Crystalline silicon PV modules Installation manual (IEC version)

Contents

Crystalline Silicon Module Products Installation Manual (IEC)

1 Scope

● This manual contains information regarding the installation and safe handling of the photovoltaic module (hereafter is referred to as "module") produced LUXEN SOLAR ENERGY CO., LTD. (hereinafter referred to as " LN").

● This manual does not have any warranty significance,Expressed or implied. Installers must read and understand the manual before installation. The installer should conform to all safety precautions in the manual and local laws & regulations when installing module; before installing a solar photovoltaic system, installers should be familiar with the mechanical and electrical requirements for such a system.

● Keep this manual in a safe place for future reference (care and maintenance) and in case of sale or disposal of the modules.

● Any questions, please contact with the salesman or customer service personnel of LN solar for further explanations.

● This manual is applicable to the following products shown in table 1.

<p style="text-align:center">Table1　Product model code</p>

Type	Product model
Mono （N-TOPCon）	LNDT-×××ND（182*105-132pcs）
	LNDB-×××ND（182*105-108pcs）
	LNDX-×××ND（182*105-96pcs）
	LNCU-×××ND（182*99.5-144pcs）
	LNCT-×××ND（182*99.5-132pcs）
	LNVH-×××ND（182.2-156 pcs）
	LNVU-×××ND（182.2-144 pcs）
	LNVT-×××ND（182.2-132 pcs）
	LNVK-×××ND（182.2-120 pcs）
	LNVB-×××ND（182.2-108 pcs）
	LNAU-xxxND（191.6-144pcs）
	Notes：×××represent module power grade, each 5W consists of a grade;

2   Disclaimer of Liability

2.1   Because using of this manual and the conditions or methods of the module installation, handling, use and maintenance are beyond the control range of LN solar, so If the conditions or methods of the module installation, handling, use and maintenance of the customer are beyond the range specified in this manual and cause damage, LN solar does not assume responsibility for any loss, damage or expense thus caused.

2.2   LN solar has the right to refuse to compensate for the product damage due to construction or design defects of the solar photovoltaic system.

2.3   No responsibility is assumed by LN solar for any infringement of patent right or other rights of third parties, which may result from the customer's use of the LN solar's modules. No patent license or patent rights is granted to customer, express or implied, due to its use of LN solar's modules.

2.4   Failure to comply with the requirements listed in this manual will invalidate the ''Limited Warranty for PV Modules'' provided by salesman of LN solar. Meanwhile, recommendations provided in this manual are in order to improve the security of installation.

2.5   The information in this manual is based on LN solar's best knowledge and experience and is believed to be reliable; but such information including product specification (without limitations) and suggestions do not give any guarantee, Expressed or implied.

2.6   LN solar reserves the right to make changes to the product specifications or installation manual without prior notice.

3   Safety precautions

3.1   General safety

3.1.1   LN solar's modules have been evaluated by according to IEC61215 and IEC61730,fire safety classaccording to UL790 class A, modules rated for use in this application class may be used in system operating at greater than 50V DC or 240W.

3.1.2   The installer should abide by the relevant local laws and regulations when installing module. It is need to obtain the required certificates in advance when necessary, such as the building permit, please don't work under no protective measures.

3.1.3   Installing solar photovoltaic systems requires professional skills and knowledge. Installation can only be carried out by qualified personnel. If module glass or other sealing materials are damaged, please wear PPE(personal protective equipment) and then isolate modules from the circuit.Do not operate when modules are wet unless you wear PPE(personal protective equipment). Please follow the cleaning requirements in this manual when cleaning modules.and bear all potential injury risks that may occur during the installation process, such as electric shock.

3.1.4   Photovoltaic modules are designed for outdoor use. Modules may be mounted on ground, rooftops, vehicles or boats. Proper design of support structures is the responsibility of the system designers or installers. When modules are mounted on rooftops, fire-protection rating of the final structure should be considered, and also the later maintenance. The rooftops and support structure for PV system should only be certified by architectural experts or engineer, which have a formal complete structure analysis results.

3.1.5   For your safety，Do not install or handle the modules under wet or adverse environment, including but not limited to strong wind, gusty wind, frosted roof surfaces ,wet environment.

3.2   Electrical properties safety

3.2.1 When exposed to direct sunlight, one individual PV module may generate DC voltages greater than 30 volts, so it is extremely dangerous to contact the metal part of the wire, which may get a shock, burn and kill. And do not touch or lean on a working module.

3.2.2   In order to avoid arc and electric shock, please do not disconnect electrical connections under load, Keep all electrical connectors dry and clean, and ensure that they are in proper working condition. Never insert metal objects into the module connector.

3.2.3   Do not apply paint or adhesive to module surface.

3.2.4   Do not use mirrors or other magnifiers to focus sunlight on the modules. Do not expose the backside of modules directly to sunlight for a long time.

3.2.5   Do not change the configuration of the bypass diodes, Do not disassemble the modules or remove any attached nameplates or components from the modules.

3.2.6   Do not contact with module surface when the module is wet unless to clean the modules, please following requirements mentioned in this manual when cleaning.

3.3   Handling safety

3.3.1   Store pallets in a ventilated, rain-proof and dry location until the modules are ready to be unpacked, Keep children and unauthorized person away from the modules while transporting or installing them. Improper transportation or placing may lead to glass breakage or power loss of the modules, resulting in the loss of the use value of modules.

3.3.2   Handle modules with care, lift and put down modules gently. It is forbidden to carry or lift the modules by grabbing the junction box or cables. Carry a module by its edges with two or more persons.

3.3.3   To avoid module damage, do not place excessive loads on the module or twist the module frame. Do not stack the modules horizontally for transportation.

3.3.4   Pay more attention not to collide, scratch or press the module backside when transporting or installing.

3.3.5   To avoid module damage, do not stand or step on the module. Do not drop or place objects on the modules, Do not put tools on the module, Do not put the module on any hard surface, which maybe cause the cells broken.

3.3.6   Inappropriate transportation may damage the module. Control the vehicle speed when the road condition is relatively poor.

3.4   Installation safety

3.4.1   Abide by the safety regulations for all other components used in the PV system, including wiring and cables, connectors, controllers, inverters, storage batteries, etc., and use suitable equipment, connectors, wiring and mounting system for a PV system. It is better to use the same type modules in one system.

3.4.2   Do not install or handle the modules when they are wet or during strong wind. Keep the junction box's cover closed.

3.4.3   The front side of modules is constructed with tempered glass, which shall be handled with care. Improper operations may cause the tempered glass breakage. If the front glass is broken or if the back sheet is damaged, contact with any module surface or the aluminum frame can cause electrical shock, particularly when the module is wet. Broken or damaged modules must be disposed properly by professional.

3.4.4   When exposed to direct sunlight, one individual solar module may generate DC voltages greater than

30 volts. It is extremely dangerous to contact it.

3.4.5   Completely cover the module with an opaque material during installation to prevent electricity generation. Do not wear metallic rings, watchbands, ear, nose, lip rings or other metallic devices while installing or repairing photovoltaic systems. Use insulated tools that are approved for working on electrical installations and always keep them dry.

3.4.6   The triangle hole punched on the backside frame of the module is the drainage hole which cannot be blocked.

3.4.7   The maximum system voltage indicated in the rating label is 1500 V. Attention: During the system Installation, the maximum open circuit voltage in series cannot exceed the maximum system voltage.

3.4.8   During modules interconnection, ensure to fix the connecting cables to supporting bracket, so as to restrict the swing amplitude of the slack part of the cables.

3.4.9   Abide by the allowable minimum bending radius of the cables (suggest no less than 43mm).

3.4.10   Always protect the cable with conduit where animals or children can touch it.

3.4.11   Please use the connector which is specially designed for photovoltaic system, and assemble it with the tools recommended or specified by the manufacturer. In case that the connector applicable to the solar photovoltaic system is required, please contact the local supplier. Ban different connectors to plug each other.

3.4.12   Make sure that the polarity is correct when connecting the module with inverter, storage battery or combiner box to avoid the damage of bypass diodes in the modules due to incorrect polarity.

