Version 1.1

Enpal AC Box 2.0

User Manual

Enpal . home

Revision History

Version No	Update Details	Date
Version1.0	Initial released	2022-05-15
Version1.1	Add Description：CT and 4G antenna extension cable installation instructions	2022-11-29

Note:The manual and documentation are constantly updated, and the latest published documentation contains all previously updated issues.

Thank you for choosing Enpal.home AC Box 2.0 productions

This user manual contains important electrical and mechanical installation information that should be known before you install the AC Box. In addition, the manual contains some other security information that you must know.

This installation manual does not have the meaning of any warranty, either express or implied. There is no provision for the compensation scheme for the loss, equipment damage or other expenses directly caused or related to the installation, operation, use or maintenance of the equipment. Enpal is not liable for any patent infringement or third party rights arising from the use of the system. Enpal reserves the right to change the Product specification and this manual without prior notice.

Failure by the customer that not follow the requirements listed in this manual during the installation of the system equipment will result in the failure of the limited warranty of the product provided to the customer. At the same time, the Suggestions in this manual are to improve the safety of photovoltaic power generation system during the installation process, which has been tested and experienced. This manual is intended to be used by installers and owners of AC Boxes for reference and gives advice on all safety, operation, and maintenance requirements and recommendations.

Enpal GmbH

Website: https://www.enpal.de

Address: Enpal GmbH, Koppenstraße 8, 10243 Berlin

Technical support: +49 -30 88789646

service@enpal.de

About this Manual

Purpose

This manual introduces the installation, electrical connection, debugging, use, maintenance and troubleshooting of AC Box. Before installation and operation, please read through this document to understand the security information and familiarize with the equipment functions and features.

Reader

The reader of this manual are:

- AC Box installer
- AC Box user

Symbols

Definition of the symbols in this manual are as the following:

Symbol	Description
	Indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.
	Indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
	Indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
	Indicates a potentially hazardous situation which, if not avoided, could result in equipment damage, data loss,

Symbol	Description
	performance deterioration, or unanticipated results. NOTICE is used to address practices not related to personal injury.
NOTE	Supplements the important information in the main text. NOTE is used to address information not related to personal injury, equipment damage, and environment deterioration.
	This symbol allows the operator to pay attention to the protection of personal safety against electricity prohibited matters.
	This symbol identifies the precautions or instructions that may pose a risk to the safety of the user or cause significant hardware damage if not properly operated.

Contents

1 Product Introduction

1.1 System schematics and wiring diagram

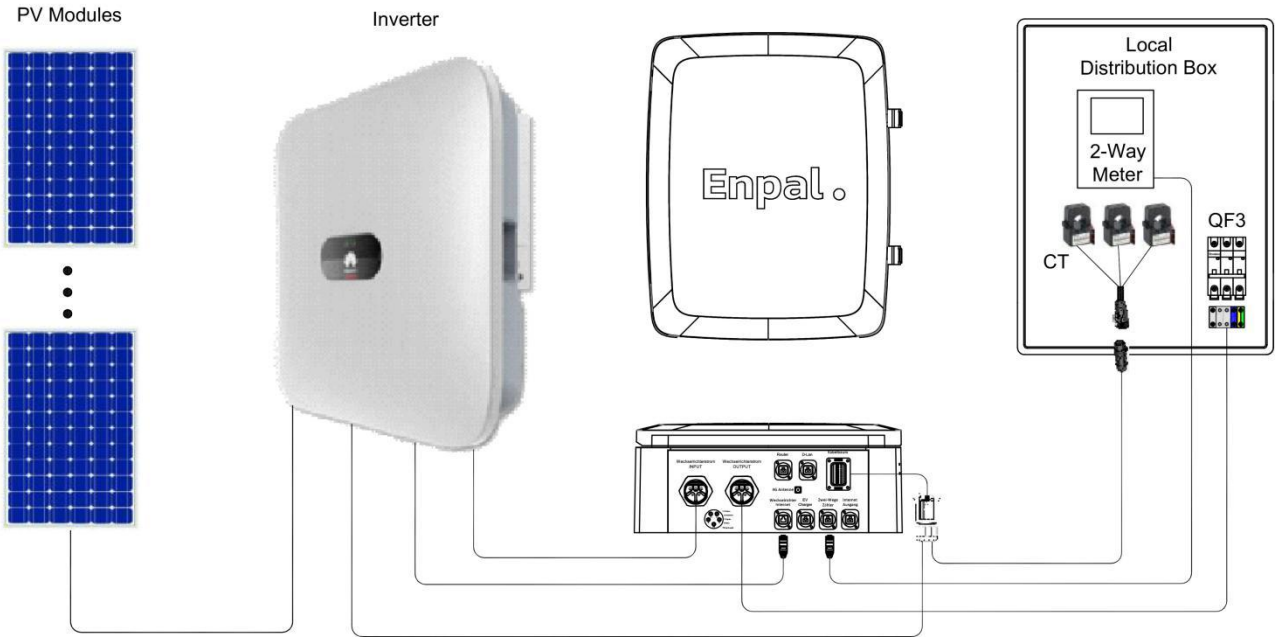


Figure 1-1 Schematics of Enpal.home PV power generation system

The AC Box in this manual works in an Enpal.home PV power generation system which is composed of PV module, inverter, AC box, mounting structure and cables, and can convert the DC power generated by the PV system into 380V 3-phase AC power via the inverter. The system is connected to the original distribution box of the user through the AC box. It is a smart power generation system that meets the local German grid connection needs and controls the feed to the grid.

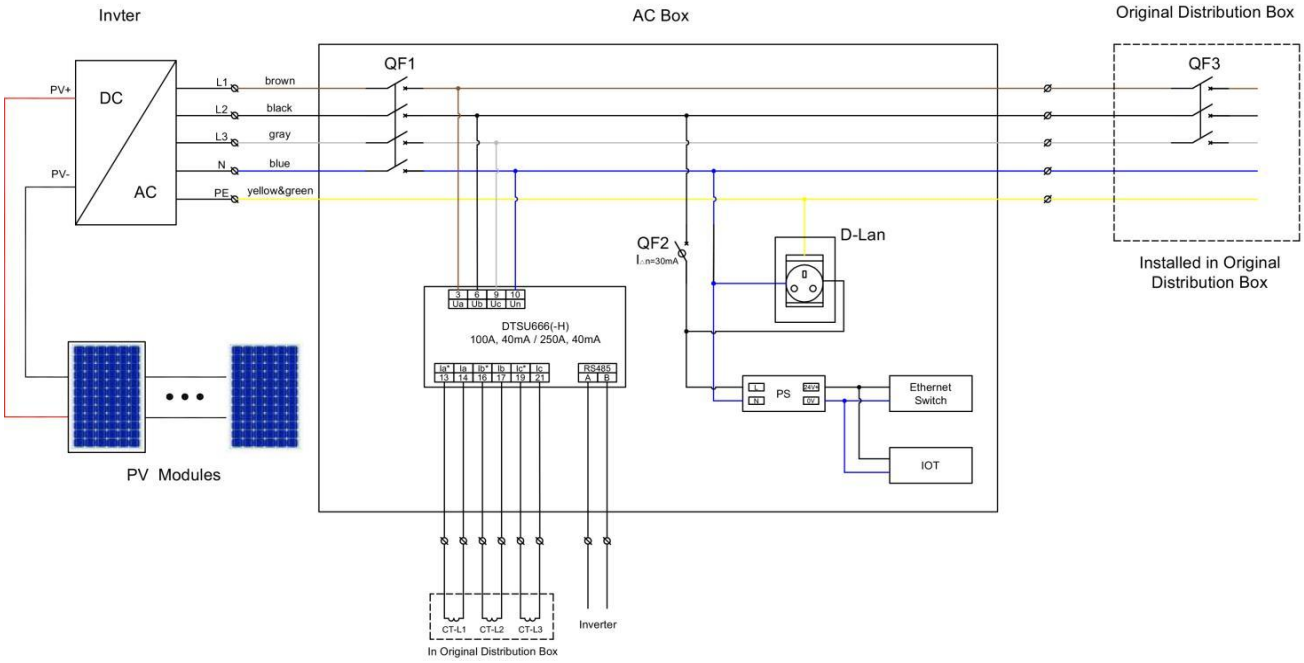


Figure 1-2 Enpal. home power generation system wiring diagram

1.2 Packing List of AC Box package

No	Item	Specification	Qt'y	Unit	Remarks
1	AC Box	CFEP10 / CFEP22	1	Pcs	AC Box 2.0
2	Installation Accessories	Mounting plate-A 1pcs Mounting plate-B 1pcs Mounting plate-C 1pcs Screws M6×10 4pcs Wall plugs 6×60 T30 4pcs	1	Set	
3	4G Antenna	\	1	Pcs	
4	Ethernet cable	CAT 5E 20cm (from D-Lan port to Router Port)	1	Pcs	

