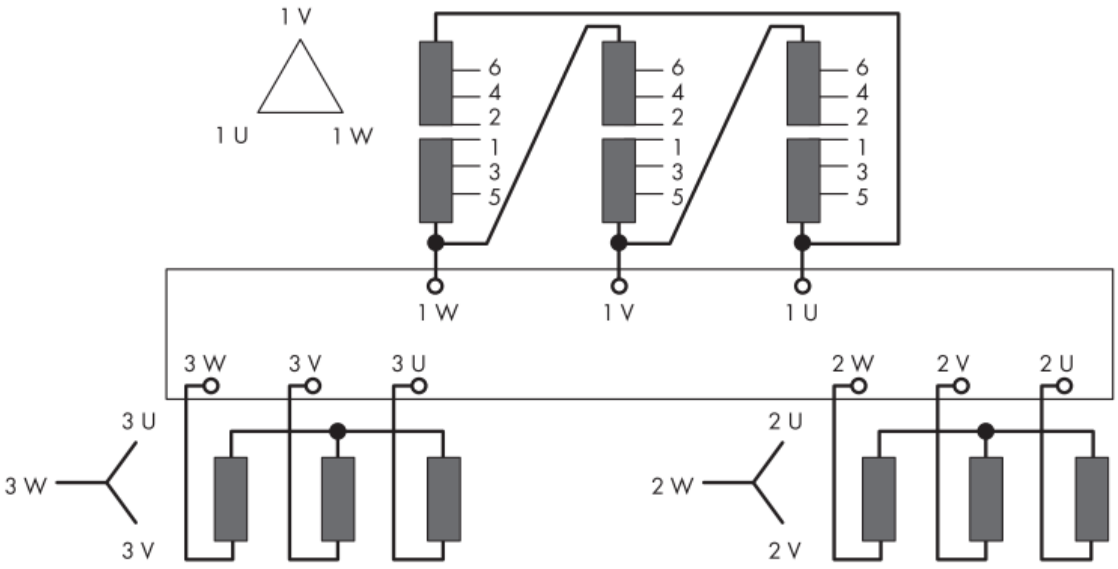
- The equivalent series impedance Z(%) of the double stack (four-winding) transformer:

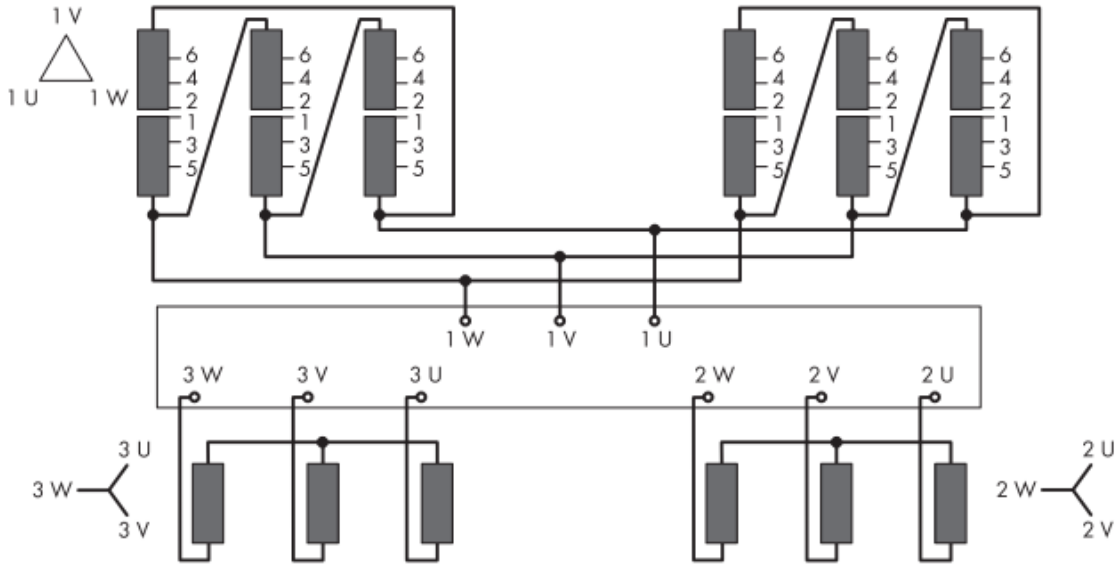
The contents of Articles 1 and 2 can be summarized that the equivalent series impedance Z(%) of the double stack (four-winding) transformer can be expressed as follows: ZL refers to the equivalent series impedance of the low-voltage winding, and ZL refers to the equivalent series impedance of the high-voltage winding.



