



**Fronius Smart Meter 240-3 UL**  
**Fronius Smart Meter 480-3 UL**

EN-US

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.

## Explanation of Safety Instructions



**DANGER!** Indicates an immediate danger. Death or serious injury may result if appropriate precautions are not taken.



**WARNING!** Indicates a possibly dangerous situation. Death or serious injury may result if appropriate precautions are not taken.



**CAUTION!** Indicates a situation where damage or injury could occur. Minor injury or damage to property may result if appropriate precautions are not taken.



**NOTE!** Indicates the possibility of flawed results and 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.



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# Safety rules

## General



The device has been 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 operating company
- inefficient operation of the equipment

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All persons involved in start-up operation, maintenance and servicing for the device must

- be suitably qualified
- have knowledge of and experience in dealing with electrical installations and
- have completely read and followed these operating instructions

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

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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

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The terminals can reach high temperatures.



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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 operating company
- inefficient operation of the device

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Safety devices that are not fully functional must be repaired by an authorized specialist before the device is turned on.

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Never bypass or disable protection devices.

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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.

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Any equipment malfunctions which might impair safety must be remedied immediately before the device is turned on.

**Your personal safety is at stake!**

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## 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.

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

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**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.

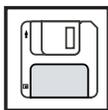
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**Copyright**

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.

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**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.



#### FCC

This device corresponds to the limit values for a digital device of class B in accordance with Part 15 of the FCC regulations. The limit values should provide adequate protection against harmful interference in homes. This device creates and uses high frequency energy and can interfere with radio communications when not used in accordance with the instructions. However, there is no guarantee against interference occurring in a particular installation.

If this device interferes with radio or television reception when turning the device on and off, it is recommended that the user solve this with one or more of the following measures:

- adjust or reposition the receiving antenna
- increase the distance between the device and the receiver
- connect the device to another circuit, which does not include the receiver
- for further support, please contact the retailer or an experienced radio/TV technician.

#### Industry Canada RSS

The device corresponds to the license-free Industry Canada RSS standards. Operation is subject to the following conditions:

- (1) The device may not cause harmful interference
- (2) The device must accept any interference received, including interference that may cause undesired operation.

# Installation

## Installation Checklist

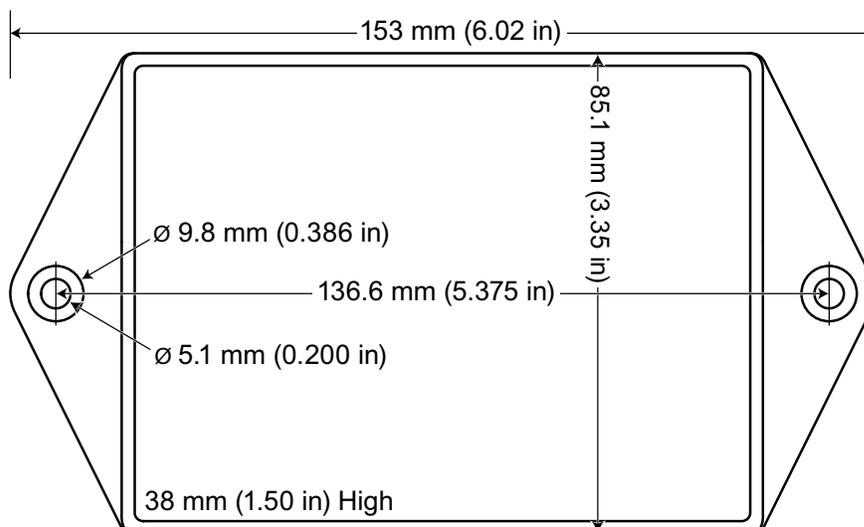
See the sections referenced below for installation details

- 1** Turn off power before making line voltage connections
- 2** Mount the Fronius Smart Meter (see „Mounting“)
- 3** Connect circuit breakers or fuses and disconnects (see „Circuit Protection“)
- 4** Connect the line voltage wires to the meter’s terminal block (see „Line Wiring“)
- 5** Mount the Current Transformers (CTs) around the line conductors. Make sure the CTs face the correct direction. An arrow might indicate either the load or the source (public grid) (see „Connect Current Transformers“)
- 6** Connect the twisted white and black wires from the CTs to the terminal block on the meter, matching the wire colors to the white and black dots on the meter label (see „CT Wiring“)
- 7** Check that the CT phases match the line voltage phases (see „Connect Current Transformers“)
- 8** Record the CT rated current for each meter, because it will be required during setup
- 9** Connect the output terminals of the Fronius Smart Meter to the monitoring equipment (see „Connecting the Data Communication Signals“)
- 10** If necessary set terminating resistors (see „Terminating Resistors“)
- 11** Check that all the wires and plugs are securely installed in the terminal blocks by tugging on each wire
- 12** Turn on the power to the Smart Meter
- 13** Verify that the LEDs indicate correct operation (see „Operation“)
- 14** Set Transformer-Ratio and Net type on the web interface of the Fronius Datamanager in Settings - Meter - Settings (see „Configuration web interface“)

## Mounting

The Fronius Smart meter has two mounting holes spaced 5.375 in. (137 mm) apart (center-to-center). These mounting holes are normally obscured by the detachable screw terminals. Remove the screw terminals to mark the hole positions and mount the meter.