No	Item	Specification	Qt'y	Unit	Remarks
5	Inspection report	\	1	Pcs	
6	Production Photos	\	1	Pcs	
7	Sticker	\	1	Pcs	

1.3 Packing List of CableSet package

Packing List of CableSet package: for system≤15.2kW (0-10KW AC BOX)

No	Item Name	Description	Qt'y	Unit	Remarks
1	AC cable	From inverter to AC Box NYY-J 5x4mm^2 7m cable+ connector	1	pcs	
2	AC cable	From inverter to AC Box NYY-J 5x4mm^2 5m cable+ connector	1	pcs	
3	DC cable	H1Z2Z2-K 1x4mm^2 Black 40m + Red 40m	1	pcs	
4	Lightning grounding cable	NYY-J 1×6mm^2 35m	1	pcs	
5	MC4 connectos	/	6	Sets	
6	Cable Lugs	TLK 6-8 5 pcs TLK 10-6 3 pcs	1	Set	
7	Screws	M8×20 T40 4 suits M6×20 T40 2 suits	1	Set	
8	AC connector cover	/	2	Set	

Packing List of CableSet package: for system between 15.2kW~30.4kW (10-22KW AC BOX)

No	Item Name	Description	Qt'y	Unit	Remarks
1	AC cable	From inverter to AC Box NYY-J 5x6mm^2 7m cable+ connector	1	pcs	
2	AC cable	From inverter to AC Box NYY-J 5x6mm^2 5m cable+ connector	1	pcs	
3	DC cable	H1Z2Z2-K 1x4mm^2 Black 70m + Red 70m	1	pcs	
4	Lightning grounding cable	NYY-J 1×6mm^2 35m	1	pcs	
5	MC4 connectos	/	10	Sets	
6	Cable Lugs	TLK 6-8 5 pcs TLK 10-6 3 pcs	1	Set	
7	Screws	M8×20 T40 4 suits M6×20 T40 2 suits	1	Set	
8	AC connector cover	/	2	Set	

1.4 Packing List of Harness package

No	Item Name	Description	Qt'y	Unit	Remarks
1	Harness1	Inverter Female Connector	1	pcs	

No	Item Name	Description	Qt'y	Unit	Remarks
2	Harness2	AC Box to Inverter and Meter Box	1	pcs	
3	Harness3	CT and Connectors	1	pcs	
4	Harness4	From Battery to Inverter	1	Pcs	
5	Junction Box Breaker	AC 380V 3P 16A (Contains 5 terminals) Packaged in one carton box	1	Set	

1.5 Optional Spare parts List

For some special situations, the following spare parts may be needed.

No	Item Name	Description	Usage	Remarks
1	Antenna extension cable	LMR200, 5mm dia, 5m length with both terminals	If the 4G signal near the AC Box is not good sufficient, an Antenna extension cable can be used to extend the 4G antenna to nearby places with a better signal strength. If one extension cable is not long enough,more extension cable can be connented to each other.	
2	RS 485 Extention Cable	Inverter extension cable harness 2.0 version, 4 wires cable with 2connectors	If the RS485 cable between the AC Box and Inverter is not long enough, an RS485 extension cable can be used to connect them.	
3	CT Extention Cable	CT extension cable harness 2.0 version, 6 wire cable with 2 connectors	If the CT cable between the AC Box and Local cabinet is not long enough, an CT Extension cable	

No	Item Name	Description	Usage	Remarks
			can be used to connect them.	
4	Ethernet connector	Ethernet Extension Connector RJ45, Waterproof	The Ethernet Extension Connector can be used to connect two Ethernet cable in case any are not long enough.	
5	D-Lan	Power line adapter	If 4G signal not good enough to use or not available, a D-Lan device can be used to get the AC Box connected to the internet.	

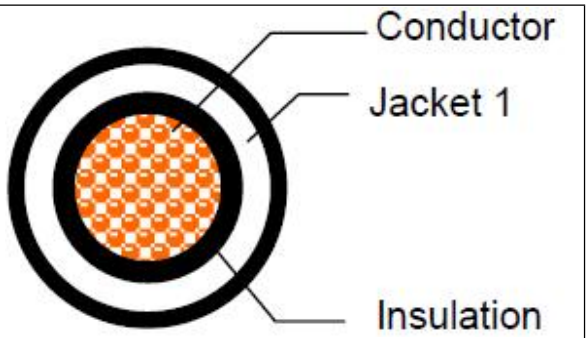
1.6 Technical data of AC Box

1	Model	AC Box	
		10kW	22kW
1.1	Rated voltage	AC400V	
1.2	Rated current	16A (16A)	32A (16A)
1.3	Dimensions(mm)	Wide×Height×Depth：348.5×437×140	
1.4	Weight	9.5 kg	9.5kg
2	Working environments		
2.1	Operation Temp.	-10℃~+50℃	
2.2	Storage Temp.	-25℃~+60℃	
2.3	Altitudes	≤2000m	
2.4	IP Degree	IP54	
2.5	Installation methods	Indoor, Hanging	
3	Standards & Certifications		
3.1	Standards	IIEC62368-1 IEC61439-1	

		IEC61439-2 IEC62477
3.2	Certifications	CE

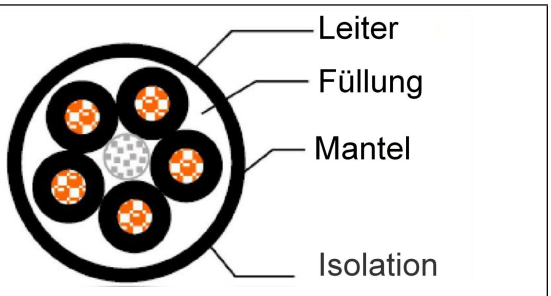
1.7 Technical data of cable

1.7.1 DC Cable

STYLE	H 1Z2Z2-K	
SIZE	1C*4 .0 m m ²	
RATING	0.6/1kV （1500 V）	
STANDARD	EN50618:2014	

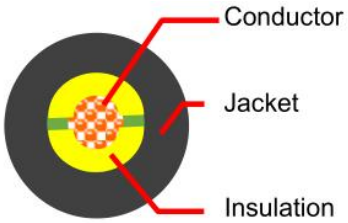
CONDUCTOR	Material	Tinned copper
	Size	4.0mm 2
	Construction	56
		0.282 ± 0.005 mm
INSULATION	Material	XLPE
	Diameter	3.90±0.15
	Average thickness	≥0.7 mm
	Thickness minimum	≥0.53 mm
	Color	Black
JACKET	Material	XLPE
	Finished diameter	5.6±0.15mm
	Color	Black or Red
Request	1	Flame Resistance : IEC 60332-1
	2	Bending radius: 5 x OD
	3	Temperature Range: -40℃ to +90℃
	4	Anti-UV:HD 605/A1
	5	Max.conductor temperature: 120℃
	6	Voltage 6.5KV(a.c.)/5min,50HZ
Conductor resistance		<3.39 (Ω/Km, 20℃)

