Fronius Modbus Card

Bedienungsanleitung
Anlagenüberwachung
Operating Instructions
System monitoring
Dear reader,

Introduction

Thank you for the trust you have placed in our company and congratulations on buying this high-quality Fronius product. These instructions will help you familiarize yourself with the product. Reading the instructions carefully will enable you to learn about the many different features it has to offer. This will allow you to make full use of its advantages.

Please also note the safety rules to ensure greater safety when using the product. Careful handling of the product will repay you with years of safe and reliable operation. These are essential prerequisites for excellent results.
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Safety rules

Safety Rules Explanation

DANGER! Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING! Indicates a potentially hazardous situation which, if not avoided, will result in death or serious injury.

CAUTION! Indicates a potentially harmful situation which, if not avoided, may result in minor and moderate injury or property damage.

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.

General

The device is manufactured using state-of-the-art technology and according to recognized safety standards. If used incorrectly or misused, however, it can cause:
- injury or death to the operator or a third party,
- damage to the device and other material assets belonging to the operator,
- inefficient operation of the device

All persons involved in commissioning, maintaining and servicing the device must:
- be suitably qualified,
- have knowledge of and experience in dealing with electrical installations and
- read and follow these operating instructions carefully

The operating instructions must always be at hand wherever the device is being used. In addition to the operating instructions, attention must also be paid to any generally applicable and local regulations regarding accident prevention and environmental protection.

All safety and danger notices on the device:
- must be kept in a legible state
- must not be damaged/marked
- must not be removed
- must not be covered, pasted or painted over

For the location of the safety and danger notices on the device, refer to the section headed "General" in the operating instructions for the device.

Before switching on the device, remove any faults that could compromise safety.

Your personal safety is at stake!
Utilization in Accordance with "Intended Purpose"

The device is to be used exclusively for its intended purpose.

Utilization for any other purpose, or in any other manner, shall be deemed to be "not in accordance with the intended purpose." The manufacturer shall not be liable for any damage resulting from such improper use.

Utilization in accordance with the "intended purpose" also includes:
- carefully reading and obeying all the instructions and all the safety and danger notices in the operating instructions
- performing all stipulated inspection and servicing work
- installation as specified in the operating instructions

The following guidelines should also be applied where relevant:
- Regulations of the utility regarding energy fed into the grid
- Instructions from the solar module manufacturer

Environmental Conditions

Operation or storage of the device outside the stipulated area will be deemed as "not in accordance with the intended purpose." The manufacturer is not responsible for any damages resulting from unintended use.

For exact information on permitted environmental conditions, please refer to the "Technical data" in the operating instructions.

Qualified Service Engineers

The servicing information contained in these operating instructions is intended only for the use of qualified service engineers. An electric shock can be fatal. Do not perform any actions other than those described in the documentation. This also applies to those who may be qualified.

All cables and leads must be secured, undamaged, insulated and adequately dimensioned. Loose connections, scorched, damaged or inadequately dimensioned cables and leads must be immediately repaired by authorized personnel.

Maintenance and repair work must only be carried out by authorized personnel.

It is impossible to guarantee that externally procured parts are designed and manufactured to meet the demands made on them, or that they satisfy safety requirements. Use only original replacement parts (also applies to standard parts).

Do not carry out any modifications, alterations, etc. without the manufacturer's consent.

Components that are not in perfect condition must be changed immediately.

Safety Measures at the Installation Location

When installing devices with openings for cooling air, ensure that the cooling air can enter and exit unhindered through the vents. Only operate the device in accordance with the degree of protection shown on the rating plate.
EMC Device Classifications

Devices in emission class A:
- Are only designed for use in industrial settings
- Can cause line-bound and radiated interference in other areas

Devices in emission class B:
- Satisfy the emissions criteria for residential and industrial areas.
  This is also true for residential areas in which the energy is supplied from the public low-voltage grid.

EMC device classification as per the rating plate or technical data.

EMC Measures

In certain cases, even though a device complies with the standard limit values for emissions, it may affect the application area for which it was designed (e.g., when there is sensitive equipment at the same location, or if the site where the device is installed is close to either radio or television receivers). If this is the case, then the operator is obliged to take appropriate action to rectify the situation.

