NOVA ELECTRIC

NESR-1600 User's Manual

Telecom / Datacom

PURE SINE WAVE INVERTER

Designed for Parallel and Redundant Operation up to 32 kW

Revised: 8/19/19

Table of Content

1. Safety Instructions

1-1. General Safety Precautions

Warning! Before using the Inverter, read the safety instructions.

- Do not expose the inverter to rain, snow, spray or dust. To reduce the risk of fire hazard, do not cover or obstruct the ventilation openings and do not install the inverter in a zero-clearance compartment.
- To avoid the risk of fire and electric shock, make sure that the existing wiring is in good electrical condition, and the wire size is not undersized.
- This equipment contains components which can produce arcs or sparks. To prevent fire or explosion do not install in compartments containing batteries or flammable materials or in locations which require ignition protected equipment. This includes any space containing gasoline-powered machinery, fuel tanks, or joints, fittings, or other connection between components of the fuel system.
- Depending on the user scenario, the AC output of the inverter may require user installed breaker or fuse. In AC output hardwire application, AC socket will not be provided. The inverter incorporates standard AC short circuit protection.
- The following precautions should be taken when working on the inverter：
  Step 1 Remove watches, rings, or other metal objects
  Step 2 Use tools with insulated handles
  Step 3 Wear rubber gloves and boots

1-2. Other Safety Notes

- Upon receipt, examine the carton box for damage. Notify the carrier immediately, before opening, if damage is evident.
- Do not operate near water or in excessive humidity.
- Do not open or disassemble the inverter, as warranty may be voided.
- The DC side connections should be firm and tight.
- Grounding：Reliable grounding should be maintained.
- Do not drop a metal tool on the battery. The resulting spark or short-circuit on the battery or on the other electrical part may cause an explosion.
- Install the inverter in a well-ventilated area. Do not block the front air vents, or the rear air exhausts of the unit.
- Wiring：Adequate input power must be supplied to the inverter for proper use; correct wiring sizes must be ensured.
- Mount the inverter such that the fan axis is horizontal.
- Do not operate the inverter close to combustible gas or open fire.
- Do not operate appliances that may feed power back into the inverter.
- Temperature：The inverter should be operated in an ambient temperature range of -25℃ to 40 ℃ otherwise the output efficiency may be affected. Air flow to the inverter must not be blocked.

2. Functional Characteristics Introduction

2-1. System

The NESR-1600 Plus is a highly reliable, modular design DC-AC inverter system, designed with advanced power electronic and microprocessor technology offering the following features：

- Simple setting and scalable system capacity supports up to 32 pcs (51.2KW)
- Seamless switch between AC and DC source
- Build-in input and output full isolation
- Wide AC input range Adjustable 150~265V (230V system), 75~132V (120V system)
- High efficiency (~95%)
- Power factor ≧ 0.99
- Advanced Protection Features
  - Input reverse, under-voltage, over voltage protection
  - Output protection：short circuit, over load, over temperature, over voltage protection
- Operating mode
  - AC mode (Default)：AC utility power is the main source. DC power is the secondary source. PFC>0.99. Max efficiency 95%. When the AC utility abnormal, the switching time is 0 second.
  - AC Ratio mode：DC and AC input at same time. The percentage of AC and DC load can be assigned to 100%. If AC set 70%, then remaining 30% is DC.

Note：

The AC input power must be higher than 300W after assigning DC and AC ratio.

  - DC mode：DC power is the main source. AC utility is the secondary source. THD<3%, Max efficiency is 91%. The switching time between AC and DC power is 0 second.

Electrical Specification

Electrical	Specification Item	Model No. NESR-1600 Plus-124	NESR-1600 Plus -148	NESR-1600 Plus -224	NESR-1600 Plus -248
AC Input	Nominal Voltage	120VAC		230VAC	
	Voltage Range (Full power rating)	90~130VAC ± 3%		180~260VAC ± 2%	
	Compliance range before transfer to DC	Adjustable from 75-132.5Vac		Adjustable from 150-265Vac	
	Power Factor	> 0.99 @ rating power			
	Frequency	50 / 60 Hz			
	Synchronization Range	47~53 Hz, 57~63 Hz			
DC Input	Nominal Voltage (Voltage range)	24VDC	48VDC	24VDC	48VDC
	Voltage Range	18~34VDC ± 3%	36~68VDC ± 3%	18~34VDC ± 3%	36~68VDC ± 3%
	Nominal Current	56A	37A	56A	37A
	Max. Input Current (15 sec.)	90A	60A	90A	60A
AC Output	Rating Power	1200W/1600VA	1600W/1600VA	1200W/1600VA	1600W/1600VA
	Overload Capacity	105%~150% rated power (15 seconds)			
	Nominal Voltage	120VAC		230VAC	
	Output Voltage Range	100~120VAC ± 3%		200~240VAC ± 2%	
	Max. Efficiency(AC)	94%		95%	
	Max. Efficiency(DC)	89%	90%	90%	91%
	Frequency	50 / 60Hz			
	THD	< 3% (Above 80% Resistive Load)			
	Turn ON Delay	< 10 seconds			
	Crest Factor at Nominal Power With short circuit management and protection	DC mode: 3 times nominal current AC mode: 6 times nominal current		DC mode: 3 times nominal current AC mode: 10 times nominal current	
Control & Signal	Indicator	LED			
	Advanced Control (Comm. protocol)	RS-485 control module (MODBUS)			
	Failure Indicator	Buzzer alarm			
Protection	DC Input	Over Voltage / Under Voltage / Reverse Polarity			
	AC Input	Over Voltage / Under Voltage / Over Current			
	Output	Short Circuit / Overload / Over Temperature			
Transfer Performance	Inverter to Utility AC	0 second			
	Utility AC to Inverter	0 second			

