

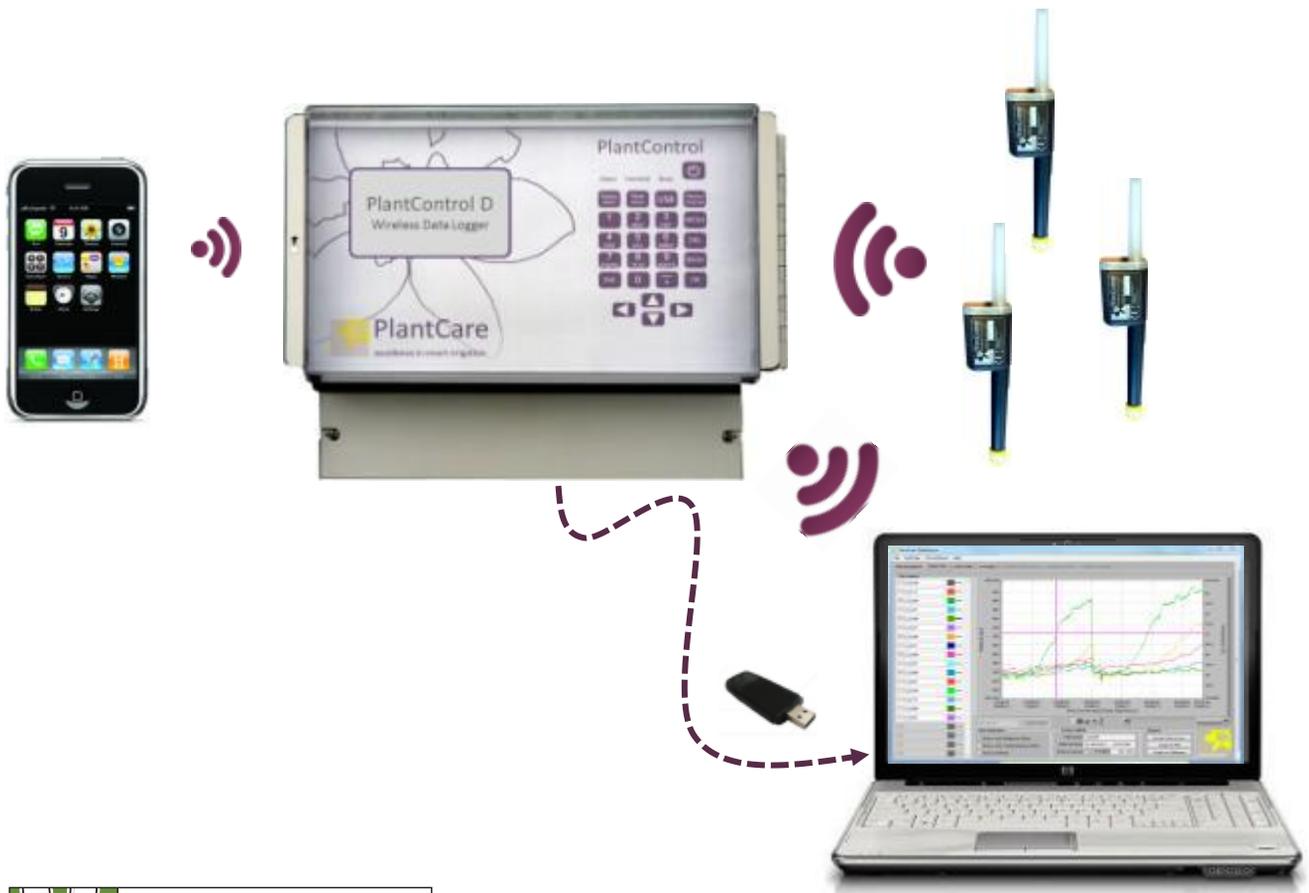


# PlantControl D

Wireless Data Logger and Soil Moisture Sensors

Operating Instructions

Ver. 3.46



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# 1. Introduction

Please read through these instructions carefully before configuring your PlantControl D central unit and the soil moisture sensors.

