# **On-Grid PV Inverter**

Residential HNS series: HNS 1000/ 1500/ 2000/ 2500/ 3000 TL-1

Installation and Operation Manual





www.aforenergy.com



Afore New Energy Technology (Shanghai) Co., Ltd. 186–21–54326236 +86–21–54326136 info@aforenergy.com No.2755,Sanlu Rd.Minhang District,Shanghai,China.201112





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# **1.About This Manual** 1.1 Scope of Validity

This manual describes the installation, commissioning, operation and maintenance of the following on-grid PV inverters produced by Afore New Energy:

```
Single-Phase(One MPPT Tracker)
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HNS1000TL-1 HNS1500TL-1 HNS2000TL-1 HNS2500TL-1 HNS3000TL-1

Please keep this manual all the time available in case of emergency.

# 1.2 Target Group

This manual is for qualified personnel. The tasks described in this manual must only be performed by qualified personnel.

# 1.3 System Diagram

The typical connection diagram for the entire PV system is on-grid.





### Circuit Breaker and Surge Protector Recommendation:

Туре	Max AC Current [A]	Rated current of AC breaker[A]
Single-Phase(On	e MPPT Tracker)	
HNS1000TL-1	6	16
HNS1500TL-1	9	16
HNS2000TL-1	12	20
HNS2500TL-1	13	20
HNS3000TL-1	15	25

• SPD: Lightning protection system, refer to the following options:

• AC side, nominal discharge current 20KA, second grade lightning protection, protection voltage 2.5KV

• DC side, nominal discharge current 20KA, second grade lightning protection, protection voltage 3.2KV

• The wiring distance between the inverter and the distribution box should be at least 5 meters.

• Utility: Referred to as "grid" in this manual, i.e. the media your electric power company provides power to your place. Please note that Inverter can only be connected to low-voltage systems (namely, 220/230Vac, 50/60Hz).

# 2.Safety & Symbols

# 2.1 Safety Precautions

1. All work on the inverter must be carried out by qualified electricians.

- 2. The device may only be operated with PV generators.
- 3. The PV generator and inverter must be connected to the ground.
- 4. Do not touch cover until 3-5 minutes after disconnecting all sources of supply.

5. Please do not touch the surface when the inverter is working, and do not rely too close to the inverter.

6. Please ensure that the used device and any relevant accessories are disposed of in accordance with applicable regulations.



7. Afore inverter should be placed upwards and handled with care in delivery. Pay attention to waterproof.

8.Alternative uses, modifications to the inverter not recommended by Afore or the installation of components not sold by Afore New Energy void the warranty claims.

# 2.2 Explanations of Symbols

Afore inverter strictly comply with relevant safety standards. Please read and follow all the instructions and cautions during installation, operation and maintenance.



Danger of Electric Shock. The inverter is directly connected with the public grid. All work on the inverter must be carried out by qualified personnel only.



Beware of hot surface. The inverter can become hot during operation. Do not contact the device during operation.



Caution, risk of electric shock Energy storage timed discharge, time to be indicated adjacent to the symbol.



Notes, Important. Non-adherence to these instructions may adversely affect the operating convenience or functionality of the device.



Do not dispose of this device with the normal domestic waste.



Without Transformer. This inverter does not use transformer for the isolation function.



CE mark. The inverter complies with the requirements of the applicable CE guidelines.



Refer to manual before service.



# **3.Installation** 3.1 Package

#### Unpacking

On receiving the inverter, please check to make sure the packing and all of the components are not missing or damaged. Please contact your dealer directly for supports if there is any damage or missing components.

### Package List

Open the package, please check the packing list shown as below.



No.	Qty	Items	No.	Qty	Items
1	1	Solar inverter	8	1	AC connector
2	1	User manual	9	2	Plastic Expansion Tube
3	1	Certificate of inspection	10	2	Tapping screw
4	1	Installation diagram	11	1	Security screw
5	1	Warranty card	12	1	Screwdriver for security screw
6	1	Wall mounting bracket	13	1 set	DC plug connector
7	1	GPRS/Wi-Fi Monitoring Module			





# **3.2 Product Overview**



### Overview of the Connection Area

The following figures show the assignment of the individual connection areas on the bottom of the inverter.



No.	Items
1	DC Switch(optional)
2	DC connectors ( + ) for the PV strings
3	DC connectors ( - ) for the PV strings
4	AC connection
5	Communication module
6	Countercurrent Connector



# **3.3 Mounting Location**

The inverters are designed for indoor and outdoor installation (IP65), to increase the safety, performance and lifespan of the inverter, please select the mounting location carefully based on the following rules:

• The inverter should be installed on a solid surface, far from flammable or corrosion materials, where is suitable for inverter's weight and dimensions.