- A neutral point is not needed in the low-voltage side. Nonetheless, if a neutral point appears in the low-voltage side, this neutral point shall not be connected or grounded.

- The double stack (four-winding) transformer that has various windings at each of the high-voltage and low-voltage sides can be used. For example, YNd11d11, YNd5d5, YNd1d1 or Dy11y11, Dy5y5, Dy1y1 has a neutral point that is not grounded at the low-voltage side.



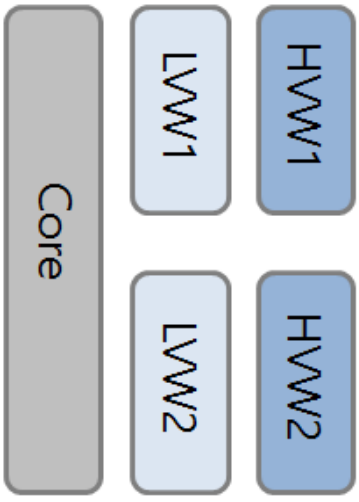


4.4 Winding technology

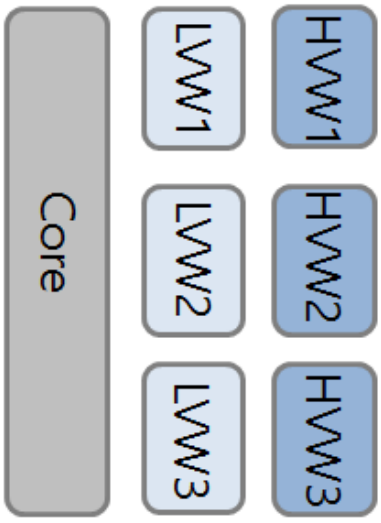
The MV transformer that is connected to the photovoltaic inverter without transformer shall be designed as a section winding transformer.

- Single layer winding transformer

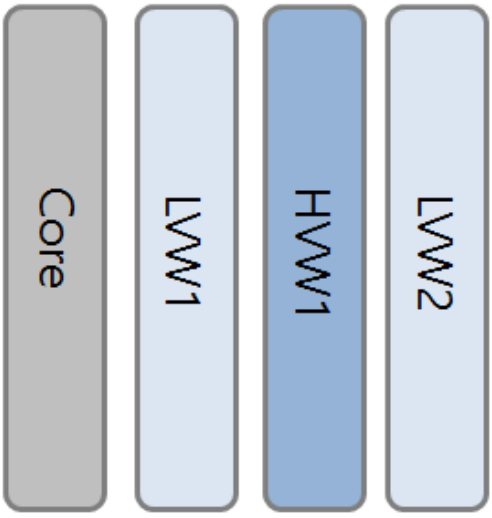
Case 1. Double stack



Case 2. Triple stack



Case 3. Triple stack (LHL)

