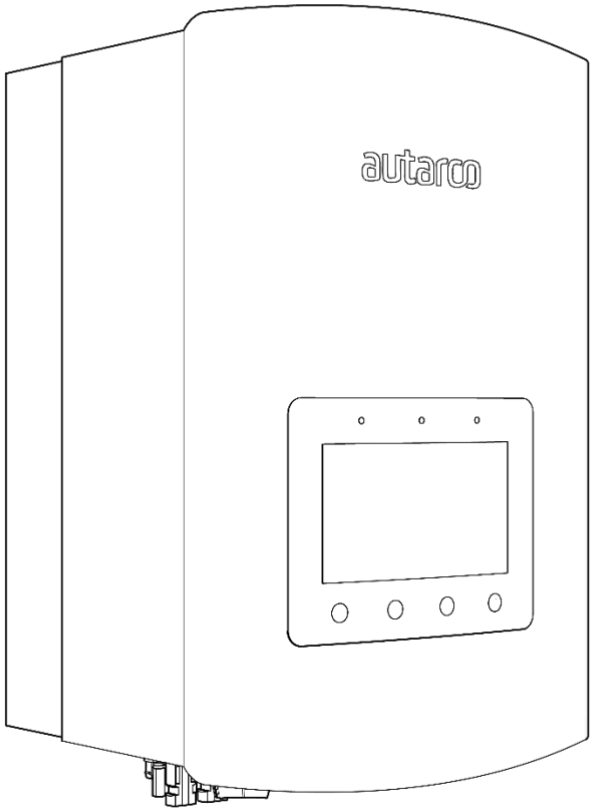
Installation and Operation Manual

Hybrid Solar Inverters MH series



Contact Information

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Other Information

This manual is an integral part of the unit. Please read the manual carefully before installation, operation or maintenance. Keep this manual for future reference.

Product information is subject to change without notice. All trademarks are recognized as the property of their respective owners.

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1 Introduction

1.1 Read this first

This manual contains important information for use during installation and maintenance of the MH series Autarco inverter.

To reduce the risk of electrical shock, and to ensure the safe installation and operation of the MH series Autarco inverters, the following safety symbols appear throughout this document to indicate dangerous conditions and important safety instructions.

WARNING! Indicates safety instructions, which if not correctly followed, could result in injury, death or property damages.

Indicates important safety instructions, which if not correctly followed, could result in damage to or the destruction of the inverter.

RISK OF ELECTRIC SHOCK! Indicates important safety instructions, which if not correctly followed, could result in electric shock.

HOT SURFACE! Indicates safety instructions, which if not correctly followed, could result in burns.

1.2 Target Audience

This manual is intended for anyone who uses Autarco MH series inverter. Before any further action, the operators must first read all safety regulations and be aware of the potential danger to operate high-voltage devices. Operators must also have a complete understanding of this device's features and functions.

ATTENTION! Qualified personnel means a person with valid license from the local authority in:

- Installing electrical equipment and PV power systems (up to 1000 V)
- Applying all applicable installation codes and using Personal Protective Equipment
- Analyzing and reducing the hazards involved in performing electrical work

WARNING! Do not use this product unless it has been successfully installed by qualified personnel in accordance with the instructions in chapter 4 Installation.

1.3 Product versions covered by this document

The main purpose of this user manual is to provide instructions and detailed procedures for installing, operating, maintaining, and troubleshooting the MH series of Autarco hybrid inverters which includes the following models:

- S2.MH3000
- S2.MH3600
- S2.MH4600
- S2.MH5000
- S2.MH6000

The 'S2' in the product code indicates that this product belongs to our product group of inverters, hybrid inverters, retrofit battery chargers and monitoring devices.

The item code or SKU will include an additional number at the end. The final number references the default grid standard and colour of inverter. For example, S2.MH5000.1 is the 5kW model with Dutch grid standard as default and Autarco blue cover.

Please keep this user manual available at all times in case of emergency.

2 Preparation

2.1 Safety instructions

DANGER! Do not touch any internal components whilst the inverter is in operation.

DANGER! Do not stand close to the inverter during severe weather conditions such as lighting, etc.

DANGER! Make sure you completely cover the surface of all PV arrays with opaque (dark) material before wiring them or make sure the DC circuit breaker or equivalent DC isolator is disconnected. This is because photovoltaic (PV) arrays create electrical energy when exposed to light, and could cause a hazardous condition.

WARNING! The MH series inverter must only be operated with PV arrays of protection class II, in accordance with IEC 61730, class A.

WARNING! The PV inverter will become hot during operation; please don’t touch the heat sink or peripheral surface during or shortly after operation.

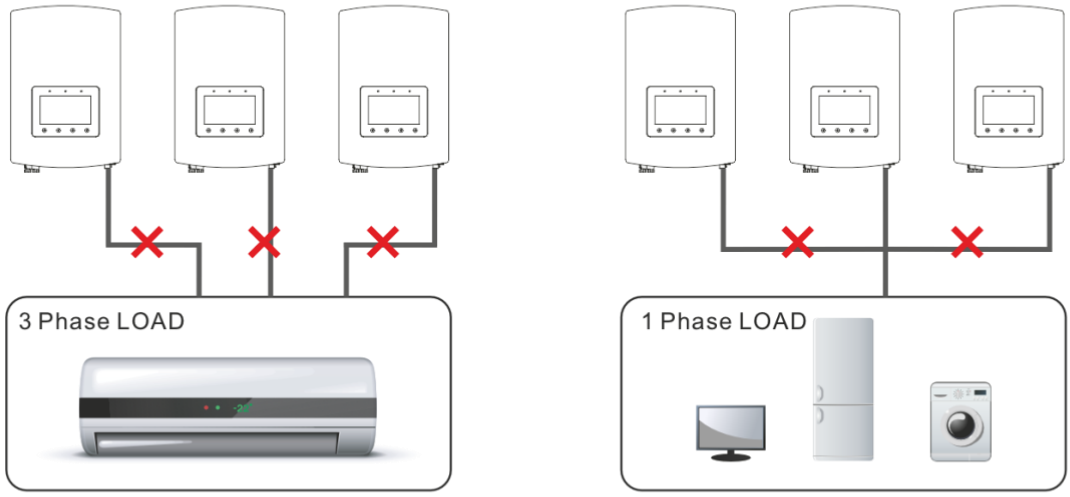
NOTICE! Do not directly connect AC output of the inverter to any private AC equipment. The PV inverter is designed to feed AC power directly into the public utility power grid.

NOTICE! The MC4 connectors supplied in the box with the inverter are to be used to make the connections with the inverter (Staubli MC4M-PV-KST4-6II-UR / MC4F-PV-KST4-6II-UR).

WARNING! The installation, service, recycling and disposal of the inverters must be performed by qualified personnel in compliance with national and local standards and regulations. Please contact your dealer to get the information of authorized repair facilities for any maintenance or repairmen.

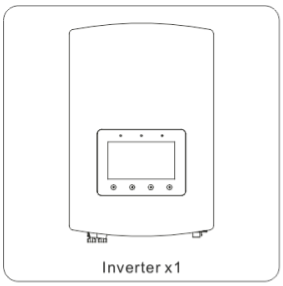
Any unauthorized actions including modification of product functionality of any form will affect the validation of warranty service; Autarco may deny the obligation of warranty service accordingly.

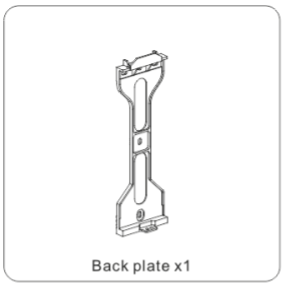
WARNING! The RHI-5G Series does not support parallel (three- and single-phase) operation on the AC-BACKUP port. Parallel operation of the unit will void the warranty.



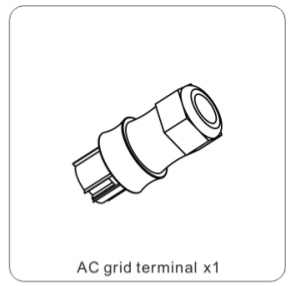
WARNING! Please refer to the specification of the battery before configuration.

2.2 Package contents

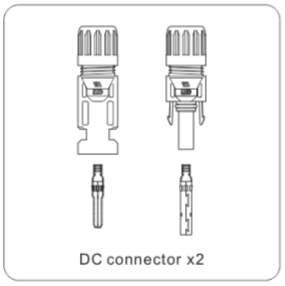

Inverter x1


Back plate x1

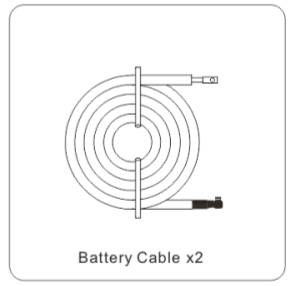

Fastening screw x3

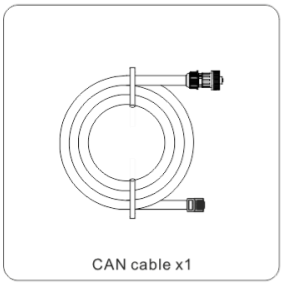

AC grid terminal x1

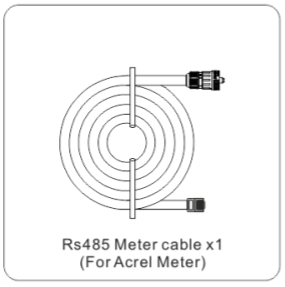

AC backup terminal x1

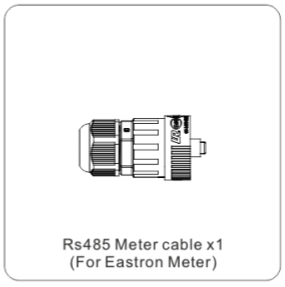

DC connector x2

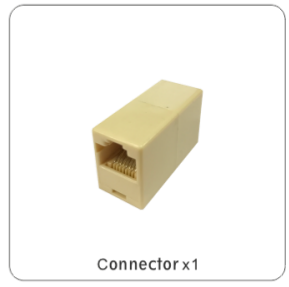

RJ45 connector x1(Only for UK)

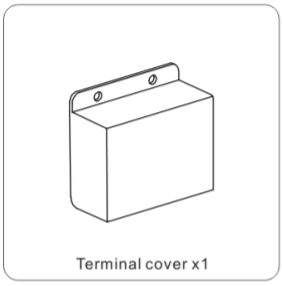

Battery Cable x2

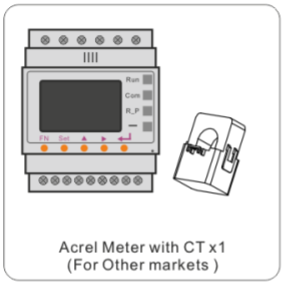

CAN cable x1


Rs485 Meter cable x1
(For Acrel Meter)

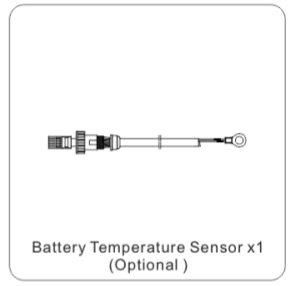

Rs485 Meter cable x1
(For Eastron Meter)

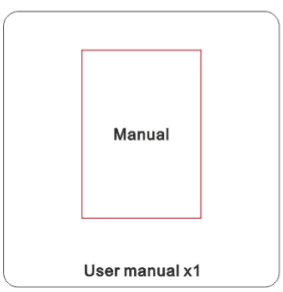

Connector x1


Terminal cover x1


Acrel Meter with CT x1
(For Other markets)


Eastron Meter with CT x1
(For Italian market Only)


Battery Temperature Sensor x1
(Optional)



User manual x1

2.3 Internal DC switch

Please verify whether your Autarco MH series inverter is equipped with internal DC switches. This switch can be found on the bottom of the inverter. If there isn't an internal DC switch it is important to apply an external DC switch in order to completely disconnect the solar PV module strings from the inverter.

2.4 Explanations of symbols on inverter

	**DANGER - HIGH ELECTRIC VOLTAGE** This device is directly connected to public grid. All work to the inverter shall be carried out by qualified personnel only. There might be residual currents in inverter for up to 10 minutes because of large capacitors.
	**ATTENTION** This device is directly connected to electricity DC generators and the public AC grid.
	**DANGER – HOT SURFACES** The components inside the inverter will get hot during operation, DO NOT touch aluminum housing during operating.
	**ATTENTION** In case of any work to the inverter, always refer to this manual for detailed product information.
	**ATTENTION** This device SHALL NOT be disposed of in residential waste. Please go to chapter 9 Recycling and Disposal for proper treatments.
	**CE MARK** This equipment conforms to the basic requirements of the EU guideline governing low voltage and electromagnetic compatibility.

3 Product information

3.1 Overview

Autarco MH series grid tied inverters are state of the art, high efficiency, robust and reliable hybrid inverters at the best price quality ratio available. They are easy to install and carry a standard 5 year product warranty. Our rigorous quality control and testing facilities guarantee Autarco inverters meet the highest quality standards possible. These inverters are the key to our international track record of delivering extremely reliable solar power solutions.

Key features:

- Maximum efficiency of 97.5%
- Wide MPPT voltage range
- Low turn off voltage
- High enclosure protection class IP65
- Standard 5 year product warranty, extendable to 15 years
- Multiple monitoring options
- Integrated DC switch

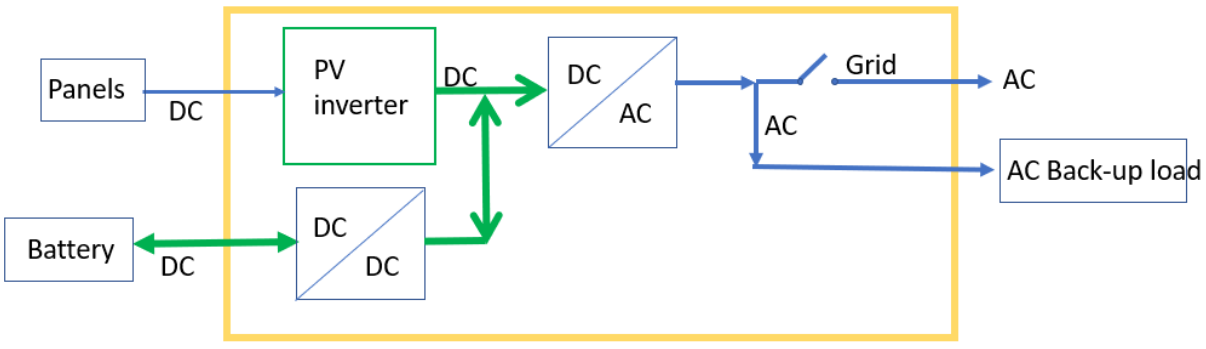
For full specifications please see chapter 10 Product Specifications.

3.2 Product identification

You can identify the inverter by the serial number (S/N) sticker on the side of the inverter. Important electrical specifications can also be found on the label which can be found on the left of the inverter housing. Do not remove the label or the serial number as this voids the product warranty.

3.3 Product overview

Find below a basic diagram of the inverter.



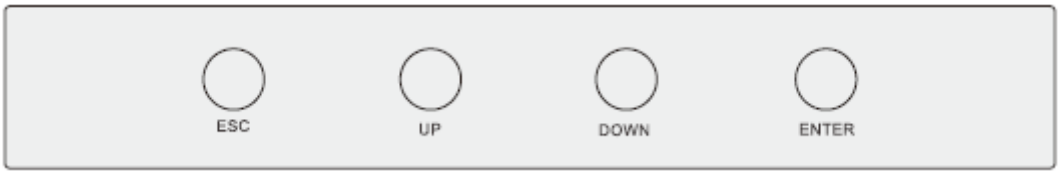
Screen

Autarco MH series has a 7 inch color screen, it displays the status, operating information and settings of the inverter.

Keypad

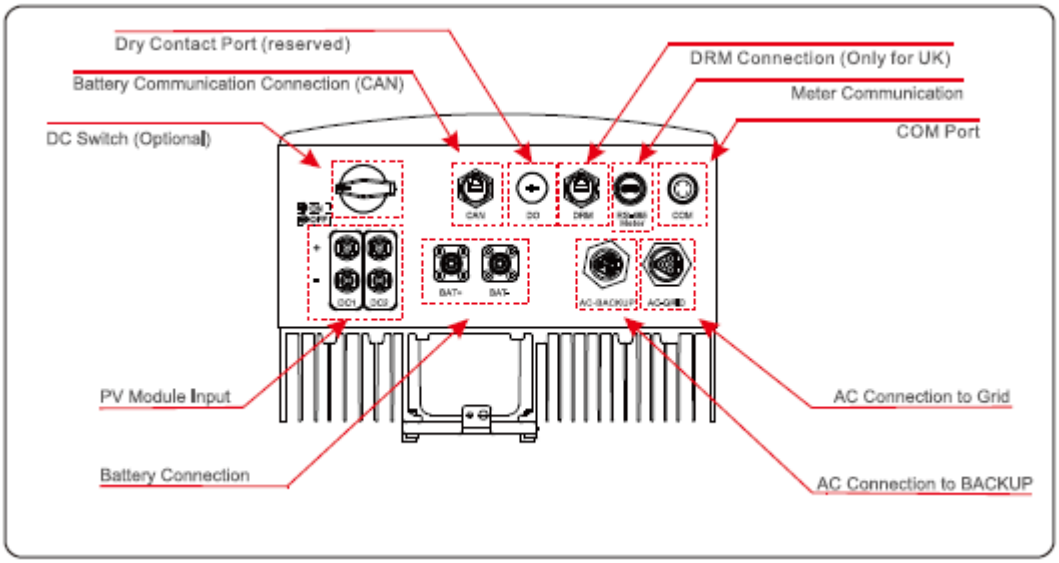
There are four keys in the front panel of the inverter (from left to right): ESC, UP, DOWN and ENTER keys.
The keypad is used for:

Scrolling through the displayed options (the UP and DOWN keys); Access and modify the settings (the ESC and ENTER keys).



Terminal connections

The Autarco MH Series inverter is different from the normal on-grid inverter, please refer to the instructions below before starting connection.