Electrical	Specification	Model No.			
	Item	NESR-1600 Plus-124	NESR-1600 Plus -148	NESR-1600 Plus -224	NESR-1600 Plus -248
Environment	Operating Temp.	-25°C ~ 40°C; refer to NESR-1600 Plus power de-rating curve			
	Storage Temp.	-40℃~70℃			
	Relative Humidity	95%, non-condensing			
	Vibration	BS EN 61373			
Safety & EMC	Safety standards	Meet UL 60950-1		Certificated EN 60950-1	
	EMC standard	Certificated FCC Class B		Certificated EN55022 Class B; EN 61204-3; EN55024; EN 61000-3-2, -3-3, -6-1, -6-3; IEC 61000-4-2, 3, 4, 5, 6, 8, 11	
Others	Dimension-Module	105x83x410 mm / 4.13x3.27x16.14 inch			
	Dimension-Shelf	446x85x509mm / 17.56x3.35x20.04 inch			
	Weight (net)	Module：3.8kg; 4pcs / Shelf：6.5kg; 1pcs			

Table 1. NESR-1600 Plus specification

2-2. Mechanical Drawings

2-3-1. NESR-1600 Plus Single Module

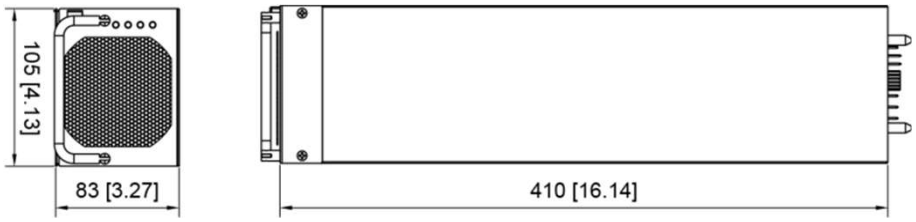

Figure 1. NESR-1600 Plus mechanical drawing-single module

2-3-2. NESR-1600 Plus Rack (19” 2U)