• The ambient temperature should be within -25  ${\rm C}$  ~ 60  ${\rm C}$  (between -13  $^{\circ}F$  and 140  $^{\circ}F$ ).

• The installation of inverter should be protected under shelter from direct sunlight or bad weather like rain, snow, lightning, etc.



• The inverter should be installed vertically on the wall, or lean back on plane with a limited tilted angle. Please refer to below figure.







• Leave the enough space around inverter, easy for accessing to the inverter, connection points and maintenance.



# 3.4 Installation On-grid PV Inverter











### **3.5 Electrical Connection**

# 3.5.1 PV Connection

The inverter have one MPPT channels, can be connected with one strings of PV panels. Please make sure below requirements are followed before connecting PV panels / strings to the inverter.

 $\cdot$  The open-circuit voltage and short-circuit current of PV string must not exceed inverter's range

- $\cdot$  The isolation resistance between PV string and ground must exceed 10 k $\!\Omega$
- $\cdot$  The polarity from PV strings are correct
- $\cdot$  Use the DC plugs in the accessory
- · The lightning protector should be equipped between PV strings and inverter
- $\cdot$  Disconnect all of the PV (DC) switch during wiring







#### Warning:

The fatal high voltage may on the DC side, please comply with electric safety when connecting.

Please make sure the correct polarity of the cable connected with inverter, otherwise inverter could be damaged.









# 3.5.2 Grid Connection

The on-grid PV inverters work with grid (220/230/240 Vac, 50/60 Hz).

The external AC switch should be installed between inverter and grid to isolate from grid. Please make sure below requirements are followed before connecting AC cable to the inverter.

- $\cdot$  The AC (grid) voltage must not exceed inverter's range
- $\cdot$  The phase-line from AC distribution box are correctly connected
- · Use the AC plugs in the accessory
- · The surge protector should be equipped between grid and inverter
- · Disconnect the AC (grid) switch during wiring







#### Warning:

The fatal high voltage may on the AC side, please comply with electric safety when connecting.

Please make sure the right line of AC grid connected with inverter, otherwise inverter could be damaged.



AC line goes through AC terminal waterproof head and cap





Step 3



Connect AC line, Live line (L), Neutral line (N) and Ground Wire (PE) according to polarity.

Step 4







### 3.5.3 Communication Connection

The monitoring module could transmit the data to the cloud server, and display the data on the PC, tablet and smart-phone.

#### Install the communication stick to the inverter

Connect AC connection and turn on AC breaker, wait till the LED indicators on Wi-Fi module flashing.

Configure the communication bar, router, account registration, etc. See the WIFI connection manual for details.



#### RJ45 socket pin assignment

PIN	Assignment for inverterscapable of both charging and discharging	Pin Assignme	nts Front View
1	DRM5	$\frown$	40045070
2	DRM6		12345678
3	DRM7	$\begin{pmatrix} 1 \rightarrow 8 \\ \hline \end{array}$	
4	DRM8		
5	RefGen		
6	COM/DRM0		
7/8	/	RJ45 Socket	RJ45 Plug

#### Method of asserting demand response modes

MODE	Rj45 socke Asserted b	et y shorting pins	Requirement
DRM0	5	6	Operate the disconnection device
DRM5	1	5	Do not generate power
DRM6	2	5	Do not generate at more than 50% of rated power
DRM7	3	5	Do not generate at more than 75% of rated power AND Sink reactive power if capabie
DRM8	4	5	Increase power generation (subject to constraints from other active DRMs)





# 4.Operation

# 4.1 Control Panel



No.	Items
1	LCD Display
2	UP Touch Button
3	DOWN Touch Button
4	ESC Touch Button
5	ENT Touch Button
	COM LED Indicator
6	POWER LED Indicator
	FAULT LED Indicator





# 4.2 Menu Structure











### Explanation of LCD Display Content

Nouns	Explanation
System Info	view the inverter information: Voltage, current, power and so on
Error record	check the error list of inverter including date and time
Set	Set the protection parameter of inverter
Clear record	clear all the record in the display
Date and time set	set date and time of the installation place
RS485 Address	default address is 1, more 23
SN number	view inverter SN ,DSP and HMI vision
Grid power ctrl	Set the output power limited value, this function can't use
WIFI info	view WIFI SN and IP address
PQ mode	set power factor , and $PQP$ ( power generation control unit) on and off
Active island	Only RD test ,customer can't use it

# 4.3 Setting

# 4.3.1 Startup Setting





# 4.3.2 Parameter Setting





#### Note:

Change all parameters that need to be modified before restarting the inverter.





