Fronius
SHIFTING THE LIMITS

Fronius Symo
Explanation of symbols and choice of location
Notes regarding installation and connection

EN

Operating Instructions

Grid-connected inverter

42,0426,0172,EN 002-21082013

Contents

Explanation of symbols 3
Explanation of safety symbols 3
Explanation of symbols - choice of location 3
Explanation of symbols - installation position 4
Choice of location 6
Proper use 6
General comments regarding choice of location 6
Installation notes 7
Selecting dowels and screws 7
Recommended screws 7
Fitting the wall bracket 7
Notes regarding grid connection 8
Monitoring the Grid 8
AC terminals 8
Type of AC cable 8
Connecting aluminum cables 8
Cross-section of the AC cable 9
Connecting the inverter to the public grid (AC) 9
Maximum fuse rating on alternating current side 10
Notes regarding DC connection 11
General comments regarding solar modules 11
DC terminals 11
Connecting aluminum cables 11
Inverter DC connection 12
Notes regarding inverters with single and multiple MPP trackers 13
Inverter with single MPP tracker 13
Inverter with multiple MPP trackers 13
Notes regarding the laying of data communication cables 15
Laying data communication cables 15
Notes regarding attaching the inverter to the wall bracket 16
Attaching the inverter to the wall bracket 16
Notes regarding starting up for the first time 17
Notes regarding starting up for the first time 17
Notes regarding software updates 18
Notes regarding software updates 18
USB Stick as a Data Logger and for Updating Inverter Software 19
USB stick as a data logger 19
Data on the USB stick 19
Data amount and memory capacity 20
Buffer memory 20
Suitable USB sticks 21
USB stick for updating the inverter software 22
Remove USB stick 22
Notes regarding maintenance 23
Maintenance 23
Cleaning 23

Explanation of symbols

Explanation of safety symbols

DANGER! indicates immediate and real danger. If it is not avoided, death or serious injury will result.

WARNING! indicates a potentially dangerous situation. Death or serious injury may result if appropriate precautions are not taken.

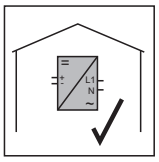
CAUTION! indicates a situation where damage or injury could occur. If it is not avoided, minor injury and/or damage to property may result.

NOTE! indicates a risk of flawed results and possible damage to the equipment.

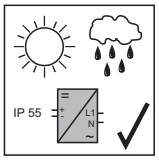
IMPORTANT! indicates tips for correct operation and other particularly useful information. It does not indicate a potentially damaging or dangerous situation.

If you see any of the symbols depicted in the "Safety rules", special care is required.

Explanation of symbols - choice of location

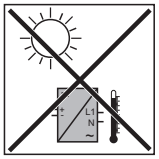


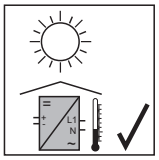
The inverter is suitable for installation indoors.



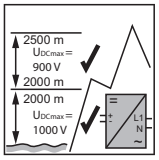
The inverter is suitable for installation outdoors.

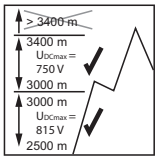
Its IP 55 degree of protection means that the inverter is resistant to water jets from any direction and can also be used in damp environments.





In order to minimise the heating up of the inverter, do not expose it to direct insolation. The inverter should ideally be mounted in a protected position, e.g. in the vicinity of the solar modules or beneath the eaves.

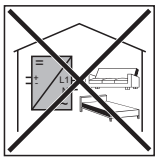




U_{DCmax} at an altitude of:
0 to 2000 m = 1000 V
2000 to 2500 m = 900 V
2500 to 3000 m = 815 V
3000 to 3400 m = 750 V

IMPORTANT! The inverter must not be installed or used at altitudes above 3400 m.

Do not install the inverter:
- in areas where ammonia, corrosive vapours, acids or salts are present
  (e.g. fertiliser stores, ventilation openings from cattle sheds, chemical plants, tanneries, etc.)



As the inverter generates low levels of noise at certain times, it should not be installed close to living areas.

Do not install the inverter:
- in places where there is an increased risk of damage from farm animals (horses, cattle, sheep, pigs, etc.)
- in stables or adjoining areas
- in storage areas for hay, straw, chaff, animal feed, fertilisers, etc.

Do not install the inverter:
- in places and environments subject to heavy build-up of dust
- in places and environments in which a heavy build-up of dust containing conductive particles (e.g. iron chips) is likely

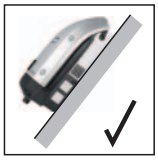
Do not install the inverter:
- in greenhouses
- in storage or processing areas for fruit, vegetables or winegrowing products
- in places used to prepare grain, green fodder or animal feeds

---

Explanation of symbols - installation position

The inverter is designed to be installed vertically on a vertical wall or pillar.

The inverter is suitable for horizontal installation.



The inverter is suitable for installation on a sloping surface.

Do not install the inverter at an angle on a vertical wall or pillar.

Do not install the inverter horizontally on a vertical wall or pillar.

Do not install the inverter on a vertical wall or pillar with its connection sockets facing upwards.

Do not install the inverter such that it overhangs.
Do not install the inverter such that it overhangs with its connection sockets facing upwards.

Do not install the inverter on the ceiling.

