SoilNet

Wireless Sensor Network for Measuring Soil Moisture

MANUAL

Installation and Initial Operation

- Version 3.12 -

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Subject to technical modifications.

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Note: In the Annex at the end of this document, you will find drawings and parts lists which can be printed out. They contain the necessary technical information for assembling the router poles and mounting the router housings.

1   Introduction

The SoilNet wireless sensor network

SoilNet is a wireless network application which is based on the IEEE802.15.4 standard (Bogena et al., 2010). The radio module used for SoilNet is a ultra-low-power, low-cost wireless microcontroller JN5148 from Jennic Ltd. ,featuring a 32-bit RISC processor with up to 32 MIPs performance, and a fully compliant 2.4GHz IEEE802.15.4 transceiver.

To develop SoilNet applications the JenNet network protocol stack is used. JenNet supports star, tree and linear network topologies, and provides self-healing functionality for robust communication. The JN5148 radio module consists of several layers. The software interfaces link the hardware components (physical layer and peripherals) with the user application. The application support layer (APS) and the application programming interface (API) allow the user to control the sensor network and to handle the communication between the devices. In addition, the APS layer specifies what kind of device the hardware is (e.g. coordinator, router, or end device). The media access control layer (MAC) based on the IEEE 802.15.4 standard operates on top of the physical layer (PHY) and is responsible for the routing within the network. The PHY layer comprises not only the transceiver, but also the sensors and energy source.

Typically, SoilNet is composed of three different components (coordinator, router, sensor unit). The coordinator unit is the top of the network tree. It stores information about the network and provides a link to other networks. SoilNet uses the tree Each SoilNet network has a single coordinator. An important task of the coordinator is to initiate the wireless links within the network. The second type of device is the router, which acts as a relay station that passes data from other devices. The third type of device is the sensor unit, which communicates with its parent node (either the coordinator or a router). The sensor unit is in a non-active sleep modus for a significant amount of the time to save energy. Therefore a 3.6 V lithium battery can support a sensor unit for at least 60000 measurements. SoilNet supports automatic routing formation and restoration, adding and moving nodes and handshaking mechanisms to ensure unbroken data package transfers.

The 2.4GHz radio transmission frequency used for SoilNet determines to a large extend the transmission range between transmitter and receiver. The maximum distance between a sensor unit and at least one router is 1000 m (free sight conditions), whereas the maximum distance between two routers or between a router and a coordinator is 2000 m. In case of hybrid underground configuration with the

sensor unit being buried 5 cm below the surface, the transmission range between a sensor unit and router decreases to max. 100 m (depending on soil water content; see also Bogena et al., 2009).

Specifications of the SoilNet components:

Sensor unit:
- A SoilNet sensor network can consist of up to 300 sensor units.
- Each sensor unit can host up to 9 SDI-12 sensors (e.g. to measure soil moisture, matrix potential, pressure etc.), 4 sensors with analog output signal, and one reed switch sensor (e.g. rain gauge).
- A real-time clock enables high precision measurement timing and synchronization.
- Measurement frequency of each sensor unit is individually configurable (from 3 to 60 minutes). The frequency can be changes remotely at any time.
- Up to 3.8 Mio measurements can be stored on the onboard SD-Card
- The offline modus enables measurements without the need of a radio network

Router:
- A full automatic weather station (Vaisala WXT520) and 2 digital temperature sensors can be connected.
- Solar panels are used for self-sustaining electrical power supply.
- A 12V battery buffer ensures electrical power supply for up to 3 months.

Coordinator:
- OpenVPN data link is used for transnational communication with a net control station.
- Solar panels are used for self-sustaining electrical power supply.
- 12V battery buffer ensures electrical power supply for up to 3 months

SoilNet software functions:
- Configuration of network parameter
- Visualization and processing of sensor data
- Data output routine for data analysis and data archiving
- Control of network connection quality
- Automatic messaging in case of critical value exceeding

Literature

Bogena, H.R., Herbst, M., Huisman, J.A., Rosenbaum, U., Weuthen, A., Vereecken, H. (2010): Potential of wireless sensor networks for measuring soil water content variability. Vadose Zone Journal, 9 (4): 1002-1013.

Bogena, H.R., Huisman, J.A., Meier, H., Rosenbaum, U., Weuthen, A. (2009): Hybrid wireless underground sensor networks: Quantification of signal attenuation in soil. Vadose Zone Journal, 8 (3): 755-761.

2   Changes Version 3 vs. Version 2

There are minor changes in design of some components in Version 3.

Most of the changes are functional:

- Using standardized SDI interface for sensors
- Max. 9 sensors per End Device (including 1 connection for a tipping bucket)
- Point of measurement at a specific time
- Measurement intervals adjustable for every sensor (3 to 60 minutes)
- Intervals can be changed by remote
- Offline modus enables measurements without the need of a radio network
- GSM Modus enables data transmission over mobile network (Email)
- Data storage capacity over several years on the end device (via SD-Card)

3   Assembling the Router Pole

The pole consists of the following parts:

- Standpipe with welded-on base plate, 2 m long

- Extension pipe, 1 m long

- 4 cantilever feet

- Fastening material

- 4 ground pegs

3.1   Mounting the Cantilever Feet

To mount the cantilever feet onto the base plate, you will need:

- 8 hexagon head bolts M8 x 50

- 8 hexagon nut M8

- 8 large-diameter washers 8.4 x 25 mm

- 8 split washers M8

Bolt the four cantilever feet (rectangular tubes) to the base plate of the pole using two M8 x 50 bolts each.
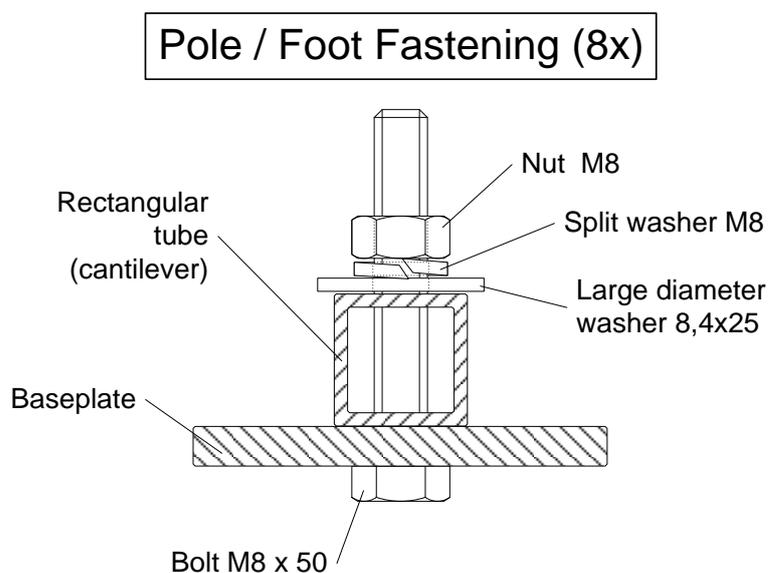
Figure 1: Pole Fastening

3.2   Assembling the Pole Pipes

To connect the two pole pipes, you will need:

- - 1 hexagon head bolt M8 x 70

- - 1 hexagon nut M8

- - 2 washers 8.4 x 16 mm

- - 1 split washer M8

The two pole pipes are bolted together using an M8 x 70 bolt.
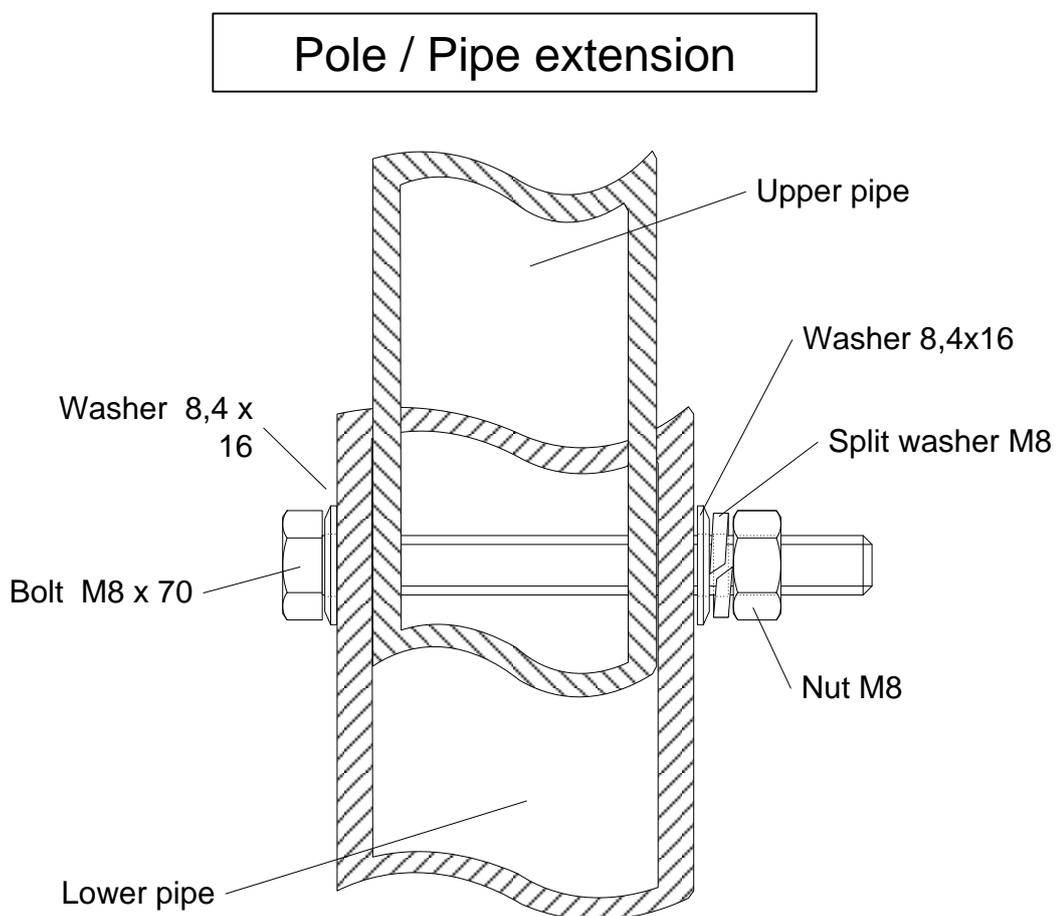
Figure 2: Pipe extension