Grid Connection

High-performance devices (> 16 A) can affect the voltage quality of the grid because of a high output current in the main supply.

This may affect a number of types of device in terms of:
- criteria with regard to maximum permissible mains impedance *)
- criteria with regard to minimum short-circuit power requirement *)

*) at the interface with the public grid

see Technical Data

In this case, the operator or the person using the device should check whether or not the device is allowed to be connected, where appropriate through discussion with the power supply company.

Electrical Installations

Electrical installations must only be carried out according to relevant national and local standards and regulations.

Protective Measures against ESD

Danger of damage to electrical components from electrical discharge. Suitable measures should be taken to protect against ESD when replacing and installing components.
Safety Measures in Normal Operation

Only operate the device when all protection devices are fully functional. If the protection devices are not fully functional, there is a risk of
- injury or death to the operator or a third party,
- damage to the device and other material assets belonging to the operator,
- inefficient operation of the device

Any safety devices that are not functioning properly must be repaired by authorized personnel before the device is switched on.

Never bypass or disable protection devices.

Safety Symbols

Devices with the CE marking satisfy the essential requirements of the low-voltage and electromagnetic compatibility directives. Further details can be found in the appendix or the chapter entitled "Technical data" in your documentation.

Disposal

Do not dispose of this device with normal domestic waste! To comply with the European Directive 2002/96/EC on Waste Electrical and Electronic Equipment and its implementation as national law, electrical equipment that has reached the end of its life must be collected separately and returned to an approved recycling facility. Any device that you no longer require must be returned to your dealer, or you must locate the approved collection and recycling facilities in your area. Ignoring this European Directive may have potentially adverse affects on the environment and your health!

Backup

The user is responsible for backing up any changes made to the factory settings. The manufacturer accepts no liability for any deleted personal settings.

Copyright

Copyright of these operating instructions remains with the manufacturer.

Text and illustrations are technically correct at the time of going to print. The right to make modifications is reserved. The contents of the operating instructions shall not provide the basis for any claims whatsoever on the part of the purchaser. If you have any suggestions for improvement, or can point out any mistakes that you have found in the operating instructions, we will be most grateful for your comments.
The Fronius Modbus Card is an optional plug-in card; it is used to retrieve data from an inverter using the Modbus protocol.

The Modbus protocol is a master/slave architecture-based communication protocol.

The Fronius Modbus Card communicates with the Modbus Master using register addresses corresponding to the following areas of the SunSpec specification:
- Common block
- Inverter model

Depending on what the customer requires, the Fronius Modbus Card can be integrated into the inverter at the factory as part of the delivery process, or at a later stage.

The version of the SunSpec specification currently in use can be found in the document "Fronius Modbus Card Register Tables". The latest version of the document "Fronius Modbus Card Register Tables" with the item number 42,0410,1885 can be obtained from the Fronius DownloadCenter.

The Fronius Modbus Card is designed to be installed in specific Fronius inverters, and nowhere else. For further details, please refer to the "Requirements for Operation of the Fronius Modbus Card" section.

The following are considered improper use:
- Utilization for any other purpose, or in any other manner
- Alterations to the Fronius Modbus Card that are not expressly recommended by Fronius

The manufacturer is not responsible for any damage resulting from improper use. All warranty claims are considered void in such cases.

Proper use also means
- following all instructions from the operating instructions for the Fronius Modbus Card and the inverter
- installing the Fronius Modbus Card in accordance with the "Inserting Option Cards" section in the operating instructions for the inverter.
Operating principle

(1) 1 x Fronius Modbus Card  
(2) 1 x 6-pin plug for connection to the Modbus system  
(3) 2 x Fronius Solar Net terminating plugs  
(4) Fronius Solar Net termination plug  
(5) Modbus connection

(1) Inverter 1  
(2) Inverter 2  
(3) Inverter 3  
(4) (5)

Scope of Supply

(1) 1 x Fronius Modbus Card  
(2) 1 x 6-pin plug for connection to the Modbus system  
(3) 2 x Fronius Solar Net terminating plugs  
(4) 1 x operating instructions  
(5) 1 x carton packaging (only for Fronius Modbus Card upgrades)

Not pictured:

The other components for the Fronius Modbus Card installed in the inverter are included in a plastic bag.
Requirements for Operation of the Fronius Modbus Card

The following requirements must be met in order to operate the Fronius Modbus Card:
- Each inverter can have one Fronius Modbus Card only.
- The Fronius Modbus Card can be used with the following Fronius inverters:
  - Fronius IG Plus
  - Fronius IG Plus V
  - Fronius IG
  - Fronius CL
- To network several inverters, only Modbus or RS 485 must be used. There must be no Solar Net connection set up between the inverters.
- In order for the Fronius Modbus Card to function correctly, the Solar Net protocol must be active in the inverter (DATCOM setting), not the IFP protocol. The Solar Net protocol is set up for the inverter in the factory.

NOTE! When installing the Fronius Modbus Card in the inverter, you should follow all relevant information in the inverter operating instructions, especially the safety rules and the "Inserting Option Cards" section.

WARNING! Danger of personal injury or damage to equipment from electric shock or spark-over. A Fronius Modbus Card must never be used at the same time as any of the following components in one and the same device:
- Fronius Com Card
- Fronius Power Control Card
- Fronius SolarCity Card
**Controls, connections and indicators**

### Safety

**WARNING!** Operating the device incorrectly can cause serious injury and damage. Do not use the functions described until you have thoroughly read and understood the following documents:
- these operating instructions
- all operating instructions for system components, especially the safety rules

### Controls, connections and indicators

<table>
<thead>
<tr>
<th>No.</th>
<th>Function</th>
</tr>
</thead>
</table>
| **(1)** | **Power LED**  
- lights up green when there is a sufficient power supply  
- does not light up when there is an insufficient or non-existent power supply |
| **(2)** | **State LED**  
provides information about the inverter status or errors  
A more detailed description of the State LED can be found in the "Troubleshooting" section. |
| **(3)** | **COM LED**  
- lights up yellow when there are Modbus queries from the Modbus Master, when the message is intended for this card or is a broadcast message |
| **(4)** | **Modbus ID setting wheels**  
for setting the Modbus device IDs |
| **(5)** | **Modbus connection (RS485)**  
6-pin connector for connection with the Modbus Master.  
The terminals on the plug are designed for a maximum cable cross section of 1.5 mm². |
| **(6)** | **Modbus connection jumper**  
for configuring the Modbus connection:  
- 2-wire or 4-wire connection  
- internal bus termination with 120-ohm resistance (yes/no) |
| **(7)** | **"Solar Net IN" RJ45 connection**  
Solar Net input  
This connection has no function at present |
(8) "Solar Net OUT" RJ45 connection  
Solar Net output  
This connection has no function at present

(9) Plug-in card connection  
for connecting the Fronius Modbus Card with the inverter
Setting up and connecting the Fronius Modbus Card

Safety

WARNING! Incorrect operation and work performed incorrectly can cause serious injury and damage! Only qualified staff are authorized to install and commission your Fronius Modbus Card and only within the scope of the respective technical regulations. Do not use the functions described until you have thoroughly read and understood the following documents:
- These operating instructions
- All operating instructions for system components, especially the safety rules

Fitting Fronius Solar Net termination plugs to Fronius Modbus Card

NOTE! The Fronius Modbus Card cannot be used at the same time as a Fronius Solar Net. For this reason, termination plugs must be fitted to both Fronius Solar Net connections on the Fronius Modbus Card.

The termination plugs are enclosed loose with the Fronius Modbus Card.

1. Insert a termination plug into the Solar Net IN connection
2. Insert a terminating plug into the Solar Net OUT connection

A clicking noise will indicate that the termination plug is in the right place

Setting up the Fronius Modbus Card

1. Using a screwdriver, set the Modbus device ID for the Fronius Modbus Card on setting wheels (1) + (2).
   Example:
   Modbus device ID = 178 = B2 hex
   
   Device ID 01 hex is set in the factory

   NOTE! To ensure flawless operation, the Modbus device ID needs to be set to a value between 1 and 247 (01 to F7 hex).
   No Modbus device ID may be used more than once in the same Modbus system.