Choice of location

Proper use

The solar inverter is intended exclusively to convert direct current from solar modules into alternating current and to feed this into the public grid.
Utilisation not in accordance with the intended purpose comprises:
- utilisation for any other purpose or in any other manner
- making any modifications to the inverter that have not been expressly approved by Fronius
- the installation of parts that are not distributed or expressly approved by Fronius.

Fronius shall not be liable for any damage resulting from such action.
No warranty claims will be entertained.

Proper use includes:
- carefully reading and obeying all the instructions and all the safety and danger notices in the operating instructions
- performing all stipulated inspection and maintenance work
- installation as specified in the operating instructions

When designing the photovoltaic system, ensure that all of its components are operated within their permitted operating ranges at all times.

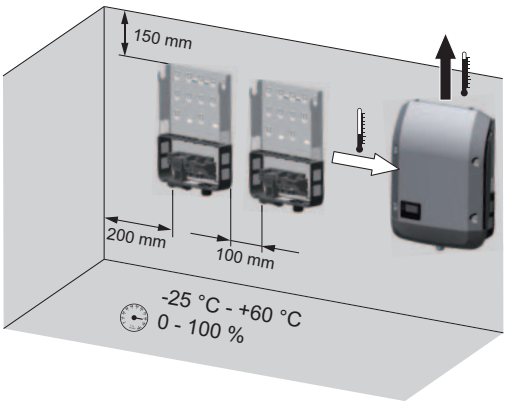
Observe all the measures recommended by the solar module manufacturer to ensure the lasting maintenance of the properties of the solar module.

Obey the regulations of the energy supply company regarding feeding energy into the grid.

General comments regarding choice of location

The following criteria should be taken into account when choosing a location for the inverter:

Install only on a solid surface



Max. ambient temperatures:
-25 °C / +60 °C

Relative humidity:
0 - 100%

The airflow within the inverter is from the left to the top (cold air taken in from the left, hot air dissipated out of the top).

If the inverter is installed in a switch cabinet or a similar sealed area, then forced-air ventilation must be provided to ensure adequate heat dissipation.

If the inverter is to be installed on the outer wall of a cattle shed, maintain a minimum all-round clearance of 2 m between the inverter and all ventilation and other openings in the building.
The installation location must not be exposed to ammonia, corrosive vapours, salts or acids.