4 Installing the Routers and the Coordinator

The coordinator and the routers are supplied pre-assembled.
They are supplied with:

- Housing with electronics and cabling

- Sonnenschein A512/60 battery

- Antenna

Figure 3: Router, open

4.1   Mounting the Fixing Rails

To mount the fixing rails, you will need:

- 4 wall brackets

- 2 fixing rails

- 2 clamps

- 4 hexagon head bolts M6 x 60

- 4 hexagon head bolts M6 x 80

- 12 hexagon nuts M6

- 16 washers 6.4 x 12 mm

- 4 large-diameter washers 6.4 x 20mm

- 4 split washers M6

To fasten the rails to the router housing, you will also need:

- 4 hexagon socket bolts M8 x 20

- 4 washers 8.4 x 16 mm

The rails are already pre-assembled.
Bolt the assembled rails to the back of the router housing with two hexagon socket bolts and two washers each at the top and the bottom (see Drawings 1–3 in the Annex).

Figure 4: Coordinator housing with fixing rail (and mounted modem antenna)

4.2   Fastening the Housing to the Pole

To fasten the housing to the pole, first release the clamps from the fixing rails, then lift the housing onto the pole and refasten the clamps.

Figure 5: Rear view of the pole plus 4 earth pegs

5 Connecting the Routers and the Coordinator

Temperature sensor 1

Radio
antenna

Temperature sensor 2

Router / Coordinator Circuit Diagram

ST1   TS2 TS1

SOILNET
Router /
Coordinator
PCB

Jennic
module

D-Sub *
9pin

RS 232 *

battery
charger
CTEK
MULTI XS
3600

MODEM *
antenna

connector

Sonnenschein
A 512 / 60
battery

FUSE
1A

connector

D-Sub *
9pin

MODEM *

MAINS
~ 220 V

* parts only used
in coordinator
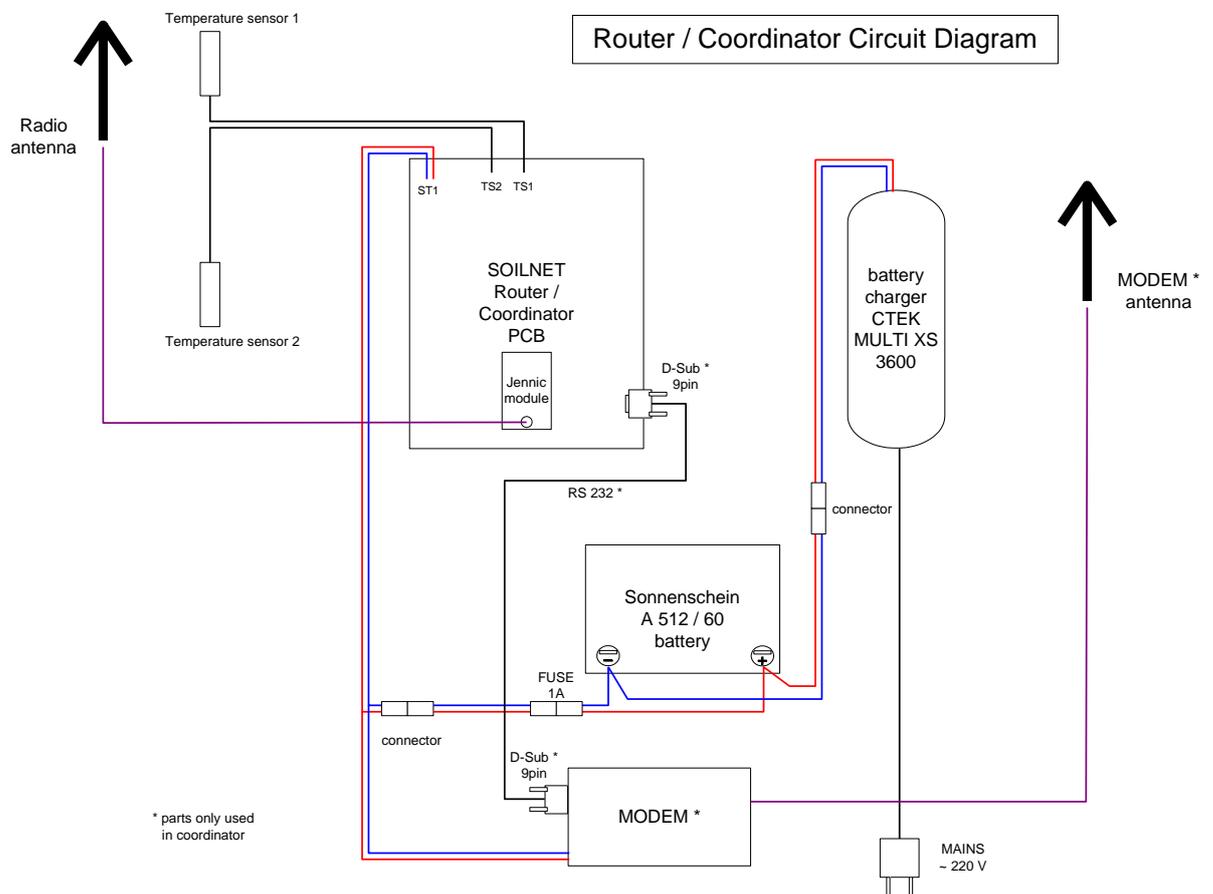
Figure 6: Schematics of Router

5.1 Battery Charger and Battery

The battery charger (e.g. CTEK MXS 3.6) is supplied with 240 V line voltage.

On the rear right on the bottom of the router housing, there is a gland for cable entry. On the secondary side, the battery charger is connected to the battery by a plug connection.

The battery must be inserted before initial operation.

Caution: The router PCB should be switched off during installation (set the switch to the left towards the housing wall)!

Connect the accompanying cable (white), which has a 1A fuse, and the short connection cable for the battery charger (red/black) to the battery terminals. The M6 x 18 bolts with nuts, washers and snap rings to be used are supplied with the cables.

Note the polarity when connecting the battery (see **Fehler! Verweisquelle konnte nicht gefunden werden.**).
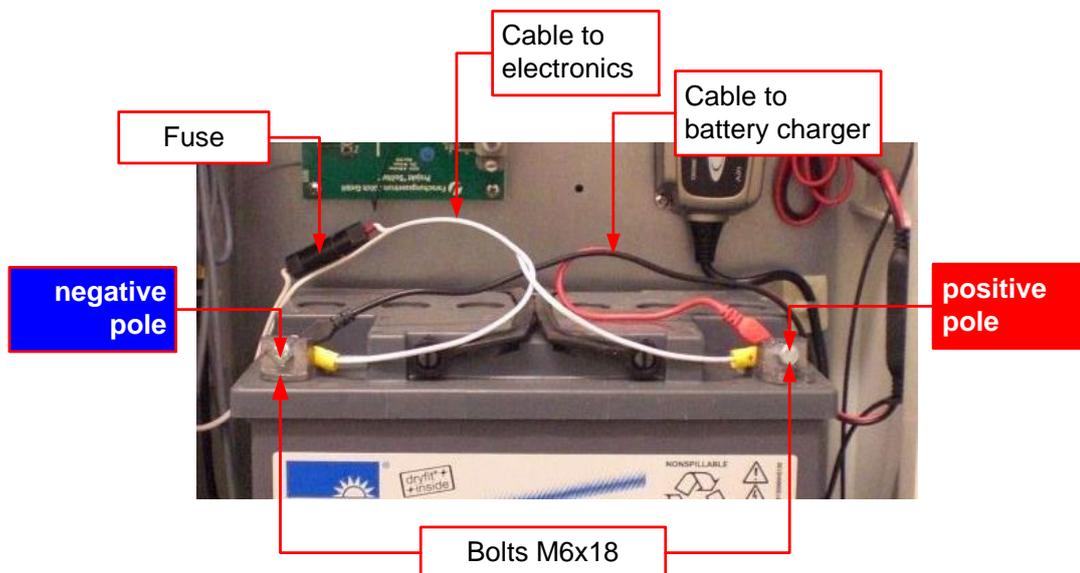
Figure 7: Connecting the battery

Using the plug connector, connect the white twin-core cable to its counterpart, which leads to the PCB (and to the modem at the coordinator). Then, connect the battery to the battery charger with the appropriate plug connector. Here, too, note the respective polarity.

5.2   Temperature Sensors

The temperature sensors are also pre-wired. However, for transport purposes, both sensors are inserted into the screwed cable gland at the bottom left of the router housing.

Loosen the screwed cable glands, pull out the temperature sensors and fasten them to the pole.
The cable for temperature sensor 1 (TS1, at the top of the pole) leads outside through the left gland, the cable for temperature sensor 2 (TS2, close to the ground) through the right gland (see Fig.8).
Once you have routed the cables, stow the surplus cable lengths in the router housing and tighten the screwed cable glands again.