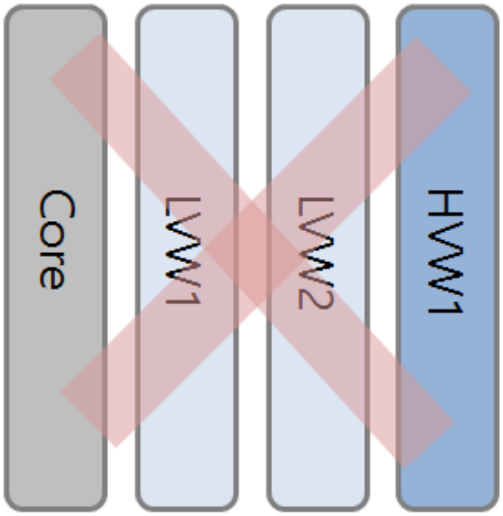


LVW : Low voltage winding

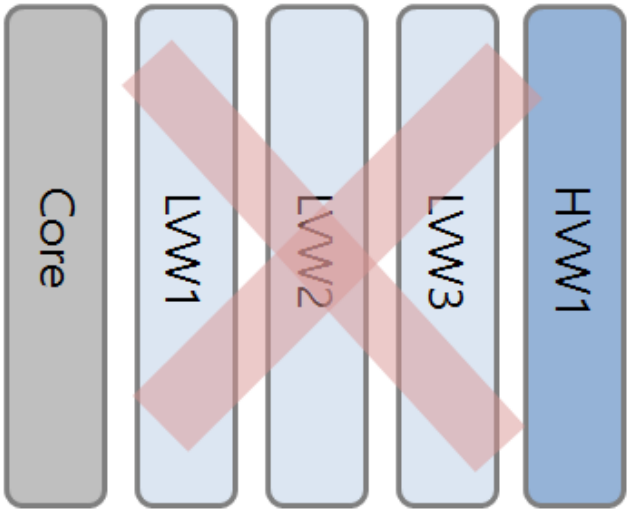
HVW : High voltage wingding

- Multi-layer winding transformer

Case 1. LLH

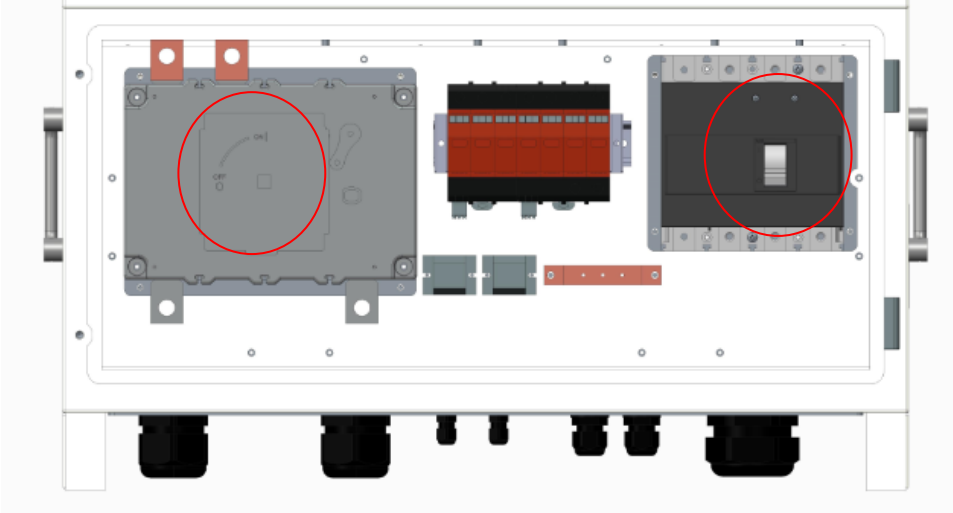


Case 2. LLLH



5. Operation

5.1 Checklist prior to Operation



① Once the connection is complete between PV cable and AC cable, the inverter is ready for startup.

② Turn the DC switch in the lower part of the inverter to the ON direction then, Turn the DC switch to the ON direction. The factory default setup of the product is OFF.

③ Upon the AC turned ON, the inverter counts 300 sec for automatic startup. The count time can be checked at the right upper end of the external LCD.