Installation notes

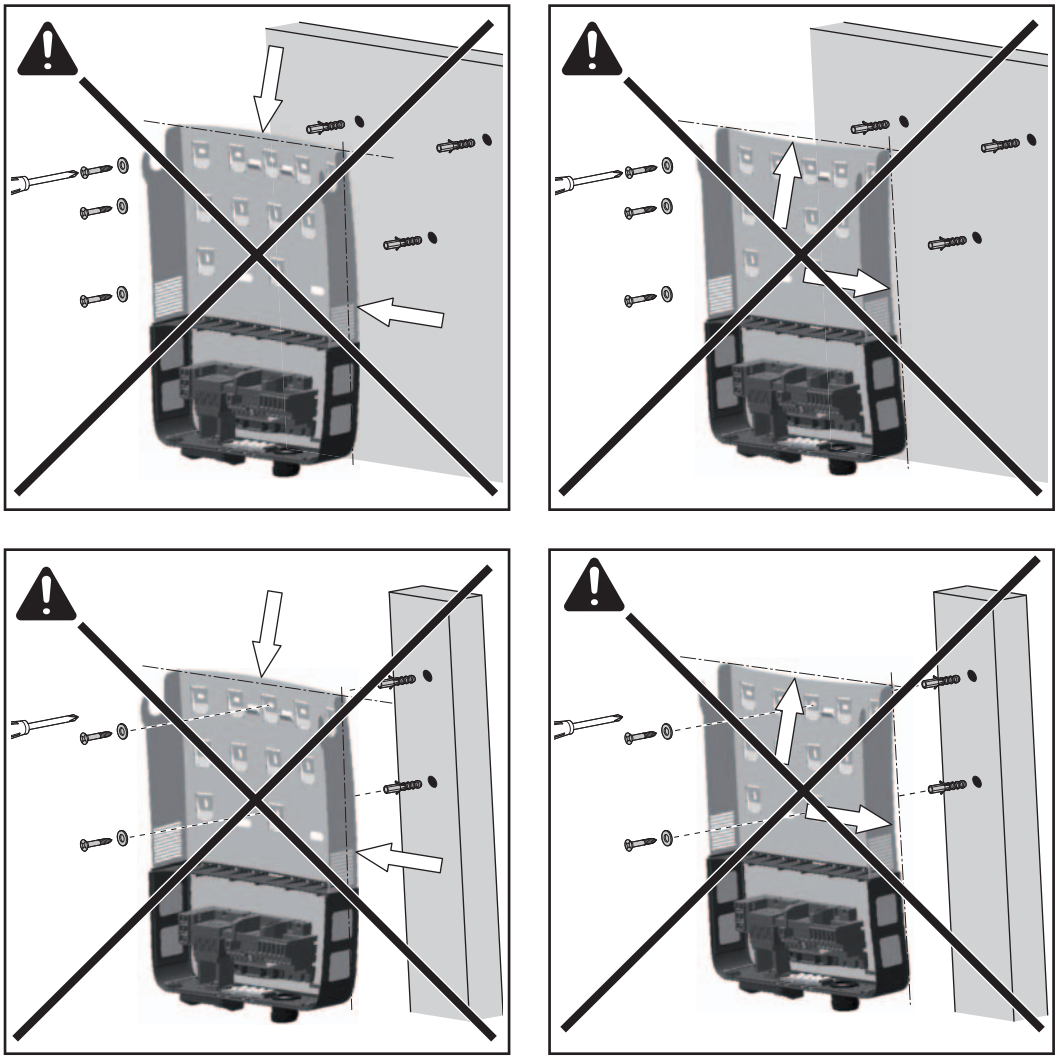
Selecting dowels and screws

IMPORTANT! Depending on the surface, different dowels and screws may be required for installing the wall bracket. Therefore, these dowels and screws are not part of the scope of supply for the inverter. The system installer is responsible for selecting the proper dowels and screws.

Recommended screws

To install the inverter, the manufacturer recommends the use of steel or aluminium screws with a diameter of 6 - 8 mm.

Fitting the wall bracket



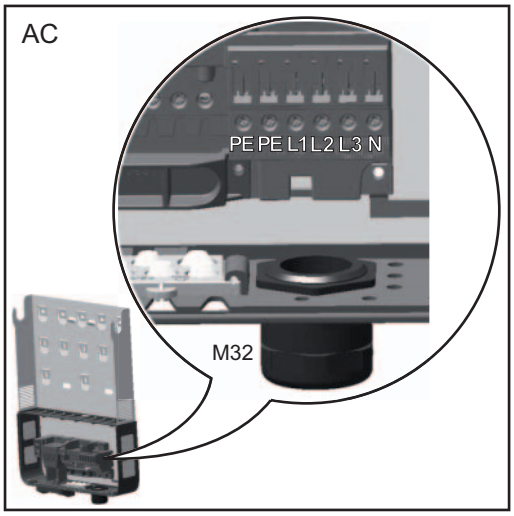
NOTE! When fitting the wall bracket to the wall, ensure that the wall bracket does not become warped or deformed.

Notes regarding grid connection

Monitoring the Grid

IMPORTANT! The resistance in the leads to the AC-side connection terminals must be as low as possible for optimal functioning of grid monitoring.

AC terminals



PE	Ground conductor / grounding
L1-L3	Phase conductor
N	Neutral conductor

Max. cross-section of each conductor cable:
16 mm²

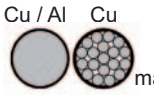
Min. cross-section of each conductor cable: in accordance with the fuse rating on the AC side, but at least 2.5 mm²

The AC cables can be connected to the AC terminals without ferrules.

In the case of an AC cable with a cross-section of 16 mm², ferrules can be either not used or used only to a limited extent depending on the type of ferrule and crimping.

Type of AC cable

The following types of AC cable can be connected to the AC terminals of the inverter:



- copper or aluminium: round, single wire
- Copper: round, finely stranded up to conductor category 4

Connecting aluminum cables

The AC-side terminals are designed for connecting single-wire, round, aluminum cables. The following points must be taken into account when connecting aluminum cables due to the non-conducting oxide layer of aluminum:

- Reduced rated currents for aluminum cables
- The connection requirements listed below

NOTE! Take into account local specifications when configuring cable cross sections.

Connection Requirements:

1 Carefully clean off the oxide layer of the stripped end of the cable, e.g., using a knife.

IMPORTANTDo not use brushes, files or sandpaper. Aluminum particles may get stuck and can transfer to other cables.

2 After removing the oxide layer of the cable end, rub in a neutral grease, e.g., acid- and alkali-free Vaseline.

3 Then immediately connect it to the terminal.

Repeat the steps above whenever the cable is disconnected and then reconnected.

Cross-section of the AC cable

When using a standard M32 metric screw joint with reducer:
cable diameter 7 - 15 mm

When using an M32 metric screw joint (reducer removed):
cable diameter 11 - 21 mm
(with a cable diameter of 11 mm the strain-relief force is reduced from 100 N to a maximum of 80 N)

With cable diameters greater than 21 mm, the M32 screw joint must be replaced by an M32 screw joint with a larger clamping area - item number: 42,0407,0780 - strain-relief M32x15 KB 18-25.

Connecting the inverter to the public grid (AC)

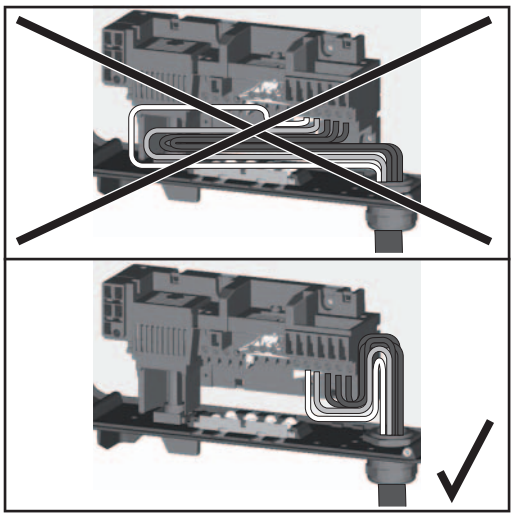
NOTE! To ensure a proper ground connection, both grounding terminals must be tightened with the specified torque when the inverter is installed.