2. Set the connection type for the Fronius Modbus Card using jumper (3).

   If the Fronius Modbus Card is the furthest participant from the Modbus Master, make a "with bus termination" setting.
Connecting the Fronius Modbus Card to the Modbus system

To set up a connection between the Fronius Modbus Card and a Modbus system, the following materials are required:
- 2-pin or 4-pin cable with cable cross section of 0.2 - 1.5 mm² (not supplied with the Fronius Modbus Card)
- 6-pin plug for connection to the Modbus system

The following jumper settings are possible on the Fronius Modbus Card:

- 2-wire connection with bus termination
- 2-wire connection without bus termination (factory setting)
- 4-wire connection with bus termination
- 4-wire connection without bus termination

**NOTE!** Laying the data lines used on the Master at a defined level is recommended as follows:
- D1 via a resistance at 5 V
- D0 via a resistance to ground

Possible resistance values according to Modbus specification: 450 to 650 Ohm

To set up a connection between the Fronius Modbus Card and a Modbus system, the following materials are required:
- 2-pin or 4-pin cable with cable cross section of 0.2 - 1.5 mm² (not supplied with the Fronius Modbus Card)
- 6-pin plug for connection to the Modbus system

1. Connect to the Modbus system by setting up connections (2) - (5) for the Modbus plug (1) based on "Assignment of connections for connection to the Modbus system" below
   - The lines (6) - (7) lead to the other bus participants
   - If the Fronius Modbus Card is the last bus participant, one of the two lines (6) - (7) is no longer used, and the jumper must be set for the bus termination.
   - Tightening torque to be used for plugs with screw terminals: 0.25 Nm

2. Insert the 6-pin plug into the Fronius Modbus Card
Assignment of connections for connection to the Modbus system

<table>
<thead>
<tr>
<th>Connection</th>
<th>2-pin cable</th>
<th>4-pin cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>- Common</td>
<td>- Common</td>
</tr>
<tr>
<td>TXD1</td>
<td>+ Send and Receive</td>
<td>+ Send</td>
</tr>
<tr>
<td>TXD0</td>
<td>not assigned</td>
<td>- Send</td>
</tr>
<tr>
<td>RXD0</td>
<td>- Send and Receive</td>
<td>- Receive</td>
</tr>
<tr>
<td>RXD1</td>
<td>not assigned</td>
<td>+ Receive</td>
</tr>
<tr>
<td>V</td>
<td>+ 11.5 V ¹)</td>
<td>+ 11.5 V ¹)</td>
</tr>
</tbody>
</table>

¹) based on a local power supply with an output power of max. 400mA (e.g. for an RS485 converter)

The max. output power is dependent on the quantity and type of any other option cards that may be installed in the inverter.
Installing the Fronius Modbus Card

**WARNING!** Danger of personal injury or damage to equipment from electric shock or spark-over. A Fronius Modbus Card and a Fronius Com Card must never be operated simultaneously in one device.

1. If a Fronius Com Card is installed in the inverter:
   Remove the Fronius Com Card from the inverter before installing the Fronius Modbus Card

**WARNING!** Danger of personal injury or damage to equipment from electric shock or spark-over.

   Insert the Fronius Modbus Card into the appropriate part of the inverter as follows:
   - if a Fronius Arc Detector Card, or an NL-MON PC board, is already installed, insert the Fronius Modbus Card in the middle slot
   - with the Fronius IG inverter, insert the Fronius Modbus Card in the far left-hand slot labeled ENS
   - in all other cases, insert the Fronius Modbus Card in the far right-hand slot

2. Insert and secure the Fronius Modbus Card in the inverter as per the "Inserting Option Cards" section in the inverter operating instructions.

**NOTE!** When laying a cable, make sure that the cable does not touch any electronic components or edges. Do not kink the cable.
## Communication with the inverter

### Indication on the inverter
Data retrieval and changes to inverter settings via the Fronius Modbus Card take place in the background and are not indicated on the inverter.

However, if the change to the settings has an effect on default values displayed for the inverter, this change will of course be visible. The default values displayed by the inverter can be found in the operating instructions for the inverter.

### Communication with the inverter
The inverter is connected to the Modbus Master via the Fronius Modbus Card. The Fronius Modbus Card communicates with the Modbus Master using register addresses corresponding to the SunSpec specification.