## Scope of delivery

- PlantControl D central unit (Data Logger)
- Wireless soil moisture sensors (quantity and version acc. to order)
- PlantCare DataViewer software for the display and analysis of the measured data



PlantControl D central unit



Wireless sensor stick version



Wireless sensor cable version



Sensor with protection cap

## Optional accessories



Solar cell with cable connection to the Data Logger



Replacement tip with felt for sensor (depending on soil type, different felts are available)



Repeater (Range Extender)



External antenna for enhanced signal reception. PlantControl central unit or GPRS Modem

## Optional functions

- Remote retrieval function
- SMS-Alarm function

## Basic aspects

In combination with PlantCare's wireless soil moisture sensors, the PlantControl D is used for the wireless monitoring of soil moisture levels and soil temperature for scientific and agricultural applications. A specially designed software allows the connection of up to 99 sensors, which are synchronized by the PlantControl D central unit and coordinated. This means that the sensors transmit the measured data sorted and in the correct sequence within a short period of time. A USB interface allows to export data very easily. The optional remote retrieval function incl. a GPRS Modem allows the remote retrieval of data over the mobile network, i.e. over virtually any distance (either automatically and/or by SMS request). In addition, all relevant system data and alarm messages are transmitted as an E-Mail attachment. With the optional SMS-Alarm function, alerts are sent by a SMS. A special software (PlantCare DataViewer) allows quick analysis of irrigation data. Corrective actions can be carried out from a distance without extensive analysis on the spot.

The worldwide patented PlantCare sensor technology is based on a micro-thermal method of measuring soil moisture. A specially designed felt material, which is in moisture equilibrium with the soil serves as a standardized interface between the soil and the sensor. For the measurement of soil moisture, the sensor is heated for a short time and the cooling time is then determined, which varies depending on the soil moisture level. The cooling time of the sensor thus provides a reliable indication of the water content in the soil. The sensors require no maintenance and have no corrosion-prone parts.

In developing the Plant Control D, performance, the ease of use and reliability were given the greatest priority.

## General Features

- Up to 99 wireless sensors can be connected.
- Weatherproof IP67 housing (central unit and sensors)
- Signal range up to 200 meters line-of-sight, dependent on the type of terrain and visual contact between sensors and the central unit. With optional range extenders, this range can be extended to several kilometers.
- Licence-free transmission frequency: 868 MHz or 915 MHz, interchangeable
- Measurement of soil moisture levels and soil temperature at freely selectable intervals.
- Measurement in: relative % or hPa (for hPa 6 standard soils to choose from)
- Speedily reaction to changes in moisture levels.
- Reliable results even at minimum depths (from 5 cm).
- Value measured is unaffected by salt or fertilizer content.
- Precise recording of measurements through built-in quartz clock in PlantControl D central unit.
- The PlantCare DataViewer Software allows an optimal display and analyses of the data.
- Various options such as remote retrieval and SMS-Alarm functions are available.
- Frost resistant
- Operating temperature: -20° C to +50° C
- Language setting German/English

## Technical specifications PlantControl D

- Up to 100.000 data sets can be recorded
- USB interface for data export on USB stick
- Power supply: 8 AA rechargeable batteries (inclusive), in combination with mains (110/230V) or solar cell 12W
- Dimensions: 29 x 23 x 15 cm

## Technical specifications sensors

- Can be used in all soil types
- Power supply: 2 AA 1.5 V batteries
- Battery life span approx. 1 year depending on measuring cycle
- Dimensions: 4 x 4 x 29 cm (shortest version)
- Available length:
  - Stick version: 18/35/60/100 cm
  - Cable version: 60/250 cm (other length available on request)

## Technical specifications repeater (range extender)

- Weatherproof IP67 housing
- Signal range sensor to repeater up to 200 meters and repeater to repeater up to 3km (line-of-sight and dependent on the type of terrain).
- Power supply: 8 AA rechargeable batteries (inclusive), in combination with mains (230V AC) or solar cell
- Dimensions: 5.5 x 13 x 17 cm

## Sensor measurement data

- Moisture display:
  - In relative %-units or
  - hPa suction pressure for 6 standard soils
- Measuring range soil moisture (at a soil temperature between 2° C to +37° C\*):
  - Relative %-units: 0 - 100%
  - hPa: 0 – 400 hPa high sensitivity / > 400 - 800 hPa lower sensitivity
- Measuring range soil temperature: -20°C to +50° C
- Measuring accuracy:
  - Soil moisture: +/- 3%
  - Soil temperature: +/- 0.3° C
- Reading accuracy:
  - Soil moisture in relative %: 1%
  - Soil moisture in hPa: 1hPa
  - Soil temperature: 0.1 °C

\* Sensors for soil moisture measurements at soil temperature range between 2° C to +50° C on request