NOTE! Form loops with the AC cables when connecting them to the AC terminals!
When securing the AC cables using a metric screw joint, ensure that the loops do not protrude beyond the connection area. Under certain circumstances it may otherwise no longer be possible to close the inverter.

NOTE!

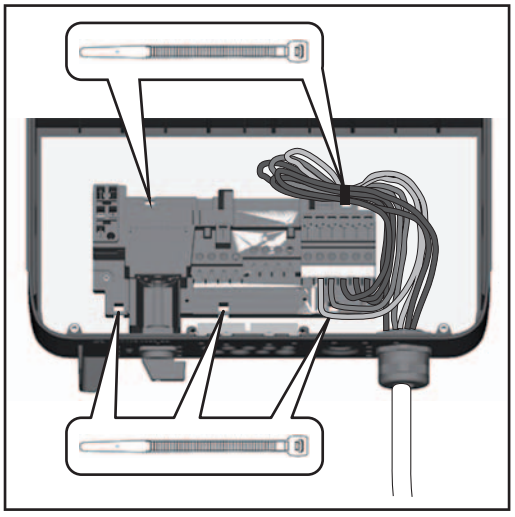
- Ensure that the grid neutral conductor is grounded. In the case of IT networks (insulated networks with no grounding) this may not be the case; it will then not be possible to use the inverter.
- In order to use the inverter, the neutral conductor must be connected.
  A neutral conductor that is too small may adversely affect the ability of the inverter to feed energy into the grid. The neutral conductor must therefore be the same size as the other live conductors.

IMPORTANT! The PE ground conductor of the AC cable must be laid in such a way that it is the last to be disconnected in the event that the strain-relief device should fail.
This can be ensured, for example, by making it somewhat longer and by laying it in a loop.



If AC cables are laid over the shaft of the DC main switch or across the connection block of the DC main switch, they may be damaged when the inverter is swung in, or they may even prevent the inverter from being swung in.

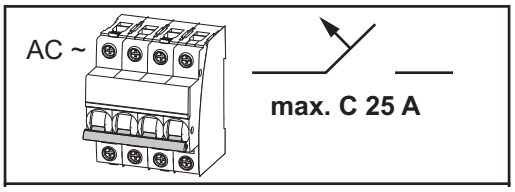
IMPORTANT! Do not lay AC cables over the shaft of the DC main switch or across the connection block of the DC main switch!



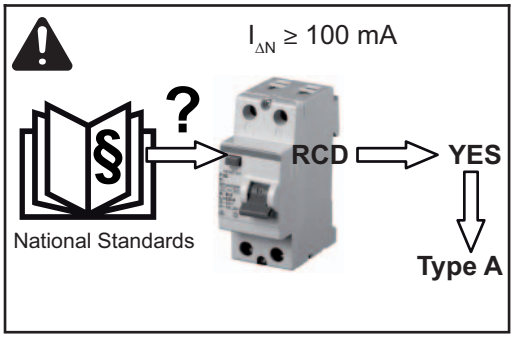
Example: AC cable

If overlength AC or DC cables are to be laid in loops in the connection area, attach the cables with cable ties to the eyelets provided on the top and bottom of the connection block.

Maximum fuse rating on alternating current side



Inverter	Phases	AC power	Fuse protection
Fronius Symo 3.0-3-S	3	3000 W	1 x C 25 A
Fronius Symo 3.7-3-S	3	3700 W	1 x C 25 A
Fronius Symo 4.5-3-S	3	4500 W	1 x C 25 A
Fronius Symo 8.2-3-M	3	8200 W	1 x C 25 A



NOTE! Local regulations, the energy supply company or other factors may require an earth-leakage circuit breaker in the grid line. For this situation, a type A earth-leakage circuit breaker with a tripping current of at least 100 mA is generally adequate. In particular cases, and depending on local factors, however, the type A earth-leakage circuit breaker may trip at the wrong time. For this reason, Fronius recommends that an earth-leakage circuit breaker that is suitable for frequency converters should be used.

Notes regarding DC connection

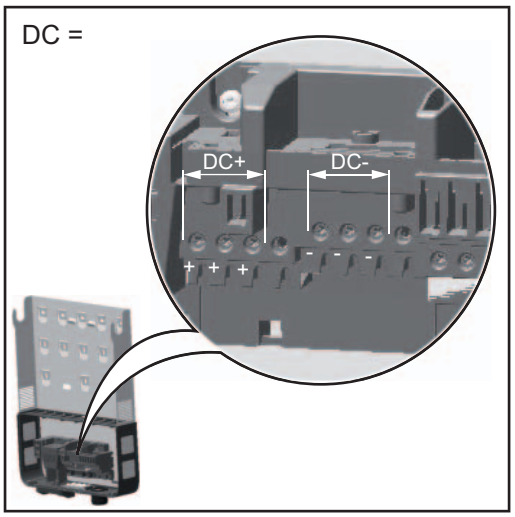
General comments regarding solar modules

To enable suitable solar modules to be chosen and to use the inverter as efficiently as possible, it is important to bear the following points in mind:

- If insolation is constant and the temperature is falling, the open circuit voltage of the solar modules will increase. The open circuit voltage must not exceed 1000 V. If the open circuit voltage exceeds the specified values, the inverter will be destroyed and no warranty claims will be entertained.
- The temperature coefficients on the solar modules data sheet must be observed
- More exact values for dimensioning the solar modules can be provided by suitable calculation programs, like the Fronius Solar.configurator (which can be downloaded from www.fronius.com).