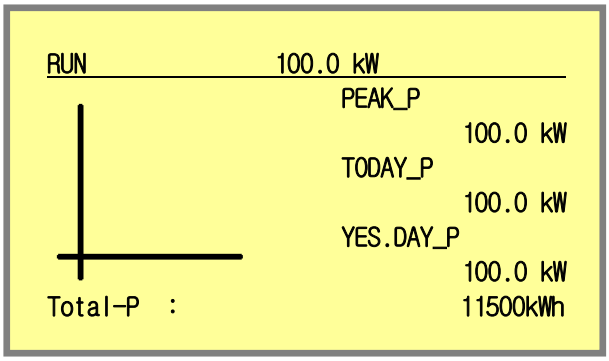
④ Once 300 sec is passed, the inverter is started up automatically and runs below the operation voltage, it is stopped automatically.

5.2 Appearance of the Display Window and Functions

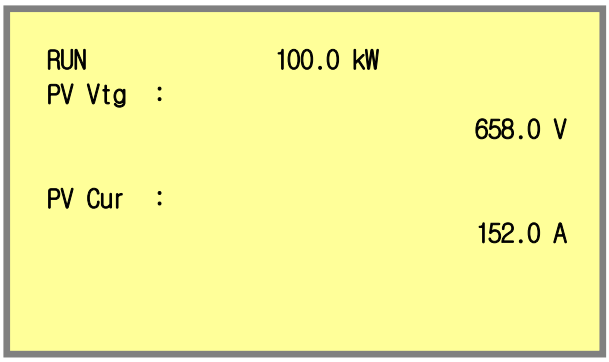
State LED	Description
PV	**Its displays the input state from the solar cell module.**
GRID	**It Displays if the grid is run normally.**
RUN	**It displays if the inverter is run normally.**
FAULT	**It displays if an error is generated in the inverter.**

- The LCD specification in the display window is 128x64 GRAPHIC LCD.
- When power is on in the inverter, the display window is converted in every 10 sec automatically.

5.3 Display Window Screen



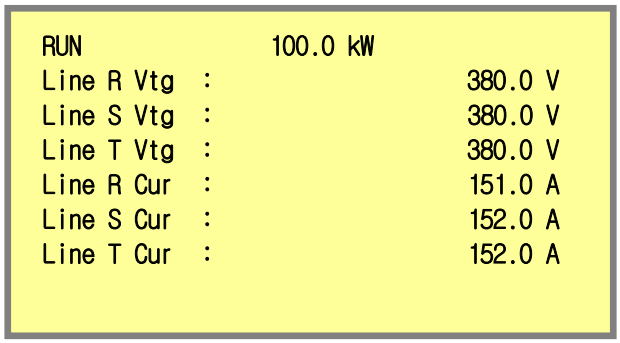
- RUN : Current generated power
- Graph : Today hourly power generation graph[%]
- PEAK_P : Today peak power
- TODAY_P : Today accumulated power
- YES.DAY_P : Yesterday generated power
- Total Po : Totally generated power



■ RUN /STOP : Present operation status, 100.0kW : Present power

■ PV Voltage : Input PV voltage

■ PV Current : Input PV current



■ RUN/STOP : Present operation status, 100.0kW : Present power

■ Line RS Vtg : Grid R-S interline voltage

■ Line ST Vtg : Grid S-T line to line voltage

■ Line TR Vtg : Grid T-R line to line voltage

■ Line R Cur : Grid R phase current

■ Line S Cur : Grid S phase current

■ Line T Cur : Grid T phase current

5.4 How to Operate

- **Checklist prior to the operation**

Check the status of wiring in the inverter and its installation.

In particular, check if the input polarity of solar cells is connected accurately or if the connection of the grid line is connected correctly.

Supply the DC power of solar cells to the inverter. Once DC power is supplied, the inverter will check automatically the status of AC power, count down 300sec, and run automatically.

Check the ON/OFF status of the DC switch at the lower part of the inverter.