The version of the SunSpec specification currently in use can be found in the document “Fronius Modbus Card Register Tables”.

The latest version of the document “Fronius Modbus Card Register Tables” with the item number 42,0410,1885 can be obtained from the Fronius DownloadCenter.

The Fronius Modbus Card Register Table contains detailed descriptions of the register addresses and the inverter data and functions associated with this.

The Fronius Modbus Card Register Table contains a description of the registers in the software installed on the card.

In the event of a software update, the latest version of the Fronius Modbus Card Register Table can be obtained from the Fronius DownloadCenter.

### Firmware update
A firmware update of the Fronius Modbus Card can be performed via the Modbus interface. The application flow and necessary register commands can be found in the enclosed register table.
Troubleshooting

General
Status information and errors are indicated by lights and flashes on the State LED. Except for in the case of an invalid device ID, the card can still be used to communicate when the State LED is flashing or lit up.

Troubleshooting

The State LED lights up red.
Cause: An error has occurred in Fronius Solar Net (e.g. an interruption).
Remedy: Check Fronius Solar Net and resolve the interruption; check whether termination plugs are plugged into free Solar Net connections for the DATCOM components.

The State LED flashes red.
Cause: Overcurrent in Fronius Solar Net
The Solar Net overcurrent shutoff has activated because a current greater than 3 A was measured at one of the Solar Net connections.
Remedy: Resolve the short circuit
After 5 seconds, the Fronius Modbus Card reattempts to create a connection to the Solar Net.

Cause: Under-voltage in Fronius Solar Net
The Solar Net under-voltage shutoff has activated because the voltage dropped to below 6.5 V as a result of overcharging in the power supply unit.
Remedy: Reduce the load
(e.g.: with an additional power supply unit when there is one Solar Net participant)
After 5 seconds, the Fronius Modbus Card reattempts to set up a connection to the Solar Net.

The State LED flashes at a fast rate (twice, with a 0.5 second pause)
Cause: Device ID setting invalid
Remedy: Set a valid device ID (1 to 247) on the Modbus ID setting wheels

The State LED flashes at a fast rate (3x, with a 0.5 second pause)
Cause: No DC power supply, inverter is switched off (e.g., at night)
Remedy: Reconnect DC power supply
Technical data

General data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>208 V / 220 V / 230 V / 240 V / 277 V AC</td>
</tr>
<tr>
<td>Supply voltage tolerance</td>
<td>+10% / -15%</td>
</tr>
<tr>
<td>Energy consumption</td>
<td>1.6 W</td>
</tr>
<tr>
<td>&quot;IN&quot; and &quot;OUT&quot; interfaces</td>
<td>RS422 / RJ45 socket</td>
</tr>
<tr>
<td>digital input / output</td>
<td>-7 V to +12 V</td>
</tr>
<tr>
<td>(RS485 interface to the Modbus system)</td>
<td></td>
</tr>
</tbody>
</table>

Factory setting of RS485 interface:

<table>
<thead>
<tr>
<th>Speed</th>
<th>9600 baud</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data frame</td>
<td>1 start bit</td>
</tr>
<tr>
<td></td>
<td>8 data bits</td>
</tr>
<tr>
<td></td>
<td>no parity</td>
</tr>
<tr>
<td></td>
<td>1 stop bit</td>
</tr>
</tbody>
</table>

Dimensions (l x w x h): approx. 140 x 100 x 30 mm

Weight: approx. 140 g

Assignment of connections for connection to the Modbus system

<table>
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<td>- Receive</td>
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<tr>
<td>RXD1</td>
<td>not assigned</td>
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</tr>
<tr>
<td>V</td>
<td>+ 11.5 V (^1)</td>
<td>+ 11.5 V (^1)</td>
</tr>
</tbody>
</table>

1) based on a local power supply with an output power of max. 400mA (e.g. for an RS485 converter).

The max. output power is dependent on the quantity and type of any other option cards that may be installed in the inverter.

CE mark

When the Fronius Modbus Card is properly used, all necessary and applicable standards and guidelines are met, as are guidelines stipulated by the applicable EU Directive.

For further information, please refer to the Appendix or the "Technical Data" chapter of the inverter's operating instructions.
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