NOTE! Before you connect up the solar modules you should check that the voltage specified by the manufacturer corresponds to the actual measured voltage.

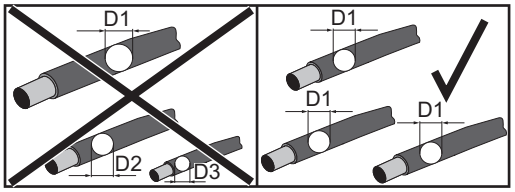
DC terminals



Max. cross-section of each DC cable:
16 mm²

Min. cross-section of each DC cable:
2.5 mm²

The DC cables can be connected to the DC terminals without ferrules.



NOTE! To ensure effective strain relief of the solar module strings, only use cables with identical cross-sections.

In the case of a DC cable with a cross-section of 16 mm², ferrules can be either not used or only used to a limited extent depending on the type of ferrule and crimping.

Connecting aluminum cables

The DC-side terminals are designed for connecting single-wire, round aluminum cables. The following points must be taken into account when connecting aluminum cables due to the non-conducting oxide layer of aluminum:

- Reduced rated currents for aluminum cables
- The connection requirements listed below

NOTE! Take into account local specifications when configuring cable cross sections.

Connection Requirements:

1 Carefully clean off the oxide layer of the stripped end of the cable, e.g., using a knife.

IMPORTANT Do not use brushes, files or sandpaper. Aluminum particles may get stuck and can transfer to other cables.

2 After removing the oxide layer of the cable end, rub in a neutral grease, e.g., acid- and alkali-free Vaseline.

3 Then immediately connect it to the terminal.

Repeat the steps above whenever the cable is disconnected and then reconnected.

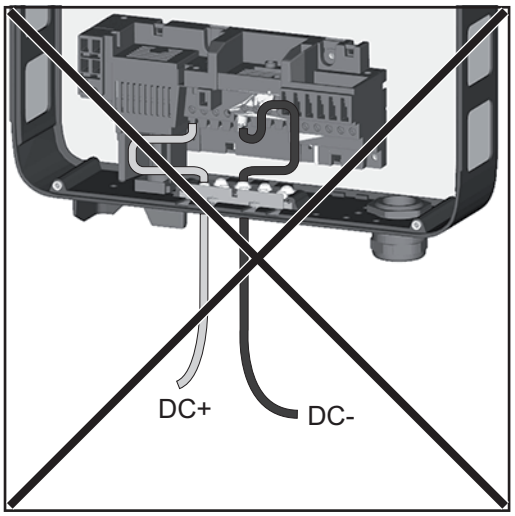
Inverter DC connection

NOTE! Only break out as many target break points as the number of cables that are provided (e.g. if there are 2 DC cables, then break out 2 recesses).

IMPORTANT! Check the polarity and voltage of the solar module strings: the voltage must not exceed the following values:

- when installed between 0 and 2000 m above sea level: 1000 V
- when installed between 2000 and 2500 m above sea level: 900 V
- when installed between 2500 and 3000 m above sea level: 815 V
- when installed between 3000 and 3400 m above sea level: 750 V

The difference between the individual solar module strings must not exceed 10 V.



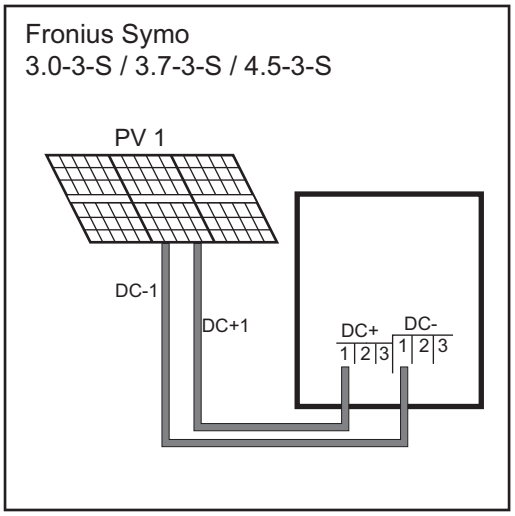
If DC cables are laid over the shaft of the DC main switch or across the connection block of the DC main switch, they may be damaged when the inverter is swung in, or they may even prevent the inverter from being swung in.

IMPORTANT! Do not lay DC cables over the shaft of the DC main switch or across the connection block of the DC main switch!