Self-tapping sheet metal screws are included. Do not over-tighten the screws, as long-term stress on the case can cause cracking.



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**Circuit Protection** The Fronius Smart Meter is considered “permanently connected equipment” and requires a disconnect means (circuit breaker, switch or disconnect) and overcurrent protection (fuse or circuit breaker).

The Fronius Smart Meter only draws 10-30 milliamps, so the rating of any switches, disconnects, fuses and / or circuit breakers is determined by the wire gauge, the mains voltage and the current interrupting rating required.

- The switch, disconnect or circuit breaker must be within sight and as close as practicable to the Fronius Smart Meter and must be easy to operate.
- Use circuit breakers or fuses rated for 20 amps or less.
- Use ganged circuit breakers when monitoring more than one line voltage.
- The circuit breakers or fuses must protect the mains terminals labeled L1, L2 and L3 (respectively  $\varnothing A$ ,  $\varnothing B$  and  $\varnothing C$ ). In the rare cases where neutral has overcurrent protection, the overcurrent protection device must interrupt both neutral and ungrounded conductors simultaneously.
- The circuit protection / disconnect system must meet IEC 60947-1 and IEC 60947-3, as well as all national and local electrical codes.

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### Line Wiring

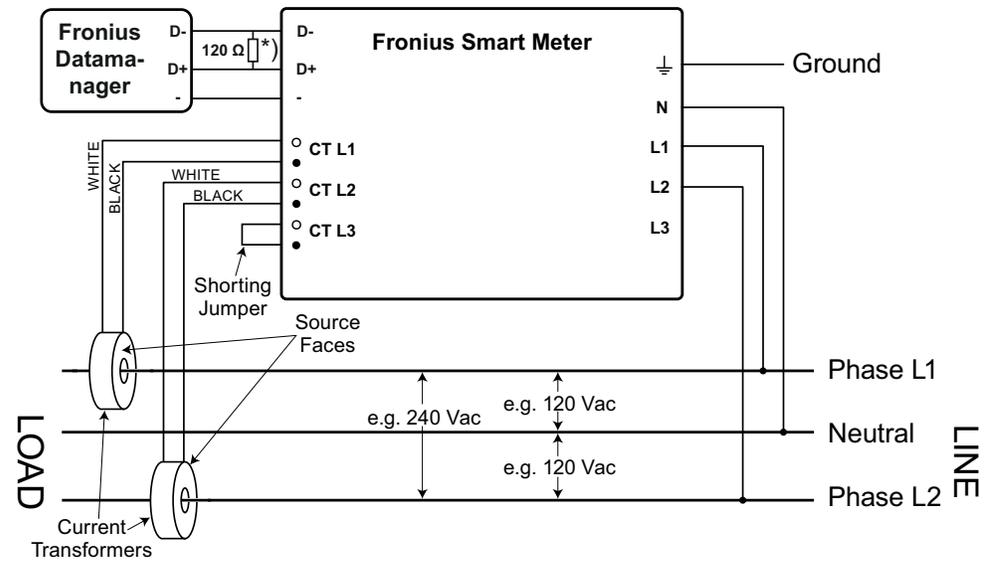
- Always turn off power before connecting the line voltage inputs to the Fronius Smart Meter.
- For the line voltage wires, 16 to 12 AWG stranded wire, type THHN, MTW or THWN, 600 V are recommend.
- Do not place more than one wire per screw terminal; use separate wire nuts or terminal blocks if needed.
- Verify that the line voltages match the line-to-line and line-to-neutral values printed in the white box on the front label.

Connect each conductor to the appropriate phase; also connect ground and neutral (if applicable). The neutral connection „N“ is not required on delta models but we recommend connecting it to ground if neutral is not present.