(At this time, PV power is provided to the inverter with DC circuit breaker)

- **Automatic operation**

The factory default value is set to automatic operation mode.

If a voltage in the solar cell module is increased to the setup value due to the sunrise, the inverter operates automatically.

A voltage in the solar cell module is decreased at sunset. Once the voltage is below the setup voltage, it is stopped automatically. The grid power is always monitored and operation is stopped automatically once fault state is found.

- **Stop during operation**

If the inverter needs to be stopped during operation, the DC switch is turned OFF or the grid is blocked to stop the operation.

⚠ Warning!

Note that the figure displayed in the operation and installation manual is explained without the front cover for the purpose of detailed explanation. However, the front cover must be installed according to the regulation when the product is operated before the product is operated according to the operation and installation manual.

6. Functions

6.1 Description of Functions

- **Grid monitoring**

  Normal or fault state in the grid voltage is determined by a difference in voltage (Fault high voltage and Fault low voltage) compared to a normal voltage. If the value is larger or smaller than the pre-set value, the inverter is stopped. If the frequency in the grid voltage is deviated from the pre-set value (line frequency) by more than fault high frequency and fault low frequency, the inverter is not operated and stopped.

  In order to start power generation at the normal grid state, the grid is operated after the operation count-down (Line transfer. time) is elapsed. The frequency of the grid voltage can be set according to the grid frequency.

- **MPPT control and total power generation**

  Since the output of the solar cell module varies depending on ambient temperature, humidity, and sunlight, the MPPT (Maximum Power Point Tracking) algorithm should be run smoothly. The method applied to the product is that the inverter is stopped when there is little current pulsation and solar cell is reached up to PV stop voltage thereby unable to run the inverter anymore.

  The total power is accumulated and memorized so that total power can be checked.

- **Occurrence of fault state**

  When fault states that stop the inverter occur, related messages are displayed. After the cause of fault state is removed, the system is re-run after some waiting time. If the same symptom occurs again or the system is not re-run, please contact the main office.

- **Verification of fault state detail**

  The fault scan stores 50 faults from No. 0 to No. 49. The latest fault becomes No. 0.

  The variables or fault state details in the past can be displayed using an UP and DOWN key in the internal keypad of the inverter.

- **Modification of set values**

  Parameter values can be modified using the internal keypad during inverter stop.

⚠ Caution!

Please contact the main office if you need to modify parameter values.

- **Initialization**

  There are two initializations: parameter and fault initializations. Parameter initialization sets all parameters and optional functions to factory default values while fault initialization removes all fault records in the past and makes the system to ready-state.

⚠ Caution!

If the internal keypad is manipulated arbitrarily, it can cause malfunction of the inverter.

Please contact the main office.

6.2 Symptoms of Warning and Fault

- If a warning occurs in the product, this is displayed in the screen.
- The product displays a system fault and stops the operation.
- The product displays a grid fault and stops the operation.
- When a fault occurs, red color is displayed at the display window Fault LED.
- When a fault occurs, fault detail is displayed in the keypad window of the display window LCD.
- If the inverter is damaged and becomes out of control, the machine may be neglected as a dangerous state. In order to prevent such circumstance, safety devices such as over-current breaker should be installed additionally.

6.3 Types of Main Faults

- **Input over-voltage protection**

  If a solar cell voltage exceeds the regulated voltage, the system is stopped to protect the inverter.

- **Input under-voltage protection**

  If a solar cell voltage is below the regulated voltage, the system is stopped to protect the inverter.

- **Output over-current protection**

  If over-current occurs due to the fault condition of the output current in the inverter, the system is stopped to protect the inverter.

- **Inverter overheat protection**

  If an internal temperature in the inverter exceeds the standard value, the system operation is stopped to prevent overheating. If an internal temperature in the inverter is returned to a normal temperature, the system is operated normally after reset.

- **Negative phase**

  In case of negative phase, the inverter does not count for running.