3.4.13   Do not drill holes in the frame, this may reduce the mechanical load ability and cause corrosion of the frame.

3.4.14   Do not scratch the anodized coating of the frame (except for grounding connection), this may cause corrosion of the frame or reduce the mechanical load ability.

4   Module specifications

4.1   Electrical characteristics

4.1.1 Under standard test conditions of 1000W/m ^{2}, AM1.5, and 25 º C, the deviation requirements between the measured electrical performance values and the nominal values are: Isc is ± 5%, Voc is ± 5%, and Pmax is ± 3%.

4.1.2 The rated fuse current value of the PV module,Please check PV Module nameplate label.

4.1.3 Open circuit voltage temperature coefficient: -0.25% / °C.

4.1.4 Short circuit current temperature coefficient: +0.045% / °C.

4.1.5 Maximum power temperature coefficient: -0.29% / °C.

4.1.6 Safety class: Class Ⅱ

4.1.7 Fire class: Class A

4.1.8 The maximum nominal voltage for all module series is 1500V according to IEC standards.

4.2   Product identification

Each module has labels providing the following information:

4.2.1 Rating label Describes the product type, rated power, rated current, rated voltage, open circuit voltage, short circuit current, all are measured at STC; weight, dimension, maximum system voltage and the fuse rating are all shown on the rating label.

4.2.2 Barcode Each module has a unique serial number. It contains the relevant production information of the module.

4.2.3 Meaning of crossed －out wheeled dustbin (as shown in FIG 1):

Do not dispose of electrical appliances as unsorted municipal waste, use separate collection facilities.

Contact your local government for information regarding the collection systems available.

If electrical appliances are disposed of in landfills or dumps, hazardous substances can leak into the groundwater and get into the food chain, damaging your health and well-being.

When replacing old appliances with new ones, the retailer is legally obligated to take back your old appliance for disposals at least free of charge.

FIG 1   Crossed －out wheeled dustbin

4.3 Current sorting

Each module has a specific label on either side of long aluminum frame (as shown in FIG 2) with the following information.
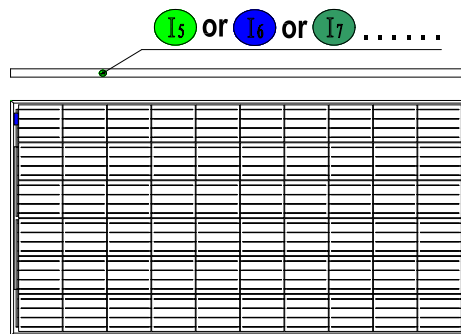
FIG 2   Label of current sorting

4.3.1 Modules are sorted by Pmax firstly,then sorted by Impp (current at maximum power point) in the same Pmax. Different color labels with distinct alphabetical letters are use to represent the Impp class.

4.3.2 LN solar recommends connecting the same Impp class modules in series in order to avoid or minimize power loss due to mismatch effects in arrays.

5 Installation Conditions

5.1 Operating environment

LN solar's PV module should operate in the following environmental conditions:

5.1.1 Ambient temperature:-20℃ to +40℃

5.1.2 Operating temperature of the module:-40℃ to +70℃

5.1.3 Humidity:85%RH

5.1.4 Designed mechanical load and safety factor: Positive:3600Pa(1.5 times safety factor).

Negative:1600Pa(1.5 times safety factor).

Notes: Professional system installers are responsible for mechanical load calculations when Design photovoltaic systems.

5.2 Installation location

5.2.1 In most applications, PV modules should be installed in a location where they will receive maximum sunlight throughout the year. In the northern hemisphere, modules should typically face south, and in the southern hemisphere, modules should typically face north.

5.2.2 The module shall be installed in the place where the sunshine is adequate. the module surface shall not be partly shaded by trees, building, clothes, tools, packaging materials, etc. because these objects will form shadow in the module surface leading to loss of system output power.

5.2.3 The module shall be installed in the well-ventilated place; meanwhile, enough space for airiness shall be sated at the back and sides of the module, so that the heat generated during operation can be radiated in time.

5.2.4 Modules must not be installed nor operated in locations with serious salt mist, hail, snow cover, sandstorm, smoke dust, air pollution, acid rain, soot, etc. and harsh environment. We suggest that the module shall be installed in dry areas with the moderate climate.

5.2.5 Never place the module near a naked flame or inflammable gas. LN solar's modules must be installed on suitable buildings with appropriate mounting structures, or other place suitable for modules installation, such as ground, carports, building facades, rooftops, PV trackers.

5.2.6 Lighting protection is necessary for PV systems in this area with high probability of lighting strikes.

5.2.7 Do not install the modules in this location with water immersion or near the sprinkler.

5.2.8 Modules must not be sited in locations with strong corrosive substances, such as salt, salt mist or other type of corrosive agent, which could affect the safety and/or performance of the modules. In case of the special installation environments such as the seaside, farm, high humidity environment and sandstorm environment, please contact the local dealer for professional support and confirmation.

5.2.9 The installation of PV modules should not exceed 2000 meters above sea level.

5.3 Tilt angle selection

5.3.1 The tilt angle of the Modules is measured between the surface of the modules and a horizontal ground surface, the modules generates maximum power output when it faces the sun directly.

5.3.2 Modules connected in series should be at the same tilt and azimuth. Differing tilt or azimuth may cause mismatch of power output due to differing amount of sunlight exposure for each module and reduce the efficiency of the PV system.

5.3.3 Do consider the power output in winter when choosing the optimal tilt angle for the module, which will lead to enough power output throughout the year.

5.3.4 For detailed information on the best installation angle, please refer to standard solar photovoltaic Installation guides or consults a reputable solar installer or systems integrator.

6 Installation instructions

6.1 Conventional requirement

6.1.1 Ensure that the installed modules and supporting rail of modules are strong enough, the entire PV system consisting of modules must be able to withstand anticipated mechanical pressure. The installer must provide the guarantee. The installation supporting rail must be tested by the third-party organization with the analysis ability of Static Mechanical according to the local national or international standards.

6.1.2 The supporting rail must be made of environmental corrosion, anti-rust and UV-resistant materials.

6.1.3 Modules must be securely fastened to the supporting rail.

6.1.4 Drilling holes on the surface of module glass or drilling additional mounting holes on module frames may void the warranty.

6.1.5 Forces generated during thermal expansion and contraction of the supporting rail may influence the performance and use of the module, so make ensure that the minimum distance between two neighboring frames is 10mm, but in order to ensure good ventilation. Suggest this distance between two neighboring frames is 30mm.

6.1.6 Dust gathering on the surface of module will reduce the power output, so solar system installer should calculate the optimal tilt of the module to make it easier for dust to be washed off by rain.

6.1.7 The bearing surface of the supporting system must be smooth without any twist or deformation, and all of them shall be at the same height without dislocation.

6.2 Two kinds of mounting

6.2.1 Roof mounting

6.2.1.1 It is necessary to provide a special supporting rail for the roof mounting. When installing a module on a roof or building, ensure that it is securely fastened and cannot fall or be damaged as a result of strong winds or heavy snow. During roof mounting, check the building codes being used to ensure that the building and its structure where the module is installed have adequate bearing and sealing capacity. The roof when penetrated during module installation shall be properly sealed to avoid rainwater leakage.

6.2.1.2 To be suitable for operation, reduce steam condensation and facilitate the ventilation & heat dissipation of the module during tile installation, the module shall be parallel to the wall or roof surface of the building, and the distance between module and surface of the wall or roof shall be at least 115mm to prevent wiring damage and to allow air circulation, ventilation and heat dissipation behind the module. For stacking type installation, the module shall be installed on the fire-resistant roof. The Fire Resistance Rated Class of the modules is Class A, and the modules are suitable for mounting on an above Class A roof. Do not install modules on a roof or building during strong wind.