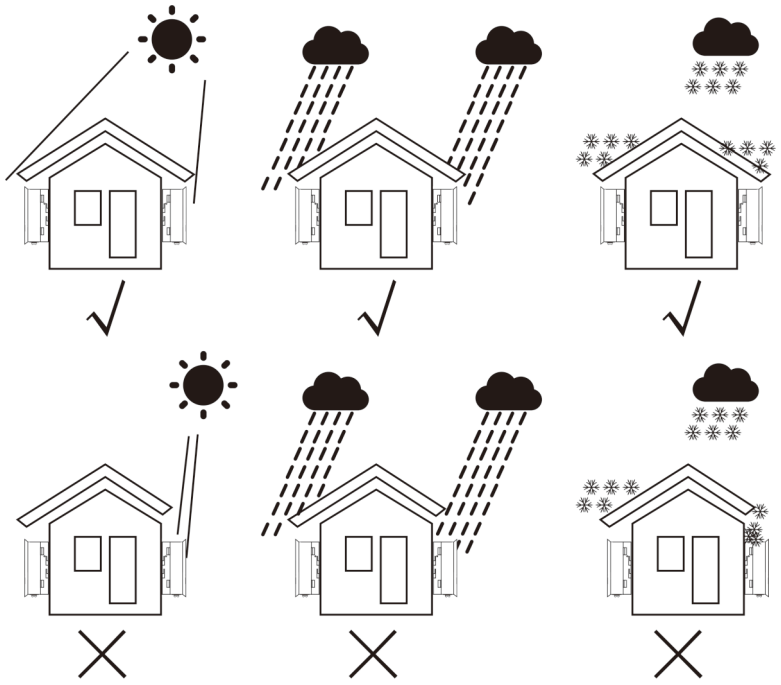
4 Installation

4.1 Select a Location for the Inverter

To select a location for the inverter, the following criteria should be considered:

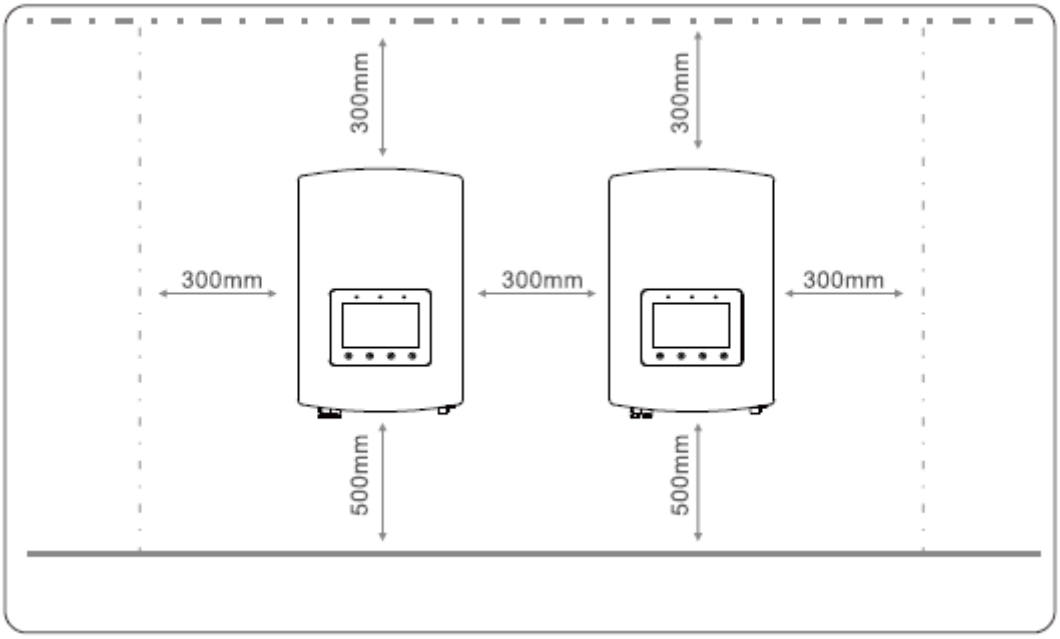
Exposure to direct sunlight may cause output power derating. It is recommended to avoid installing the inverter in direct sunlight.
It is recommended that the inverter is installed in a cooler ambient which doesn't exceed 104F/40C.

Warning: Risk of fire Despite careful construction, electrical devices can cause fire.
Do not install the inverter in areas containing highly flammable materials or gases.
Do not install the inverter in potentially explosive atmosphere.



Install on a wall or strong structure capable of bearing the weight of the inverter (17kg).
Install vertically with a maximum incline of +/- 5 degrees; exceeding this may cause output power derating.
To avoid overheating, always make sure the flow of air around the inverter is not blocked.

A minimum clearance of 300mm should be kept between inverters or objects and 500mm clearance between the bottom of the inverter and the ground.

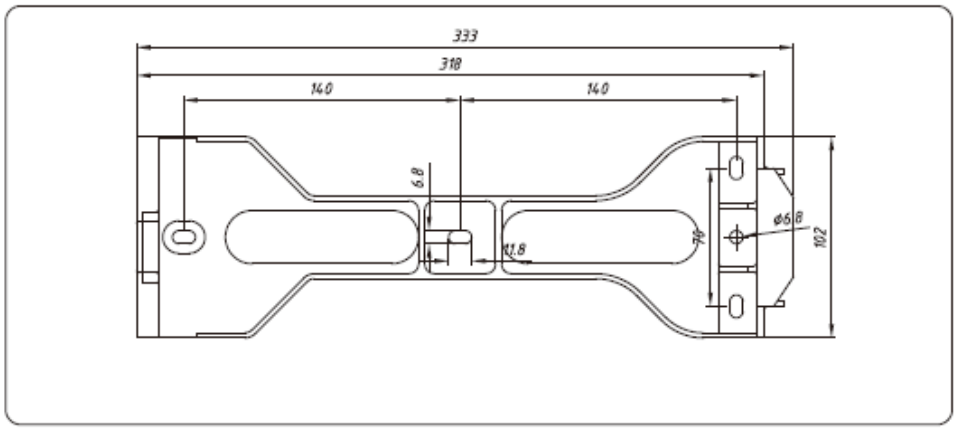


Visibility of the LEDs and LCD should be considered.
Adequate ventilation must be provided.

Note:
Nothing should be stored on or placed against the inverter.

4.2 Mounting of the inverter

Dimensions of mounting bracket:



Once a suitable location has be found accordingly to 4.1 using figure 4.3 and figure 4.4 mount the wall bracket to the wall.

The inverter shall be mounted vertically.
The steps to mount the inverter are listed below:

1. Select the mounting height of the bracket and mark the mounting holes.
For brick walls, the position of the holes should be suitable for the expansion bolts

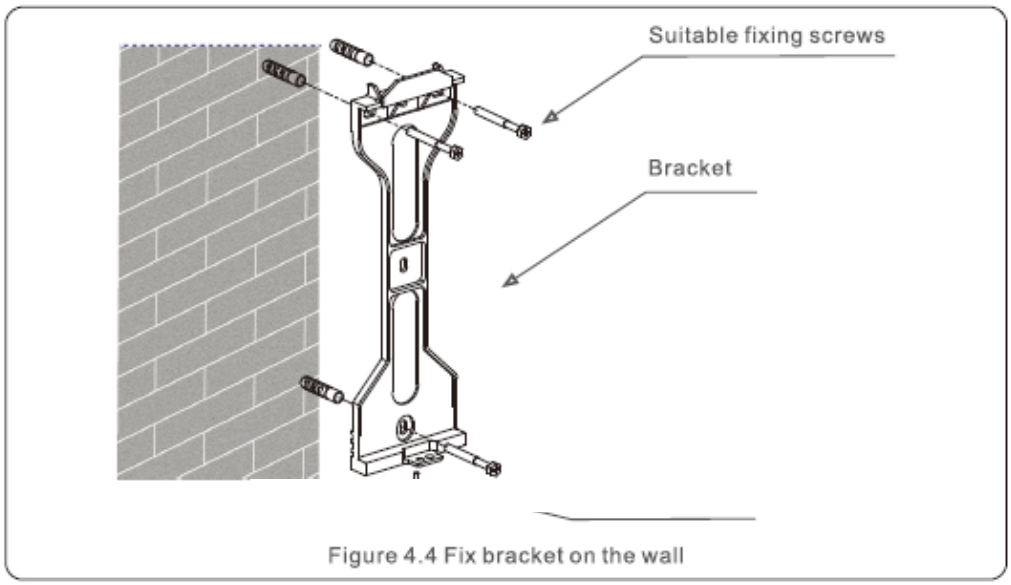


Figure 4.4 Fix bracket on the wall

2. Lift the inverter up (be careful to avoid body strain) and align the back bracket on the inverter with the convex section of the mounting bracket.
3.Hang the inverter on the mounting bracket and make sure the inverter is secure (see below)

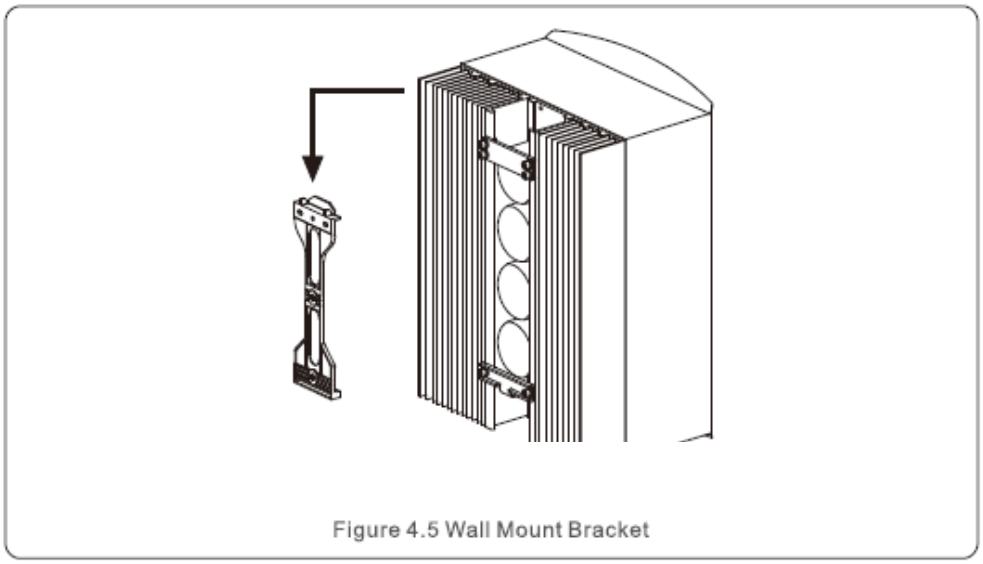


Figure 4.5 Wall Mount Bracket

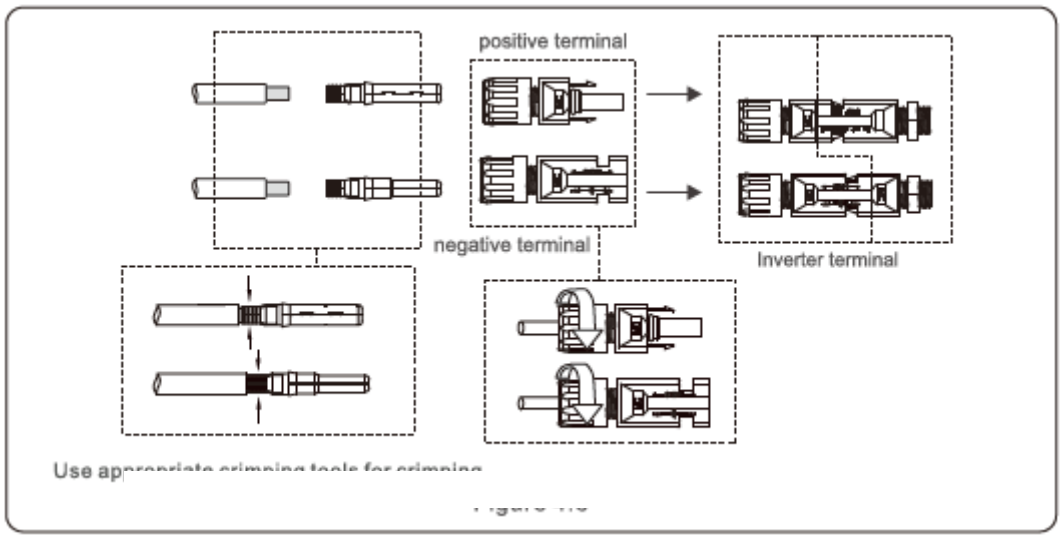
4.3 PV Input Terminal Assembly

Please ensure the following before connecting the inverter:

- Make sure the voltage of the PV string will not exceed the max DC input voltage (600Vdc). Violating this condition will void the warranty.
- Make sure the polarity of the PV connectors is correct.
- Make sure the DC-switch, battery, AC-BACKUP, and AC-Grid are all in their off-states. Make sure
- the PV resistance to ground is higher than 20K ohms.

The Autarco MH Series inverter uses MC4 connectors. Please follow the picture below to assemble the MC4 connectors.

PV wire diameter requirements: 2.5~6mm².



DANGER! Do not connect the strings with an open circuit voltage greater than the Max DC voltage of the inverter.

DANGER! For protection against electric shock, MC4 connectors must be isolated from the PV array while being assembled or disassembled.

DC connections must not be unplugged while under load. They can be placed in a no-load state by switching off the DC/AC converter or breaking the DC circuit interrupter. Plugging while under voltage is permitted.

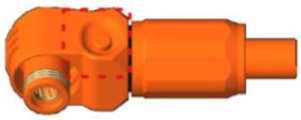
CAUTION! MC4 connectors are watertight IP67 but cannot be used permanently under water. Do not leave MC4 connectors directly on the roof surface, but always tie them up..

If any tools or parts are used in the MC4 connector assembly other than those listed in the MC4 connector manual, neither safety nor compliance with the technical data can be guaranteed.

4.4 Battery Terminal Components

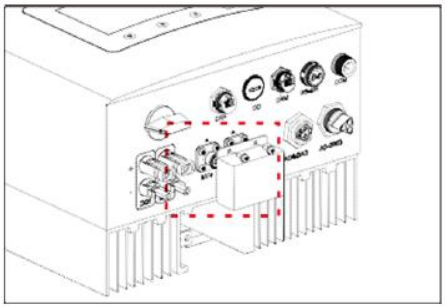
To avoid a DC Arc, Autarco recommends installing a suitable DC switch between batteries and Hybrid Inverter.
Ensure the correct polarity of batteries before connecting to the inverter.

WARNING:
Power cables use water-proof AMPHENOL connectors. When pull out the power cable, you must press the button as indicated in the right figure.



Connect the Battery cable to the inverter and make sure the positive and negative poles are correct. A "Click" sound means full connection and fasten the cables with the terminal protection cover as indicated.

Note: Before connecting the battery, please carefully read the user manual of the battery and perform the installation exactly as the battery manufacturer requests



4.5

Assembling the AC-connector

DANGER! Never connect or disconnect the connectors under load.

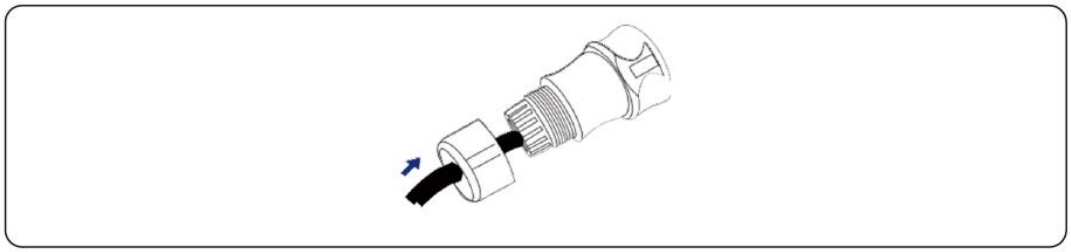
NOTICE! The AC connection to the electrical distribution grid must be performed only after receiving authorization from the utility that operates the grid.

There are two AC terminals on this inverter and the assembly steps for both are the same. Take out the AC connector parts from the packaging.

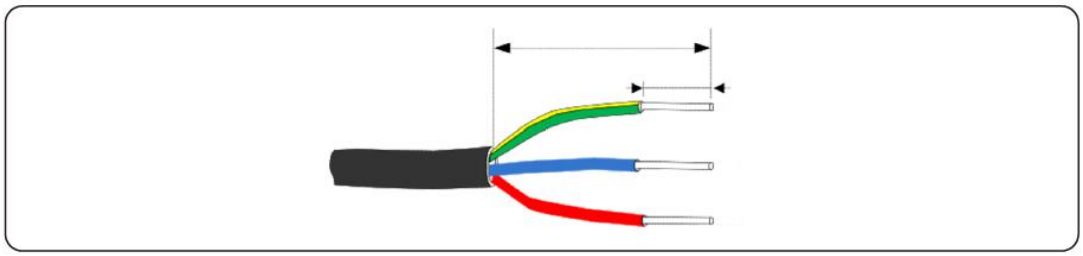
1. Make sure you use a cable within the correct specifications as shown in the image below.

Description	Numerical Value
Wire Diameter	10-12 mm
Traverse cross sectional area	2.5-6 mm2
Exposure Length	13 m

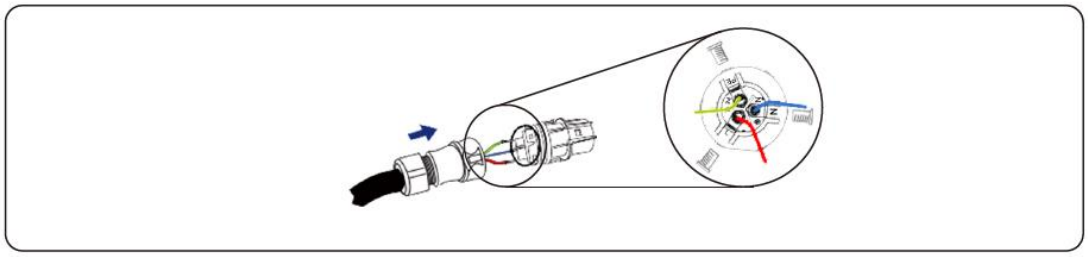
2. Lead the AC cable through the cable gland and the housing.



3. Remove a length of 40mm of the cable jacket and strip the wire insulation to a length of 8 – 15mm.



4. Each of the terminals are labeled. Ensure that the correct conductor is fastened (1.2 Nm torque) to the correct terminal.

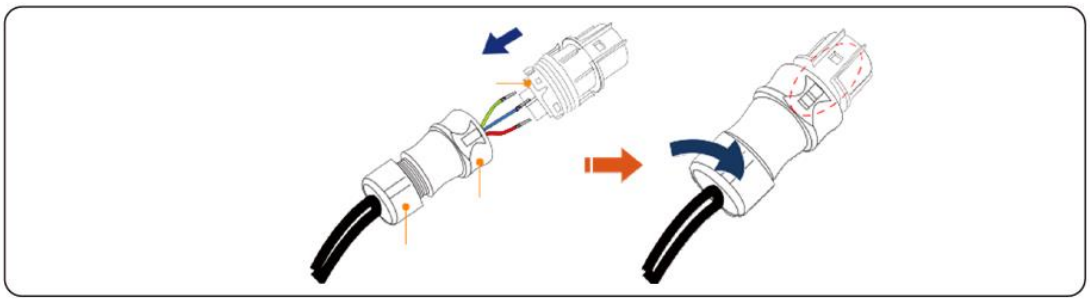


WARNING:

Observe the terminal layout of terminal block.