- **Grounding fault protection**

  If a leakage current occurs due to grounding fault, the system is stopped.

- **Grid fault protection**

  Upon the fault occurrence in the grid power, the system is stopped.

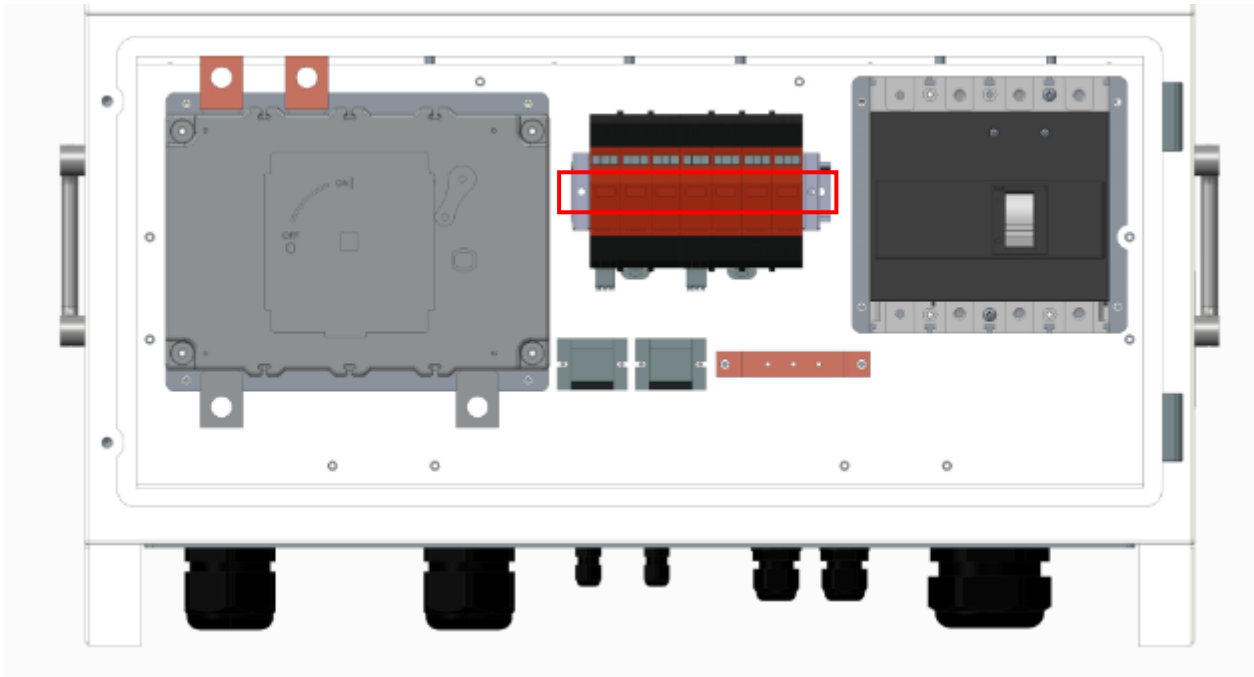
(Grid over-voltage protection, grid under-voltage protection, grid over-frequency protection, and grid under-frequency protection)

- **PWM control fault**

  If PWM control fault occurs in the inside of the inverter, the system is stopped.

- **SPD indication**

  SPD the top indicator's red light turns on as a warning.



6.4 Types of Faults and Corrective Actions

No.	Type of Error	Display	Cause of Error	Corrective Action
1	DC_LINK Overvoltage	InsDC-Link OV, AvgDC-Link OV	Overvoltage of DCP, DCN, DC_LINK	Contact the service center.
2	DC_LINK Undervoltage	InsDC-Link UV	Undervoltage of DCP, DCN, DC_LINK	Contact the service center.
3	Input overvoltage	AvgPV OV	If the solar cell voltage exceeds the set voltage	Operate the inverter after inspecting the solar cell module. If the system cannot be rerun, please contact the service center.
4	Input undervoltage	AvgPV UV	If the solar cell voltage is below the set voltage	It can occur during sunrise and sunset. If it occurs frequently, Operate the inverter after inspecting the solar cell module.
5	Input overcurrent	InsPV OC, AvgPV OC	If the solar cell current exceeds the set current	Operate the inverter after inspecting the solar cell module.