1.6.2 AC Cable

STYLE	NYY-J			
RATING	600/1000V			
STANDARD	VDE0276-603, IEC60502			
SIZE			5G4mm ²	5G6mm ²
CONDUCTOR	Material		Bare copper	
	Size		4.0mm2	6.0mm2
	Construction		73	109
			0.25 ± 0.008 mm	0.25 ± 0.008 mm
INSULATION	Material		FRPVC	
	Diameter		4,50 ± 0,15mm	5,4 ± 0,15 mm
	Average thickness		1.0 mm	1.2 mm
	Thickness minimum		≥0,8 mm	⩾0,98 mm
	Color		Yellow-Green Blue Brown Black Grey	
Strand	Fill		PP	
	Finished diameter		12.2 mm	14.6 mm
JACKET	Material		FRPVC	
	Finished diameter		16,3 ± 0,5 mm	19,1 ± 0,5 mm
	Color		BLACK	
PHYSICL PROPER	INSULATION	Elongation	>100 %	
		Tensile Strength	⩾10MPa	⩾10MPa
Request	1		Flame Resistance : IEC 60332-1-2	
	2		Bending radius: 10 x OD	Bending radius: 10 x OD
	3		Temperature Range: -15℃ to +70℃	Temperature Range: -15℃ to +70℃
	4		Test Voltage:4000V	Test Voltage:4000V

	5	Max.conductor temperature: 70℃	Max.conductor temperature: 70℃
	6	Max.short circuit temperature:160 ℃ , not more than 5sec	Max.short circuit temperature:160 ℃ , not more than 5sec
Conductor resistance		<4.95(Ω/Km, 20℃)	<3.3 (Ω/Km, 20℃)

1.6.3 Earthing Cable

STYLE		NYY-J	
SIZE		1C*6.0mm²	
RATING		600/1000V	
STANDARD		VDE0276-603, IEC60502	
CONDUCTOR	Material		Bare copper
	Size		6.0mm2
	Construction		109
			0.25 ± 0.008 mm
INSULATION	Material		FRPVC
	Diameter		5.4±0.30mm
	Average thickness		1.2 mm
	Thickness minimum		0.98 mm
	Color		Yellow/Green
JACKET	Material		FRPVC
	Finished diameter		9.5±0.20mm
	Color		BLACK
PHYSICL PROPER	INSULATION	Elongation	>100%
		Tensile Strength	>10Mpa
Request	1		Flame Resistance : IEC 60332-1-2
	2		Bending radius: 10 x OD
	3		Temperature Range: -15℃ to +70℃
	4		Test Voltage:4000V
	5		Max.conductor temperature: 70℃
	6		Max.short circuit temperature:160 ℃ ,not more than 5sec
Conductor resistance			<3.3(Ω/Km, 20℃)

2 Safety

2.1 Safety notice

The AC Box is used in Enpal.home residential PV Systems, which is a new energy generation system that uses PV modules to generate electricity for household loads. Improper use of AC Box may cause harm to life and health of the user or third parties as well as damage to the AC Box and other items. The following points must therefore be observed to comply with the intended use of the system:

- Before performing operations, read through this manual and follow all the precautions to

prevent accidents. The DANGER, WARNING, CAUTION, and NOTICE statements in the document do not represent all the safety instructions. They are only supplements to the safety instructions.

- Only certified electricians are allowed to install, connect cables for, commission, maintain, and troubleshoot the product，and they must understand basic safety precautions to avoid hazards.
- The transport and storage conditions must be observed.

2.2 Disclaimer

Enpal shall not be liable for any consequence caused by any of the following events:

- Damage during the transportation by the customer
- Storage conditions that do not meet the requirements specified in this document.
- Incorrect storage, installation, or use
- Installation or use by unqualified personnel
- Failure to follow the operation instructions and safety precautions in this document
- Operation in extreme environments which are not covered in this document
- Operation beyond specified ranges.
- Unauthorized modifications to the product or software code or removal of the product

- Device damage due to force majeure (such as earthquake, fire, and storm)
- Warranty expiration without extension of warranty service.
- Installation or use in environments which are not specified in relevant international standards

2.3 Operator requirements

The installation, electrical connection, commissioning, maintenance, troubleshooting and replacement of the AC Box must be performed by professional technicians. The operator must meet the following requirements:

- Operation personnel should receive professional training and instructions.
- Operation personnel should read through this document and follow all the precautions.
- Operation personnel should be familiar with the safety standards relevant to electrical systems.
- Operation personnel should understand the composition and working principles of the grid-tied PV system and be aware of local regulations.
- Operation personnel must wear proper personal protective equipment (PPE).

2.4 Protecting Labels

Do not scrawl, damage, or block any warning label on the device.

3 Transportation and storage

If the AC box does not need to be installed for the time being, the following should be noted when storing.

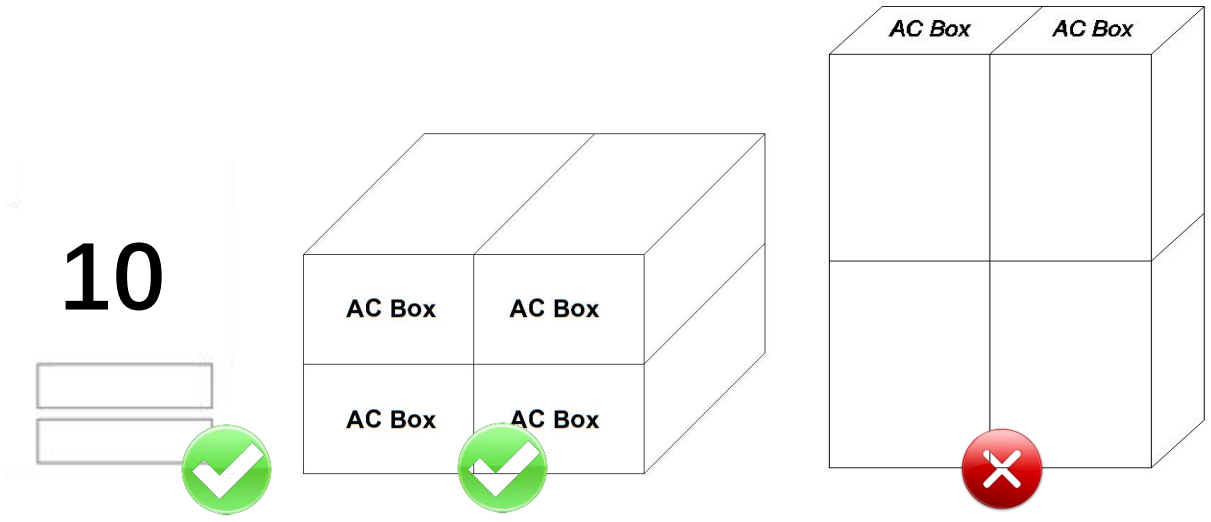
3.1 Storage environment

The AC Box shall be stored in a cool, dry, water-free steam-free or corrosive gas-free, dust-free environment with ambient temperature not exceeding -30℃~70℃.

Design protection grade of AC Box is IP54, but before installing wiring, the inlet and outlet holes are not locked and may be in open state. At this point, if exposed to rain or water vapor, ingress of water vapor or corrosive gas into the combiner box may occur, and then affect the electrical performance of the combiner box and safe use.

3.2 Stacking Restrictions

The AC Box should be stacked horizontally, and vertical stacking is prohibited.



Stack limited　　Horizontally Stack　　Vertically Stack

When horizontally stack, the layer should be no more than 8.

3.3 Using after long-term storage

If the AC Box is stored for more than one year, it needs to be checked and tested by professional person before using, or contact the manufacturer.

4 Equipment installation and wiring

4.1 Checking Before AC Box Installation

The following cautions should be noticed before installing the AC Box.

DANGER

Electric shock! Non-Professional operation is prohibited.

Be sure the power is off during installation and maintenance/operation.

