



*SunSniffer*<sup>®</sup>

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# Installation Manual

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VERSION 2.0

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## Foreword

Please read this manual carefully before installing SunSniffer® system.

This manual serves as a support for the installation of the SunSniffer® Monitoring System for photovoltaic plants which allows a module-level monitoring of the plant. Section 1 includes an overview of the SunSniffer® Monitoring System and its individual components.

The manual describes the procedure after the modules have been installed on the roof. Every important step from the installation of the SunSniffer® hardware to the final completion of the plant in the Webportal is described.

Should you have any questions or ambiguities, please don't hesitate to contact SunSniffer® Team.

Please note that non-compliance to the instructions especially the warning notes can lead to irreparable hardware damages. These damages are not covered by the warranty!

## Notes

1. Internet connection is needed to configure the Webportal and receive data from the plant.
2. SunSniffer® Gateway needs to have a constant power supply. Make sure that a 230V AC outlet is available in the plant for the power supply unit of the Gateway.
3. For the plant view, the serial numbers of the modules and their spatial location are required. This can be done either by manually inserting the serial numbers in an Excel sheet or, more conveniently, by using a high resolution bar code scanner as described in section 3 of the manual.
4. In order to configure the SunSniffer® gateway, you need a laptop, Ethernet cables, and a switch if your router has only one port.
5. It is advisable to print out this manual in order to have it on-site and be able to use the documentation forms (appendices).
6. To install the string readers and the gateway, a waterproof installation box, RS485 cables and tools such as screw drivers, cutters etc. are needed.

# 1. Hardware Installation

## 1.1. SunSniffer® System Components

The installation can be divided into 3 parts:

1. Hardware installation
2. Configuration
3. Plant creation in the Webportal

The SunSniffer® Monitoring System consists of the sensor and receiving devices.

### 1.1.1. SunSniffer® Sensor

This small chip is directly integrated by the manufacturer into the junction box of the module. The measured data, voltage, and temperature, combined with the module's serial number, are sent from the sensor to the String Reader. Measurements are transmitted every 30 seconds with an accuracy of +/- 1 %. The sensor can also be equipped to modules of other manufacturers with the help of a SunSniffer® Retrofit.



Figure 1: SunSniffer® Sensor.

**Retrofit:** You can also retrofit your current plant with the SunSniffer® Sensor via the Retrofit-Box. To do so, connect the Retrofit-Box with the integrated sensor parallel to the module. The short cables are directly connected to the junction box and the longer ones go to the next module. After that the module can be mainstreamed into the string as usual. It is important that the assignment of the Retrofit's serial number to the module's serial number is done. The connectors used for the Retrofit-Box are MC4 connectors.

While connecting the Retrofits to the modules, it is recommended to scan the module's serial number first, and then scan the serial number of the retrofit connected to this module. In this manner you get a clean assignment of the Retrofit to the module. The schematic of the connection is shown in Figure 2.

Locally the Retrofit-Box has to be mounted onto the back of the module. A suitable fixing has to be chosen depending on the conditions. Make sure to use only **certified tapes** if the Retrofit-Box is to be stuck directly on the back of the module because the temperature of the cell rises.

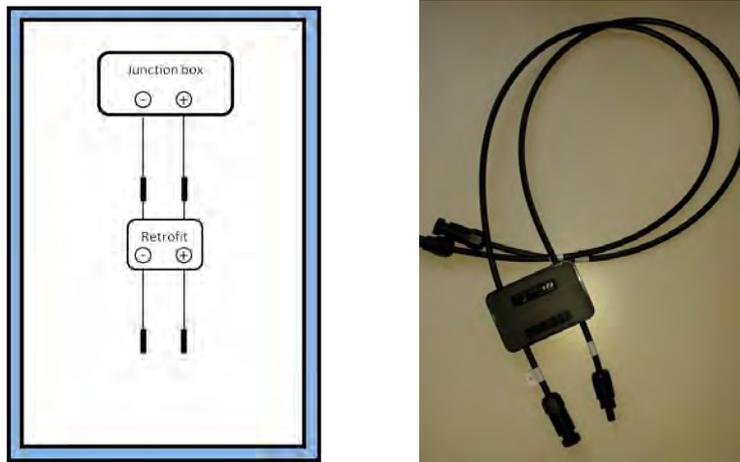


Figure 2: Connecting a Retrofit-Box to a module.

### 1.1.2. Receiver devices

**String Reader:** The String-Reader is a device connected to the end of a string (series of modules) which measures string current and voltage, and reads the data transmitted from the sensors, and sends them to the Gateway.



Figure 3: SunSniffer® String Reader.

**Gateway:** The Gateway gathers data from the String-Readers and sends them to the SunSniffer® Webportal.



Figure 4: SunSniffer® Gateway.

## 1.2. Connection Overview

The hardware installation includes the assembly of the receiver devices the String-Reader and the Gateway, as well as their correct wiring. The corresponding wiring is shown in Figure 5. The yellow arrows represent DC lines, whereas the black arrows represent data lines.

If the SunSniffer® Monitoring System is to be connected to an already existing plant, the installation of the so-called Retrofits is required, in which the sensor is integrated.

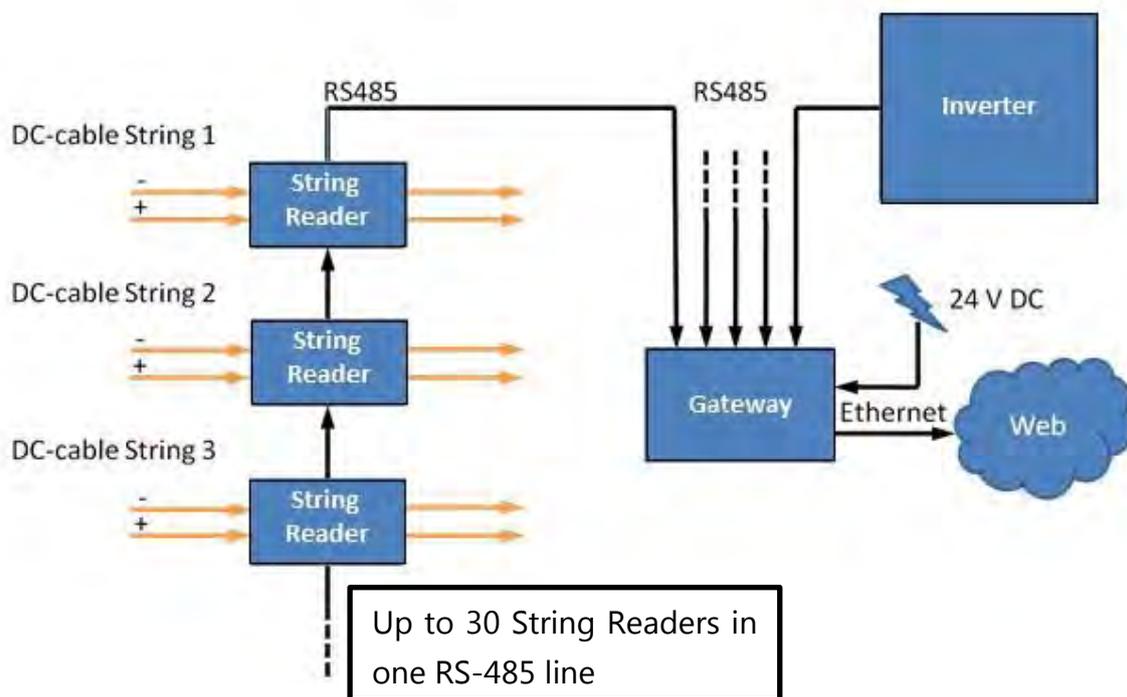


Figure 5: Schematic representation of the SunSniffer® Monitoring System

## 1.3. String Reader Installation

1. Take a SunSniffer® String Reader and note the serial number carefully.
2. In addition to the serial number, note the string number in which you want to use the String Reader. Follow these steps for every String Reader to get an exact documentation which you can comprehend later on. Orientate yourself on the example given in Figure 6. The model is in appendix A.3, and can be printed out for using.

Assignment of Strings, String Readers and Inverters						PV-plant: Date: Editor:			
					Webbox	Serial-No.	Installation ID	Revision	Notes
					1	7.1.002001	2001	C	
					2				
String- No.	Inverter- No.	Inverter-serial No.	Inverter- Port No.	Type of Inverter	Serial no. of String reader	Port No. of the Gateway	String No. Webportal	String Reader Revision	Notes
1	1	ABCD123456789	1	Sinvert PVM20	5.5.006548	1	1_1	D	
2	1	ABCD123456789	2	Sinvert PVM20	5.5.006549	1	1_2	D	
3	1	ABCD123456789	3	Sinvert PVM20	5.5.006550	1	1_3	D	
4	1	ABCD123456789	4	Sinvert PVM20	5.5.006551	1	1_4	D	
5	2	ABCD123456795	1	Sinvert PVM20	5.5.006552	2	2_1	D	
6	2	ABCD123456795	2	Sinvert PVM20	5.5.006553	2	2_2	D	
7	2	ABCD123456795	3	Sinvert PVM20	5.5.006554	2	2_3	D	
8									

Figure 6: Assignment of the Inverter, String Reader and Gateway.

3. Choose a place to install the String Reader. An ideal place would be close to the inverter, because all the cabling is going there.
4. Safely connect the power cables. Figure 7 clearly illustrates the proper connectivities from the string and to the Inverter.