Do not connect the phase lines to "PE" terminal, otherwise the inverter will not function properly.

5. Make sure the rib of the terminal block and the groove on the housing engage perfectly until a "click" is heard.



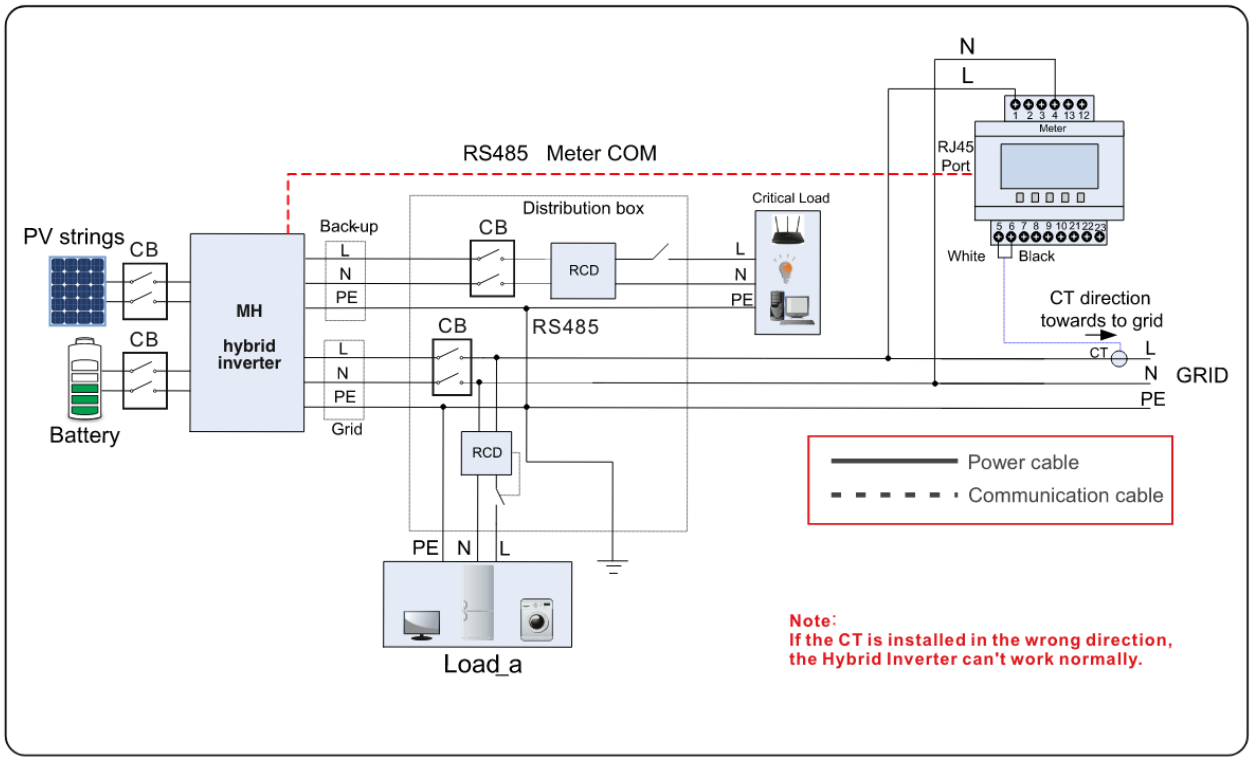
4.6 Meter Installation

Autarco MH series inverter can be connected to Acrel meters or Eastron meters to fulfill the control logic of the self-consumption mode, export power control, monitoring, etc.

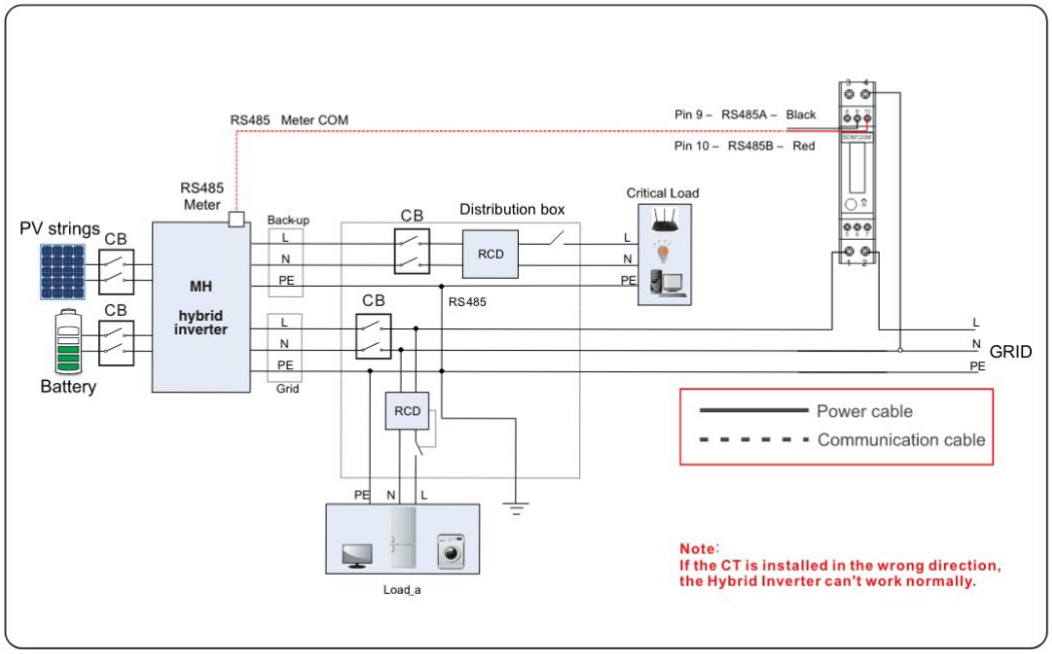
Acrel 1ph meter (With CT): ACR10R-D16TE
Acrel 3ph meter (With CT): ACR10R-D16TE4 (Optional)
Eastron 1ph meter (Direct Insert): SDM120M
Eastron 1ph meter (With CT): SDM120CTM
Eastron 3ph meter (Direct Insert): SDM630M (Optional)
Eastron 3ph meter (With CT): SDM630MCT (Optional)

The section below describes the connection diagram of the Acrel 1ph meter (With CT) (Standard Accessory for all other markets excluding Italy)
Below section describes the connection diagram of the Eastron 1ph meter (Direct Insert) (Standard Accessory for Italian market)

4.6.1 Single phase meter installation (Europe)

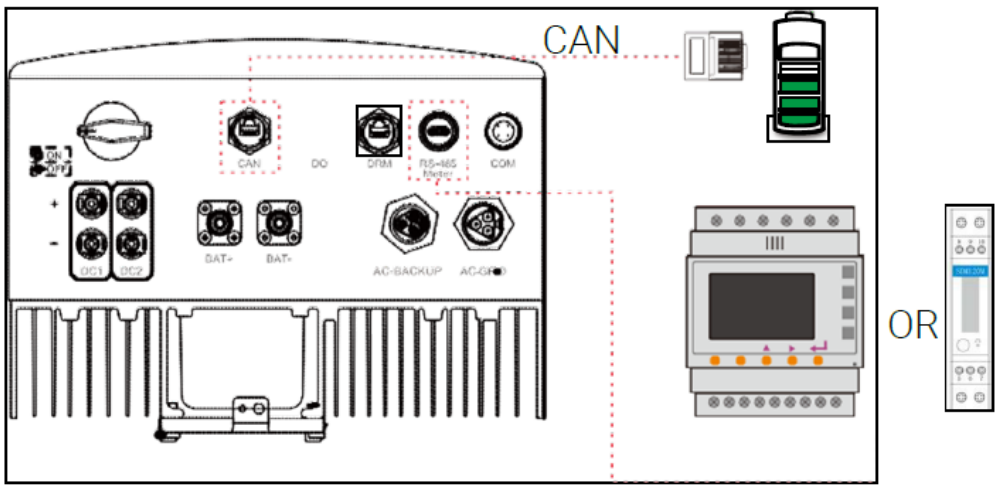


4.6.2 Single phase meter installation (Italy)



4.7 Communication Cable Assembly

The MH series inverter uses RS485 cable to communicate with the meter and CAN to communicate with the battery's BMS. The image below shows the assembly of the RS485/CAN communication cables.



Note:
The CAN-cable enables communication between the inverter and the Lithium-Ion batteries.

Procedure for connecting the CAN cable:

Take out the CAN cable (terminal marks ‘CAN' on one end and 'to Battery' on the other end).
Unscrew the swivel nut from CAN port.
Insert the RJ45 terminal with CAN label into the CAN port, then fasten the swivel nut.
Connect the other end to the battery.

Note: Lead-Acid and other older-technology battery types require experienced and precise design, installation and maintenance to work effectively.
For MH series inverters there is no temperature compensation , thus client need BTS (battery temperature sensor) which is connected to CAN port at one side and battery negative pole at the other side.
BTS is optional. For further information please contact the sales manager. For lead-acid battery , battery SOC calculation may not be accurate according to battery inconformity between cells, battery aging or other specifications of lead-acid battery etc.

Note: For CAN cable pin 4 (blue) and pin 5 (white-blue) are used for the communication.

Procedure for connecting the RS485 cable:
Take out the RS485 cable (terminal marks ‘RS485' on one end and 'to Meter' on the other end).
Unscrew the swivel nut from RS485 port.
Insert the Two-pin terminal with RS485 label into the RS485 port, then fasten the swivel nut.
Connect the other end to the Meter.

4.8 External Ground Connection

DANGER! Never connect or disconnect the connectors under load.

NOTICE! The AC connection to the electrical distribution grid must be performed only after receiving authorization from the utility that operates the grid.

NOTICE! Make sure to set the correct grid standard as part of system commissioning, see chapter 6.2.

There are two options for ground protection: through grid terminal connection and external heat sink connection.

If AC terminal is used to connect ground, please refer to the contents of chapter 4.5.

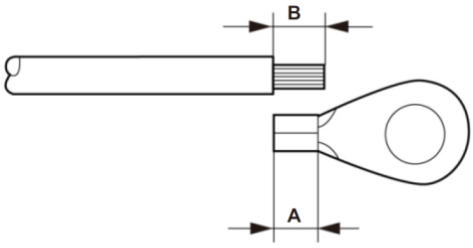
If the heat sink is used to connect the ground, please follow the steps below.

1) Prepare the grounding cable: recommended to use the 16-35mm² outdoor copper-core cable.

2) Prepare OT terminals M4

WARNING! No matter what kind of grounding connection is adopted, it is strictly forbidden to connect the ground of the inverter with the lightning protection of a building, otherwise Autarco will not be responsible for any damage caused by lightning.

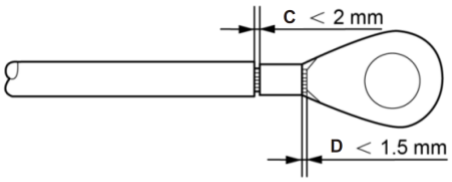
3) Strip the grounding cable insulation to the suitable length as shown in Figure 5.7.



▲ Figure5.7 suitable length

IMPORTANT! B (insulation stripping length) is 2-3mm longer than A (OT cable terminal crimping area)

4) Insert the stripped wire into the OT terminal crimping area, and use an hydraulic clamp-tool to crimp the terminal to the wire (as shown in Figure 5.8).

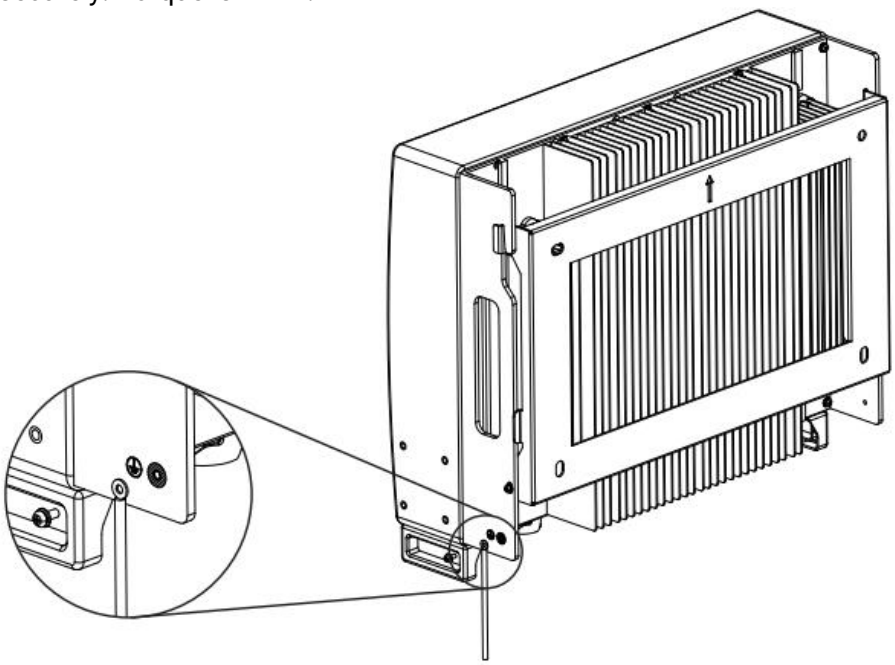


▲ Figure5.8 strip wire

IMPORTANT! After crimping the terminal to the wire, inspect the connection to ensure the terminal is solidly crimped to the wire.

5) Remove the screw from the heat sink ground point

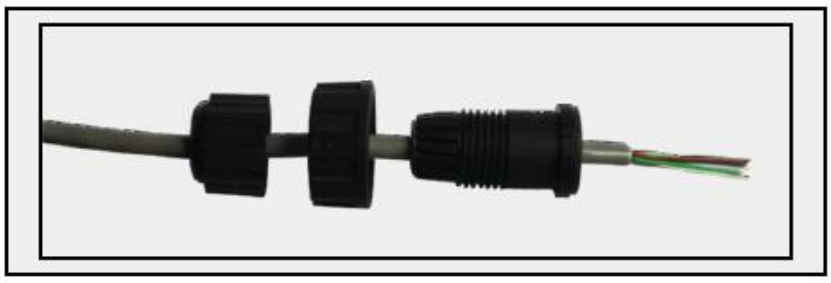
6) Use the screw of the ground point to attach the grounding cable (as shown as in Figure 5.9). Tighten the screw securely. Torque is 2 Nm.



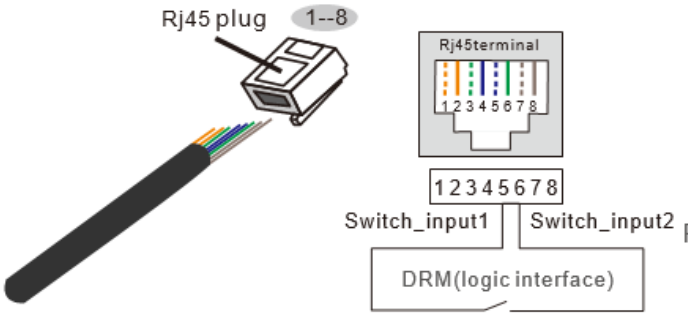
4.9 Logic interface connection

Logic interface is required by some local regulations that can be operated by a simple switch or contactor (Not available in South Africa).
When the switch is closed the inverter will operate normally. When the switch is opened, the inverter will reduce it's output power to zero within 5s.
Pin5 and Pin6 of RJ45 terminal are used for the logic interface connection.

Please follow the steps below to assemble RJ45 connector.



1. Insert the network cable into the communication connection terminal of RJ45.
2. Use the network wire stripper to strip the insulation layer of the communication cable. According to the standard line sequence connect the wire to the plug of RJ45, and then use a network cable crimping tool to make it tight.
3. Connect RJ45 to DRM (logic interface) . To use this function, please contact Autarco.

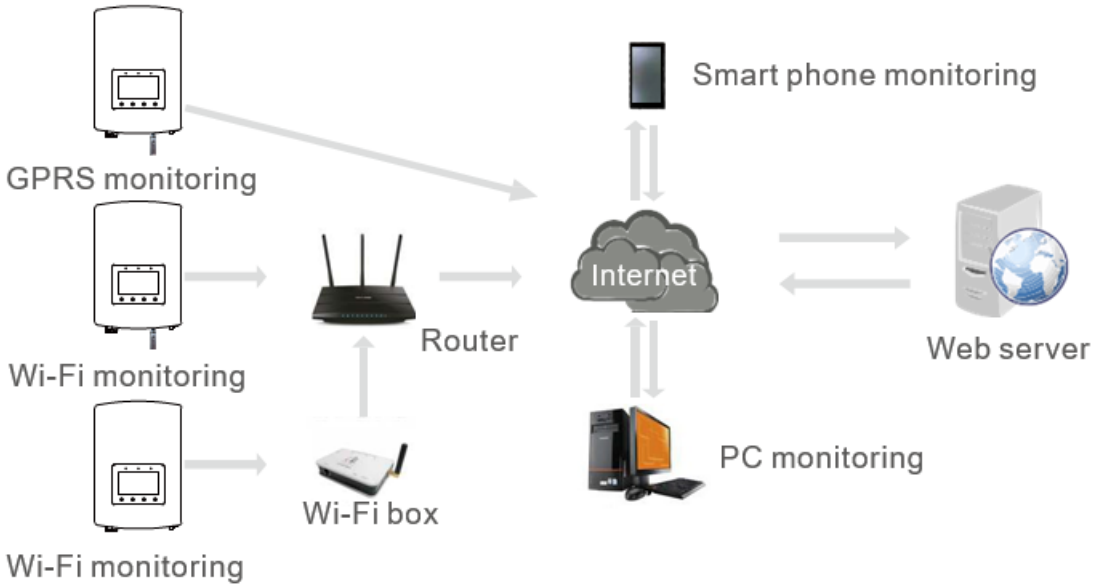


Correspondence between the cables and the stitches of plug, Pin5 and Pin6 of RJ45 terminal is used for the logic interface, other Pins are reserved.

Pin 1: Reserved; Pin 2: Reserved
Pin 3: Reserved; Pin 4: Reserved
Pin 5: Switch_input1; Pin 6: Switch_input2
Pin 7: Reserved; Pin 8: Reserved

4.10 Inverter Monitoring Function

The inverter can be monitored via Wi-Fi, GPRS or Ethernet.
All Autarco communication devices are optional. For connection instructions, please refer to the Autarco Monitoring Device installation manuals.