Antenna cable

Temperature sensor
TOP
(TS1)

Temperature sensor
BOTTOM
(TS2)
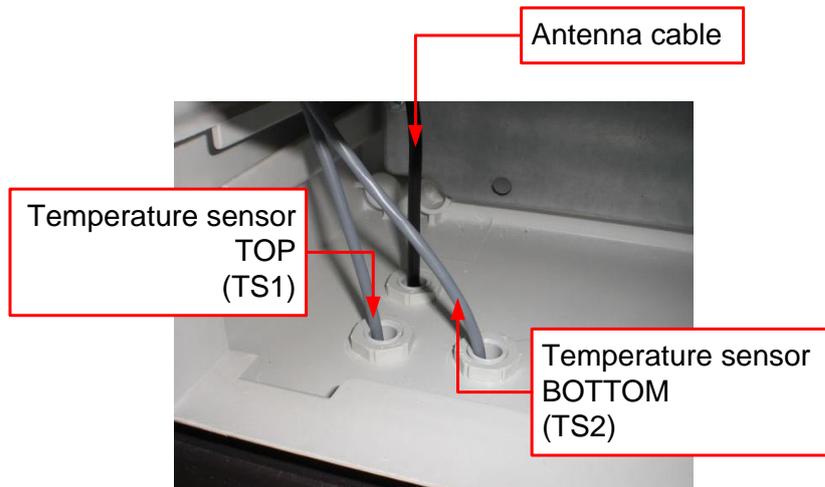
Figure 8: Screwed cable glands for temperature sensors

5.3 Antenna

Install the antenna for the router/coordinator at the end of the pole extension using the accompanying U-bolts and wing nuts. Screw the lightning protection system for the coaxial cable onto the N connection of the antenna and connect the green discharge cable to the pole below one of the winged nuts with the cable lug.
Then screw the antenna cable onto the lightning protection system.

Figure 9: Assembling the antenna with the lightning protection system

After mounting the antenna to the pole and connecting the cable to the antenna, it is necessary to protect the connection against humidity!

Please find the reel of self bonding electrical tape in the cardboard box labelled "replacement parts". This tape isn't adhesive, but by stretching and winding it around the cable, the overvoltage protector and the connector, it will bond and kind of vulcanize so the protection is very waterproof.

Please start winding at the bottom end and be sure to include the green cable for overvoltage protection. Please attach the green cable to the clamp of the antenna also.
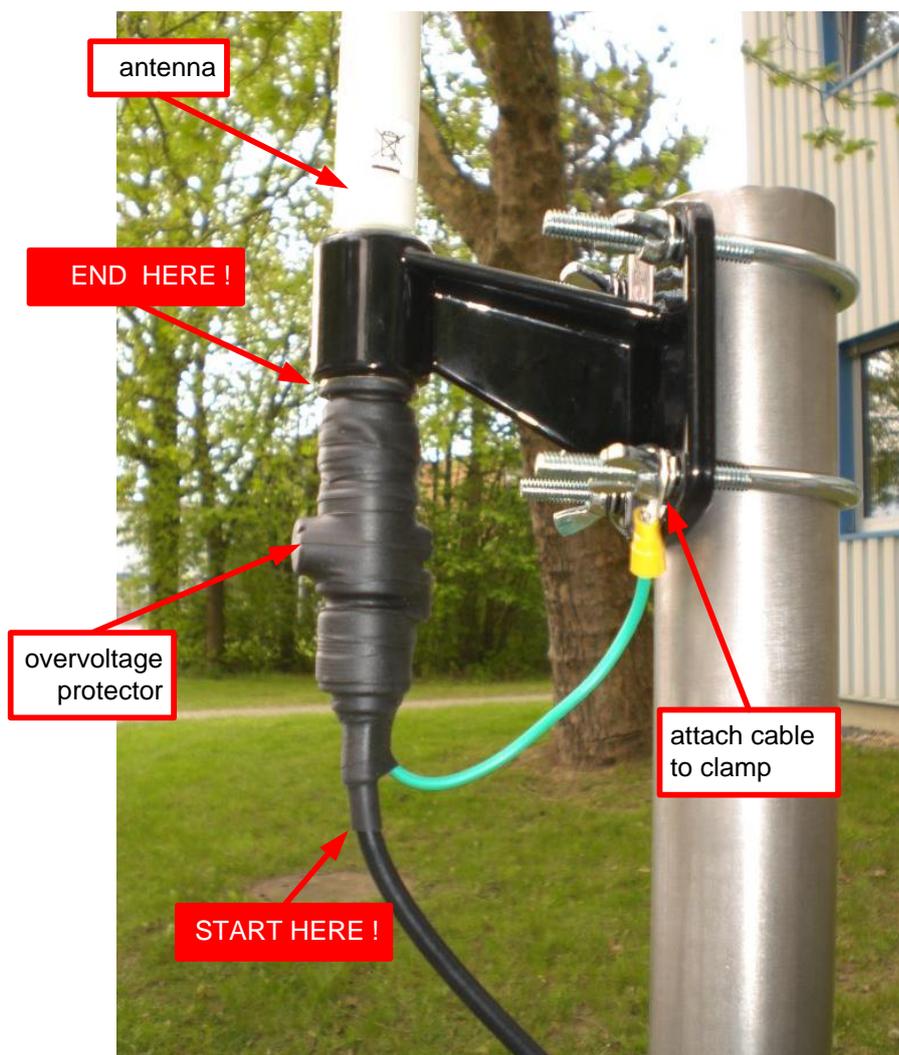
Figure 9b

5.3.1 Connecting to the router

Insert the cable into the left screwed cable gland at the back of the router housing and connect it to the Jennic module on the PCB using the SMA-U.FL adapter ("pigtail"). This U.FL connection is very small and must therefore be handled with care. The

connector has a snap fastener design and is simply pressed onto the module. While attaching the connector, it is advisable to keep the module pressed on the PCB with your other hand.

Secure the screwed connection between the antenna cable and the pigtail at the housing wall with a cable tie. In addition, route the pigtail cable below the PCB so that is cannot be pulled out accidentally (see **Fehler! Verweisquelle konnte nicht gefunden werden.**).
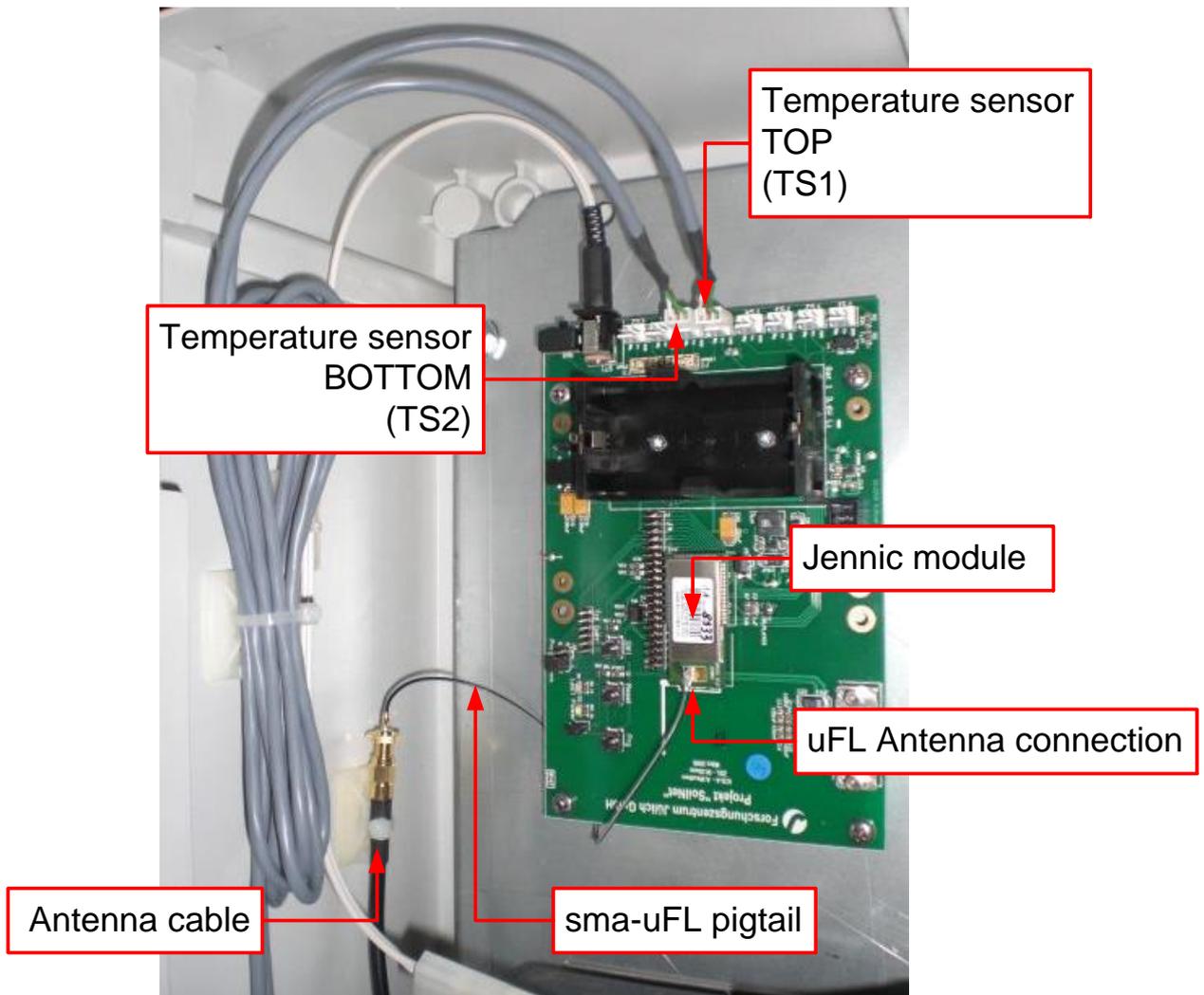
Figure 10: Cabling of the temperature sensors and the antenna