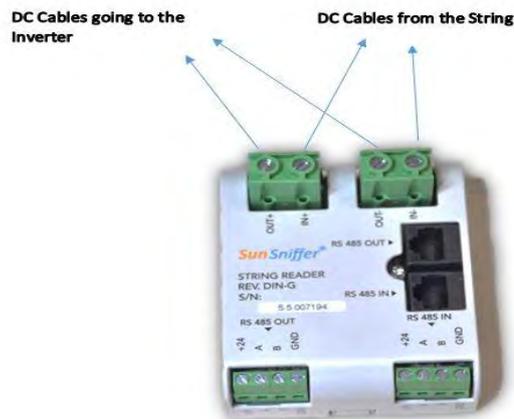


Figure 7: SunSniffer® String Reader showing the polarities of the DC cables.

- IN = Negative cable from the module string
- +IN = Positive cable from the module string
- OUT = Negative cable to the inverter
- +OUT = Positive cable to the inverter

- 5. The cables come from the string and go to the inverter as seen in Figure 7. Make sure that connections of the incoming DC lines to the String reader have the correct polarity.
- 6. Now for the RS-485 connections, also the above figure can be referred. To be more precise the table below with the sequence with color codes for the RS 485 cables can be seen. Make sure they are connected in this manner.

BLUE Wire	+24 V
WHITE Wire	A
BROWN Wire	B
BLACK Wire	GND

Table 1: Color code sequence of the 2-wire RS-485 cable.

- 7. Do all these steps for every String Reader. Be aware of an assembly which ensures an interconnection of all individual servers. The String Reader should be connected in series via the RS-485 data line or the assembly should be done in a way such that only few additional data lines are necessary for the interconnection of the String Readers.

**Important note: Please make sure you follow the guidelines above, as well as the clear indications on the String Readers themselves. A false connection scheme might result in irreparable hardware damage.**

**Note for connecting the String Readers to the Gateway:**

The Gateway has 4 input ports for the String Readers. If Inverters are to be connected to the Gateway, ports 1 and/or 2 must be used in that case. This is due to the fact that these ports have flexible baud rate settings to accommodate for the high baud rates of some inverters. **A maximum of 30 String Readers can be connected in series to each RS-485 line.** The String Readers can be connected in series by using either RS-485 data cable as in Figure 8, or RJ-45 as in Figure 9.

Using all four input ports for connecting String Readers, a maximum of 120 String Readers can be connected to the Gateway.

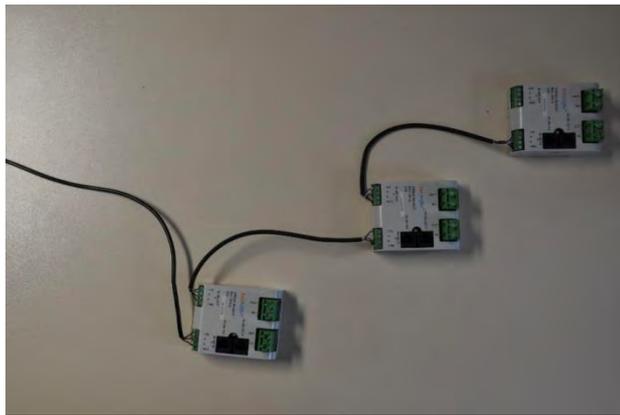


Figure 8: String Readers connected in series via RS-485.



Figure 9: String Readers connected in series via RJ-45.



Figure 10: String Readers connected by RS-485 data lines in a water-proof housing.

## 1.4. Gateway Installation

Take a SunSniffer® Gateway and look at the top cover of it. The following numbers must be noted down correctly for proper installation of the Gateway onto the Webportal:

1. Serial Number (Example: 7.1.002038)
2. ID (Example: 2038)
3. Revision (Example: D)

### 1.4.1. Connections

1. Plug in the RS-485 data cables correctly as shown in Figure 11.
2. Plug in the inverters in ports 1 and 2 of the Gateway to set the required baud rates.
3. Plug in the String Readers into ports 1 to 4 of the Gateway as required.
4. Plug in the environment sensors,  $S_o$ , and ripple control receiver to the Gateway.
5. Plug in the Ethernet cable from the router to the Gateway.
6. Plug in the power supply (Output 24V DC) to the Gateway. Pay attention to polarity, otherwise the device will be damaged.
7. The power supply unit usually used is 24V and 1.5A DC (36 Watt). However, if **more than 40 String Readers** are connected to the Gateway, a power supply unit with 24V and **2.5A DC (60 Watt)** has to be used instead. This power supply unit is provided by SunSniffer GmbH & Co. KG. The power supply units are manufactured by MEAN WELL Enterprises.

Number of String Readers	Power Supply
Less than 40 String Reader	24V and 1.5A DC
More than 40 String Reader	24V and 2.5A DC

Table 2: Power supply according to String Readers connected to the Gateway.

**Note for connecting the inverters via RS-485:** Some inverters have the labels "+" and "-" instead of "A" and "B" in the RS-485 ports. In this case, the "+" sign corresponds to "A", and the "-" sign corresponds to "B".

**Note regarding powering up the Gateway:** When powering up the Gateway, it might take some time for it to start up properly, so wait for a minute from powering the Gateway up before doing any configuration.

## 1.4.2. Gateway Ports

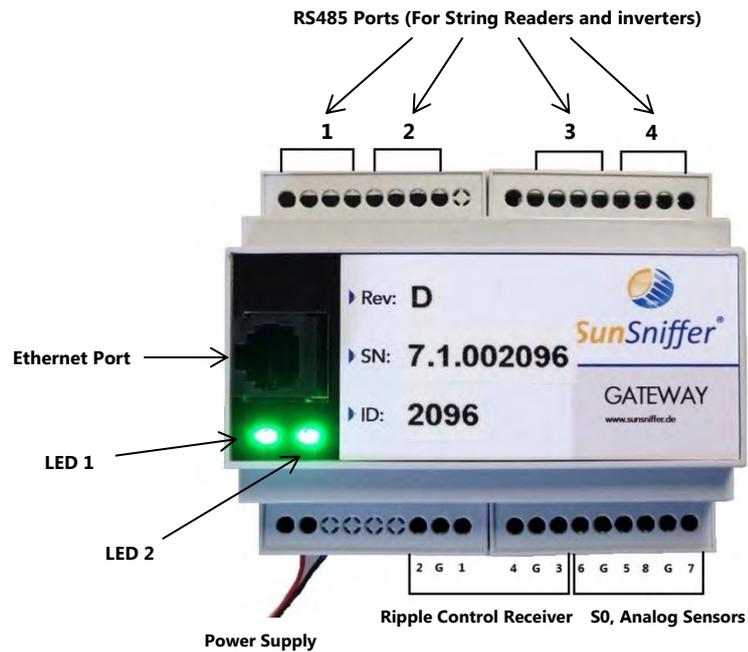


Figure 11: SunSniffer® Gateway with marked inputs and outputs.

## 1.4.3. Gateway's LED Indicators

LED	Status	Indication
1	Green	Gateway is powered on
	Off	Gateway is powered off
2	Green	Gateway is online
	Off	Gateway is offline

Table 3: LED Indicators' statuses.

## 1.5. Design of the installation box

To ensure maximum ease of use in a service case, it would be useful to meet the design points in the installation box illustrated in Figure 12.

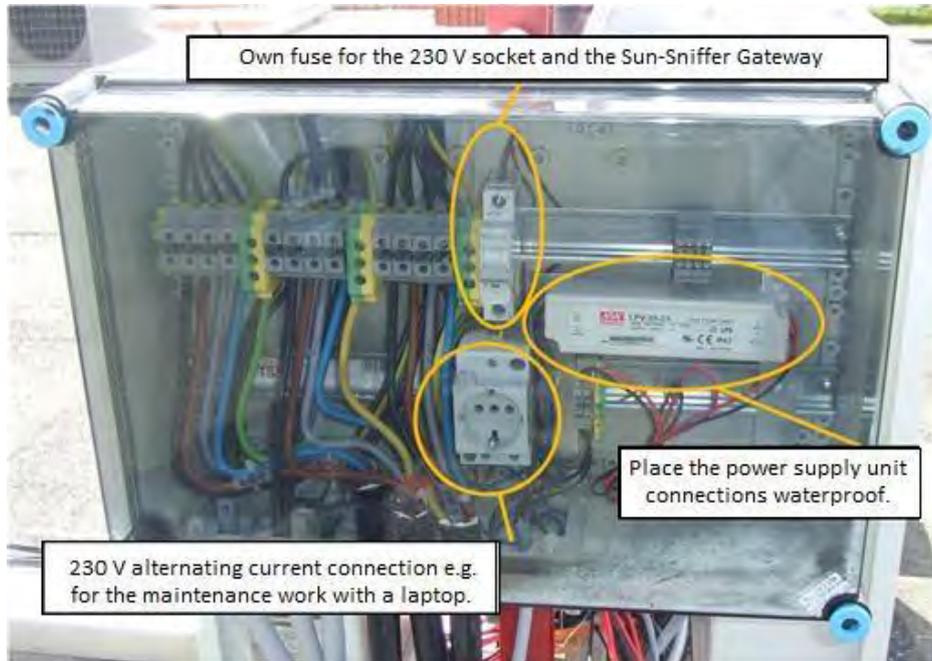


Figure 12: Installation box design.

## 1.6. Specification cables and connectors

### Cables

For outdoors the use of a UV-resistant cable is required. However, a non-UV-resistant PVC line can be used in cable channels.

#### Usage below 10m length

For a length of 10m or less and with little interference you can use a cable without shielding. The coloring is compatible too.