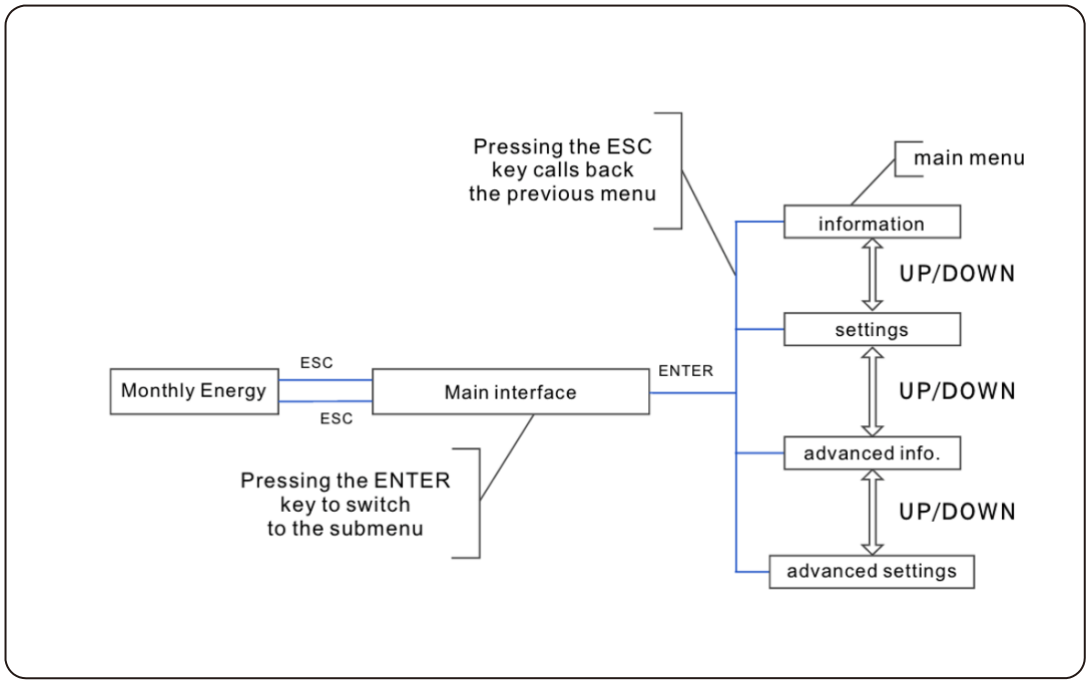
4.11 Status LED indicators

There are three LED status indicator lights at the front panel of MH series inverters. The left POWER light (red) indicates power status of the inverter. The middle OPERATION light (green) indicates the operation status. The right ALARM light (yellow) indicates the alarm status. Table 3.1 explains their meanings.

Light	Status	Description
POWER (red)	ON	The PV array provides power to the inverter
	OFF	The PV array does not provide power to the inverter
OPERATION (green)	ON	The inverter is feeding AC power to the grid
	OFF	The inverter is not feeding AC power to the grid
	FLASHING	The inverter is initializing
ALARM (yellow)	ON	There is a fault. Refer to the inverter display and chapter 8 of this manual for details
	OFF	The inverter is operating normally

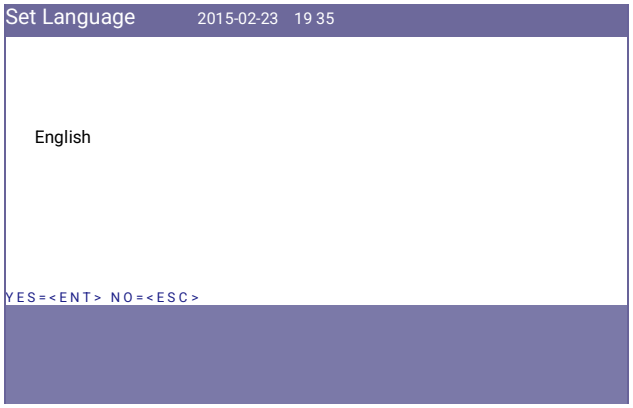
When the inverter DC switch and AC switch have been turned on the inverter will start initializing. After approx. 3 minutes the inverter will start normal operation with the inverter display showing GENERATING.

5 Operation

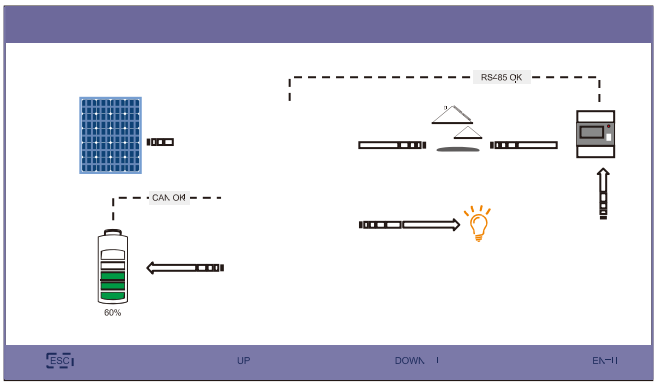


5.1 Initial Display

When powering up the inverter for the first time, it is required to set the language. Press "ENT" to select.



After setting the language, press "ESC" to access the main page.



On the main page:

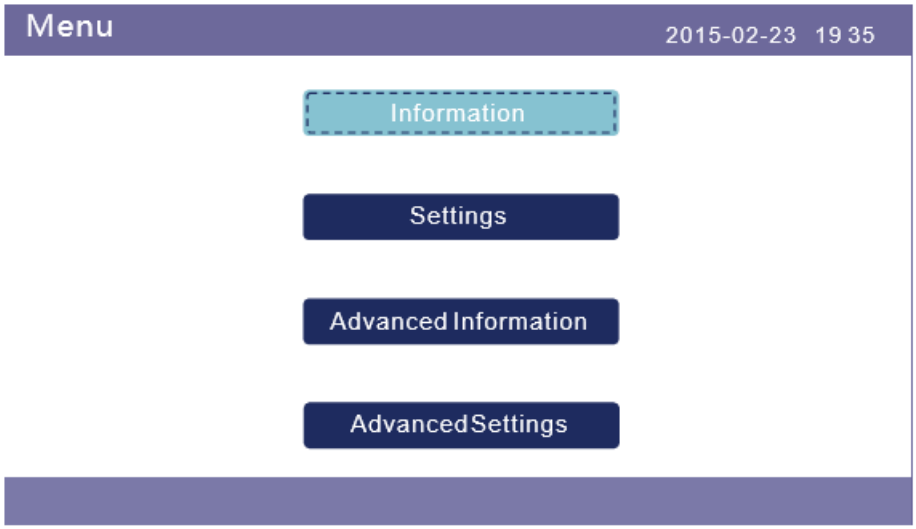
Press "ESC" : View the yield data on monthly bar charts. Then use "UP" and "DOWN" to change the date and "ENT" to move the cursor.
Press "UP" or "DOWN": View different status on the top left of the main page.
Press "ENT": Enter the main menu.

	Solar Power: When solar power is generated, an arrow indicates the direction of the power flow and the value is shown above the arrow.
	Battery: When the battery is connected successfully, it will display "CAN OK", meanwhile battery SOC, arrow and value of power flow is shown. Otherwise, it will display "CAN Fail".
	Non-Critical Loads: Loads connected to the AC Grid port which will shutdown if the grid is in malfunction.
	Smart Meter: When the smart meter is connected successfully, it will display "RS485 OK", otherwise "RS485 Fail".
	Critical Loads: Loads connected to the AC Backup port which will be supported by battery and solar even if the grid is in malfunction.
	Grid: The arrow and value indicate the export/import power of the hybrid system.

5.2 Main Menu

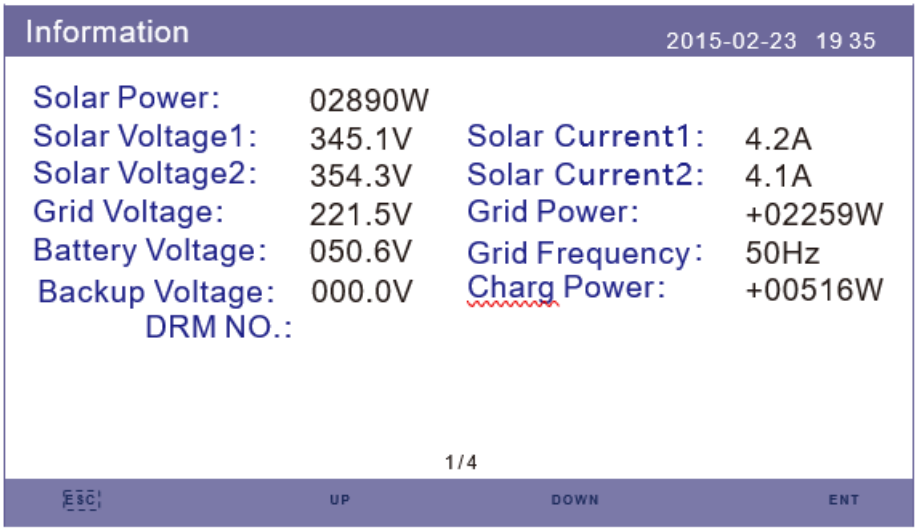
There are 4 submenu's in the Main Menu:

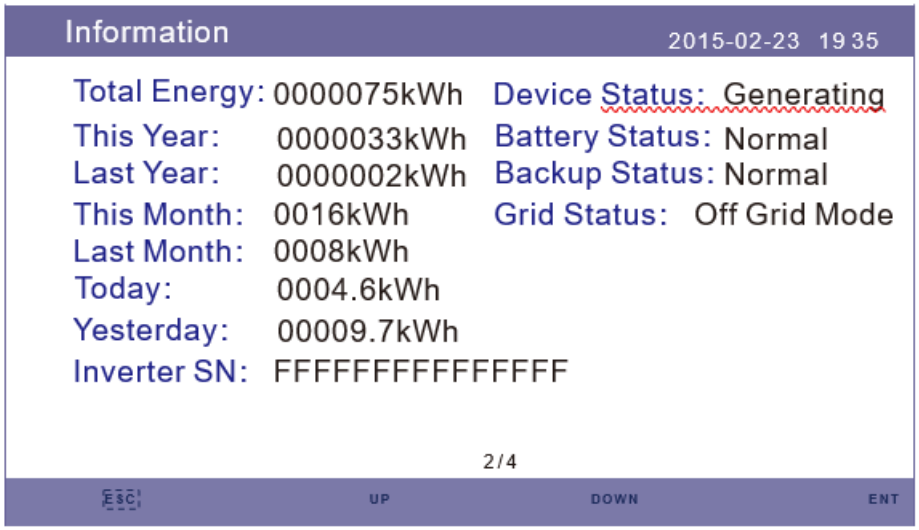
1. Information
2. Settings
3. Advanced Information
4. Advanced Settings

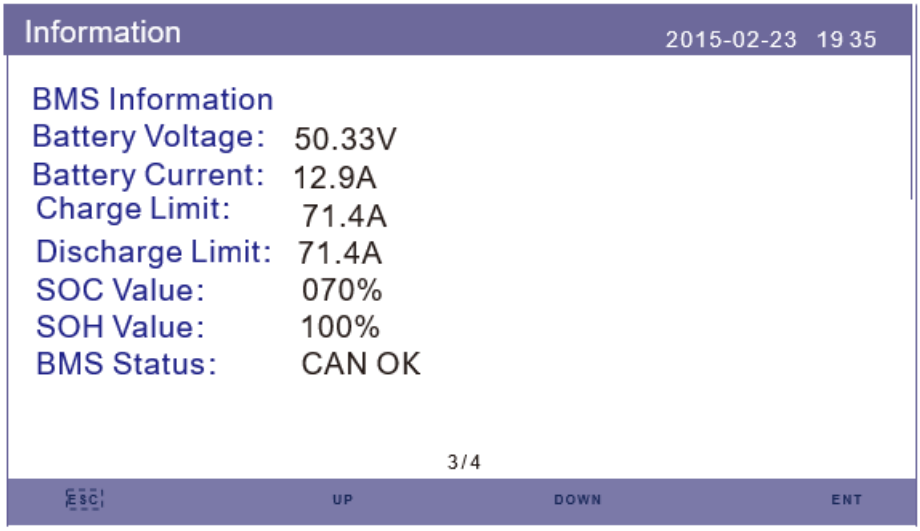


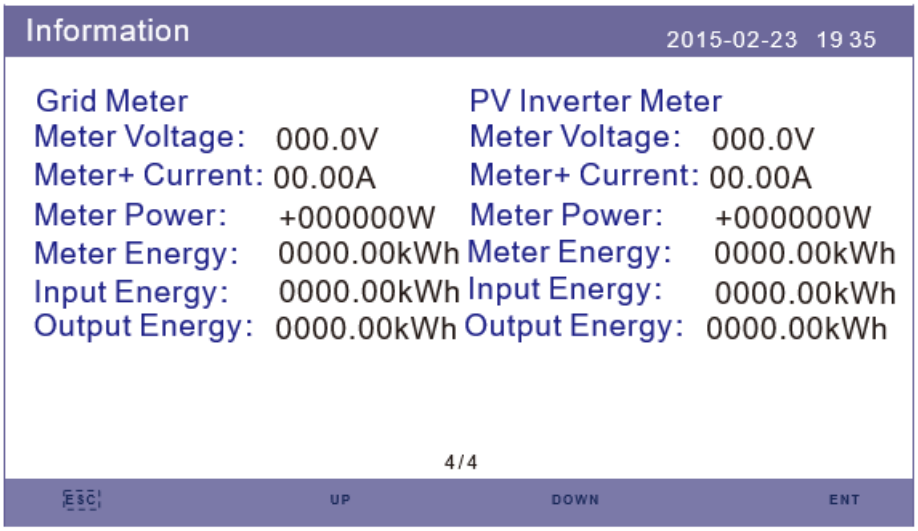
5.3 Information

In the "Information" section, operating data and information can be viewed. Three pages of information can be checked by press "UP" or "DOWN".
The example display is shown in the following Figure 5. Values are for reference only.









NOTE:

Meter Power/Grid Power: Positive value indicates exporting power to the grid, negative value indicates importing power from the grid

Charge Power: Positive value indicates charging, negative value indicates discharging

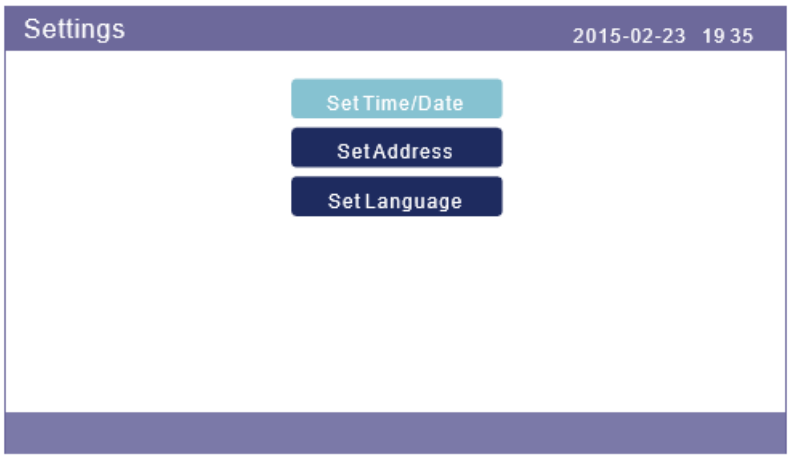
NOTE:

Information for "PV Inverter Meter" is only available when two Eastron meters are used and Meter Placement is selected as "Grid+PV Meter".

Details please consult Autarco service department.

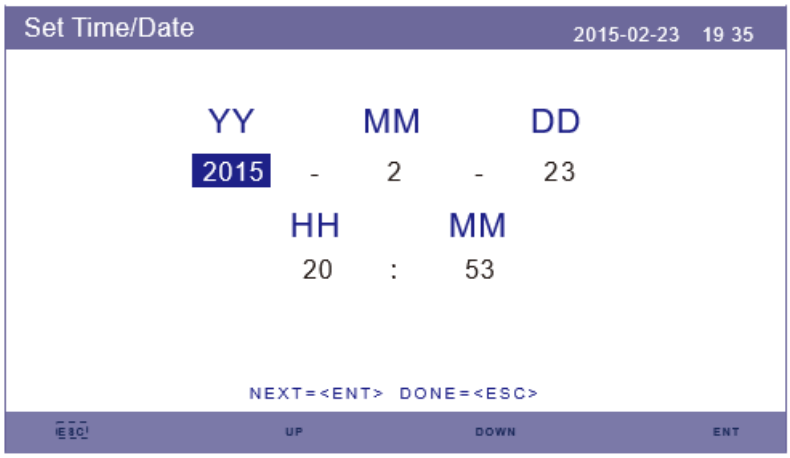
5.4 Settings

In the "Settings" section, Time/Date, Slave address and language can be modified.