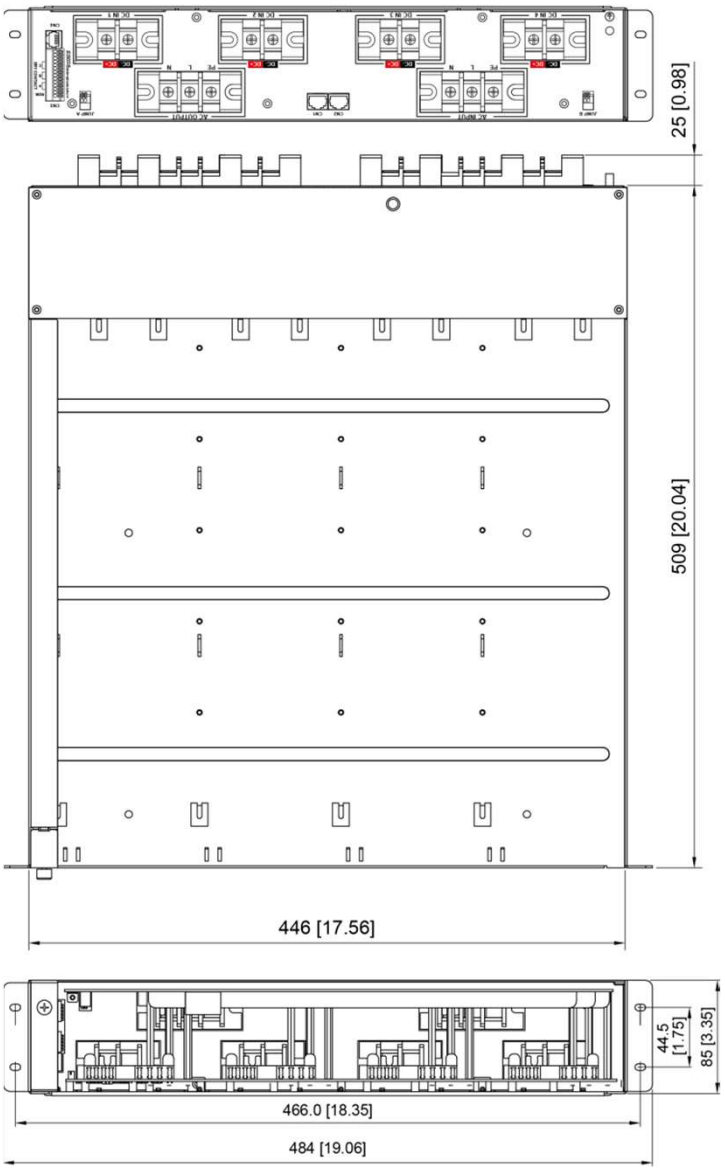

Figure 2. NESR-1600 Plus mechanical drawing-rack

2-3. NESR-1600 Plus De-rating Curve

NESR-1600-124/224

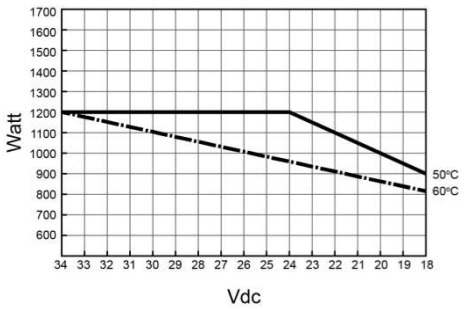

Figure 3. NESR-1600 Plus de-rating curve: NESR-1600 Plus-124/224

NESR-1600-148/248

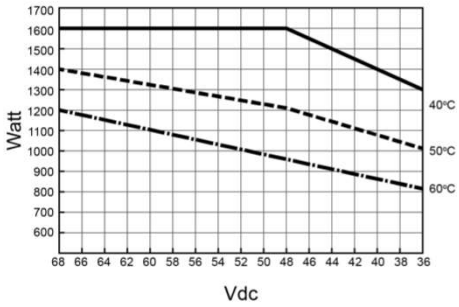

Figure 4. NESR-1600 Plus de-rating curve: NESR-1600 Plus-148/248

2-4. Protection Mechanism

Type	Over Voltage			Under Voltage		
	Shutdown	Restart	Alarm	Shutdown	Restart	Alarm
110 Vac	130±3%	125±3%	125±3%	90±3%	95±3%	95±3%
230 Vac	260±3%	250±3%	250±3%	180±3%	190±3%	190±3%
24 Vdc	34±0.5	28±0.5	33±0.5	18±0.5	25±0.5	21±0.5
48 Vdc	68±1	56±1	66±1	36±1	50±1	42±1