6.2.1.3 For the roof system installed in the area with relatively heavy snowfall or snow cover in the meteorological records, the installer shall reinforce the supporting system at the lower frame of the module, in order to prevent the lower frame from being pressed and damaged by the falling snow or freezing of the melt ed snow. LN solar suggests selecting the support reinforcing mechanism shown in FIG 3.
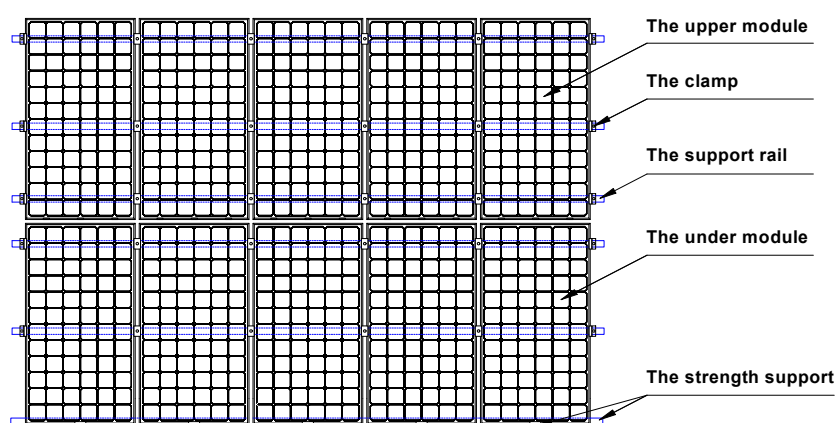
FIG 3　Schematic diagram of reinforcement mounting of module

6.2.2 Ground mounting

Select the height of the mounting system to prevent the lowest edge of the module from being covered by snow for a long time in winter in areas with heavy snowfalls. The module shall be installed on the supporting rail with appropriate height instead of being directly laid on the ground. In addition, the lowest portion of the module shall be high enough (≥500 mm) from ground, so that it is not shaded by plants and trees, or damaged by sand and stone driven by wind, or not shaded by the mud splashed by rain water.

6.3 Installation methods

6.3.1 General rules

a) Modules can be fastened on the supporting system using clamps. Modules must be installed according to the following methods or instructions. If not the warranty may be void.

b) The modules have been passed the mechanical load test according to IEC standard. For standard installation, the four symmetry holes close to the inner side on module frames or clamps shall be used to fasten the module to the supporting rail. LN solar's modules can sustain 2400 Pa wind pressure and 5400 Pa snow load. System designer and installer are responsible for load calculations.

c) The supporting rail and other materials required (such as screw) shall be made of durable, resistance to environmental corrosion, anti-rust and UV-resistant materials.

6.3.2　Clamp fasten the module

6.3.2.1 Using suitable number of clamps to fasten the module to the supporting rail, LN SOLAR suggest installer clamp the module by the long side of the module frame, and the area of module frame fastened by each clamp shall be no less than 800 mm^2.(clamp length ≥50mm, the clamped width of module frame shall be in this area: 9-11mm).

6.3.2.2 Do not contact the front glass, and do not scratch or deform the module frame in any way when fastening the module. Avoid shading effects from the clamps. Drainage holes on the modules frame must not be plugged.

6.3.2.3 Using at least four clamps to fasten each module，two clamps should be fastened on each long side of the module. According to local Environment (depending on wind power and snow loads), additional clamps may be required to ensure modules and PV system to withstand anticipated mechanical pressure. We recommends using the following clamps （as shown in FIG 4）,or approved by reputable solar installer or systems integrator.
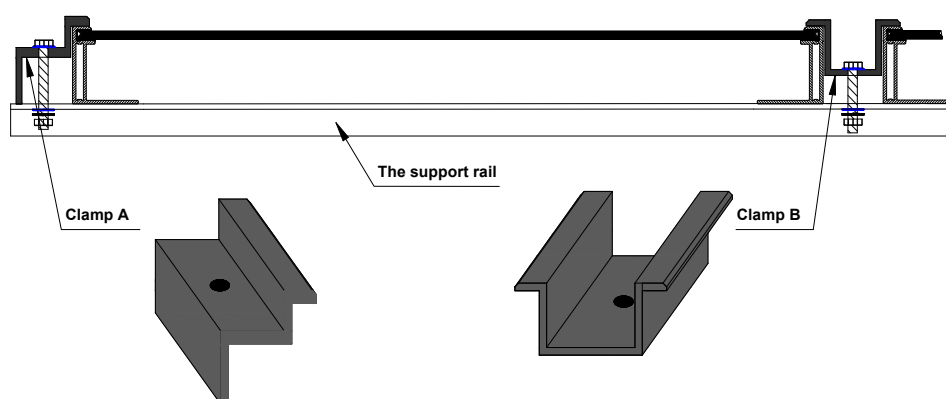
Clamp A: Fasten the Fringe modules   Clamp B: Fasten the Middle modules

FIG 4   Schematic diagram of module fastened by clamp method

6.3.2.4 The modules should be fastened to the supporting rail using anti-corrosion clamps, screws, spring washers and flat washers. And the clamps should always be mounted in a symmetric position respect to the center. LN solar suggested selecting M8 screw together with matched nut. Recommended torque should be 8 Newton-meters.

6.3.2.5 Under normal circumstances,LN solar suggests the installers to selecting the clamping methods of +5400Pa/-2400Pa mechanical loading to clamp the module (as shown in Table 2) to improve the bearing capacity for snow load at front side and wind pressure at back side, and enhance the system capacity.

Table 2   Range of clamp to fasten the module

Module type	Mechanical Loading/Pa(Positive)	Mechanical Loading/Pa(Negative)	A/mm	B/mm	C/mm	D/mm	E/mm
LNDT-×××ND（182*105-132pcs）	5400	2400	2382	1134	1/4 A±50	≥50	8～11
LNDB-×××ND（182*105-108pcs）	5400	2400	1961	1134	1/4 A±50	≥50	8～11
LNDX-×××ND（182*105-96pcs）	5400	2400	1762	1134	1/4 A±50	≥50	8～11
LNCU-×××ND（182*99.5-144pcs）	5400	2400	2465	1134	1/4 A±50	≥50	8～11
LNCT-×××ND（182*99.5-132pcs）	5400	2400	2278	1134	1/4 A±50	≥50	8～11
LNVH-×××ND（182.2-156）	5400	2400	2465	1134	1/4 A±50	≥50	8～11
LNVU-×××ND（182.2-144）	5400	2400	2278	1134	1/4 A±50	≥50	8～11
LNVT-×××ND（182.2-132）	5400	2400	2094	1134	1/4 A±50	≥50	8～11
LNVK-×××ND（182.2-120）	5400	2400	1910	1134	1/4 A±50	≥50	8～11
LNVB-×××ND（182.2-108）	5400	2400	1722	1134	1/4 A±50	≥50	8～11

Note:
A: Length of this type of module.
B: Width of this type of module.
C: The distance of clamp center from the edge of this type of module.
D: Clamped length of the module frame by the clamp of this type of module.
E: Clamped width of the module frame by the clamp of this type of module.

* Notes: LN solar's limited warranty will be void in cases where improper clamps or installation methods deviating from this manual are used. When using clamps to fasten the modules, pay attention to the following requirements:

      (b) Take care of the module frames, not to twist or deform them.

      (c) Avoid the clamps' shading influence the module.

      (d) Not to damage the surface of module frame.

      (e) Make sure that the module's drainage holes not be plugged.

6.3.2.6 For matters concerning clamp or installation not mentioned in this manual, contact the local dealer for professional support.

7 Electrical installations

7.1 General with regard to electrical installation

7.1.1 Under normal outdoor conditions, a module is likely to produce different current and voltage than the values measured under STC in the specification of LN solar's module. Therefore, when determining the parameters (for example, nominal voltage, conductor capacity, fuse capacity and controller capacity, etc.) related to the power output of the PV system, the values of short-circuit current and open circuit voltage of the modules should be multiplied by a factor of 125% during design and installation.