## Quick start guide

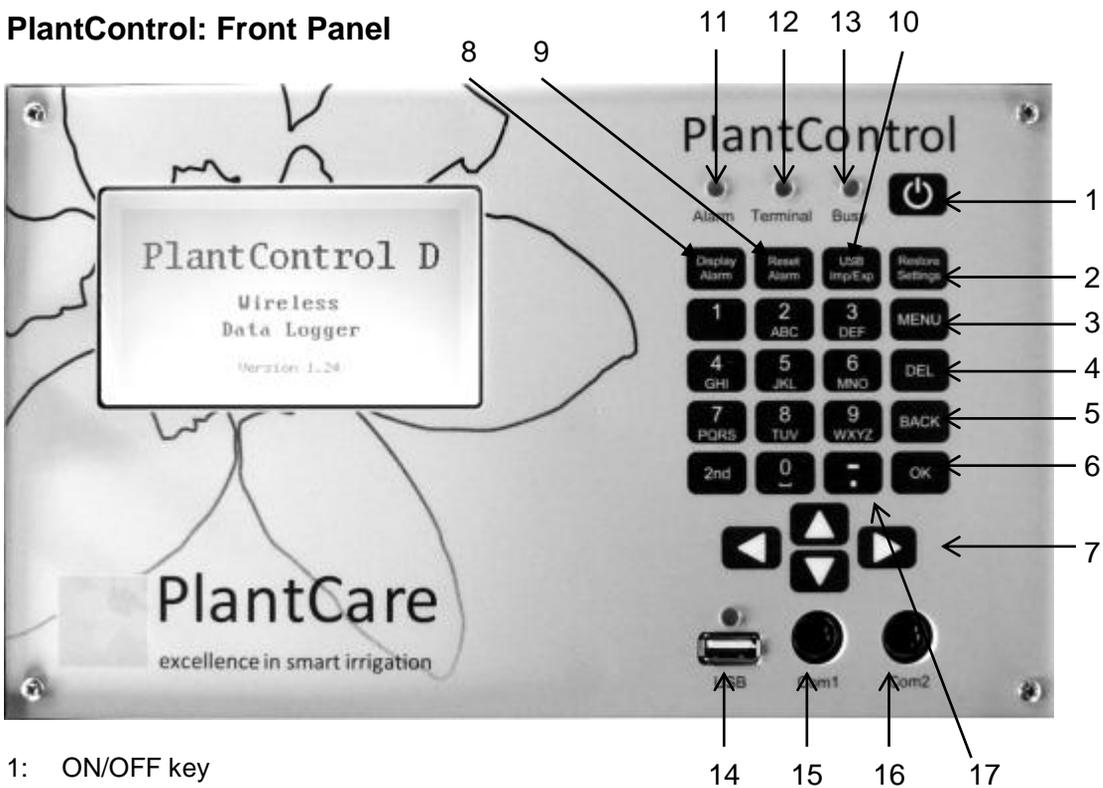
### At the office

1. Connect cable for mains-connection or solar cell to the PlantControl central unit.
2. Outside Switzerland, pull out security film from the PlantControl central unit (already assembled with batteries). Insert sensor batteries.
3. Define settings for the PlantControl D central unit: Menu Settings > Controller
4. Initialize repeater (if part of delivery scope): Menu Initialize > Repeater → OK-button, hold the button on the repeater for 5 seconds.
5. Initialize sensors: Menu Initialize > Sensors
6. Define sensor settings: Menu Settings > Sensors
7. For settings of optional functions such as remote retrieval and SMS-Alarm function, go to the appropriate chapter in this manual.

### On-Site:

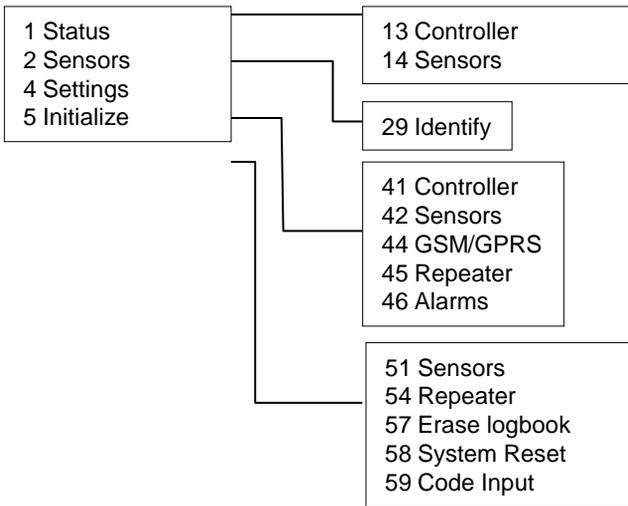
1. Switch on sensors at the insertion place and check reception strength : Menu Status> Sensors. Insert afterwards the sensor with the protection cap into the soil.