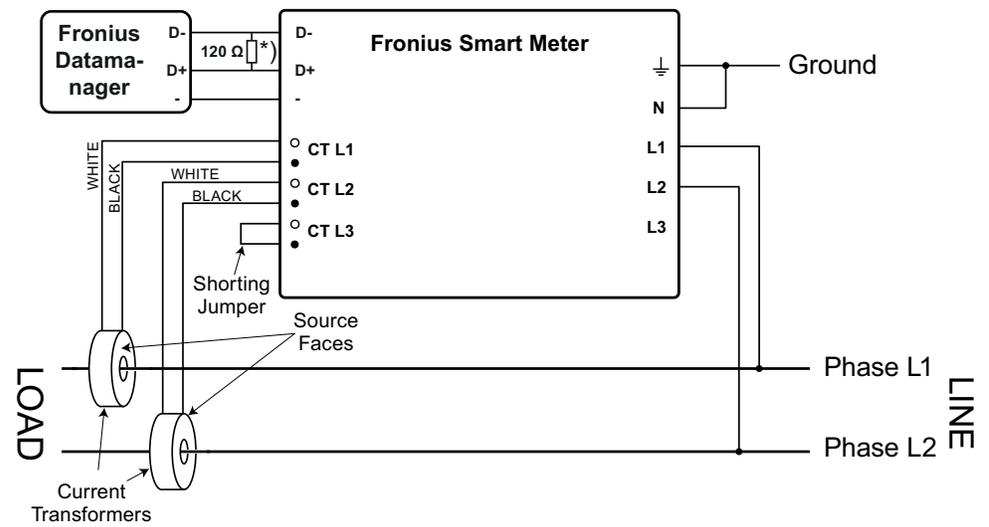
The screw terminal can handle wire up to 12 AWG. Connect each voltage line to the green terminal block as shown in the figures below. After the voltage lines have been connected, make sure both terminal blocks are fully seated in the Fronius Smart Meter.

When power is first applied, check that the LEDs behave normally. If you see LEDs flashing red-green-red-green, the voltage is too high for this model, so disconnect the power switch immediately!

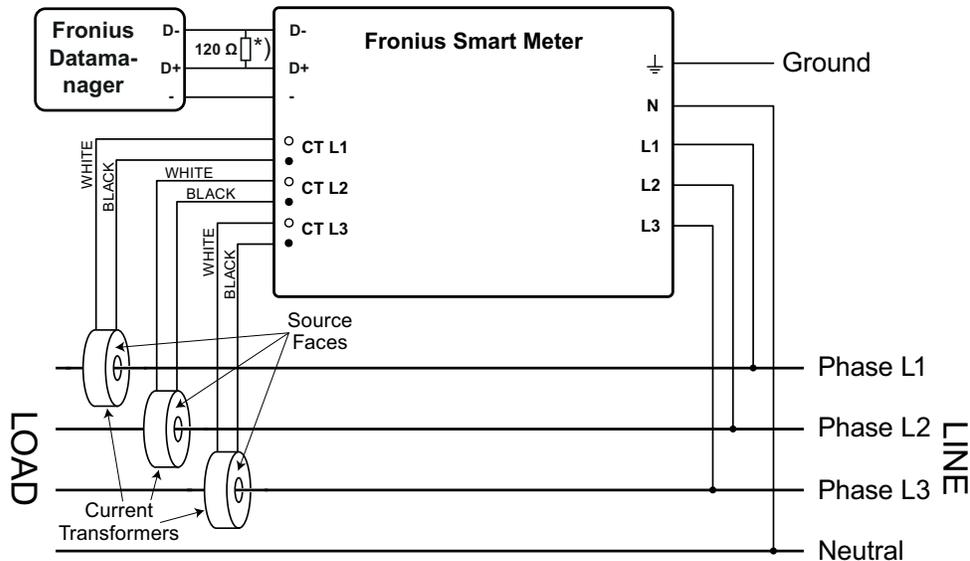
### Single-Phase Three-Wire (Mid-Point Neutral)



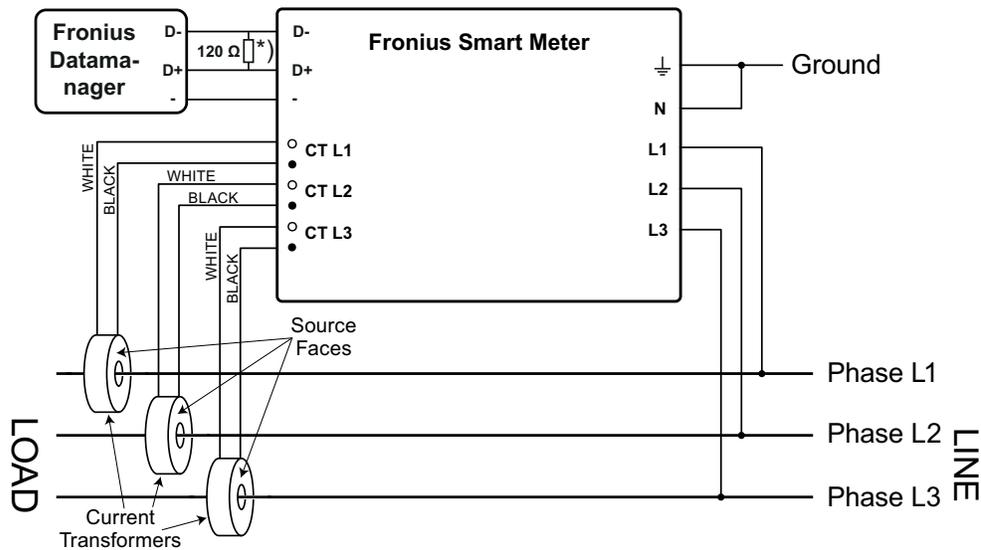
### Single-Phase Two-Wire without Neutral