5.4.1 Set Time/Date

Set the time and date on the inverter. Must set this according to local time as it affects the daily yield calculation. (If Autarco monitoring system is used, you can set the correct time zone of the system, but it is necessary. MyAutarco will update the inverter time based on the time zone of the system.)
Press "UP" and "DOWN" to change the value. Press "ENT" to mover the cursor.
Press "ESC" to save the change

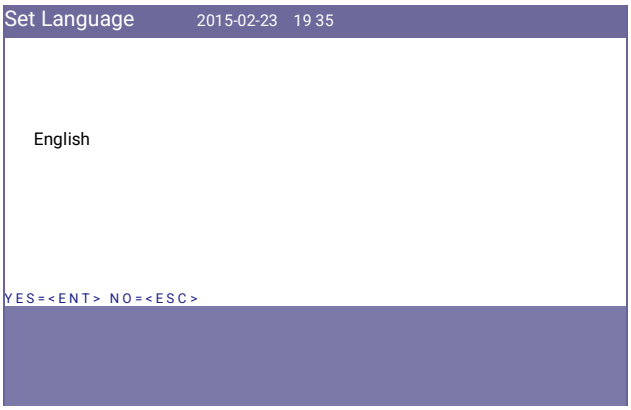


5.4.2 Set Address

Set the slave address of the inverter. The default address is 01

5.4.3 Set Language

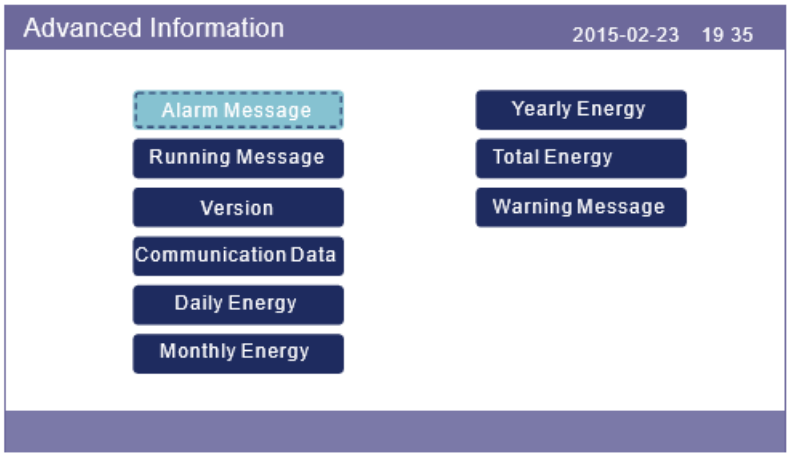
Set system language. English is default



5.5 Advanced Information

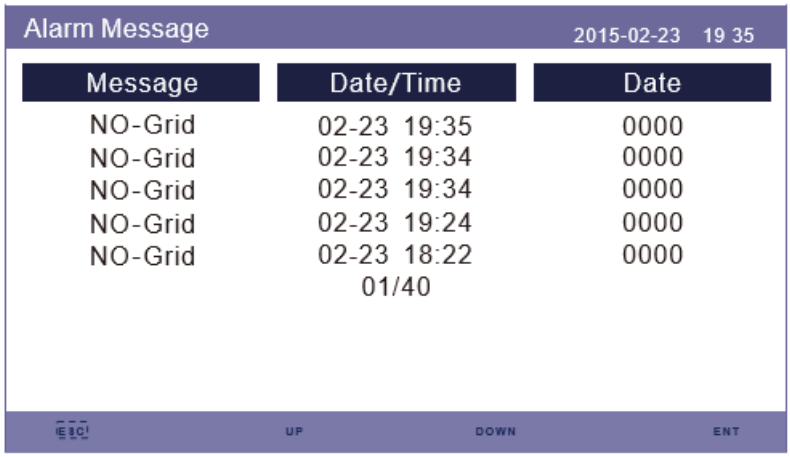
Detailed information can be viewed in this section

1. Alarm Message
2. Running Message
3. Version
4. Communication data
5. Daily Energy
6. Monthly energy
7. Yearly Energy
8. Total Energy
9. Warning message



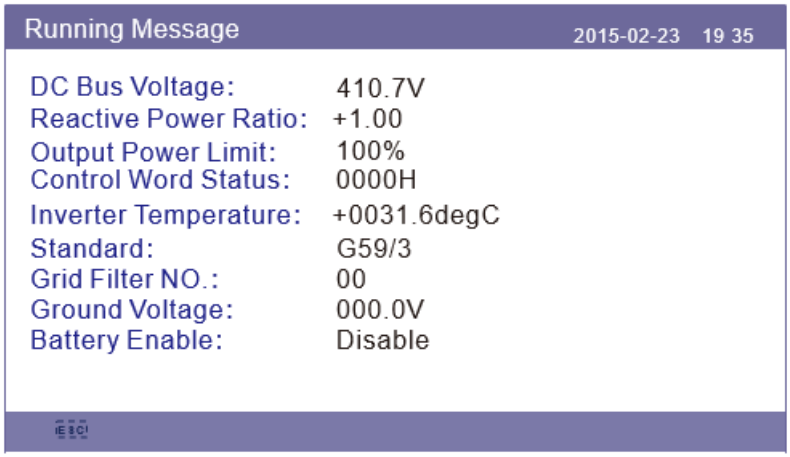
5.5.1 Alarm message

There are 40 pages with the latest alarm messages (5 per page). Alarm messages shows also the alarm that will lead to inverter shutdown.



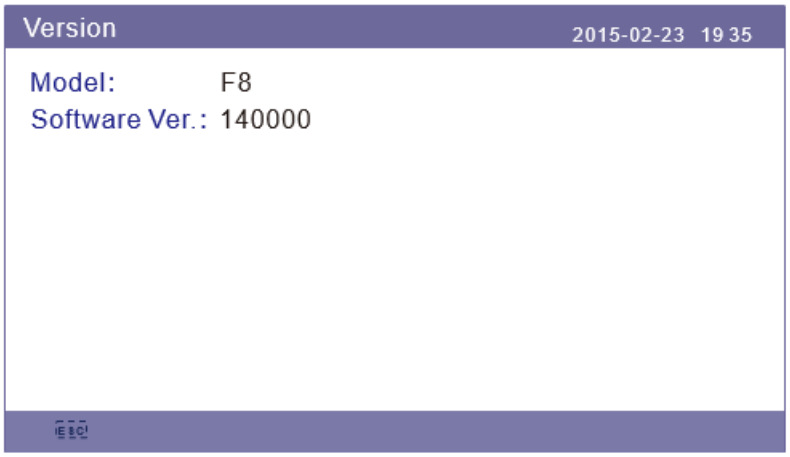
5.5.2 Running message

This function is for a maintenance person to get running message such as internal temperature, Standard NO. etc. (Values are for reference only)



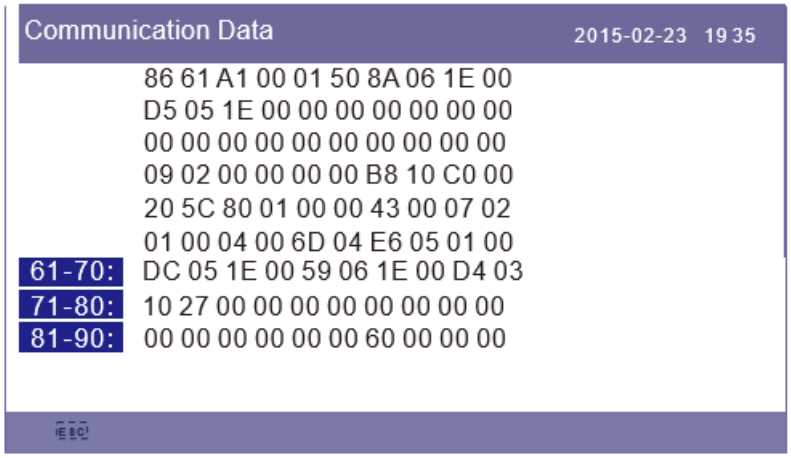
5.5.3 Version

Inverter model and firmware version can be viewed in this section.
(Values are for reference only).



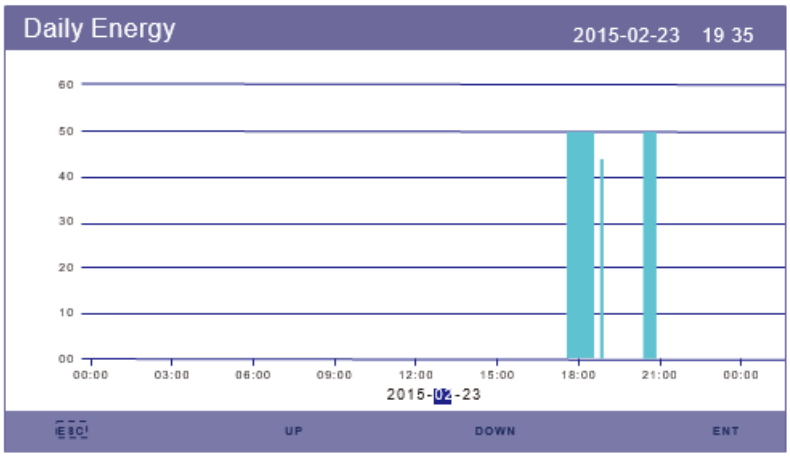
5.5.4 Communication data

Internal communication data can be viewed in this section. For maintenance person only. (Values are for reference only).



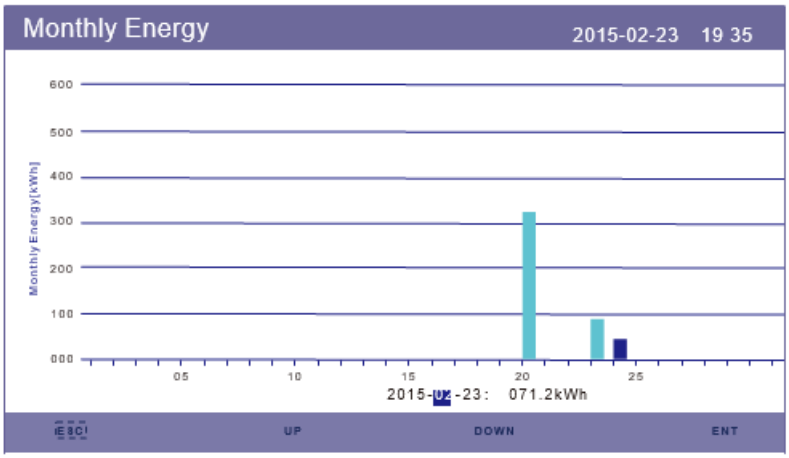
5.5.5 Daily energy

The screen shows the daily energy detail of the inverter



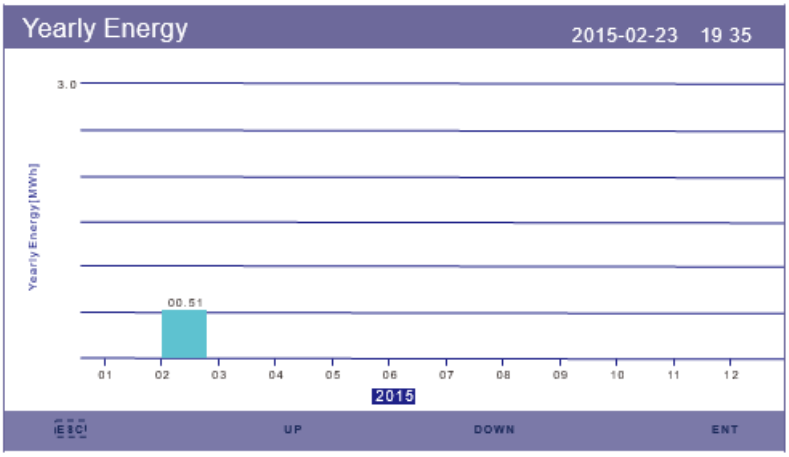
5.5.6 Monthly energy

The screen shows the inverter monthly energy detail of different month.



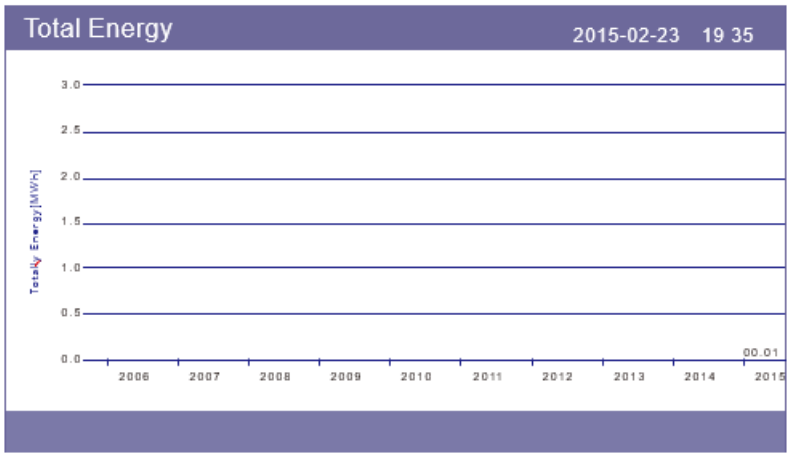
5.5.7 Yearly Energy

The screen shows the inverter yearly energy detail of consecutive years.



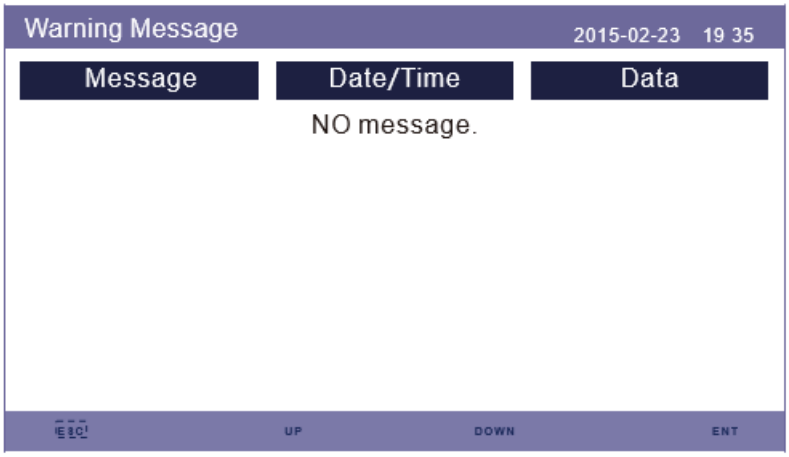
5.5.8 Total Energy

The screen shows the inverter total energy detail.



5.5.9 Warning message

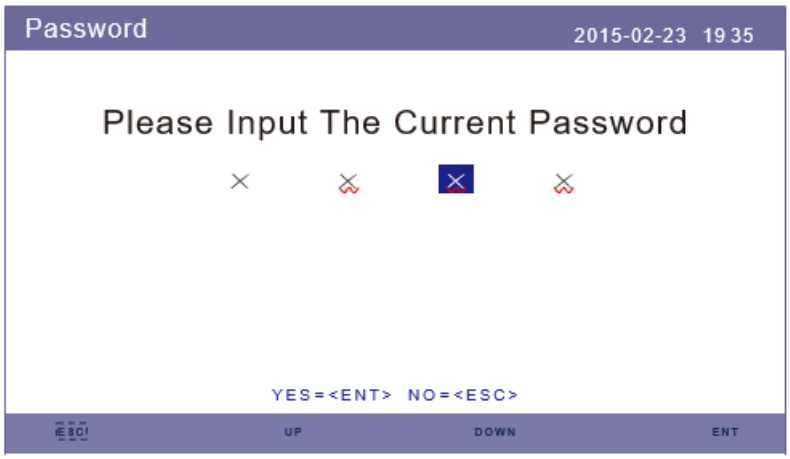
10 pages of latest warning messages (5 per page).
Warning message shows the warning that is abnormal but will not lead to inverter shutdown



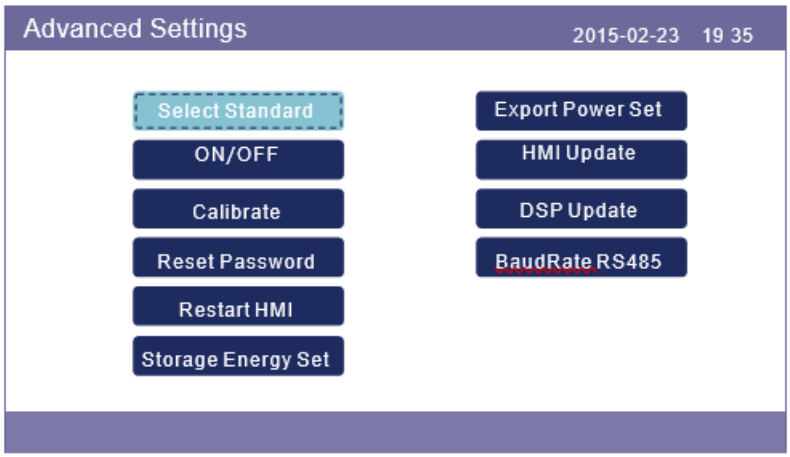
5.6 Advanced Settings

WARNING! Access to this section of the menu is for Autarco qualified and accredited technicians only. Unauthorized access will void the product warranty and any kWh Guarantee.

Select Advanced Settings from main menu, the LCD screen is asking for the password.

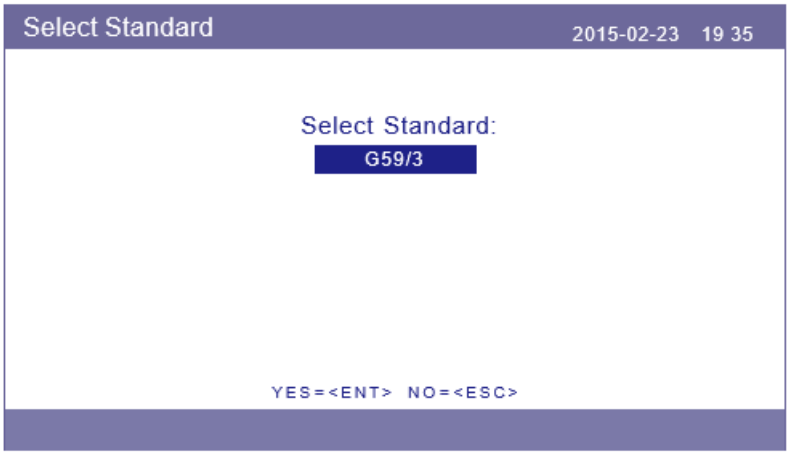


Press "DOWN" to move the cursor.
Press "UP" to change the number.
Press "ENT" to enter the restricted section



5.6.1 Select standard

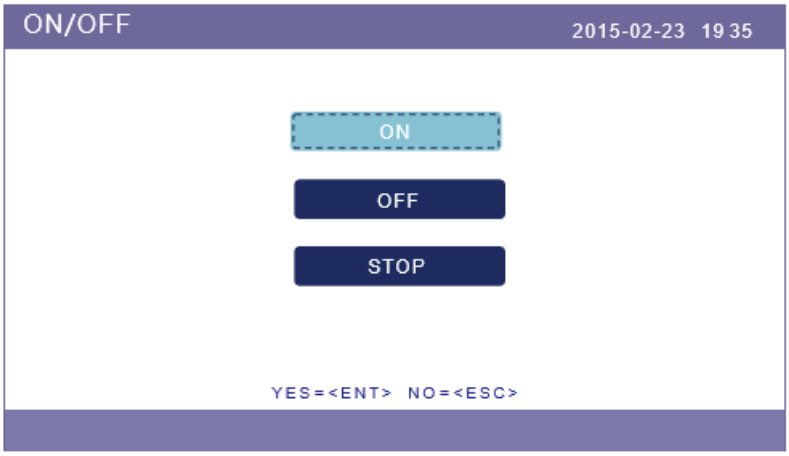
This function is used to select the correct local grid-code/standard.
Please refer to the actual LCD setting for the grid standard options. A relevant list is supplied at the end of this document.



Press "UP" and "DOWN" to go through the list.
Press "ENT" to check the parameters, press "ENT" again to select the standard.

5.6.2 ON/OFF

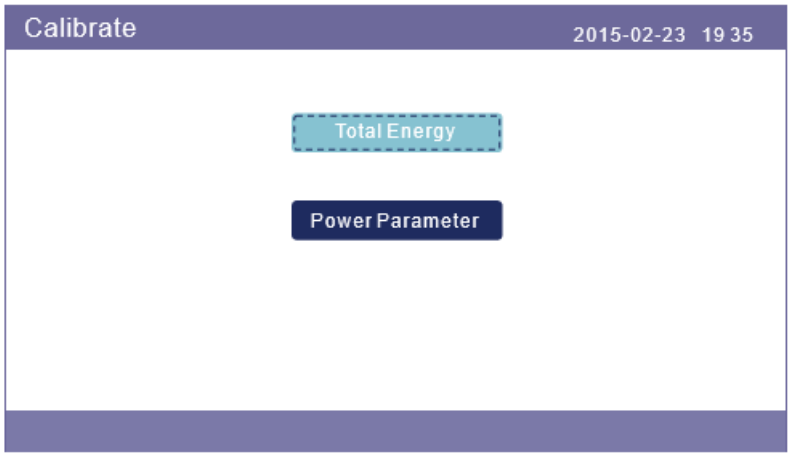
This function is used to start or stop the generation of the inverter.