Example: Lumberg Automation Lumflex STL 225 4 x 0,34 mm<sup>2</sup> (UV-resistant), or LIYCY, LIYY (not UV-resistant) LI2YCYv (TP) (UV-resistant) e. g. Lapp cable with at least 0,25mm<sup>2</sup>.

#### Usage between 10m and 500m length

- For distances over 10m, a shielded cable should be used (LIYCY (not UV-resistant) LI2YCYv (TP) (UV-resistant), e.g. Lapp cable).
- To prevent damages by animals or weather conditions, long distances should be laid with cable channels or underground.

#### Usage above 500m length

Although there is a theoretical maximum of 1200m, distances that long should be avoided for the following reasons:

1. Sinking data rates
2. Risk of surge, e.g. by lightning
3. Interference

To compensate for these effects, we recommend:

1. Use of RS-485 repeaters
2. Use of surge protection or optocoupler for RS-485.

**Note:** After installing the system, each module needs to be scanned before leaving the plant site to be used later in plant creation (section 3).

## 2. Configuration

### Internet connection

The SunSniffer® Gateways installed in a photovoltaic plant can be connected to the internet via an Ethernet cable to a router. This router must ensure an adequate uninterrupted internet connection with enough data bandwidth.

### Connection over Intranet

If internet connection is to be established over an intranet, special settings may be necessary (IP address, Gateway, etc.), or the network may be protected by a proxy. In such cases, the network settings of the Gateway have to be configured accordingly.

The Graphical User Interface (GUI) is used to configure the Gateway such as assigning an IP address, configuring the ports, power reduction control etc. The following steps explain how the GUI can be accessed.

#### 2.1. Logging in to the GUI

There are two methods to connect to the Gateway and login to the GUI: via WiFi and via Ethernet cable.

##### 2.1.1. Connecting to the Gateway via WiFi

1. Remove the cover piece at the side of the Gateway where the power supply unit is to be connected (“+24” and “GND” pins), then power up the Gateway by connecting the power supply unit to it.
2. There is a small button in the space between the two connector pins as shown in Figure 13 below. Press and hold this button for a few seconds. Now the WiFi access point is activated.

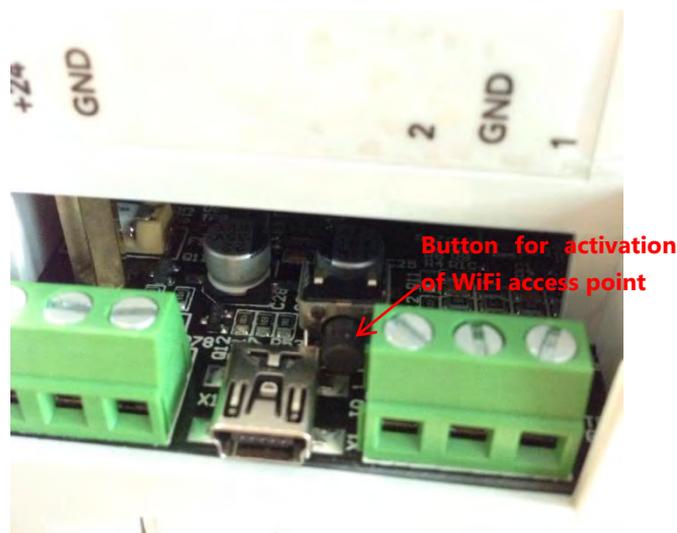


Figure 13: WiFi activation button on Gateway.

3. Click on the Network icon on the taskbar of your laptop. A list of the available wireless networks will be shown. Click on the one that belongs to the Gateway (usually begins with storm) and connect to it. If it doesn't show up, repeat step 2 again.



Figure 14: Gateway's wireless network.

4. When asked for a password, type in "stormpass" and click on "OK".



Figure 15: Password for wireless network.

5. After the connection is established, you can access the Gateway's GUI by typing in the IP address 192.168.12.1 to your web browser. Login by typing "admin" in both the username and password fields.

### Notes regarding the Gateway's WiFi AP:

- The WiFi AP stays active for one hour after pressing the button. To reactivate it, simply press on the button again just as described in step 2.
- If the Gateway is online while connecting to it through WiFi, your laptop will also have internet access from the Gateway.
- The IP address 192.168.12.1 will only work if you are connected to the Gateway via the WiFi AP. If the Gateway is connected via Ethernet cable, another IP address has to be used to access the GUI. This will be discussed in the next section.

## 2.1.2. Connecting to the Gateway via Ethernet cable

1. In order to access the GUI of the Gateway, you will need to connect the Gateway to a laptop using Ethernet cable, and connect a power supply unit to the Gateway. Pay attention to polarity!
2. After connecting the Gateway to the laptop, go to Control Panel -> Network and Sharing Center -> Change adapter settings. Right-click on your Ethernet adapter's name and click on Properties. Choose Internet Protocol Version 4 from the list, and then click on Properties. From there, check the box next to "Use the following IP address:". Type in the IP address 192.168.2.X, where X is any number between 1 and 255, except 100, which is reserved for the Gateway. Subnet mask will be auto-filled. Click on OK to apply changes made (Figure 16).

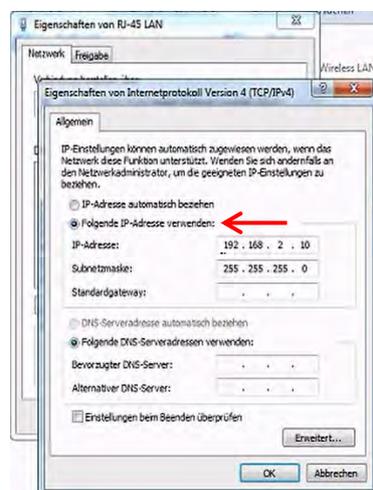


Figure 16: IP Address settings.

3. Open your web browser (Google Chrome, Mozilla Firefox etc.) and type in the IP address 192.168.2.100 which is the default static IP address of the Gateway. You will then be redirected to the login page of the GUI (Figure 17). If not, double check all the connections to the Gateway, power supply, and the laptop.



Figure 17: Start page of the GUI.

4. Login by typing admin to both username and password. A screen with the possibility of changing the login data will then appear. There you can change the login credentials. (Figure 18)



Figure 18: Change Login Data page.

## 2.2. Network Connection

The Network connection tab allows you to check the connection status of the Gateway and assign an IP address to it. The Gateway's status will be offline at first, and it will have the default static IP address 192.168.2.100, so in order to connect it to the internet and change its status to online, a new IP address has to be assigned to it. The IP address can be assigned either automatically or manually.

### 2.2.1. Assigning an IP address automatically (recommended method)

To assign the IP address automatically, check the box next to "DHCP" in Network Connection Settings window (Figure 19). This will allow the router to automatically assign a new IP address to the Gateway when they are connected together via Ethernet cable. After selecting DHCP and clicking on "Apply", the Gateway's IP address will no longer be 192.168.2.100. A new IP address will then be assigned to the Gateway by the router to which it is connected. This newly assigned IP address will be displayed in "Network Connection Status" as shown in Figure 20, and the Gateway's status should now change to online (Figure 21).

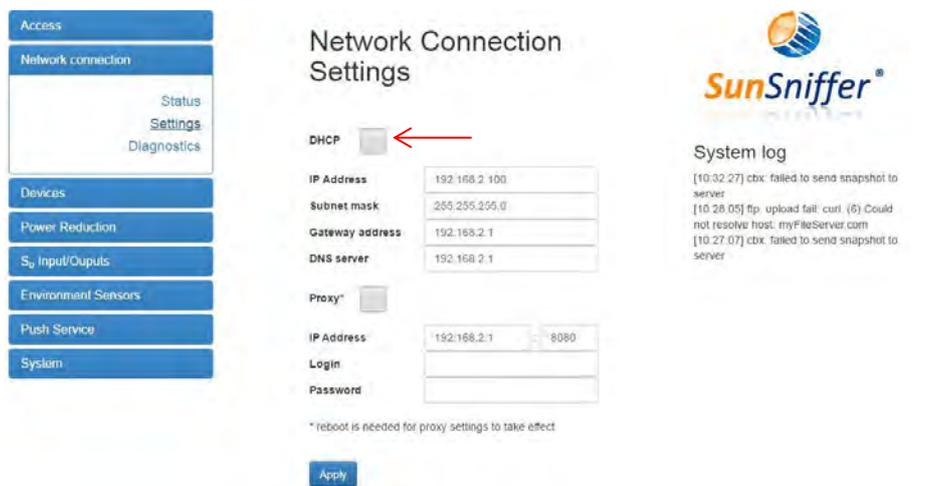


Figure 19: Network Connection Settings window.

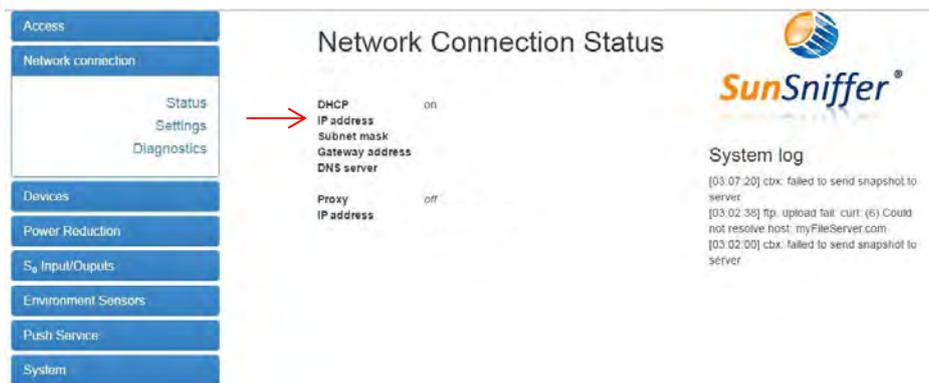


Figure 20: Newly assigned IP address will be displayed here.