## PlantControl: Front Panel



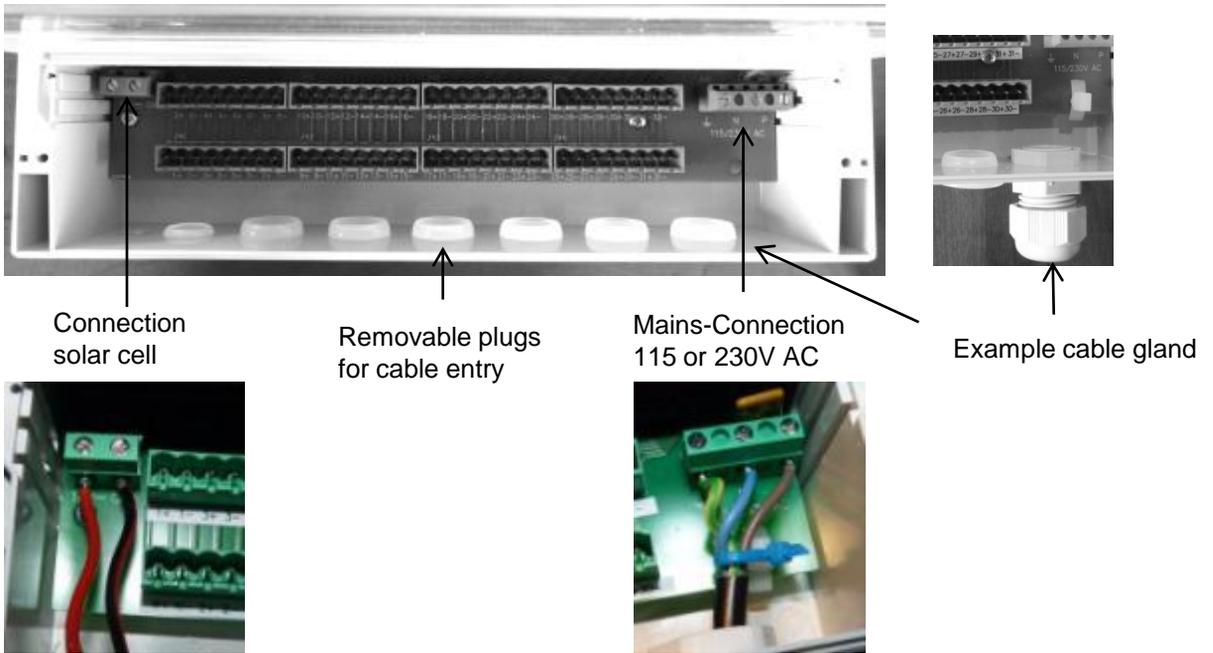
- 1: ON/OFF key
  - 2: Restore-Settings: not yet activated
  - 3: Main Menu
  - 4: DEL = Deletes last entry
  - 5: BACK = Goes back one menu level
  - 6: OK = Confirm selection or entry
  - 7: Cursor keys
  - 8: Display Alarm: Displays active alarms
  - 9: Reset Alarm: Resets alarms
  - 10: USB Imp/Exp: Button to call the import-export functions via USB interface
  - 11: Alarm-LED
  - 12: GPRS-Terminal-LED: Flashes every 3 seconds when network connection is established
  - 13: Busy-LED: Lights up when the central unit is busy (operating panel is blocked)
  - 14: USB-Interface
  - 15: Service Interface
  - 16: Service Interface
  - 17: Space key: Deletes entries in a text field
- Special characters can be found under the key "1" and the "semicolon" key.
  - Key Lock: By simultaneously pressing the keys "2nd" and "MENU" on or off.

# PlantControl Menu Structure



Go to the required menu item by using the cursor keys. Selectable menu items as well as data entry fields are shaded in grey. Enter in selected menu or data field by pressing the OK key.

# PlantControl Electrical Power Connections



Please note that no mains plug is included in the delivery, as every country requires its own special plugs. For each required cable entry, a cable gland is recommended, in order to protect the electronics. Do not connect to the power supply, unless you have finished the cabling as described below.

To connect your specific mains plug or any other cable connection, please unscrew the lid at the bottom of the casing.

**Mains 115 or 230 VAC:** The picture above shows the connection terminals for the mains. Besides the phase (P) and the neutral line (N) a ground wire has to be used. The power cable is fed through one of the cable entries and connected to the screw terminal.

**Caution:** Check first under the menu Settings> Controllers> AC Input, whether 115 or 230 volt is displayed. If you would like to change the AC input, please contact your supplier.

**Solar Cell:** The solar cell is connected to the 16V DC screw terminals. For this, the cable is pulled through one of the cable entries. Connect the black wire to GND and the red wire to 16 VDC.