Table 2. NESR-1600 Plus protection mechanism

3. Installation and Maintenance

3-1. Introduction

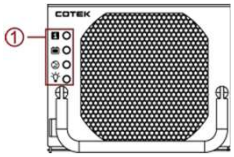

Figure 5. NESR-1600 Plus module front panel view

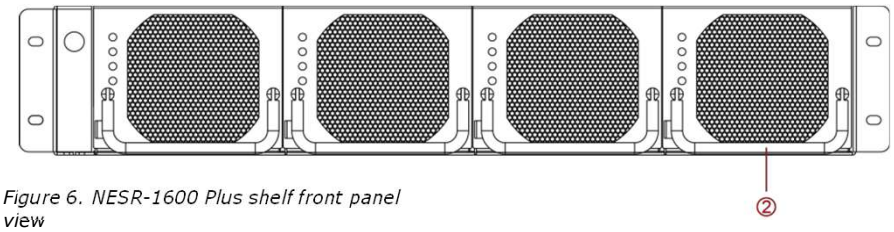

Figure 6. NESR-1600 Plus shelf front panel view

	Description		
①	LED indicator	②	Inverter handle

Table 3. NESR-1600 Plus description

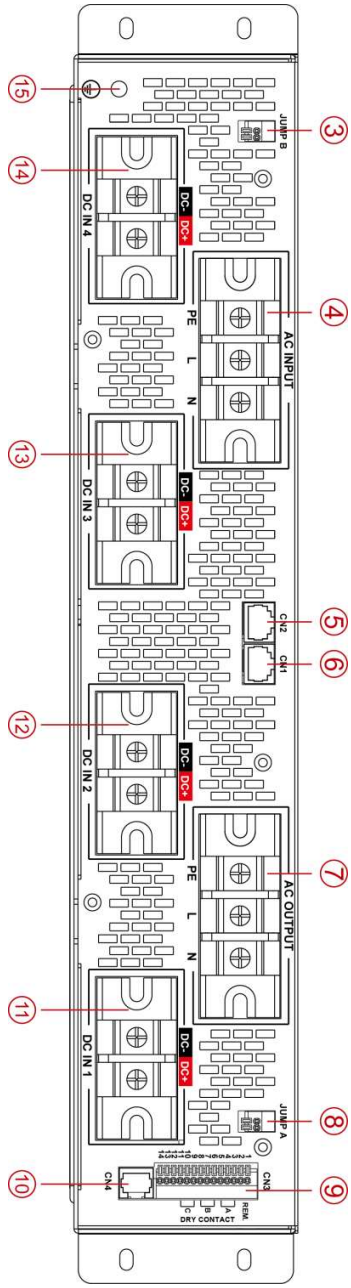

Figure 7. NESR-1600 Plus shelf rear panel

	Description		Description
③	Jumper B (terminal resistor)	⑩	RS-485
④	AC input terminal	⑪	DC input (Battery) #1
⑤	Parallel connection port CN2	⑫	DC input (Battery) #2
⑥	Parallel connection port CN1	⑬	DC input (Battery) #3
⑦	AC output terminal (load)	⑭	DC input (Battery) #4
⑧	Jumper A (terminal resistor)	⑮	Chassis ground
⑨	CN3 Dry contact and remote		

Table 4. NESR-1600 Plus description

3-1-1. LED Indicator ①

Icon	Description	Icon	Description
	System status LED indicator		AC input power indicator
	DC battery power indicator		Load indicator

Example: NESR-1600 Plus - 248

Status	LED Indicator				
Green	Off				No output
	Solid ON	Power by AC (Grid)	Normal (48~66V)	Voltage & Frequency OK	Load 0~60%
	Fast Blinking	Power by AC & DC (Grid & Battery)			
	Slow Blinking	Startup		Frequency synchronization	
Orange	Solid ON	Power by DC (Battery)	Battery Low voltage (42~48V)		Load 60~105%
	Fast Blinking		Battery High voltage alarm (Default > 66V)	Grid AC high voltage alarm (Default >250V)	Overload alarm (>105%)
	Slow Blinking	Remote off	Battery Low voltage alarm (Default < 42V)	Grid AC low voltage alarm (< 190V)	
Red	Solid ON	Module failure			Overload /Short protection
	Fast Blinking	Different system output voltage	Battery over voltage (Default >68V)	Over voltage (Default >260V)	
	Slow Blinking	Different system frequency (50/60Hz)	Battery under voltage (Default <36V)	Under voltage (Default <180V)	
	Intermittent Blinking	Temp. protection		Abnormal Frequency	
	Intermittent Blinking	Fan failure			

Table 5. LED indicator

3-1-2. Green Terminal Introduction ③⑧⑨

There are three green terminals at the rear side, please refer to following figure：

Terminal	Description
Jumper A & B	Single shelf / Parallel connection setting
CN3 Dry contact and remote	Remote setting, and dry contacts

Table 7. NESR-1600 Plus green terminal introduction

3-1-2-1. Jumper A & B ③⑧

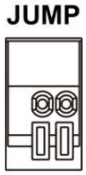

Figure 8. Jumper A & B

Pin	Function	Wiring	Status description
1	Terminal Resistor	Pin#1 and Pin#2 short/open	**Short：** 1. Single shelf setting＊Note 2. Parallel connection setting at first and last shelf (terminal shelf) **Open：** Parallel connection：non-terminal shelf (Refer to 3-2-2.)
2			

Table 8. NESR-1600 Plus jumper A & B status description

＊Note：Jumper A pin1 & pin2 must be shorted and Jumper B pin1 & pin2 must be shorted.

3-1-2-2. Dry contact and remote ⑨

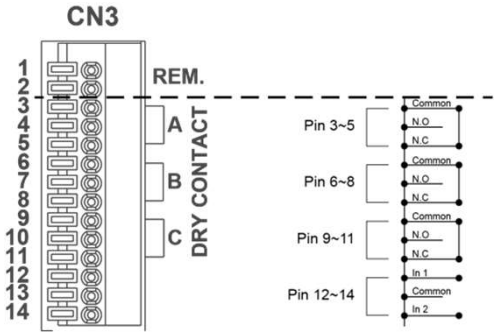

Figure 9. CN3 dry contact pin assignment

Pin	Function	Wiring	Status Description
Pin 1~2	Remote ON/OFF	Pin#1 and pin #2 short/open	Open：Normal output Short：Stop output
Pin 3~5	Major alarm	Switching power 60W Rating 2A at 30VDC wire size 20~24AWG	Normal：N.C-Common short Action：N.O-Common short (Refer to Figure 9.)
Pin 6~8	Minor alarm		
Pin 9~11	Selectable extra alarm to go with Major or minor alarm by RS485/LCM		
Pin 12~13	Digital signal input for Major alarm	Signal voltage：5V wire size 20~24AWG	High：+5V Action Low： 0V Normal
Pin 13~14	Digital signal input for Minor alarm		