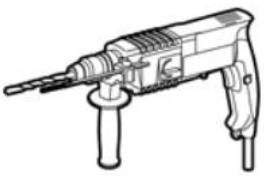
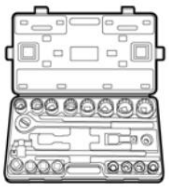
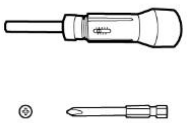
DANGER

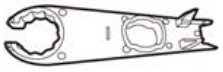
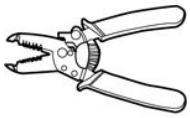
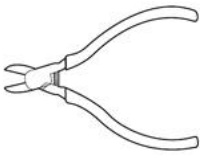
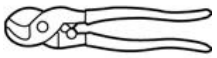
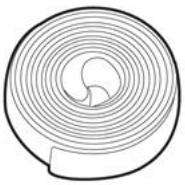
Do not operate AC IN or AC OUT plug when load is on.

DANGER

If the AC IN or AC OUT plug need to be pulled out, make sure both of them are pulled out, don't leave only one of the plugs connected on the box. After pulled out both the plugs, wait for no less than 2 minutes to make sure no electricity is left in the box.

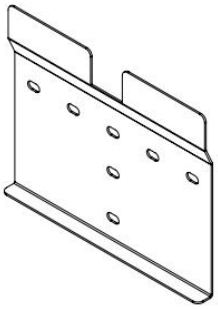
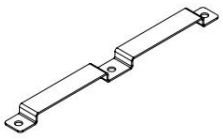
4.2 Installation tools

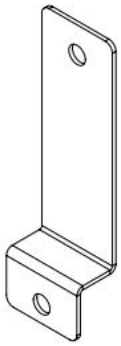
Type	Tools			
Installation Tools				

	Hammer drill: Drill bit: Φ8 mm	Socket wrench set	Multimeter DC voltage measurement range ≥ 1100 V DC	Torque screwdriver Phillips head: M3
				
	Removal wrench Model: H4TW0001; manufacturer: Amphenol	Crimping tool Model: H4TC0003/H4TC0002 ; manufacturer: Amphenol	Wire stripper	Diagonal pliers
				
	Utility knife	Cable cutter	OT terminal crimping tool	Hammer
				
	Measuring tape	Bubble or digital	Vacuum cleaner	Heat shrink

		level		tubing
				
	Heat gun	Cable tie	Marker	
PPE				
	Safety gloves	Safety goggles	Anti-dust respirator	Safety shoes

4.3 Mounting Accessories

No	Item	Picture	Quantity
1	Mounting Plate-A		1pcs
2	Mounting Plate-B		1pcs

3	Mounting Plate-C		1pcs
4	Screws		4pcs
5	Plastic Wall Plugs		4pcs

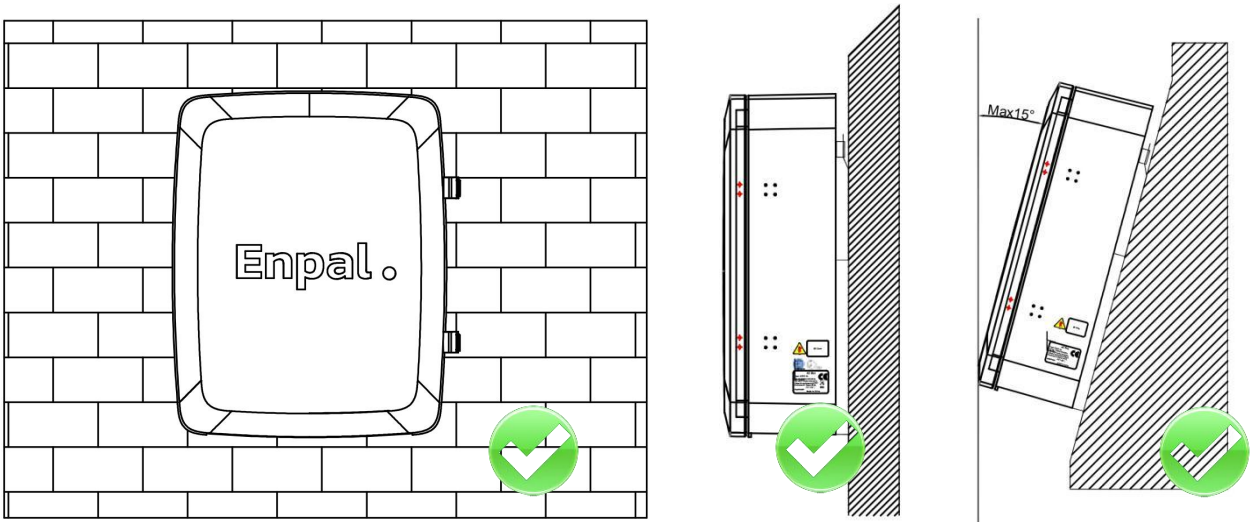
4.4 AC Box installation

4.4.1 Bolt AC Box to wall

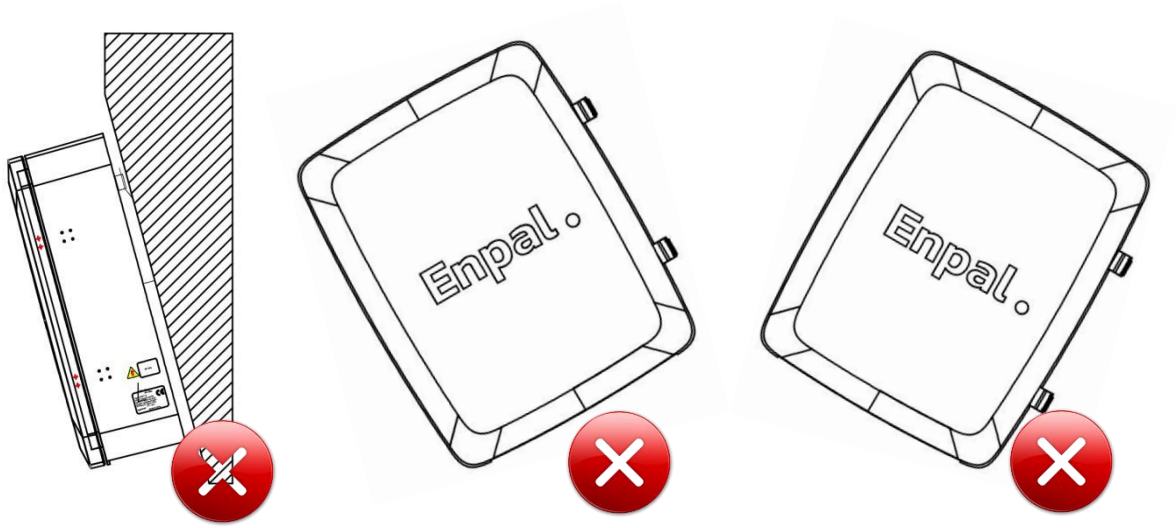
The AC Box can only be installed indoor, far from heat sources.

The AC Box should be bolted on the wall with a right angel like bellow.