After finishing the cabling, the cover has to be placed and screwed again. Please make sure that the rubber seal on the lid as well as the opposite side is not dirty.

# Introducing the Repeater (Range Extender)

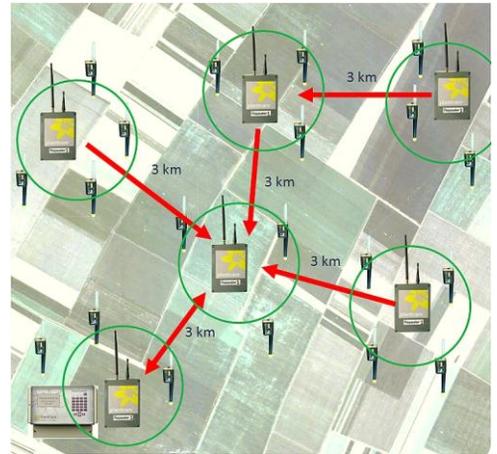
Since the signal range between a sensor and the PlantControl central unit is limited to a maximum of 200 meters, repeaters with a signal range of up to 3 kilometers have been developed. If several such repeaters are used, the signal range can be extended up to 30 km. Power is supplied by either an AC adapter or a solar cell.

## Configuration options

- Up to 30 repeaters can be connected with a PlantControl.
- Up to 10 repeaters can be connected to each other in a row (max. 30 km).
- Up to 5 repeaters can be connected to one repeater.
- Up to 60 sensors can be connected with a repeater.

## Note:

- The first repeater must be positioned within 200 meters from the PlantControl.
- No sensors may be assigned to the first repeater.
- A PlantControl system requires a minimum of two repeaters.
- Signal range is up to 3 km line-of-sight and dependent on the type of terrain.
- The repeater frequency band is 868 MHz. Therefore the PlantControl as well as the sensors must be set to 868 MHz.



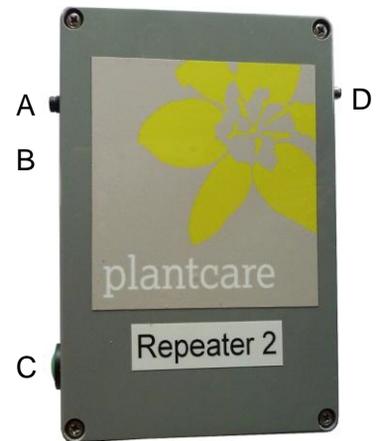
## Control button / Connections

- A. Power connection (power supply or solar cell)
- B. LED
- C. Control button
- D. Interface for external antenna (optional)

## Switching on/ switching off/ checking power supply

Please note that repeater are usually delivered with built-in rechargeable batteries (8x AA).

1. Unscrew the 4 screws and remove the front cover.
2. Attach the battery connector to the battery holder (see picture). By doing so the repeater is switched on.
3. Mount the front cover.
4. Plug now the AC adapter or solar cell to the power connection.
5. To switch off the repeater the battery connector must be removed from the battery holder. It is not enough to just pull out the AC adapter or solar cell cable.
6. Check by pressing the control button, whether the repeater is receiving sufficient power. If the LED flashes, the repeater is operational. If the LED does not flash then either there is currently not enough power available (if a solar cell is used, the repeater enters in a sleep mode if the battery voltage is < 8.2V in and is only ready for operation again when the battery voltage rises again) or the repeater is defective.



## Operating (check also chapter "Initializing the repeater")

- By pressing the control button, the repeater sends a test message to the Plant Control. The test Telegram can be used to identify the repeater (see also Plant Control menu Sensors> Identify.)
- To initialize a repeater, hold down the control button for 5 seconds (see also chapter "Initializing the repeater").

# Sensor operation

Please note that the sensors are usually supplied without installed batteries.

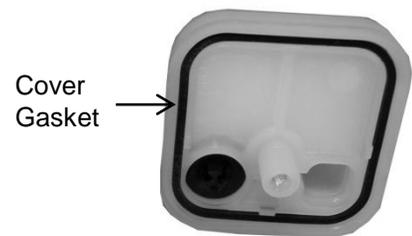
## Inserting/replacing the batteries

Switch off the unit if it is still on.

1. Release the retaining screw to remove the sensor cover.
2. Carefully remove the battery holder from the casing.
3. Insert 2 AA batteries. Ensure correct polarity to avoid damaging the sensor. Dispose of old batteries properly.
4. Reinsert the battery holder carefully into the casing, ensuring that the wires are positioned between the battery holder and the partition in the white interior casing.
5. Check if frequency band setting is correct for your country (Europe generally 868 MHz - see also next page).
6. Replace the cover so that it sits on the white interior casing. Ensure that the cover seal is located in its groove in the cover and is free of any dirt. Reattach the cover by tightening the retaining screw firmly but not too tightly.
7. Switch on the sensor. If the sensor has already been initialized, all the settings will have been saved and it is ready for use again immediately.