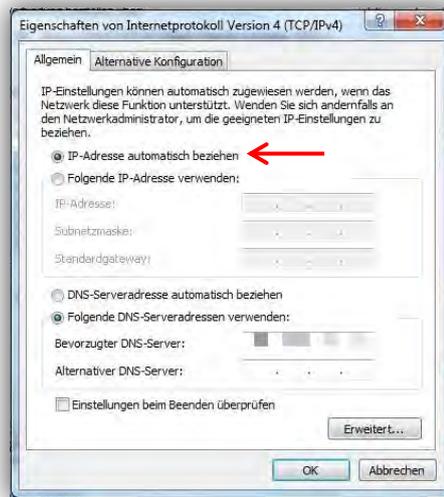


Figure 23: Setting IPv4 of ethernet adapter to automatic.

### 2.2.2. Assigning an IP address manually

The IP address can also be assigned manually to the Gateway. However, it should be within the router's local IP address range used to connect to the Internet. To do so, navigate to Network Connection Settings in the GUI of the Gateway and enter the IP address, Subnet mask, Gateway address, and DNS server manually, while leaving the DHCP box unchecked. These should be in accordance to those of the router. To find the IP settings of your router, open command prompt on your PC and type the command "ipconfig /all", and press enter. Note down the values you get for IP address, Subnet mask, Gateway address, and DNS server as illustrated in Figure 24. After doing so, type the values you got in their respective fields in "Network Connection Settings" as shown in Figure 25. For the IP address of the Gateway, type in the same IP address you got for the router, but only change the last digits to any value from 1 to 255 except for the value that's already in the PC's IP address, and type the other values as they are without changing them. After doing so, you can access the GUI by typing the newly assigned IP address in the address bar of your web browser and check the status of the Gateway which should be online at this time.



## 2.3. Devices

After the connections are made, the order and values of the devices connected to the ports of the Gateway (String Readers and inverters) can be seen in "Status".

Port	Type	Baudrate	Devices
Port1	RefuSol	57600	
Port2	none	9600	
Port3	SunSniffer	9600	
Port4	none	9600	

Figure 26: Devices Status page.

To change the baud rate and/or the type of devices used, click on the settings as shown below. For occupied ports, "scan" option has to be enabled. Depending on the manufacturer of the devices connected to the ports, "SunSniffer®", "Refusol" etc. has to be selected.

Port	Baudrate	Type	Scan
Port 1	57600	RefuSol	<input checked="" type="checkbox"/>
Port 2	9600	none	<input type="checkbox"/>
Port 3	9600	SunSniffer	<input checked="" type="checkbox"/>
Port 4	9600	none	<input type="checkbox"/>

Figure 27: Ports customization page.

**Important:** For better use of the ports of the Gateway, inverters should be connected to ports 1 and 2 only as the baud rates can be set accordingly, while String Readers can be connected to any of the four ports.

Port	Min Baud	Max Baud
Port 1	2400	115200
Port 2	2400	115200
Port 3	9600	9600
Port 4	9600	9600

Table 4: Baud ranges for the 4 ports.

## 2.4. Power Reduction

As indicated earlier, the Gateway is equipped with the functionality of connecting a ripple control receiver to it for the purpose of power reduction.

In “Power Reduction Settings” pages the user can configure the connected ripple control receiver accordingly. For this purpose the I/O pins 1 to 4 are used for ripple control receiver and its power reduction settings.

Relay	K1	K2	K3	K4	Power in %
Input pin	I/O_1	I/O_2	I/O_3	I/O_4	
Level 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	100
Level 2	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	60
Level 3	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	30
Level 4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	0

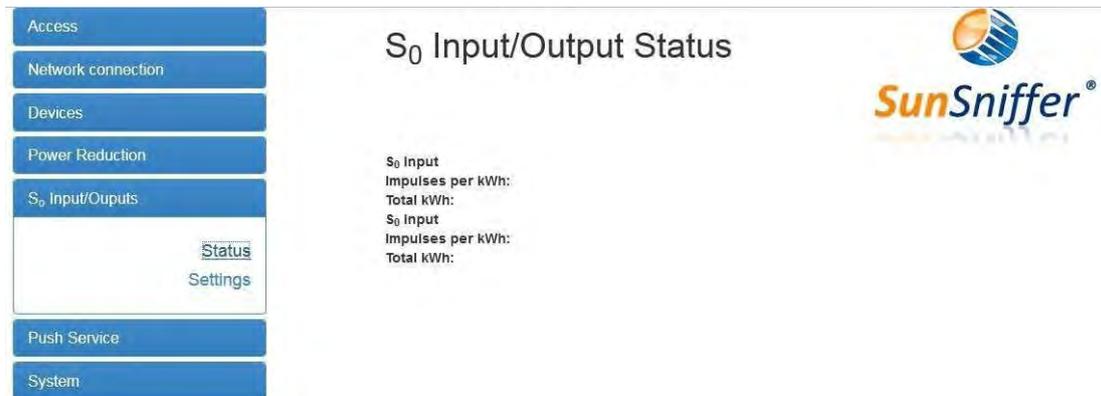
Figure 28: Active Power Reduction Settings.

Relay	K1	K2	K3	K4	Power cos(phi)
Input pin	I/O_1	I/O_2	I/O_3	I/O_4	
Level 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0,85
Level 2	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0,9
Level 3	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	0,95
Level 4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1

Figure 29: Reactive Power Reduction Settings.

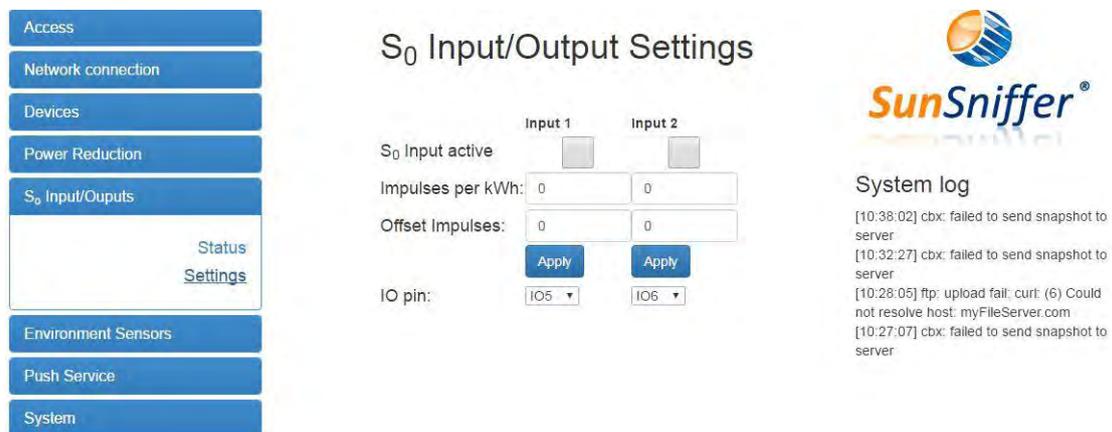
## 2.5. S<sub>0</sub> Input/Outputs

Activation of the S<sub>0</sub> input signal generates the data of the connected devices according to the pulse rate and is integrated over time. The I/O pins 5 to 8 on the Gateway are used for S<sub>0</sub> Input/Output functionality.



The screenshot shows the 'S<sub>0</sub> Input/Output Status' page. On the left is a navigation menu with buttons for 'Access', 'Network connection', 'Devices', 'Power Reduction', 'S<sub>0</sub> Input/Outputs', 'Push Service', and 'System'. The 'S<sub>0</sub> Input/Outputs' button is highlighted and contains sub-links for 'Status' and 'Settings'. The main content area is titled 'S<sub>0</sub> Input/Output Status' and features the SunSniffer logo. Below the title, there are two sets of data: 'S<sub>0</sub> Input Impulses per kWh: Total kWh:' and 'S<sub>0</sub> Input Impulses per kWh: Total kWh:'. The values for these fields are currently blank.

Figure 30: S<sub>0</sub> Input/Output Status page.



The screenshot shows the 'S<sub>0</sub> Input/Output Settings' page. The navigation menu on the left is similar to Figure 30 but includes an 'Environment Sensors' button. The 'S<sub>0</sub> Input/Outputs' button is highlighted and contains sub-links for 'Status' and 'Settings'. The main content area is titled 'S<sub>0</sub> Input/Output Settings' and features the SunSniffer logo. Below the title, there are settings for 'Input 1' and 'Input 2'. The 'S<sub>0</sub> Input active' checkbox is checked. The 'Impulses per kWh' and 'Offset Impulses' fields are set to 0 for both inputs. There are 'Apply' buttons for each input. The 'IO pin' dropdowns are set to 'IO5' and 'IO6'. On the right, there is a 'System log' section with a list of error messages: '[10:38:02] cbx: failed to send snapshot to server', '[10:32:27] cbx: failed to send snapshot to server', '[10:28:05] ftp: upload fail: curl: (6) Could not resolve host: myFileServer.com', and '[10:27:07] cbx: failed to send snapshot to server'.

Figure 31: S<sub>0</sub> Input/Output Settings page.