The AC Box should be installed under the following Installation tilts



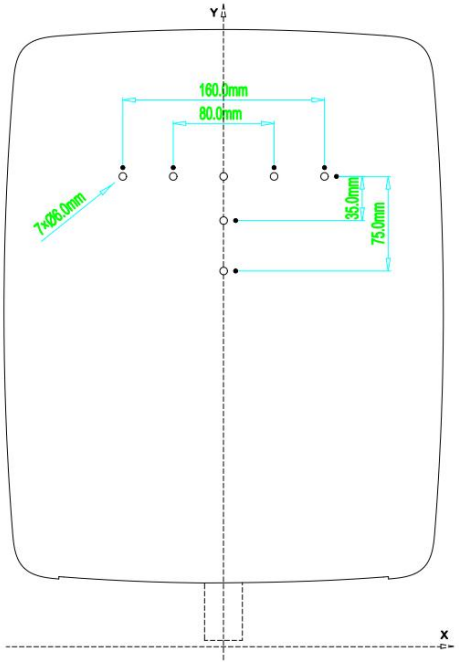
Right installation tilts



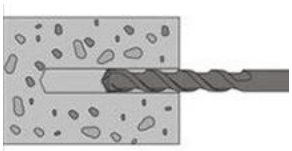
Wrong installation tilts

Figure 4-11 Installation tilts of the AC Box

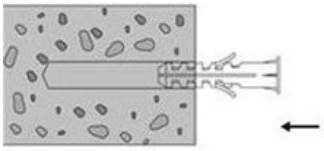
Step 1 Determine the installation positions for drilling holes, and mark the positions using a marker. Drill installation holes on the wall, Knock in the wall lugs, mount the Mounting Plate-A. Four installation holes are need, the distance between holes is like bellow:



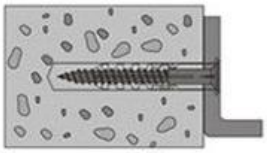
Mark the position of 4 holes with template



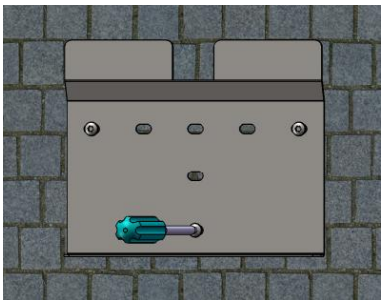
Drill 4 ×∅ 10 holes on the wall



Knock in the wall lugs



Mount the plate



Mounting Plate-A

Figure 4-12 Drill holes on the wall and mount the Mounting Plate-A

Step 2 Install the Mounting Plate B&C onto the AC Box enclosure.

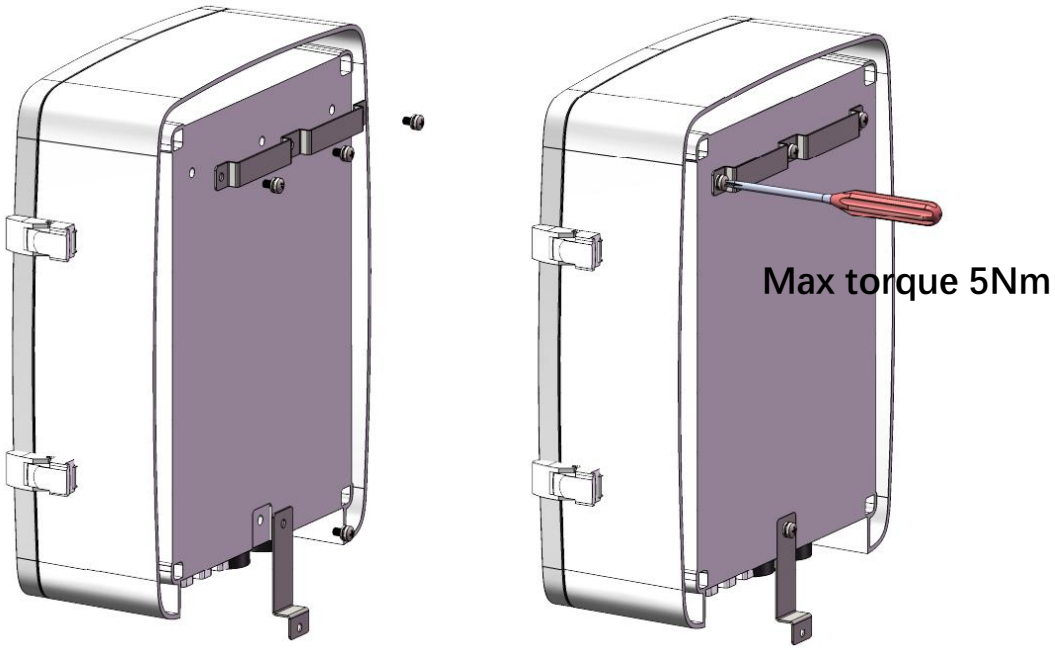


Figure 4-13 Install mounting ears on the AC Box

Step 3 Hung the AC Box onto the back plate, and fasten the plate on the bottom.

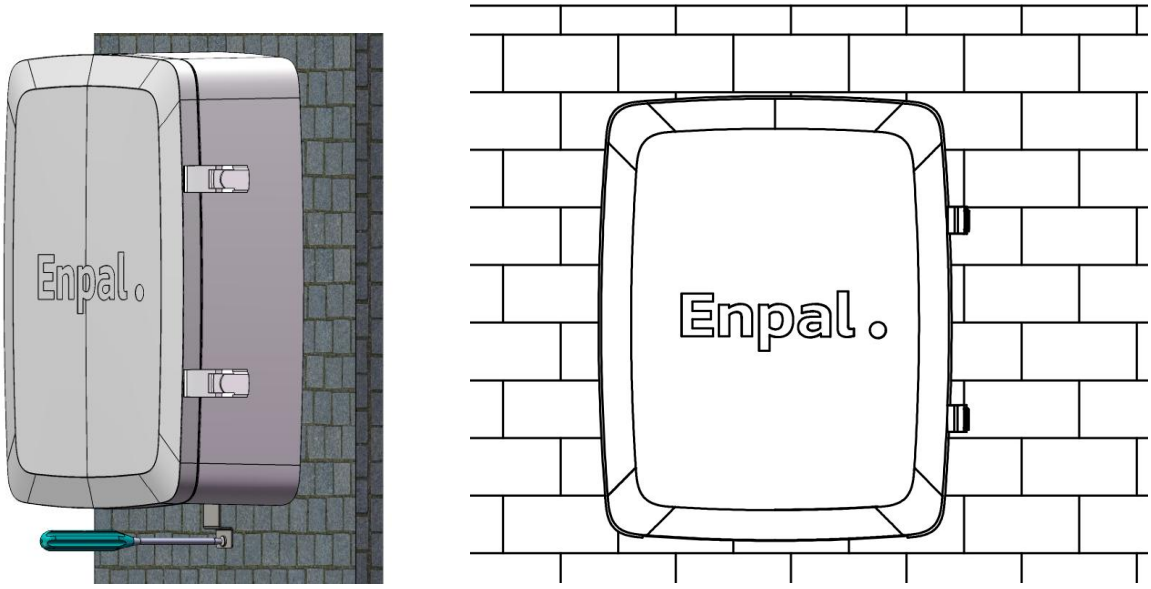
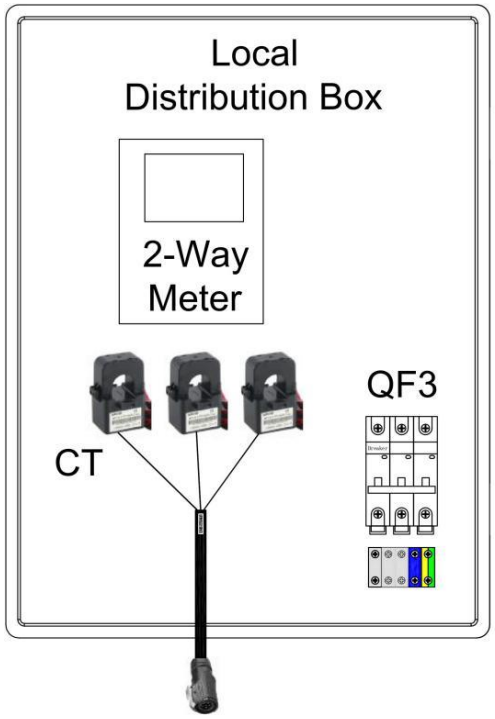