Table 9. NESR-1600 Plus CN3 status description

Alarm	Description	Possible Cause
Major	Over Load	The system over the rated capacity(OLA >15sec)
	Module Fault	Parallel Fault or Module Fault
	Over Temp.	Temperature is too high
	DC abnormal & Grid abnormal	Second source abnormal
	Major relay on	Pin 12~13 Action
	CAN signal fail	Not connected properly
Minor	Grid abnormal	AC source failure
	Over Load Alarm	The system over the ratedcapacity(OLA)
	Fan failure	Fan does not work
	Redundancy Fault	Remove the redundancy module or redundant module failure
	Minor relay on	Pin 13~14 Action
	BAT. Low	Under DC voltage protection

Alarm	Description	Possible Cause
	BAT. High	Over DC voltage protection
	BAT. Low Alarm	Under DC voltage Alarm
	BAT. High Alarm	Over DC voltage Alarm

Table 10. Alarm list for dry contact

3-1-2-3. Single Shelf Setting

1. Please short the Jumper A pin#1 and pin#2.
2. Please short the Jumper B pin#1 and pin#2.

3-1-3. AC Input / Output Terminal ④⑦

3-1-3-1. AC Input Terminal ④

NESR-1600 Plus provides the AC utility input terminal at the rear side, and user can connect the AC cable at L / N / PE. The NESR-1600 Plus support the AC input side internal parallel connection.

3-1-3-2. AC Output Terminal ⑦

The AC output terminal at the rear side of the NESR-1600 Plus. User can connect the L / N / PE.

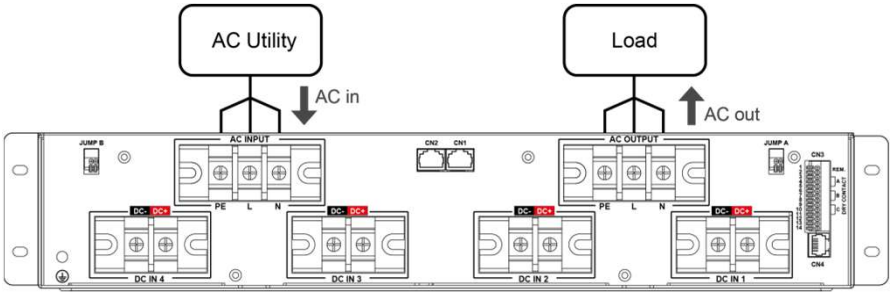

Figure 10. AC terminal connection

3-1-3-3. Cabling

Interface		Wire Color	Wire AWG
AC Input	Line (L)	Black	Breaker suggestion 200-240Vac：50A/Shelf/8AWG 100-120Vac：80A/Shelf/6AWG
	Neutral (N)	White	
AC Output	Line (L)	Black	
	Neutral (N)	White	
Ground		Green-Yellow	6 ~16AWG

Table 11. AC cabling definition

3-1-4. Parallel Connection Port ⑤⑥

In case the user needs more than 1 shelf, please use the CN1 and CN2 port to connect multi-shelves. Ensure that user sets the terminal resistor first (please refer to section 3-2).

Please use RJ-45 cable for connection. To have better performance, we suggest the cable length is less than 100cm.

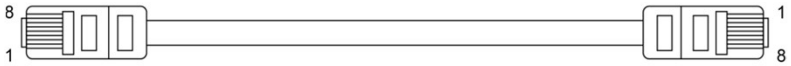

Figure 11. RJ-45 cable

#Pin	CN 1	CN 2
1	CAN_H	CAN_H
2	CAN_L	CAN_L
3	Reserved	Reserved
4	Reserved	Reserved
5	Reserved	Reserved
6	Reserved	Reserved
7	GND	GND
8	5V	5V

Table 12. RJ-45 pin assignment

3-1-5. Battery Cabling ⑪⑫⑬⑭

Connect the 24V/48V battery [+] / [-] to the NESR-1600 Plus [DC+] / [DC-] There are three battery input sets (DC+, DC-) on the NESR-1600 Plus rear side, and every set is independent. In case the user needs parallel connection, please do the parallel wiring outside the NESR-1600 Plus (please refer to following wiring figure).