7.1.2 Try to use the modules with the same configuration in the same PV system. If the modules are connected in series, the total voltage is the sum of voltages of all the modules. The maximum voltage of string does not exceed the maximum system voltage of the modules (the maximum system voltage of LN solar modules is 1500V), the maximum number of modules that can be connected in a series string must be calculated in accordance with applicable regulations, make sure the open circuit voltage of string does not exceed the maximum system voltage of the modules and the other electrical DC components required at the minimum temperature at the PV system location. Using the following formula:

$$\text{System voltage} = N * V_{oc} * [1 + \lambda v_{oc}(T_{min} - 25\,°C)]$$

    N——number of modules in series

    V_{oc}——open circuit voltage at STC (refer to product label or data sheet)

    λv_{oc}——Thermal coefficient of Voc of each module (refer to product data sheet)

    T_{min}——minimum ambient temperature at the PV system location

7.1.3 If the PV system requires the installation of high current, several PV modules can be connected in parallel, and total current is the sum of current of all the modules. The maximum parallel number of the modules N= Imax (fuse rating) /Isc.

7.1.4 There are tolerances between the rated values of the electrical performance under STC and measured values. lsc, Vocand Pmax under STC (1000 W/㎡ lrradiance, a cell temperature of 25℃ and an AM1.5).

When modules are in series connection, the string voltage is sum of every individual module in one string. When mod.ules are in parallel connection, the current is sum of the individual module as shown in below fiaure. Modules withdifferent electric performance models cannot be connected in the same string.

Series Connection and Parallel Connection Circuit Diagram
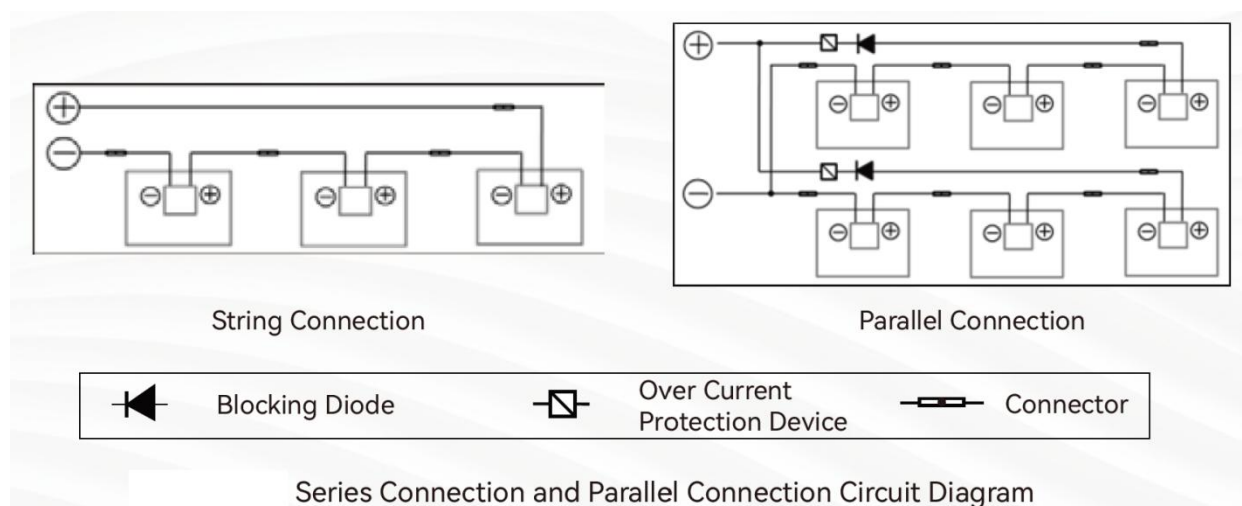
7.1.5 An over-current protection device with appropriately rated must be used when reverse current could exceed the value of the maximum fuse rating of the module, an over-current protection devices is required for each series string if more than two series strings are connected in parallel.

7.1.6 When installing the module, place the end with the junction box up and try to avoid the rain.

7.1.7 Do not carry out installation in rainy weather, because humidity will void the insulation protection, Thus cause safety accidents.

7.2 Cables and wiring

7.2.1 The junction boxes with IP68 protection class have been designed to be easily interconnected in series by the connectors. Each module has two single-conductor wires, one positive and one negative, which are pre-wired inside the junction box. Installers can connect two modules by firmly inserting the positive connector of a module into the negative connector of the other module.

7.2.2 Never perform pretreatment to modules including connector, junction box and cable with lubricating oil or cleaning agent made of alkanet materials during installation.

7.2.3 The cross section area of the cable and connector capacity selected must satisfy the maximum short-circuit current of the system (It is recommended that the cross section area of the cable used for the single module is 4mm^2, Please note that the temperature limit range of the cable is -40℃～+85℃).

7.2.4 When fastening the cables to the supporting rail, pay attention to avoid mechanical damage to the cables or modules, and also making a special design to protect the cables from environmental corrosion and direct sunshine, for example, put the cable into the supporting beam or special pipes with UV-resistant materials.

7.2.5 The cables designed are sunlight resistant and waterproof, but also to avoid direct sunlight exposure

and water immersion of the cables

7.3 Junction box and Connectors

7.3.1 When connecting modules, make sure that the connectors of the same series module shall come from the same manufacturer or totally be compatible with each others, the connector should be mated with its original female or male connector of the same supplier,and the same requirements shall go to the connection terminals of series string and PV system, because the connectors from different manufacturers may not be compatible with each others, which easily leads to mismatch risk.

7.3.2 The junction box, connector and diode model list is as follows:

Junction box:

Supplier 1: Jiangsu Tonglin Electric Co., Ltd

Model 1:TL-BOX216x

Connector:

Supplier 1: Jiangsu Tonglin Electric Co., Ltd

Model 1:TL-CABLE01S Pro

The connector should be mated with its original female or male connector of the same supplier.

Bypass diode:

Supplier 1: Jiangsu Tonglin Electric Co., Ltd

Model 1: PT001H-30

7.3.3 Ensure that connector caps are tightened before connecting the modules, keep connectors dry and clean. Do not attempt to make an electrical connection when the connectors are wet, soiled, or otherwise faulty conditions. Avoid sunlight exposure and water immersion of the connectors.

7.4 Bypass diodes

The junction boxes of LN Solar's modules contain bypass diodes wired in parallel with the PV cell strings. In case of partial cell shading or damaged, the parallel diodes will bypass the current generated by the non-shaded cells, thereby limiting modules heating and performance losses. Take care, the bypass diodes are not over-current protection devices.

7.5 Grounding

7.5.1 LN Solar modules use anti-corrosion and oxidation resistance aluminum frame as rigid supporting. In order to protect the module from lightning strike, electrostatic damage, and personnel safety, all module frames and mounting racks must be properly grounded, as shown in Figure 4: grounding hole and grounding label. Use the recommended connector terminal, or an equivalent, to connect the cable to the frame, and assure good electrical contact as shown in Figure 5: Grounding method.
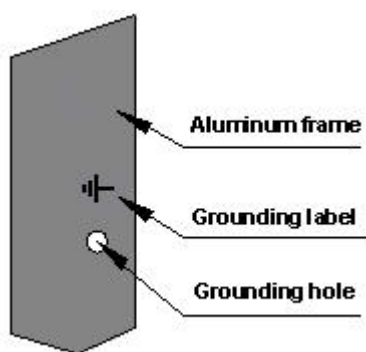
FIG 4   Grounding hole and ground label   FIG 5   Grounding method
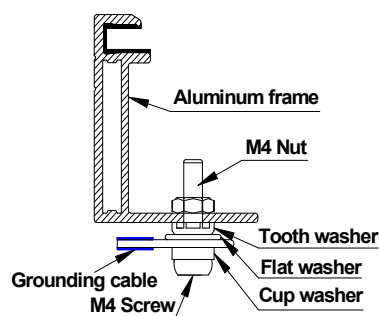
7.5.2 The frames have pre-drilled grounding holes and brand with signs, these holes should be only used for grounding purposes, but not for mounting the modules. And do not drill any additional grounding holes on the frames of the module, which may void the warranty.

7.5.3 If the supporting system is made of metal, the surface must be electroplated and have excellent conductivity.

7.5.4 The grounding cables must be fully contact with inside of the aluminum alloy, and the connection terminal must penetrate the oxidation coating of frame during grounding. Connecting the module frames and supporting beams using suitable grounding conductors can achieve good grounding.