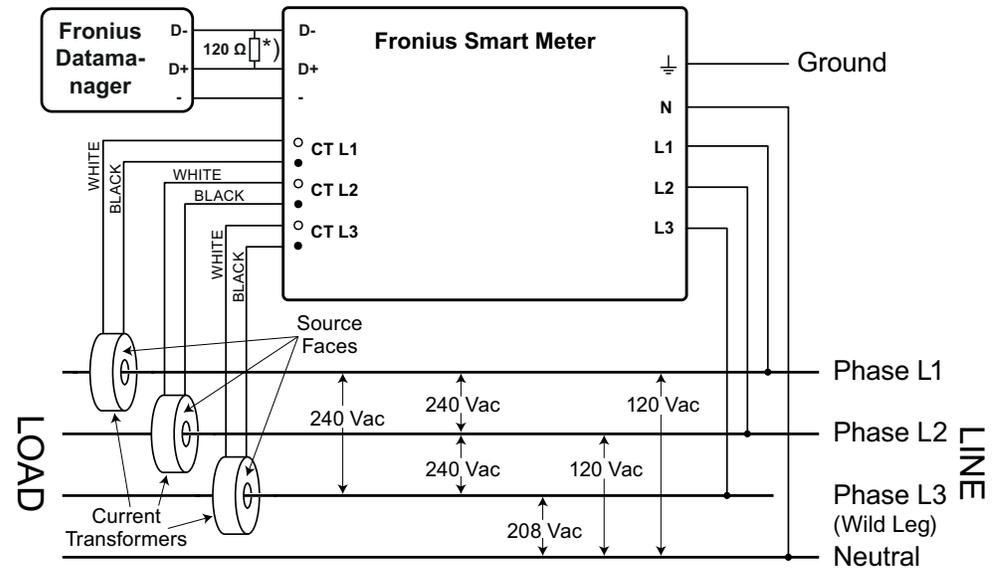
### Three-Phase Four-Wire Wye



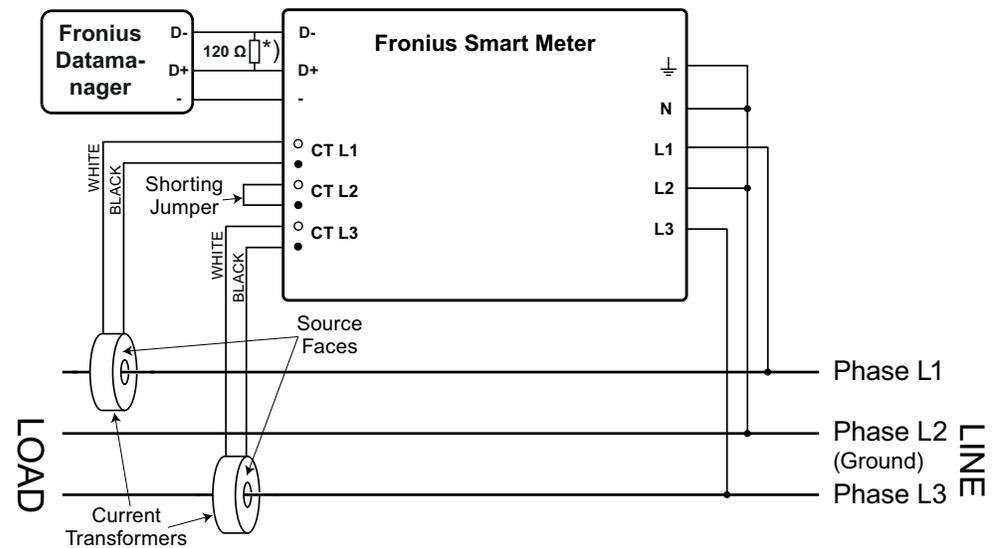
### Three-Phase Three-Wire Delta without Neutral



### Three-Phase Four-Wire Stinger



### Three-Phase Two-Wire Corner Grounded Delta



\*) see „Terminating Resistors“

#### Connect Current Transformers

The current transfer must generate 333.33 millivolts AC at rated current. See the current transformer data sheets for CT ratings.