5.4 Modem (Coordinator Only)

Place the modem into the coordinator housing underneath the battery.
It is supplied with voltage by the second connection of the white twin-core cable.
Connect the modem to the coordinator PCB with a 9-pin serial D-Sub cable.
The antenna for the modem is screwed tightly to the coordinator housing. Connect it to the modem with the cable attached.
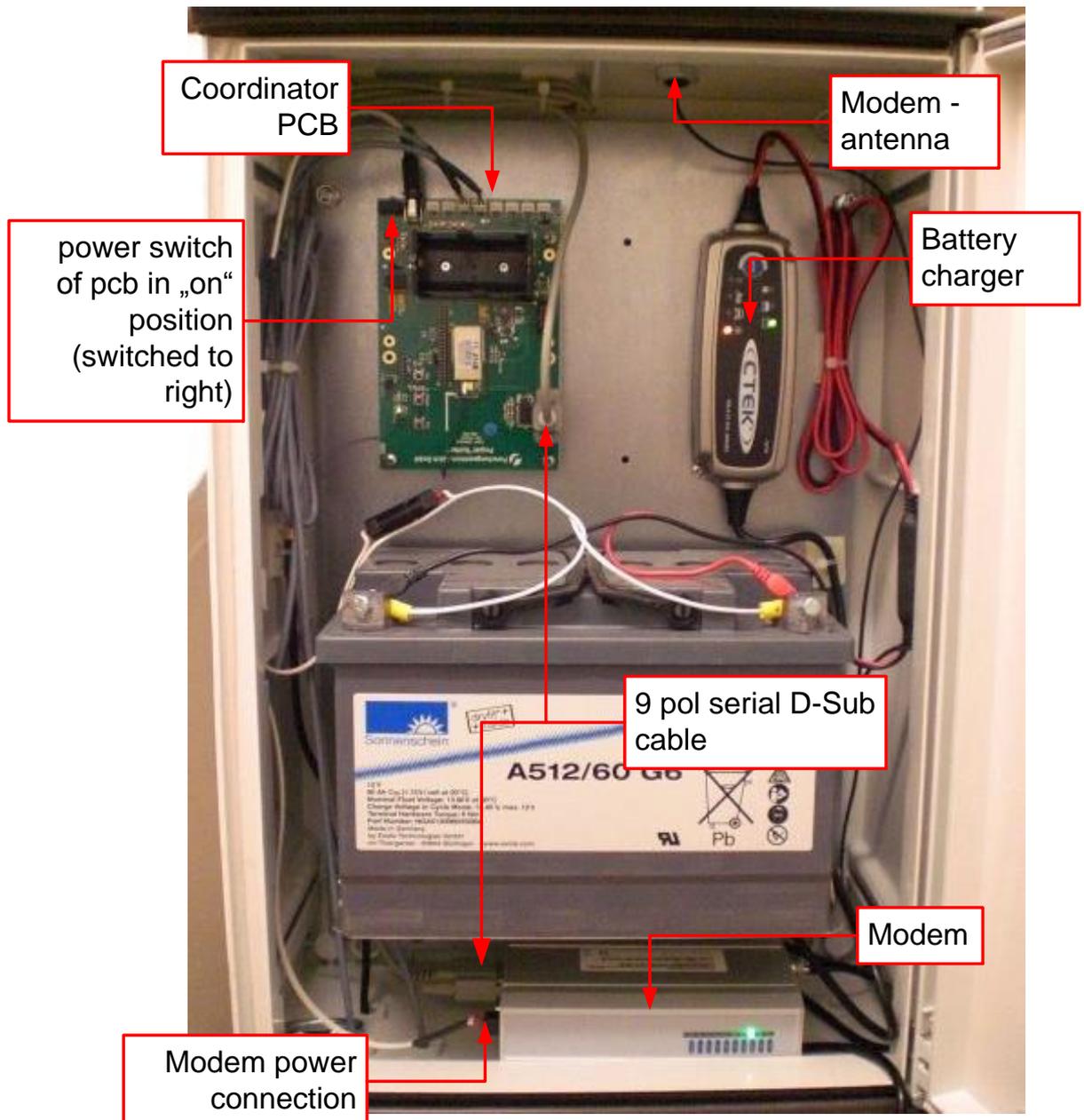
Figure 11: Coordinator

5.4.1 OpenVPN Modem

The OpenVPN modem is slightly deeper than the standard modem and must therefore be installed in a slanted position. For this purpose, a Plexiglas support is mounted inside the housing. The modem does not require any further fastening (the on/off button is located at the rear) and should be installed after the coordinator has been installed on the pole and is in its final position.

Be careful to position the modem in such a way that the door of the router housing closes properly.
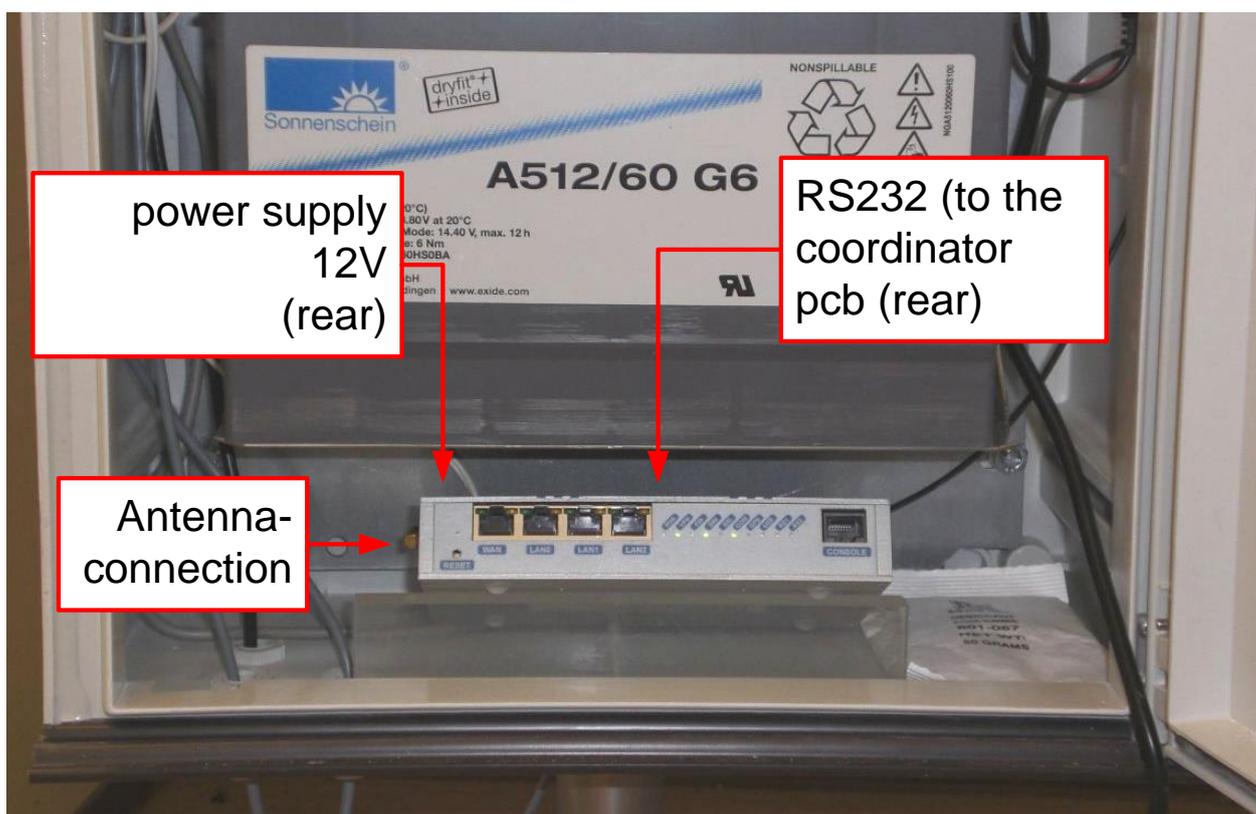
Figure 12: Installing the OpenVPN modem

6   Initial Operation of the Network

Position the coordinator and the routers and put them into operation before installing the end devices with the sensors, so that the end devices can be immediately tested for functionality before the drilled holes are closed again and filled.

This requires the PC to be ready for operation with the LabView software installed (see SoilNet CPA instructions).

6.1   Initial Operation of the Coordinator

The coordinator should be installed, ready for operation and in the correct position.

Connect the modem, switch it on (at the rear) and wait until the modem has logged into the network. The LEDs at the front indicate the current status. The LEDs have the following meaning:

Figure 13: Signal LEDs of the OpenVPN modem during operation

- **Run:**
  In flash mode when the modem is ready for operation.

- **VPN:**
  In flash mode while the connection is being established.
  In steady mode when the OpenVPN connection has been established.

- **SIM:**
  In flash mode while SIM card recognition is running.

In steady mode when the SIM card has been recognized and it is ready for operation.

- **SIG:**
  In flash mode when the signal strength of the cellular network connection is of medium quality.
  In steady mode when the signal strength is good.

- **COM:**
  In flash mode during startup.
  In steady mode when the SIM card communicates properly with the cellular network.

As soon as the modem is working properly and the connection with the CPA software (LabView) has been established on the target PC (virtual COM driver shows TCP/IP status as "connected"), put the coordinator into operation by switching on the coordinator PCB (move "Power" switch to the right towards the centre of the PCB, (see figure 11).

In the LabView software running on the PC, an entry will be displayed shortly afterwards on the "Router" page under the number of the coordinator.

6.2 Initial Operation of the Routers

When you have switched on the coordinator, use the same procedure to put the router(s) into operation (excluding the modem). Here, too, put the "Power" switch in the "ON" position (towards the right).

Like the coordinator, the router(s) send(s) a data packet to the PC; this packet becomes visible through an entry in the corresponding line on the "Router" page.