# 5.Commissioning

Before starting up commissioning at site, please make sure below procedures and requirements are fully meet.

 $\cdot$  Mounting location is meet the requirements.

· All of the electrical wiring is firmly connected, including PV wiring, Grid wiring and Earth wiring.

• The inverter setting has been finished accordingly to local standards or regulations.

#### **Commissioning Procedures**

· Turn on the AC switch between inverter grid output and the public grid;

- · Turn on the DC switch on the inverter;
- · Turn on the PV switch of the system.

#### LED Indication



Sign	Color	Instructions		
POWER	Green	On : Power On		
COM	Green	On: Normal Operation and feed into the utility grid		
FAULT	Red	Flash: Check wiring		



# 6.Shut Down & Restart the Inverter

### 6.1 Shut Down Procedures

- · Turn off the DC switch on the inverter;
- · Turn off the PV switch of the system;
- $\cdot$  Turn off the AC switch between inverter grid output and the public grid.



Note: The inverter will be operable after minimum 5 minutes.

### 6.2 Restart the inverter

Follow the procedures below when the inverter needs to be restarted.

- · Follow the Shut Down Procedures of Article 6 to shut down inverter;
- · Follow the Commissioning Procedures of Article 5 to turn on the inverter.

# 7.Maintenance&Trouble Shooting

### 7.1 Maintenance

The inverter needs maintenance periodically, the following details should be noticed.

PV connection: check the PV connection twice a year

AC connection: check the AC connection twice a year

Earth connection: check the Earth connection twice a year

Heat sink: clean the heat sink once a year with dry towel

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# 7.2 Fault Code and Trouble Shooting

The LCD and LED will report the fault when the error occurs, please follow thetrouble shooting list to solve the problem.

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LED	Display	Description	Suggestion
POWER	Light	Control system is activated	
	Light off	Low DC side voltage	No power generation
FAULT	Light	Terminated due to failure	Need troubleshooting
COM	Light	Working normally	
	Light off	System waiting	



# Trouble-Shooting List

Code	Error Display	Error Message	Possible Fault	Correctie Measure
E0	GFCI Fault	Ground Fault Circuit Interrupter	Ground Fault Circuit Interrupter fault	restart the inverter
E6/E11	Bus High Fault/Bus Fault	Bus Voltage High /Bus Fault	<ul> <li>PV Input voltage high</li> <li>AC side poor connection</li> </ul>	check PV input voltage within 450Vdc(up to 3.0kw model), 500Vdc(up to 5.0kw model) check AC connector, circuit breaker well connection
E9	No Utility	Utility loss	<ul> <li>utility loss</li> <li>AC side circuit breaker turn off</li> <li>AC side poor connection</li> <li>inverter fault</li> </ul>	grid back to the normal, the inverter will restart automatically     replace the AC circuit breaker     check AC connector well     connection     after seceral retart the fault remains,     replace inverter
E10	E10 Ground Current Fault Leakage current high 1. poor earthing, leakage current high 2. PV(+) or PV(-) earthed		1. check the AC output wring and restart the inverter 2. check PV array wiring	
E13	Over Temperatu re Fault	Inverter too hot	<ul> <li>inverter enclosure too hot</li> <li>temperatrue sensor fault</li> </ul>	<ul> <li>turn off the inverter still the temperature down to the normal. Or install the inverter at a well ventilated site.</li> <li>replace the temperature sensor</li> </ul>
E15	PV Over Fault	PV input voltage high	· PV array's Voc high	<ul> <li>re-design the PV array configuration</li> <li>measure the PV array voltage is the same as inverter displayed.</li> </ul>
E17	M Grid Volt Fault	Grid voltage out of range	<ul> <li>grid voltage out of the setting range</li> </ul>	grid back to the normal, the inverter will restart automatically     check Country standard setting is correct
E18	lsolation Fault	Insulation Resistance high	· PV(+) or PV(-) earthed	check the resistance between PV(+) and ground, PV(-) and ground bigger than $2M\Omega$ .