- Do not use ratio or current output such as 1 amp or 5 amp output models!
- See the CT data sheets for the maximum input current ratings.
- Be careful to match the CTs with the voltage phases. Make sure the CT L1 is measuring the current on the same phase being monitored by the L1 voltage input and the same for phases L2 and L3. Use the supplied colored labels or colored tape to identify the CT leads.
- To minimize current measurement noise, avoid extending the CT wires, especially in noisy environments. If it is necessary to extend the wires, use twisted pair cable 22 to

- 14 AWG, rated for 300 V or 600 V (not less than the service voltage) and shielded if possible
- Make sure the CTs face the correct direction. An arrow might indicates either the load or the source (public grid)
- Optional: if you see strange readings on unused phases, jumper the unused CT inputs: for each unused CT, connect a short cable from the terminal marked with a white dot to the terminal marked with a black dot.

Install the CTs around the conductor to be measured and connect the CT leads to the Fronius Smart Meter. Always turn off power before disconnecting any live conductors. Put the line conductors through the CTs as shown.

CTs are directional. If they are mounted backwards or with their white and black wires swapped the measured power will be negative. The status LEDs indicate negative measured power by flashing red.

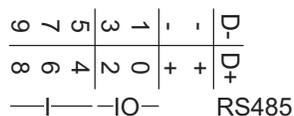
Split-core CTs can be opened for installation around the conductor. A nylon cable tie may be secured around the CT to prevent inadvertent opening.

### CT Wiring

The current transformers connect to the six position black screw terminal block. Connect the white and black CT wires to the Fronius Smart Meter terminals marked CT L1, CT L2 and CT L3 (respectively  $\varnothing$ A CT,  $\varnothing$ B CT and  $\varnothing$ C CT). Excess length may be trimmed from the wires if desired. Connect each CT with the white wire aligned with the white dot on the label and the black wire aligned with the black dot. Note the order in which the phases are connected, as the line voltage phases must match the current phases for accurate power measurement.

### Connecting the Data Communication Signals

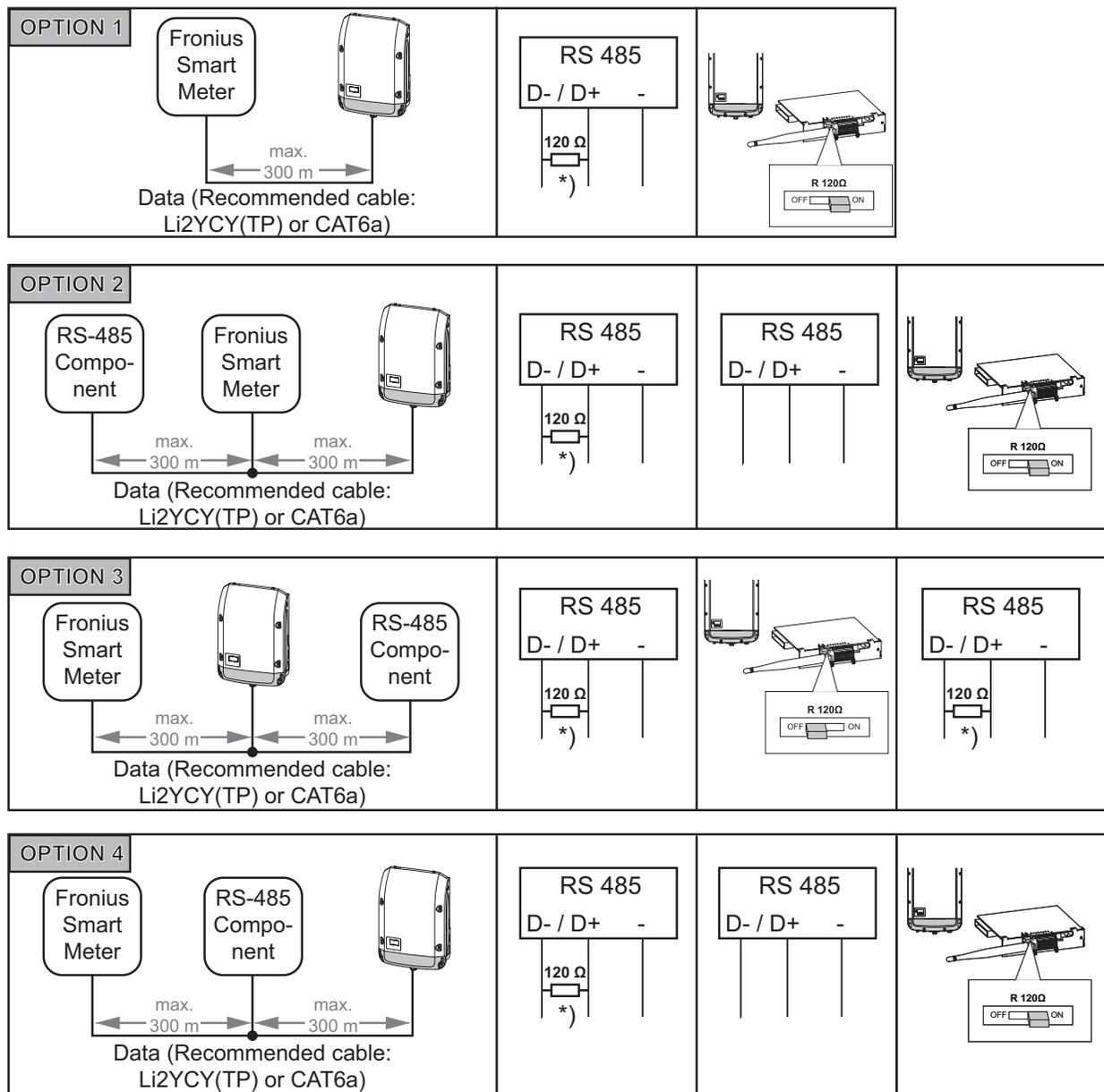
- Connect the Data Communication Terminal from the Fronius Smart Meter to the Fronius Inverter
  - D+ (respectively B+) to D+
  - D- (respectively A-) to D-
  - - (respectively C) to -