**CAUTION:** When you remove the sensor cover, take care to put it back on the same sensor.



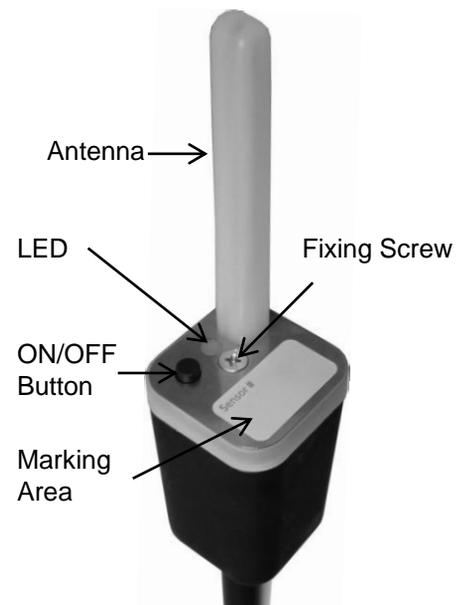
## Switching on/ switching off/ testing reception

- **Switching on:** Briefly press the ON/OFF button. The LED will flash for a moment.
- **Switching off:** Depress the ON/OFF button until the LED lights up and goes out. Then release the button.  
**IMPORTANT:** The sensor cannot be switched off if a measurement is being taken. If so, wait for 2-3 minutes and try again.
- **Testing reception**

This is only possible if the sensor has been switched on and already initialized and if moisture measuring is not taking place:  
Briefly press the ON/OFF button. The LED will flash for a moment and a test telegram sent to the PlantControl. After a few seconds, the reception strength and other data can be read off the PlantControl display in Status > Sensors.

On completion of a successful transmission, the LED will briefly flash twice. Otherwise the LED will light up for 1 second.

Use this function, for example, when repositioning a sensor.



## LED display on the sensor

- Switching on: LED flashes for a moment.
- Switching off: LED lights up and goes out.
- Successful initialization: LED emits 1 long and 1 short flash.  
PlantControl was in initialization mode and the sensor has been initialized successfully.
- LED flashes 1x 12 seconds after switching on: Control unit was not in initialization mode and the sensor has been started successfully.  
This is what normally happens if the sensor has previously been initialized successfully and then switched off and on again.
- LED flashes 1x every ½ second after switching on → Error:  
Sensor has not been initialized yet.
- LED stays on continuously → Error:  
The frequency band switch on the sensor has been changed and no longer matches the frequency band on the PlantControl unit (switch off the sensor/correct the frequency band on the sensor/switch on the sensor).
- LED flashes continuously 2x in quick succession → Error:  
Replace batteries.

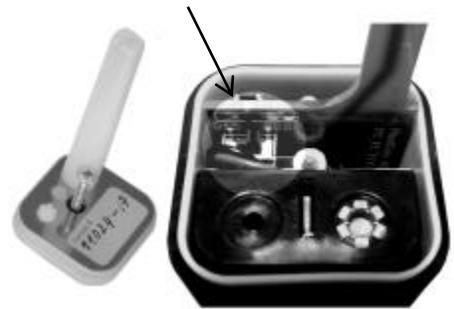
Frequency band 868/915 MHz  
sliding switch

## Setting the sensor frequency band

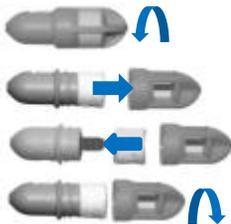
The frequency band must have the same setting as defined in the controller. Q.v. also Settings > Controller > "Frequency band"

The factory setting for the frequency band is 868 MHz.

1. Switch off the sensor and unscrew the retaining screw to remove the sensor cover.
2. Use the sliding switch to set the frequency band permitted in your country. The frequencies are marked on the PCB.



## Replacing the sensor felt



## 2. Commissioning

### Step 1. Switching on your PlantControl

1. Withdraw the safety film to activate the factory-installed and charged 8 AA batteries.
2. Press the ON button
3. Press the MENU button
4. Check, if the battery status symbol on the display shows at least one bar. Otherwise charge up the batteries either with a mains plug or, if ordered along with the PlantControl, the solar cell.

### Step 2. Configuring your PlantControl central unit

#### Settings > Controller > OK button:

Press the ▲-▼ cursor keys in a sub-menu to scroll up or down and then select with the **OK button**. Use the alphanumeric keypad for your input.

