RADIUS Industrial
String inverters

APV-S Solar Inverters

Models: APV-S-..k-AE-TL

.... Installation & operation manual

Manufactured & Supplied by

RISHABH

Information about this manual

Please read the safety instructions carefully before using the product. Keep the manual in a safe place and make sure it is available to engineering and installation personnel throughout the product's service life.

Rishabh Instruments Pvt Ltd has the right to modify products, data and dimensions without notice.

The data can only be used for the product description and they can not be understood as legally stated properties.

Thank you for choosing this Rishabh product.

Please send any information that could help us improve this manual to the following address:

inverters@rishabh.co.in

Contents

1. How to use this manual

1.1 Validity

This manual describes the assembly, installation, commissioning and maintenance of the following RADIUS Industrial **APV-S** Inverters :

APV-S-34k-AE-TL-2...

1.2 Target Group

Qualified personnel means people who have received training and have proven skills and knowledge of the construction and operation of this device.

Qualified personnel are trained to deal with the dangers and hazards involved in installing electric devices.

Additional information

Further information on specific topics contact .

1.3 SW version

This manual applies to SW version V1.XX.

The sw uses FreeRTOS™ (www.freertos.org).

1.4 Documentation and declaration of conformity

This technical documentation describes the procedures that must be followed in order to ensure safety during the transportation, installation, use and maintenance of the electrical equipment to which the manual refers.

Store this manual so that it can be referred to whenever necessary.

Rishabh declares that the equipment is designed to conform the current law in the country of installation & that the declaration of conformity can be consulted or requested from Rishabh radius - solar service personnel.

(Inverter is designed to conform the below metioned applicable standards & meet the requiements of the given grid code)

Grid code	CEI 0-16– CEI 0-21
	VDE- AR – N 4105
	RD1669 - RD661
	VDE 0126-1-1: 2006-02
	VDE 0126-1-1/A1: 2012-02
Photovoltaic (PV) systems. Characteristics of the utility interface.	IEC 61727: 2004
Electromagnetic Compatibility (EMC)	EN 61000-6-2/-3
Procedure for measuring efficiency.	IEC 61683
Environmental testing	IEC 60068-2-1, 60068-2-2, 60068-2-14, 60068-2-30
Anti islanding	IEC 62116: 2008
Safety of power converters for use in photovoltaic power systems	IEC 62109-1, 62109-2

Note! Available certifications can be availed at Rishabh Instruments Pvt Ltd Nashik.

In case of any problem, you can email us at: inverters@rishabh.co.in .

2. Safety Precautions

2.1 Symbols used in the manual

Warning!

Indicates a procedure, condition, or statement that, if not strictly observed, could result in personal injury or death.

Caution

Indicates a procedure, condition, or statement that, if not strictly observed, could result in damage to or destruction of equipment.

Indicates that the presence of electrostatic discharge could damage the appliance. When handling the boards, always wear a grounded bracelet.

Attention

Indicates a procedure, condition, or statement that should be strictly followed in order to optimize these applications.

Note ! Indicates an essential or important procedure, condition, or statement.

2.2 Symbols used on outside labels

	Indicates that you must read the manual before doing any work.
	Indicates absence of the isolation transformer.
	Indicates risk of electrocution due to high voltage. All work on the inverter must be done ONLY by trained technicians.
 **Warning** Multiple power supply	Indicates risk of electric shock. Machine equipped with multiple power supply (DC and AC). Before doing any work, check that both the DC and the AC power supply have been disconnected.
 **Warning** Hot surface	Indicates risk of burning due to very hot surfaces. Before doing any work, let the unit cool sufficiently; wear personal protective equipment (for example, gloves).
  10 minutes	Indicates risk of electric shock. Before doing any work, allow all stored energy to drain for at least 10 minutes.

2.3 General warnings and safety information

Please read these instructions carefully in order to ensure your personal safety and that of others and to prolong the service life of this product and of the plant connected to it.

Operators must be instructed or skilled persons. They must have read and fully understood the operating instructions contained in this manual and those relating to the machine before having access to equipment controls. Persons who are not skilled or instructed must not be allowed to use the equipment.

The term "specially trained and competent" operator refers to the person responsible for installing and transporting the electrical equipment.

According to standard CEI EN 60204-1:

A skilled person: is a person with technical knowledge or sufficient experience to be able to avoid the dangers which electricity may create.

An instructed person: is a person adequately advised or supervised by skilled persons to be able to avoid the dangers which electricity may create (e.g. maintenance operators).

Safety Instructions

All maintenance operations carried out on live equipment can involve serious risks. These operations must be carried out by skilled persons who are fully aware of the risks and provided with all the appropriate personal protective equipment and suitable tools.

To remove all dangerous voltage from inside the panel, disconnect all the external power connections (AC side, DC side and auxiliary voltage) and make sure these cannot be reconnected inadvertently (put up a work in progress sign).

Energy stored in the equipment's DC link capacitors can be an electric shock hazard. Even after the unit is disconnected from the grid and photovoltaic panels, there may still be high voltages in the APV-S inverter. Do not remove the casing (terminal side) until at least 10 minutes after disconnecting all power sources.

Follow all the safety instructions in this manual.

Make sure all power supplies have been disconnected before touching any parts.

Do not modify circuits or software programs or make adjustments without the manufacturer's prior consent. Any such modifications could pose a risk for persons or equipment.

Failure to comply with the manufacturerís instructions when using the inverter could undermine safety.

The installer is responsible for choosing the most appropriate residual current-operated circuit breaker according to the characteristics of the PV plant.

Danger of burn injuries due to hot enclosure parts!

- **Some parts of the equipment may become very hot during operation. DO NOT touch the heat sink while the inverter is working.**

Grounding the PV generator

- **Comply with local requirements for grounding the PV modules and the PV generator.**
- **Rishabh recommends connecting the generator frame and other electrically conductive surfaces in a manner which ensures continuous conduction and grounding these in order to achieve maximum protection of the system and personnel.**

2.4 Intended or permitted purpose

This device is a multistring inverter designed to:

convert direct current (DC) from a PV generator into alternating current (AC) suitable for connection to a 3-phase public grid.

Limits of use:

- The inverter can be used only with PV modules that do not require grounding of one of the poles.
- For PV modules that require grounding of one of the poles, use the dedicated version of the product (-P/-N depending on the grounded pole) and an external transformer (as described in the specific addendum).
- Only a PV generator can be connected to the inverter in input (DO NOT connect batteries or other power sources).
- The inverter can be connected to the grid only in qualified countries.
- The inverter can be used only by respecting all of the technical characteristics.

Use the equipment ONLY for its INTENDED OR PERMITTED PURPOSE. If you need any explanations, please contact Rishabh Solar Service.

2.5 Improper or prohibited use

NEVER:

- Install the equipment in potentially flammable / explosive environments or in environments with adverse or prohibited conditions (temperature and humidity).
- Use the equipment with defective or disabled safety devices.
- Use the equipment or parts of the equipment by connecting it to other machines or devices (unless specifically permitted).
- Modify work parameters not accessible to the operator and/or any parts of the equipment to change its performance or insulations.

3. Transportation – Handling - Storage

Caution

All transportation, handling and storage operations must only be performed by specially trained and competent operators.

3.1 Handling packed equipment

The equipment can easily be transported using a lift truck, or fork crane with adequate load capacity,

Dimensions and weights are specified in chapter“12. Dimensions and weight” on page 82.

Correct methods of transportation, storage, installation and assembly, as well as appropriate use and maintenance, are essential for ensuring the proper and safe operation of this equipment.

Protect the equipment against shocks and vibrations during transportation.

Make sure it is also protected against water(rain), humidity and extreme temperatures.

3.2 Packaging and unpacking

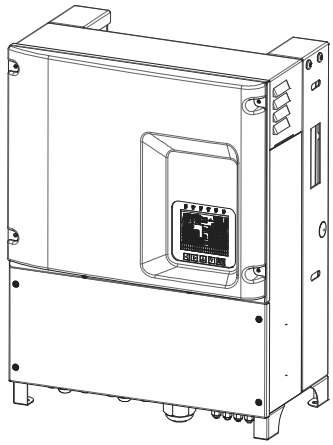
The packaging consists of a wooden crate and 2 expanded Polyethylene(EP) protectors.Wooden crate dimensions: 800x600x505 mm.

Note ! These materials must be disposed of in accordance with local regulations.

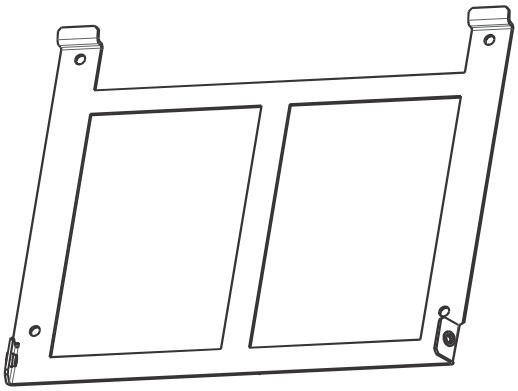
As soon as the equipment is delivered check that:

- there is no visible damage to packaging,
- the details in the delivery note correspond to the order.
- after opening the package, please check the contents of the box. It should contain the following:

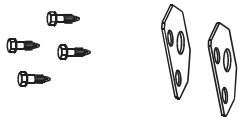
(A)



(B)



(C)



(D)

(E)

REF.	Description	Q.ty
A	APV-S-.... Inverter	1
B	Mounting bracket	1
C	2 transport brackets and 4 M8 x 25 hexagonal head screws	2+4
D	Plastic caps	2
E	Mc4 Connectors male and female	Based upon model

Figure 1 : Packaging contents

Open the packaging carefully and make sure that:

- no parts of the equipment have been damaged during transportation,
- the equipment is that actually ordered.

Please notify the local sales office if you notice any damage or if the equipment supplied is in complete or not what was ordered.

Remove the top cover(1) from the crate and the 2 cross beams(2) by unscrewing all of the screws with a Phil - lips screw driver; remove the accessories as well.Proceed as described below.

Removal of the inverter from the crate can be carried out:

- using chain hoists or crane, attach two tie rods in the appropriate slots on the sides of the inverter, see Figure 2 (slots dimensions:11,5x39mm. **Attention** : use these slots only to remove the inverter from the crate. See chapter 3.4 for information on how to handle the equipment: 3.4:
- manually by using the appropriate handles, see Figure 5. In this case, also remove the side panels of the crate(3).Seefigure2.

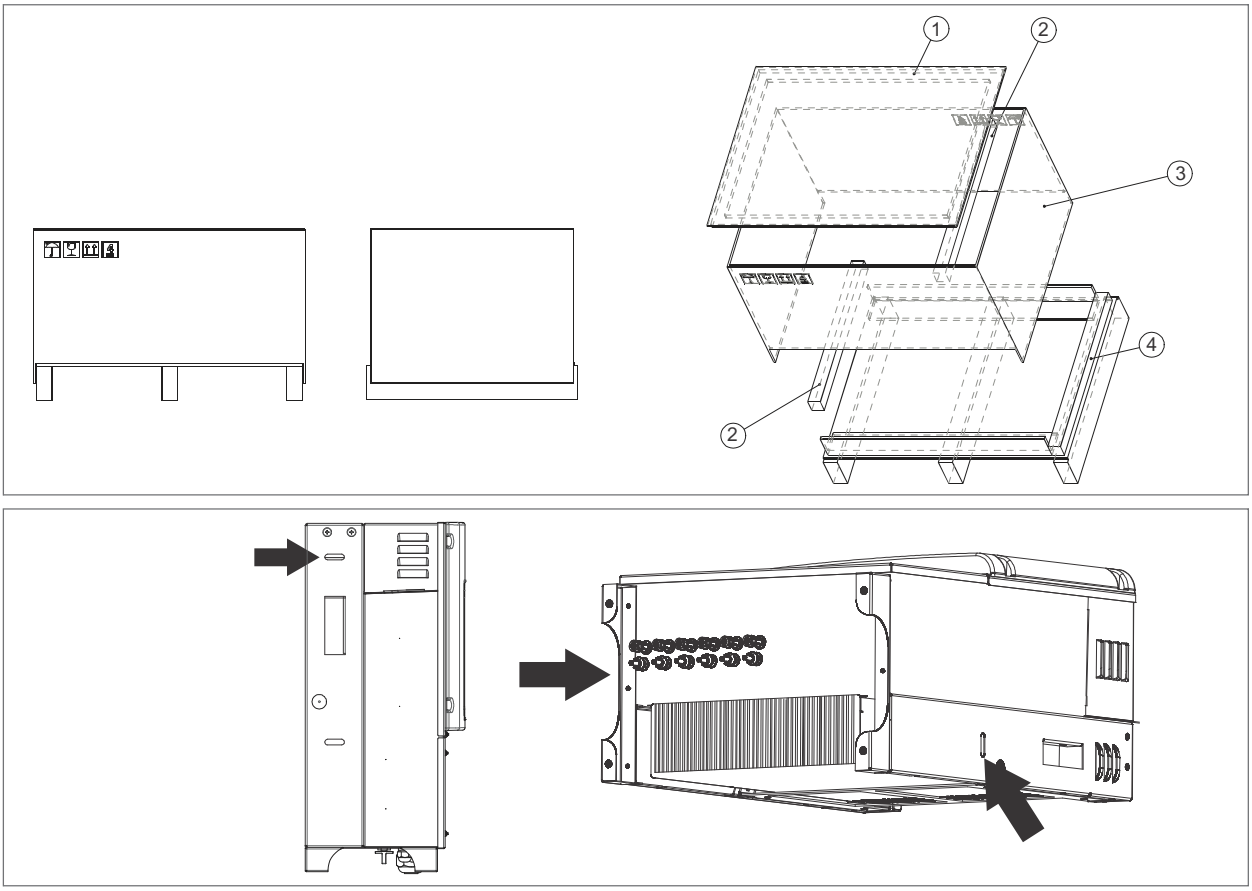


Figure 2 : wooden crate and slots for extraction of the inverter from crate

3.3 Storage

This equipment must be stored in a dry place within the specified temperature range, see chapter“11. Specifi - cations”on page79.

4	If the crate is stored correctly it can be stacked for a maximum of 4 crates. Do not stack other products or materials on top of it.

Caution

Changes in temperature may lead to the formation of condensation inside the equipment. This is acceptable in certain conditions but not when the equipment is in use. Therefore it is always important to ensure that there is no condensation in the equipment before connecting it to the power supply!

3.4 Handling the equipment after unpacking

The equipment can be handled with chain hoists or crane after installation of the two transport brackets with the 4 M8 hexagonal head bolts supplied with the equipment. Tightening torque = 25 Nm. See Figures 4 and 5.

Alternatively, it can be handled by using the appropriate handles, see Figure 6.

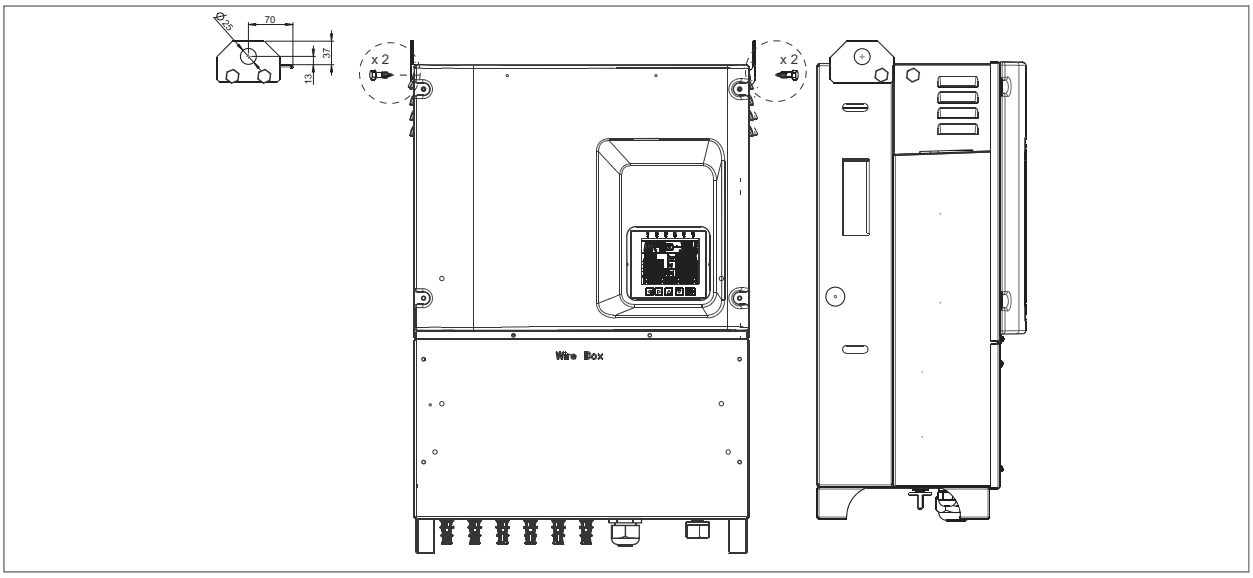


Figure 3 : Mounting of transport brackets for handling with hoist

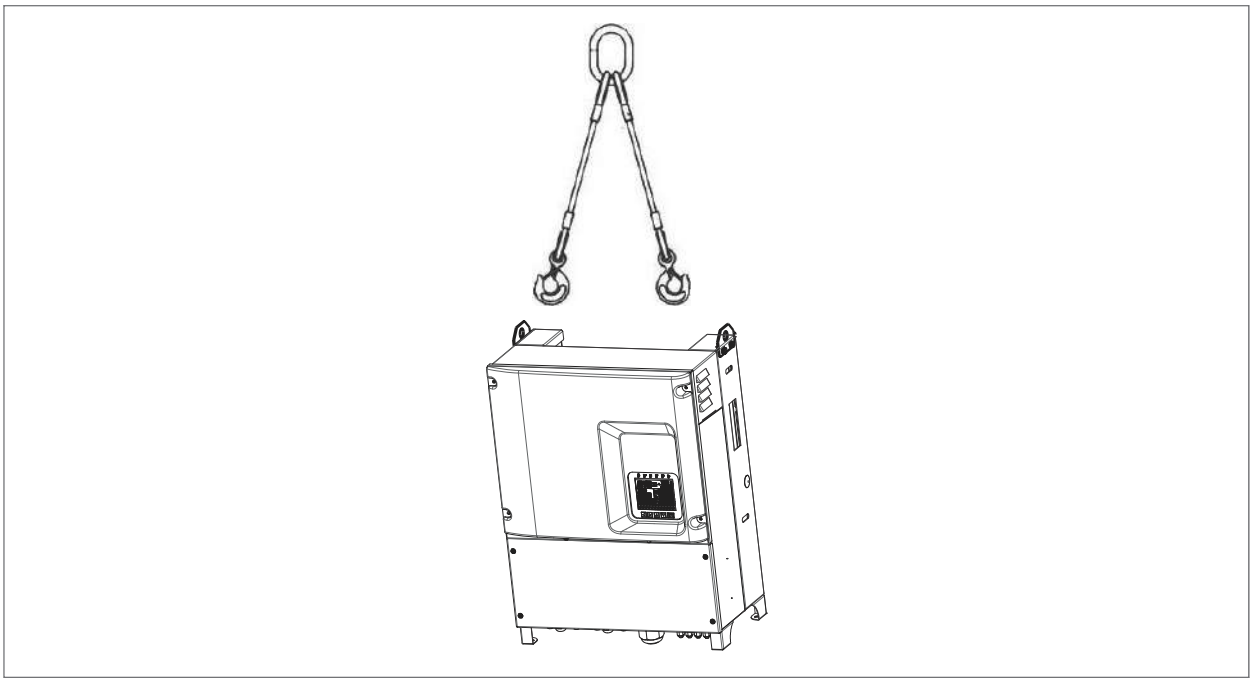


Figure 4 : Handling with hoist and two cable tie rod

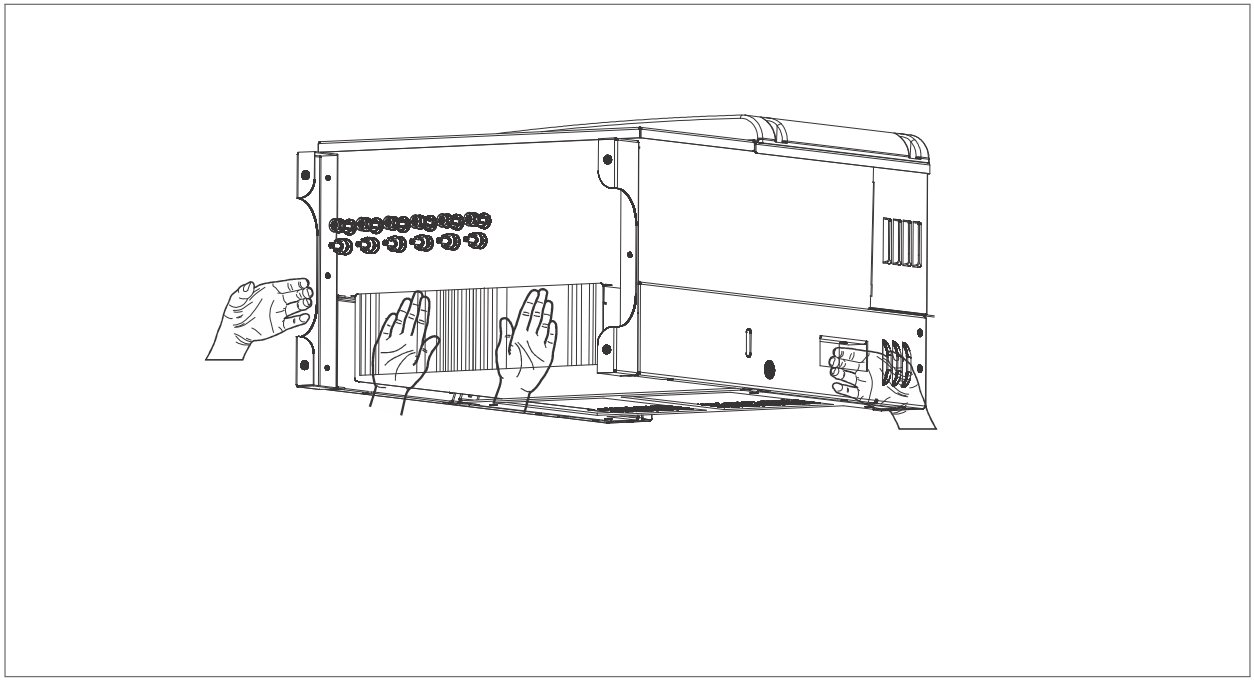


Figure 5 : Manual handling

3.5 Disposal of the device

The APV-S inverter can be disposed of as electronic waste according to national regulations in force for the disposal of electronic components.

4. Description of the RADIUS APV-S inverter

4.1 Introduction

The Radius model APV-S inverter is a multistring inverter designed to:

convert direct current(DC) from a PV generator into alternating current(AC) suitable for connection to a 3-phase public grid.

At the application level, the range of string inverters consists of main product line:

- Advanced Energy APV-S-AE

This is very extensive and flexible, intended mainly for photovoltaic roof arrays with complex tracking and ir-radiation features.

For more information and advice on the ideal configuration for your PV plant, please contact Rishabh's pre sales service and see the latest updated SW version of the Radius Planner configurator, downloadable free of charge from www.rishabh.co.in.

The main product line offers the following power levels:

AC Power	Advanced Energy
10 kW	APV-S-10k-AE-TL-...
12 kW	APV-S-12k-AE-TL-...
15 kW	APV-S-15k-AE-TL-...
18 kW	APV-S-18k-AE-TL-...
20 kW	APV-S-20k-AE-TL-...
25 kW	APV-S-25k-AE-TL-...

Depending on the model, the APV-S inverter can have 2 or 3 MPPTs.

	Advanced Energy
1MPPT	APV-S-10k-AE-TL-1... APV-S-12k-AE-TL-1...

	Advanced Energy
2MPPT	APV-S-15k-AE-TL-2... APV-S-18k-AE-TL-2... APV-S-20k-AE-TL-2... APV-S-25k-AE-TL-2...

- **APV-S-AE** is supplied with display **KA** (modelsAPV-S-..k-AE-TL-.....-KA) for the 10,12,15,18 & 20kW AE models.