- The Fronius Solar Meter outputs are electrically isolated from dangerous voltages.
- If the output wiring is near line voltage wiring, use wires or cables with a 300 V or 600 V rating (never less than the service voltage).
- If the output wiring is near bare conductors, it should be double insulated or jacketed.
- You may install two wires into each screw terminal by twisting the wires together, inserting them into the terminal and tightening them securely. Note: a loose wire can disable an entire network section.
- Use shielded twisted-pair cable (D+ and D- drilled) to prevent interference. If there is no common conductor, connect the shield to the - (respectively C) terminal.

## Terminating Resistors

The system might work without terminating resistors. Due to interferences the use of terminating resistors according the following schemes are recommended.



\*) Terminating resistor R 120 is supplied with the Fronius Smart Meter

## Modbus RTU

The Fronius Smart Meter must be connected to the Fronius Datamanager. If only one Fronius Smart Meter is installed, the Modbus Address is 1.

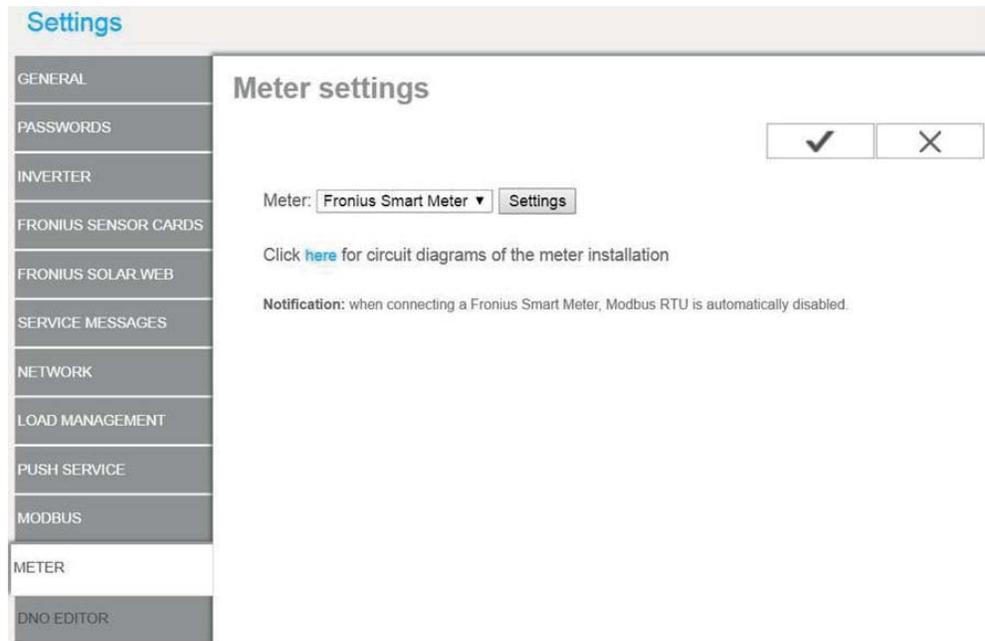
DIP Switch	1	2	3	4	5	6	7
Up (1) value	1	2	4	8	16	32	64
Address	Modbus Address 1						
1	1, Up	0, Down					

Select the baud rate by setting DIP switch position 8 (see below)! The change will take effect immediately.