7 End Devices

Figure 14: End device with sensors connected

The end device consists of a housing containing the electronics (measuring and transmitting module) and six sensors.

The electronics are located in the lower part of the housing; the six cables of the sensors are permanently connected to the sensors through a screwed cable gland in the housing base plate. The base plate is connected to the housing cylinder by six screws and a sealing ring and does not need to be opened during normal operation.

The cover is located at the top and is fastened to the housing cylinder with three screws. The cover is placed on the screws by means of the longitudinal bayonet slots, so that the screws can remain in the cylinder during initial operation or any necessary maintenance work.

Caution:

Do not fasten the cover screws of the cover more than finger tight.

If they are tightened with a cordless electrical screwdriver, the bayonet slots in the cover may be damaged, so that the cover can no longer be turned.
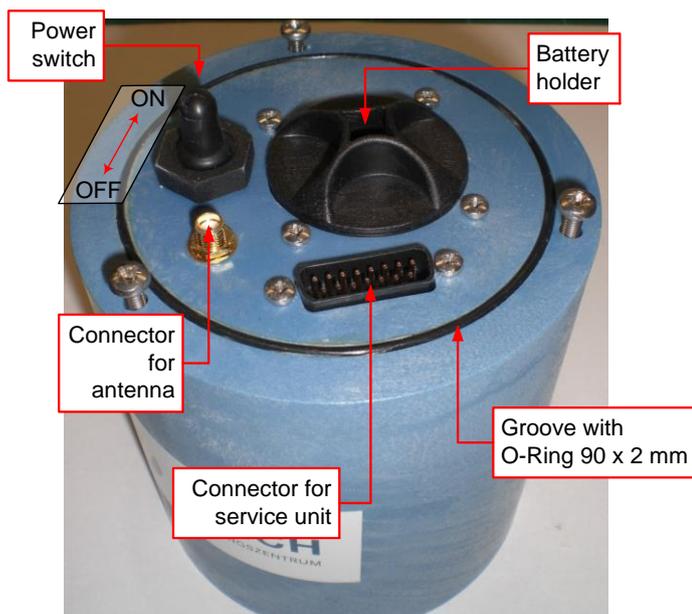
Figure 15: Operating elements of the end device

The antenna of the end device is located in the cover.

The power switch, the battery compartment and a multipin socket for connecting the service unit are located under the cover.

7.1 Inserting the Battery

In the end device, use a **ER34615M** type battery. Especially the appendage "**M**" is important, it stands for the high current capability.

Because of its Lithium ingredients, attention should be payed to European and local laws and safety instructions!

Batteries from the manufacturer "EVE" are highly recommended.

This is recommended because this type of battery has been thoroughly tested. This type of battery has a high short-time current rating, which is necessary for the measuring process, and a good long-term capacity.

Insert the battery into the compartment with the positive pole facing upwards.

Figure 16: Battery from "EVE", compartment cover

7.2   Battery Replacement

If the battery in the SoilNet End Device is low (< 3,2V) the correct working of the sensors is not ensured. The battery should be replaced.

Because of the long delivery time from China, there is a voltage drop of the normally used batteries (ER34615**M**) over the time. So the batteries, sold as "new" might have a voltage about 2,8V for instance.

Each new battery must be checked and perhaps activated before use.

7.3   Activator

The tool to activate the batteries is simply a battery holder with a load resistor mounted to its back. The resistor is about 18 Ohm, so the current drawn is about 200mA.

7.4   Activation

Place the new battery into the activator and connect a Voltmeter in DC mode to its terminals. The voltmeter shows the lower voltage rising with the time. At least the voltage should show not less than 3,4V. This can take 2-5 minutes, depending on the state of the battery.

Figure 17: Measuring battery voltage with activating tool

7.5   Installing the End Device

The end device is supplied with a commercial drain pipe (referred to as a "KG pipe") that has a cover and is sunk into the ground. Inside the pipe, a cap nut prevents the end device from sliding down. At the lower end of the pipe, there is an opening for routing the cables of the sensor to the outside.

Figure 18: KG pipe with end device and cable opening

When cutting the cables to size, make sure that there is sufficient additional length to roll up some of the cable inside the KG pipe, so that the end device can be pulled out for maintenance work.

When installing the sensors, ensure they are in good contact with the soil. No air should be trapped between the sensors and the soil, and no large stones should be in direct contact with the sensors to avoid an adverse effect on the accuracy of the measurement result.

Install the sensors with the flat surface in a vertical position to prevent water from collecting on the sensors.

SoilNet

Installation schemes

End-Device
under service

End-Device

50 cm

(A)

4 x Spade-
Sensors

50 cm

(B)

80 cm

KG pipe with
cover

(C)

60 cm

Spade Sensors
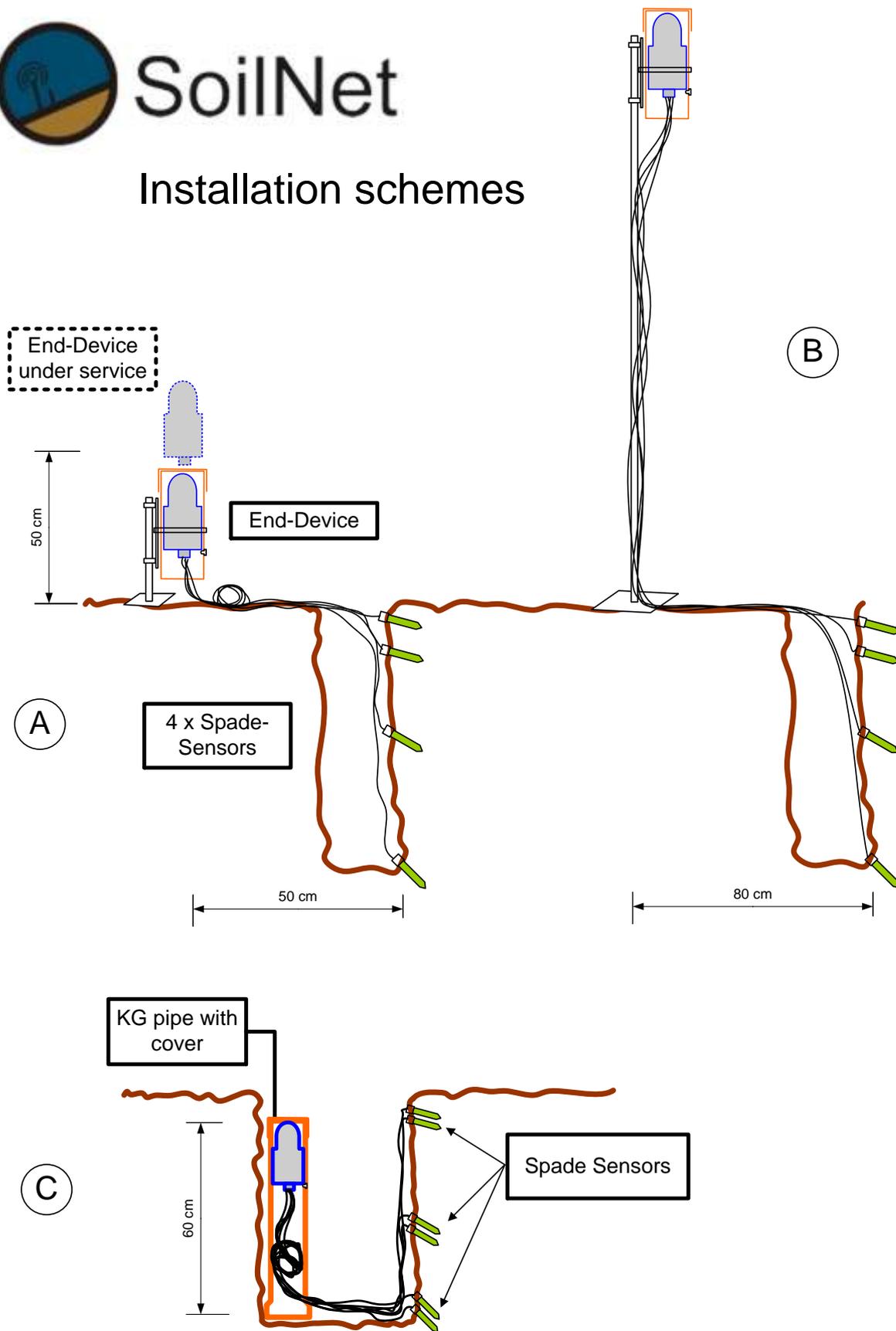
Figure 19: Different installing schemes in the ground

7.5.1 Positioning Tool

The SoilNet is supplied with a positioning tool made of aluminium, which consists of a head end for the sensor and two threaded poles that can be screwed together.
With this tool, the sensors can be driven into the ground at a greater depth. It is important that you do <u>not</u> try to push the sensor into the ground, as it may fold sideways and break, or the electronics may be damaged.
Instead, drive the sensor into the ground with short blows on the end of the pole using a hammer or rubber mallet.

Caution:

Before screwing together the poles and the head end of the positioning tool, lubricate the threads with grease or oil (WD40 or similar) to prevent the aluminium from cold-welding.

Figure 20: Positioning tool with sensor

As soon as you have installed the sensors, immediately check the measurement result with the service unit before screwing on the cover of the end device and sealing the KG pipe.

7.5.2 Service Unit

Figure 21: Service Unit

The service unit can be used to read out the current measurement data while installing, to set the configuration of the End-Device and to program the end device with new firmware. It provides only two buttons: the black one for resetting the End-Device, the blue one to set the Device into program mode.

Connect the USB connector to a notebook or PC. The software "BoxCon" should be installed already. See manual "SoilNet BoxCon".

Connect the service unit to the end device using the special **15-pin D-sub connector cable**.