Figure 4-14 Installed AC Box, fasten the bottom ears

4.4.2 Install QF3 and other components in local distribution box

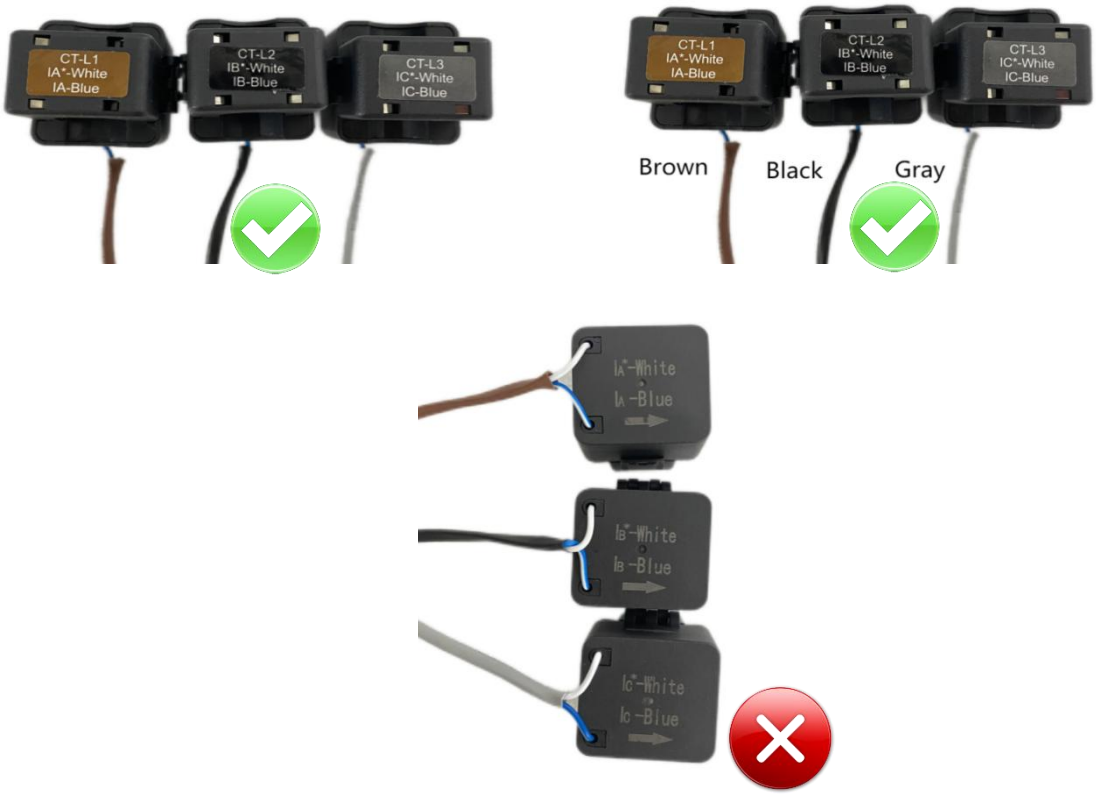
Install QF3 and terminal blocks into local distribution box.

Install CTs into local distribution box.



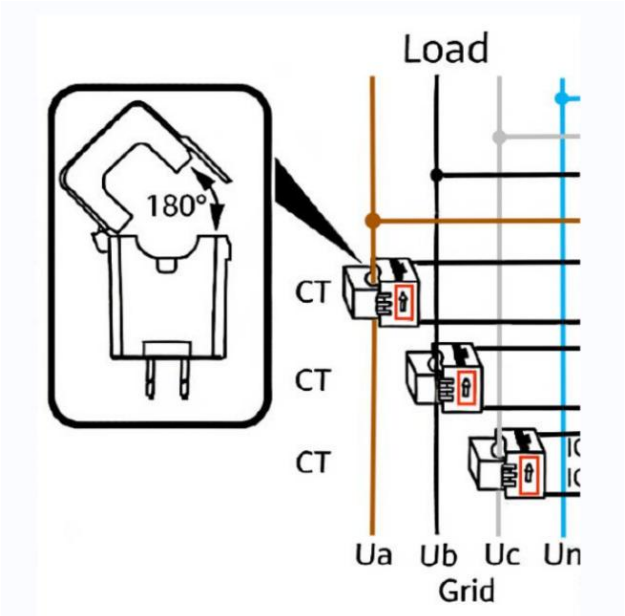
4.4.3 Current Transformer installation.

Step 1: install CT according to the corresponding CT number which label marked on top of CT, or distinguish CT by its shrinkage tube: CT-L1 brown, CT-L2 Black, CT-L3 Grey.



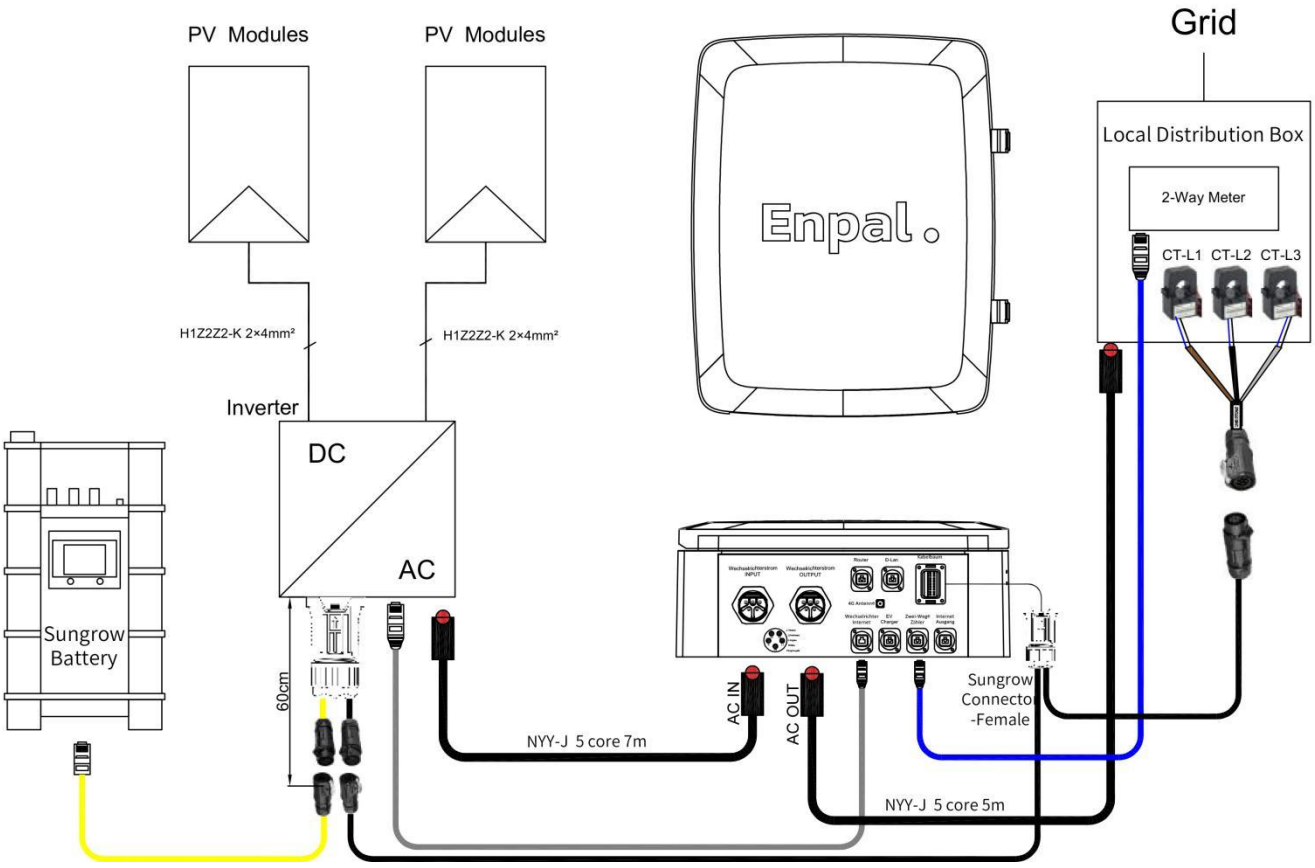
ignore the printing on bottom of CT.

Step 2: The CT installation must be consistent with the arrow direction as shown in the preceding figure.



4.5 Electrical connections

- Connect AC IN of AC box to AC Output Port of Inverter with NYY-J 5×4mm²/ 5×6mm² cable.
- Connect AC OUT of AC Box to local distribution box with NYY-J 5×4mm²/ 5×6mm² cable.
- Connect Sungrow connector to AC Box.
- Connect 6 pin poka-yoke connector with CT connector;
- Connect 4 pin poka-yoke connector with Inverter poka-yoke connectors.
- Install the 4G antenna
- Connect blue Ethernet cable with 2-way meter Ethernet port;
- Connector Gray Ethernet cable with Inverter dongle port;



screw and lcok the AC connector cover on AC IN/AC out connector, refer below pic.