7.5.5 The grounding cables must be connected to the earth through a suitable grounding electrode. Recommend to use the grounding accessories (lugs) to connect the cables. Welding grounding cable to the jack of lugs, then inserting M4 screws into the ring of the lugs and the grounding holes of module frames, fastening with M4 nuts(Suggested torque range 2-4 N.m). Spring washers should be used to prevent the screws from loosening and lead to poor grounding.

7.5.6 LN solar modules passes the most rigorous PID testing before leaving the factory, and the negative pole of the component usually does not need to be grounded, so it can be compatible with isolated (with transformer) or non isolated types Inverter.

① Under the combined effects of high humidity, high temperature, and high voltage, photovoltaic modules sometimes experience potential induced attenuation (PID). Components may experience PID attenuation in the following situations:

    1)   Installation in warm and humid climate conditions

    2)   Installation in long-term humid locations (such as near water bodies)

② To reduce the risk of PID, we recommend that the negative electrode on the DC side of the photovoltaic array be correctly grounded in a high temperature and humidity installation environment. The recommended grounding method for inverters is as follows:

    1)   For isolated photovoltaic inverters, the negative electrode of the photovoltaic DC measurement can be directly grounded

    2)   For non isolated photovoltaic inverter, virtual ground mode can be adopted after adding isolation transformer (usually the inverter manufacturer needs to provide grounding method guidance).

8 Maintenance

8.1 Usual maintenance

8.1.1 In the warranty period，the user must carry out regular inspection and maintenance using，which is the user's responsibility. And the user must inform the supplier within one week when founding the damages of modules.

8.1.2 When modules are working. There should not be environmental influence factors to cover shadows in the modules, such as other modules, supporting rail, plants, large number of dust etc., which may directly reduce the power output and may even cause regional hot–spot effect. Therefore clean the glass surface on a regular basis, clean modules take measures so as:

   (a) In general, normal rainfall can keep the glass surface clean，if the dirt accumulated too much, using water and a soft sponge or cloth for cleaning. If necessary, a mild, non-abrasive cleaning agent can be used to remove stubborn dirt.

   (b) Avoid pressing part of the module hard during cleaning, which may cause glass deformation, cell damage and reduction of the module's life.

   (c) Remove the snow covered on the module in time to avoid the module damage caused by long-term accumulation of snow cover and freezing of melted snow.

   (d) Do not clean module with cold water when the module temperature is highest in the daytime, and the thermal shocks might damage the module.

   (e) when cleaning the back of the module needs to avoid piercing back-sheet, module needs to be often cleaned for horizontal installation（the cleaning frequency depends on the degree of dirt）.

8.2 Visual inspection of modules

   Inspect the modules visually to find whether there are appearance defects, the following need special attention:

   (a) Check whether the module glass is broken ;

   (b) Check whether there is burning vestige or back up on the back-sheet;

   (c) Check whether there is corrosion along the cell bus–bar or damaged of encapsulation materials or a large area of the bubbles etc;

   (d) Check aluminum frame holes are normal; the screws of installation are tightness and electrical cables are situation.

8.3 Check cables and connectors

8.3.1 Carry out regular inspection of mechanics and electric, ensure the cleaning of the connector and be reliable connected.

8.3.2 Check whether all electrical connections are tight or corrosion free.

8.3.3 Maintenance should be carried out at least once a year.

8.3.4 Completely cover the module with an opaque material during repairing the module to prevent electric shock. When exposed to direct sunlight, one individual PV module may generate high DC voltages, so please be cautious of repairing. And repairing modules must be disposed properly by professional.

Note 1: If any problem arises, have it consulted by a competent specialist.

Note 2:If the maintenance measures are not included in this manual, please contact the local dealer for professional support.

8.4 Electrical ratings for all models

STC: 1000W/m²、25℃、AM1.5G	LNDT-575ND	LNDT-580ND	LNDT-585ND	LNDT-590ND	LNDT-595ND	LNDT-600ND	LNDT-605ND	LNDT-610ND	LNDT-615ND	LNDT-620ND	LNDT-625ND
Pmp [W] /Tolerance±3%	575	580	585	590	595	600	605	610	615	620	625
Voc [V] /Tolerance±5%	47.59	47.79	47.99	48.18	48.37	48.57	48.75	48.94	49.13	49.32	49.50
Isc [Adc] /Tolerance±5%	15.38	15.44	15.50	15.56	15.62	15.68	15.74	15.80	15.86	15.92	15.98
Vmp [V]	39.76	39.94	40.12	40.30	40.48	40.65	40.82	40.99	41.16	41.33	41.50
Imax [Adc]	14.46	14.52	14.58	14.64	14.70	14.76	14.82	14.88	14.94	15.00	15.06
BSI: GE=1000w/m²+φ*300w/m²	LNDT-575ND	LNDT-580ND	LNDT-585ND	LNDT-590ND	LNDT-595ND	LNDT-600ND	LNDT-605ND	LNDT-610ND	LNDT-615ND	LNDT-620ND	LNDT-625ND
Short Circuit Current (Isc)	18.95	19.02	19.10	19.17	19.24	19.32	19.39	19.47	19.54	19.61	19.69
BNPI: GE=1000w/m²+φ*135w/m²	LNDT-575ND	LNDT-580ND	LNDT-585ND	LNDT-590ND	LNDT-595ND	LNDT-600ND	LNDT-605ND	LNDT-610ND	LNDT-615ND	LNDT-620ND	LNDT-625ND
Maximum Power（Pmax）	637.10	642.64	648.18	653.72	659.26	664.80	670.34	675.88	681.42	686.96	692.50
Open Circuit Voltage (Voc)	47.68	47.88	48.09	48.29	48.50	48.70	48.90	49.10	49.29	49.49	49.68
Short Circuit Current (Isc)	16.98	17.05	17.11	17.18	17.24	17.31	17.38	17.44	17.51	17.58	17.64
5% back gain (Pmax)	604	609	614	620	625	630	635	641	646	651	656
5% back gain (%)	22.35%	22.55%	22.74%	22.93%	23.13%	23.32%	23.52%	23.71%	23.91%	24.10%	24.29%
15% back gain (Pmax)	661	667	673	679	684	690	696	702	707	713	719
15% back gain (%)	24.48%	24.69%	24.91%	25.12%	25.33%	25.54%	25.76%	25.97%	26.18%	26.40%	26.61%
25% back gain (Pmax)	719	725	731	738	744	750	756	763	769	775	781
25% back gain (%)	26.61%	26.84%	27.07%	27.30%	27.53%	27.77%	28.00%	28.23%	28.46%	28.69%	28.92%

STC: 1000W/m²、25℃、AM1.5G	LNDB-470ND	LNDB-475ND	LNDB-480ND	LNDB-485ND	LNDB-490ND	LNDB-495ND	LNDB-500ND	LNDB-505ND	LNDB-510ND
Pmp [W] /Tolerance±3%	470	475	480	485	490	495	500	505	510
Voc [V] /Tolerance±5%	38.64	38.87	39.10	39.33	39.55	39.78	40.00	40.22	40.44
Isc [Adc] /Tolerance±5%	15.48	15.54	15.60	15.66	15.72	15.78	15.84	15.90	15.96
Vmp [V]	32.28	32.49	32.70	32.90	33.11	33.31	33.51	33.71	33.91
Imax [Adc]	14.56	14.62	14.68	14.74	14.80	14.86	14.92	14.98	15.04
BSI: GE=1000w/m²+φ*300w/m²	LNDB-470ND	LNDB-475ND	LNDB-480ND	LNDB-485ND	LNDB-490ND	LNDB-495ND	LNDB-500ND	LNDB-505ND	LNDB-510ND
Short Circuit Current (Isc)	19.07	19.15	19.22	19.29	19.37	19.44	19.51	19.59	19.66
BNPI: GE=1000w/m²+φ*135w/m²	LNDB-470ND	LNDB-475ND	LNDB-480ND	LNDB-485ND	LNDB-490ND	LNDB-495ND	LNDB-500ND	LNDB-505ND	LNDB-510ND
Maximum Power（Pmax）	520.76	526.30	531.84	537.38	542.92	548.46	554.00	559.54	565.08
Open Circuit Voltage (Voc)	38.76	38.99	39.23	39.46	39.69	39.92	40.14	40.37	40.59
Short Circuit Current (Isc)	17.09	17.16	17.22	17.29	17.35	17.42	17.49	17.55	17.62
5% back gain (Pmax)	494	499	504	509	515	520	525	530	536
5% back gain (%)	22.19%	22.43%	22.66%	22.90%	23.14%	23.37%	23.61%	23.84%	24.08%
15% back gain (Pmax)	541	546	552	558	564	569	575	581	587
15% back gain (%)	24.31%	24.56%	24.82%	25.08%	25.34%	25.60%	25.86%	26.12%	26.37%
25% back gain (Pmax)	588	594	600	606	613	619	625	631	638
25% back gain (%)	26.42%	26.70%	26.98%	27.26%	27.54%	27.82%	28.11%	28.39%	28.67%