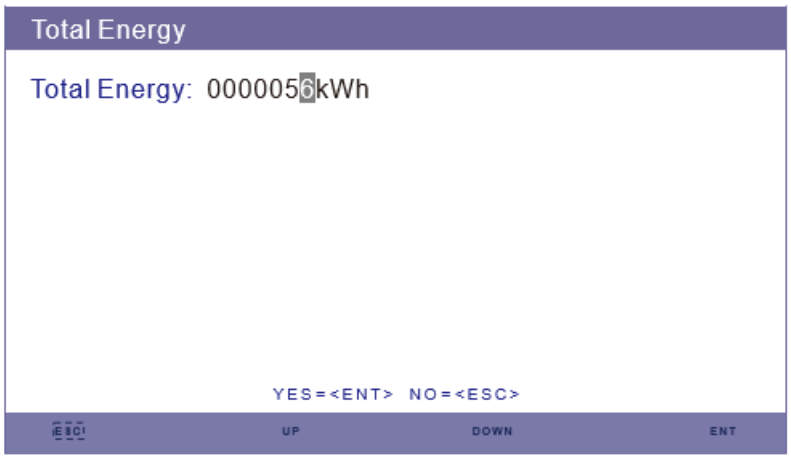


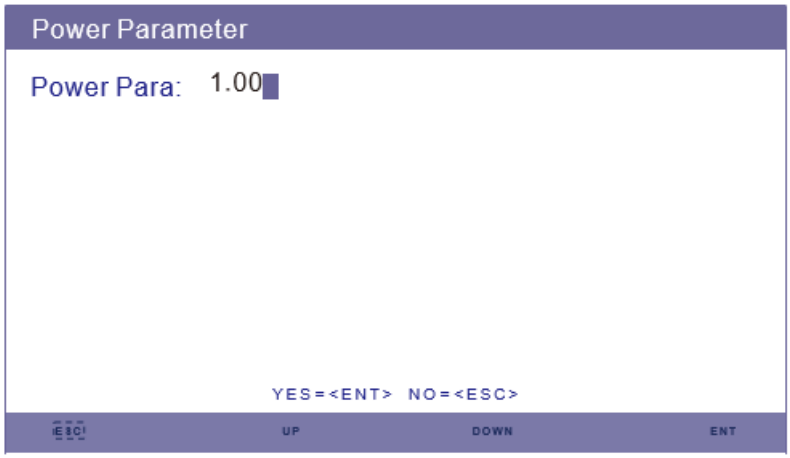
5.6.3 Calibrate energy

Warranty or maintenance may result in resetting total generated data.
This function allows maintenance personnel to amend the total generating data of replacement inverter to the original one.

By using our data monitoring hardware, the data on monitoring website can automatically synchronize with the preset total generating power of inverter. Making unallowed changes to this field may void the kWh-guarantee.







5.6.4 Reset password

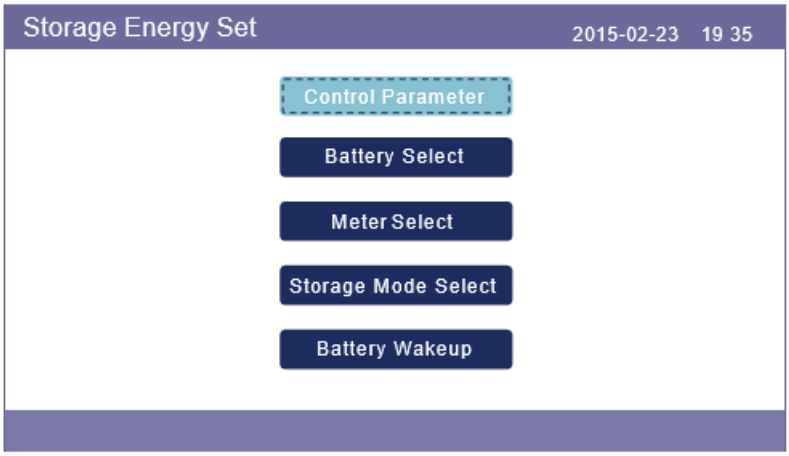
Reset Password: On this page, a user can reset the inverter password. Note that the admin password remains always valid.

5.6.5 Restart HMI

This function is to reboot the LCD screen.

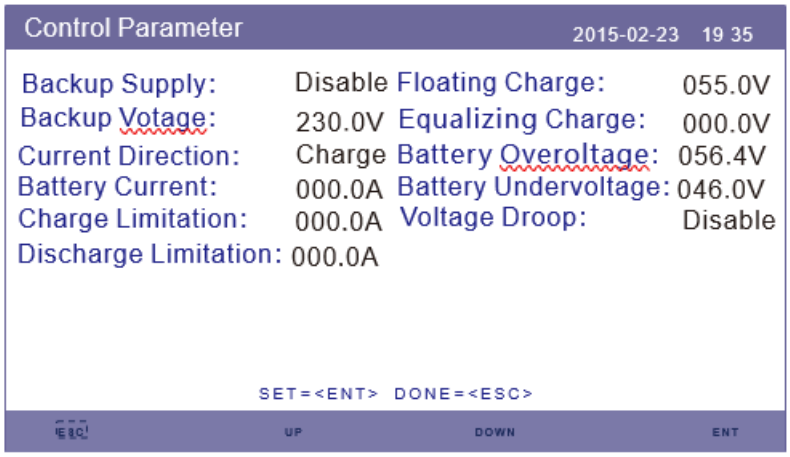
5.6.6 Storage Energy Set

This section contains working mode setting, battery control setting etc.



5.6.6.1 Control parameter

Enter the Control Parameter menu as shown below:
Don't change the settings without the permission of technicians.



5.6.6.2 Battery Select

This product is compatible with the following battery modules:

Brand	Model	Setting
BYD	Box Pro 2.5-13.8	Select "B-BOX"
LG Energy Solution	RESU 3.3/6.5/10/13 (CEI 0-21)	Select "LG Chem"
Pylontech	US2000(CEI 0-21)/US3000(CEI 0-21)/ ForceL1(CEI 0-21)/ForceL2(CEI 0-21)/ Phantom-S/US2000C/US3000C/UP5000	Select "Pylon"
Dyness	Powerdepot/Powerbox/B4850	Select "Dyness"
Puredrive	48V-100Ah	Select "Puredrive"
AOBOET	AOBOET Uhome-LFP 6.8kWh	Select "AoBo"
WECO	5K3-R20	Select "WECO"
Jiawei	Home E11	Select "Jiawei"
Soluna	4K PACK	Select "Soluna"
Highstar	HSD5870	Select "Highstar"
Freedom	Freedom Won Lite	Select "Freedom"
KODAK	FL5.2	Select "KODAK"
FOX	LV5200	Select "FOX"
UZ Energy	L051100-A	Select "CATL"
GSL	48V-100Ah	Select "GSL"
Zeta	51.2V-100Ah	Select "Zeta"

Note: If the hybrid inverter is not connected to a battery, select "No Battery" to avoid alarms.

For above compatible battery modules, only two parameters need to be defined:

1. OverDischg SOC (10%~40%, default 20%)
--Inverter will not discharge the battery when the OverDischg SOC is reached. Battery self-discharge is unavoidable,SOC may go lower than the limit if the battery can't get charged for a long period of time.
2. ForceCharge SOC (5%~OverDischg SOC, default 10%)
--To prevent the battery going into sleep mode, when the ForceCharge SOC is reached, inverter will charge the battery using the power from either PV or Grid.

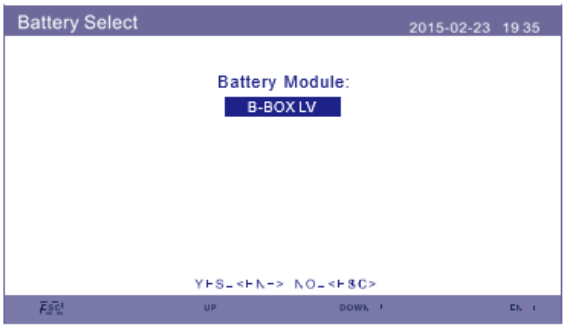


Figure 5.33 Battery Select

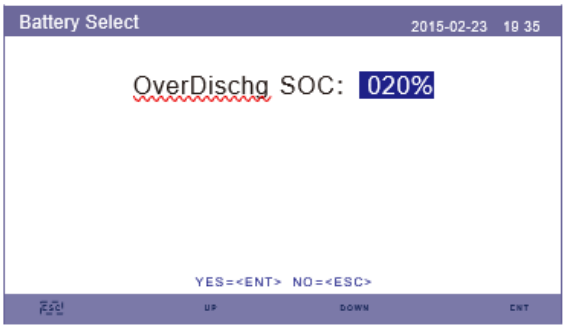
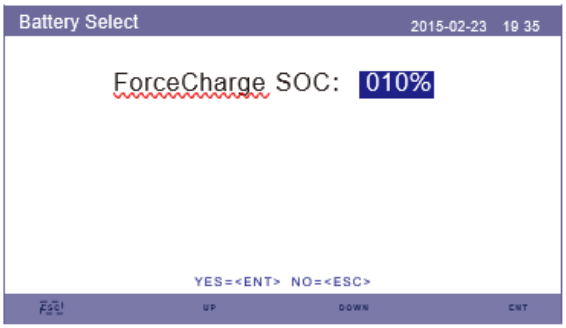
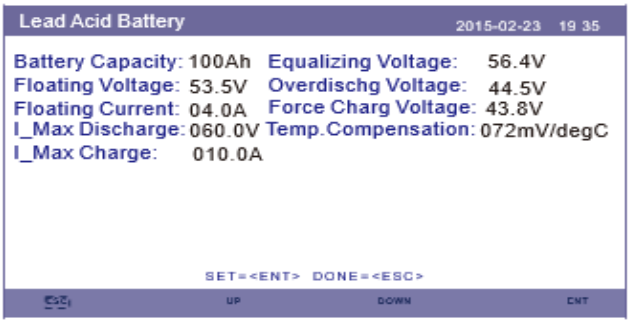


Figure 5.34 Over Discharge SOC.



Note:

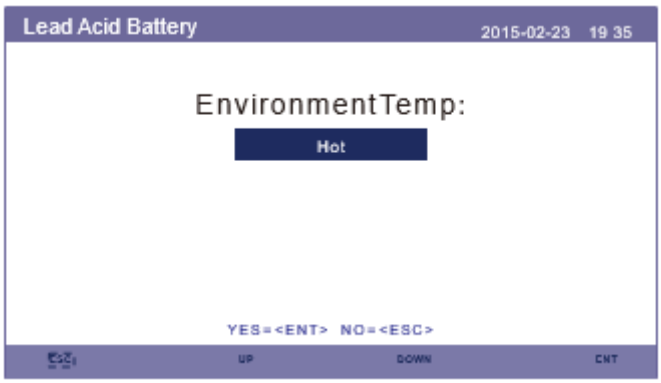
The MH-inverter support lead-acid battery. Select "Lead-Acid" in the "Battery Select" and configure the following parameters according to different lead-acid batteries.



Lead Acid Battery (Values are examples Only)

1. Battery Capacity: Define the capacity of the battery.
2. Equalizing Voltage: Define the voltage for equalizing charge.
3. Floating Voltage: Define the voltage for floating charge.
4. Floating Current: Define the current for floating charge.
5. Overdischg Voltage: Define the voltage that stops discharging the battery.
6. Force Charg Voltage: Define the voltage that forces to charge the battery to prevent a dead battery.
7. I_Max Discharge: Define the max discharge current for the battery.
8. I_Max Charge: Define the max charge current for the battery.
9. Temp.Compensation: Define the temperature compensation parameter for the battery.

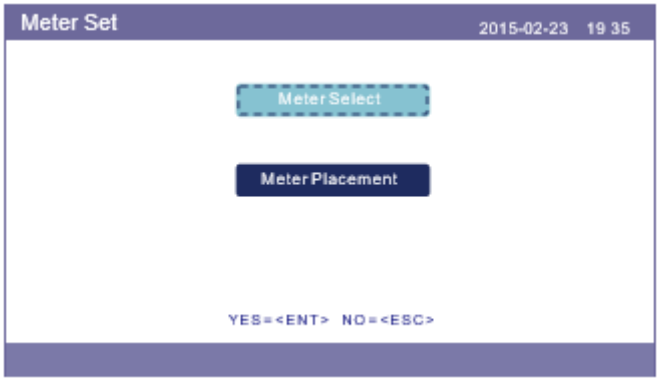
After configuration, click on Save and send. Select the Environment Temp based on real condition.(Hot/Warm/Cold)



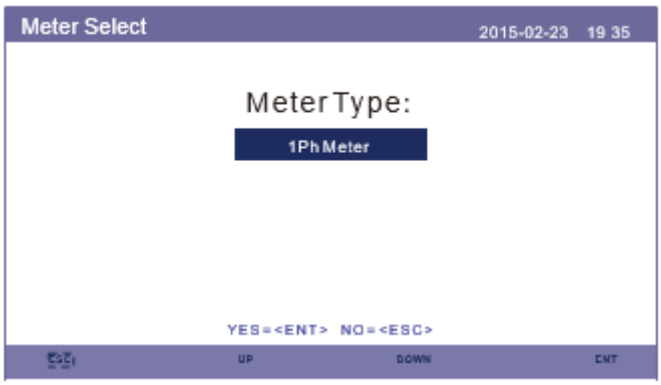
Note:
Connecting Lead-acid batteries is not recommended for general customers as it requires experienced installers and technicians who can fully understand the battery parameters and configure the settings and installations correctly.
Due to the inconformity between battery cells, damage due to incorrect selection may happen. Autarco is not responsible for any potential damages caused by the use of lead-acid batteries.

5.6.6.3 Meter Set

These settings are used to select the meter types and meter installed locations based on the actual configuration.



5.6.6.3.1 Meter Select



Meter Model	Meter Type Options
Acrel 1ph meter (With CT): ACR10R-D16TE	“1ph meter”
Acrel 3ph meter (With CT): ACR10R-D16TE4 (Optional)	“Acrel 3ph meter”
Eastron 1ph meter (Direct Insert): SDM120M	“Eastron 1ph meter”
Eastron 1ph meter (With CT): SDM120CTM (Optional)	“Eastron 1ph meter”
Eastron 3ph meter (Direct Insert): SDM630M (Optional)	“Eastron 3ph meter”
Eastron 3ph meter (With CT): SDM630MCT (Optional)	“Eastron 3ph meter”
No meter is connected	“No Meter”

5.6.6.3.2 Meter Placement

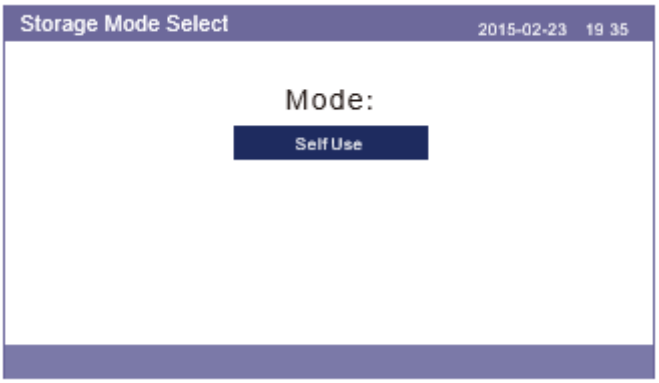
Grid: Meter is installed at the grid connection point.
Load: Meter is installed at the load branch circuit.
Grid+PV Inverter: One meter is connected at the grid connection point, the other meter is connected at the AC output port of an extra PV inverter. (Eastron Meter is supported).

5.6.6.4 Storage Mode Select

There are 5 working modes available.

1. Self Use Mode
2. Feed in Priority Mode
3. Backup Mode
4. Off Grid Mode
5. EPS Mode

Only 1 mode can be enabled at the same time.
Please refer to Appendix for explanations and setting instructions for each mode.

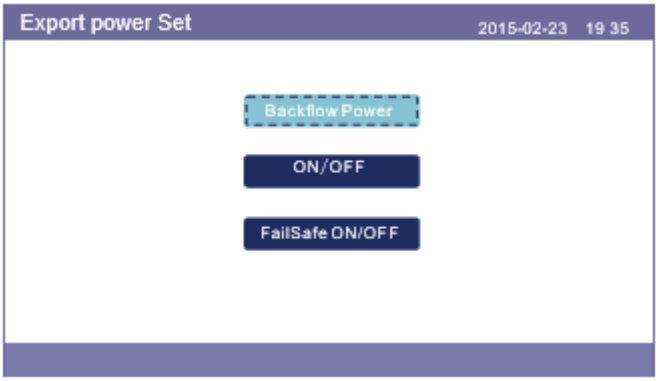


5.6.6.5 Battery Wake Up

This function should be activated only after the installation. In the case of a low battery voltage shutdown, the inverter will shut-down. This setting can be enabled, so when the inverter detects PV or grid, it wakes up the battery. This function conflicts with the battery reverse polarity protection. (If the installer connects cables with wrong polarity, the inverter can protect itself from damage).To avoid the possible damage during installation, do not active battery wakeup function before finishing the first commissioning !

5.6.7 Export Power Set

This function is to set the export power control.
1.Backflow Power.
2. ON/OFF.
3.Failsafe ON/OFF
Setting 1&3 are only valid when Setting 2 is set to "ON".

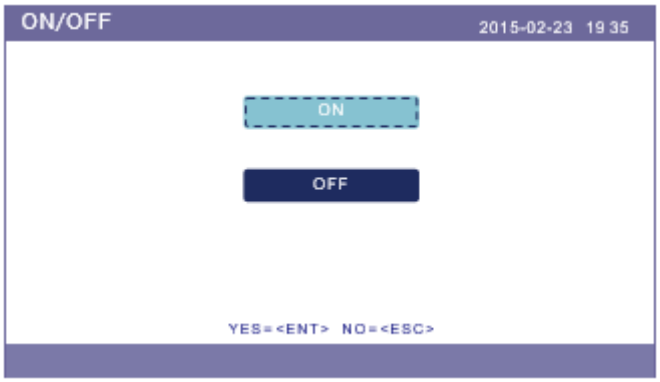


5.6.7.1 Backflow power

Determine the allowed backfeed power. (System export to the grid)

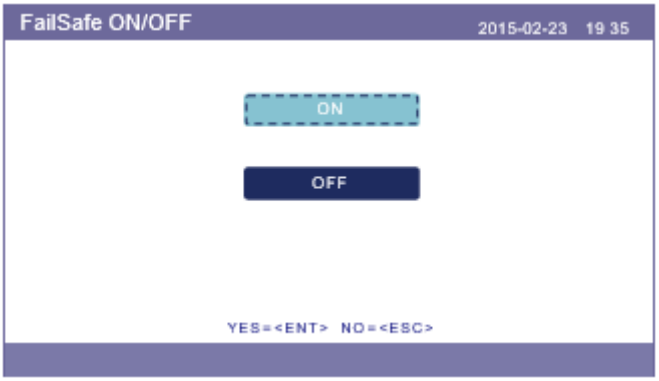
5.6.7.2 ON/OFF

Enable/Disable the function



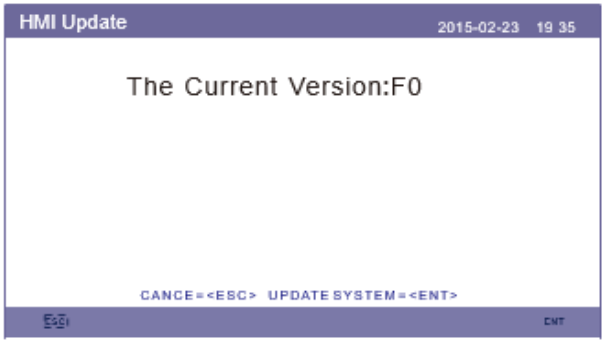
5.6.7.3 Fail Safe ON/OFF

When the Failsafe function is ON, the inverter will shutdown once it loses communication with the meter. This avoids backflow power exceeding the limit.