## 2.6. Environment Sensors

In this page the analog sensors connected to the Gateway can be configured accordingly. The I/O pins 5 to 8 are also used for this purpose.

	Channel 1	Channel 2	Channel 3	Channel 4
IO pin:	none	none	none	none
Scale:	1	1	1	1
Offset:	0	0	0	0
Quantity:	Temper	Windsp	Irradiati	Irradiati
Units:	°C	m/s	W/m2	W/m2

**System log**

```
[10:38:02] cbx: failed to send snapshot to server
[10:32:27] cbx: failed to send snapshot to server
[10:28:05] ftp: upload fail: curt: (6) Could not resolve host: myFileServer.com
[10:27:07] cbx: failed to send snapshot to server
```

Figure 32: Environment Sensors Settings.

## 2.7. Push Service

This service enables sending SunSniffer® data to a FTP server. For further information, please contact SunSniffer GmbH & Co. KG.

## 2.8. System

This tab shows the status of the Gateway (online or offline) as well as the serial number and ID. In addition, some commands can be sent to the Gateway such as scan ports, restart etc.

## 3. Plant Creation

### 3.1. Module Scan

„Module scan“ is used to set up the “PlantView” in the Webportal. PlantView is a digital map of the PV plant that enables exact localization of every single module. Module serial numbers are scanned in a specific way to generate an excel sheet that describes their arrangement on-site.

#### 3.1.1. Preparation

To run the module scan, the scanner ARGOX PT-20 is necessary. Click on the link [http://www.argox.com/content.php?sno=0000033&P\\_ID=51](http://www.argox.com/content.php?sno=0000033&P_ID=51) to download the manual of ARGOX PT 20. Furthermore, the barcode sheet is necessary for the module scan, so that the running routes during the scan can be comprehended. To have an efficient procedure, we recommend carrying a printed copy of the existing module plan for orientation.



Figure 33: ARGOX PT-20 Scanner.

#### 3.1.2. Scan order

The first module you have to start scanning from is the module which is situated in the northwestern direction (in viewing direction on the module front it is the module back left).

Start the module scan by scanning the „Start“ code on the code sheet. If you would like to scan a row, you have to set the walking direction to be able to assign the module order correctly. Going in eastern direction means going right on the module plan and going in the western direction means going left.

If the module row is completely scanned, you have to scan the code “end of row” to finish it. After that either a row through the code “empty row between modules” is omitted, or another row is directly connected. The next row starts again by specifying the walking direction “Right” or “Left”.

If there are gaps in your row, this can be input via the code "Gap". One "Gap" scan represents one module length. Gaps are initiated with the "Gap" code, then the length of the gaps is assigned in dependence to the binary code via the number codes 1, 2, 4, and 8. The length of bigger gaps is thereby summed up out of these numbers.

**Example:**

Submitting a gap of 7 modules via scanning the codes:

„Gap” → „1” → „2” → „4” represents a break of the length 7, because  $1+2+4=7$

Submitting a break of 13 modules via scanning the codes:

„Gap” → „1” → „4” → „8” represents a break of the length 13, because  $1+4+8=13$

After detecting the length of the break, the scan can be continued. If the scan of a series row is finished, the code "end of row" must be scanned. To create a distance between two series, the code "empty row between modules" must be scanned. When all rows and modules of the plant have been scanned, the code "Stop" must be scanned to finish the module scan. The serial numbers of the modules are in the storage of the scanner and have to be transferred to the PC. You have to change to transmission mode by selecting the arrow key „Up" on the keypad. The following examples help to understand the procedure better.

**Example: Double-rowed module construction**

The procedure in Figure 34 is recommended for a double-rowed module construction.

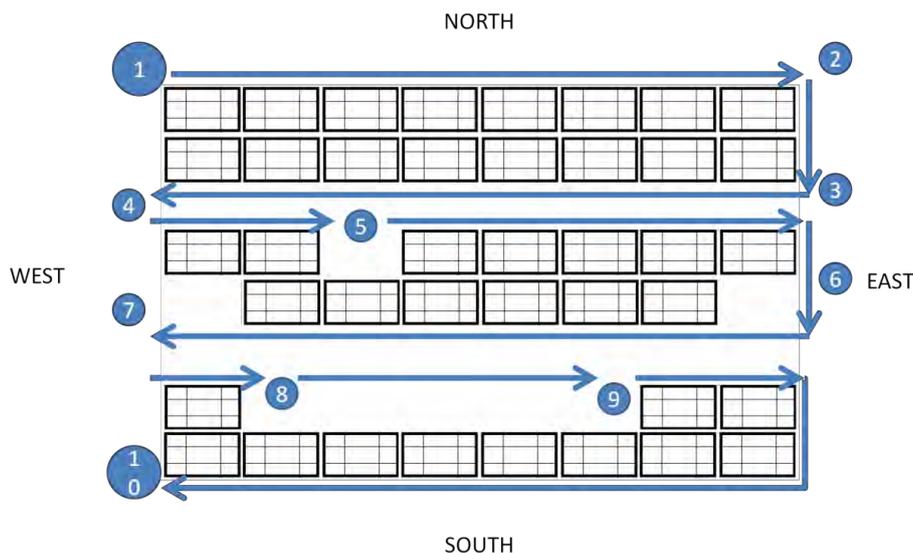


Figure 34: The procedure when scanning a module for a double-row construction.

1. The start is at the northwestern module (module at the top left). Scan the "Start" code to begin with the module scan. Scan the "Right" code for the walking direction. Scan the appropriate series of barcodes with the serial numbers of the modules (sticker under the glass of the modules) of the first upper row one after another.
2. To finish the row, scan the „end of row" code.
3. Add the next row directly by setting the walking direction with the code „Left". Scan the serial numbers of the modules (the lower of the double-row) one after another.
4. Finish the series with „end of row "again. Now there is spacing till the next double series. This is detected with the code „empty row between modules". After that start the next series with the running direction "Right" again.
5. Scan till the gap as exactly described before. Because one module is missing here, it is a gap of length 1. Scan the code "gap" to detect the break. Then scan the number code „1" to detect the length of the gap. After that, the scan of the modules' serial numbers can be continued just like before.
6. End the row and start the new one by simulating the running direction. The missing module can be submitted via scanning the "Gap" and the "1" code.
7. A gap at the end of a series is also detected via the „gap" code and the „1" code. Note that missing modules at the beginning and end of the row must also be detected. Add an empty row with the code „empty row between modules "and start the next row with the walking direction.
8. Initiate the gap by scanning the „gap" code. Then scan the codes „1 and „4" on the code sheet to reach the number of missing modules.
9. After the length of the gap is detected, the scan can be continued as usual.
10. After you finished the last row with „end of row „ and every module of the plant is detected, the module scan is completely finished by scanning the code "Stop".

With the described process you can create a double-rowed module construction. In principle the procedure is the same with single-rowed module constructions. You just have to be careful that a series gets left out between the module series using the code „empty row between modules". The recommended walking direction is shown in Figure 35.

## Single-rowed module construction

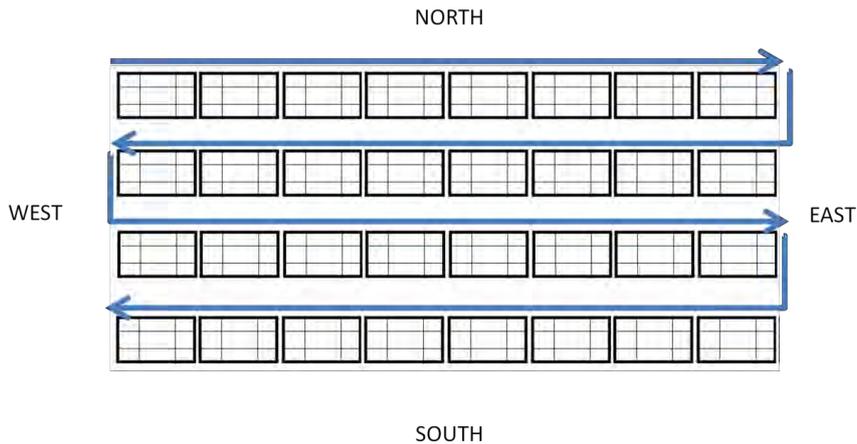


Figure 35: Recommended walking direction of a single-rowed module construction.

### 3.1.3. Transferring the data to the computer

To transfer the data to the computer, the scanner has to be connected to the computer. The software ARGOX PT File Manager and ARGOX PT Link must be installed on the computer. It is important to install the software before you connect the scanner.

After starting the software ARGOX, choose the correct scanner (Figure 36). If the connection was successful, the correct scanner is always chosen automatically. It is only important that the name starts with "PT-20-". The rest depends on the scanner.

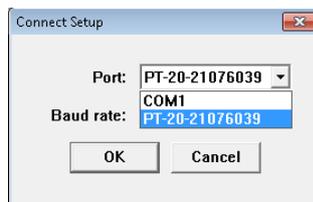


Figure 36: Selecting a scanner.

If the connection is successful, you can directly access the scanner. (Figure 37)



Figure 37: Select the file „OUT.TXT“.

The file OUT.txt has to be copied on the computer and opened with Editor. Select the content of the file beginning with "Start" and use copy. Then open the excel file "Plantview.xlsm" and, if you get asked for it, enable the built-in macros. This file can be downloaded from Webportal in "Monitoring & Analysis" -> "Plant View & Layout" -> "Upload XLS". Select the field A1 in table 1 and use paste to copy the content from the editor file to the excel file. In doing so, the data gets automatically distributed to different fields.