STC: 1000W/m²、25℃、AM1.5G	LNDX-415ND	LNDX-420ND	LNDX-425ND	LNDX-430ND	LNDX-435ND	LNDX-440ND	LNDX-445ND	LNDX-450ND	LNDX-455ND
Pmp [W] /Tolerance±3%	415	420	425	430	435	440	445	450	455
Voc [V] /Tolerance±5%	33.51	33.76	34.01	34.25	34.49	34.74	34.97	35.21	35.45
Isc [Adc] /Tolerance±5%	15.60	15.66	15.72	15.78	15.84	15.90	15.96	16.02	16.08
Vmp [V]	28.54	28.77	28.99	29.21	29.43	29.65	29.87	30.08	30.29
Imax [Adc]	14.54	14.60	14.66	14.72	14.78	14.84	14.90	14.96	15.02
BSI: GE=1000w/m²+φ*300w/m²	LNDX-415ND	LNDX-420ND	LNDX-425ND	LNDX-430ND	LNDX-435ND	LNDX-440ND	LNDX-445ND	LNDX-450ND	LNDX-455ND
Short Circuit Current (Isc)	19.22	19.29	19.37	19.44	19.51	19.59	19.66	19.74	19.81
BNPI: GE=1000w/m²+φ*135w/m²	LNDX-415ND	LNDX-420ND	LNDX-425ND	LNDX-430ND	LNDX-435ND	LNDX-440ND	LNDX-445ND	LNDX-450ND	LNDX-455ND
Maximum Power（Pmax）	459.82	465.36	470.90	476.44	481.98	487.52	493.06	498.60	504.14
Open Circuit Voltage (Voc)	33.65	33.90	34.15	34.39	34.63	34.87	35.11	35.34	35.58
Short Circuit Current (Isc)	17.22	17.29	17.35	17.42	17.49	17.55	17.62	17.69	17.75
5% back gain (Pmax)	436	441	446	452	457	462	467	473	478
5% back gain (%)	21.81%	22.07%	22.33%	22.60%	22.86%	23.12%	23.38%	23.65%	23.91%
15% back gain (Pmax)	477	483	489	495	500	506	512	518	523
15% back gain (%)	23.89%	24.17%	24.46%	24.75%	25.04%	25.32%	25.61%	25.90%	26.19%
25% back gain (Pmax)	519	525	531	538	544	550	556	563	569
25% back gain (%)	25.96%	26.27%	26.59%	26.90%	27.21%	27.53%	27.84%	28.15%	28.46%

STC: 1000W/m²、25℃、AM1.5G	LNCU-590ND	LNCU-595ND	LNCU-600ND	LNCU-605ND	LNCU-610ND	LNCU-615ND	LNCU-620ND	LNCU-625ND	LNCU-630ND	LNCU-635ND	LNCU-640ND
Pmp [W] /Tolerance±3%	590	595	600	605	610	615	620	625	630	635	640
Voc [V] /Tolerance±5%	50.47	50.67	50.87	51.07	51.27	51.46	51.65	51.84	52.03	52.22	52.41
Isc [Adc] /Tolerance±5%	14.76	14.82	14.88	14.94	15.00	15.06	15.12	15.18	15.24	15.30	15.36
Vmp [V]	42.48	42.65	42.83	43.00	43.17	43.34	43.51	43.68	43.84	44.01	44.17
Imax [Adc]	13.89	13.95	14.01	14.07	14.13	14.19	14.25	14.31	14.37	14.43	14.49
BSI: GE=1000w/m²+φ*300w/m²	LNCU-590ND	LNCU-595ND	LNCU-600ND	LNCU-605ND	LNCU-610ND	LNCU-615ND	LNCU-620ND	LNCU-625ND	LNCU-630ND	LNCU-635ND	LNCU-640ND
Short Circuit Current (Isc)	18.18	18.26	18.33	18.41	18.48	18.55	18.63	18.70	18.78	18.85	18.92
BNPI: GE=1000w/m²+φ*135w/m²	LNCU-590ND	LNCU-595ND	LNCU-600ND	LNCU-605ND	LNCU-610ND	LNCU-615ND	LNCU-620ND	LNCU-625ND	LNCU-630ND	LNCU-635ND	LNCU-640ND
Maximum Power（Pmax）	653.72	659.26	664.80	670.34	675.88	681.42	686.96	692.50	698.04	703.58	709.12
Open Circuit Voltage (Voc)	50.63	50.83	51.04	51.24	51.44	51.64	51.83	52.03	52.22	52.41	52.60
Short Circuit Current (Isc)	16.30	16.36	16.43	16.49	16.56	16.63	16.69	16.76	16.82	16.89	16.96
5% back gain (Pmax)	620	625	630	635	641	646	651	656	662	667	672
5% back gain (%)	22.16%	22.35%	22.54%	22.73%	22.91%	23.10%	23.29%	23.48%	23.66%	23.85%	24.04%
15% back gain (Pmax)	679	684	690	696	702	707	713	719	725	730	736
15% back gain (%)	24.27%	24.48%	24.68%	24.89%	25.10%	25.30%	25.51%	25.71%	25.92%	26.12%	26.33%
25% back gain (Pmax)	738	744	750	756	763	769	775	781	788	794	800
25% back gain (%)	26.38%	26.61%	26.83%	27.05%	27.28%	27.50%	27.73%	27.95%	28.17%	28.40%	28.62%

STC: 1000W/m²、25℃、AM1.5G	LNCT-540ND	LNCT-545ND	LNCT-550ND	LNCT-555ND	LNCT-560ND	LNCT-565ND	LNCT-570ND	LNCT-575ND	LNCT-580ND	LNCT-585ND
Pmp [W] /Tolerance±3%	540	545	550	555	560	565	570	575	580	585
Voc [V] /Tolerance±5%	46.38	46.60	46.81	47.03	47.24	47.45	47.66	47.86	48.07	48.27
Isc [Adc] /Tolerance±5%	14.79	14.85	14.91	14.97	15.03	15.09	15.15	15.21	15.27	15.33
Vmp [V]	38.79	38.98	39.17	39.36	39.55	39.73	39.92	40.10	40.28	40.46
Imax [Adc]	13.92	13.98	14.04	14.10	14.16	14.22	14.28	14.34	14.40	14.46
BSI: GE=1000w/m²+φ*300w/m²	LNCT-540ND	LNCT-545ND	LNCT-550ND	LNCT-555ND	LNCT-560ND	LNCT-565ND	LNCT-570ND	LNCT-575ND	LNCT-580ND	LNCT-585ND
Short Circuit Current (Isc)	18.22	18.30	18.37	18.44	18.52	18.59	18.66	18.74	18.81	18.89
BNPI: GE=1000w/m²+φ*135w/m²	LNCT-540ND	LNCT-545ND	LNCT-550ND	LNCT-555ND	LNCT-560ND	LNCT-565ND	LNCT-570ND	LNCT-575ND	LNCT-580ND	LNCT-585ND
Maximum Power（Pmax）	598.32	603.86	609.40	614.94	620.48	626.02	631.56	637.10	642.64	648.18
Open Circuit Voltage (Voc)	46.53	46.75	46.97	47.18	47.40	47.61	47.82	48.04	48.24	48.45
Short Circuit Current (Isc)	16.33	16.39	16.46	16.53	16.59	16.66	16.73	16.79	16.86	16.92
5% back gain (Pmax)	567	572	578	583	588	593	599	604	609	614
5% back gain (%)	21.95%	22.15%	22.36%	22.56%	22.76%	22.97%	23.17%	23.37%	23.57%	23.78%
15% back gain (Pmax)	621	627	632	638	644	650	656	661	667	673
15% back gain (%)	24.04%	24.26%	24.48%	24.71%	24.93%	25.15%	25.37%	25.60%	25.82%	26.04%
25% back gain (Pmax)	675	681	688	694	700	706	713	719	725	731
25% back gain (%)	26.13%	26.37%	26.61%	26.86%	27.10%	27.34%	27.58%	27.82%	28.07%	28.31%