Caution:

- **This cable should not exceed 80cm length to ensure save operation.**
- **Switch off the end device before connecting the devices.**

As soon as the end device is switched on, the **"Power" LED** of the service unit is lit. This LED therefore indicates the operating state of the end device, not of the service unit. The LED signed "**Power USB**" is lit when the Service Unit is connected to a computer. To make sure, the USB cable is recognized, it's driver should be installed, see chapter 8.2 .

With the Service Unit and a PC connected, the values of the sensors of the just installed End Device can be read out via the BoxCon Software.

With these values, a plausibility check can be carried out as soon as the sensors have been installed. The drilled hole should be filled only when the entries seem plausible.

To configure the End-Device see the BoxCon-Manual also.

7.5.3 Closing the End-Device

Make sure, the antenna cover is already connected if the Service Unit is used and the End-Device will be switched on. After installation of all sensors and checking their values, the End-Device can be closed.
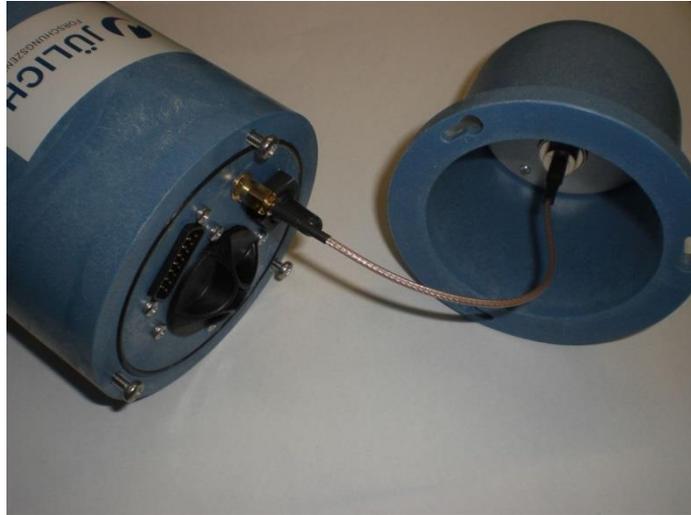
Figure 22: End device with antenna cover connected

Caution:

When screwing on the cover closed, ensure that

- **the interface between the cylinder and the cover as well as the groove for the O-ring are clean,**

- **that the O-ring (90 x 2 mm) is inserted correctly and lubricated with some grease** and

- **the three screws are only tightened by hand, since the longitudinal bayonet slots may otherwise be damaged**.

Afterwards, you can insert the closed end device into the KG pipe and close the pipe with the accompanying lid. Here, too, make sure that the rim of the pipe and the inner edge of the lid are clean, so that the lid can be easily removed later.
In order to later open the pipe, you can additionally use the dedicated pull-off tool. Put it over the lid, let the three clips snap into place and pull off the lid.

Figure 23: Pull-off tool for pipe lid

8 Firmware Updates

The current firmware of the Jennic module is installed on the devices supplied (coordinator, routers and end devices). However, in the case of future further developments, it is possible to update the firmware on the devices.

For an update, you will require the following:

- Service Unit

- PC or notebook with up-to-date Flash software
  (Jennic JN51xx Flash Programmer 1.8 or later)

- Up-to-date binary file

8.1 Service Unit

The service unit serves not only as an interface between a computer and the End Device to check the current measurement and status values, but also for downloading new firmware.
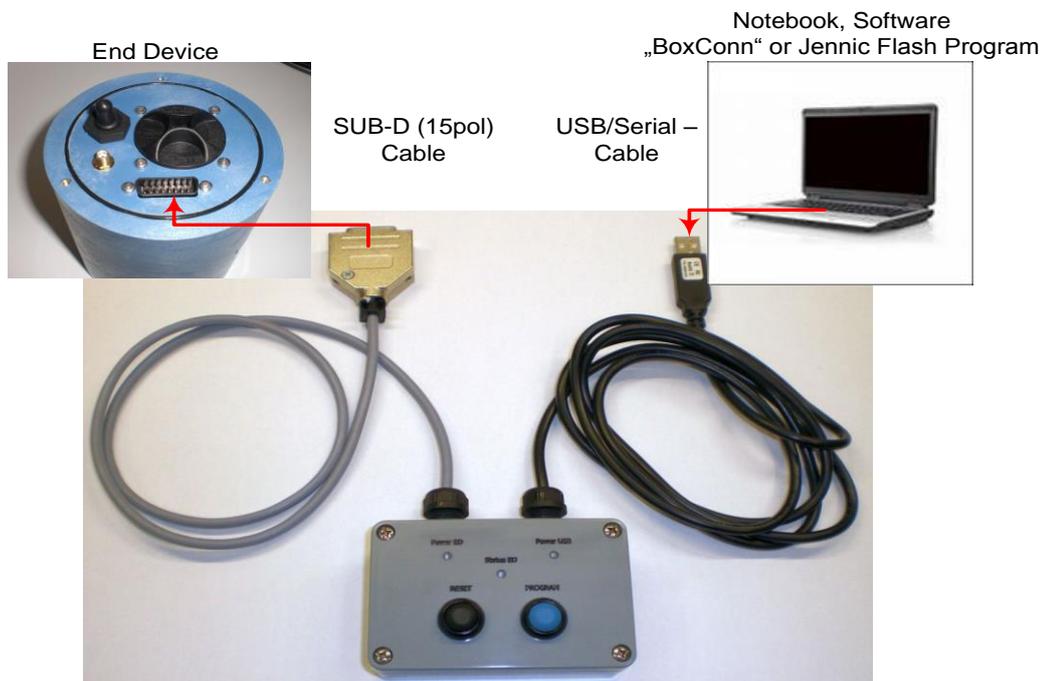
Figure 24: Connecting the Service Unit

There are two buttons on the Service Unit:

- Reset: This button resets the End-Device and restarts it.

- Program: This button puts the End-Device into the programming mode, so that new firmware can be installed.

8.2   Installing the Virtual COM Port

A USB - Serial cable is also needed for updating the routers and the configurator.
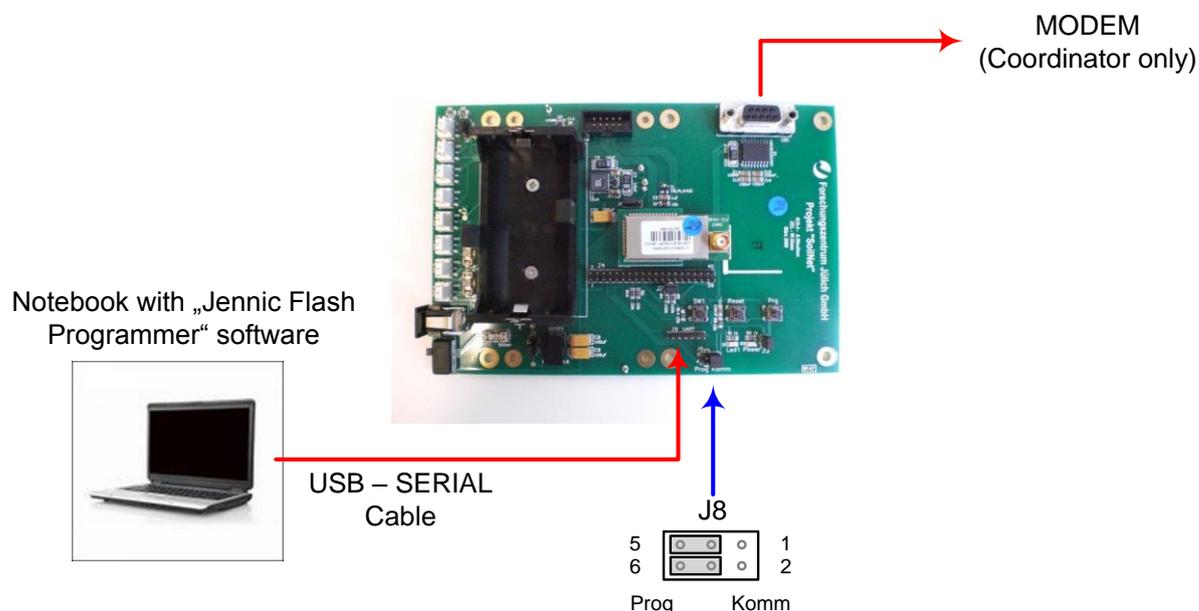
Figure 25: Router PCB with serial cable

Using a USB serial interface cable as a stand alone cable as well as in conjunction with the Service Unit (fix mounted) requires a driver to be installed under Windows XP.

The driver can be found on the notebook supplied in the directory c:\SoilNet\Software\Treiber_USB_RS232.
Alternatively, the driver can be downloaded from the Internet at
http://www.ftdichip.com/FTDrivers.htm.

When you connect the USB cable for the first time, Windows will detect the new hardware and open the "New hardware detected" window.

Window will then install two drivers: the USB driver and the driver for the virtual COM interface.

Please select the location of the drivers manually (the same location for both drivers).

On Windows 7 or later, the hardware detection will automatically recognize the new cable and will install the drivers.

8.3 Installing the "Jennic JN51xx FlashProgrammer"

The software for updating the devices can also be found on the notebook supplied.

In the directory "c:\SoilNet\Software\Jennic Flashprogrammer", you will find the file "FlashGUI.exe". Double-click on the file to install the software.

When the software and the driver for the USB cable have been installed, the devices can be programmed with the new firmware.