The editor file can also be imported in excel via the field "Data " -> "From text". Pay attention that the file origin should be "1250: Central European (Windows)".

After copying the file "OUT.txt", it must be deleted on the scanner, because otherwise a new scan would replace the old file.

Now the module plan can be created by following these instructions:

First use the excel option to highlight duplicate entries to highlight modules which got scanned twice. Delete any duplicates.

18	SEGPP6-60A212080151210
19	Lücke
20	Zahl 2
21	SEGPP6-60A212080152012
22	SEGPP6-60A212080151966
23	SEGPP6-60A212080151701
24	SEGPP6-60A212080152013
25	SEGPP6-60A212080152033
26	SEGPP6-60A212080152011
27	SEGPP6-60A212080152011
28	SEGPP6-60A212080152011
29	SEGPP6-60A212080150826
30	SEGPP6-60A212080150807
31	Lücke
32	Zahl 1
33	SEGPP6-60A212080151181
34	SEGPP6-60A212080151151
35	SEGPP6-60A212080151138
36	SEGPP6-60A212080150812
37	SEGPP6-60A212080151135
38	SEGPP6-60A212080150854
39	SEGPP6-60A212080150840
40	Lücke

Figure 38: Highlighted modules that got scanned twice. Make sure to delete duplicates.

Then click on cell A1 that says "Start" and press the following combination: Strg+B, which counts the scanned modules to check the module count.

With a correct module count the actual PlantView can be created. Therefor mark cell A1 again and press the following combinations: Strg+Y, which starts the PlantView creation based on the scan list.

The PlantView will be inscribed in the same Excel file in table 2. For the macro to work properly, table 2 has to be existing and empty. Also enter the serial number of the used inverters in a fitting cell of the newly created plan, so that they get displayed in the PlantView as well.

To upload the PlantView to the Webportal, the compiled plan has to be copied into a separated Excel file and saved as Excel 97-2003 Worksheet. This new file can then be uploaded. Do not save and overwrite the original Plantview.xlsm, as you may use it again for later projects (the file is read-only).



Furthermore, you need a PC with access to the internet and a user account with operator rights. Contact the Support team at SunSniffer GmbH & Co. KG for a user account with operator rights.

The integration of the plant takes place in two steps: In the first step the plant is applied, and in the second step the detection of the String Readers to the corresponding inverter and Gateway is done.

### 3.2.2. Application of the plant with Plant Creation Wizard

1. Open your browser and visit our Webportal at [webportal.sunsniffer.de](http://webportal.sunsniffer.de). Now log in with your login data and you will be redirected to the home page. Open the drop-down menu "Hardware Manager" on the left side and click on "Plant Creation Wizard" (Figure 40).



Figure 40: Plant Creation Wizard.

2. Fill in the fields with the appropriate data in the now open window of the plant creation wizard (Figure 41).

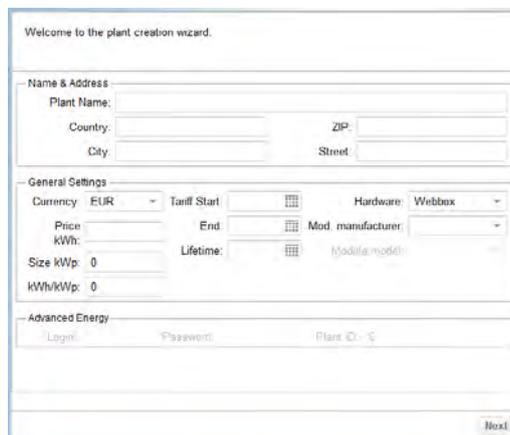
A screenshot of a web form titled 'Welcome to the plant creation wizard.' The form is divided into several sections: 'Name & Address' with fields for Plant Name, Country, City, ZIP, and Street; 'General Settings' with fields for Currency (EUR), Tariff Start, End, Lifetime, Price kWh, Size kWp, kWh/kWp, Hardware (Webbox), Mod. manufacturer, and Modifa. model; and 'Advanced Energy' with fields for Login, Password, and Plant ID. A 'Next' button is located at the bottom right of the form.

Figure 41: Filling in the plant creation wizard.

**Note:** You have to use dots for decimals. Example: 123.45 instead of 123,45. Confirm the input with "Next".

3. The inverters of the plant are set up in the next window (Figure 42). Click "Add Inverter" and use your documentary to fill in the necessary data. Confirm your entry for this inverter by clicking "Save". Do the following for all Inverters in the plant and select "Next".

**Note:** If you have plants, which are also adjusted in the Refusol-Portal, the serial number of the inverter, which is deposited there, must be adopted into SunSniffer® Webportal. The additional drop-down menu „Refulog inverter“ serves for that purpose. Choose the appropriate serial number here.

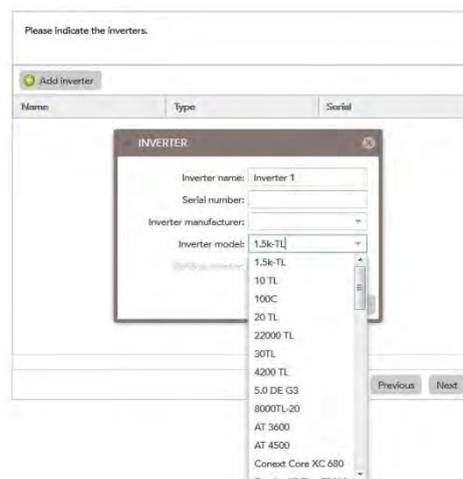


Figure 42: Adjusting inverters.

4. Click „Add Gateway“ and adjust it. Click „Save“ to save your input. Adjust all the installed Gateways on the plant like this, then click "Next". The Gateways are adjusted in the next window (Figure 43).



Figure 43: Adjusting the Gateways.

5. Check both boxes in the next window (Figure 44) and click „Finish“.

**Important:** Only when the plant is active the data are read and prepared in the Webportal.

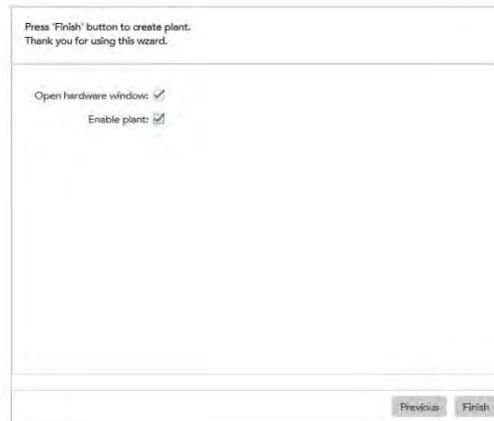


Figure 44: End of the Plant Creation Wizard.

By terminating the Plant Creation Wizard, the “Hardware Settings” window opens (Figure 45). The structure of the plant can be adjusted there. You can also reach the “Hardware Settings” window from the menu bar at the top left by clicking “Hardware Manager” -> “Hardware Settings”.

### 3.2.3. Hardware Settings and Plant Set-up



Figure 45: Hardware Settings window.

There are 3 columns in “Hardware Settings” window, “DEVICES”, “CONNECTION-BOXES/GATEWAYS”, and “MODULES”. Devices column displays the inverters that were assigned in Plant Creation Wizard and the strings connected to said inverters. Gateways column displays the Gateway and its ports. Modules column displays the modules in a string, when this string is highlighted.

**Subplants:** if a plant is installed on several buildings, and the user wants to arrange them on the Webportal, then there is the functionality of creating “Subplants”. The user can assign inverters under each subplant accordingly.

To create subplants, go to "Plant Configuration" -> "General". Check the box next to Subplants support and click on "Save" to apply changes.

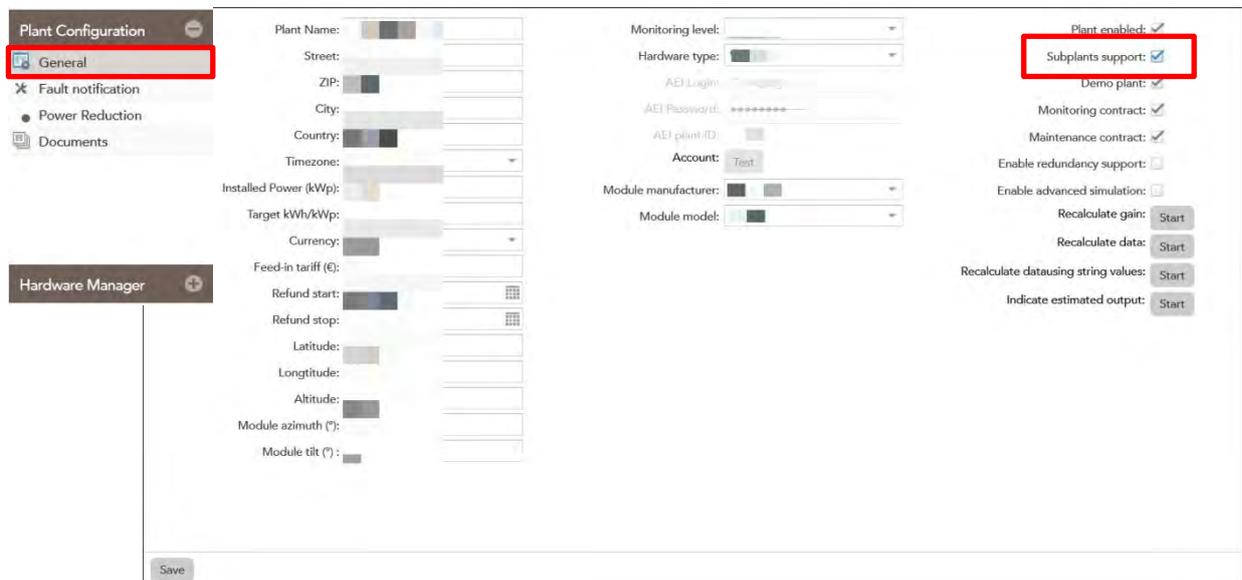


Figure 46: Allowing Subplants creation from „Plant Configuration“.