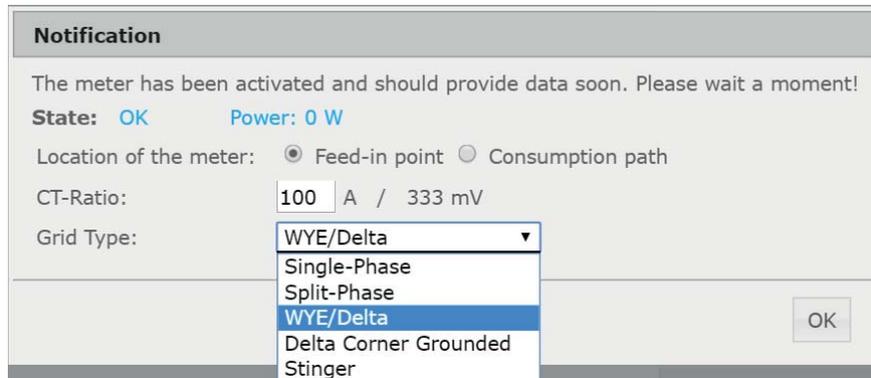
Baud Rate	DIP Switch 8
9600 (default)	0, Down

**Configuration web interface**

- 1 Go to the web interface of the Fronius Datamanager in Settings - Meter - Settings
- 2 Select „Fronius Smart Meter“



- 3 Click on „Settings“



- 4 Set Location of the meter, CT-Ratio and Grid Type

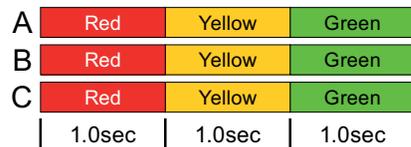
# Operation

## Power Status LEDs

The three status LEDs on the front of the Fronius Smart Meter can help indicate correct measurements and operation. The “L1”, “L2”, and “L3” on the diagrams indicate the three phases.:

### Normal Startup

The Fronius Smart Meter displays the following startup sequence whenever power is first applied.



### Positive Power

Any phase with the LEDs flashing green is indicating normal positive power (Import of energy from public grid).



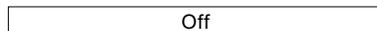
### No Power

Any phase with a solid green LED indicates no power, but line voltage is present.



### No Voltage

Any phase LED that is off indicates no voltage on that phase.



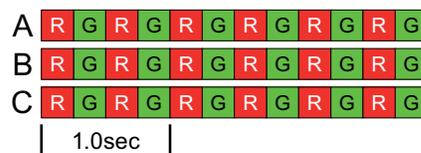
### Negative Power

Red flashing indicates negative power for that phase. Reversed CTs, swapped CT wires, or CTs not matched with line voltage phases can cause this (Export of energy to the public grid).



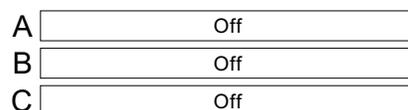
### Overvoltage Warning

The following indicates that the line voltage is too high for this model. Disconnect power immediately! Check the line voltages and the meter ratings (in the white box on the label).



### Meter Not Operating

If none of the LEDs are illuminated, check that the correct line voltages are applied to the meter. If the voltages are correct, call customer service for assistance.



**Error**

If the meter experiences an internal error, it will light all LEDs red for 3 or more seconds. If you see this happen repeatedly, return the meter for service.



**Modbus Communication LEDs**

Near the upper left corner, there is a diagnostic Com (communication) LED that can indicate the following:



A short green flash indicates a valid packet addressed to this device.



Short yellow flashes or rapid flashing indicate valid packets addressed to different devices.



A one-second red flash indicates an invalid packet: bad baud rate, bad CRC, noise, bad parity, etc.



Rapid red/yellow flashing indicates a possible address conflict (two devices with the same DIP switch address).



Solid red indicates the address is set to zero: an invalid choice.

# Technical Data

**Normal Operation**    **Line voltage:** -20% to +15% of nominal  
**Power factor:** 1.0  
**Frequency:** 48 - 62 Hz  
**Ambient Temperature:** 23° C ± 5° C  
**CT Current:** 5% - 100% of rated current  
**Accuracy:** ± 0.5% of reading

**Measurement**        **Update Rate:** 1.0 second. Internally, all measurements are performed at this rate.  
**Startup Time:** ~1.0 second. The Fronius Smart Meter starts communicating this long after AC voltage is applied. Energy measurement starts 50-100 milliseconds after AC is applied.  
**Default CT Phase Angle Correction:** 0.0 degrees.

## Models and Electrical

Meter Service Type	Nominal Vac Line-to-Neutral	Nominal Vac Line-to-Line	Phases	Wires
240-3 UL	120	208-240	1 - 3	2 - 4
480-3 UL	277	480	1 - 3	2 - 4

The Fronius Smart Meter has an optional neutral connection that may be used for measuring wye circuits. In the absence of neutral, voltages are measured with respect to ground. The Fronius Smart Meter uses the phase L1 (øA) and phase L2 (øB) connections for power.