There is no further documentation for the software. In the following screenshot, only those elements are labelled that are required for a firmware update on the end device, router and coordinator.
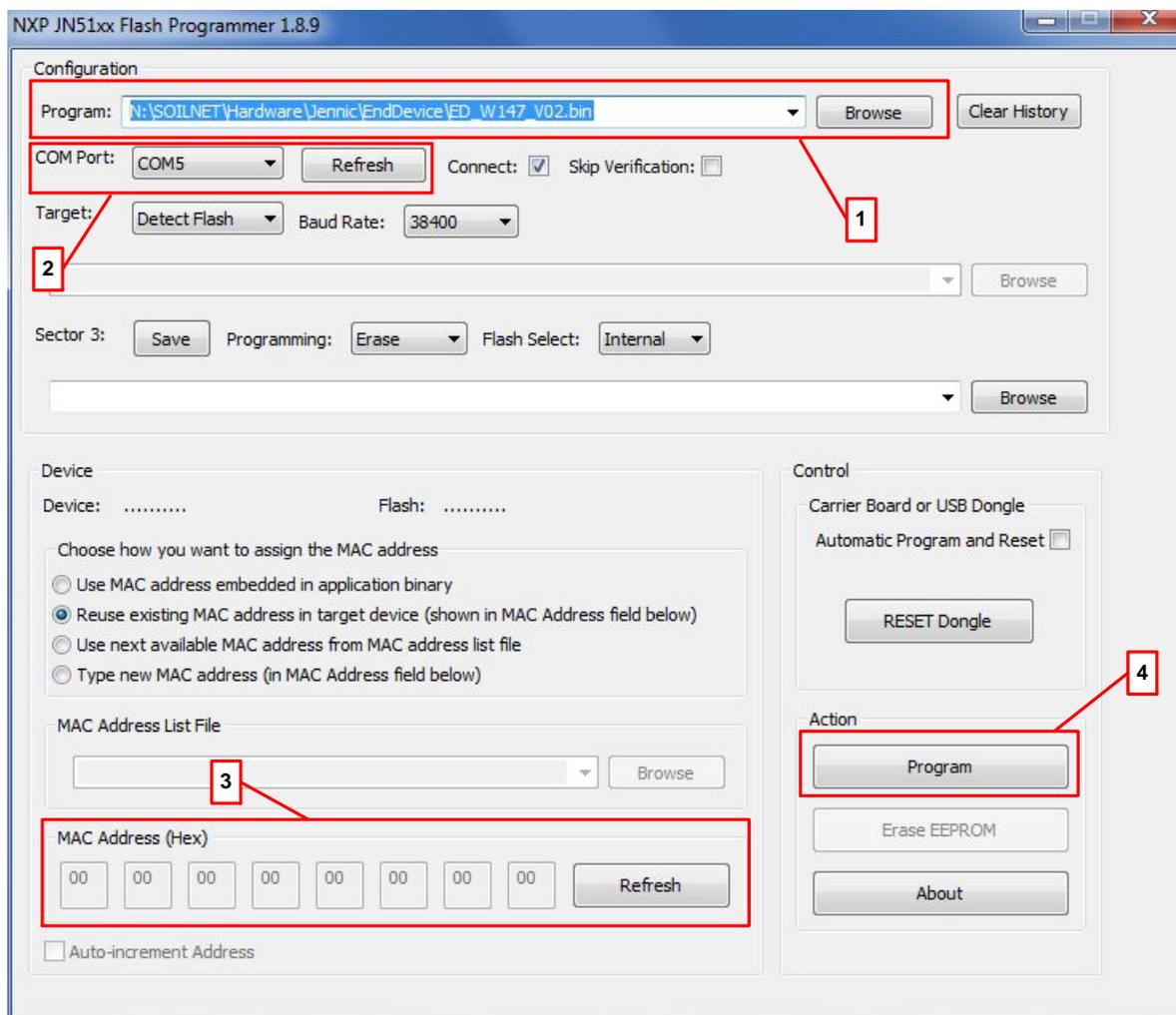
Figure 26: Jennic Flash Tool

8.4   Firmware update of the End Device

- Switch off the End-Device.
- Run the computer
- Connect the Service Unit with its USB cable to a free USB Port at the computer. The LED above the program button should lit ("Power USB").
  If the computer is running Windows 7 or later, it will automatically recognize a new virtual RS232 (COM) port.
  If you're running Windows XP you may have to install a FTDI driver first (see 8.2).
- Open the computers device manager (press keys "win"&"pause" to open) and look for the entry "Ports (COM&LPT)/ USB serial port). You will find the number of the COM port)
- Start the Software "**NXP JN51xxFlash Programmer 1.8.9**" (or later version, see 8.3).
- Connect the End-Device to the Service Unit
- Press and hold both **Reset- AND** the **Program** buttons on the service unit while switching on the End-Device.
- Release the reset button first, then release the program button.
  The End-Device is now in program state.
- In the Flash software you'll find under "Configuration" a dropdown field called COM port (see "2" in figure 26). Here you have to insert the number of the virtual COM port you've found in the device manager above. Make sure, the End Device is in program state already, otherwise the flash program will reply an error.
- In the Configuration tab you'll find a field "Program" where you can browse your actual *.bin file (see "1" in figure 26).
  Please find the file "ED_Ro_W251_V26" or later. This is the new firmware for the End-Device.
- You may press the "Refresh" button (see "3" in figure 26) to verify the correct recognized MAC Adress of the Jennic module.
- Press the "Program" button (see "4" in figure 26) and wait for the transmission of the file and its verifying.
- After programming the End-Device, switch it off.
- Close the Flash Software
- Open the BoxCon Software.
- Make sure, the COM port for the Service Unit is set correctly in the BoxCon Software (the same number as above).
- Press and hold "Reset" on the Service Unit while switching on the End-Device. Release the Reset button. The End-Device will immediately start to measure.
- On the "Data V3" tab you will see the results.
- Keep the End-Device running while disconnecting the cable from the Service Unit.

8.5 Updating Routers and Coordinator
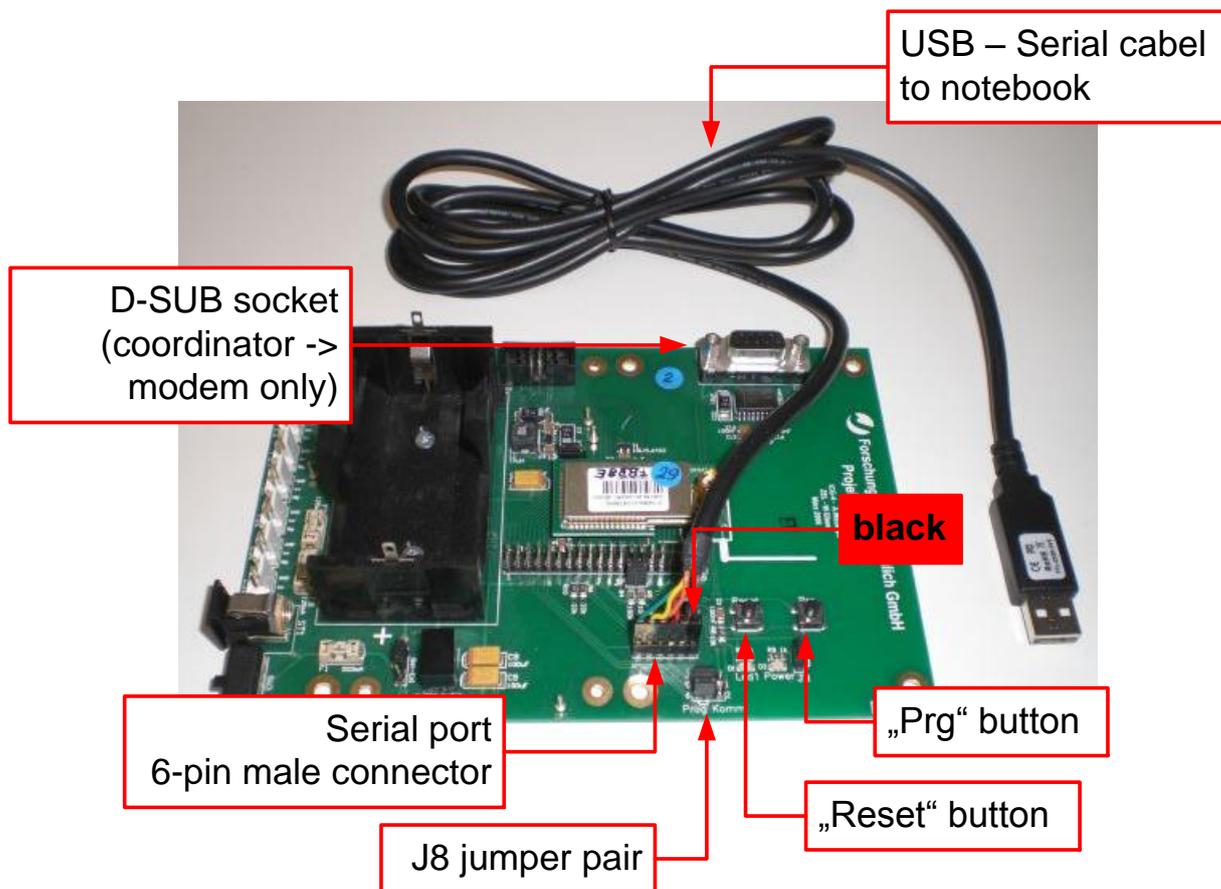
Figure 27: Router pcb with USB - serial cable

A Serial USB interface cable is used for updating routers and the coordinator. This cable has a single pole 6-pin header .

It will be connected directly to the PCB of the **coordinator** or a **router** (**Fehler! Verweisquelle konnte nicht gefunden werden.**).

See 8.2 for detailed information on using the serial USB cable.

Caution:

Note the mating direction of the socket strip. The black wire must take place in the direction of the lower edge of the circuit board if used in the router housing. In the picture Fig.27 the black wire is on the right side of the connector.