The column "DEVICES" will now be renamed to "SUBPLANTS", and the inverters will be assigned under Subplant 1. More subplants can then be created by clicking on "Add" and then "Add subplant". Inverters can then be assigned under newly created subplants accordingly via drag & drop. This is illustrated in Figure 47.

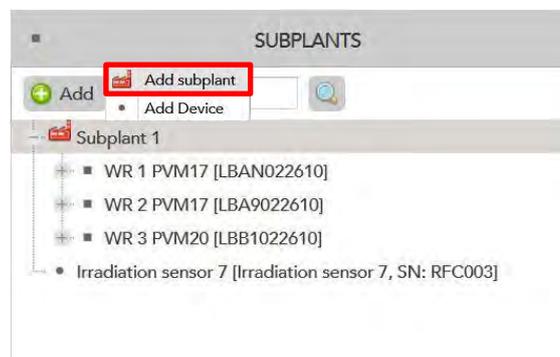


Figure 47: Assigning subplants.

### Setting up the plant in "Hardware Settings":

1. In the column "Devices/Subplants", you can see the inverters which were adjusted by you. Click the „+“ to see the individual strings of the inverter. If string connections of the inverter are not occupied, the strings must be deactivated. Go to the affected string via right-click and click „Edit“ (Figure 48 left). Change the setting „Enabled“ in the drop-down menu to „Disabled“ in the newly opened window (Figure 48 right) and click „Save“. Deactivated strings are displayed gray.



Figure 48: Deactivating unused connections of the inverter.

- To define string servers, click on any port of the Gateway and then "Set type". "1-String" has to be selected here. The settings can be confirmed by clicking "Save". The appropriate port is now configured.

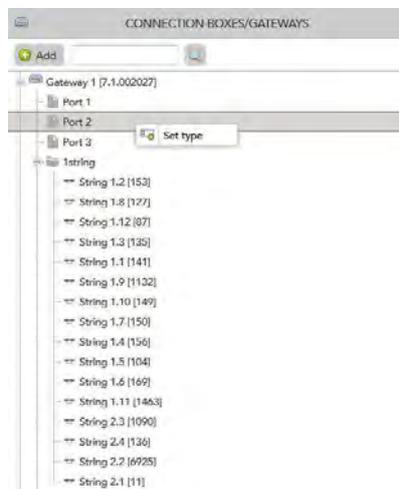


Figure 49: Configuration of the Gateway.

- Now you have to check if the Gateway sends data to the Webportal, and if all String Readers are correctly recognized. For that purpose right-click the Gateway and click „Status “ (Figure 50).

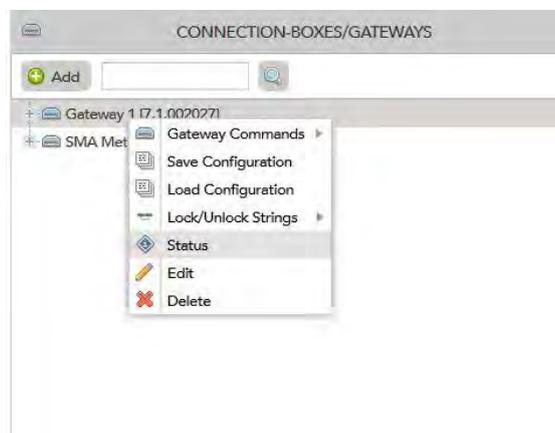


Figure 50: Opening the Status window of the Gateway.

4. Gateway data upload -> parsed data -> strings -> devices. Here should be the correct number of String Readers. Data packages are sent every 5 minutes.

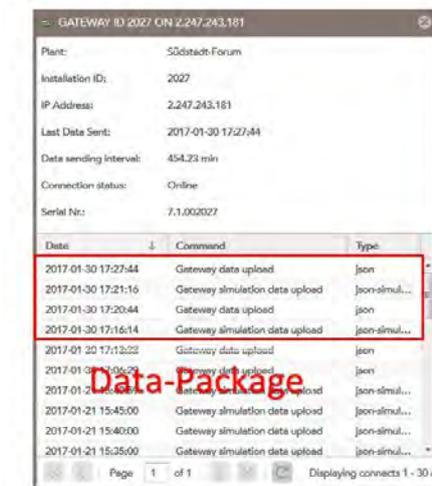


Figure 51: Status window of the Gateway with data packages.

5. Start now with assigning the individual strings to the Gateway. To do so pull the individual strings one by one via drag & drop out of the column "Devices" into the port "1string".

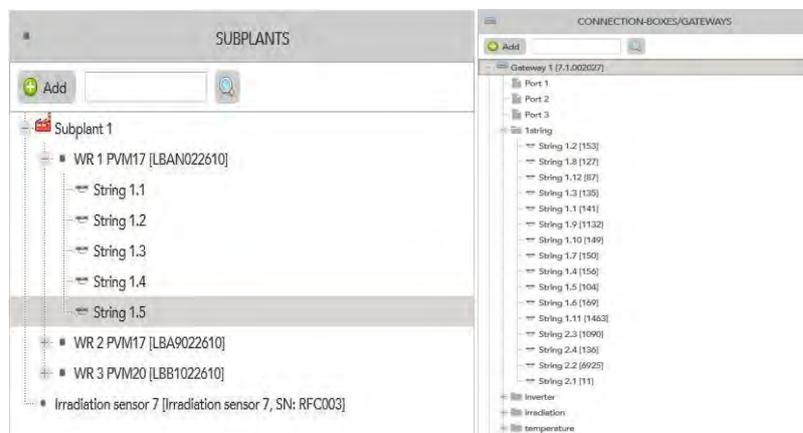


Figure 52: Assigning strings to the Gateway.

6. There should open a window according to Figure 53. Choose the right String Reader out of the drop-down menu. Orientate yourself on the documentary created by you.

In the column „String failure trigger “a percentage of the power has to be entered. If the String Reader generates less power than the average of all String Readers on the plant, an alarm in the Webportal will be released when the power percentage falls below the entered value. Usually a value of 80 per cent is entered. You can find the revision – similar to the Gateway on the plate or on the sticker with the

serial number. If you do not know what to write in the gap firmware, leave a 0 in this gap. Add all of the String Readers to the Gateway in this manner.

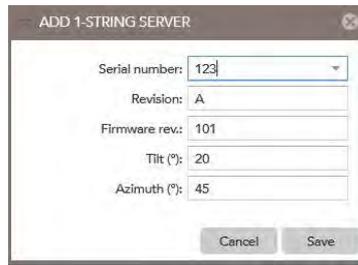


Figure 53: Add String Readers.

The application of the String Readers can also be done in a different way, shown in Figure 54.

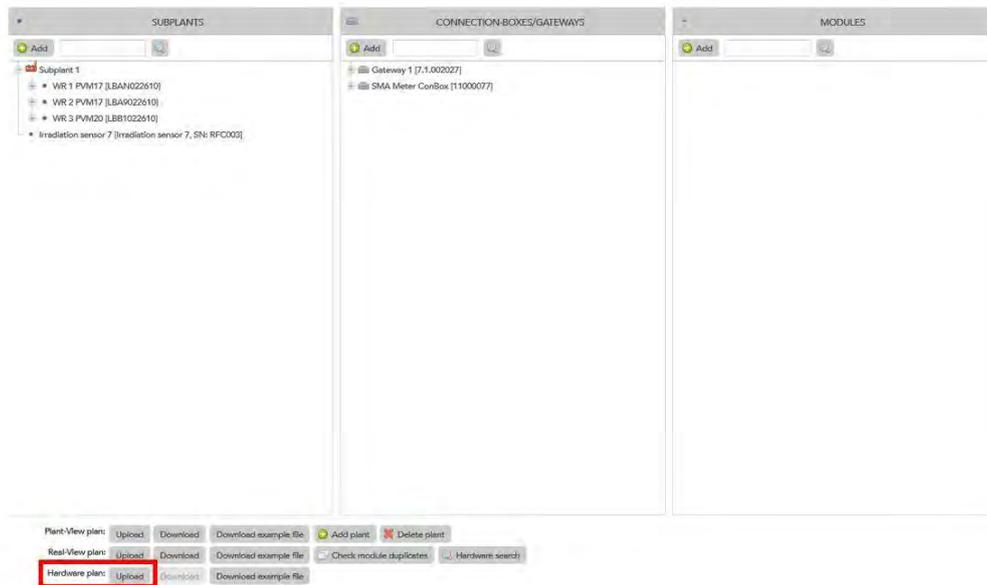


Figure 54: Alternative way to apply the String Readers using „Hardware plan“.

Click on the button “Upload mapping” on the top of the hardware window. Now you have to upload an excel sheet, in which the inverters and String Readers are listed as shown in Figure 55.

	A	B	C	D	E	F
1	String Serial Number	Inverter Serial Number	Inv Port Number	Webbox Serial Number	Webbox Port Number	Webbox Port Type
2		1269	1233	1	1233	1 1-String
3		780	1233	2	1233	1 1-String
4		111111	1233	3,4	1233	2 2-String
5			1233		1233	5 Inverter
6						

Figure 55: String Reader application using an excel sheet.