STC: 1000W/m²、25℃、AM1.5G	LNAU-575ND	LNAU-580ND	LNAU-585ND	LNAU-590ND	LNAU-595ND	LNAU-600ND	LNAU-605ND	LNAU-610ND	LNAU-615ND	LNAU-620ND
Pmp [W] /Tolerance±3%	575	580	585	590	595	600	605	610	615	620
Voc [V] /Tolerance±5%	51.15	51.36	51.56	51.76	51.96	52.16	52.35	52.55	52.74	52.93
Isc [Adc] /Tolerance±5%	14.29	14.35	14.41	14.47	14.53	14.59	14.65	14.71	14.77	14.83
Vmp [V]	42.81	42.99	43.17	43.35	43.53	43.70	43.87	44.04	44.21	44.38
Imax [Adc]	13.43	13.49	13.55	13.61	13.67	13.73	13.79	13.85	13.91	13.97
BSI: GE＝1000w/m²+φ*300w/m²	LNAU-575ND	LNAU-580ND	LNAU-585ND	LNAU-590ND	LNAU-595ND	LNAU-600ND	LNAU-605ND	LNAU-610ND	LNAU-615ND	LNAU-620ND
Short Circuit Current (Isc)	17.61	17.68	17.75	17.83	17.90	17.97	18.05	18.12	18.20	18.27
BNPI: GE＝1000w/m²+φ*135w/m²	LNAU-575ND	LNAU-580ND	LNAU-585ND	LNAU-590ND	LNAU-595ND	LNAU-600ND	LNAU-605ND	LNAU-610ND	LNAU-615ND	LNAU-620ND
Maximum Power（Pmax）	637.10	642.64	648.18	653.72	659.26	664.80	670.34	675.88	681.42	686.96
Open Circuit Voltage (Voc)	51.38	51.58	51.78	51.98	52.18	52.37	52.57	52.76	52.95	53.14
Short Circuit Current (Isc)	15.78	15.84	15.91	15.97	16.04	16.11	16.17	16.24	16.31	16.37
5% back gain (Pmax)	604	609	614	620	625	630	635	641	646	651
5% back gain (%)	22.35%	22.55%	22.74%	22.93%	23.13%	23.32%	23.52%	23.71%	23.91%	24.10%
15% back gain (Pmax)	661	667	673	679	684	690	696	702	707	713
15% back gain (%)	24.48%	24.69%	24.91%	25.12%	25.33%	25.54%	25.76%	25.97%	26.18%	26.40%
25% back gain (Pmax)	719	725	731	738	744	750	756	763	769	775
25% back gain (%)	26.61%	26.84%	27.07%	27.30%	27.53%	27.77%	28.00%	28.23%	28.46%	28.69%

STC: 1000W/m²、25℃、AM1.5G	LNVH-590ND	LNVH-595ND	LNVH-600ND	LNVH-605ND	LNVH-610ND	LNVH-615ND	LNVH-620ND	LNVH-625ND	LNVH-630ND	LNVH-635ND	LNVH-640ND
Pmp [W] /Tolerance±3%	590	595	600	605	610	615	620	625	630	635	640
Voc [V] /Tolerance±5%	54.94	55.06	55.18	55.30	55.41	55.53	55.64	55.75	55.87	55.98	56.09
Isc [Adc] /Tolerance±5%	13.76	13.83	13.90	13.97	14.04	14.11	14.18	14.25	14.32	14.39	14.46
Vmp [V]	45.21	45.35	45.49	45.63	45.76	45.90	46.03	46.16	46.29	46.42	46.55
Imax [Adc]	13.05	13.12	13.19	13.26	13.33	13.40	13.47	13.54	13.61	13.68	13.75
BSI: GE＝1000w/m²+φ*300w/m²	LNVH-590ND	LNVH-595ND	LNVH-600ND	LNVH-605ND	LNVH-610ND	LNVH-615ND	LNVH-620ND	LNVH-625ND	LNVH-630ND	LNVH-635ND	LNVH-640ND
Short Circuit Current (Isc)	16.95	17.04	17.12	17.21	17.30	17.38	17.47	17.56	17.64	17.73	17.81
BNPI: GE＝1000w/m²+φ*135w/m²	LNVH-590ND	LNVH-595ND	LNVH-600ND	LNVH-605ND	LNVH-610ND	LNVH-615ND	LNVH-620ND	LNVH-625ND	LNVH-630ND	LNVH-635ND	LNVH-640ND
Maximum Power（Pmax）	653.72	659.26	664.80	670.34	675.88	681.42	686.96	692.50	698.04	703.58	709.12
Open Circuit Voltage (Voc)	55.08	55.24	55.40	55.55	55.71	55.86	56.02	56.17	56.32	56.46	56.61
Short Circuit Current (Isc)	15.19	15.27	15.35	15.42	15.50	15.58	15.65	15.73	15.81	15.89	15.96
5% back gain (Pmax)	620	625	630	635	641	646	651	656	662	667	672
5% back gain (%)	22.16%	22.35%	22.54%	22.73%	22.91%	23.10%	23.29%	23.48%	23.66%	23.85%	24.04%
15% back gain (Pmax)	679	684	690	696	702	707	713	719	725	730	736
15% back gain (%)	24.27%	24.48%	24.68%	24.89%	25.10%	25.30%	25.51%	25.71%	25.92%	26.12%	26.33%
25% back gain (Pmax)	738	744	750	756	763	769	775	781	788	794	800
25% back gain (%)	26.38%	26.61%	26.83%	27.05%	27.28%	27.50%	27.73%	27.95%	28.17%	28.40%	28.62%

STC: 1000W/m²、25℃、AM1.5G	LNVU-545ND	LNVU-550ND	LNVU-555ND	LNVU-560ND	LNVU-565ND	LNVU-570ND	LNVU-575ND	LNVU-580ND	LNVU-585ND	LNVU-590ND
Pmp [W] /Tolerance±3%	545	550	555	560	565	570	575	580	585	590
Voc [V] /Tolerance±5%	50.72	50.87	51.00	51.14	51.28	51.41	51.55	51.68	51.81	51.94
Isc [Adc] /Tolerance±5%	13.80	13.87	13.94	14.01	14.08	14.15	14.22	14.29	14.36	14.43
Vmp [V]	41.63	41.79	41.95	42.11	42.26	42.41	42.56	42.71	42.86	43.00
Imax [Adc]	13.09	13.16	13.23	13.30	13.37	13.44	13.51	13.58	13.65	13.72
BNPI: GE＝1000w/m²+φ*135w/m²	LNVU-545ND	LNVU-550ND	LNVU-555ND	LNVU-560ND	LNVU-565ND	LNVU-570ND	LNVU-575ND	LNVU-580ND	LNVU-585ND	LNVU-590ND
Maximum Power（Pmax）	603.86	609.40	614.94	620.48	626.02	631.56	637.10	642.64	648.18	653.72
Open Circuit Voltage (Voc)±5%	50.90	51.04	51.18	51.32	51.46	51.60	51.73	51.86	52.00	52.13
Short Circuit Current (Isc)±5%	15.24	15.31	15.39	15.47	15.54	15.62	15.70	15.78	15.85	15.93
BSI: GE＝1000w/m²+φ*300w/m²	LNVU-545ND	LNVU-550ND	LNVU-555ND	LNVU-560ND	LNVU-565ND	LNVU-570ND	LNVU-575ND	LNVU-580ND	LNVU-585ND	LNVU-590ND
Short Circuit Current (Isc)±5%	17.00	17.09	17.17	17.26	17.35	17.43	17.52	17.61	17.69	17.78
5%背面增益（Pmax）	572	578	583	588	593	599	604	609	614	620
5%背面增益（%）	22.15%	22.36%	22.56%	22.76%	22.97%	23.17%	23.37%	23.57%	23.78%	23.98%
15%背面增益（Pmax）	627	633	638	644	650	656	661	667	673	679
15%背面增益（%）	24.26%	24.48%	24.71%	24.93%	25.15%	25.37%	25.60%	25.82%	26.04%	26.27%
25%背面增益（Pmax）	681	688	694	700	706	713	719	725	731	738
25%背面增益（%）	26.37%	26.61%	26.86%	27.10%	27.34%	27.58%	27.82%	28.07%	28.31%	28.55%