- \* **Device name:** The controller can be allocated a specific name or location. The unit name will also appear in data files exported.
- \* **Measure cycle: sensor** Your entry specifies the time between two measurements (minimum: 5 minutes/maximum: 360 minutes).
- \* **Time:** Enter hours, minutes and seconds
- \* **Date:** Enter day, month, year
- Network number:** Automatically allocated. The network number is determined by the system with a random generator and also transmitted to all sensors linked to the PlantControl unit. This prevents any mutual interference from neighboring networks. Recommendation: Do not change the network numbers allocated by the system.
- Radio channel:** The factory setting for the radio channel is 5. Channels 2,3,4 and 5 can be selected. The channel number should only be changed if there is radio-frequency interference from a neighboring installation. If you change the channel number, the corresponding sensors must be initialized again.
- Frequency band:** The factory setting for the frequency band is 868 MHz. Two frequency bands are available. The 868 MHz waveband is permitted and standard in Europe. 915 MHz is permitted in the US and certain other countries. Your national telecommunications authorities can provide information on which frequency band is allowed in your country. You can then adjust the factory setting as needed. However, all the allocated sensors will also need switching to the frequency band selected (q.v. Operation > Sensors).  
**If your system has already been initialized at the factory and you change the frequency band, the sensors will require initializing again.**
- \* **Language:** Choose between German and English.
- \* **LCD contrast:** The contrast of the LCD display can be optimized by entering a higher or lower number.
- \* **LCD light on:** Here, you can select how many seconds the background illumination will stay on. Recommendation: Set as short a period as possible to conserve battery power.
- AC Input:** AC Input display

**\* ONLY THESE ADJUSTMENTS MAY BE MADE!**

### Step 3. Initializing a repeater (range extender)

**Skip this chapter, if you do not use a repeater.**

Wireless systems must first “recognize” each other if they are to communicate. Initialization of the PlantControl unit with the repeater must therefore be carried out first.

#### Commissioning of already initialized repeaters:

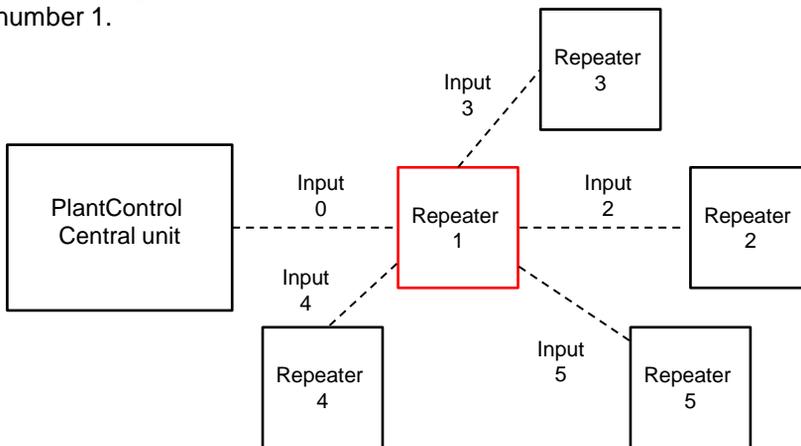
If the PlantControl unit and repeaters have been initialized already at the factory (would be labeled on PlantControl central unit), no initialization must be performed.

#### Initializing a repeater

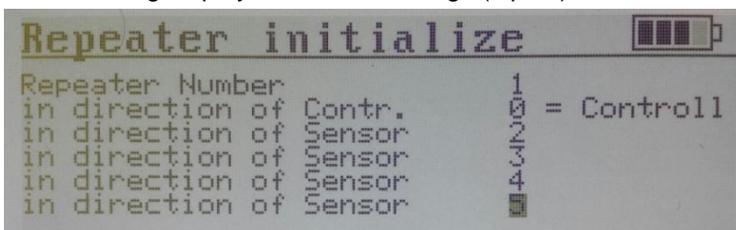
Initialize > Repeater > OK-button

Before you begin initializing the repeater, you should create a simple plan with the position of the individual components. The plan should show the assignment of repeaters to the PlantControl respectively how the repeaters are assigned between themselves.

For a better understanding see the following example with a total of 5 repeaters, wherein repeater 1 is directly assigned to the PlantControl and repeater 2 to 5 are connected with the PlantControl via repeater number 1.