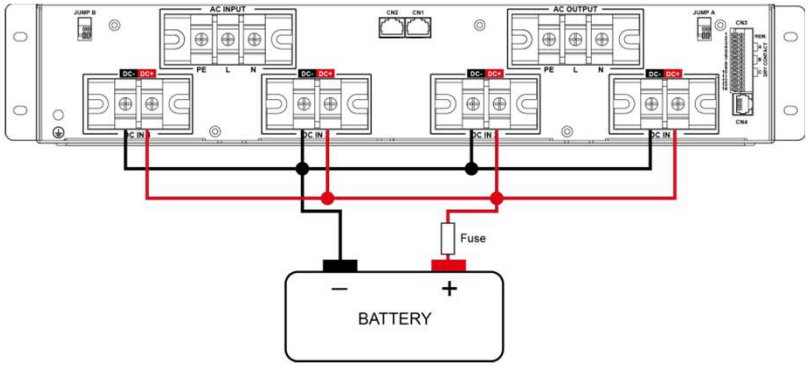

Figure 12. NESR-1600 Plus battery cabling

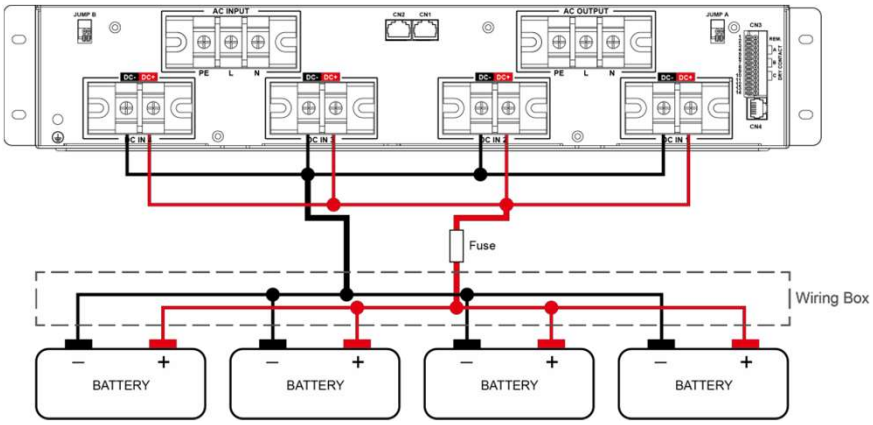

Figure 13. NESR-1600 Plus battery cabling (multi battery I)

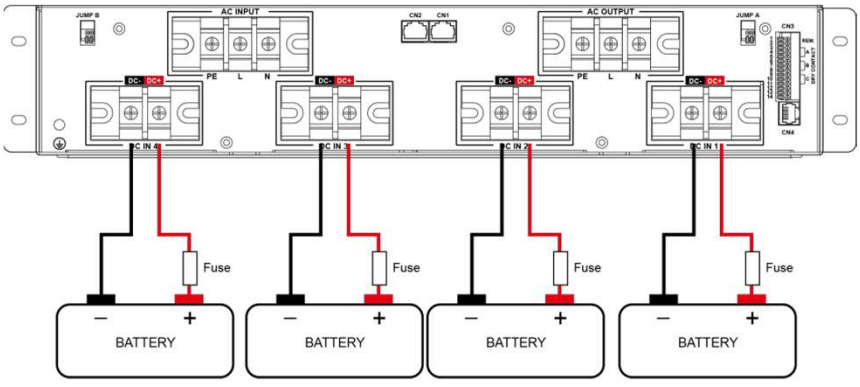

Figure 14. NESR-1600 Plus battery cabling (multi battery II)

Please refer to the suggested battery cable size.

Models	AWG	Cable diameter / per module	Fuse(slow) / per rack	Fuse(slow) / per module
NESR-1600 Plus-124 / 224	#6	4 mm	400A	100A
NESR-1600 Plus-148 / 248	#8	3.1 mm	300A	75A

Table 13. Cable and fuse size

3-1-6. Chassis Ground ⑮

To prevent the electric shock, please make sure the chassis ground is connected.

Warning! High current needs grounding.

3-1-7. Installation Space Requirement

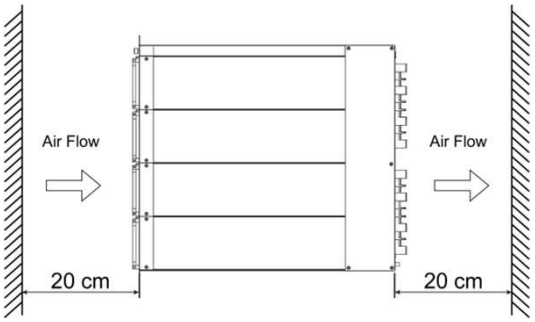

Figure 15. NESR-1600 Plus installation space requirement

Please keep 20 cm clear space for air flow at front and rear side of NESR-1600 Plus.

3-1-8. RS-485 Modbus ⑩

RJ-45 pin definition

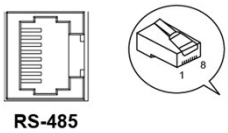

Figure 16. RS-485

NESR PLUS Series	
PIN Num.	**RS-485 Description**
1	Not used
2	Not used
3	Not used
4	485B
5	485A
6	Not used
7	Not used
8	GND

Table 14. RS-485 cable size

3-2. Parallel Connection

3-2-1. Multi-shelves Installation

There are two parallel connection methods for the NESR-1600 Plus system capacity expansion:

3-2-2. Parallel Connection with Jumper Setting

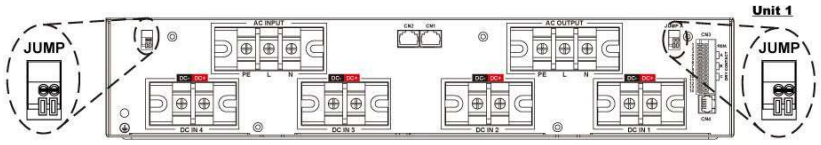

Figure 17-1. Parallel connection via jumper setting

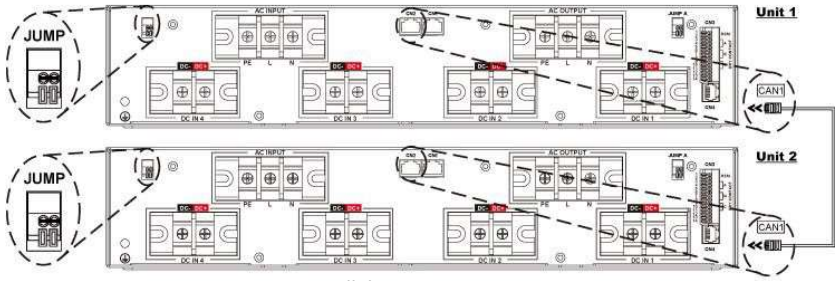

Figure 17-2. Parallel connection via jumper setting

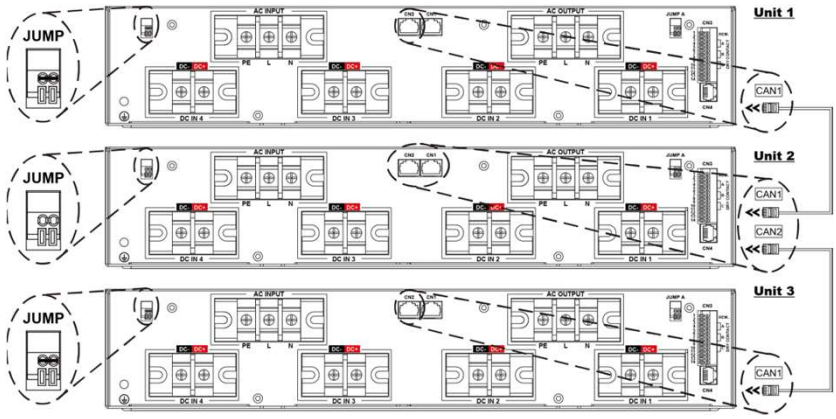

Figure 17-3. Parallel connection via jumper setting

Green terminal JUMP connection：

Parallel connect	Unit 1	Unit 2	Unit 3
JUMP	Connected	Not connected	Connected

※ Take 3 units for example, only the first and the last unit need to connect jumper.

3-3. Maintenance

3-3-1. Inverter Module Replacement

3-3-1-1. Remove the inverter module

Step 1：Pull up the NESR-1600 Plus handle

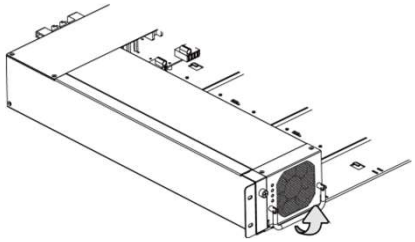

Figure 19. Remove the inverter module: step 1

Step 2：Remove the NESR-1600 Plus out of the shelf

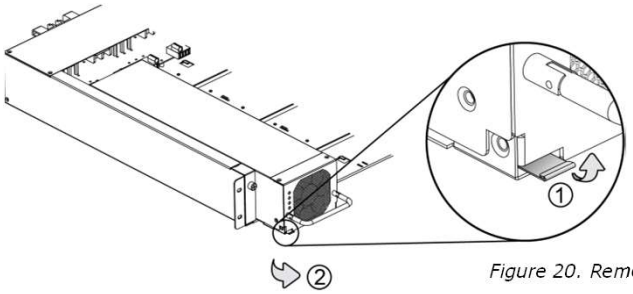

Figure 20. Remove the inverter module: step 2

3-3-1-2. Insert the inverter module

Step 1：Insert the NESR-1600 Plus Plus into the shelf slot

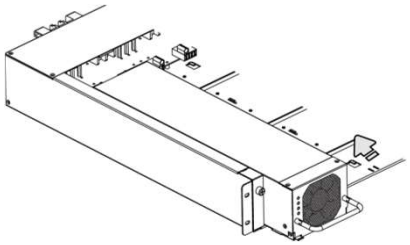

Figure 21. Insert the inverter module: step 1

Step 2：Make sure the handle at down position

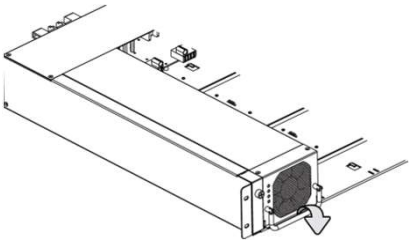

Figure 22. Insert the inverter module: step 2

3-3-2. Fan Module Replacement

Warring! Please contact technical person to replace fan module.

Step 1：Please follow the 3-3-1-1. to remove the NESR-1600 Plus module out of shelf.