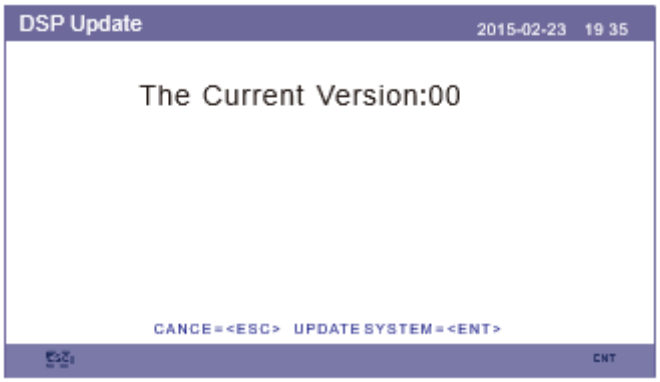
5.6.8 HMI Update

This function is used to update HMI software. Values are for reference only.



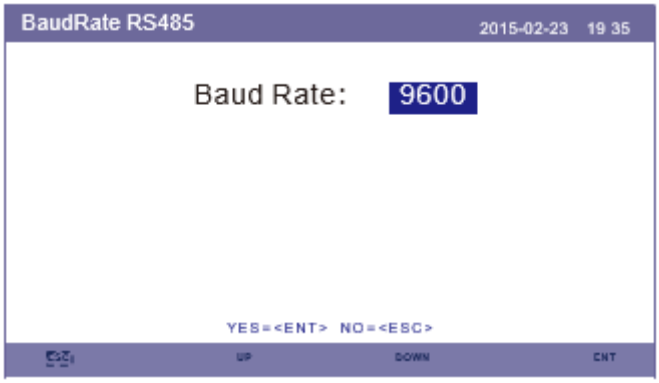
5.6.9 DSP Update

This function is used to update DSP software. Values are for reference only.



5.6.10 BaudRate RS485

This function is to change the internal communication Baudrate.



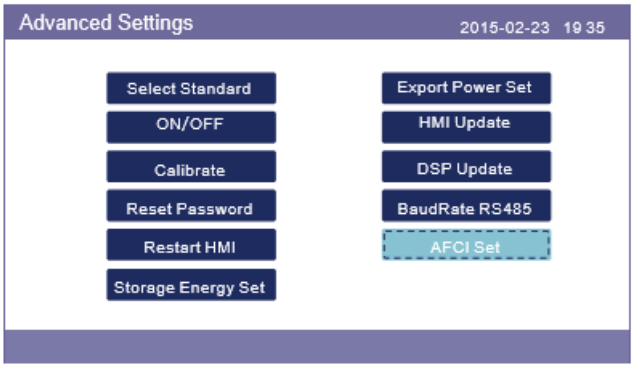
Warning: This function is for maintenance personnel only, wrong operation will prevent the inverter from working properly.

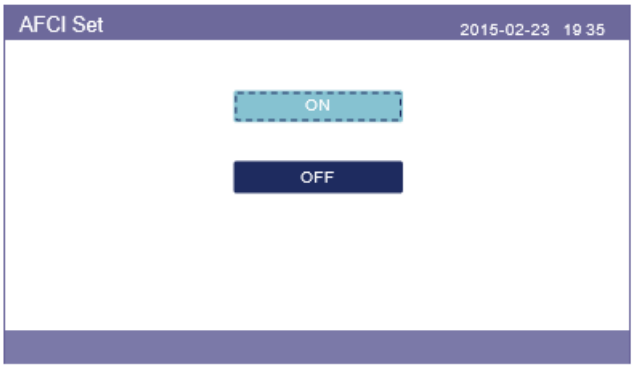
5.7 AFCI function

Inverters have a built-in AFCI function which can detect arc faults on the DC circuit and shut down the inverter to prevent a fire disaster.

5.7.1 Enable the AFCI function

The AFCI function can be enabled in the following menu:





Note: If you find your inverters's user interface is different from what's in the fast installation guide, please contact after-sales engineer or technical support.

Note: The "AFCI Level" is reserved for technicians ONLY. Do not change the sensitivity otherwise it will lead to frequent false alarms or malfunctions. Manufacturer is not responsible for any further damages caused by unauthorized modifications.

Warning: The setting corresponds to the current status as well which can be used to inspect the ON/OFF state of the AFCI function.

5.7.2 Enable the AFCI function

If an DC Arc Fault is detected, during normal operation, the inverter will shut down and give out the following alarm at the LCD-screen:

Installer needs to thoroughly inspect the DC circuit to ensure all the cables are correctly fastened.

Once the DC circuit issue has been fixed or it is confirmed to be OK, press “ESC” for 3s and wait for the inverter to restart.

6 Inverter commissioning sequence

6.1 Preparation of Commissioning

- Ensure all the devices are accessible for operation, maintenance and service. Check and confirm that
- the inverter is firmly installed.
- Space for ventilation is sufficient for one or multiple inverters. No tools or other materials are left on the
- top of the inverter or battery module.
- Inverter and accessories are correctly connected.
- Cables are routed in a safe way or protected against mechanical damage. Warning signs and labels are
- suitably affixed and durable

6.2 Commissioning procedure

If all the items mentioned above meet the requirements, proceed as follows to start up the inverter for the first time.

Turn on inverter DC switch
Turn on battery breaker or battery switch button on the battery.
Select the grid standard code.
Configure the parameters.
Switch on AC backup and AC grid.
Verify inverter initializing.

6.3 Shutdown procedure

1. Turn off the AC isolator at the grid connection point.
2. Turn off the DC switch of the inverter.
3. Turn off the DC switch between inverter and battery.

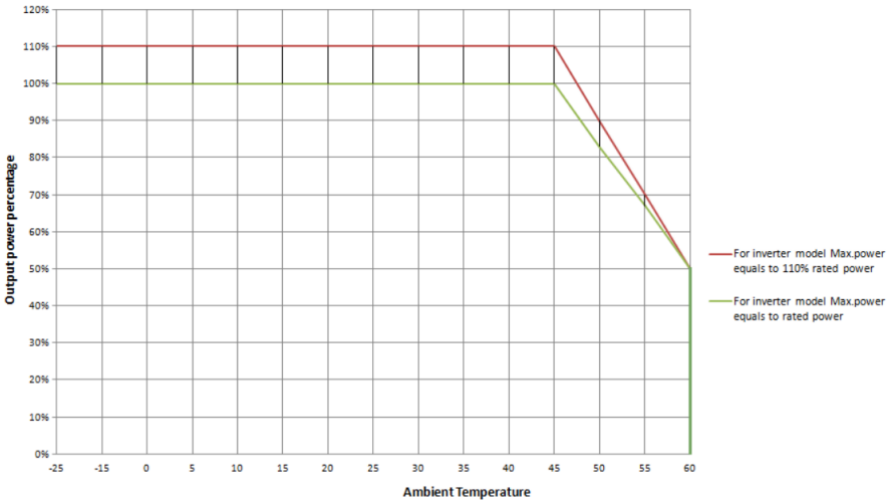
7 Maintenance

CAUTION! Do not touch the heat sink when the inverter is in operation. Turn OFF the inverter (see section 5.5) and allow for cooling down before cleaning or maintenance.

CAUTION! Never use any solvents, abrasives or corrosive materials to clean the inverter or the LCD-screen.

The MH series inverters require general maintenance to be performed once per year. Impurities such as dust and dirt accumulation on the heat sink may negatively affect the inverter's ability to dissipate heat. Any dirt or dust can be removed with a cloth or soft brush.

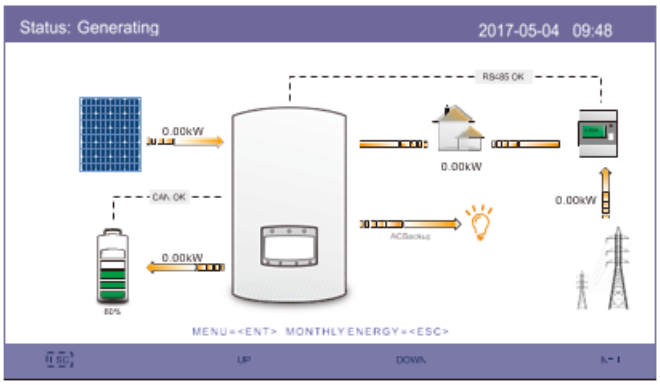
The output power of the inverter varies with ambient temperature, as shown in the figure below.



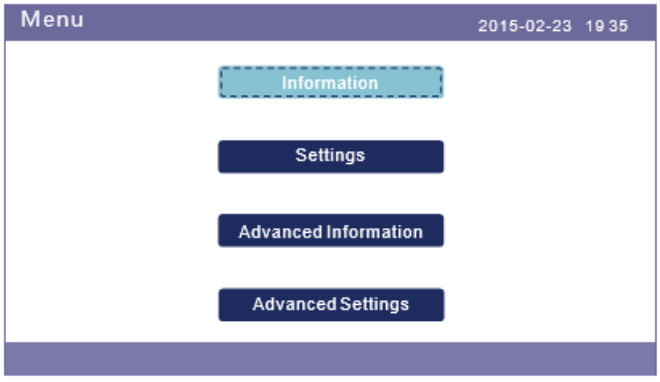
8 Troubleshooting

The inverter has been designed in accordance with international grid tied standards for safety, and electromagnetic compatibility requirements.
Before delivering to the customer the inverter has been subjected to several test to ensure its optimal operation and reliability.
In case of a failure the LCD screen will display an alarm message. In this case the inverter may stop feeding energy into the grid. The alarm descriptions and their corresponding alarm messages are listed in the table below.

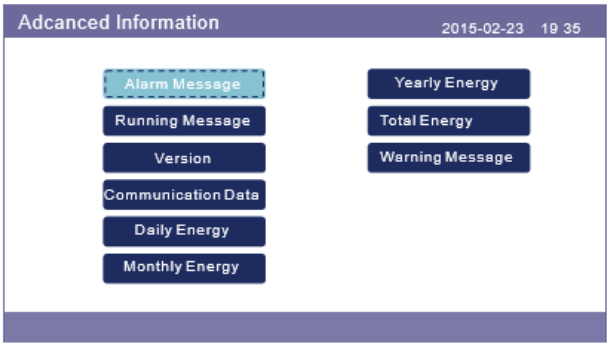
Step1: Press ENTER.



Step2: Press DOWN to select Advanced Information, then press ENTER.



Step3: Press DOWN to select Alarm Message, then press ENTER.



8.1 Alarm messages

Alarm Message	Failure description	Solution
ARC-FAULT	ARC detected in DC circuit	1. Check if there's arc in PV connection and restart inverter.
AFCI Check FAULT	AFCI module self check fault	1. Restart inverter or contact installer.
DCinj-FAULT	High DC injection current	1. Restart inverter or contact installer.
DSP-B-FAULT	Comm. failure between main and slave DSP	1. Restart inverter or contact installer.
DC-INTF	DC input overcurrent	1. Restart inverter. 2. Identify and remove the string to the fault MPPT. 3. Change power board.
G-IMP	High grid impedance	1. Use user define function to adjust the protection limit if it's allowed by electrical company.
GRID-INTF01/02	Grid interference	1. Restart inverter. 2. Change power board.
IGBT-OV-I	Over IGBT current	
IGFOL-F	Grid current tracking fail	1. Restart inverter or contact installer.
IG-AD	Grid current sampling fail	
ILeak-PRO 01/02/03/04	leakage current protection	1. Check AC and DC connection. 2. Check inverter inside cable connection.
INI-FAULT	Initialization system fault	1. Restart inverter or contact installer.
LCD show initializing all the time	Can not start-up	1. Check if the connector on main board or power board are fixed. 2. Check if the DSP connector to power board are fixed.
NO-Battery	Unconnected battery	1. Check the wire of battery power is connected correctly or not. 2. Check the output voltage of battery is correctly or not.
No power	Inverter no power on LCD	1. Check PV input connections. 2. Check DC input voltage (single phase >120V, three phase >350V). 3. Check if PV+/- is reversed.
NO-GRID	No grid voltage	1. Check connections and grid switch. 2. Check the grid voltage inside inverter terminal.
OV-BUS	Over DC bus voltage	1. Check inverter inductor connection. 2. Check driver connection.

Alarm Message	Failure description	Solution
OV-DC01/02/03/04	Over DC voltage	1. Reduce the module number in series.
OV-DCA-I	DC input overcurrent	1. Restart inverter. 2. Identify and remove the string to the fault MPPT. 3. Change power board.
OV-G-V01/02/03/04	Over grid voltage	1. Resistant of AC cable is too high. Change bigger size grid cable. 2. Adjust the protection limit if it's allowed by electrical company.
OV-G-I	Over grid current	1. Restart inverter. 2. Change power board.
OV-G-F01/02	Over grid frequency	1. Use user define function to adjust the protection limit if it's allowed by electrical company.
OV-IgTr	AC side transient overcurrent	1. Restart inverter. 2. Return-factory repair.
OV-ILLC	LLC hardware overcurrent	
OV-VBackup	Bypass overvoltage fault	
OV-TEM	Over Temperature	1. Check inverter surrounding ventilation. 2. Check if there's sunshine direct on inverter in hot weather.
OV-Vbatt1	The detection of battery overvoltage	1. Check the protect point for over voltage sets correctly or not. 2. Restart inverter.
OV-Vbatt-H	Battery overvoltage hardware fault	1. Check the circle whether the circuit for battery power jumps. 2. Restart inverter.
Over-Load	Bypass overload fault	1. Check the load of Backup port is over rating output power or not. 2. Reduce the load of Backup port, then restart inverter.
PV ISO-PRO01/02	PV isolation protection	1. Remove all DC input, reconnect and restart inverter one by one. 2. Identify which string cause the fault and check the isolation of the string.
RelayChk-FAIL	Relay check fail	1. Restart inverter or contact installer.

Alarm Message	Failure description	Solution
UN-BUS01/02	Under DC bus voltage	1. Check inverter inductor connection. 2. Check driver connection.
UN-G-F01/02	Under grid frequency	1. Use user define function to adjust the protection limit if it's allowed by electrical company.
UN-G-V01/02	Under grid voltage	
12Power-FAULT	12V power supply fault	1. Restart inverter or contact installer.
AFCI self-detection (model with AFCI module)	AFCI module self-detect fault	1.Restart inverter or connect technician.
Arcing protection (model with AFCI module)	Detect arc in DC circuit	1. Check inverter connection whether arc exists and restart inverter.

Note: If the inverter displays any alarm message as listed in the table above; please turn off the inverter and wait for 5 minutes before restarting it . If the failure persists, please contact your local distributor or Autarco support.

Please keep the following information ready before contacting your installer.

Serial number of the Autarco Hybrid Inverter;
The distributor/dealer of the Autarco Hybrid Inverter
Installation date.
The description of the problem (i.e. the alarm message displayed on the LCD and the status of the LED status indicator lights. Other readings obtained from the Information submenu will also be helpful.
The PV array configuration (e.g. number of panels, capacity of panels, number of strings, etc.)
Your contact details.

9 Recycling and Disposal

To comply with European Directive 2002/96/EC on waste Electrical and Electronic Equipment (WEEE) and its implementation as national law, electrical equipment that has reached the end of its life must be collected separately and returned to an approved recycling facility. Ignoring this EU Directive may have severe effects on the environment and public health.

10 Specifications

	S2.MH3000	S2.MH3600	S2.MH4600	S2.MH5000*	S2.MH6000**
Input DC					
Recommended max PV power (W)	7000		8000		
Max. DC voltage (V)	600				
MPPT voltage range (V)	90-520				
Turn on voltage (V)	120				
Full load MPPT range (V)	141-520	169-520	215-520	234-520	280-520
Number of MPP trackers	2				
Max. DC current per MPPT (A)	11				
Max short circuit input (A)	17.2				
Number of DC connections per MPPT	1				
Total number of strings	2				
DC connection type	MC4				
Battery					
Battery type	Li-Ion/Lead-Acid				
Battery voltage range (Vdc)	42-58				
Battery capacity (Ah)	50-2000				
Max charging power (KW)	3		5		
Max charge/discharge current (A)	62.5		100		
Battery communication	CAN				
Output AC (backup)					
Rated output power (kW)	3		5		
Max. apparent output power (VA)	4000		6000		
Back-up switch time (sec)	< 20 ms				
Rated output voltage (V)	1P/NE/PE (220 /230)				
Rated frequency (Hz)	50/60				
Rated output current (A)	13.6/13		22.7/22		
THDv (@linear load)	<2%				

*This model is not available in Germany. For Belgium market, the max apparent output power is 5KVA.
**This model is not available in Germany and Belgium.

	S2.MH3000	S2.MH3600	S2.MH4600	S2.MH5000*	S2.MH6000**
In/output AC grid side					
Input voltage range (V)	184-264				
Max. input current (A)	26.1				
AC Grid frequency range (Hz)	45..55/55..65 (According to EN50549 VDE 0126-1-1, UL1741, G99)				
Rated output power (kW)	3	3.6	4.6	5	6
Max. apparent output power (kVA)	3.3	4	4.6	5.5*	6
Operation	1P/N/PE (220/230 V)				
Grid voltage range (V)	184-264				
Rating grid frequency (Hz)	50/60				
AC grid frequency range (Hz)	45-55/55-65				
Rating grid output current (A)	13.6/13	16.3/15.7	20.9/20	22.7/21.7	27.2/26.1
Max output current (A)	15.7	17.3	23	23.9	23.9
Power factor (at rated output power)	> 0.99 (0.8 leading …1… 0.8 lagging))				
Harmonic distortion at nom. output (THDI)	<2%				
Efficiency					
Max. efficiency (%)	>97.5%				
Euro efficiency (%)	>96.8				
Safety protection					
DC-reverse polarity protection	Yes				
Output short protection	Yes				
Output over current protection	Yes				
Ground fault monitoring	Yes				
Integrated AFCI	Yes				
Protection class/Over voltage	I/II				

*This model is not available in Germany. For Belgium market, the max apparent output power is 5KVA.
**This model is not available in Germany and Belgium.