APV-S-34k-AE-TL-.....-KA models

4.2 Block diagrams APV-S

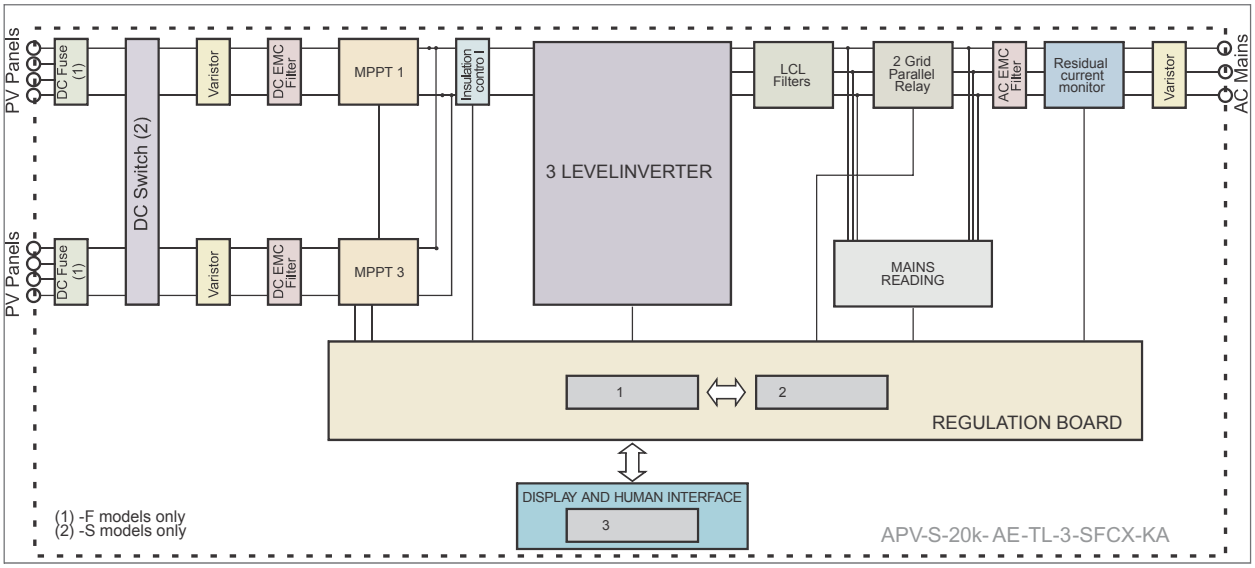


Figure 6 : Block diagrams APV-S-AE

Note! The unit is equipped with an automatic circuit breaker conforming to the safety requirements specified in VDE0126-1-1.

The block diagrams are show for models AE. See section 11 for the number of strings for each MPPT channel and the number of MPPTs for each model.

4.3 Installation notes

APV-S is available in several configurations that integrate the following devices.

For further information and connection details,refer to the chapter specified:

- **S** DC circuit breaker,see chapter“6.11 DC circuit breaker”on page 31.
- **F** Fuses on the DC side,see chapter“6.7 DC side fuses and string current monitoring”on page 27.

4.4 Device identification

4.4.1 Data plate

The data plate with details of the specific model is attached to the left side of the inverter.

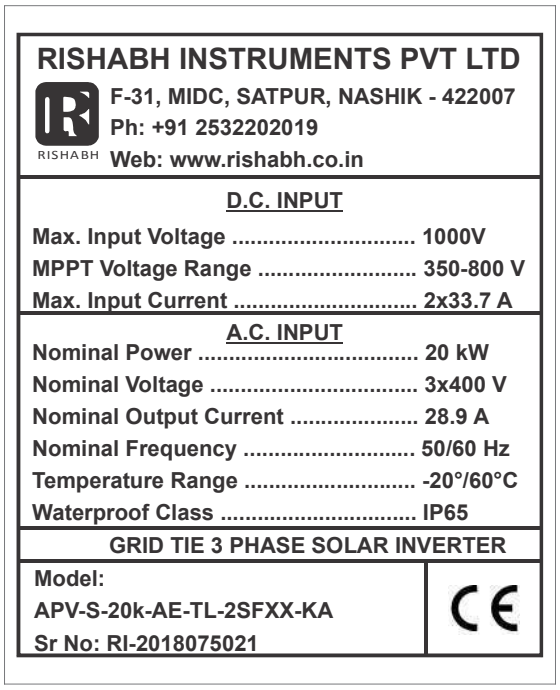


Figure 7: Data Plate

4.4.2 Model identification(Type)

APV-S	-XXk-	XX	-TL	-X	X	X	X	X	-XX		
										Display	KA = advanced keypad
										Grounding kit	X = not included
										Interface protection system to CEI-021 standard and AC3 contactor (not available)	X = not included
										DC fuses and Broken string recognition	F = included
										DC circuit breaker under load	S = included
										MPPT numbers	1 = 1 MPPT 2 = 2 MPPT
										Transformer	TL = not included
										Model	AE = Advanced Energy
										Inverter power in kW	25k = 25 kW 20k = 20 kW 18k = 18 kW 15k = 15 kW 12k = 12 kW 10k = 10 kW
										PV inverter, APV-S series	

5. Installation

5.1 Safety instructions

Warning!

A) Do not remove the upper casing. The inverter contains no user-serviceable parts. All servicing must be performed by qualified service personnel. All wiring and electrical installation should be performed by qualified service personnel and must meet national requirements.

B) Both AC and DC voltage sources are terminated inside the **APV-S** Inverter. Please disconnect these circuits before servicing.

C) When a photovoltaic panel is exposed to light, it generates a DC voltage. When connected to this equipment, a photovoltaic panel will charge the DC link capacitors.

D) Energy stored in the equipment's DC link capacitors can be an electric shock hazard. Even after the unit is disconnected from the grid and photovoltaic panels, there may still be high voltages in the **APV-S** inverter. Do not remove the casing (terminal side) until at least 10 minutes after disconnecting all power sources.

E) This unit is designed to feed power to the public power grid (utility) only. Do not connect this unit to an AC source or generator. Connecting the inverter to external devices could result in serious damage to your equipment.

F) Although designed to meet all safety requirements, some parts and surfaces of the inverter are still hot during operation. To reduce the risk of injury, do not touch the heat sink at the back of the **APV-S** inverter or nearby surfaces while the inverter is operating.

5.2 Selecting the Installation site

Warning!

- **Do not install the inverter on structures made of flammable or thermolabile materials.**
- **The mounting location and method must be suitable for the weight and dimensions of the inverter. Choose a wall or solid vertical surface that can support the APV-S inverter.**
- **DO NOT install the inverter in locations at risk of explosion or near easily inflammable materials.**

Caution

- Never install the inverter in an environment with little or no air flow or in a dusty environment. This could undermine the efficiency of the inverter.
- Mount on a solid surface, the mounting location must be accessible at all times.
- Mount the inverter in a vertical position or with a maximum backward tilt of 15°. The connection area must point downwards. Never install the device with a sideways tilt. Do not install horizontally. (See figure below).

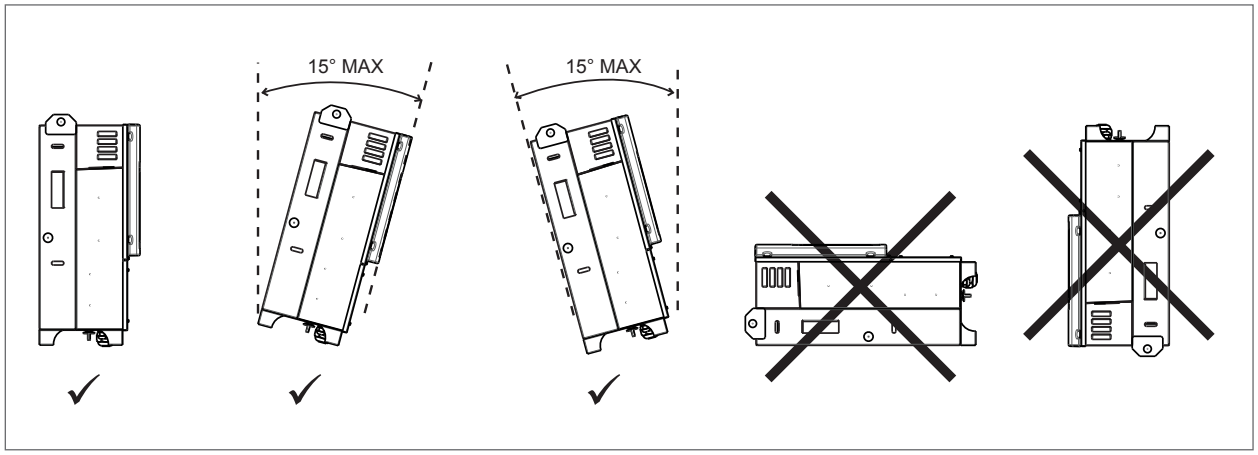


Figure 7 : Installation warning

- The ambient temperature should be -20 ... +50 °C to ensure optimal operation.
- Do not expose the inverter to direct sunlight to avoid any reduction in power due to excessive heating.
- Do not install the inverter in living areas, the noise caused by the machine could affect daily life.

- Be careful not to obstruct the slits or the equipment cooling systems.
- DO NOT place anything on the inverter while it is working.

5.3 Mounting

The inverters must be positioned so as to ensure free movement of ventilation air around them and facilitate wiring and maintenance operations.

- Maximum permissible inclination 15 with respect to the vertical
- Minimum upper and lower distance 400 mm and 620 mm
- Minimum distance between drives 250 mm

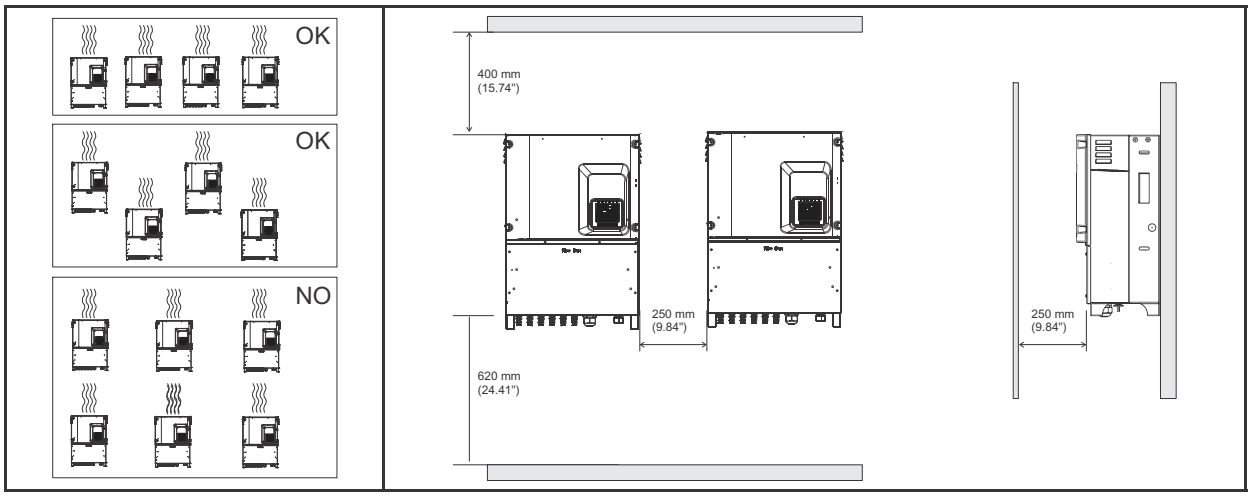


Figure 8 : Free movement of ventilation air and Minimum distances

5.3.1 Mounting the device on a wall

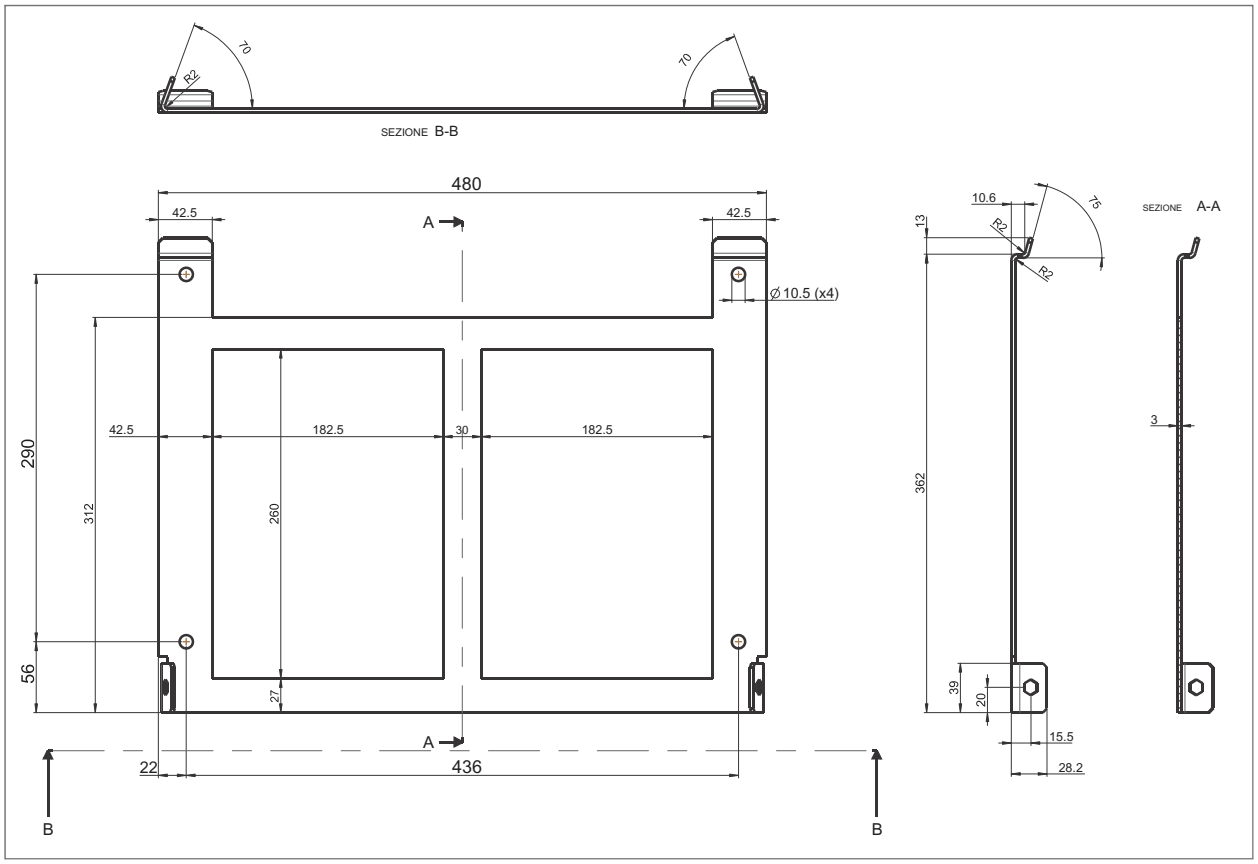


Figure 9 : Wall-mounting bracket dimensions

(1) Use the mounting bracket as a template,ensure it is positioned horizontally.
Drill 4 holesin the wall in correspondence with the holes on the bracket shown in the figure.
Attach the bracket to the wall with 4 M10 screws (not supplied).

Attention

The size of the holes depends on the wall material and the anchorage system used(e.g. expansion plugs).

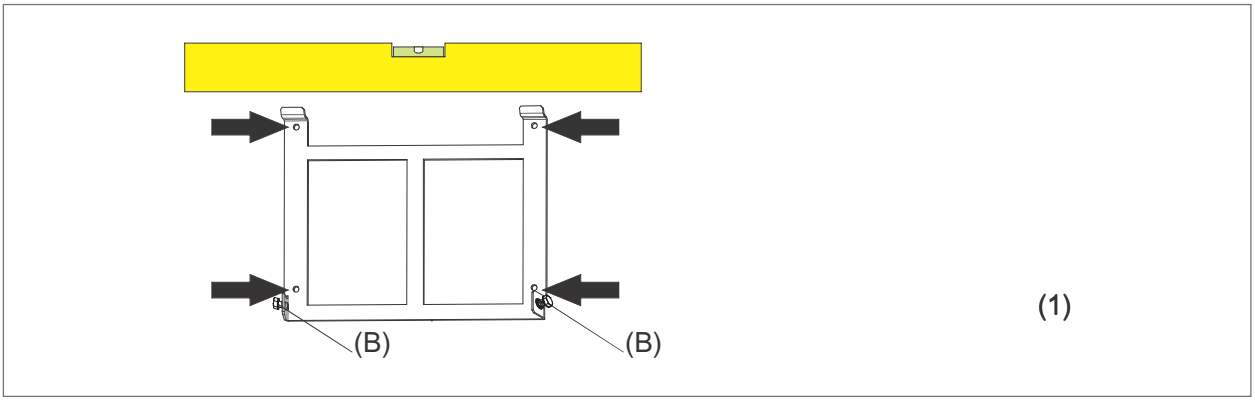


Figure 10 : Mounting bracket fixing

5.3.2 Mounting the inverter on the bracket

(2) Lift the inverter and hang it on the mounting bracket at the top,then rest it on the wall.
(3) Tighten the two fixing screws (B) (M8x25, one on each side) with a 13 socket wrench.The screws (B) are supplied in the packaging.
(4) Fix the 2 end caps(C).

Caution

Ensure that the installation of the inverter is stable by trying to lift it from the bottom. The inverter must remain securely in place.

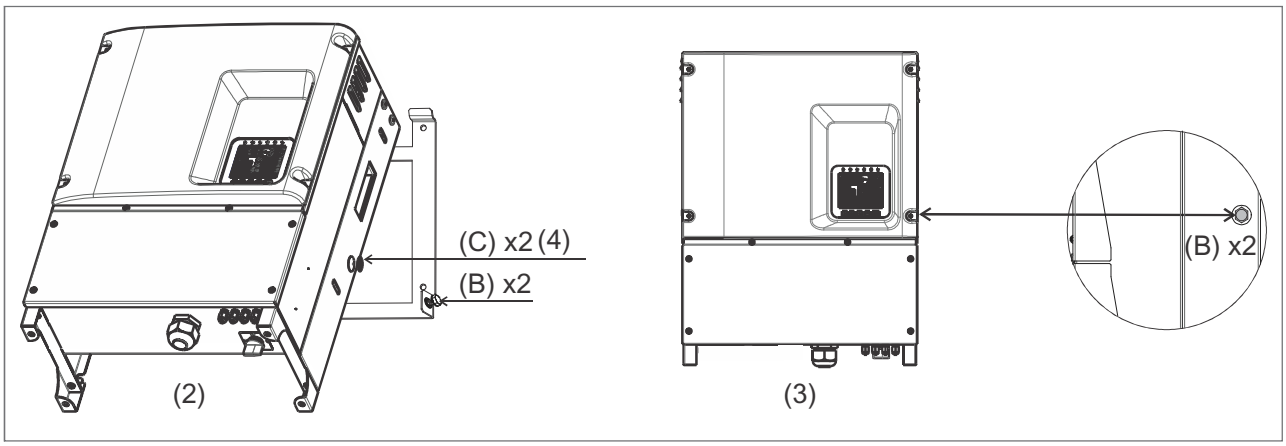


Figure 11 : Fixing the inverter on the bracket

6. Electrical Connection

6.1 System Diagram with Inverter and Electrical connection

- PV Panel: Supplies DC power to the inverter
- Inverter: Converts DC (Direct Current) power from the PV panel(s) to AC (Alternating Current) power. The inverter will always try to convert the maximum power from your PV panel(s).
- Utility: Referred to as the “grid” in this manual, this is the way your electricity company provides power to your place.

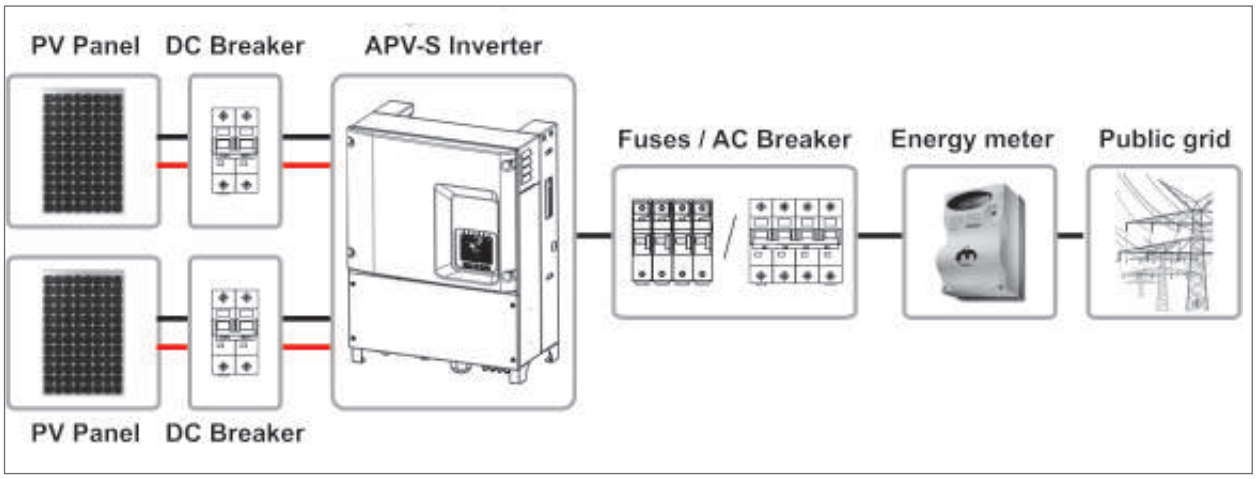


Figure 12 : Schematic diagram of the system

Note! The system configuration depends on many factors (module type, production target, AC connection, installation site, current regulations, etc.) and must therefore be designed, built, and decided by a qualified technician.

The Radius Planner program, downloadable from www.rishabh.co.in, can help you correctly size the PV module strings.

6.2 Safety

Warning!

Connect the ground connector to the terminal (PE) of the APV-S inverter.

The ground conductor must be the first to be connected.

If replacing the APV-S inverter, the ground connector must be the last to be disconnected.

High voltages exist when the PV panel is exposed to the sun. To reduce the risk of electric shock, avoid touching live components and treat connection terminals carefully.

The DC cable must be disconnected before disconnecting the AC cable.

The DC circuit breaker (only on models APV-S-TL-..k-S..) can operate under load.

Operation to be performed by specially trained personnel.

Risk of electric shock. If the PV field is illuminated, voltage is present on the DC side.

There is voltage on the input terminals even if the DC circuit breaker (see Figure 26 on page 31)) is in position 0.

6.3 Removal of the lower panel

To remove the lower panel unscrew the 6 torque T5 screws shown in the figure.

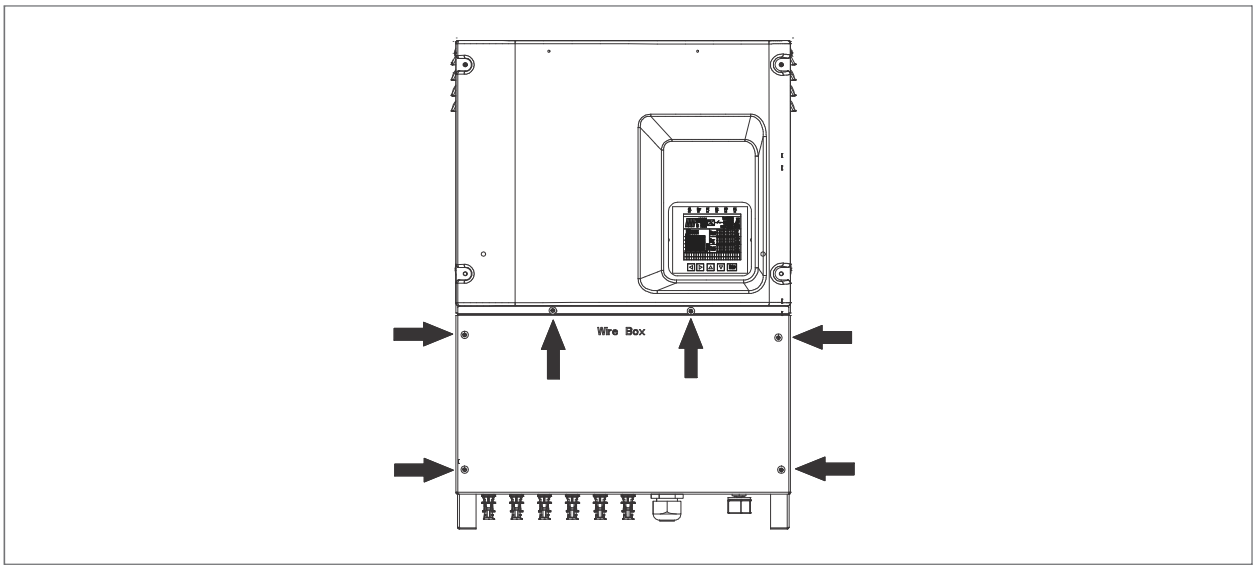


Figure 13 : removal of the lower panel

6.4 Connecting to the grid (utility grid) and ground cable (PE)

- Measure grid(utility) voltage and frequency(See“11.Specifications” on page 79).
- Open the circuit breaker and/or fuses between the APV-S inverter and the utility grid.
- Use insulated cables with minimum working temperature of 90 C.