**Over-Voltage Limit:** 125% of nominal Vac. Extended over-voltage operation can damage the Fronius Smart Meter and void the warranty.

**Over-Current Limit:** 120% of rated current. Exceeding 120% of rated current will not harm the Fronius Smart Meter but the current and power will not be measured accurately.

**Maximum Surge:** 4 kV according to EN 61000-4-5

**Power Consumption:** The following table shows maximum volt-amperes, the power supply ranges, typical power consumption, and typical power factors with all three phases powered at nominal line voltages. The power supply consumes most of the total power, while the measurement circuitry draws 1-10% of the total (6-96 milliwatts per phase, depending on the model). Due to the design of the power supply, the Fronius Smart Meter draws slightly more power at 50 Hz.

Meter Service Type	Real Power (60 Hz)	Real Power (50 Hz)	Power Factor	Rated VA *)	Power Supply Range (Vac)	Power Supply Terminals
240-3 UL	1.2 W	1.5 W	0.70	4 VA	166 - 276	L1 and L2
480-3 UL	1.2 W	1.6 W	0.70	3 VA	384 - 552	L1 and L2

\*) The Rated VA is the maximum at 115% of nominal Vac at 50 Hz. This is the same as the value that appears on the front label of the Fronius Smart Meter.

**Maximum Power Supply Voltage Range:** -20% to +15% of nominal (see table above). For the 3D-240 service, this is -20% of 208 Vac (166 Vac) to +15% of 240 Vac (276 Vac).

**Operating Frequencies:** 50 / 60 Hz

**Measurement Category:** CAT III

Measurement category III is for measurements performed in the building installation. Examples are measurements on distribution boards, circuit breakers, wiring, including ca-

bles, bus bars, junction boxes, switches, socket outlets in the fixed installation, and equipment for industrial use and some other equipment, for example, stationary motors with permanent connection to the fixed installation.

The line voltage measurement terminals on the meter are rated for the following CAT III voltages (these ratings appear on the front label):

Meter Service Type	CAT III Voltage Rating
240-3 UL	120
480-3 UL	277

**Current Transformer Inputs:**

**Nominal Input Voltage (At CT Rated Current):** 0.33333 Vac RMS

**Absolute Maximum Input Voltage:** 5.0 Vac RMS

**Input Impedance at 50/60 Hz:** 23 kOhm

**Certifications**

**Safety:**

- UL 61010-1
- CAN/CSA-C22.2 No. 61010-1-04
- IEC 61010-1

**Immunity:** EN 61326: 2002 (Industrial Locations)

**Electrostatic Discharge:** EN 61000-4-2

**Radiated RF Immunity:** EN 61000-4-3

**Electrical Fast Transient / Burst:** EN 61000-4-4

**Surge Immunity:** EN 61000-4-5

**Conducted RF Immunity:** EN 61000-4-6

**Voltage Dips, Interrupts:** EN 61000-4-11

**Emissions:**

- FCC Part 15, Class B
- EN 55022: 1994, Class B

**Environmental**

**Operating Temperature:** -30° C to +55° C (-22° F to 131° F)

**Altitude:** Up to 2000 m (6560 ft)

**Operating Humidity:** non-condensing, 5 to 90% relative humidity (RH) up to 40°C, decreasing linearly to 50% RH at 55°C

**Pollution:** POLLUTION DEGREE 2 - Normally only non-conductive pollution; occasionally, a temporary conductivity caused by condensation must be expected.

**Indoor Use:** Suitable for indoor use

**Outdoor Use:** Suitable for outdoor use if mounted inside an electrical enclosure (Hammond Mfg., Type EJ Series) rated NEMA 3R or 4 (IP 66).

**Mechanical**

**Enclosure:** High impact, ABS/PC plastic

**Flame Resistance Rating:** UL 94V-0, IEC FV-0

**Size:** 6.02 in. x 3.35 in. x 1.50 in. (153 mm x 85 mm x 38 mm)

**Connectors:** Euroblock pluggable terminal blocks

**Green:** up to 12 AWG (2.5 mm<sup>2</sup>), 600 V

**Black:** up to 12 AWG (2.5 mm<sup>2</sup>), 300 V

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**Fronius Manufacturer's Warranty**

Detailed warranty terms and conditions specific to your country can be found online: [www.fronius.com/solar/warranty](http://www.fronius.com/solar/warranty)

To take advantage of the full warranty duration for your newly installed Fronius inverter or accumulator, register your product at: [www.solarweb.com](http://www.solarweb.com).



# Fronius Worldwide - [www.fronius.com/addresses](http://www.fronius.com/addresses)

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