STC: 1000W/m²、25℃、AM1.5G	LNVT-500ND	LNVT-505ND	LNVT-510ND	LNVT-515ND	LNVT-520ND	LNVT-525ND	LNVT-530ND	LNVT-535ND	LNVT-540ND
Pmp [W] /Tolerance±3%	500	505	510	515	520	525	530	535	540
Voc [V] /Tolerance±5%	46.42	46.59	46.75	46.92	47.08	47.24	47.41	47.56	47.72
Isc [Adc] /Tolerance±5%	13.84	13.91	13.98	14.05	14.12	14.19	14.26	14.33	14.40
Vmp [V]	38.08	38.26	38.43	38.61	38.78	38.95	39.11	39.28	39.44
Imax [Adc]	13.13	13.20	13.27	13.34	13.41	13.48	13.55	13.62	13.69
BNPI: GE＝1000w/m²+φ*135w/m²	LNVT-500ND	LNVT-505ND	LNVT-510ND	LNVT-515ND	LNVT-520ND	LNVT-525ND	LNVT-530ND	LNVT-535ND	LNVT-540ND
Maximum Power（Pmax）	554.00	559.54	565.08	570.62	576.16	581.70	587.24	592.78	598.32
Open Circuit Voltage (Voc)±5%	46.59	46.76	46.92	47.09	47.25	47.42	47.58	47.74	47.89
Short Circuit Current (Isc)±5%	15.28	15.36	15.43	15.51	15.59	15.67	15.74	15.82	15.90
BSI: GE＝1000w/m²+φ*300w/m²	LNVT-500ND	LNVT-505ND	LNVT-510ND	LNVT-515ND	LNVT-520ND	LNVT-525ND	LNVT-530ND	LNVT-535ND	LNVT-540ND
Short Circuit Current (Isc)±5%	17.05	17.14	17.22	17.31	17.40	17.48	17.57	17.65	17.74
5%背面增益（Pmax）	525	530	536	541	546	551	557	562	567
5%背面增益（%）	22.11%	22.33%	22.55%	22.77%	22.99%	23.21%	23.44%	23.66%	23.88%
15%背面增益（Pmax）	575	581	587	592	598	604	610	615	621
15%背面增益（%）	24.21%	24.46%	24.70%	24.94%	25.18%	25.43%	25.67%	25.91%	26.15%
25%背面增益（Pmax）	625	631	638	644	650	656	663	669	675
25%背面增益（%）	26.32%	26.58%	26.85%	27.11%	27.37%	27.64%	27.90%	28.16%	28.43%

STC: 1000W/m²、25℃、AM1.5G	LNVK-455ND	LNVK-460ND	LNVK-465ND	LNVK-470ND	LNVK-475ND	LNVK-480ND	LNVK-485ND	LNVK-490ND
Pmp [W] /Tolerance±3%	455	460	465	470	475	480	485	490
Voc [V] /Tolerance±5%	42.29	42.51	42.72	42.94	43.15	43.36	43.57	43.78
Isc [Adc] /Tolerance±5%	13.81	13.88	13.95	14.02	14.09	14.16	14.23	14.30
Vmp [V]	34.73	34.93	35.12	35.31	35.50	35.69	35.87	36.06
Imax [Adc]	13.10	13.17	13.24	13.31	13.38	13.45	13.52	13.59
BNPI: GE＝1000w/m²+φ*135w/m²	LNVK-455ND	LNVK-460ND	LNVK-465ND	LNVK-470ND	LNVK-475ND	LNVK-480ND	LNVK-485ND	LNVK-490ND
Maximum Power（Pmax）	504.14	509.68	515.22	520.76	526.30	531.84	537.38	542.92
Open Circuit Voltage (Voc)±5%	42.40	42.62	42.85	43.07	43.29	43.51	43.72	43.94
Short Circuit Current (Isc)±5%	15.25	15.32	15.40	15.48	15.56	15.63	15.71	15.79
BSI: GE＝1000w/m²+φ*300w/m²	LNVK-455ND	LNVK-460ND	LNVK-465ND	LNVK-470ND	LNVK-475ND	LNVK-480ND	LNVK-485ND	LNVK-490ND
Short Circuit Current (Isc)±5%	17.01	17.10	17.19	17.27	17.36	17.45	17.53	17.62
5%背面增益（Pmax）	478	483	488	494	499	504	509	515
5%背面增益（%）	22.06%	22.30%	22.54%	22.78%	23.03%	23.27%	23.51%	23.75%
15%背面增益（Pmax）	523	529	535	541	546	552	558	564
15%背面增益（%）	24.16%	24.42%	24.69%	24.95%	25.22%	25.49%	25.75%	26.02%
25%背面增益（Pmax）	569	575	581	588	594	600	606	613
25%背面增益（%）	26.26%	26.55%	26.84%	27.12%	27.41%	27.70%	27.99%	28.28%

STC: 1000W/m²、25℃、AM1.5G	LNVB-410ND	LNVB-415ND	LNVB-420ND	LNVB-425ND	LNVB-430ND	LNVB-435ND	LNVB-440ND
Pmp [W] /Tolerance±3%	410	415	420	425	430	435	440
Voc [V] /Tolerance±5%	38.01	38.25	38.49	38.73	38.96	39.19	39.42
Isc [Adc] /Tolerance±5%	13.85	13.92	13.99	14.06	14.13	14.20	14.27
Vmp [V]	31.20	31.42	31.63	31.84	32.04	32.25	32.45
Imax [Adc]	13.14	13.21	13.28	13.35	13.42	13.49	13.56
BNPI: GE=1000w/m²+φ*135w/m²	LNVB-410ND	LNVB-415ND	LNVB-420ND	LNVB-425ND	LNVB-430ND	LNVB-435ND	LNVB-440ND
Maximum Power（Pmax)	454.28	459.82	465.36	470.90	476.44	481.98	487.52
Open Circuit Voltage (Voc)±5%	38.14	38.38	38.62	38.86	39.10	39.33	39.56
Short Circuit Current (Isc)±5%	15.29	15.37	15.44	15.52	15.60	15.68	15.75
BSI: GE=1000w/m²+φ*300w/m²	LNVB-410ND	LNVB-415ND	LNVB-420ND	LNVB-425ND	LNVB-430ND	LNVB-435ND	LNVB-440ND
Short Circuit Current (Isc)±5%	17.06	17.15	17.24	17.32	17.41	17.49	17.58
5%背面增益（Pmax)	431	436	441	446	452	457	462
5%背面增益（%)	22.05%	22.31%	22.58%	22.85%	23.12%	23.39%	23.66%
15%背面增益（Pmax)	472	477	483	489	495	500	506
15%背面增益（%)	24.15%	24.44%	24.73%	25.03%	25.32%	25.62%	25.91%
25%背面增益（Pmax)	513	519	525	531	538	544	550
25%背面增益（%)	26.25%	26.57%	26.89%	27.21%	27.53%	27.85%	28.17%

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