Cable requirements for maximum length of 30 meters

Model	Terminals	Recommended section		Maximum section		Note
		(mm^2)	AWG no.	(mm^2)	N. AWG	
APV-S-10k-TL-...	L1–L2-L3-N-PE	8	8	16	5	Tool Free terminals: no need to attach lugs or metal tips to the cable.
APV-S-12k-TL-...	L1–L2-L3-N-PE	8	8	16	5	
APV-S-15k-TL-...	L1--L2-L3-N-PE	16	5	16	5	
APV-S-18k-TL-...	L1--L2-L3-N-PE	16	5	16	5	
APV-S-20k-TL-...	L1--L2-L3-N-PE	16	5	16	5	
APV-S-25k-TL-...	L1--L2-L3-N-PE	16	5	16	5	

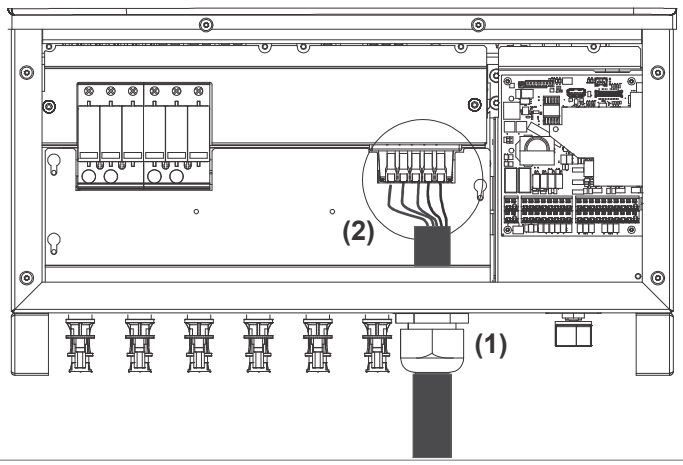


Figure 14 : AC connection (APV-S-AE-... models)

1. To ensure IP 65 degree of protection,the cables must pass through the specific cable holder with sealing membrane(see figure).
2. Connect the cables to the corresponding terminals of the AC connector.
   APV-S-AE:the terminals are of the spring with lever type(*).

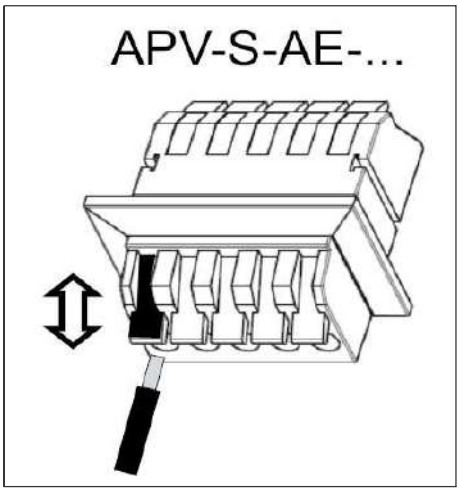


Figure 15 : Insertion of cables in spring connectors

(*) **Spring terminals with lever;** allow direct connection of a rigid or flexible cable with or without terminal (pin type).
To insert the cable, raise the lever; close the lever to clamp it. To remove the cable, raise the lever.

6.4.1 Connecting to the PV panel (DC input)

Caution

- **Before connecting the PV panels to the DC terminals, please make sure the polarity is correct. Incorrect polarity connection could permanently damage the unit.**
- **Before connecting the PV panels to the DC terminals, check that the maximum PV string current is below the maximum current allowed by the model (see chapter 11). On models with fuses (-F), check that the current is below the size of the installed string fuse.**
- **Check that poles pertaining to different mppt are not connected under the same MPPT.**
- **Make the DC side connections without voltage by isolating the PV field circuit.**
- **In case of non-insulated installations, the string inverter must be used only with PV generators that comply with insulation class II in conformity with application class A of IEC 61730.**

Under all conditions, always make sure the maximum open circuit voltage(Voc) of each PV string is less than 1000Vdc.

Cable requirements

Terminals	Section (mm^2)	AWG no.	Note
+, -	2.5 ... 6	13 ... 10	• The section depends on the string current. • MC4 connectors for DC connections

1. Crimp the positive and negative wires from the panels appropriately, following the steps given on the page 24

2. Connect the positive and negative terminals from the PVpanel to the positive(+) terminals and negative(-) terminals on the **APV-S**-Inverter.

   APV-S-AE: the terminals are of the spring with lever type(*)see previous page.

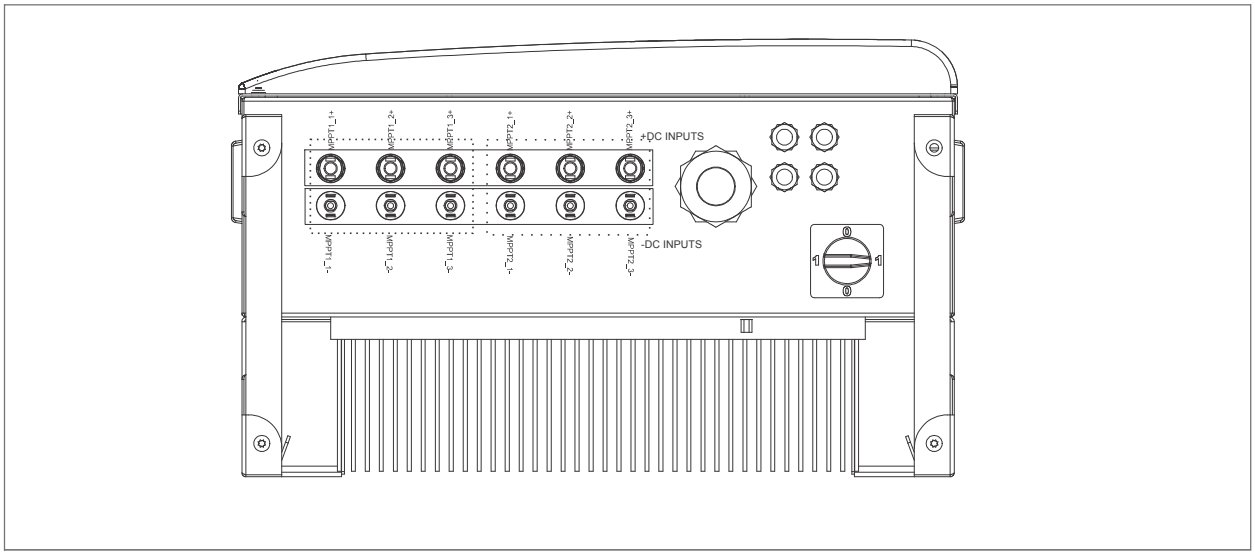


Figure 16 :Connecting to the PV panel 2MPPT model

(3 Refer to the tables and diagrams below for recommended connections to the photovoltaic field for 20kW and 25kW 2MPPT models.

Terminals	Signal	Description	Electrical Level	Recommended stripping
MPPT1_1	+	String 1 current input MPPT1	10A 1000V	12 mm
MPPT1_2	+	String 2 current input MPPT1	10A 1000V	12 mm
MPPT1_3	+	String 3 current input MPPT1	10A 1000V	12 mm
MPPT2_1	+	String 1 current input MPPT2	10A 1000V	12 mm
MPPT2_2	+	String 2 current input MPPT2	10A 1000V	12 mm
MPPT2_3	+	String 3 current input MPPT2	10A 1000V	12 mm

Terminals	Signal	Description	Electrical Level	Recommended stripping
MPPT1_1	-	String 1 current input MPPT1	10A 1000V	12 mm
MPPT1_2	-	String 2 current input MPPT1	10A 1000V	12 mm
MPPT1_3	-	String 1 current input MPPT2	10A 1000V	12 mm
MPPT2_1	-	String 2 current input MPPT2	10A 1000V	12 mm
MPPT2_2	-	String 1 current input MPPT2	10A 1000V	12 mm
MPPT2_3	-	String 2 current input MPPT2	10A 1000V	12 mm

(3 Refer to the tables and diagrams below for recommended connections to the photovoltaic field for 15kW and 18kW 2MPPT model.

Terminals	Signal	Description	Electrical Level	Recommended stripping
MPPT1_1	+	String 1 current input MPPT1	10A 1000V	12 mm
MPPT1_2	+	String 2 current input MPPT1	10A 1000V	12 mm
MPPT2_1	+	String 1 current input MPPT2	10A 1000V	12 mm
MPPT2_2	+	String 2 current input MPPT2	10A 1000V	12 mm

Terminals	Signal	Description	Electrical Level	Recommended stripping
MPPT1_1	-	String 1 current input MPPT1	10A 1000V	12 mm
MPPT1_2	-	String 2 current input MPPT1	10A 1000V	12 mm
MPPT2_1	-	String 2 current input MPPT2	10A 1000V	12 mm
MPPT2_2	-	String 1 current input MPPT2	10A 1000V	12 mm

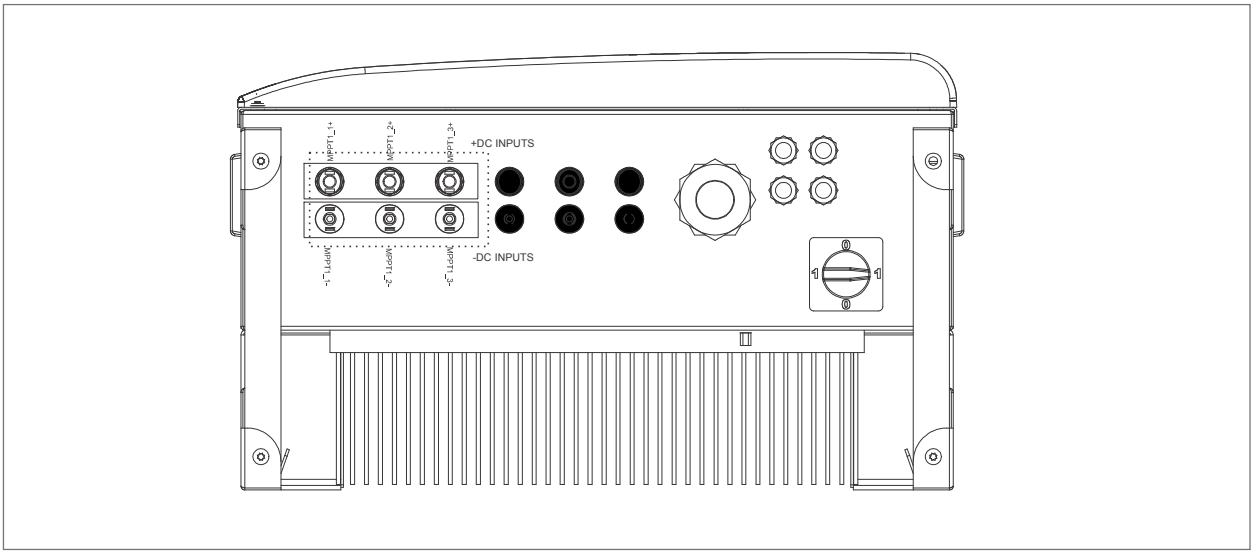


Figure 16 : Connecting to the PV panel 1MPPT model

(3 Refer to the tables and diagrams below for recommended connections to the photovoltaic field for 10kW and 12kW 1MPPT models.

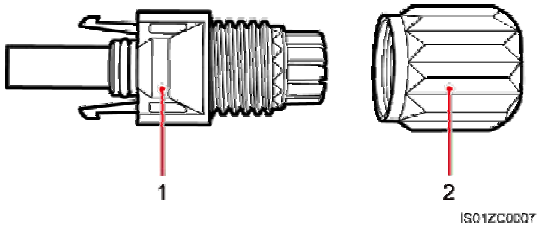
Terminals	Signal	Description	Electrical Level	Recommended stripping
MPPT1_1	+	String 1 current input MPPT1	10A 1000V	12 mm
MPPT1_2	+	String 2 current input MPPT1	10A 1000V	12 mm
MPPT1_3	+	String 3 current input MPPT1	10A 1000V	12 mm

Terminals	Signal	Description	Electrical Level	Recommended stripping
MPPT1_1	-	String 1 current input MPPT1	10A 1000V	12 mm
MPPT1_2	-	String 2 current input MPPT1	10A 1000V	12 mm
MPPT1_3	-	String 3 current input MPPT1	10A 1000V	12 mm

6.4.2 Connection APV-S-AE-... models

Follow the steps given in the below figure to connect the PV strings to the Mc4 connectors

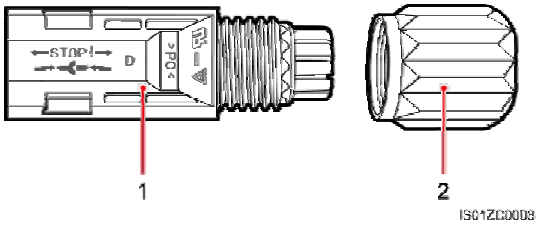
Positive connector composition



1. Housing

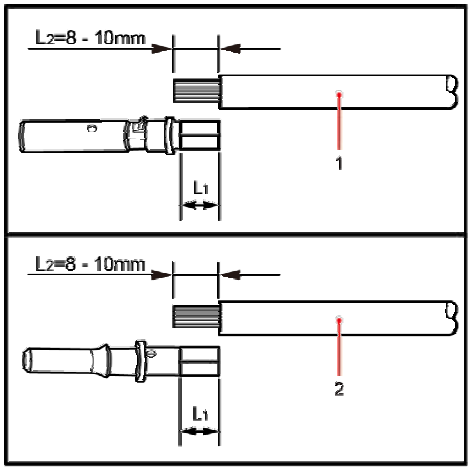
2. Cable gland

Negative connector composition

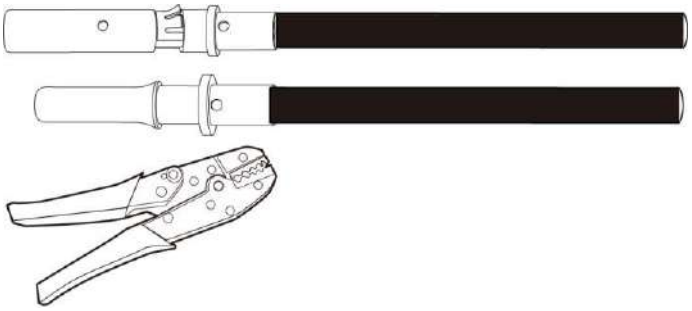


1. Housing

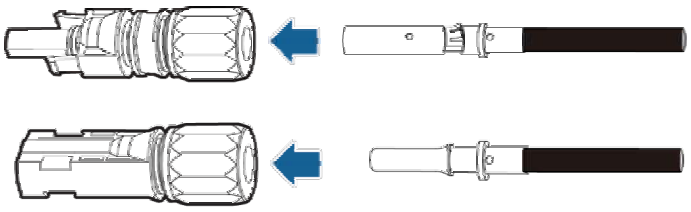
2. Cable gland



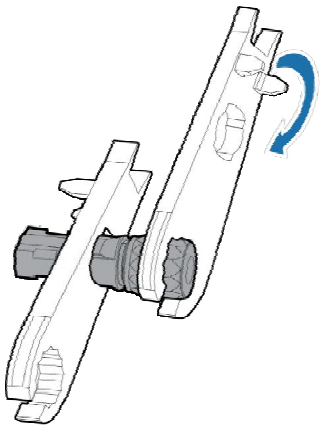
Step -I :Stripping the cable



Step -II : Crimping a metal terminal



Step -III : Engaging metal terminals



Step -IV: Locking the nut

6.5 Removing the backup battery protection

The APV-S inverter is equipped with a backup battery.

Remove the protective plastic tab during installation/programming.

See“ Figure 38: Position of battery on electronic card” on page 85.

6.6 Fixing of the lower panel

Reposition the lower panel by tightening the 6 torx T25 screws shown in the figure.
Recommended tightening torque 4.5 Nm.

Caution

In order to maintain IP65 protection level of the inverter, the recommended tightening torques must be applied whenever the lower panel is repositioned.

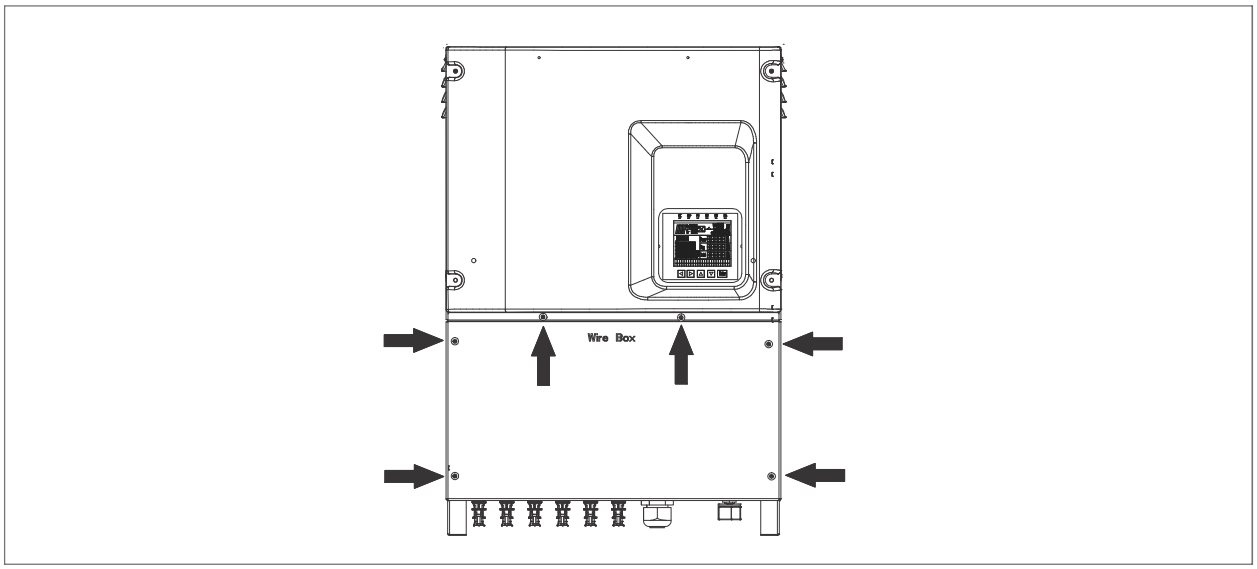


Figure 17 : Fixing of the lower panel

6.7 DC side fuses and string current monitoring

6.7.1 DC side fuses (integrated inside -F models)

The DC side fuses are very useful because in case of a malfunction or short-circuit of a string module or cable they trip and eliminate the defective string. This prevents the currents from all of the other strings in parallel from contributing to the short-circuit.

This reduces risks of fire or damage to the PV array.

Warning!

Operation to be performed by specially trained personnel.

ELECTROCUTION RISK!

Even with the APV-S switched off and circuit breaker (*) in position 0, there could still be dangerous voltage fromthephotovoltaicfield.

(*)The circuit breaker is only present in-S models.

Warning!

The string cable terminals are live! Cut voltage from the DC side (open the up-line isolator (if present) or shade the PV panels or disconnect the last PV panel of each string) and from the AC side.

The DC side fuses are integrated in models of series APV-S-..k-AE-TL-.F...

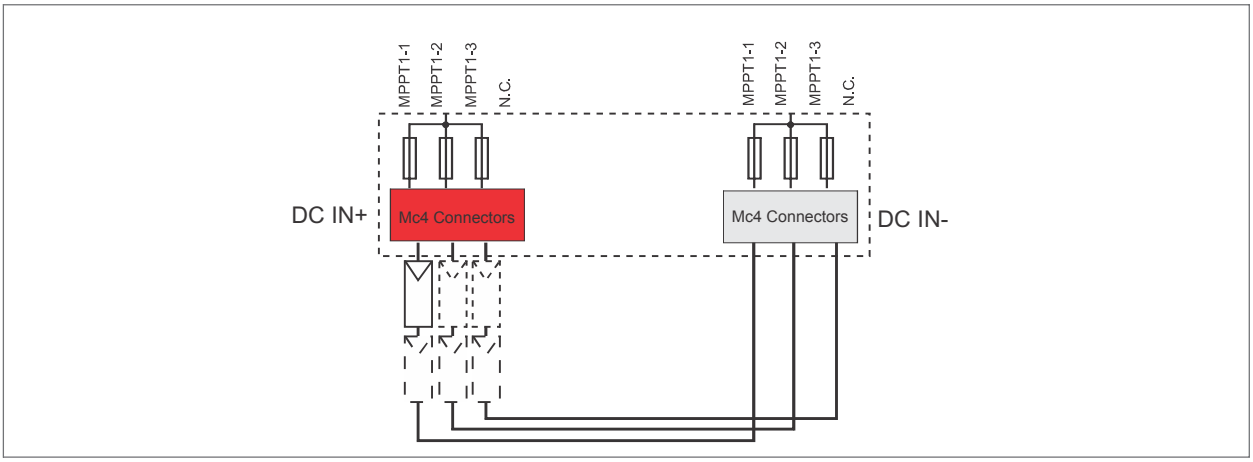


Figure 18 : APV-S-20k-AE-TL-1F diagram

The string fuses may have to be replaced in case of:

1) change off use rating based on type of PV panel used
2) damaged fuse.

To replace the fuses it is necessary to:

1)disconnect voltage from the AC and DC side
2)remove the lower panel as described in chapter 6.3
3)disconnect all cables from the DC terminals (models-Fonly)
4)loosen the 3 M4x10 screws and remove the metal shield (models - F only)
5)identify and replace the blown fuse(see table below),then replace the panels and connections.

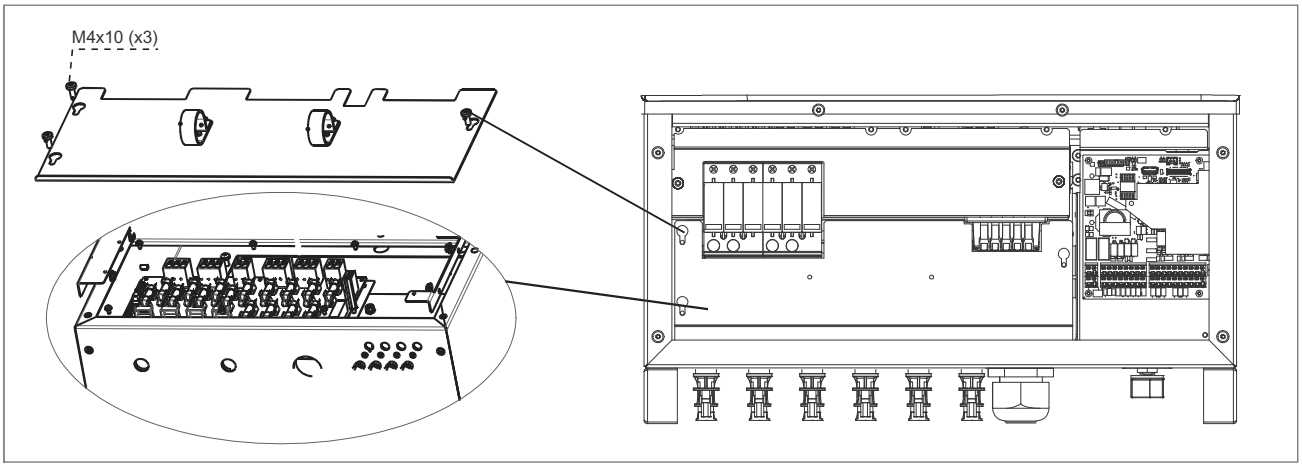


Figure 19 : DC side fuses series APV-S-..k-AE

Model	Fuse	Quantity
APV-S-10k-AE-TL-1.F..	gpV / 1000Vcc / 12A (*)	6(3+3)
APV-S-12k-AE-TL-1.F..		6(3+3)
APV-S-15k-AE-TL-2.F..		8 (4+4)
APV-S-18k-AE-TL-2.F..		8 (4+4)
APV-S-20k-AE-TL-2.F..		12 (6+6)
APV-S-25k-AE-TL-2.F..		12 (6+6)

(*) 12A is the standard fuse size installed in the factory. Other fuse sizes (type gpV / 1000Vcc) can be installed according to the instructions of the PV module manufacturer. These fuses can be ordered on request.

6.7.2 String current monitoring

This function is included in the -F models.

By current sensors in series with each string, the current in each string is monitored (see section “Strings data” on page 49)and any anomalies or faults are signalled.