6	Output overcurrent	InsLine x OC, AvgLine x OC	If output of the inverter is in over-current state	Contact the service center.
7	PWM FAULT	Line x OC2, x UVLO	Inverter internal fault	Contact the service center.
8	Relay FAULT	Relay_Open Relay-Short	Relay fuse and failure	Contact the service center.
9	Communication FAULT	Comm. Error	MMI communication fault	Contact the service center.
10	Temperature FAULT	Over Heat1	Over-temperature failure	Contact the service center.
11	Output current FAULT	Balance Current	Output current imbalance	Contact the service center.
12	HARDWARE FAULT	Hardware OC	Output over-current	Contact the service center.
13	INSULATION FAULT	PV Insulation	Insufficient insulation resistance	Contact the service center.
14	HARDWARE OH	Over Heat2	Hardware overheat	Contact the service center.
15	RCMU FAULT	Residual OC	Leakage current is over the standard value	Contact the service center.
16	Grid Overvoltage	InsLine xx OV, AvgLine xx OV	If the grid voltage exceeds the set voltage	Contact the installation company and then call the service center.
17	Grid Undervoltage	AvgLine xx UV	If the grid voltage is below the set voltage	Contact the installation company and then call the service center.
18	Grid Frequency fault	Over Frequency, Under Frequency	Grid frequency fault	Contact the installation company and then call the service center.
19	Output DC detection	x DC Current	DC output is introduced to the grid	Contact the service center.

20	Negative phase	PHASE REVERSE	Negative phase	Rewire the output cable.
21	Grid (phase) overvoltage	InsLine xN OV, AvgLine xN OV	Grid R, S, and T phase overvoltage	Contact the service center.
22	Grid (phase) undervoltage	AvgLine xN UV	Grid R, S, and T phase undervoltage	Contact the service center.

6.5 Types of Warnings and Corrective Actions

No.	Type of Error	Display	Cause of Error	Corrective Action
1	Warning of lifespan limit	LIFE_W	Warning for lifespan of main parts	Contact the service center.
2	Output current warning	LIMIT_O	Maximum output current limit notice	When grid voltage is decreased and the inverter's current is over Max. value, there can be limited current.
3	Input current warning	LIMIT_I	Maximum input current limit notice	Contact the service center.
4	Temperature current limit	LIMIT_D	Output limit notice according to temperature	Contact the service center.
5	FAN warning	FAN_W	FAN failure notice	Contact the service center.
6	PV module power shortage	PV Low Power	PV module power shortage	Please wait until PV power can be or over the minimum power
7	PV SPD FAULT	PV SPD Error	PV SPD Fault	Contact the service center.
8	GRID SPD FAULT	AC SPD Error	GRID SPD Fault	Contact the service center.

6.6 Failure Repair

- Check whether or not the inverter has a fault.
- Check the date, time, and failure display description when the product is broken.
- The following items are checked and service repair is requested.

1) Model name
2) Manufacture No.
3) Purchase place
4) Purchase year
5) Warranty Letter
6) Failure details

6.7 Disposal

- Please dispose the product as general industrial waste.

7. Maintenance and Cleaning

- Be sure to carry out maintenance of the inverter regularly.

Recommended service period	Service work	내용
6 months	Cleaning	- Remove fan dust at the right side of the inverter - Remove vent dust at the left side of the inverter
12 months	Cleaning	- Remove fan dust at the right side of the inverter - Remove vent dust at the left side of the inverter
	Visual inspection	- If the inverter enclosure has any rust - The connector at the lower part of the inverter - The cable glad at the lower part of the inverter - DC SWITCH at the lower part of the inverter - Dust and humidity of the front display of the inverter - INPUT cable bolt tightness of the inverter

⚠ Caution

Do not carry out dust removal during inverter operation.
Do not touch any part of the product such as inverter enclosure, connectors, cable gland, cables, etc. during visual check.