In addition, the procedure is different depending on whether the coordinator or a router is to be updated:

- **Coordinator**
  If the coordinator is in normal operation, the J8 jumper pair is set in the "Komm" position (pin 1 and 2). That means that the "DB1" D-sub socket is activated on the PCB connected to the modem.
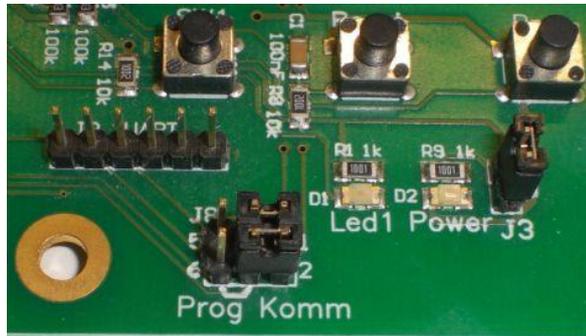
For the programming process, set the two jumpers in the "Prog" position (pin 5 and 6) in order to activate the serial interface at the 6-pin male connector.

- **Router**
  The D-sub socket is not required for the router during normal operation. Therefore, the J8 jumper pair is already in the "Prog" position (pin 5 and 6) and the serial interface at the 6-pin male connector is activated.

1. Switch off coordinator/router (PCB).

2. Coordinator: Set J8 jumpers to "Prog" position (see above).

3. Connect USB serial cable to notebook and PCB
   (observing orientation of the socket terminal strip)!

4. Start the notebook.

5. Simultaneously press the "Reset" and "Prg" buttons on the PCB and keep pressed.

6. Switch on the PCB with the buttons depressed.

7. Release the "Reset" button (keep "Prg" depressed).

8. Release the "Prg" button.

9. Start "Jennic Flash Programmer" software.

10. Software: Select the required file using "Browse".

11. Software: Select the correct COM port under "Configuration".

12. Software: Press "Refresh" button, check MAC address.

13. Software: Press "Program" button and wait until programming and verification process is complete.

14. Switch off the PCB.

15. Coordinator: Reset J8 jumpers to "Komm" position.

16. Disconnect USB serial cable.

17. Switch on PCB with the "Reset" button pressed.

9 Annex: Technical Drawings

Drawing 1: Pole Fastening (Overview)

Drawing 2: Router – Fixing Rail 1/3

Drawing 3: Router – Fixing Rail 2/3

Drawing 4: Router – Fixing Rail 3/3

Parts List of Fastening Material

Drawing 5: Router/Coordinator Circuit Diagram

Router mounting at rail, 2 routers back to back

Wall bracket [WH]

Nut M6 [M1/1-2], [M3/1-4]

Rail [RS1]

Screw M6 x 80 [S3/1-2]

Split washer M6 [SF1/1-2]

Washer 6,4 x 12 [SS1/1-2]

large diameter washer 6,4 x 20 [SK1/1-6]
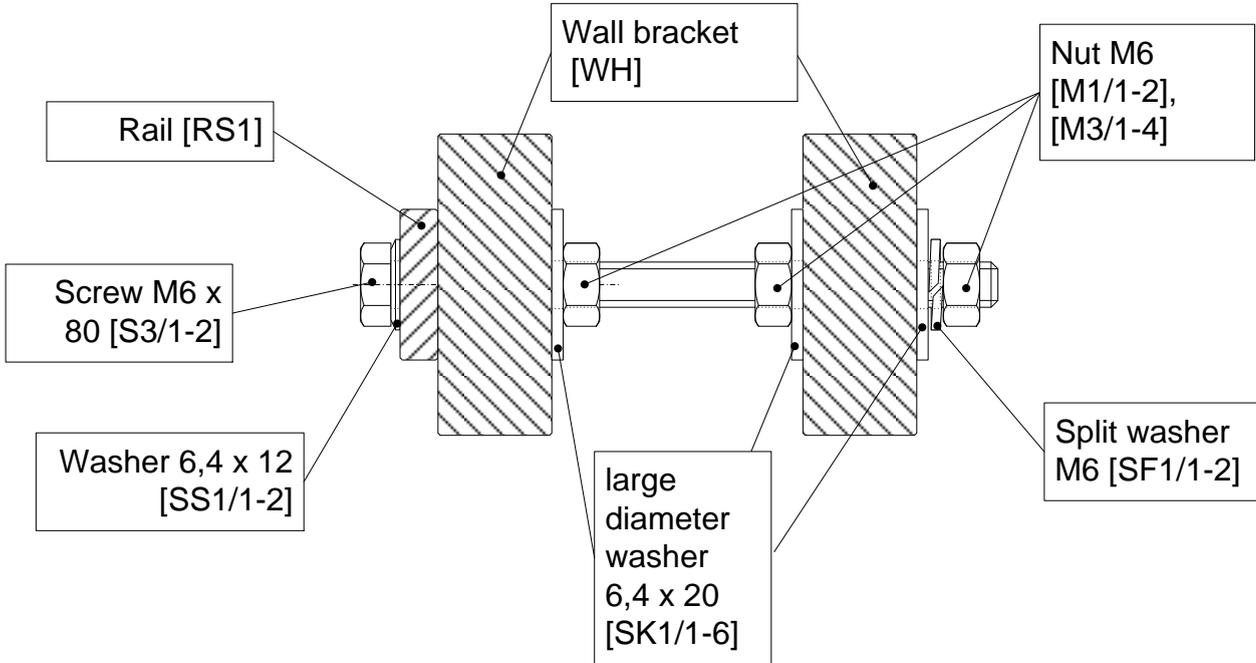
Pole / cantilever fastening (8x)

Nut M8   [M3/1-4]

Square tube cantilever [MR3/1-4]

split washer M8 [SF2/1-4]

Baseplate [MR4/1]

large diameter washer 8,4 x 25 [SS4/1-4]

Mast / Rohr - Verlängerung (1x)

Screw M8 x 50 [S5/1-4]

Upper pipe [MR2]

split washer M8 [SF3]

Screw M8 x 50 [S4]

Washer 8,4 x 16 [SS3/1-2]

Nut M8 [M4]

lower pipe [MR1]

A

Washer
6,4 x 12 [SS1/1-2]

Large diameter washer
6,4 x 20 [SK1/1-2]

Split washer M6
[SF1/1-2]

Fixing Rail
[RS1]

A

Bolt M6 x 30
[S1/1-2]

Wall Bracket
[WH]

Nut M6
[M1/1-2]

Hexagon Socket Bolt M8x20 [SI1/1-2]
with washer [WS1/1-2] for fastening to the router housing

					Datum	Name	SN.KS 60.40.rail		
Bernd Schilling IBG-3 Agrosphäre Tel. 02461-614562							Soilnet Router		
				Gezeichnet	14.07.2011	B.Schilling	Fixing Rail		
				Kontrolliert					
				Norm					
				Forschungszentrum Jülich GmbH 52425 Jülich			Router Pole 1/3		1
									A4
Status	Änderungen	Datum	Name						

Wall bracket
Router [WH]

Fixing rail
[RS1]

Bolt M6 x 60
[S2/1-2]

Washer 6,4 x 12
[SS1/1-6]

Bolt M6 x 30
[S1/1-2]

Hexagon socket bolt M8x20 [SI1/1-2] with washer 8,4x16
[WS1/1-2] for fastening to the router housing

n:\SOILNET\Hardware\Router\Montage Router-Mast_2_Single_EN.idw

SN.KS 60.40.rail

Soilnet Router

				Datum	Name	
			Gezeichnet	14.07.2011	B.Schilling	
			Kontrolliert			
			Norm			

Fixing Rail Single

Forschungszentrum
Jülich GmbH
52425 Jülich

Router Pole 2/3

1

A4

B

mount to router housing

Fixing rail
[RS1]

B

Washer
6,4 x 12
[SS2/1-6]

[Clamp]

Bolt M6 x 60 [S2/1-2]

Nut M6 [M2/1-4]

n:\SOILNET\Hardware\Router\Montage Router-Mast_3_Single_EN.idw

Bernd Schilling							SN.KS 60.40.rail		
IBG-3 Agrosphere Tel. 02461-614562							Soilnet Router		
					Datum	Name			
				Gezeichnet	14.07.2011	B.Schilling	Fixing Rail Single		
				Kontrolliert					
				Norm					
				Forschungszentrum Jülich GmbH 52425 Jülich			Router Pole 3/3		1
									A4
Status	Änderungen	Datum	Name						

Parts List of Router Fastening

Baseplate

1 standpipe 2m with baseplate
4 pcs cantilever feet (rectangular tube) 20 x 20
8 pcs hexagon head bolts M8 x 50
8 pcs hexagon nuts M8
8 pcs large diameter washer 8,4 x 25
8 pcs split washer M8

Standpipe connection

1 pipe extension 1m
1 hexagon head bolt M8 x 70
1 hexagon nut M8
1 washer 8,4 x 16
1 split washer M8

Router Installation

2 pcs fixing rails
2 pcs clamps
4 pcs hexagon bolts M6 x 30
4 pcs hexagon bolts M6 x 60
12 pcs hexagon nuts M6
16 pcs washers 6,4 x 12
4 pcs large diameter washers 6,4 x 20
4 pcs split washers M6
4 pcs wall brackets
4 pcs hexagon socket bolts M8 x 20
4 pcs washers 8,4 x 16

Radio
antenna

Temperature sensor 1

Temperature sensor 2

Router / Coordinator Circuit Diagram

ST1   TS2 TS1

SOILNET
Router /
Coordinator
PCB

Jennic
module

D-Sub *
9pin

RS 232 *

battery
charger
CTEK
MULTI XS
3600

connector

MODEM *
antenna

Sonnenschein
A 512 / 60
battery

FUSE
1A

connector

D-Sub *
9pin

MODEM *

MAINS
~ 220 V

* parts only used
  in coordinator