	S2.MH3000	S2.MH3600	S2.MH4600	S2.MH5000*	S2.MH6000**
General data					
Dimensions (W x H x D) (mm)	333x505x249				
Weight (kg)	17				
Type of inverter	High frequency isolation (for battery)				
Operating temperature range (°C)	-25..60				
IP protection rating	IP65				
Noise level (dB(A))	<20				
Cooling concept	Natural convection				
Maximum operational altitude (m)	2000				
Grid connection standards	G98 or G99, VDE-AR-N 4105 / VDE V 0124, EN 50549-1, VDE 0126 / UTE C 15/VFR:2019, RD 1699/RD 244 / UNE 206006 / UNE 206007-1, CEI 0-21, C10/11, NRS 097-2-1, TOR, EIFS 2018.2, IEC 62116, IEC 61727, IEC 60068, IEC 61683, EN 50530, MEA, PEA				
Safety & EMC standard	IEC 62109-1/-2 ,EN 61000-6-1/-3				
Features					
DC Connection	MC4 connector				
AC connection	Quick connection plug				
Display	7 inch LCD color screen				
Communication	RS485, optional Wifi, GPRS				
Standard warranty	5 years (extendable to 15 years)				

*This model is not available in Germany. For Belgium market, the max apparent output power is 5KVA.
**This model is not available in Germany and Belgium.

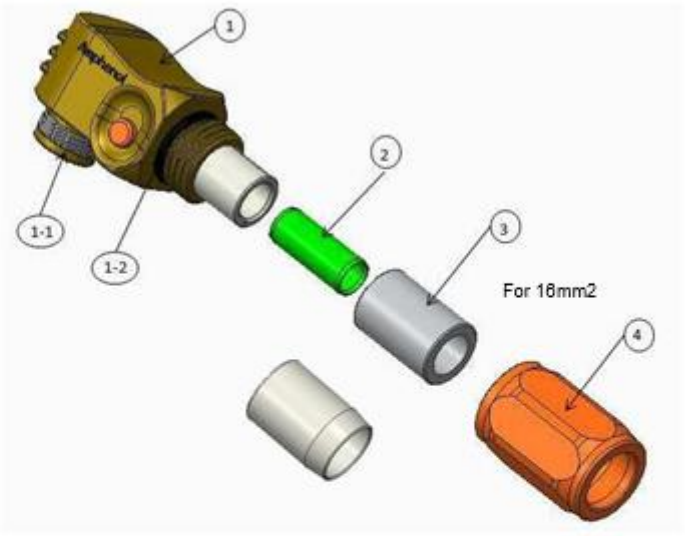
11 Appendix

In the appendix additional information on settings and assembly is shown. Always check with the supplier of the materials on the right working procedures.

A) Battery Terminal Assembly

In order to avoid DC arcs, Autarco suggests to install a DC switch between the battery and MH inverter.

Be sure the polarities of battery is correct before connecting to the inverter.
Please follow the instructions below to choose the battery power cable
Battery power cable use water-proof AMPHENOL connectors. To unlock, pressing the side Lock Button when pulling out the power plug.

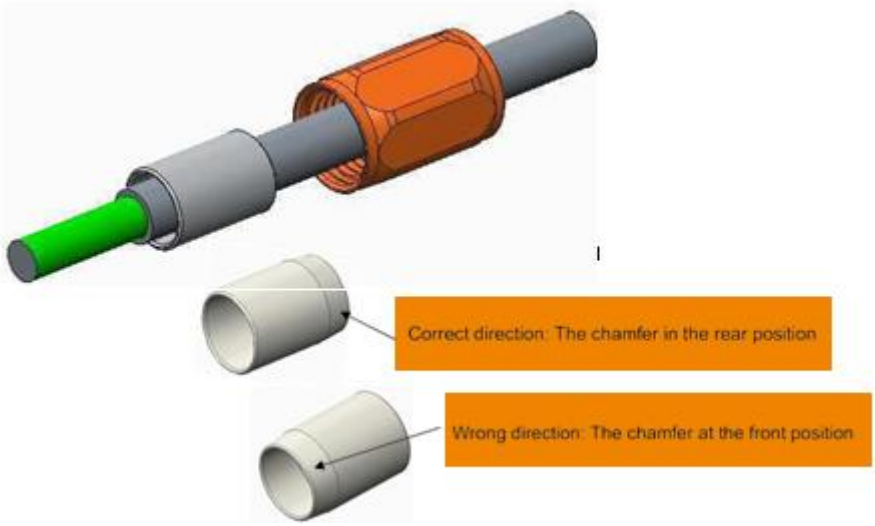


①: Connector Body
1-1: Barrel sealing (Not included when no sealing requirement)
1-2: O-Ring (Not included when no sealing require ment)
②: Barrel(Only for cable size 16mm²)
③: Grommet(Not included when no sealing requirement)
④: Back Shell

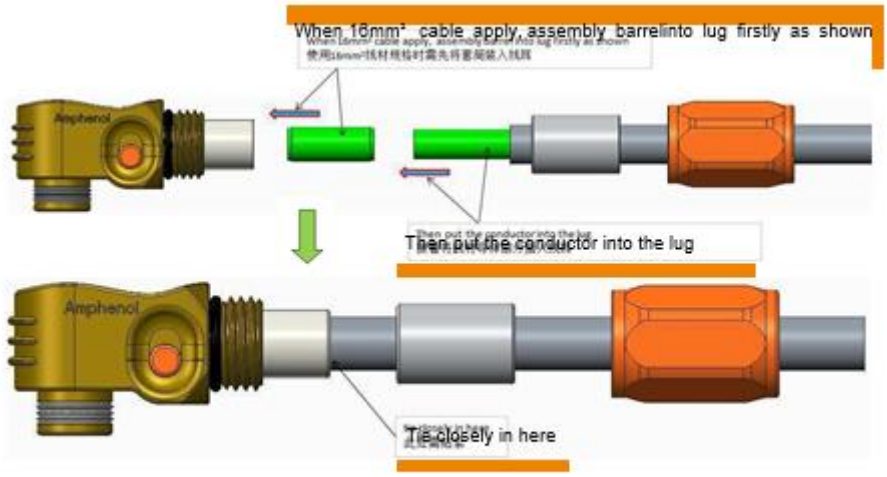
Instructions for cable assembly

Step 1: Strip the cable to a length of 18 mm

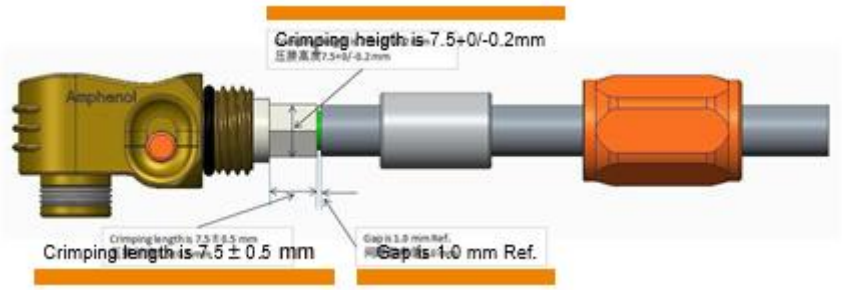
Step 2: Check the position of the chamfer



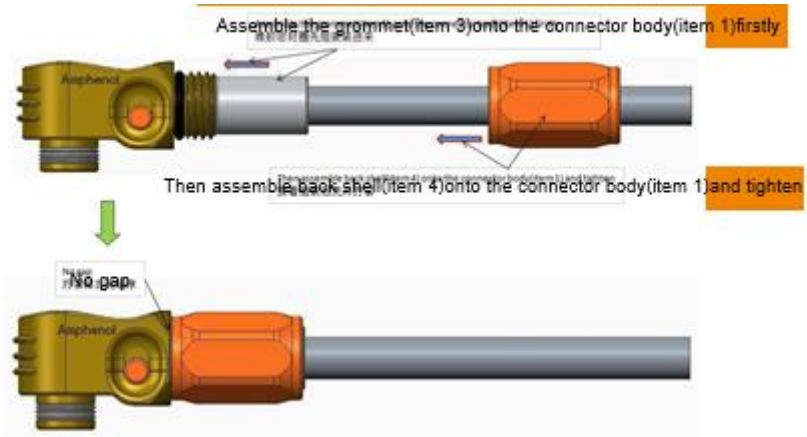
Step 3: Follow steps to assemble



Step 4: Crimp the lug as shown. Crimping heigth is 7.5+0/-0.2 mm, crimping length is 7.5+/- 0.5 mm. Gap is 1.0 mm reference. Use die of 25 mm in the crimping tool.



Step 5: Install grommet and back shell



11.1 Working Mode description

In this chapter the different working modes of the hybrid inverters are described. Please note that certain modes are not allowed by each net-operator.

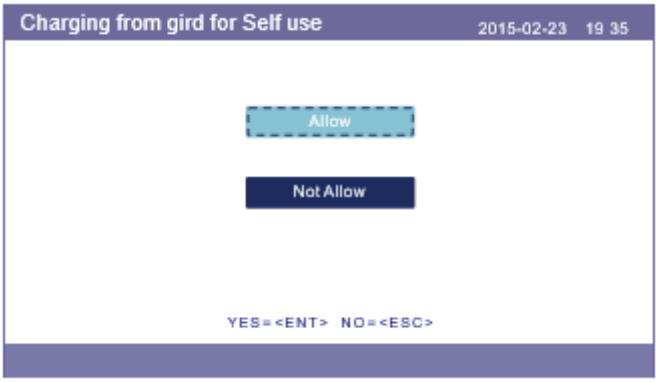
Mode 1: Self-Use Mode Logic(Maximize the usage of PV)

PV Power Using Priority: Load>Battery>Grid Load Support Priority: PV>Battery>Grid
Battery Charging Power comes from PV. (If “Charging From Grid” is allowed, it can also come from Grid)
If “Time of Use” is “Run”, the logic will follow the charging/discharging settings and time settings as defined in “Time of Use”. For those undefined period of time, it will still follow the Self-Use logic.

Time of use for Self use
Path: Advanced Settings->Storage Energy Set->Storage Mode Select->Self-Use Mode-> ON->Time of use for Self use

Charging from grid self use (Please check first in your country if this mode is allowed)

Path: Advanced Settings->Storage Energy Set->Storage Mode Select->Self-Use Mode-> ON->Charging from grid for Self use



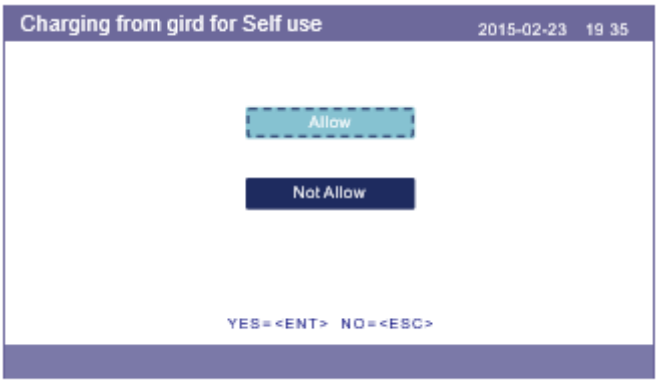
Mode 2: Feed In Priority Mode Logic(Feed the excess PV to Grid in order to gain subsidies)

PV Power Using Priority: Load>Grid>Battery Load Support Priority: PV>Battery>Grid
Battery Charging Power comes from PV. (If “Charging From Grid” is allowed, it can also come from Grid)
If “Time of Use” is “Run”, the logic will follow the charging/discharging settings and time settings as defined in “Time of Use”. For those undefined period of time, it will still follow the Feed in Priority logic.

Time of use for Feed for priority
Path: Advanced Settings->Storage Energy Set->Storage Mode Select-> Feed in Priority Mode->ON->Time of use for Feed for priority

Charging from grid for Feed for priority **(Please check first in your country if this mode is allowed)**

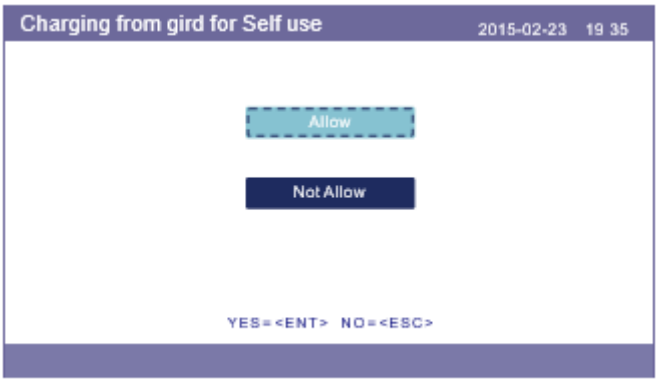
Path: Advanced Settings->Storage Energy Set->Storage Mode Select-> Feed in Priority Mode->ON->Charging from gird for Feed for priority



Mode 3: Backup Mode Logic(Keep the Battery at a certain SOC and only use it during power outage)

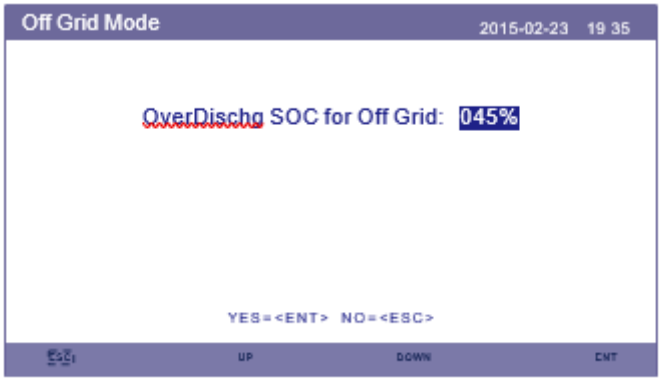
Backup Mode Logic: Keep the Battery at a certain SOC and only use it during power outage.
Backup SOC Setting Range: From Battery "Overdischarge SOC" to 100% PV Power Using Priority: Battery>Load>Grid
Load Support Priority: PV>Grid>Battery
Battery Charging Power comes from PV. (If "Charging From Grid" is allowed, it can also come from Grid)
* The "Backup Mode" is not applicable for Lead-acid batteries.

Charging from grid for Backup mode (**Please check first in your country if this mode is allowed)**
Path: Advanced Settings->Storage Energy Set->Storage Mode Select->Backup Mode-> ON->Backup SOC->Charging from grid for Backup mode



Mode 4: Off-Grid Mode Logic(For Off-grid use and AC-Grid Port Disconnected)

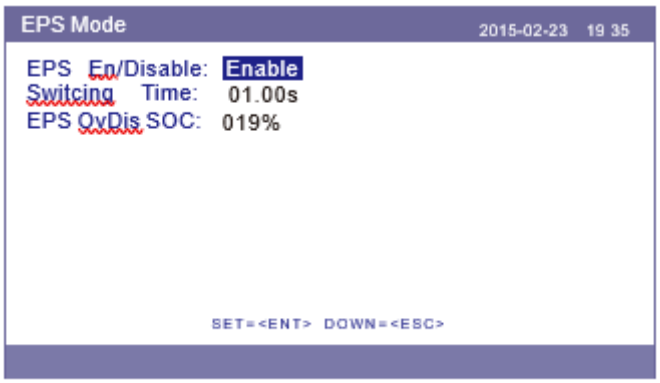
OverDischg SOC for Off-Grid Setting Range: From Battery “Forcecharge SOC” to 100% PV Power Using Priority: Load>Battery
Load Support Priority: PV>Battery Battery Charging Power comes from PV.
Off Grid Mode
Path: Advanced Settings->Storage Energy Set->Storage Mode Select->Off-Grid Mode-> ON->Off Grid Mode



Mode 5: EPS Mode Logic (Need to work with external Autarco NPS switching Box to achieve switching function; not implemented now)

When grid is available, only the Grid Port is enabled and load is supported through NPS box by the grid. When grid is lost, Grid Port will be disabled and after the “Switching Time”, the Backup Port will be enabled and then load is supported through NPS box by the Backup Port.
*It gives up the UPS function of the backup port and manually set the switching time. This mode must work with the Autarco NPS switching Box.
Otherwise it may cause some unexpected control mistakes.

EPS Mode
Path: Advanced Settings->Storage Energy Set->Storage Mode Select->EPS Mode-> EPS > En/Disable->Enable



11.2 Grid standard selection guide

For different countries and regions, corresponding grid code needs to be selected in the inverter LCD to meet the requirements of local network provider.
This instruction indicates how to change the grid code and what code should be selected in different places.
This following list illustrates the grid standard options in the inverter which are subject to change. More settings are available.
If a customer has any doubts or uncertainty, please consult Autarco service department for confirmation.
To set the correct grid code, please enter the following path: Advanced Settings -> Password-> Select Standard

Detailed protection limits can be viewed when choosing the code. Please select "Save&Send" to enforce the code.

NO.	Code in LCD	Country/Region	Comments
1	VDE4015	Germany	For German Low Voltage Grid.
2	EN50549 PO	Poland	For Polish Low Voltage Grid
3	EN50549 NL	Netherlands	For Dutch Low Voltage Grid
4	EN50438 L	-	General EN50438 Requirement. Possible to be used in Austria, Cyprus, Finland, Czech Republic, Slovenia, etc.
5	EIFS- SW	Sweden	For Swedish Low Voltage Grid
6	France	France	For French Low Voltage Grid
7	C10/11	Belgium	For Belgian Low Voltage Grid
8	NRS097	South Africa	For South African Low Voltage Grid
9	CEI0-21	Italy	For Italian Low Voltage Grid
10	EN50549L (EN50549-1)	-	General EN50549-1 requirement which meets local requirements of most European countries
11	G98	UK	For UK Low Voltage Grid <16A
12	G99	UK	For UK Low Voltage Grid >16A

NO.	Code in LCD	Country/Region	Comments

13	G98 NI	North Ireland	For North Ireland Low Voltage Grid <16A
14	G99 NI	North Ireland	For North Ireland Low Voltage Grid >16A
15	User-define	-	Customized Protection Limits
16	Gen50	-	Generator Connected, Frequency-Derating, 50Hz
17	Gen 60	-	Generator Connected, Frequency-Derating, 60Hz
18	DK1	East Denmark	For East Danish low voltage grid
19	DK2	West Denmark	For West Danish low voltage grid
20	50438IE	Ireland	For Irish low voltage grid
21	RD1699	Spain	For Spanish low voltage grid
22	EN50549 L	-	General EN50549 Requirement. Possible to be used in Cyprus, Finland, Czech Republic, Slovenia,Jamaica