6.8 GROUND KIT

The ground kit is needed only for thin film or back contact modules where specifically required by the manufacturer. It is available for grounding either the positive or negative pole by means of a 1A fuse.

The inverter with ground kit must be requested at the time of order; specify the polarity to be grounded.

Inverters with ground kit must be connected to the grid by interposing an isolation transformer in order to have galvanic separation.

Warning!

The fuse will blow if the PV generator loses isolation and there is leakage to the ground. Replace the open fuse with a new one after you have found and eliminated the cause of the blow-out.

Replace fuses as follows:

1) disconnect voltage from the AC and DC side
2) remove the lower panel as described in chapter 6.3
3) disconnect all cables from the DC terminals (models APV-S-AE-...-F only)
4) loosen the 3 M4 x 10 screws and remove the metal shield (models APV-S-AE-...-F only)
5) identify and replace the blown fuse (gR/1000Vcc/1A), then replace the panels and connections.

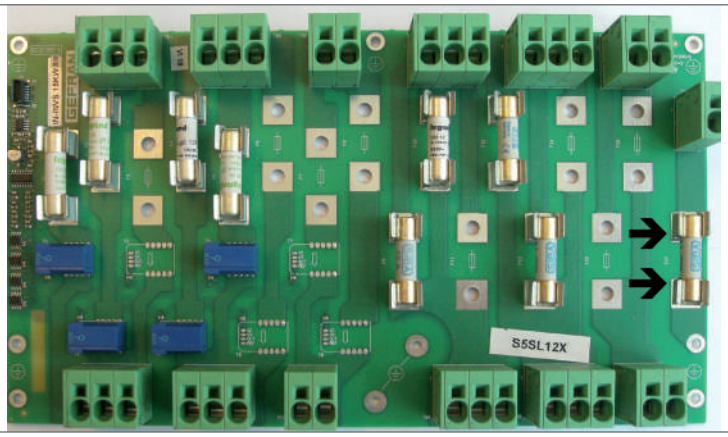


Figure 20 : Ground kit fuse (-F models)

6.9 AC side fuses

These fuses are not supplied with the equipment but are available on request.

In compliance with IEC 62109, the AC output must be protected with fuses or a circuit breaker.

The following is a table of recommended fuses:

Model	Fuses
APV-S-10k-AE-TL-1.F..	gR / 40A
APV-S-12k-AE-TL-1.F..	gR / 40A
APV-S-15k-AE-TL-2.F..	gR / 50A
APV-S-18k-AE-TL-2.F..	gR / 50A
APV-S-20k-AE-TL-2.F..	gR / 50A
APV-S-25k-AE-TL-2.F..	gR / 60A

6.10 Choice of leakage breaker on AC side

Rishabh string inverters are equipped with a protection against ground faults in conformity to German safety standard VDE 0126-1-1. Specifically, they are equipped with a redundancy reading of leakage current to ground applicable to all current components (both DC and AC).

Leakage current to ground is measured simultaneously and independently by two different processors. The protection trips if one (or both) of them detects a fault, with consequent disconnection from the grid and stop of the generation process.

There is an absolute limit of 300 mA of total AC+DC leakage current with tripping of the protection within 300 msec.

There are also three other trip limits to protect against fault currents caused by accidental contact with leaking live parts; these limits are 30mA with trip in 0.3 sec, 60 mA with trip in 0.15 sec, and 150 mA in 0.04 sec.

The integrated device protects the system only against ground faults occurring up-line of the inverter (toward the DC side). Any leaks in the section on the AC side between the grid and the inverter are not detected and require an external protection.

Therefore, a type B leakage breaker does not have to be installed to protect the AC line.

Due to their construction, Rishabh string inverters do not inject ground fault direct currents (a type A breaker can be used).

It is advisable to use a breaker with trip current of at least 300 mA to avoid false faults due primarily to capacitive leakage of the PV modules.

6.11 DC circuit breaker

The DC circuit breaker is connected downstream of the fuses and galvanically disconnects the DC source on the AC side.

Breaking is done simultaneously on the positive and negative poles of all MPPT present.

Warning!

Warning: the DC circuit breaker DOES NOT switch off the AC side.

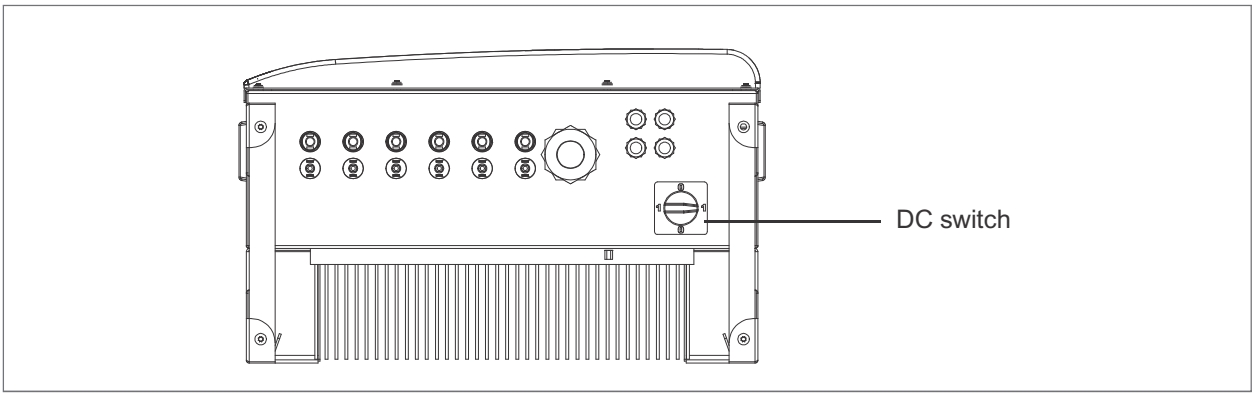


Figure 21 : DC circuit breaker

Position 0= Open (OFF), switches off the inverter completely.

Position 1=Closed (ON)

Model	Circuit breaker type and characteristics
APV-S-10k-AE-TL-1.F..	1000V 32A / DC21B
APV-S-12k-AE-TL-1.F..	1000V 32A / DC21B
APV-S-15k-AE-TL-2.F..	1000V 25A / DC21B (for each MPPT)
APV-S-18k-AE-TL-2.F..	1000V 25A / DC21B (for each MPPT)
APV-S-20k-AE-TL-2.F..	1000V 32A / DC21B (for each MPPT)
APV-S-25k-AE-TL-2.F..	1000V 32A / DC21B (for each MPPT)

6.12 Other connections

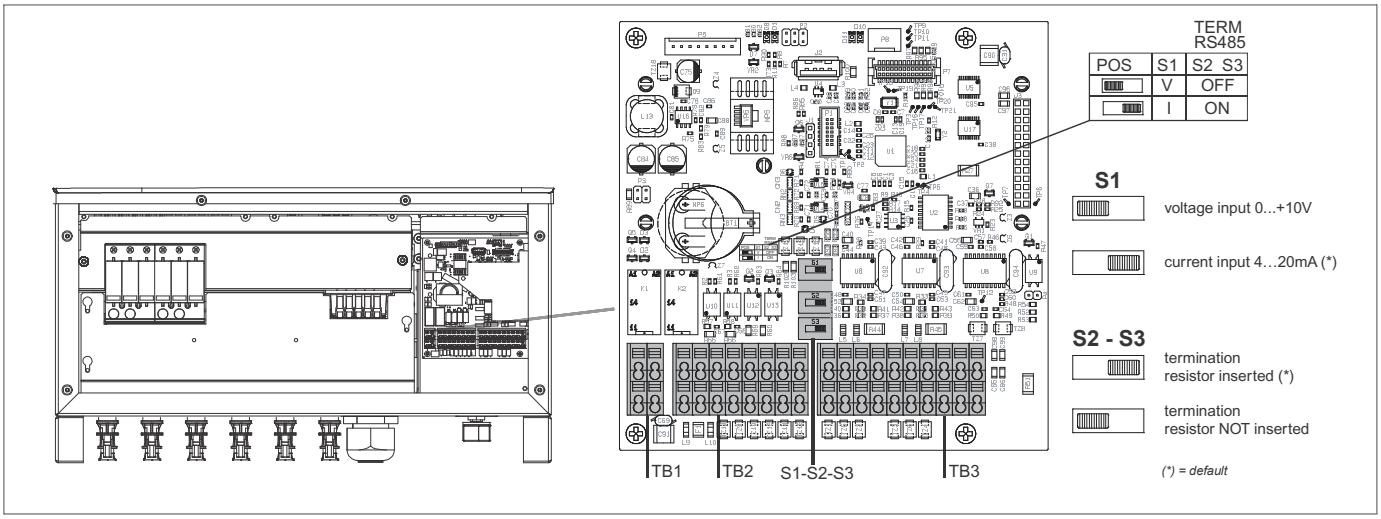


Figure 22 : Regulation and communication terminals. S1-S2-S3 switches

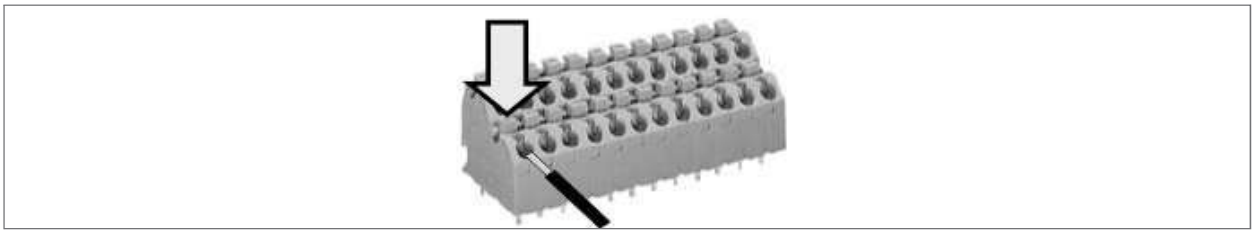


Figure 23 : Insertion of cables in spring connectors

TB1, **TB2** and **TB3** regulation and communication terminals are pressure spring type; they allow direct connection of a rigid or flexible cable with terminal(pin type), exerting cable pressure (force) on the connection terminal.

Connection of a flexible cable or cable disconnection is possible by pressing the appropriate lever shown in the figure.

Terminal strips	Maximum Cable Cross Section (flexible conductor)	Rigid cable cross section	Recommended stripping
TB1	0.75 - 1.5 mm² 20 - 14 AWG	0.5 - 1.5 mm² 20 - 14 AWG	9 mm
TB2			
TB3			

Antenna connections with GSM monitoring system

Radius inverter comes with optional inbuilt data logger monitoring card mounted on the HMI PCB. The antenna for the GSM network connectivity comes along with the inverter. It is essential that the antenna should be place in the open shed, as it directly affects the network connectivity. The interface connector of the antenna should be passed from the appropriate communication cable gland. After passing through the gland, tighten the interface connector to the connector on the GSM card as shown in the below figure.

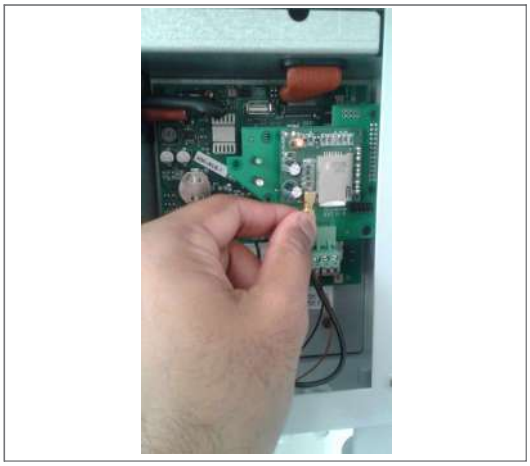


Figure 23 -1 : Connection of antenna and GSM card

6.12.1 Inputs / Outputs regulation circuit

- 3 analog inputs (environment sensors, 0 ... 10V, 4 ... 20mA)
- 2 opto-isolated digital inputs (0-24V)
- 2 opto-isolated digital outputs (0-24V)
- 24V OUT (500 mA MAX)
- 2 relays single contact (30 Vdc, 250 Vac / 2A)
- optional: CAN (synchronization management)

TB1 terminal strip: 2 single-contact relays

The inverter has two relays with normally open contact. The relays can be configured to close at the occurrence of an event (for example: tripping of an alarm, hazardous condition) or to signal correct connection with the grid and production of energy.

Devices (flashers, buzzers, etc.) can be connected to the ends of the relay terminals.

2	4
RO_1NO	RO_2NO
RO_1COM	RO_2COM
1	3

Pins		Signal	Description	IN/OUT	I/F elect.
1		RO_1COM	common relay 1	OUT	HVOLT
	2	RO_1NO	relay 1 output – NO contact	OUT	HVOLT
3		RO_2COM	common relay 2	OUT	HVOLT
	4	RO_2NO	relay 2 output – NO contact	OUT	HVOLT

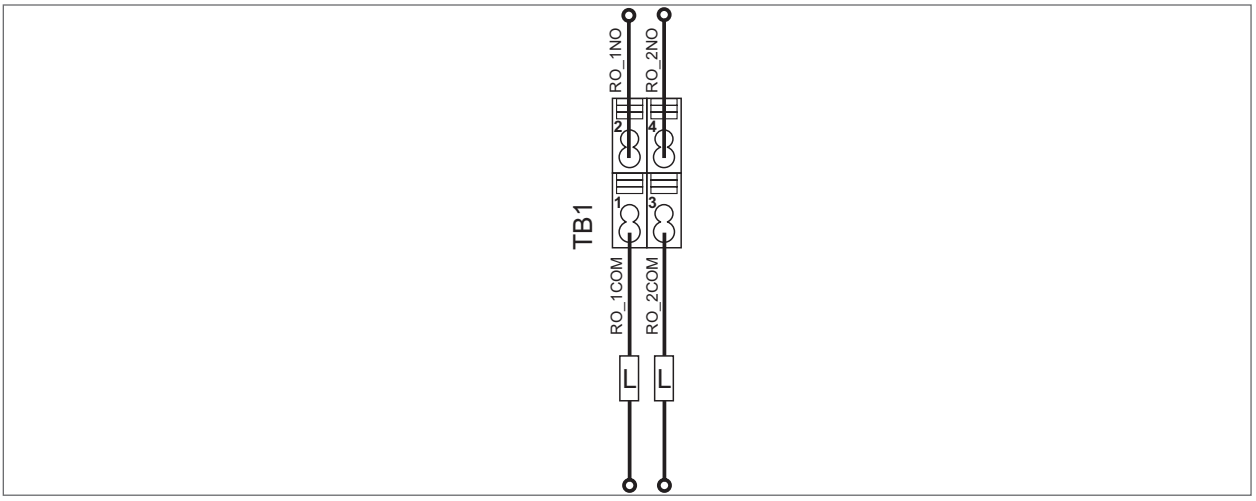


Figure 24 : Relay output wiring diagram (example)

TB2 terminal strip: digital inputs/outputs and analog inputs

The standard inverter controls a large number of inputs and outputs:

- 3 analog inputs for direct connection to ambient sensors (ambient temperature, module temperature, ir-radiation, wind speed and direction, etc). They can receive a 0-10V signal or, by setting switch S1, 2 inputs (AI1 and AI2) can also accept 4-20mA signals.
- 2 digital inputs to receive signals from outside. Examples of use: disable the inverter, change settings, etc.
- 2 configurable digital outputs. Examples of use: interface with a lighted panel to display energy generated or perform functions described for relay outputs.

2	4	6	8	10	12	14	16
0V24	+24V	DI_1	DI_2	AI_1P	AI_2P	AI_3P	SH
0V24	+24V	DO_1	DO_2	AI_1N	AI_2N	AI_3N	SH
1	3	5	7	9	11	13	15

Pins		Signal	Description	IN/OUT	I/F elect.
1	2	0V24	0V24 reference	OUT	POWER
3	4	+24V	output +24	OUT	POWER
5		DO_1	digital output 1	OUT	HVOLT
	6	DI_1	digital input 1	IN	HVOLT
7		DO_2	digital output 2	OUT	HVOLT
	8	DI_2	digital input 2	IN	HVOLT
9		AI_1N	analog input 1 (–), 0...+10V / 4…20mA (selection via S1 switch)	IN	ANALOG
	10	AI_1P	analog input 1 (+), 0...+10V / 4…20mA (selection via S1 switch)	IN	ANALOG
11		AI_2N	analog input 2 (–), 0...+10V / 4…20mA (selection via S1 switch)	IN	ANALOG
	12	AI_2P	analog input 2 (+), 0...+10V / 4…20mA (selection via S1 switch)	IN	ANALOG
13		AI_3N	analog input 3 (–), 0...+10V	IN	ANALOG
	14	AI_3P	analog input 3 (+), 0...+10V	IN	ANALOG
15		SH	shield for ambient sensors		
	16	SH	shield for analog inputs		

S1 Switch: V = voltage input 0...+10V;
I = current input 4…20mA (default)
See Figure 27.

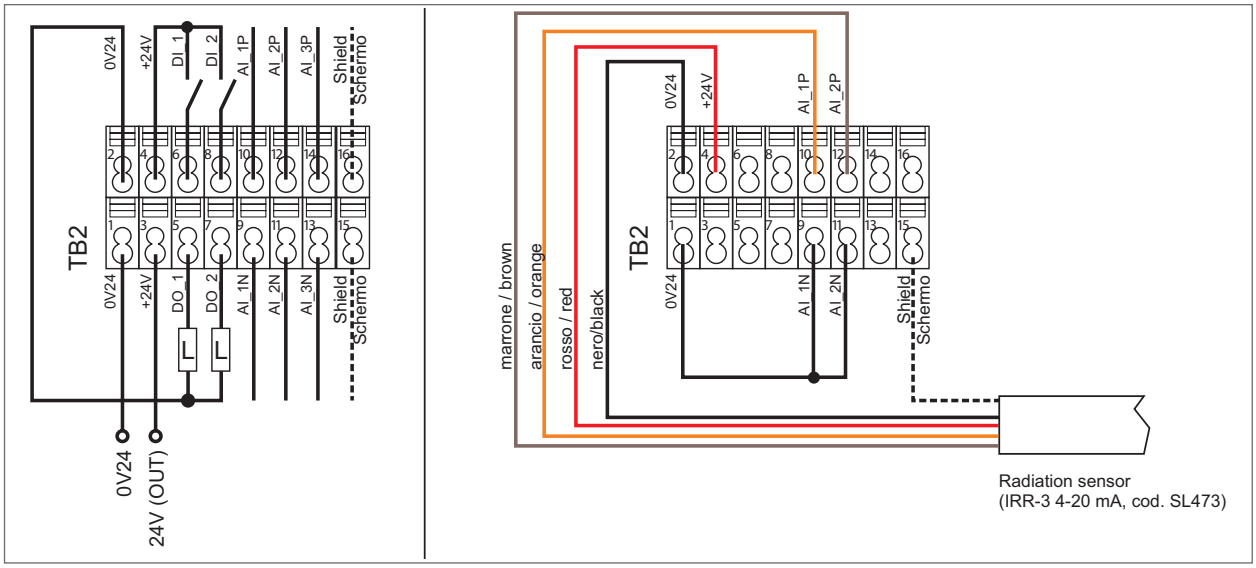


Figure 25 : Regulation circuit Input/Output connection diagram (example)

Note! 24V for digital I/O: if you use an external 24V, connect the power supply reference to 024V.

Connecting ambient sensors:

Contact the pre-sale technical department for information on connecting other types of sensors.

Radiation sensor (IRR-3 4-20 mA, cod. SL473) or Radiation sensor+PV module temperature sensor (IRR-3-T 4-20 mA, cod. SL474)

TB2 Terminals	Sensor cables colour
4	Red
2	Black
10	Orange
12	Brown
15	Shield
9	
11	
1	

SIGNAL CONVERTER / AMPLIFIER 4-20 mA (TEMP-CONVERTER PT100-24V, cod. SL439 or TEMP-CONVERTER PT100-230V cod SL440)

TB2 Terminals	TEMP-CONVERTER Terminals
4	A1
2	A2
12	Iout
11	Oout

Temperature sensor for PV module

TEMP-PT100 NO CASE-2, cod. SL432 Sensor cables	TEMP-CONVERTER Terminals
White	Y1
White	Y2
Red - Red	Y3

Ambient temperature sensor (TEMP-PT1000-CONVERTER, cod. SL436) 0-10V

TB2 Terminals	Sensor cables colour
14	OUT
4	UB
2	GND
13	
1	

Heated cup anemometer (WIND-SPEED-12, cod. SL475) 4-20 mA

TB2 Terminals	Sensor cables colour
4	White
2	Brown
14	Green
13	Yellow
3	Grey
1	Pink
15	Shield

Note! For sw settings, see section “Analog input” on page 52

6.12.2 Communication

- 2 opto-isolated RS485 ports (both with separate in/out)
- 1 standard USB port
- 1 expansion connector for wireless connection: WiFi / Bluetooth, RF, GSM, etc. (not yet available)

TB3 terminal strip

2	4	6	8	10	12	14	16	18	20
A1	B1	EQP1	SH1	A2	B2	EQP2	SH2	CAN_H	CAN_L
A1	B1	EQP1	SH1	A2	B2	EQP2	SH2	CAN_SH	CAN_GND
1	3	5	7	9	11	13	15	17	19

Pins		Signal	Description	IN/OUT	I/F elect.
1	2	A1	RS485-A1 data line	BID	LINE DRV
3	4	B1	RS485-B1 data line	BID	LINE DRV
5	6	EQP1	equipotential reference (120Ω to GND)	IN	POWER
7	8	SH1	shield (flat cable shielded)	---	---
9	10	A2	RS485-A2 data line	BID	LINE DRV
11	12	B2	RS485-B2 data line	BID	LINE DRV
13	14	EQP2	equipotential reference (120Ω to GND)	IN	POWER
15	16	SH2	shield (flat cable shielded)	---	---
17		CAN_SH	(*) shield (flat cable shielded) - (Not available)	---	---
	18	CAN_H	(*) CAN (+) data line - (Not available)	BID	LINE DRV
19		CAN_GND	(*) equipotential reference (120Ω to GND) - (Not available)	IN	POWER
	20	CAN_L	(*) CAN (-) data line - (Not available)	BID	LINE DRV

(*) : CAN termination resistor managed by parameter.

S2 Switch (RS485_1): 0 = termination resistor not inserted
1 = termination resistor inserted (120 Ω)
See Figure 27.

S3 Switch (RS485_2): 0 = termination resistor not inserted
1 = termination resistor inserted (120 Ω)
See Figure 27.

Note! The first and last element of the modbus chain must have the termination resistor inserted.
The RS485 terminals are doubled to facilitate multipoint wiring.

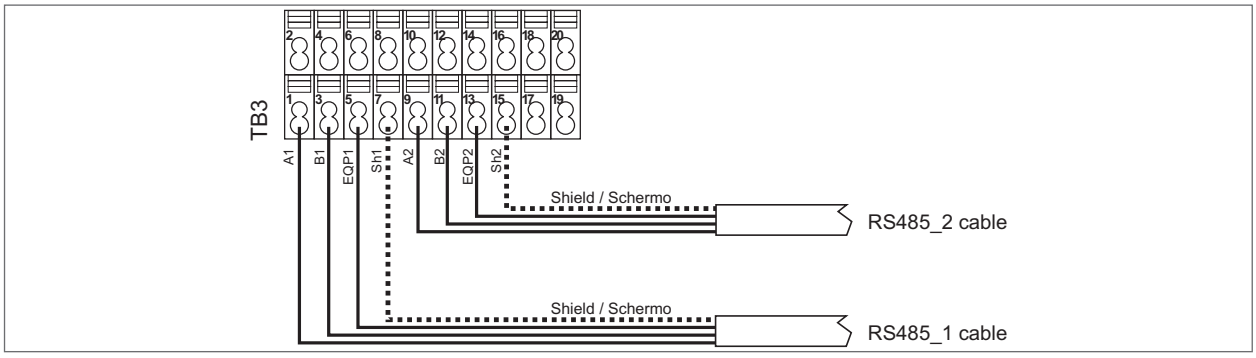


Figure 26 : RS485 connection wiring diagram (example)

6.12.3 USB functions use

Warning!

Operation to be performed by specially trained personnel.

To access the USB port remove the lower panel as described in par. 6.3 on page 21.