⚠ Danger

Deadly risk due to electric shock
Do not carry out any service with the inverter cover open except the above service list.
Touching any electrically-live part may cause deadly electric shock.

8. Product Specifications

Model name		DSP-33100E-0D-HV
DC Input	DC. Vmax. PV	1000Vd.c
	Operating voltage range	580 ~ 980Vd.c
	MPPT voltage range	580 ~ 800Vd.c
	Rated voltage	650Vd.c
	Operating start voltage	650Vd.c
	Max. short-circuit current per MPPT route	200A
	Max. inverter back-feed current to the array	0A
	Maximum input current	178A
	Control	Maximum Power Point Tracking (MPPT)
	The number of MPP input	1

Model name		DSP-33100E-0D-HV
AC Output	Rated power, 380V, 60Hz	100,000W
	Rated voltage	400Va.c
	Rated frequency	50/60Hz
	Rated current	152.0Arms
	Constant	3-phase 3-wire (Transformer-less Type)
	Power factor	0.9(lagging) - 0.9(leading)
	Max. output overcurrent protection	Rated 110%
	Current distortion (Current THD)	Total: 3% or less
		Each: 2% or less
	Control method	PWM
	Anti-islanding	Within 0.5 sec.
	Overload	110%
	Efficiency	98% or above

Model name		DSP-33100E-0D-HV
Structure	Cooling method	Forced-air cooling
	Protection structure	IP 65
	Noise	Less than 70 dB
	Dimension(W x H x D)	650mm x 910mm x 360mm
	Weight	85kg
	Communication interface	RS485
Protection Function	Inverter	Input overvoltage
		Output short-circuit
		DC overvoltage protection
		Insulation monitoring
		Inverter overheat protection
		Relay fault detection
	Grid	Anti-islanding
		Short circuit current control
		Grid overvoltage, undervoltage protection
		Grid overfrequency, underfrequency protection
		Reactive power control
		Residual current monitoring
	Overvoltage category OVCIII	PV II, AC III
Environment	Ambient temperature	-25℃ ~ 50℃
	Preserving temperature	-25℃ ~ 65℃
	Ambient humidity	Relative humidity : 90 % RH or less (No dewfall)
	Altitude · vibration	1,000 m or less · 5.9m/sec² (=0.6g) or less
	Environment	No corrosive gas, oil mist and dust

9. Warranty Letter

Warranty Letter

DASS Tech

Product		Grid connected power conditioning system (PCS)
Model		DSP-33100E-OD-HV
Purchase date		
Warranty period		Five(5) years from the date of installation date (not exceeding 60days from purchase)
Customer	**Name**	
	Address	
	Contacts	
Dealer	**Name**	
	Address	
	Contacts	

• The company manufacturing this product doesn't take any responsibility for safety accident or failure due to the customer's mistake or false use violating specifications.
• The dimension or appearance design of this product can be changed without any notice.

◀ ***Free A/S*** ▶

If failure occurred under normal using condition within the warranty period, your product can be tested and repaired for free.

◀ ***Charged A/S*** ▶

For following cases, A/S could be provided at a cost

- *The product is out of order due to the customer's intention or carelessness*
- *The product is out of order due to failure in connected devices by error of applied power supply*
- *Any failure occurred by natural calamity*
- *In case the product was repaired or revised at unofficial service center/man, not designated*
- *In case of without the nameplate of DASS Tech*
- *In case any failure occurs after the user dismantled, repaired or replaced our products*
- *Replacement of consumable parts without any notice to a manufacturer in advance*
- *In case warranty period is expired*

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