Install the AC Connector Cover.

4.5 4G Antenna and Extension Cable connections

4.5.1 4G Antenna installed on AC Box without Extension Cable

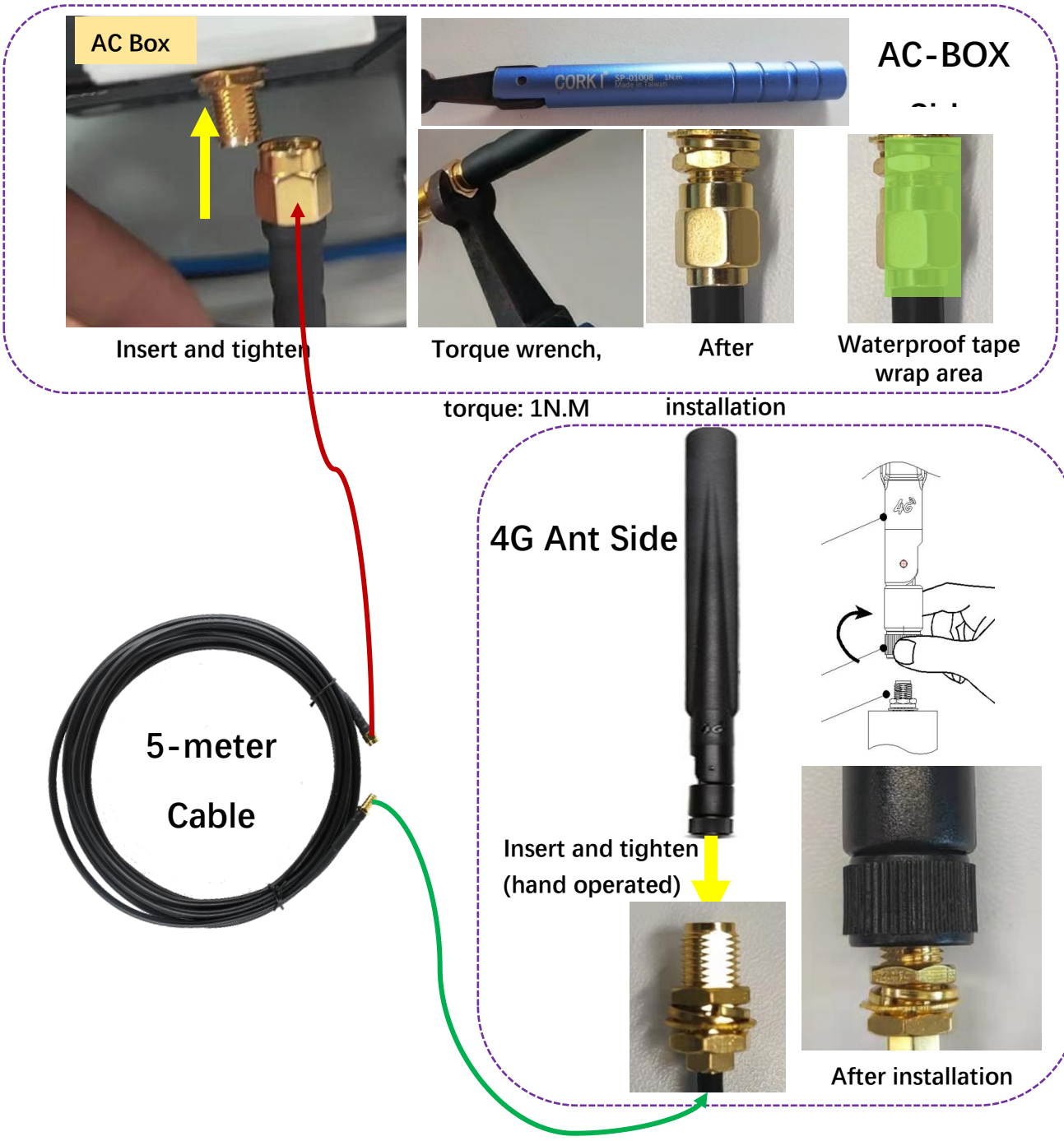
If 4G signal good enough, the 5 meter extension cable may also not needed. In this case, just need connect the 4G antenna on the AC Box

NOTICE

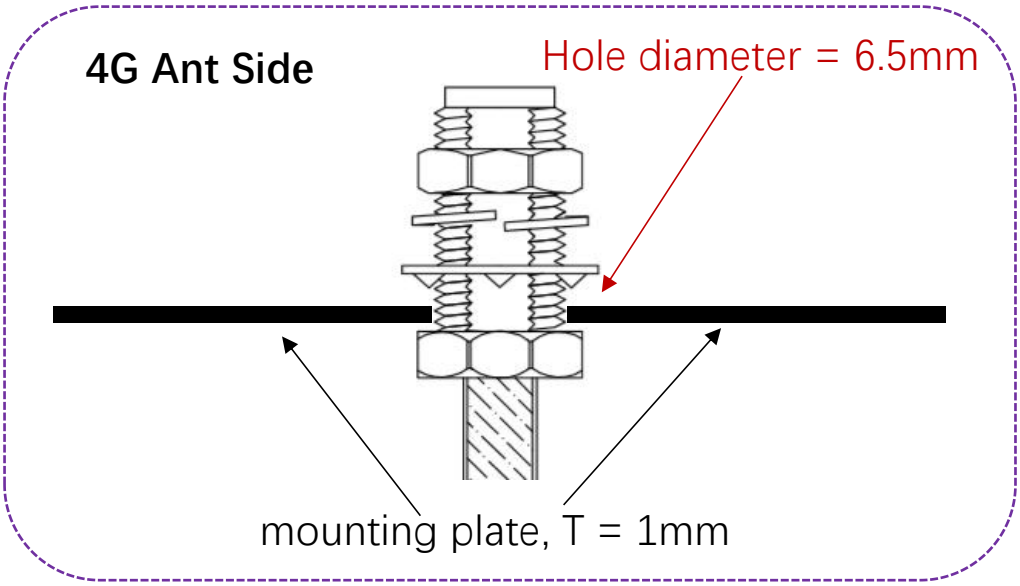
- If D-Lan is used instead of 4G, the 20cm Ethernet cable in the package must be used to connect the D-Lan port with router port;
- If customer router in user's house is used instead of 4G or D-Lan, the user needs to use an additional Ethernet cable to connect the Router port to user's router.

4.5.2 4G Antenna installed with Extension Cable

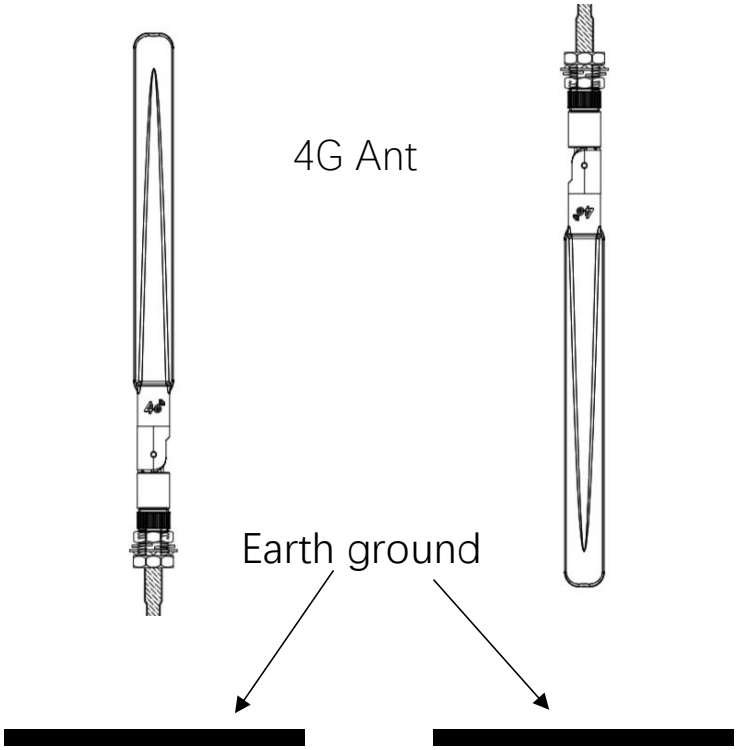
If 4G signal is not good enough, one or more 5m antenna extension cables can get used to extend the antenna to a better-suited location.