Notes regarding inverters with single and multiple MPP trackers

Inverter with single MPP tracker

Fronius Symo 3.0-3-S / 3.7-3-S / 4.5-3-S



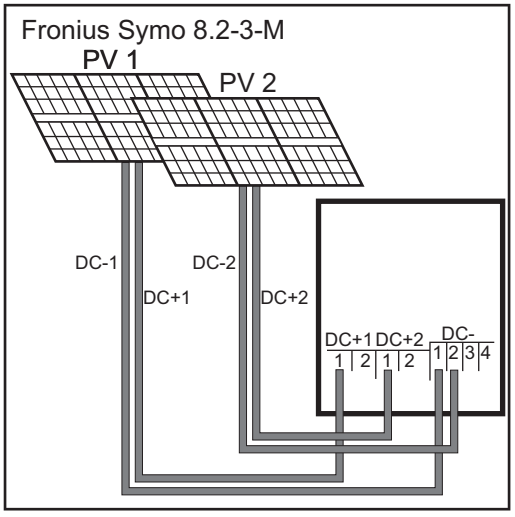
Connecting one solar module field to an inverter with a single MPP tracker

In the case of these inverters, there are 3 terminals available for each DC+ and DC-. The terminals are internally connected and are not fused. This means that a maximum of 3 strings can be connected in parallel directly to the inverter.
In this case, the solar modules must be able to carry at least the single reverse current (for 2 strings) or twice the reverse current (for 3 strings) (see data safety sheet for solar module).

Where there are more than 3 strings, an external collection box with string fuses must be used. In this case, the strings must contain the same number of modules in each case.

Inverter with multiple MPP trackers

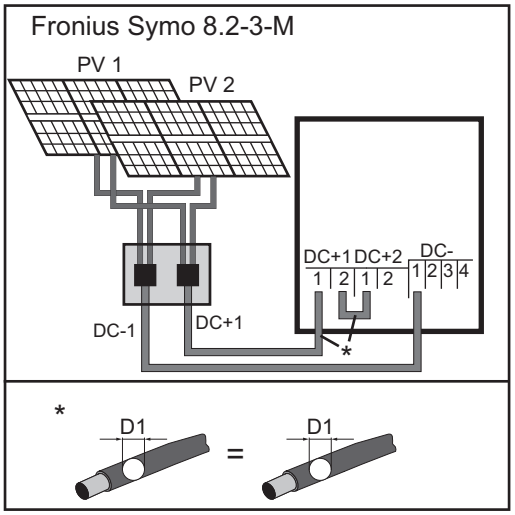
Fronius Symo 8.2-3-M



Connecting two solar module fields to an inverter with multiple MPP trackers

In the case of inverters with multiple MPP trackers, there are 2 independent DC inputs (MPP trackers) available. These can be connected to an unequal number of solar modules.
There are 2 terminals for DC+ available per MPP tracker. In total there are 4 terminals for DC-.

Connecting 2-4 strings in multiple MPP tracker mode:
divide the strings between the two MPP tracker inputs (DC+1/DC+2). The DC- terminals can be used however you wish, as they are internally connected.
When starting up for the first time, set MPP TRACKER 2 to “ON” (this will also later be possible from the Basic menu)



Connecting multiple interconnected solar module fields to an inverter with multiple MPP trackers using one lead

Single MPP tracker mode on an inverter with multiple MPP trackers:

If the strings are connected using a string collection box and only one bus is used for connection to the inverter, the connection DC+1 (pin 2) and DC+2 (pin 1) must be jumpered.
The wire diameter of the DC connection lead and the jumpering must be the same.
Jumpering of the DC terminal is not necessary, as these terminals are jumpered internally.

When starting up for the first time, set MPP TRACKER 2 to “OFF” (this will also later be possible from the Basic menu)

If the inverter with multiple MPP trackers is operated in single MPP tracker mode, the currents from the DC leads connected are divided evenly across both inputs.

Notes regarding the laying of data communication cables

Laying data communication cables

IMPORTANT! Operating the inverter with an option card and 2 broken-out option card divisions is not permitted.
To cater for this eventuality, a relevant blanking cover (42,0405,2020) is available from Fronius as an option.

IMPORTANT! Note the following if data communication cables are being introduced into the inverter:

- depending on the number and cross-section of the data communication cables that are being introduced, take the relevant blanking plugs out of the sealing insert and insert the data communication cable.
- insert without fail the relevant blanking plugs into the free openings on the sealing insert.

Notes regarding attaching the inverter to the wall bracket

Attaching the inverter to the wall bracket

The side sections of the housing lid are designed to function as holding and carrying handles.

NOTE! For safety reasons, the inverter is fitted with a latch that prevents the inverter from being swung into the wall bracket unless the DC main switch is switched off.

- Never attach the inverter to the wall bracket or swing it in unless the DC main switch is switched off,
- Never use force to attach the inverter or swing it in.

The fastening screws in the data communication area of the inverter are used for securing the inverter to the wall bracket. Correctly tightened fastening screws are a prerequisite if proper contact is to be established between inverter and wall bracket.

CAUTION! If the fastening screws are not tightened correctly, then the inverter is at risk of being damaged.
Fastening screws that are not correctly tightened can result in arcs occurring when the inverter is in operation, which in turn can cause fires. Always use the specified torque when tightening the fastening screws.