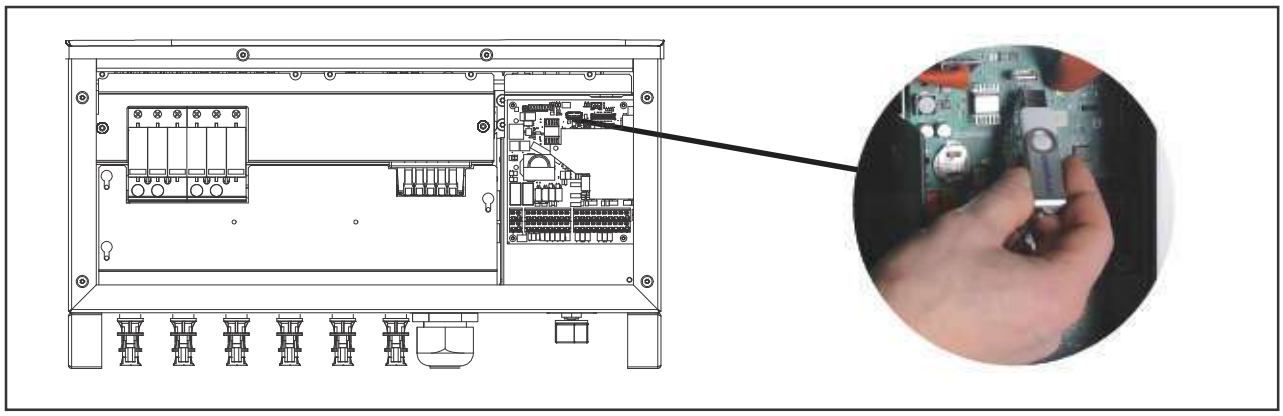


Figure 27 : USB Port

Note! The USB memory used must be of a standard type (format FAT32 with single partition)

You can use the USB port of the inverter for the following features:

1) PRODUCTION LOGS DOWNLOAD ON A USB MEMORY

You can save on a USB memory key main production and operation data saved on the inverter internal memory. Follow the procedure below:

a) Insert the USB key and wait until the display is showing the symbol U

b) Enter the parameter 584 and confirm the selection ON. The symbol U will be replaced by the symbol B.

c) When the operation is completed the symbol B will again be replaced by the symbol U. This means that the production and operation data on the internal memory of the inverter have been saved correctly on the USB memory device. You can then remove the USB stick.

Note! Production and operation data are saved in CSV format and can be visualized via Radius PV Monitor SW

2) ALARM LOGS DOWNLOAD ON A USB MEMORY

You can save on a USB memory key the alarm history saved on the inverter internal memory. Follow the procedure below:

a) Insert the USB key and wait until the display is showing the symbol U

b) Enter the parameter 584 and confirm the selection ON.The symbol U will be replaced by the symbol B.

c) When the operation is completed the symbol B will again be replaced by the symbol U. This means that the alarm history on the internal memory of the inverter have been saved correctly on the USB memory device. You can then remove the USB stick.

Note! Alarm history is saved in CSV format and can be visualized via Radius PV Monitor SW

3) PARAMETERS SET DOWNLOAD ON USB MEMORY

You can save on a USB memory device the inverter parameters set. This feature allows you to restore the saved parameters set on the same inverter or replicate the same on other inverters.

a) Insert the USB key and wait until the display is showing the symbol U

b) Enter parameter 598, select and then confirm the desired memory slot to store the configuration parameters.

Memory slots identify the position in which are stored the various parameters sets. There are 256 memory slots, this means that up to 256 different parameters sets can be saved.

Note! It is recommended to keep clear track or the various parameters sets saved for later reuse

c) Enter parameter 586 and confirm the selection ON. The symbol U will be replaced by the symbol B.
d) When the operation is completed the symbol B will again be replaced by the symbol U. This means that the parameters set has been saved correctly on the USB memory device. You can then remove the USB stick.

4) DOWNLOAD ON THE INVERTER OF THE PARAMETERS SET SAVED ON A USB MEMORY

You can save on the inverter a parameters set previously saved on a USB memory device. This feature can only be done with access profile Expert.

a) Insert the USB key and wait until the display is showing the symbol U
b) Enter parameter 598, select and then confirm the desired memory slot.
c) Enter parameter 587 and confirm the selection ON. The symbol U will be replaced by the symbol B.
d) When the operation is completed the symbol B will again be replaced by the symbol U. This means that the parameters set has been read and downloaded correctly on the inverter memory. You can then remove the USB stick.
e) If you want to save the downloaded parameters set and keep it loaded on subsequent inverter reboots, enter parameter 550 and confirm the selection ON.


Attention

ATTENTION: If you don’t perform the operation described in letter e), at the next reboot of the inverter, the parameters loaded from USB memory will be lost and previous settings saved on the drive will be restored.


Attention

Replace the lower panel as described in chapter 6.6 on page 26

7. Display and Functionality

7.1 KA Display

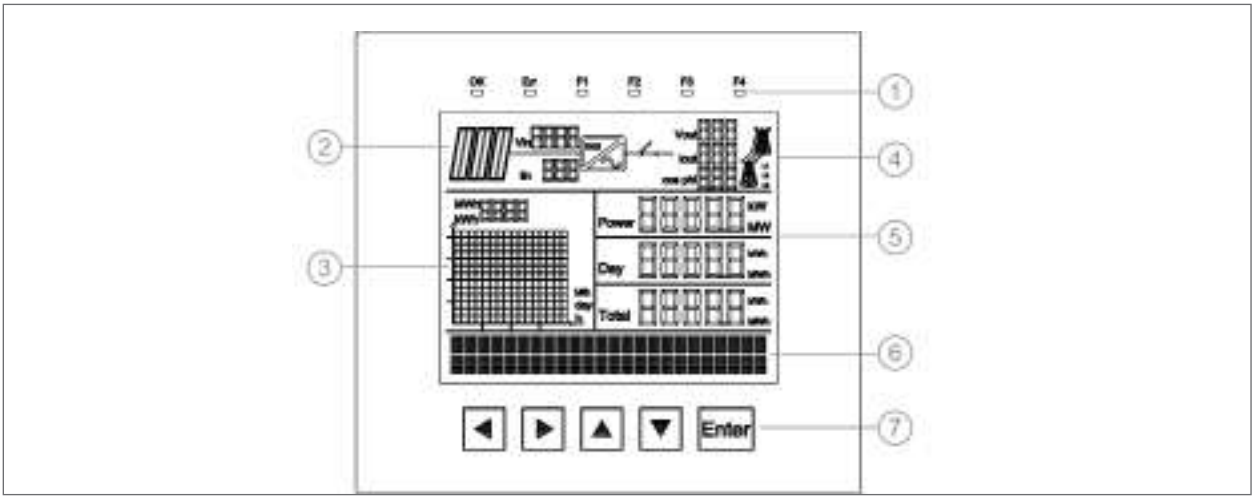


Figure 28 : KA Display

Position	Function
(1)	Status LEDs
(2)	Input graphic display and electrical data: input voltages and currents
(3)	Energy graphic display (Last 16: Hours, Month, and Day) and peak value (MWh or kWh)
(4)	Display of output electrical data for each phase (in sequence, L1-L2-L3): voltage, current and cosphi, AC status switch (ON/OFF)
(5)	Display of output istantaneous power (Power), total daily energy produced (Day) and total energy produced since power on (Total)
(6)	2 alphanumeric lines displaying status and navigation
(7)	Navigation keys

7.2 Meaning of LEDs

7.2.1 Inverter status: initialization procedure

Reference	Colour	Function
OK	Green	Lit. Indicates operational status is OK
Err	Red	Off
F1	White	**F1 and F2 ON:** the inverter is performing initialization procedures, calculating the isolation resistance, or waiting for the start command (if not started previously).
F2	White	
F3	White	Off
F4	White	Lit

7.2.2 Inverter status: DC-Grid Connection phase

The inverter has powered the DC circuit and is executing the ramp for connection to the grid.

Reference	Colour	Function
OK	Green	Lit. Indicates operational status is OK
Err	Red	Off
F1	White	Lit
F2	White	**Off**
F3	White	Off
F4	White	Lit

7.2.3 Inverter status: Grid Connected

The inverter has connected to the grid (the AC Switch has closed, see Figure 33 ref. 4).

Reference	Colour	Function
OK	Green	Lit. Indicates operational status is OK
Err	Red	Off
F1	White	Lit
F2	White	Off
F3	White	Off
F4	White	**Off**

7.2.4 Inverter status: Generation Ramp

The inverter is executing the generation ramp.

Reference	Colour	Function
OK	Green	Lit. Indicates operational status is OK
Err	Red	Off
F1	White	**Flashes**
F2	White	Off
F3	White	Off
F4	White	Off

7.2.5 Inverter status: Generation

The inverter is generating (MPPT function is active).

Reference	Colour	Function
OK	Green	Lit. Indicates operational status is OK
Err	Red	Off
F1	White	**Spento**
F2	White	Off
F3	White	Off
F4	White	Off

7.2.6 Inverter status: Special Function / Power Limitation

Power generated to the grid is limited due to a derating or to a function imposed by regulations in the country of installation.

Reference	Colour	Function
OK	Green	Lit. Indicates operational status is OK
Err	Red	Off
F1	White	Off
F2	White	Off
F3	White	**Flashes**
F4	White	Off

7.2.7 Inverter status: Fault

The inverter is in a fault condition.

Reference	Colour	Function
OK	Green	**Off**
Err	Red	**Lit**

7.2.8 Inverter status: Warning

A warning is present.

Reference	Colour	Function
OK	Green	**Blinking**
Err	Red	Off

7.3 Meaning and function of keys

Symbol	Meaning	Function
◄	Arrow Left	Returns to the higher level menu. During modification of a parameter, moves the cursor to the left.
►	Arrow Right	Accesses the submenu or parameter selected. During modification of a parameter, moves the cursor to the right. When the description of the parameter is displayed, pressing this key displays the parameter number (PAR) and Access level (E, R, W).
▲	Arrow up	Moves selection in a menu or a list of parameters up. During modification of a parameter, increases the value of the digit under the cursor.
▼	Arrow down	Moves the selection in a menu or a list of parameters down. During modification of a parameter, decreases the value of the digit under the cursor.
Enter		Accesses the submenu or parameter selected or selects an operation, Is used during parameter modification to confirm the new value set.

7.4 Commissioning

Warning!

Operation to be performed by specially trained personnel.

First power on

After you have carefully executed the electrical connection of the APV-S inverter, at first power-on the display automatically shows a guided procedure for performing the initial settings required to start the inverter on the grid to which it is connected.

The guided procedure lets you set:

a) The country's grid standard (MANDATORY)
b) The language for display menus (MANDATORY)
c) The date and time (MANDATORY)

MANDATORY: operation required for commissioning of the APV-S inverter.

There are different grid parameters (dictated by the national/local grid code and/or by the distributor) depending on the country of installation.

Before commissioning, the grid standard must be set for the country of installation; the installer must know the correct standard to be configured.

The screens shown at power-on are:

APV-S Starting ...

Grid code India

or

Grid code CEI 021

Press ▲ or ▼ to scroll the multiple choice menu and select the correct grid standard.

Grid code CEI 021	▼	Grid code VDE 4105	▼	Grid code VDE 0126	▼
Grid code India	▼	Grid code …….			

Nota! If "None" is chosen, the inverter will not start at the end of the procedure and "**APV-S Not enabled**" will be displayed.

When the correct grid standard has been selected, confirm by pressing **Enter**.

You will see the following screen (example in case of selection of standard CEI 0-21):

CEI 021 Confirm NO	▼	CEI 021 Confirm YES

If the selection is correct, continue by pressing **Enter** on "Confirm YES;" if not, scroll the menu and select "Confirm NO" to return to the previous menu for a new selection of grid parameters.

Simultaneously with setting of the grid standard, the language of the display menus is automatically set to the factory settings.

The following table shows the grid standards selectable on the ADVANCED menu and the related factory language settings.

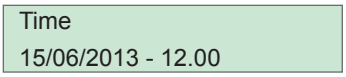
	Grid standard	Mains voltage	Factory setting for display
1	CEI 021	400 V	Italian
2	VDE 4105	400 V	English
3	VDE 0126 2006	400 V	English
4	India	400 V	English
5	VDE 0126 – A1/2012	400 V	English
6	RD 1699/2011	400 V	English
7	RD 661/2007	400 V	English
8	IEC 61727/2004	400 V	English
9	CEI 016	400 V	Italian

Before selecting, check that the grid code is correct for the grid to which the inverter will be connected.
If you are not sure, check the technical specification of the system/grid or contact your local utility.
The grid standard is saved automatically and will not be requested when the inverter is switched on again.
If the wrong grid code has been selected, see chapter “7. DESCRIPTION OF DISPLAY AND MENUS.”
After you have confirmed the grid code, you will see the following screen:

You will see the language set in the factory according to the selected grid code.

Press Enter to confirm the language displayed or scroll the menu with the ▲ ▼ keys to select the language you want, then press **Enter** to confirm.

The next screen lets you set the date and time:



To change the date and time by using the ▲ ▼ and ◀ ▶ keys.

When the correct date is set, press **Enter** to confirm.

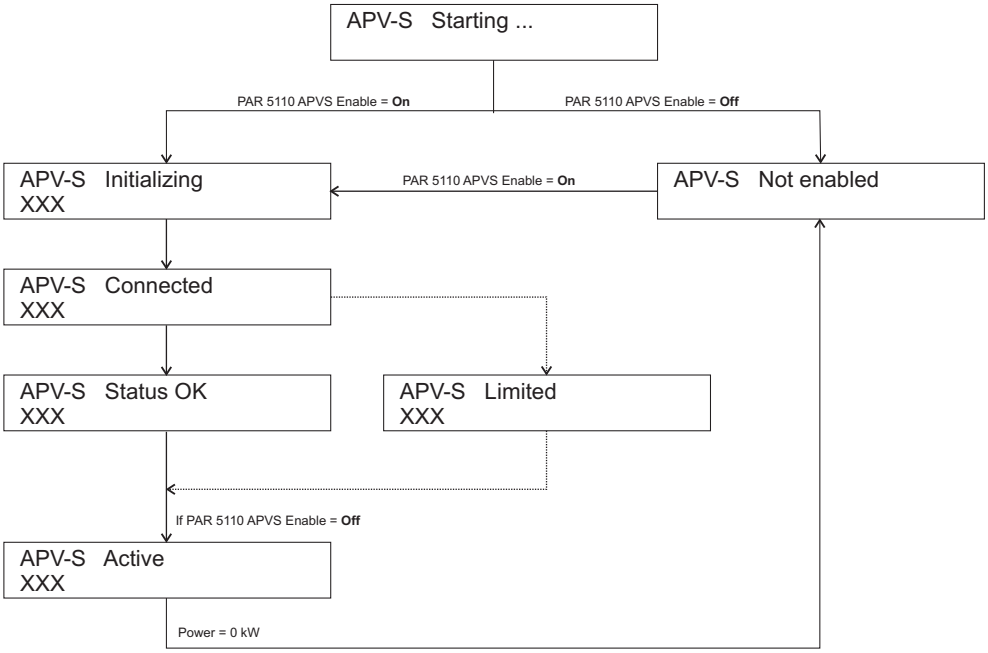
Attention

Correct setting of the TIME and DATE is necessary for saving the operating and alarm data in the inverter’s integrated memory.

The starting procedure is now ended, and the home page of the APV-S inverter will appear. The inverter starts the grid connection procedure.

7.5 Display screens: Operating statuses, stand by, alarms and warnings

7.5.1 Operating statuses (advanced level)



Starting	Displayed for a few seconds after power-on.
Initializing	Initialization procedures and connection to DC circuit.
Connected	Inverter connects to AC grid and prepares for generation.
Status OK	Inverter is generating.
Limited	Power generated to the grid is limited due to a derating or to a function imposed by regulations in the country of installation.
Active	0 power is generated: inverter is disabled (PAR 5110 = Off) or is in test mode.
XXX	Sequential display of “Stand-by” data (see below).

7.5.2 Stand-by

The following screens are shown in sequence in the absence of alarms or warnings during normal operation of the APV-S inverter.

APV-S Status OK Vin XXX Iin YYY	Input voltage and current for each MPPT channel
APV-S Status OK Vout XXX Iout YYY	Output voltage and current by phase
APV-S Status OK Power	Instantaneous power
APV-S Status OK E day	Total daily energy
APV-S Status OK Total	Total energy since firing
APV-S Status OK Cosphi	Display of power factor

7.5.3 Alarms and warnings

When an alarm trips, the display automatically shows the alarm, as described in the section “Active alarms” on page 60.

The **Active alarms** mode persists until all alarms are removed or you exit the menu by pressing the ◄ key.
In either case, to go to display mode in Stand-by, press any key and wait for the time set in PAR 593 “Display time.”

The display shows, in sequence, the name of the Alarm or Warning and the message “Alarm” or “Warning”.
I.e.:

◄

Input OV DC Bus Vin XXX Iin YYY	Alarm Vin XXX Iin YYY

8. Menu and description of parameters

8.1 Easy menu

1st level menu	2nd level menu	Note
Info		
	Input data	
	Strings data	Menu displayed only on models APV-S-...-F.
	Output data	
	Power info	
	Analog inputs	
	Digital in/out	
	Inverter info	
History		
	Total	
	Today	
	Last 7 days	
	Last 12 Mths	
	Last 10 years	
Alarms		
	Active alarms	
	Alarm history	
Settings		
	System	

8.2 Expert menu

1st level menu	2nd level menu	Note
Info		
	Input data	
	Strings data	Menu displayed only on models APV-S-...-F.
	Output data	
	Power info	
	Analog inputs	
	Digital in/out	
	Inverter info	
History		
	Total	
	Today	
	Last 7 days	
	Last 12 Mths	
	Last 10 years	
Alarms		
	Active alarms	
	Alarm history	
Settings		
	System	
	Advanced	
	Digital in/out	
	Analog input	Menu displayed if the “Types” of analog inputs are different from “None”.
	Communication	
	Display	
	Time	

8.3 Parameters description

8.3.1 Legenda

PAR	Description	UM	Def	Min	Max	Access
Parameter identifier	Parameter description	Unit of measure	Default value	Minimum value	Maximum value	Accessibility : E=Expert R=Read W= Write

Info

The **Info** menu displays the values of measured quantities, operating parameters, and information to identify the inverter and the configuration.

Note! The values on the display may diverge from real values and cannot be used to calculate an official invoice. The quantities read by the inverter are needed to check its operation and to control the current to be injected in the grid. The inverter does not have a meter approved for legal metrology.

Input data

Models	MPPTn	Displayed parameters VinMpptX (PAR 650-652-654) IinMpptX (PAR 656-658-660) Power input X (PAR 140-142-144)		
		1	2	3
APV-S-10k-AE-TL-1	**1**	Displayed	Not displayed	Not displayed
APV-S-12k-AE-TL-1	1	Displayed	Not displayed	Not displayed
APV-S-15k-AE-TL-2	2	Displayed	Displayed	Not displayed
APV-S-18k-AE-TL-2	2	Displayed	Displayed	Not displayed
APV-S-20k-AE-TL-2	2	Displayed	Displayed	Not displayed
APV-S-25k-AE-TL-2	2	Displayed	Displayed	Not displayed

"Not displayed" indicate that the inputs are not available / provided on the inverter model.

PAR	Description	UM	Def	Min	Max	Access
650	**VinMppt1**	V				R
652	**VinMppt2**	V				R
654	**VinMppt3**	V				R

Display of DC voltage at input to MPPT channel no.
Refer to table above for details of display.
I.e..: model APV-S-12k-AE-TL-2, only voltages **VinMppt1** and **VinMppt2** are displayed.

656	**IinMppt1**	A				R
658	**IinMppt2**	A				R
660	**IinMppt3**	A				R

Display of DC current at input to MPPT channel no.
Refer to table above for details of display..
I.e.: model APV-S-12k-AE-TL-2, only currents **IinMppt1** and **IinMppt2** are displayed.

140	**Power input 1**	W				R
142	**Power input 2**	W				R
144	**Power input 3**	W				R

Display of power at input to MPPT channel no.
Refer to table above for details of display.
I.e.: model APV-S-20k-AE-TL-2, only **Power input 1** and **Power input 2** are displayed.

Strings data

This menu is displayed only for models APV-S-...-F.

Models	MPPTn	Displayed parameters String current x, PAR 150 ... 160 (*)					
		1	2	3	4	5	6
APV-S-10k-AE-TL-1.F..	1	Displayed	Displayed	Displayed	Not displayed	Not displayed	Not displayed
APV-S-12k-AE-TL-1.F..	1	Displayed	Displayed	Displayed	Not displayed	Not displayed	Not displayed
APV-S-15k-AE-TL-2.F..	2	Displayed	Displayed	Displayed	Displayed	Not displayed	Not displayed
APV-S-18k-AE-TL-2.F..	2	Displayed	Displayed	Displayed	Displayed	Not displayed	Not displayed
APV-S-20k-AE-TL-2.F..	2	Displayed	Displayed	Displayed	Displayed	Displayed	Displayed
APV-S-25k-AE-TL-2.F..	2	Displayed	Displayed	Displayed	Displayed	Displayed	Displayed

"Not displayed" indicate that the inputs are not available / provided on the inverter model.

(*) On APV-S-...-F models only. Enable monitoring to display string currents (see PAR 380 ... 385). Unavailable strings have value 0.

PAR	Description	UM	Def	Min	Max	Access
150	**String current 1**	A				R
152	**String current 2**	A				R
154	**String current 3**	A				R
156	**String current 4**	A				R
158	**String current 5**	A				R
160	**String current 6**	A				R

Display of current at input of string "n".

Based on the models, only the parameters shown on the table are displayed.

I.e..: model APV-S-10k-EE-TL-1.F.., only **String current 1** and **String current 2** are displayed.

172 **String status** ER

Display of strings status:

0 String not configured or out the threshold setting (*)

1 String OK

(*) occurs only if the string current is beyond the set limit (PAR 597) for the set time (PAR 596) compared to the average current of the strings.

Example: display 011111

0	1	1	1	1	1
String 6 = Fault	String 5= OK	String 4= OK	String 3= OK	String 2= OK	String 1= OK

176 **String active** ER

Display of active strings: each bit corresponds to a string present. Together with PAR 172, indicates the strings present, the ones that are monitored, and in error.

0 String not active

1 String active

Example: display 011111

0	1	1	1	1	1
String 6 = not active	String 5= active	String 4 = active	String 3 = active	String 2 = active	String 1 = active

PAR	Description	UM	Def	Min	Max	Access
370	**String Status 1**					ER
371	**String Status 2**					ER
372	**String Status 3**					ER
373	**String Status 4**					ER

374 **String Status 5** ER

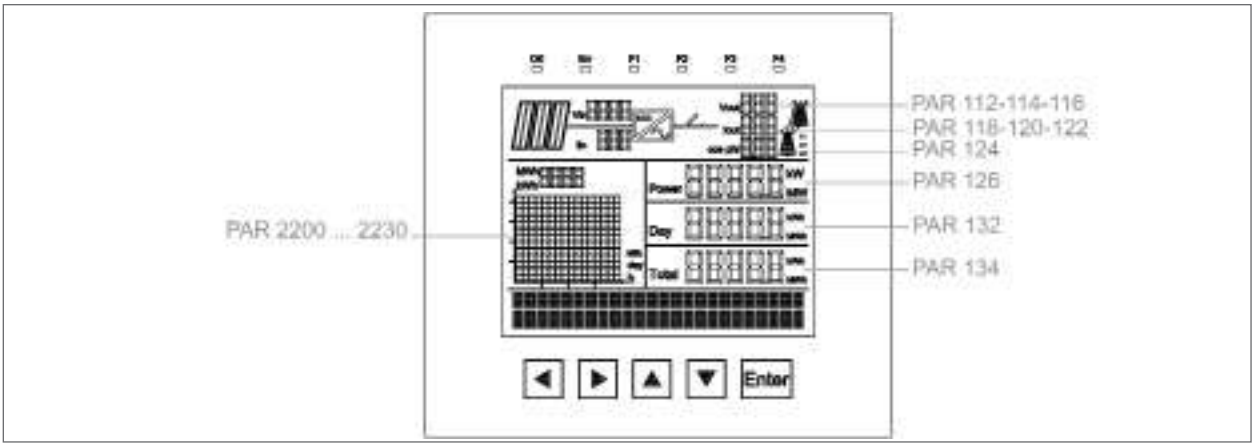
375 **String Status 6** ER

Based on the models, only the parameters shown on the table are displayed.

Display of strings status:

Not Available	string not present.
Not included	string present but not configured for assembly (see PAR 380 ... 385 String config X on ADVANCED menu).
Active	string functioning.
Error	string current beyond limit (“String error” warning is generated). For more information see chapter “10.2 Alarms and Warnings list” on page 76.

Output data



PAR	Description	UM	Def	Min	Max	Access
112	**Vout L1**	V				R
114	**Vout L2**	V				R
116	**Vout L3**	V				R

Display of AC output voltage of drive (L1= phase U, L2 = phase V, L3 = phase W).
These are the values shown on the KA display.