Step 2：Use the screw driver to remove the 4 screws on the fan module (top side 2 pcs, rear side 2 pcs), and user can remove the fan module.

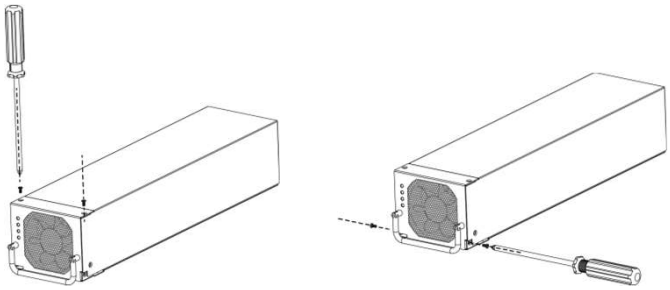

Figure 23. Fan module replacement: step 2

Step 3：Remove 4 screws and power cord on fan

Step 4：Replace the new fan and fix 4 screws and power cord on new fan

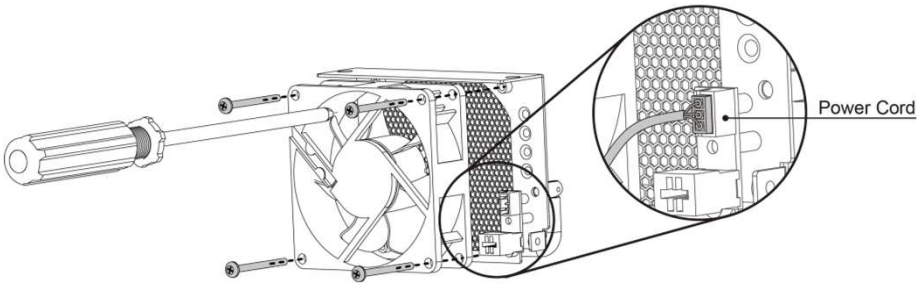

Figure 24. Fan module replacement: step 4

Step 5：Connect the fan module into the front side of inverter and make sure PCB pin plugged into the slot

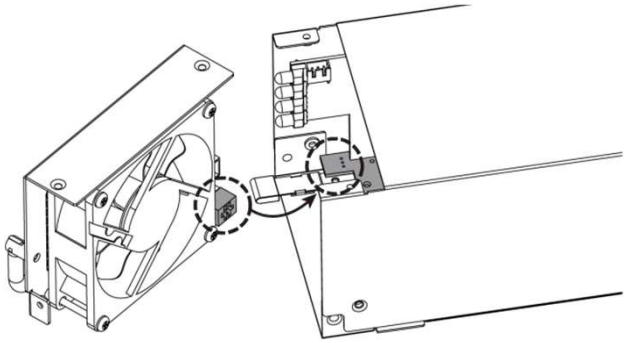

Figure 25. Fan module replacement: step 5

Step 6：Use the screw driver to fix 4 screws on fan module.

Step 7：Follow 3-3-1-2 to insert the inverter module.

Note：

1. Please make sure the fan power cable is connected well.
2. Suggest to clean the dust of the fan guard (every 3 months), to keep fan operating longer.

4. Trouble shooting

LED status	Possible Description	Solution
LED red intermittent blinking — · — · —	Fan failure	1. Make sure the fan is not stuck 2. Replace the fan
LED red intermittent blinking — — — —	Over temperature protection (OTP)	1. Make sure the installation space 2. Check the fan and clean the fan filter 3. Reduce the environment temperature 4. Reduce the load
LED red fast blinking • • • • • •	Different output voltage module in the same rack	1. Confirm system output voltage 2. Remove abnormal module 3. Confirm module type
LED red slow blinking — — —	Module frequency mismatch	1. Confirm system frequency 2. Use RS-485 to set the frequency
LED red fast blinking • • • • • •	Input over voltage protection (OVP)	1. Check input voltage 2. Reduce the input voltage
LED red slow blinking — — —	Input under voltage protection (UVP)	1. Battery deep discharge: please charge the battery 2. Please check the battery connection A. Cable diameter B. Tighten the connector
LED red intermittent blinking — — — —	AC frequency not synchronization	1. Check the AC source frequency 2. Check the NESR-1600 Plus frequency setting
LED red slow blinking — — —	Under AC voltage	Check the AC source voltage
LED red fast blinking • • • • • •	Over AC voltage	Check the AC source voltage
LED red solid on ———	Short / Over load	1. Check the connection and make sure the cable is not short 2. Reduce the load

Table 32. Trouble shooting

5. Warranty

Warning! Do not open or disassemble the Inverter. Attempting to do so may cause risk of electrical shock or fire.

We guarantee this product against defects in materials and workmanship for a period of 24 months from the date of purchase. In case you need to repair or replace any defective power inverters, please contact Nova Electric.
This warranty will be considered void if the unit has been misused, altered, or accidentally damaged. Nova Electric is not liable for anything that occurs as a result of the user's fault.

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