E19	Current DC Offset	DC bias high	· AC side DC bias high	restart the inverter
E12	Over Current	Over current fault	<ul> <li>grid fluctuate</li> <li>AC side poor connection</li> </ul>	• the inverter will restart automatically • check the AC output wring and restart the inverter
E24	Relay 1/2 Fault	Relay fault	· inverter fault	restart the inverter
E29	MGrid FreqFault	Grid frequency out of range	grid fluctuate     grid frequency out of     setting range	grid back to the normal, the inverter will restart automatically check inverter frequency setting range correct





# 8.Specifications

PV Input Data	HNS1000TL-1	HNS1500TL-1	HNS2000TL-1	HNS2500TL-1	HNS3000TL-1
Max. DC Power ( W )	1500	2250	3000	3750	4200
Max. DC Voltage ( V )	500	500	500	500	500
MPPT Voltage Range ( V )	50-500	50-500	50-500	50-500	50-500
MPPT Full Power Voltage Range ( V )	70-500	110-500	145-500	180-500	220-500
Rated Input Voltage ( V )	360	360	360	360	360
Start-up Voltage ( V )	50	50	50	50	50
Max. Input Current ( A )	14	14	14	14	14
Max. Short Current ( A )	18	18	18	18	18
No. of MPP Tracker / No. of PV String	1/1	1/1	1/1	1/1	1/1
Input Connector Type	MC 4	MC4	MC4	MC4	MC4
AC Output Data	HNS1000TL-1	HNS1500TL-1	HNS2000TL-1	HNS2500TL-1	HNS3000TL-1
Max. Output Power ( W )	1100	1650	2200	2750	3300
Nominal Output Power ( W )	1000	1500	2000	2500	3000
Max. Output Current ( A )	6	9	12	13	15
Nominal Output Voltage (V)		L/N/	PE, 220Vac, 230Vac, 240	/ac	
Grid Voltage Range		180Vac-27	6Vac (According to local	standard)	
Nominal Output Frequency (Hz)			50/60		
Grid Frequency Range		45~55Hz/54	1~66Hz (According to loca	al standard)	
Output Power Factor		1 default (adj	ustable from 0.8 leading	to 0.8 lagging)	
Output Current THD			<3%		
Efficiency	HNS1000TL-1	HNS1500TL-1	HNS2000TL-1	HNS2500TL-1	HNS3000TL-1
Max. Efficiency	97.50%	97.80%	98.10%	98.10%	98.13%
Euro Efficiency	96.60%	96.70%	96.80%	97.23%	97.56%
Protection	HNS1000TL-1	HNS1500TL-1	HNS2000TL-1	HNS2500TL-1	HNS3000TL-1
PV Reverse Polarity Protection	YES	YES	YES	YES	YES
PV Insulation Resistance Detection	YES	YES	YES	YES	YES
AC Short Circuit Protection	YES	YES	YES	YES	YES
AC Over Current Protection	YES	YES	YES	YES	YES
AC Over Voltage Protection	YES	YES	YES	YES	YES
Anti-Islanding Protection	YES	YES	YES	YES	YES
Residual Current Detection	YES	YES	YES	YES	YES
Over Temperature Protection	YES	YES	YES	YES	YES
Integrated DC switch	YES	YES	YES	YES	YES
Surge Protection (DC & AC)			Integrated (Type III)		
General Data	HNS1000TL-1	HNS1500TL-1	HNS2000TL-1	HNS2500TL-1	HNS3000TL-1
Dimensions (W x H x D, mm)			278 x 261 x 118		
Weight ( kg )		5.1	10.55	5.	.3
Protection Degree			IP65		
Enclosure Material			Aluminum		
Ambient Temperature Range (°C)			-25~+60		
Humidity Range			0-100%		
lopology		(	Transformerless		
Communication Interrace		RS485 / W	iFi / Wire Ethernet / GPR	5 (optional)	
Cooling Concept	Convenction				
Noise Emission ( db )	<21				
Night Power Consumption ( W )	<0.	.2	1000	<1	
Max. Operation Altitude ( m )			4000		
Certifications and Standards	HINS10001L-1	HINSISUUIL-1	HINS20001L-1	HINS25001L-1	HINS30001L-1
EMC Standard	EN/IEC 6100	U-D-2, EN/IEC 61000-6-3,	ENDIUUU-3-2, EN61000-	3-3, EN61000-3-11, EN61	000-3-12
Sarety Standard	ENERGE 10 A	EN/IEC 6	2109-1/-2 ,UL1547, IEC 6		1054105
Grid-connection	EN30343-1, EN30438, KD 1033,UNE 217001, KD 413, IEC61727, IEC62116, IEC61683, VDE4105, UL1741 VDE0126 AS4777.2 NB/T 32004-2013, UNT C 15-712-1, ABNT NBR 16149, ABNT NBR 16150				