118	**Iout L1**	A				R
120	**Iout L2**	A				R
122	**Iout L3**	A				R

Display AC output current of drive (L1= phase U, L2 = phase V, L3 = phase W).
These are the values shown on the KA display.

Power info

PAR	Description	UM	Def	Min	Max	Access
126	**Active Power**	kW				R

The value of the active power generated into the mains is displayed. This is the value shown on the KA display (**Power**).

124	**Cos phi**					R

The power factor value (cosφ) is displayed. This is the value shown on the KA display (**Cos phi**).

128	**Reactive Power**	kW				R

The value of the reactive power generated into the mains is displayed.

180	**Apparent Power**	kW				R

Display of value of apparent power generated on the grid.

130	**AC Frequency**	Hz				R

The drive output frequency is displayed.

Analog input

PAR	Description	UM	Def	Min	Max	Access
222	**Analog Inp 1**	-				R
224	**Analog Inp 2**	-				R
226	**Analog Inp 3**	-				R

Display of value of analog input n; the unit of measurement depends on the type of sensor set in PAR 1010 **AI 0 sensor**, 1011 **AI 1 sensor** and 1012 **AI 2 sensor**.

Digital in/out

PAR	Description	UM	Def	Min	Max	Access
30	**Digital Inp**					R

Display of status of digital inputs. The information is contained in a word, where each bit corresponds to 1 if there is voltage on the corresponding input terminal.

1 Input Hi

0 Input Low

I.e. 01:

0	1
Digital input 2 Not Active	Digital input 1 Active

31	**Digital Inp 1**					R
32	**Digital Inp 2**					R

Display of status of digital input no.

ON Input ON

OFF Input OFF

60	**Digital Out**					R

Display of status of digital outputs. The information is contained in a word, where each bit corresponds to 1 if there is voltage on the corresponding output terminal.

0 Output ON

1 Output OFF

I.e.: 0111:

0	1	1	1
Relay Out2 Not Active	Relay Out1 Active	Digital Out2 Active	Digital Inp1 Active

61	**Digital Out1**					R
62	**Digital Out2**					R

Display of status of digital output no.

ON Output ON

OFF Output OFF

63	**Relay Out1**					R
64	**Relay Out2**					R

Display of status of relay output no..

ON Output ON

OFF Output OFF

Inverter info

PAR	Description	UM	Def	Min	Max	Access

478 **Name** R

Display of inverter family: APV-S.

480 **Model** R

Display the inverter model, i.e.: 34k-AE-TL-1XFXX-KA.

482 **Size** ER

Display of inverter size (for example: 10KwAE1mppt)

490 **Software Version** R

Display of FW version (Main inverter version and release of internal SW components).
I.e.:

V 01	00	00	00
Main version	Release HMI	Release AFE	Release Boost

T00
Type

498 **Build date** ER

Display of date of FW version.

511 **Work status** R

Display of inverter work status.

0	Starting	Displayed for a few seconds after power-on.
1	Initializing	Initialization procedures and connection to DC circuit.
2	Not Enabled	Inverter not enabled to generate power
3	Connected	Inverter connects to AC grid and prepares for generation.
4	Status OK	Inverter is generating.
5	Limited	Power generated to the grid is limited due to a derating or to a function imposed by regulations in the country of installation.
6	Warning	Inverter in warning status
7	Alarm	Inverter in alarm status
8	Active	0 power is generated: inverter is disabled (PAR 5110 = Off) or is in test mode.

174 **Inverter state** ER

Status bit code.

510 **USB Status** R

Display of USB output status:

Status	*Meaning*	*Note*
Not Ready	USB drive non inserted	
Removed	USB drive removed	The letter R appears on the display for 5 s, then go to Not Ready Status.
Ready	USB drive inserted	The letter U appears on the display:
Busy	USB drive in use	The letter B appears on the display:

APV-S Menu **R**
Info

APV-S Menu **U**
Info

Save param USB **B**
Off

Error	Drive error	The letter E appears on the display:	APV-S Menu **E** Info

PAR	Description	UM	Def	Min	Max	Access
146	**Inverter Temp**	°C				R

Display of heat sink temperature read by sensor 1 (lower).

148	**Boost Temp**	°C				R

Display of heat sink temperature read by sensor 2 (upper). Only for APV-S-AE.

240	**Temp micro**	°C				ER

Display of HMI micro temperature.

242	**Temp board**	°C				ER

Display of temperature in HMI card.

500	**Boot rel**					ER

Display of boot SW release.

501	**Boot ver**					ER

Display of boot SW version.

520	**SerialNumber**					R

Display of inverter serial number.

530	**TimeDate**					R

Display of current date and time of inverter. Format dd/MM/YY hh:mm:ss.

4840	**Warning 1**					ER

Bit code of status of alarms specified on table. 1 bit for each alarm.
For more information, see chapter 10 on page <?>

Bit	Code	Description
0	1	AFE Comm
1	2	Boost Comm
2	3	AFE Boot
3	4	Boost Boot
4	5	EEPROM error
5	6	String error
6	7	Log error
7	8	HMI Boot
8	9	Low Battery
9	10	File error
10	11	USB error
11	12	LoadDefault error
12	13	Slave Comm
13	14	Watchdog Error

PAR	Description	UM	Def	Min	Max	Access

4841 **Alarm B1** ER

Bit code of status of alarms specified on table. 1 bit for each alarm.
For more information, see chapter 10 on page 78.

Bit	Code	Description
0	17	Input OV DC Bus
1	18	Input OC 1
2	19	Com err
3	20	Input OC 2
4	21	Insulation err
5	22	Missed config 1
6	23	Leakage curr B
7	24	Micro OT B
8	25	Internal err 1
9	26	Ground kit err
10	27	Klixon err 1
11	28	Redundancy err 1
12	29	Internal err 2
13	30	Internal err 3

4842 **Alarm B2** ER

Bit code of status of alarms specified on table; 1 bit for each alarm.
No alarm provided in this section.

Bit	Code	Description
15	48	Slave alarm

4843 **Alarm A1** ER

Bit code of status of alarms specified on table. 1 bit for each alarm.
For more information, see chapter 10 on page 76.

Bit	Code	Description
0	49	DC Link UV A
1	50	DC LINK OV A
2	51	DC Link Unbalance
3	52	Output OC 1
4	53	Output OC 2
5	54	Grid UV
6	55	Grid OV
7	56	Grid UF
8	57	Grid OF
9	58	Redundancy err 2
10	59	Sink OT B
11	60	Sink UT B
12	61	Sink OT A
13	62	Sink UT A
14	63	DC Current Inj
15	64	LeakageCurrent A

4844 **Alarm A2** ER

Bit code of status of alarms specified on table. 1 bit for each alarm.
For more information, see chapter 10 on page 76.

Bit	Code	Description
0	65	Power Relay err
1	66	Micro OT A
2	67	Klixon err 2
3	68	Missed config 2

4	69	AC Unbalanced
5	70	Internal err 4
6	71	Internal err 5
7	72	Internal err 6
8	73	A Overload

4845 **Warning 2** ER

Bit code of status of alarms specified on table. 1 bit for each alarm.
For more information, see chapter 10 on page 76.

Bit	Code	Description
0	81	OverVoltageVin
1	82	Module OT
2	83	Heatsink OT
3	84	Varistor not OK

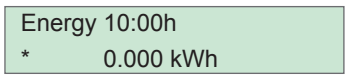
History

Total

PAR	Description	UM	Def	Min	Max	Access
134	**E tot**	MWh				R
	Displays total energy generated since first firing. Value shown on KA display (**Total**).					
138	**Time tot**	h				R
	Displays total generating / enabling time.					
184	**LifeTime**	h				R
	Displays total operating / non operating time.					

Today

PAR	Description	UM	Def	Min	Max	Access
132	**E day**	kWh				R
	Displays total daily energy. Value shown on KA display KA (**Day**).					
136	**PW peak Day**	kW				R
	Displays daily energy peak value.					
2200	**Energy hh:mmh**	kWh				R
2202	**Energy hh:mmh**	kWh				R
2204	**Energy hh:mmh**	kWh				R
2206	**Energy hh:mmh**	kWh				R
2208	**Energy hh:mmh**	kWh				R
2210	**Energy hh:mmh**	kWh				R
2212	**Energy hh:mmh**	kWh				R
2214	**Energy hh:mmh**	kWh				R
2216	**Energy hh:mmh**	kWh				R
2218	**Energy hh:mmh**	kWh				R
2220	**Energy hh:mmh**	kWh				R
2222	**Energy hh:mmh**	kWh				R
2224	**Energy hh:mmh**	kWh				R
2226	**Energy hh:mmh**	kWh				R
2228	**Energy hh:mmh**	kWh				R
2230	**Energy hh:mmh**	kWh				R
	Displays value of energy generated in previous 16 hours.					
	I.e.: if the time is 11:30, PAR 2200 shows “10:00h”, PAR 2202 shows “09:00h”, etc.					



Last 7 days

PAR	Description	UM	Def	Min	Max	Access
2000	**E 7days**	MWh				R
	Displays total energy generated in last 7 days.					

PAR	Description	UM	Def	Min	Max	Access
2002	**Time 7days**	h				R
	Displays operating time in last 7 days.					
2004	**CO2 7days**	kg				R
	Displays calculation of kg of CO_2 saved in last 7 days (compared to generation of electricity with fossil fuels).					
2030	**Energy dd/MM/YYYY**	kWh				R
2032	**Energy dd/MM/YYYY**	kWh				R
2034	**Energy dd/MM/YYYY**	kWh				R
2036	**Energy dd/MM/YYYY**	kWh				R
2038	**Energy dd/MM/YYYY**	kWh				R
2040	**Energy dd/MM/YYYY**	kWh				R
2042	**Energy dd/MM/YYYY**	kWh				R
	Displays value of energy generated in previous 7 days. I.e.: if today is 30 August 2013, PAR 2030 shows “29/08/2013”, PAR 2032 shows “28/08/2013”, etc.					

Last 12 Mths

PAR	Description	UM	Def	Min	Max	Access
2012	**E 30days**	MWh				R
	Displays total energy generated in last 30 days.					
2014	**Time 30days**	h				R
	Displays operating time in last 30 days.					
2016	**CO2 30days**	kg				R
	Displays calculation of kg of CO_2 saved in last 30 days (compared to generation of electricity with fossil fuels).					
2100	**Energy MM/YYYY**	MWh				R
2102	**Energy MM/YYYY**	MWh				R
2104	**Energy MM/YYYY**	MWh				R
2106	**Energy MM/YYYY**	MWh				R
2108	**Energy MM/YYYY**	MWh				R
2110	**Energy MM/YYYY**	MWh				R
2112	**Energy MM/YYYY**	MWh				R
2114	**Energy MM/YYYY**	MWh				R
2116	**Energy MM/YYYY**	MWh				R
2118	**Energy MM/YYYY**	MWh				R
2120	**Energy MM/YYYY**	MWh				R

2122	**Energy MM/YYYY**	MWh	R

Displays value of energy generated in previous 12 months.
I.e.: if today is 30 August 2013, PAR 2100 shows “07/2013”, PAR 2102 “06/2013”, etc.

Last 10 years

PAR	Description	UM	Def	Min	Max	Access
2018	**E 1Yr**	MWh				R

Displays total energy generated in last 12 months.

2020	**Time 1Yr**	h	R

Displays operating time in last 12 months.

2022	**CO2 1Yr**	kg	R

Displays calculation of kg of CO_2 saved in last 12 months (compared to generation of electricity with fossil fuels).

2150	**Energy YYYY**	MWh	R
2152	**Energy YYYY**	MWh	R
2154	**Energy YYYY**	MWh	R
2156	**Energy YYYY**	MWh	R
2158	**Energy YYYY**	MWh	R
2160	**Energy YYYY**	MWh	R
2162	**Energy YYYY**	MWh	R
2164	**Energy YYYY**	MWh	R
2166	**Energy YYYY**	MWh	R
2168	**Energy YYYY**	MWh	R

Displays total energy generated in last 10 years.
I.e.: if today is 30 August 2013, PAR 2150 shows “2012”, PAR 2152 “2011”, etc.

Alarms

Note: For more information on alarms and warnings, see chapter 10.

Active alarms

The list of active alarms and warnings is saved on this menu, with indication of the time the alarm tripped.
Alarms are shown starting from the most recent (no. 1) to the oldest (no. 10).
Use the ▲ and ▼ arrows to scroll the screens. Press ◄ to exit the menu.
This mode remains active until all alarms are removed or you exit the menu.

The Code is used by technical service personnel to more precisely identify the type of alarm in question.

I.e :

Press **Enter** to reset the alarms:

I.e :

Note: The alarms reset command deletes only alarms and warnings whose cause has been eliminated or is no longer active.

Alarm history

The history of tripped alarms is saved on this menu, with indication of the time the alarm tripped
Alarms are shown starting from the most recent (no. 1) to the oldest.

The Code is used by technical service personnel to more precisely identify the type of alarm in question.
Use the ▲ and ▼ arrows to scroll the screens of the alarm history. The alarm history cannot be deleted.

I.e :

System

Note! Any change to the value of parameters has an immediate effect on inverter operations, but is **not automatically saved** in permanent memory. All unsaved changes **will be lost** when power to the drive is switched off.

Run PAR 550 Param Save to save the value of currently used parameters.

PAR	Description	UM	Def	Min	Max	Access
550	**Param Save**		Off	Off	On	ERW

Any change to the value of parameters has an immediate effect on inverter operations, but is not automatically saved in permanent memory.

All unsaved changes will be lost when power to the drive is switched off.

PAR 550 **Param Save** is used to save the value of currently used parameters in the permanent memory.

This parameter is also visible in Easy mode if a valid password has been entered (factory or personal).

590	**Password**		-	-	-	RW

Changing the password for advanced parameterization.

Attention Make a note of the new password: when it is changed and saved, the default password is no longer valid. Only the new password can be used.

554	**Access Mode**		Easy	Easy	Expert	RW

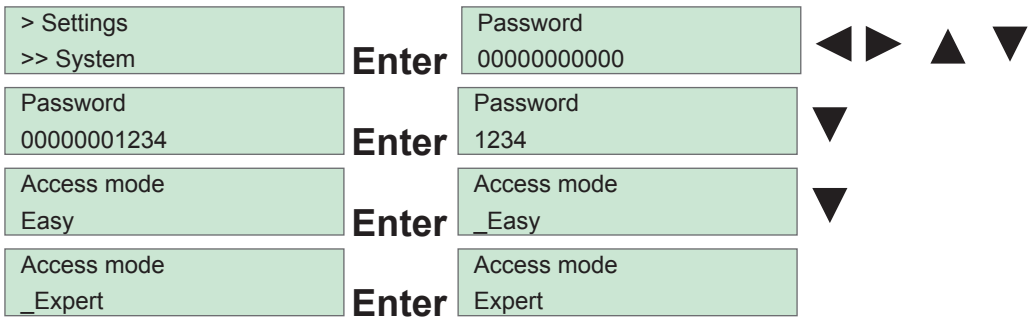
Easy

Expert

Set the parameter to Expert to access advanced parameterization.

To access the parameter, enter password 1234 (factory default).

The password can be changed with PAR 590 **Password**.



595	**Language**		None			ERW

Setting the display language

None (English)

English

Italiano

580	**Param Default**		Off	Off	On	ERW

Transfers the standard factory-set values to the inverter memory (“Def” column on the parameters table).

Attention

After the **Default param** command is run, you have to repeat the Commissioning procedure when the inverter is switched on again.

This parameter can be changed only with the inverter disabled (PAR 5110 **APVS Enable** = Off) and when the inverter is not generating (PAR 511 **Work status** = 2, Not enabled).

PAR	Description	UM	Def	Min	Max	Access
584	**Save Log**		Off	Off	On	RW
	Saving the production history on USB drive (csv format).					
586	**Save param USB**		Off	Off	On	RW
	Saving current parameter configuration on USB drive. The configuration is saved in the slot set with PAR 598 **Slot param USB**					
587	**Load param USB**		Off	Off	On	ERW
	Overwrite configuration of inverter parameters with parameters on USB drive. The configuration is saved in the slot set with PAR 598 **Slot param USB.**					

Attention

This parameter can be changed only with the inverter disabled (PAR 5110 **APVS Enable** = Off) and when the inverter is not generating (PAR 511 **Work status** = 2, Not enabled).

598	**Slot param USB**		0	0	255	RW
	Selection of slot (automatic numbering of file) for saving/loading a configuration					
599	**Save Err**		Off	Off	On	RW
	Saving of alarms list on USB drive. The configuration is saved in the slot set with PAR 598 **Slot param USB**.					
5024	**Alarm Reset**		Off	Off	On	ERW
	Resets the alarms.					
301	**Log Time**	s	300			ERW
	Setting of interval for saving production history. Total memorization time, variable according to selected recording cycle. Circular memory: the oldest data are automatically overwritten.					

Recording cycles	Memorization time
0 sec	no history
60 sec	55 gg
120 sec	abt 3.5 months
300 sec	abt 9 months
600 sec	1.5 years
900 sec	2.2 years
1200 sec	3 years

Note! Any change to the value of parameters has an immediate effect on inverter operations, but is **not automatically saved** in permanent memory. All unsaved changes **will be lost** when power to the drive is switched off.

Run PAR 550 Param Save to save the value of currently used parameters.

PAR	Description	UM	Def	Min	Max	Access
5110	**APVS Enable**		Off	Off	On	ERW

Starts and stops inverter regeneration by remote control through serial communication.

On Automatically set to ON during first firing.

Off The inverter must be set to Off to make changes to PAR 5111, 580 and 587.

5111	**Grid code**		None	-	-	ERW

Setting of Grid code. Requested and set at first firing.

0	None
1	CEI 021
2	VDE 4105
3	VDE 0126
4	India
5	VDE 0126 – A1/2012
6	RD 1699/2011
7	RD 661/2007
8	IEC 61727/2004
9	CEI 016

Nota! This parameter can be changed only with the inverter disabled (PAR 5110 **APVS Enable** = Off) and when the inverter is not generating (PAR 511 **Work status** = 2, Not enabled).

5120	**AbsPwrSetPLim**	%	100	0	100	ERW

Setting percentage of active power setpoint related to absolute power according to standard.

0 = 0% of absolute active power

100 = 100% of absolute active power

5114	**ReactPwrSetP**	%	0	-100%	+100%	ERW

Defines the reactive power that the inverter will generate at the connection point in “Fixed-Q” mode (PAR 5118 set to 1).

It is expressed as a percentage of rated active power Pn. The permitted range of values is:

-100.0 ….+100.0.

0.0 equals no reactive power delivery/draw

-10.0 equals reactive power of 0.1*Pn drawn from the grid.

The current produced by the inverter will be phased in advance compared to voltage, with convection of the generator (inductive behavior).

30.0 equals reactive power delivery of 0.3*Pn to the grid.

The current produced by the inverter will be phased in delay compared to voltage, with convection of the generator (capacitive behavior).

5116	**CosPhi Setp**		1.0	-0.9	+0.9	ERW

Defines the cosphi that the inverter controls at the connection point in “Fixed cos-phi” mode (PAR 5118 set to 2).

1.0 equals no reactive power delivery/draw

-0.9 equals production of current phased in advance compared to voltage, with convection of the generator (inductive behavior).

0.9 equals production of current phased in delay compared to voltage, with convection of the generator (capacitive behavior).

PAR	Description	UM	Def	Min	Max	Access
5118	**ReactPwrCtrl**		-	-	-	ERW

Setting of reactive power control mode.

0	None	Funzionamento a cosfi unitario
1	Fixed Q	Regolazione potenza reattiva in funzione del valore definito dal PAR 5114
2	Fixed cos-phi	Regolazione del cosfi in funzione del valore definito al PAR 5116
3	Q(U)	Regolazione potenza reattiva in funzione della tensione di rete secondo curva caratteristica Q(U) predefinita
4	Cos-phi(P)	Regolazione automatica del cosfi in funzione della potenza attiva secondo curva caratteristica Cos-phi(P) predefinita

380	**String config 1**		Included			ER
381	**String config 2**		Included			ER
382	**String config 3**		Included			ER
383	**String config 4**		Included			ER
384	**String config 5**		Included			ER
385	**String config 6**		Included			ER

Setting string monitoring.

Only the parameters of strings actually present in the inverter are shown. See the table on the "**Input Data**" menu.

Not Included string not configured for monitoring.

Included configured for monitoring.

596	**StringAvgTime**	s	300	5	1800	ERW

Setting string currents monitoring time.

597	**StringThresh**	mA	3000	0	30000	ERW

String currents monitoring limit.

594	**CO2factor**		531	1	1000	ERW

Conversion factor for calculating Kg CO_2.

Digital in/out

Note! Any change to the value of parameters has an immediate effect on inverter operations, but is **not automatically saved** in permanent memory. All unsaved changes **will be lost** when power to the drive is switched off.

Run PAR 550 Param Save to save the value of currently used parameters.

PAR	Description	UM	Def	Min	Max	Access
1050	**DI 1 Function**		None	-	-	ERW
1051	**DI 2 Function**		None	-	-	ERW

Remote enabling of digital input no. :

None	Digital input performs no function.
Enable	Digital input enables inverter.
Disable	Digital input disables inverter.
Reduce	Not available.

1060	**DO 1 Function**		None	-	-	ERW
1061	**DO 2 Function**		None	-	-	ERW

Select function of digital output no. :

None	No assigned function.
Inverter OK	Output active when inverter is not in alarm and is not in warning.
Alarm	Output active when inverter is in alarm.
Warning	Output active when inverter is in warning.
Contactor	Output active when output contactor is closed.
Energy counter	The pulse train set in PAR 1064 is generated for each kWh produced.

1062	**Relay 1 Function**		None	-	-	ERW
1063	**Relay 2 Function**		None	-	-	ERW

Select function of relay no. :

None	No assigned function.
Inverter OK	Relay active when inverter is not in alarm and is not in warning.
Alarm	Relay active when inverter is in alarm.
Warning	Relay active when inverter is in warning.
Contactor	Relay active when output contactor is closed.

1064	**PulsesKWh**		100	1	2000	ERW

Pulses per kWh per digital counter output:

Analog input

Note! Any change to the value of parameters has an immediate effect on inverter operations, but is **not automatically saved** in permanent memory. All unsaved changes **will be lost** when power to the drive is switched off.

Run PAR 550 Param Save to save the value of currently used parameters.

When PAR 1043 = None, PAR 1010, 1020, 1030 and 1040 are not displayed.
When PAR 1044 = None, PAR 1011, 1022, 1032 and 1041 are not displayed.
When PAR 1045 = None, PAR 1012, 1024, 1034 and 1042 are not displayed.

PAR	Description	UM	Def	Min	Max	Access
1043	**AI Type 1**		None	-	-	ERW
1044	**AI Type 2**		None	-	-	ERW
	Setting of analog input no. Must match hardware settings. None 0-10V 4-20mA 0-20mA					
1045	**AI Type 3**		None	-	-	ERW
	Setting of analog input no. 3. Must match hardware settings. None 4-20mA 0-20mA					
1010	**AI 1 sensor**		V	-	-	ERW
1011	**AI 2 sensor**		V	-	-	ERW
1012	**AI 3 sensor**		V	-	-	ERW
	Select sensor type: V mA W/m² (IRR-PIR-1400, cod. SL421; IRR-PIR-4000, cod. SL423; IRR-3 4-20 mA, cod. SL473; IRR-3-T 4-20 mA, cod. SL474) °C (IRR-3-T 4-20 mA, cod. SL474; TEMP-PT100 NO CASE-2, cod. SL432; TEMP-PT100 COMPACT-5, cod. SL433; TEMP-PT1000-CONVERTER, cod. SL436) m/s (WIND-SPEED-12, cod. SL475) deg. (WIND-DIRECTION-12, cod. SL476)					
1020	**AI Gain 1**		10	-1000000	1000000	ERW
1022	**AI Gain 2**		10	-1000000	1000000	ERW
1024	**AI Gain 3**		10	-1000000	1000000	ERW
	Gain of analog input no. :					
1030	**AI Offset 1**		0	-1000000	1000000	ERW
1032	**AI Offset 2**		0	-1000000	1000000	ERW
1034	**AI Offset 3**		0	-1000000	1000000	ERW
	Offset of analog input no. :					
1040	**AI Filter 1**	ms	0	0	60000	ERW

1041	**AI Filter 2**	ms	0	0	60000	ERW
1042	**AI Filter 3**	ms	0	0	60000	ERW

Filter on analog input no.