Notes regarding starting up for the first time

Notes regarding starting up for the first time

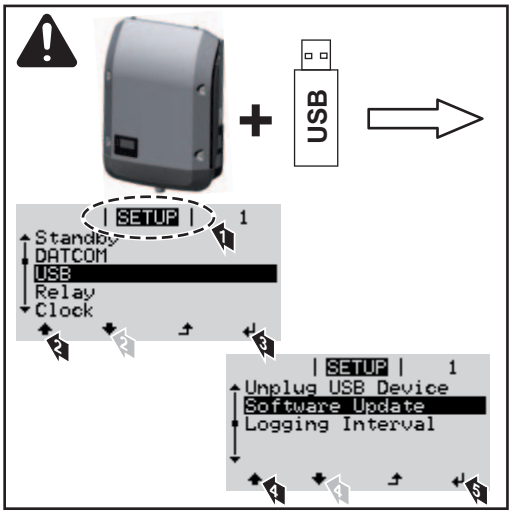
When starting up the inverter for the first time, it is necessary to select various setup settings.

If setup is interrupted before it is complete, it can be restarted by means of an AC reset. An AC reset is performed by switching the automatic circuit breaker off and then on again.

The country setup can only be set when starting up the inverter for the first time. If it becomes necessary to modify the country setup at a later date, please contact your Technical Support team.

Notes regarding software updates

Notes regarding software updates



If the inverter is supplied with a USB stick, the inverter software must be updated as soon as the inverter has been commissioned:

1. Plug the USB stick into the data communication area of the inverter
2. Open the Setup menu
3. Select the "USB" menu item
4. Select "Update Software"
5. Update the software

USB Stick as a Data Logger and for Updating Inverter Software

USB stick as a data logger

A USB stick connected to the USB A socket can act as a data logger for an inverter.

Logging data saved to the USB stick can at any time
- be imported into the Fronius Solar.access software via the included FLD file,
- be viewed directly in third-party applications (e.g., Microsoft® Excel) via the included CSV file.

Older Excel versions (up to Excel 2007) have a row limit of 65536.

Data on the USB stick

If a USB stick is used as a data logger, three files are automatically created:

- System file *.sys:
  This file saves information from the inverter that is irrelevant to the customer. The file must not be deleted individually. Only delete all files together (sys, fld, csv).

- Log file TLxxx_yy.fld (xxx = IG number, yy = a serial 2-digit number):
  Log file for reading out data in Fronius Solar.access.

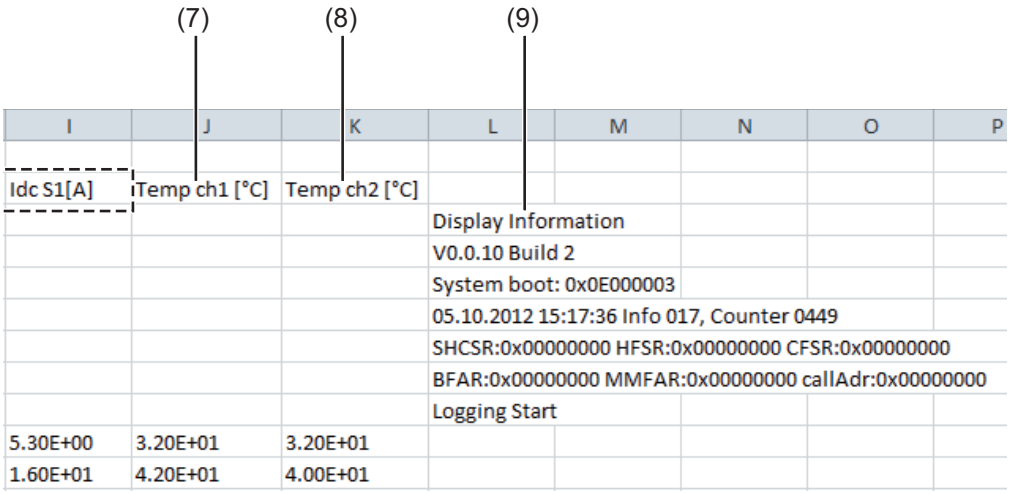
  You can find additional information on the Fronius Solar.access Software in the "DAT-COM Detail" operating instructions at http://www.fronius.com

- Log file TLxxx_yy.csv (xxx = IG number, yy = a serial 2-digit number):
  A log file for reading out data in a spreadsheet program (e.g., Microsoft® Excel)

Structure of the CSV file:

(1) (2) (3) (4) (5) (6)

	A	B	C	D	E	F	G	H
1	SerialNr.: 123456789'							
2	Date	Time	Inverter No.	Device Type	Periode [s]	Energy [Ws]	Uac L1 [V]	Udc S1[V]
3	05.10.2012	15:22:22	1	248				
4	05.10.2012	15:22:22	1	248				
5	05.10.2012	15:22:22	1	248				
6	05.10.2012	15:22:22	1	248				
7	05.10.2012	15:22:22	1	248				
8	05.10.2012	15:22:22	1	248				
9	05.10.2012	15:22:22	1	248				
10	05.10.2012	15:55:00	1	248	1.96E+03	1.44E+06	2.33E+02	1.50E+02
11	05.10.2012	16:25:00	1	248	1.80E+03	4.62E+06	2.35E+02	1.66E+02



(1) ID
(2) Inverter no.
(3) Inverter type (DATCOM code)
(4) Logging interval in seconds
(5) Energy in watt-seconds with reference to the logging interval
(6) Averages over the logging interval (AC voltage, DC voltage, DC current)
(7) Temperature value 1
(8) Temperature value 2
(9) Additional information

Data amount and memory capacity

One USB stick with a memory capacity of 128 MB, for example, can record logging data at a logging interval of 5 minutes for approx. 7 years.