7. After adding all the String Readers, wait for the next data transmission. Now the serial numbers of Sunsniffer® Sensors should stand in square brackets next to the module numbers in the column "Modules" (Figure 56).

Check here, if all sensors are present, or if individual modules are missing. In case of doubt wait for a few more transmissions. Sometimes it can happen that sensors need multiple data transmissions to be recognized correctly. If the weather is too bad, the sensors may be out of service (when the voltage is below 20 V because the modules are covered in snow for example). When all sensors got recognized or when there is no further improvement after sufficient waiting time, you can continue with the next step.

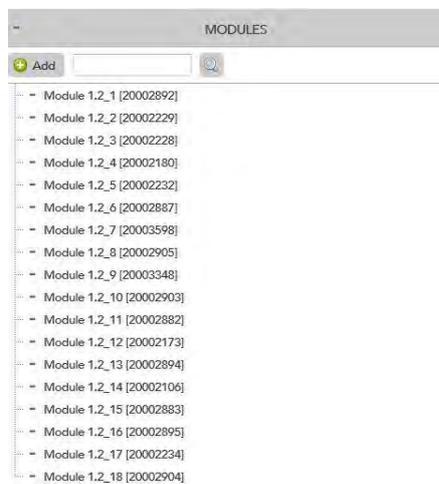


Figure 56: Serial numbers of modules in squared brackets.

8. Now all strings must be locked, which means that they do not recognize new sensors anymore and the recognized serial numbers are saved.

This is necessary because sometimes String Readers receive the signal of sensors from other strings due to back couplings. To lock strings right-click on the appropriate Gateway and choose „Lock/Unlock strings“ -> „Lock all strings“ (Figure 57). Now the strings in the column „Subplants“ are shown black and not red anymore.

The locking can be removed again for later changes. Individual strings can also be locked and unlocked by right-clicking on the string and then clicking "Edit". In the newly opened window the setting "locked" can be checked or unchecked.

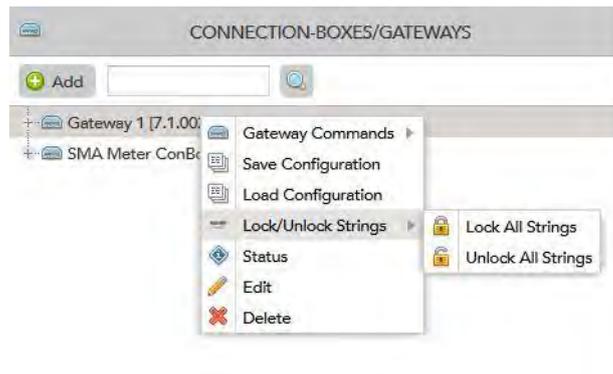


Figure 57: Locking of the strings.

- Inverters and environment sensors have to be assigned to the gateway by drag & drop to "inverter", "irradiation" etc. of the Gateway as shown in Figure 58.

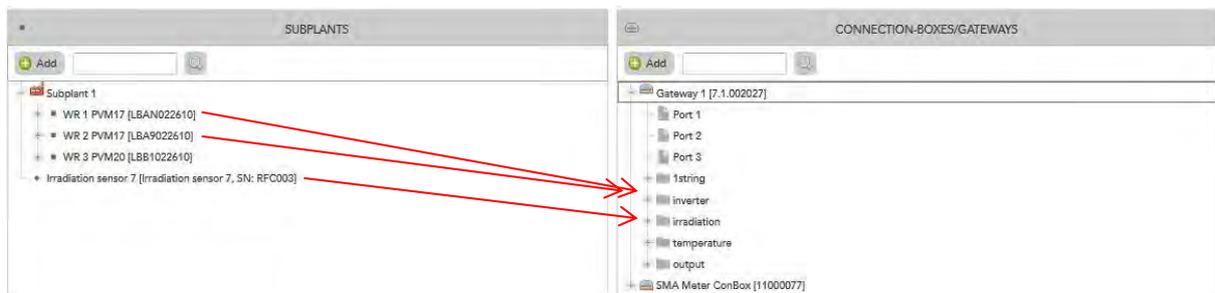


Figure 58: Assigning inverters and environmental sensors via drag & drop.

The integration of the plant structure is done and the open windows can now be closed.

- Now change to the tab „Plant Configuration“ and enter more information: latitude and longitude of the plant (these can be determined by Google Earth), module angle and module alignment to the south.

- Close this window and open the drop-down menu „Monitoring & Analysis“ and select the sub-menu “Monitoring & Analysis“. Afterwards, press on the tab “Plant View & Layout“ from the menu above.

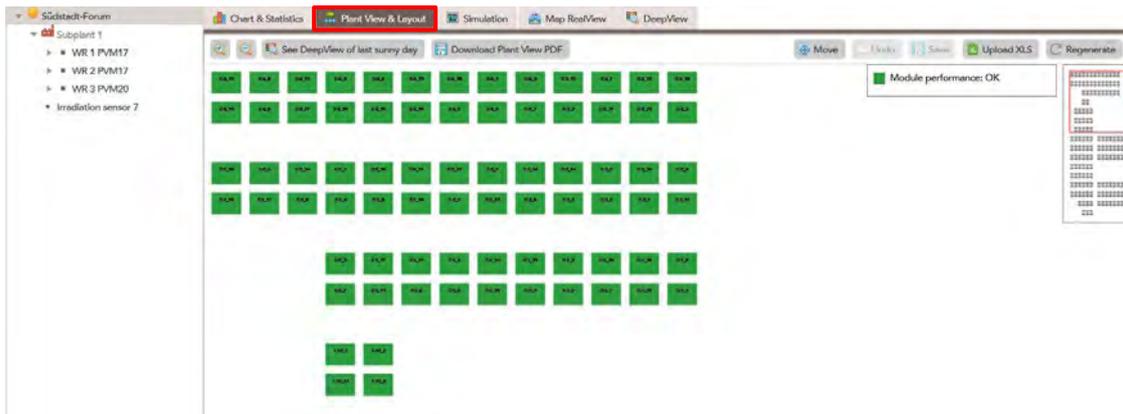


Figure 59: „Plant View & Layout“ tab.

- Click on the button „Upload XLS “(Figure 60) on the top right corner. Then choose and upload the excel-workbook, which contains the PlantView that was created by you.

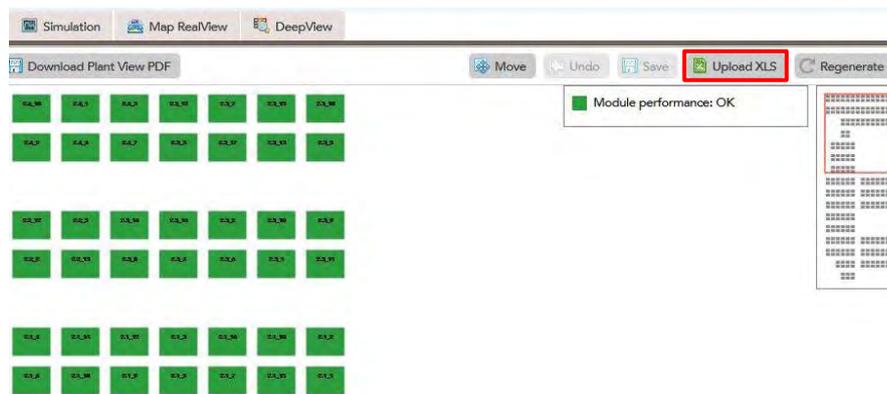


Figure 60: Click on „Upload XLS“ to upload the PlantView

Congratulations!

Your plant is now fully configured. Please do not hesitate to contact SunSniffer® Support Team if you require further assistance.

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# Appendices

## A.1 Barcode sheet for module scan



Stop  
end scan



Start  
begin scan



Links  
movement direction left



Rechts  
movement direction right



Ende Reihe  
end of row



Leer  
empty row between  
modules



error



Lücke  
gap between modules



1



2



4



8

## A.2 Template to record the plant properties

Name of the plant	
Adress	
Land: City: Postcode: Street:	
Additional Information	
Feed-in tariff:	€/kWh
Size of the plant:	kWp
Earnings forecast:	kWh/kWp
Start date of infeed	
Type of module:	
Siemens-monitoring	yes/no
Hardware	
Documentry like pattern:	yes/no
Number of modules per string:	

### A.3 Template to assign strings, String Readers and inverters

 <b>Assignment of Strings, String Readers and Inverters</b>					PV-plant: Date: Editor:				
					Webbox	Serial-No.	Installation ID	Revision	Notes
					1				
					2				
String- No.	Inverter- No.	Inverter- serial No.	Inverter- Port No.	Type of Inverter	Serial no. of String reader	Port No. of the Gateway	String No. Webportal	String Reader Revision	Notes
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
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28									
29									

## Checklist for the installation process

- Register String Readers in assignment list (appendix A.3)
- Insert String Readers in DC-cabling, pay attention to the right polarity
- Connect String Readers via RS-485-Data line in series (up to 30 pieces)
- Register the Gateway in the assignment list
- Connect String Readers via RS-485 to Gateway
- Connect Gateway via Ethernet cable with the router

## Checklist to close the hardware installation

- To start the Gateway connect the power supply unit(s) to the power supply system
- Login in to Gateway browser interface and configure Gateway
- Check in the Webportal if the Gateway sends data
- Check the data sendings in the Webportal:
  - Number of String Readers
  - Measurements of electricity and voltage of the String Readers
  - Do the String Readers receive sensors?