Communication

Note! Any change to the value of parameters has an immediate effect on inverter operations, but is **not automatically saved** in permanent memory. All unsaved changes **will be lost** when power to the drive is switched off.

Run PAR 550 Param Save to save the value of currently used parameters.

PAR	Description	UM	Def	Min	Max	Access
201	**PortA Baudrate**	bps	38400	1200	115200	ERW

Select baudrate (in bps) of first port.
1200bps
2400bps
4800bps
9600bps
19200bps
38400bps
57600bps
115200bps

202	**PortA Settings**		N81			ERW

Configure data packet of first port.
N81
E81
O81
N71
E71
O71
N82
E82
O82
N72
E72
O72

203	**PortA Address**		1	1	63	ERW

Modbus address.

204	**PortB Baudrate**	bps	9600	1200	115200	ERW

Baudrate (in bps) of second port.
1200bps
2400bps
4800bps
9600bps
19200bps
38400bps
57600bps
115200bps

PAR	Description	UM	Def	Min	Max	Access
205	**PortB Settings**		N81			ERW
	Configure data packet of second port. N81 E81 O81 N71 E71 O71 N82 E82 O82 N72 E72 O72					
206	**PortB Address**		2	1	63	ERW
	Modbus address.					
207	**PortMaster**		None			ERW
	Select port A or B for use as Modbus master. Not enabled. None PortA PortB					
208	**LastSlave**		0	0	15	ERW
	Select number of Modbus slaves if a port is Master. Not enabled.					
210	**Remote Address**		0	0	15	ERW
	In a Master/Slave connection, this parameter selects the number of the APV-S **Slave** inverter to be remoted (two lines of the display and key functions) on the APV-S **Master** inverter. This parameter cannot be saved.					
6070	**SlaveErrAddress**		0	0	?	ER
	In a Master/Slave connection, this parameter indicates if all of the Slaves are OK or if the Slave address (configured in PAR 203 PortA Address) does not respond or is in error. 0 all monitored inverters are OK, ≠ 0 contains the address of the first inverter that has a problem (does not respond or is in error).					
6075	**SlaveErrCode**		0	0	?	ER
	In a Master/Slave connection, this parameter shows the code: 0 if all monitored inverters are OK, or (if PAR 6070 ≠ 0) when the inverter at that address does not respond. ≠ 0 is the alarm or warning code for the monitored inverter (selected in PAR 6070).					

Display

Note! Any change to the value of parameters has an immediate effect on inverter operations, but is **not automatically saved** in permanent memory. All unsaved changes **will be lost** when power to the drive is switched off.

Run PAR 550 Param Save to save the value of currently used parameters.

PAR	Description	UM	Def	Min	Max	Access
54	**BackLight Time**	s	100	0	7200	ERW
	After a key is pressed, the display stays on for the number of seconds set with this parameter. Note: 0 always ON.					
589	**Display Contrast**		0	-20	20	ERW
	Adjusts display contrast.					
592	**Graph Source**		hour			ERW
	Setting of display in hours or days or months of graph on KA display. Hour Day Month HourDayMonth The graph display changes in sequence every two seconds					
593	**Display AutoTime**	s	60	0	1000	ERW
	If enabled, after a few seconds displays information in the text area instead of the menu.					

Time

Note! Any change to the value of parameters has an immediate effect on inverter operations, but is **not automatically saved** in permanent memory. All unsaved changes **will be lost** when power to the drive is switched off.

Run PAR 550 Param Save to save the value of currently used parameters.

PAR	Description	UM	Def	Min	Max	Access
70	**Set DateTime**					ERW
	Setting internal clock. Format: dd/MM/YY hh:mm.					
72	**Year**	YY				ERW
	Setting year. Format: YY (example: 2014 = 14).					
74	**Month**	MM				ERW
	Setting month. Format: MM (example: June = 06).					
76	**Day**	GG				ERW
	Setting day. Format: GG (example: 05).					
78	**Hour**	DD				ERW
	Setting hour. Format: 24H (example: 10 PM = 22).					
80	**Minute**	m				ERW
	Setting minutes. Format: mm (example: 9' = 09).					
82	**Second**	s				ERW
	Setting seconds. Format: ss (example: 6" = 06).					
83	**TimeZone**		0	-12	+12	ERW
	Time zone set relative to Universal Coordinated Time UTC).					
84	**DayLightSaving**		On	Off	On	ERW
	Automatic setting of Daylight Saving Time. With 84 "Daylight saving" = On (default), the time automatically switches from solar to daylight saving time (last Sunday in March and October) (check applicability in country of installation). On Automatic Daylight Saving Time set. Off Setting off.					

9.1 RS485 serial connection with MODBUS RTU protocol

Communication is performed via RS485 serial connection with MODBUS RTU protocol.

To configure communication between the inverter and the monitoring/software system, you have to respect numerous elements in order to ensure correct functioning.

You can connect and communicate with a maximum of 50 nodes. DO NOT exceed 250 meters for the communication line (for longer lengths please contact Rishabh Solar Service).

In case of communication between a single inverter and a PC (with supervision SW or inverter configuration SW installed), you need to use a USB - RS 485 converter cable (we recommend our cable code 8S8F60 length 1.8 meters or code 8S8F61 length 5 meters (laboratory tested); other “passive” converters may not work).

Example of connection: with multiple inverters see Figure 35, with one inverters see Figure 36.

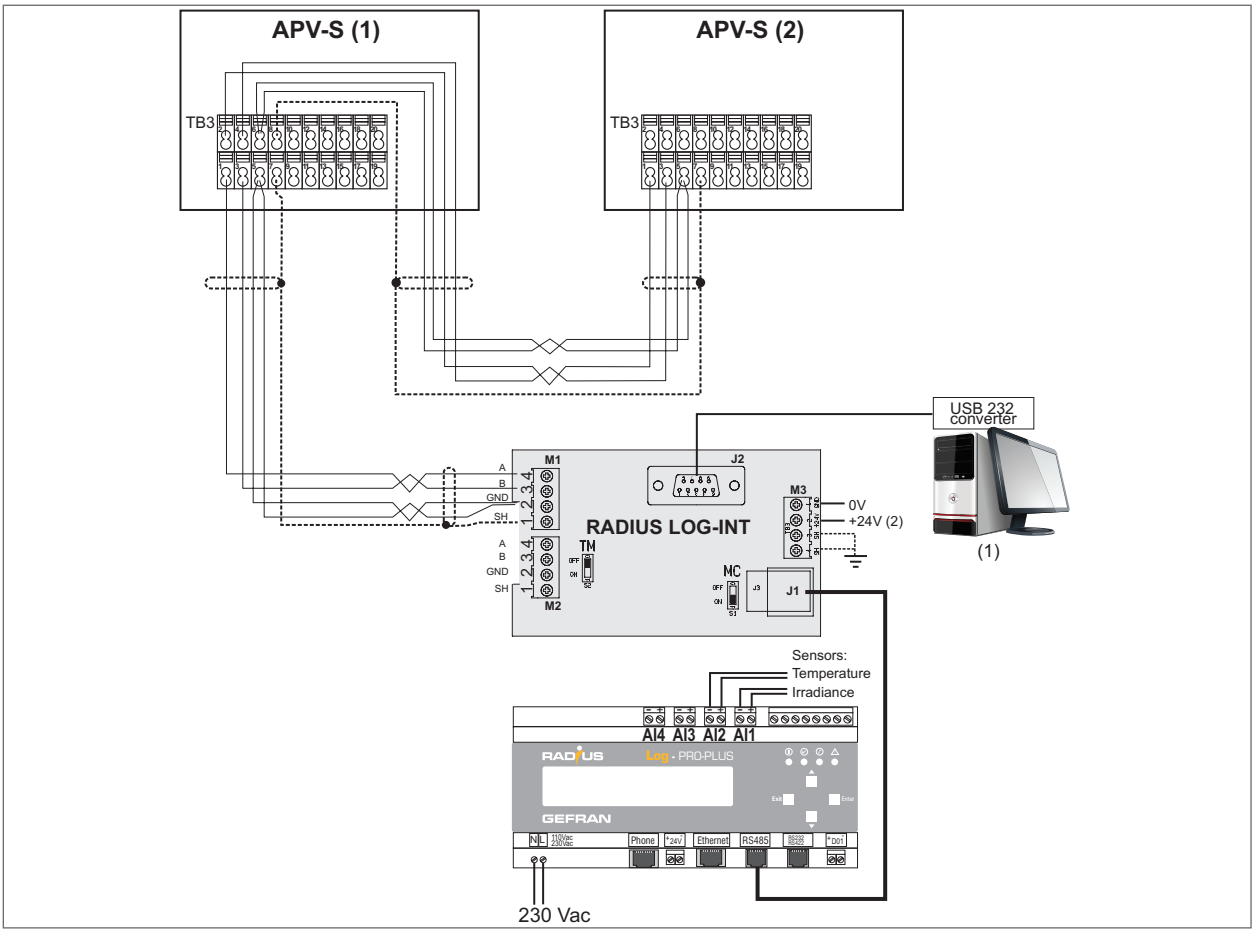
Attention

We recommend running the serial connection cable in a **tray separated from power cables**.
In case of systems with high interference, we recommend shielding the cables with a metal pipe (grounded at a single point).

In case of communication between multiple inverters and a PC or between one or more inverters and the datalogger, you have to insert an SL605 optocoupler connection kit interface card to isolate the grid and do as follows:

- for the connection, use a cable consisting of two symmetrical twisted pairs, spiraled with a single shield, typical impedance Z0=120 ohm (minimum 2x2x0.22 mm^2 or min. 2x2AWG24),
- the cable shield must be continuous for the entire chain and must be grounded at a single point.

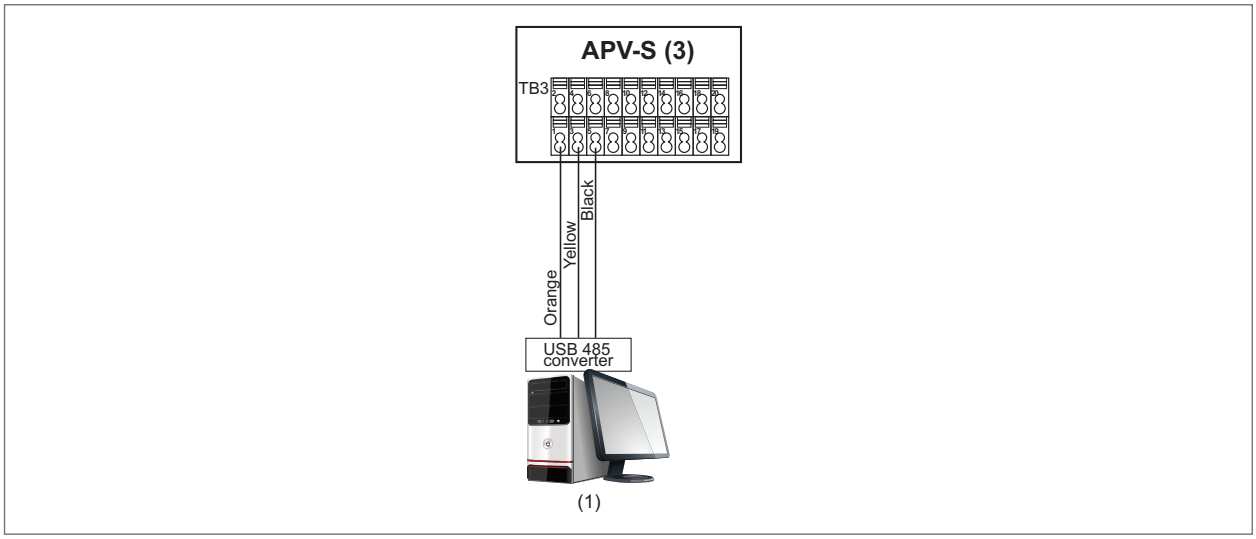
Figure 29 : Example of connection with multiple inverters



(1) supervision PC or configuration SW.

(2) Only for configurations that do not require the Data Logger.

Figure 30 : Example of connection with one inverters



(1) supervision PC or configuration SW.

Note! The first and last element of the modbus chain must have the termination resistor inserted.

APV-S: S2 / S3 (Switch): see Figure 27.

Radius Log Int (see Figure 35)

TM (Switch): OFF = termination resistor not inserted; ON = termination resistor inserted (120 Ω).

If RADIUS LOG-INT is present, you can connect only one monitoring device. Therefore, if you connect the datalogger to port J1 you have to leave the connector to tray J2 free. If you decide to do supervision with the PC by connecting it to serial port J2, the RADIUS log datalogger will not work; disconnect the connector in port J1. For the latter solution, use an USB-RS232 cable converter (code S8F62 length 1meter or code 8S8F63 length 5 meters).

With datalogger RADIUS Log : switch MC on RADIUS LOG-INT = ON.

With PC: switch MC on RADIUS LOG-INT = OFF.

Attention

The RADIUS LOG INT card requires an external 24 VDC power supply when it is used with a PC (i.e., without RADIUS Log datalogger).

The RADIUS LOG INT card is supplied in the "Optocoupler Connection Kit", code SL605 (for more information, see the RADIUS APV Solar Inverters catalog).

9.2 Master/Slave alarm monitoring and remote control functions

These functions can be useful when the APV-S inverters are positioned in different, hard-to-reach, points of the system.

The inverters have to be connected via RS485 serial with MODBUS RTU protocol, as shown in the figure below. See section 9.1 for further details.

Note! The first and last element of the modbus chain must have the termination resistor inserted.

See Figure 27.

The RS485 terminals are doubled to facilitate multipoint wiring.

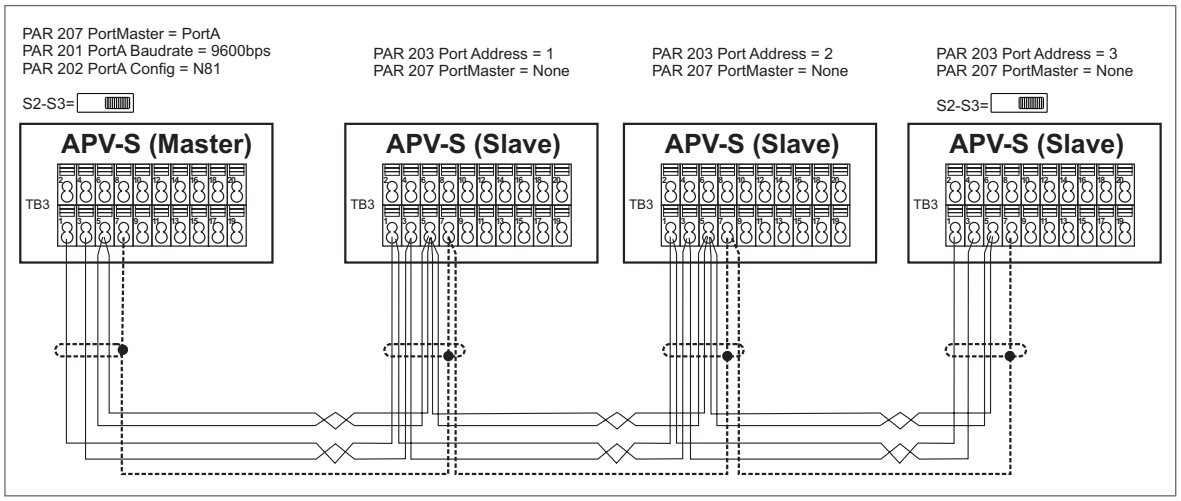


Figure 31 : Example of M/S connection

9.2.1 M/S alarm monitoring function

This function lets you monitor the alarm status of multiple APV-S inverters set as Slaves from a APV-S inverter set as a **Master**.

The **Master** cyclically reads the **Slave** inverters to check if they are in alarm. If at least one Slave inverter is in alarm or does not respond, the warning code 13 “Slave comm” is generated.

APV-S **Slave** settings:

- For each APV-S **Slave** inverter, set a different address number with PAR 203 **PortA Address** (or PAR 206 **PortB Address)**. The addresses must be numbered progressively.
- PAR 207 **PortMaster** = None (not enabled).

APV-S **Master** settings:

- PAR 207 **PortMaster** on “PortA” or “PortB” (default = “None”, slave mode). To enable the new setting, save and restart the inverter.

  Only APV-S inverters set as **Slaves** can be connected to this port (no other device, such as a datalogger, PV-monitor, etc.).
- Set the same Baudrate and data packet settings for all connected inverters (PAR 201 **PortA Baudrate** and PAR 202 **PortA Settings** or PAR 204 **PortB Baudrate** and PAR 205 **PortB Settings**).
- In PAR 208 **LastSlave**, set the number of the last APV-S **Slave** inverter in the RS485 connection: specify how many slaves are to be monitored.

  No restart is required to enable the new settings of PAR 208.

9.2.2 Control function from remote M/S

This function lets you display (and change) on the APV-S inverter set as **Master** the parameters of the APV-S inverters set as **Slaves**.

Note! The top part of the KA and KB display (LED, graph, power, etc.) is not remoted. The data shown are always those of the APV-S Master inverter.

APV-S **Slave** settings:

- For each APV-S **Slave** inverter, set a different address number with PAR 203 **PortA Address** (or PAR 206 **PortB Address**). The addresses must be numbered progressively.
- PAR 207 **PortMaster** = None (not enabled).

APV-S **Master** settings:

- PAR 207 **PortMaster** on “PortA” or “PortB” (default = “None”, slave mode). To enable the new setting, save and restart the inverter.

  Only APV-S inverters set as **Slaves** can be connected to this port (no other device, such as a datalogger, PV-monitor, etc.).
- Set the same Baudrate and data packet settings for all connected inverters (PAR 201 **PortA Baudrate** and PAR 202 **PortA Settings** or PAR 204 **PortB Baudrate** and PAR 205 **PortB Settings**).
- In PAR 210 **Remote Address**, set the number of the APV-S **Slave** inverter to be remote controlled.
- If the **Slave** inverter does not respond or is in warning status, warning code 13 “**Slave comm**” is displayed.
- If the **Slave** inverter responds but is in error, alarm code 48 “**Slave Alarm**” is displayed.

Display on APV-S **Master**

- The two lines of the APV **Master** inverter display will now show the menu and parameters of the APV-S **Slave** inverter set with PAR 203 (or PAR 206) = address 1 in the following example:

APV-S Menu	
Info	**1**

  In this mode, the line at the bottom right shows the address number of the APV-S **Slave** inverter (= 1).

  You can navigate among the menus and parameters by using keys:

APV-S Menu		**Enter**	VinMppt1
Info	**1**		500 Vcc

- To display data of the other APV-S **Slave** inverters:

  1) press the ◄ key for a few seconds to exit.

  2) on the **Communication** menu, set the new address of the APV-S **Slave** in PAR 210 **Remote Address** (for example, 2):

> Communication	**Enter**	Remote Address	**Enter** ▼ (x2)
Remote Address			

Remote Address	**Enter**
02	

  3) The two lines of the APV **Master** inverter display will now show the menu and parameters of the APV-S **Slave** inverter address 2:

APV-S Menu	
Info	**2**

  The line at the bottom right shows the address number of the APV-S Slave inverter (= 2).

  You can navigate among the menus and parameters by using keys:

APV-S Menu		**Enter** ▼ (x4)	IinMppt1
Info	**2**		10 A

- Press the ◄ key for a few seconds to exit.

- If Slave data are not displayed:

A) on the **Communication** menu, display PAR 6070 **SlaveErrAddress**: this contains the address of the first inverter that has a problem (does not respond or is in error). I.e.: 3.

> Communication SlaveErrAddress	**Enter**	SlaveErrAddress 3

B) on the **Communication** menu, display PAR 6075 **SlaveErrCode**:

- if = 0, it means that all of the monitored inverters are OK or (if PAR 6070 ≠ 0) when the inverter at that address does not respond.
- ≠ 0 = is the alarm or warning code for the monitored inverter (selected in PAR 6070)

> Communication SlaveErrCode	**Enter**	SlaveErrCode 0

10. Troubleshooting

10.1 Error messages classification

The inverter APV-S is able to report alarms / warnings on the display if the input voltage is higher than the VSTART.

It is possible to distinguish the type of error in “alarm” or “warning” as described in the following table:

Alarms	Red led on Green led off	These alarms stop the inverter
Warnings Code from 1 to 16	Red led off Green led blinking	The inverter continues to operate and generate but it reports this warning by detecting an abnormality at inverter level. The inverter can stop if these warnings are combined with other alarms.
Warnings Code from 81 to 84	Red led off Green led blinking	The inverter continues to operate and generate but it reports this warning by detecting an abnormality at system / plant level or the need to perform maintenance

10.2 Alarms and Warnings list

Cod. (1)	Displayed message	Type	Description	Cause	Solution
1	AFE Comm	Warning	AFE Communication error	No communication with AFE micro	Do an alarm reset. *
2	Boost Comm	Warning	Boost Communication error	No communication with Boost micro	Do an alarm reset. *
3	AFE Boot	Warning	AFE in Boot State	AFE did not load software. Occurs if update is interrupted	Do an alarm reset. *
4	Boost Boot	Warning	Boost in Boot State	Boost did not load software. Occurs if update is interrupted	Do an alarm reset. *
5	EEPROM error	Warning	Parameter Save/Load error	HMI lost saved parameters	Re-parameterize inverter. *
6	String error	Warning	String Current Test error	One or more monitored strings have values beyond limit	Check set limits and that strings are correctly connected.. * / **
7	Log error	Warning	Log error	Cannot read or write production or alarms log	Check that log was correctly copied to USB drive. If not, copy it again. If you are not copying the log to a USB drive, contact Rishabh Solar Service **
8	HMI Boot	Warning	HMI in Boot State	HMI did not load software	Contact Rishabh Solar Service
9	Low Battery	Warning	Low Battery	Replace clock battery	Check that battery is correctly inserted. If it is, it means that it is drained. Replace it by following the instructions in the manual. */**
10	File error	Warning	File error	USB read/write error	Check that USB is inserted correctly and that process was successful. If not, reinsert USB and/ or repeat process. *
11	USB error	Warning	USB error	USB hardware error	Do an alarm reset. *
12	Default error	Warning	Load default error	Cannot load default parameters	Check inverter parameterization. */**
13	Slave Comm	Warning	APVS Slave comm error	Communication error with other inverter configured as slave	Check that slave inverters are connected and on
14	Internal error 7	Warning	Internal Error 7	Internal error in inverter 7	Do an alarm reset. *
17	Input OV DC Bus	Alarm	Over Voltage on DC bus detected from Boost	Input voltage too high .	Check that configuration of strings conforms to characteristics of inverter specified in manual. */**
18	Input OC 1	Alarm	Over Current Boost 1	Maximum input current exceeded	Check that inputs are correctly configured. */**
19	Com err	Alarm	Wrong internal communication	Communication problems among internal devices	Switch inverter OFF and then back ON. *
20	Input OC 2	Alarm	Overcurrent Boost 2	Maximum input current exceeded	Check that inputs are correctly configured. */**
21	Insulation err	Alarm	Insulation Resistance Error	PV field insulation below limits	Check insulation of PV field. *
22	Missed config 1	Alarm	Wrong Configuration / Size	Initialization error	Do an alarm reset. *