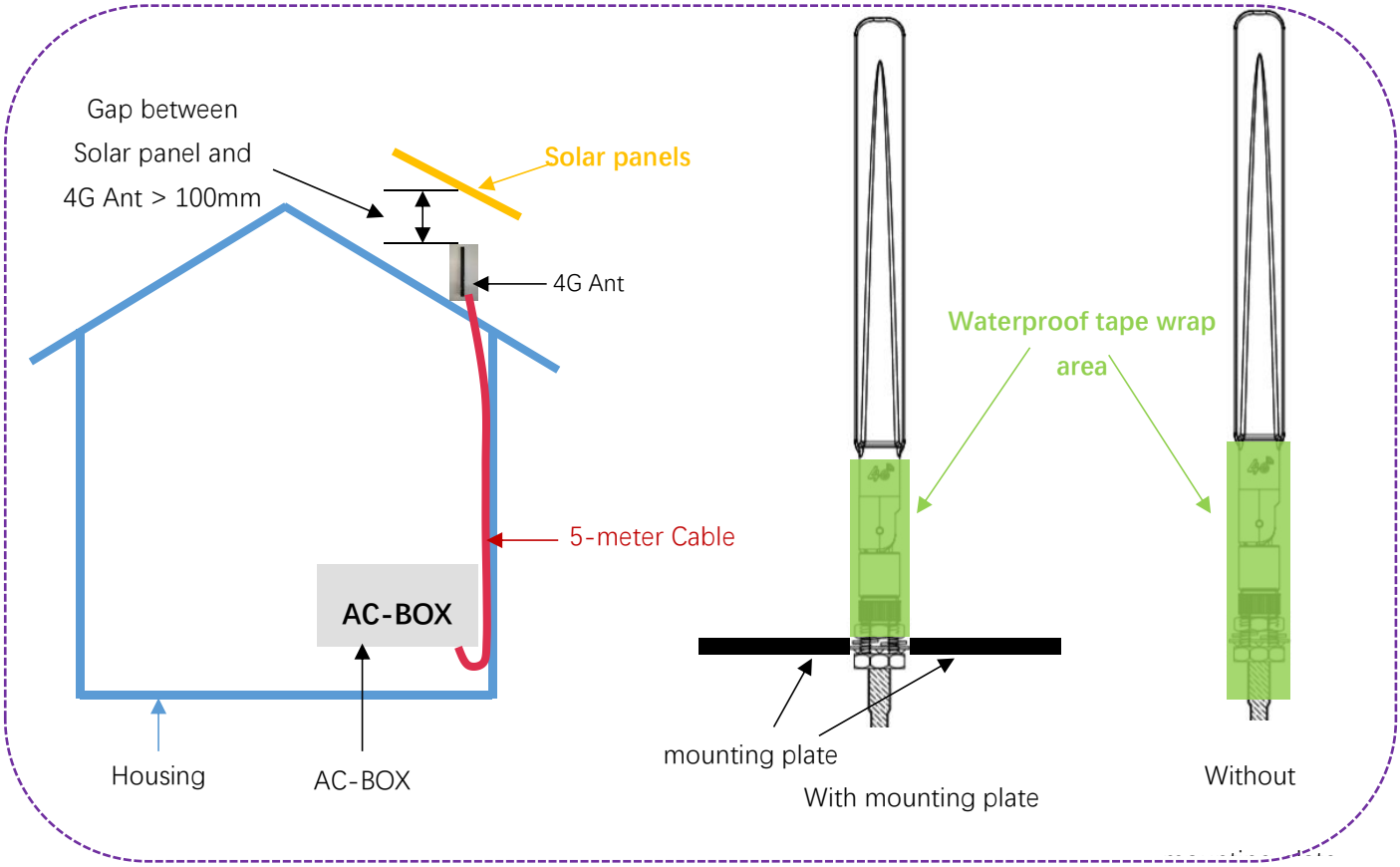
The SMA-Female connector of the 5-meter cable is recommended to be fixed with a piece of 1mm thick mounting plate (Φ 6.5mm hole suggested), and then install the 4G Ant



When used indoors, the antenna needs to be installed vertically to the earth ground.



When used outdoors(in the rain), the antenna also needs to be installed vertically to the earth ground, and from the bending area of the antenna to the SMA-Female connector needs to be wrapped with waterproof tape to prevent the rainwater from damaging the antenna (as shown in following Picture 2). (highly recommended)



5 Power on the AC Box

5.1 Check Before Power-On

Table 6-1 Installation checklist

No.	Check Item	Acceptance Criteria
1	Inverter installation	The inverter is installed correctly, securely, and reliably.
2	Smart Dongle	The Smart Dongle is installed correctly and securely.
3	Cable layout	Cables are routed properly as required by the customer.
4	Cable tie	Cable ties are secured evenly, and no burr exists.
5	Grounding	The grounding cable is connected correctly, securely, and reliably.
6	Turn off the switches	The DC SWITCH and all the switches connected to the inverter are set to OFF.
7	Cable connections	The AC output power cable and DC input power cable are connected correctly, securely, and reliably.
8	Unused terminals and ports	Unused terminals and ports are locked by watertight caps.
9	Installation environment	The installation space is proper, and the installation environment is clean and tidy, without foreign matter.

5.2 Powering on the AC Box

NOTICE

Before turning on the AC switch between the Inverter and the power grid, use a multimeter set to the AC position to check that the AC voltage is within the specified range.

Procedure

Step 1 Turn on the AC switch between the inverter and the power grid.

Step 2 If there is a DC switch between the PV string and the inverter, turn on the DC switch.

Step 3 Set the DC SWITCH at the bottom of the inverter to the ON position.

Step 4 Wait for about 1 minute, and then observe the LED indicators of the inverter to check the running status.

6 Troubleshooting of AC Box

Table 7-3 Troubleshooting of AC Box

No.	Faults	Possible Cause	Troubleshooting Suggestion
1	QF1 Trip	Connections between AC Box and Inverter fault, maybe a short-circuit happened. Maybe breaker fault.	Check the connection between AC Box and the inverter. Replace the broken QF1 breaker.
2	QF2 Trip	a leakage fault happened on the D-Lan extender, or Ethernet switch, or IOT. QF2 broken.	Remove the cover plate and check the circuit behind QF2. Replace QF2.
3	No Wi-Fi signal	Ethernet connection in the house fault. The main module of the D-Lan powered off. The submodule of the D-Lan in the AC Box not connected well with the socket.	Check the Ethernet connection of the house. Check if the main module of the D-Lan is connected with the socket and router. Check the sub module of the D-Lan the AC Box
4	The energy meter and D-Lan not working	Maybe the connection of AC IN and AC OUT is not OK, or energy meter / D-Lan failed.	Re-connect the AC IN and AC OUT connector; still not OK, remove the cover plate of the AC Box, check the voltage of QF1 terminals; or try another connector. If the voltage of QF1 terminals is

No.	Faults	Possible Cause	Troubleshooting Suggestion
			within 400V±30V，Please contact us to replace the energy meter and D-Lan.

7 Removing and Disposing of AC Box

NOTICE

- Before removing the AC box, disconnect both the AC power supplies. After powering off the AC box, wait at least 5 minutes before performing operations on the AC box.

Perform the following operations to remove the AC box:

- Disconnect all cables from the AC box, including communications cables, AC output power cables and GND cables.
- Remove the AC box from the mounting bracket on the wall.