CSV file
CSV files can store only 65535 rows (data records) (up to Microsoft® Excel version 2007, afterwards there is no limit).
At a logging interval of 5 minutes, the 65536 rows are written within approx. 7 months (CSV data size of approx. 8 MB).
To avoid loss of data, the CSV file should be backed up to a PC within these 7 months and deleted from the USB stick. If the logging interval is set longer, this time frame is extended accordingly.

FLD file
The FLD file should not be larger than 16 MB. At a logging interval of 5 minutes, this cor-responds to a storage duration of approx. 6 years.
If the file exceeds this 16 MB limit, it should be backed up to a PC, and all data should be deleted from the USB stick.

After you have backed up the data and removed it from the USB stick, the stick should be immediately reinserted so that it can record logging data; no further steps are required.

NOTE! A full USB stick can lead to the loss of data or the overwriting of data. When inserting the USB stick, make sure that it has sufficient memory capacity.

Buffer memory

If the USB stick is unplugged (e.g. for data backup purposes), the logging data is written to a buffer memory in the inverter.
As soon as the USB stick is plugged in again, the data is copied automatically from the buff-er memory to the stick.

The buffer memory can store a maximum of six logging points. Data is only logged while the inverter is running (output greater than 0 W). The logging interval determines the time period over which data is stored, e.g.:

Logging interval [min]	Time period [min]
5	30

When the buffer memory is full, the oldest data in the memory will be overwritten by the next batch of data.

IMPORTANT! The buffer memory requires a permanent power supply.
If there is a power failure while the inverter is in operation, all the data in the buffer memory will be lost. To avoid losing data during the night, the automatic night switch-off facility must be deactivated (switch the 'Night Mode' setup parameter to ON - see the section 'Setting and displaying the menu items', 'Viewing and adjusting parameters in the DATCOM menu item').

Suitable USB sticks

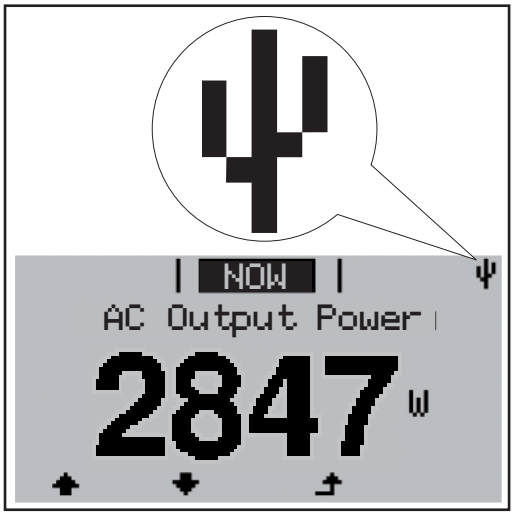
Due to the number of USB sticks on the market, we cannot guarantee that every USB stick will be recognized by the inverter..

Fronius recommends using only certified, industrial USB sticks (look for the USB-IF logo).

The inverter supports USB sticks using the following file systems:
- FAT12
- FAT16
- FAT32

Fronius recommends that the USB stick only be used for recording logging data or for updating the inverter software. USB sticks should not contain any other data.

USB symbol on the inverter display, e.g.,
in the 'NOW' display mode:



When the inverter recognizes a USB stick, the USB symbol will appear at the top right of the display.

When inserting the USB stick, make sure that the USB symbol is displayed (it may also be flashing).

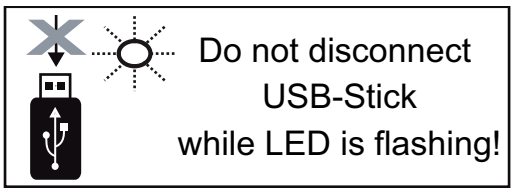
NOTE! Please be aware that in outdoor applications the USB stick may only function in a limited temperature range. Make sure, for example, that the USB stick will also function at low temperatures for outdoor applications.

USB stick for updating the inverter software

With the help of the USB stick, end customers can also update the inverter software via the USB item on the SETUP menu: the update file is first saved to the USB stick, from where it is then transferred to the inverter.

Remove USB stick

Security note concerning the removal of a USB stick:



IMPORTANT! To avoid any loss of data, a USB stick may only be removed if the following conditions are met:

- only remove a USB stick via the 'Safely remove USB / HW' item on the SETUP menu
- the 'Data transmission' LED has stopped flashing or comes on steady.

Notes regarding maintenance

Maintenance

NOTE! When installed outdoors in a horizontal position:
once a year, check that all screw joints are tight!

Cleaning

Clean the inverter and the display as required with a damp cloth.
Do not use cleaning agents, abrasives or solvents to clean the inverter.

Fronius Worldwide - www.fronius.com/addresses

Fronius International GmbH
4600 Wels, Froniusplatz 1, Austria
E-Mail: pv@fronius.com
http://www.fronius.com

Fronius USA LLC Solar Electronics Division
6797 Fronius Drive, Portage, IN 46368
E-Mail: pv-us@fronius.com
http://www.fronius-usa.com

Under http://www.fronius.com/addresses you will find all addresses of our sales branches and partner firms!