Cod. (1)	Displayed message	Type	Description	Cause	Solution
23	Leakage curr B	Alarm	Leakage current Error detected from Boost	Leakage current detected on AC side	Check insulation of PV field. *
24	Micro OT B	Alarm	Boost micro over temperature	Temperature too high	Wait for inverter to cool and return to working range. If problem persists, contact Rishabh Solar Service
25	Internal err 1	Alarm	Internal error 1	Internal error in inverter 1	Switch inverter OFF and then back ON. *
26	Ground kit err	Alarm	Ground Kit Error	Loss of PV generator isolation and leakage to ground	Check isolation to ground and replace fuse after eliminating cause of error.. *
27	Klixon err 1	Alarm	Klixon error	Temperature too high	Wait for inverter to cool and return to working range. If problem persists, contact Rishabh Solar Service
28	Redundancy err 1	Alarm	Redundancy Error	Conflict between measurements of leakage current	If problem persists, contact Rishabh Solar Service
29	Internal err 2	Alarm	Internal error 2	Internal error in inverter 2	Switch inverter OFF and then back ON. *
30	Internal err 3	Alarm	Internal error 3	Internal error in inverter 3	Switch inverter OFF and then back ON. *
48	Slave alarm	Alarm	Alarm on remote slave	Remote slave in alarm	Check state of slave in alarm
49	DC Link UV A	Alarm	DC bus undervoltage	Voltage on DC bus below limits	If problem persists, contact Rishabh Solar Service
50	DC LINK OV A	Alarm	DC bus overvoltage (Inverter)	Voltage on DC bus above limits	Do an alarm reset. *
51	DC Link Unbalance	Alarm	DC bus unbalanced	Voltage on DC bus above limits	Check that configuration of strings conforms to characteristics of inverter specified in manual. */**
52	Output OC 1	Alarm	Over Current SW Inverter	Maximum output current exceeded	Do an alarm reset. *
53	Output OC 2	Alarm	Over Current HW inverter	Maximum output current exceeded	Do an alarm reset. *
54	Grid UV	Alarm	Grid Under Voltage	Grid voltage below minimum levels	Wait for return of grid conditions needed to start the inverter
55	Grid OV	Alarm	Grid Over Voltage	Grid voltage above maximum levels	Wait for return of grid conditions needed to start the inverter
56	Grid UF	Alarm	Grid Under Frequency	Grid frequency below minimum levels	Wait for return of grid conditions needed to start the inverter
57	Grid OF	Alarm	Grid Over Frequency	Grid frequency above maximum levels	Wait for return of grid conditions needed to start the inverter
58	Redundancy err 2	Alarm	Redundancy Error	Conflict between measurements of output voltage	Do an alarm reset. *
59	Sink OT B	Alarm	Input Side Module Over Temperature	Temperature too high	Wait for inverter to cool and return to working range. If problem persists, contact Rishabh Solar Service
60	Sink UT B	Alarm	Input Side Module Under Temperature	Temperature below allowed limits	Wait for temperature to return to working range. If problem persists, contact Rishabh Solar Service
61	Sink OT A	Alarm	Output Side Module Over Temperature	Temperature too high	Wait for inverter to cool and return to working range. If problem persists, contact Rishabh Solar Service
62	Sink UT A	Alarm	Output Side Module Under Temperature	Temperature below allowed limits	Wait for temperature to return to working range. If problem persists, contact Rishabh Solar Service
63	DC Current Inj	Alarm	DC Injected Over Limit	DC current injected in grid has exceeded limit	Do an alarm reset. *
64	LeakageCurrent A	Alarm	Leakage Current Over Limit	Leakage current detected on AC side	Check insulation of PV field. *
65	Power Relay err	Alarm	Grid Relay Fault	Relay check procedure failed	Do an alarm reset. *
66	Micro OT A	Alarm	Inverter Micro Over Temperature	Temperature too high	Wait for inverter to cool and return to working range. If problem persists, contact Rishabh Solar Service
67	Klixon err 2	Alarm	Clicson Fault Detected	Temperature too high	Wait for inverter to cool and return to working range. If problem persists, contact Rishabh Solar Service
68	Missed config 2	Alarm	Wrong Configuration / Size	Initialization error	Do an alarm reset. *

Cod. (1)	Displayed message	Type	Description	Cause	Solution
69	AC Unbalanced	Alarm	AC Voltage Unbalanced detected	Grid unbalanced	Check voltages and connection to grid
70	Internal err 4	Alarm	Internal error 4	Internal error in inverter 4	Switch inverter OFF and then back ON. *
71	Internal err 5	Alarm	Internal error 5	Internal error in inverter 5	Switch inverter OFF and then back ON. *
72	Internal err 6	Alarm	Internal error 6	Internal error in inverter 6	Switch inverter OFF and then back ON. *
73	A Overload	Alarm	Overload detected	Overload in output	Check grid voltages
81	OverVoltageVin	Warning	Over Voltage Input Voltage	Input voltage is in over the warning level	Check the PV plant
82	Module OT	Warning	Over Temperature IGBT Boost Module (first level)	Inverter temperature over the warning level	Check the PV plant
83	Heatsink OT	Warning	Over Temperature Sink Module (first level)	Inverter temperature over the warning level	Check the PV plant
84	Varistor not OK	Warning	At least one varistor failed	At least one varistor failed	Do an alarm reset. *

(1) Code showed on display (press ►)

* If problem persist contact Rishabh Solar Service

** Do an alarm reset, see section “Alarms” on page 60.

11. Specifications

11.1 APV-S-..k-AE models

APV-S model		10k-AE-TL-1	12k-AE-TL-1	15k-AE-TL-2	18k-AE-TL-2	20k-AE-TL-2	25k-AE-TL-2
INPUT DATA (DC SIDE)							
MPPT number		1	1	2	2	2	2
Number of strings per MPPT		3	3	2	2	3	3
Maximum DC current per MPPT	(A)	33.7	33.7	22.5	22.5	33.7	33.7
Max short circuit current Isc	(A)	42	42	56.2	56.2	84	84
Absolute maximum permessible DC voltage (without load)	(V)	1000					
MPPT range (@ maximum power)	(V)	350 ... 800	420 ... 800	390 ... 800	470 ... 800	350 ... 800	450 ... 800
Switch ON DC voltage	(V)	> 200					
OUTPUTS DATA (AC SIDE)							
Rated AC power (from cosphi -0.9 to cosphi 0.9)	(kW)	10	12	15	18	20	25
AC Rated current / Max current	(A)	14.4/16	17.3/19.2	21.6/ 24	26/ 28.9	28.9 / 32	36.2/ 37
AC voltage	(V)	400V 3-phases + Neutral (output voltage interval 320 ... 480 [1])					
Rated AC frequency	(Hz)	50/60 (output frequency interval 47...53/ 57...63 [1])					
Grid connection		TN-C / TN-S / TN-C-S / TT					
THDI	(%)	≤ 3					
Power factor (settable)		± 0.8					
Max inverter backfeed current to the array (AC or DC)	(A)	0					
EFFICIENCY (2)							
Maximum efficiency	(%)	98.1		98.2	98.3		98.3
European efficiency (Euro ETA)	(%)	97.7		97.8	98		97.6
PROTECTIONS							
Interface protection (grid monitor)		Integrated (Excluded models for Italy)					
Anti-Islanding		Integrated (Where required by local regulations)					
Insulation control		Integrated					
Residual current monitoring		Integrated					
Reverse DC polarity protection		Integrated					
DC circuit breaker		Circuit beaker under load					
AC/DC overvoltage category		Type 2 alongwith Type 3 SPD on DC side with indication and Type 3 SPD standard on AC side					
DC Fuses and String failure detection		12A Fuses on both poles of each string + Current sensors for each string (-F models)					
DC Injection control		Integrated					

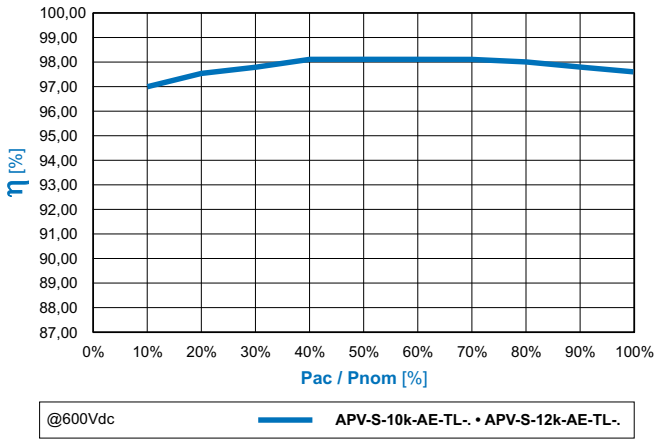
APV-S model	10k-AE-TL-1	12k-AE-TL-1	15k-AE-TL-2	18k-AE-TL-2	20k-AE-TL-2	25k-AE-TL-2
INTERFACES						
Display	KA					
	KA = 100 x 100mm graphic display with keypad.					
Communications	2 RS485 ports (both with separate in/out). 1 standard USB port (only for firmware updates and downloading of historical data) In built GSM based remote monitoring system (Optional)					
Inputs / Outputs	3 analog inputs (environment sensors, 0 ... 10V) 2 digital inputs (0-24V) 2 digital outputs (0-24V) 24V OUT (500 mA MAX) 2 relays single contact (30 Vdc, 250 Vac / 2A)					
COOLING						
Cooling method	Natural convection					
ENVIRONMENT DATA						
Temperature Range	-20…+60°C (over 50°C with derating)					(over 40°C derating)
Vibration	1G					
IP protection degree	IP65					
Environment conditions	4K4H					
Maximum permissible value for relative humidity, non-condensing	100%					
Pollution degree	EN 60721-3-4, free from direct solar radiation To avoid increasing the internal temperature of the inverter and cause a reduction of output power (derating).					
Altitude	Up to 2000 m with derating (1.2% each 100 m above 1000 m)					
STANDARDS						
Directives and standards	IEC 62109-1, IEC 62109-2, IEC 62116					
Electromagnetic immunity and emissions	EN 61000-6-3, EN 61000-6-2					
CE marking	Yes					
Grid connections	IEC 61683, IEC 60068-2-1/2/14/30, IEC 60529 IEC 61727 DIN V VDE V 0126 (VDE V 0126-1-1):2006-02 VDE V 0126-1-1:2012/A1 VDE-AR-N 4105 CEI 0-21, CEI 0-16 ed. III RD 661:2007 – RD1699:2011 South African Grid code, NRS 097-2-1					Designed to meet all the relevant application IEC standards

(1) The output voltage and frequency interval may vary according to the grid connection standard.

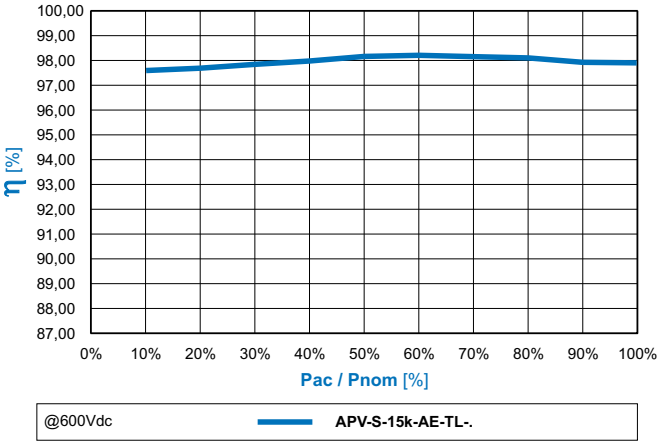
(2) The efficiency values are defined through measuring process with high precision instruments during nominal conditions. The inverters not working under nominal conditions can have different efficiency data.

11.1.1 Efficiency curves

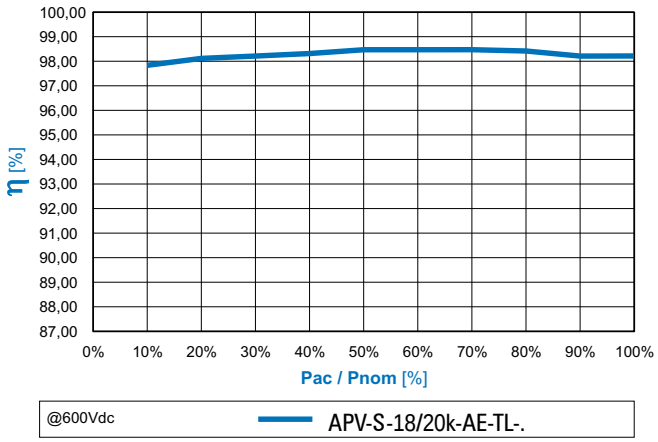
APV-S-10K/12k-AE-TL-.



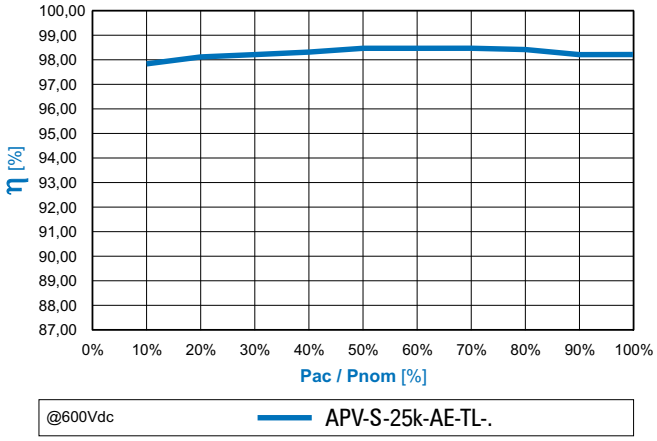
APV-S-15k-AE-TL-.



APV-S-18/20k-AE-TL-.

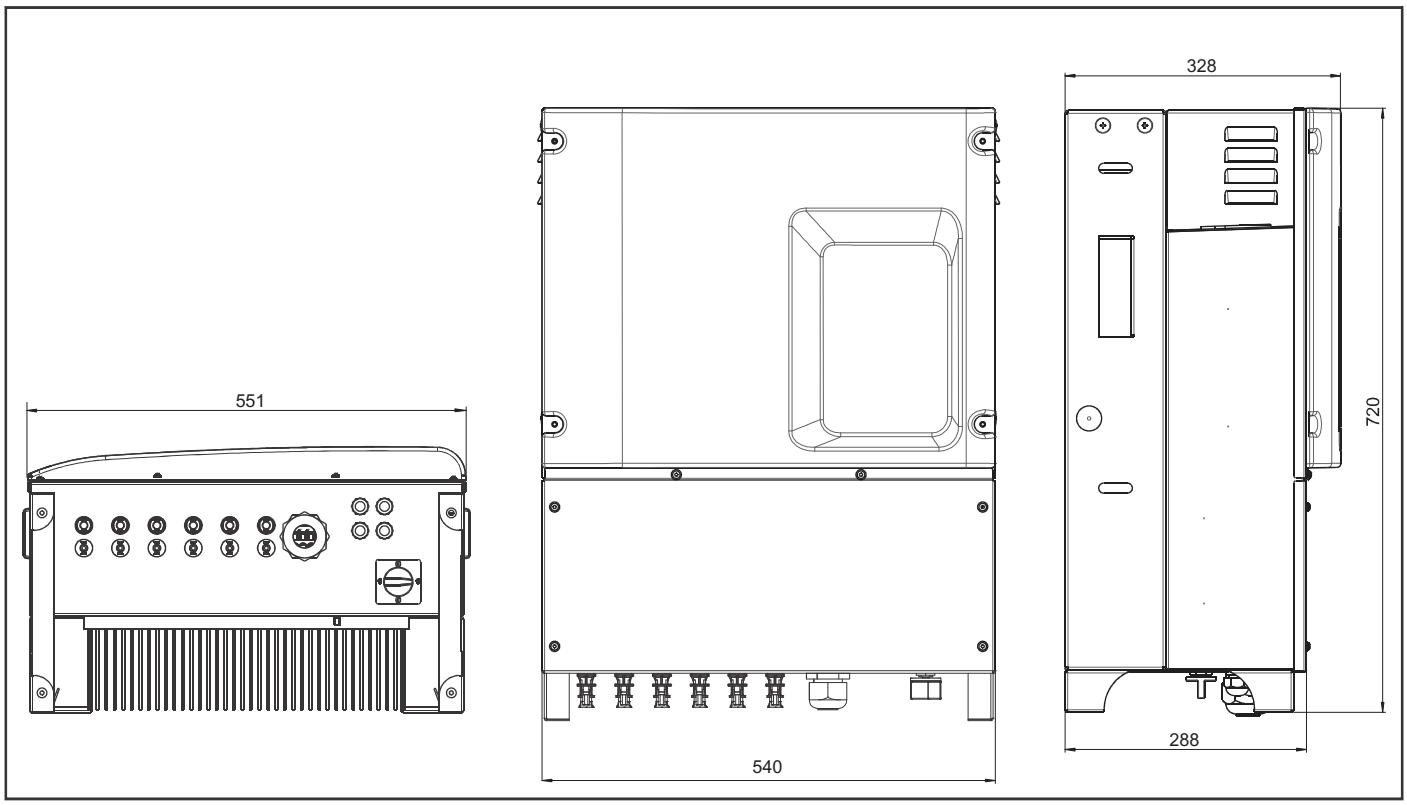


APV-S-25k-AE-TL-.



Nota! The efficiency values are defined through measuring process with high precision instruments during nominal conditions. The inverters not working under nominal conditions can have different efficiency data.

12. Dimensions and weight



APV-S model		10k-AE-TL-1	12k-AE-TL-1	15k-AE-TL-2	18k-AE-TL-2	20k-AE-TL-2	25k-AE-TL-2
Dimensions: Width x Height x Depth	mm	551 x 720 x 328					
	[inches]	[21.26 x 28.34 x 12.91]					
Weight	kg	66		72		76	
	[lbs]	[145.5]		[158.7]		[167.5]	

13. Maintenance and cleaning

The maintenance and cleaning operations described here are necessary to guarantee the minimum safety requirements of the PV inverter. It is strongly recommended to have maintenance and cleaning procedures performed by Rishabh personnel.

Operation to be performed by specially trained personnel.

Before carrying out any maintenance or cleaning operations, remove all dangerous voltage from inside the panel.

To remove all dangerous voltage from inside the panel, disconnect all the external power connections (AC side and DC side) and take steps to prevent voltage from being accidentally re-applied. Put up appropriate signs to indicate work in progress and to prohibit all maneuvers.

Wait 10 minutes before starting any work (to allow the capacitors to discharge).

Follow all the safety instructions in this manual.

Make sure all power supplies have been disconnected before touching any parts.

Maintenance personnel must be qualified and provided with adequate protective equipment.

Qualified personnel must have the following skills:

- **Knowledge of how an inverter works and is operated;**
- **Training in how to deal with the dangers and risks associated with controlling and servicing electrical devices and plants;**
- **Training in the maintenance of electrical devices and plants;**
- **Knowledge of all applicable standards and directives;**
- **Knowledge of and adherence to these instructions, including all safety precautions.**

Protective equipment used must meet the requirements of directive 89/686/EC. Protective equipment must also include any additional protections required under applicable legislation or otherwise prescribed.

Never remove any interlocks, guards or protective devices on the equipment or use these incorrectly.

Do not remove or conceal warning signs affixed to machinery.

Do not modify circuits or software programs or make adjustments without the manufacturer's prior consent. Any such modifications could pose a risk for persons or equipment.

13.1 Product label

The product label identifies the inverter.

Environmental conditions during maintenance

The penetration of humidity and dust can damage the inverter.

Maintenance must only be carried out in humidity- and dust-free conditions.

Keeping technical documentation

This manual must always be available for use by persons responsible for operating and servicing the equipment.

Keep this documentation next to the inverter.

13.2 Cleaning operations

It is important to avoid any build-up of dust on the outside of the inverter. DO NOT use corrosive products or material that generates electrostatic charges for this purpose.

Check the cleanliness of the internal components of the inverter panel every 12 months. Remove any dust with a low-pressure jet of water or soft cloth.

Cleaning must be performed on inverters installed in particularly dusty environments.

13.3 Routine maintenance procedures

- **Periodic checks**

Action	Frequency
Check that all labels and danger signs are completely legible	12 months
Check that the cables coming from outside the inverter are in perfect condition	12 months
Visually check for any damage to the inverter casing	12 months
Check that the ambient conditions of the inverter installation still comply with the ambient data shown on chapter 11.	12 months
Check integrity of cable clamps	12 months
Check fastening of lower panel (tightening torque see par. 6.6 on page 26).	12 months

13.4 Replacing the backup battery

Operation to be performed by specially trained personnel.

Replace the backup battery when the message “ALL.9 low battery” appears on the display. The battery is a CR2032 and installs on the electronic card under the display.

To replace the battery:

1. disconnect voltage from the AC and DC side
2. remove the lower panel as described in chapter 6.3 on page 21
3. remove the old battery (check polarity to ensure insertion of new battery in the same position)
4. wear insulating gloves when installing the new battery; check polarity
5. replace the lower panel as described in chapter 6.6 on page 26
6. re-enable the inverter
7. reset the correct date and time.

Note: replacement of the battery causes the loss of saved daily data; the date and time must also be reset.

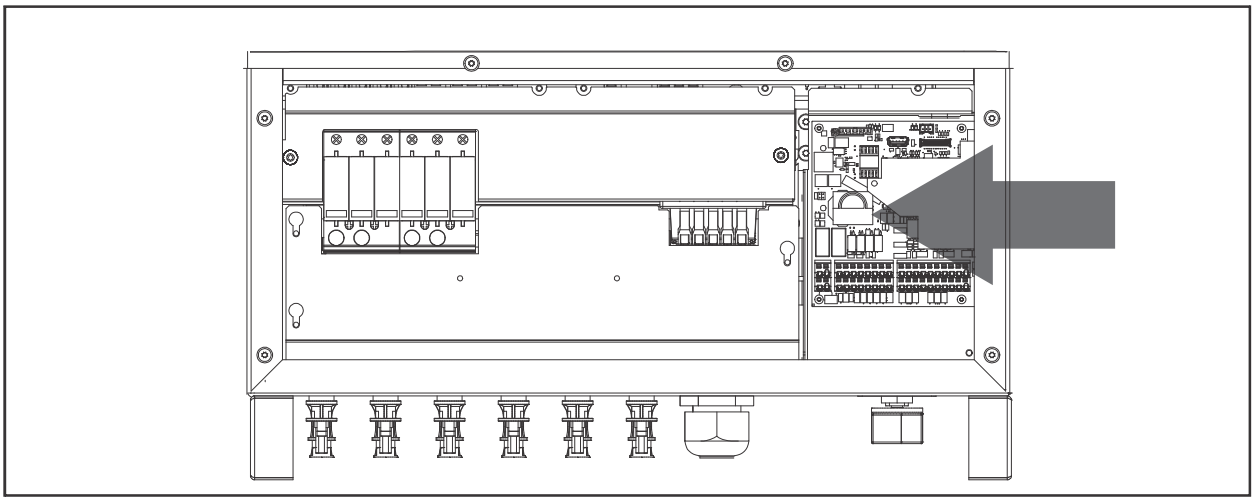


Figure 32 : Position of battery on electronic card

13.5 Replacing the SPDs

Warning!

Operation to be performed by specially trained personnel.

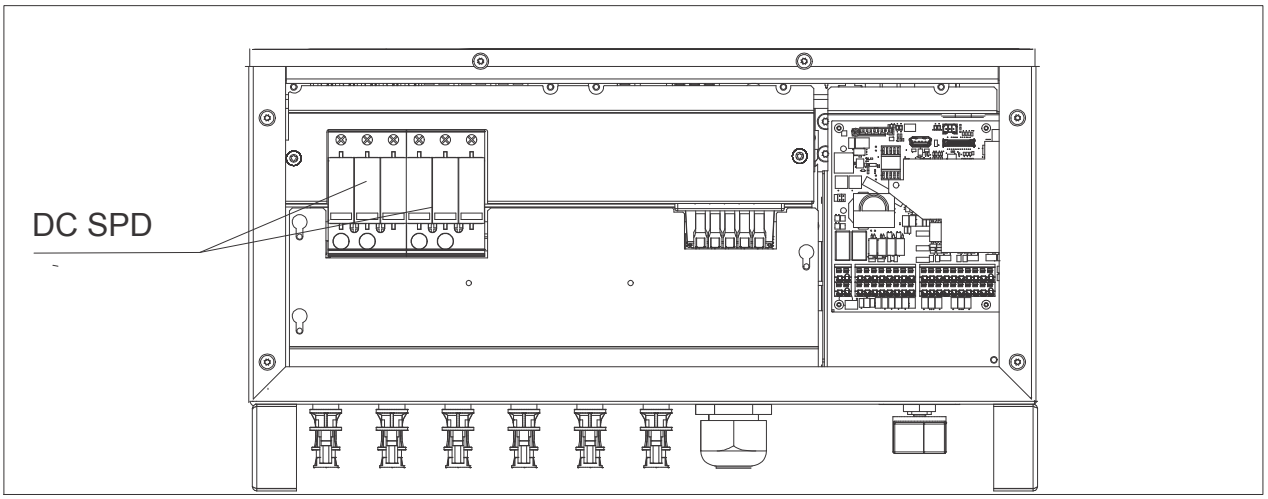


Figure 33 : Position of Type 2 DC SPD

Radius APVS inverter is equipped with replaceable TYPE II DC SPD to provide protection against surge and ovevoltage. In case of SPD failure it is indicated by red indication on the SPD cartridge itself.
To replace the faulty/damaged SPD call the Rishabh solar service.

14. Warranty conditions

The warranty is valid from the date of delivery of the Rishabh RADIUS products.

The standard manufacturer’s warranty, included in the price of the product, is valid for 5 years starting from the date of delivery.

Before the end of that period you may purchase the RWE to extend the manufacturer’s warranty.

For more information on warranty terms and conditions, see the most recent edition of the RADIUS Solar Service catalog on www.radius.rishabh.co.in .

15. Contact

RADIUS Solar Service (Worlwide)
Tel: +91 253 2202 019
e-mail: inverters@rishabh.co.in
fax: +91 253 2351 064

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