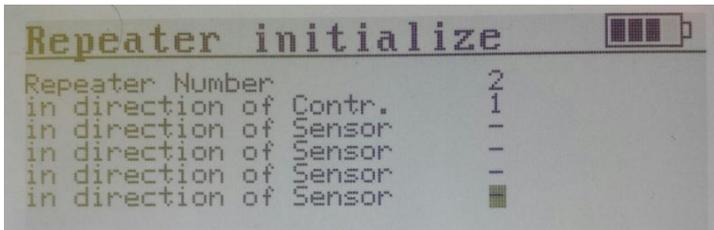


The following display shows the settings (inputs) for the above example of repeater number 1.



1. Select Initialize > Repeater > OK-button.
2. Before initializing a repeater, you must first make the following settings:
  - **Repeater Number:** Here, number 1 is displayed as the first repeater.
  - **in direction of Controller:** Enter here over which other repeater, a repeater is connected to the PlantControl central unit. As in the example above no other repeater is placed in direction to the PlantControl enter here the number zero (number 0 = Controller). Otherwise press the OK-button and enter the repeater number, which is between repeater 1 and the Plant Control.
  - **in direction Sensor:** You can assign up to five other repeaters to a certain repeater. Therefore, you have to enter here which other repeaters are connected to the repeater number 1. In this example, the repeater number 2, 3, 4 and then 5 were entered.
  - Place the repeater approximately at a distance of 1 meter from the controller and press the control button on the repeater for 5 seconds. Now release the button. Once the controller has detected a repeater, you label it with the repeater number assigned by the system. You can then initialize the next repeater. When the repeater has not been detected, “failed” will be displayed. In such a case, the procedure from point 1 must be repeated.

The settings for the second repeater are as on the following display:

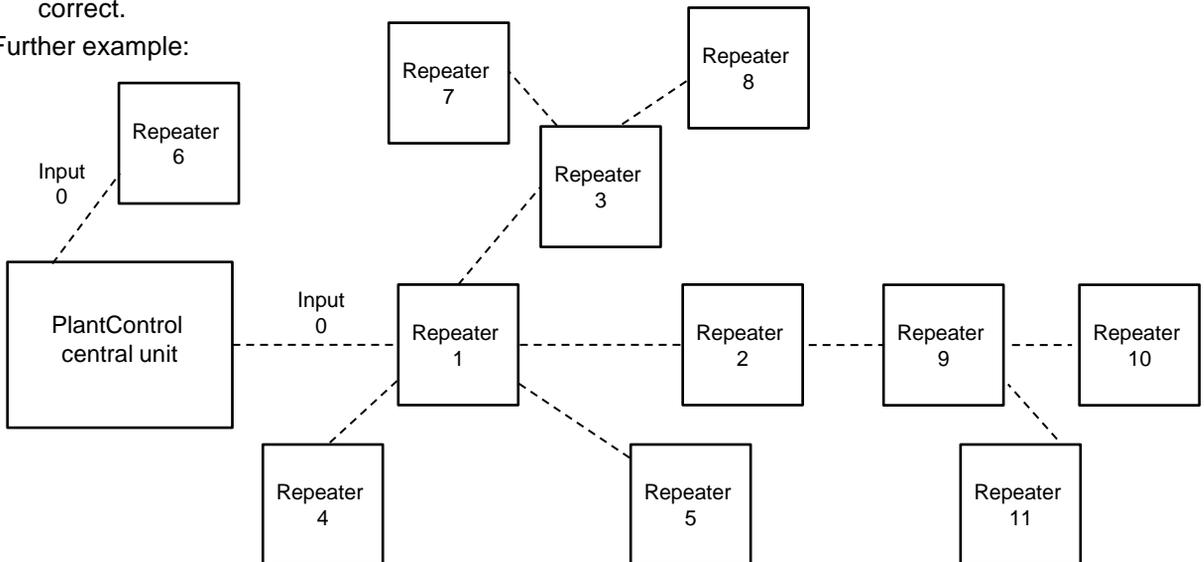


- **Repeater Number:** Here, number 2 is displayed as the first repeater.
- **in direction of Controller:** Enter here over which other repeater, repeater number 2 is connected to the PlantControl central unit. As in the example above repeater number 1 is placed in direction to the PlantControl enter here number 1 (see also sketch on previous page).
- **in direction of Sensor:** As no other repeater is placed into the direction of sensors, no input is required (see also sketch on previous page).
- Initialize now the second repeater as described previously.

Further repeaters can be initialized as described with the above examples.

4. After having initialized all repeaters press the BACK-button to return to the main menu.
5. Check under the menu item Settings > Repeater> OK-button if the number of initialized repeaters is correct.

Further example:



- **Example repeater number 6:** Enter under "in direction of Controller" the number 0. Nothing to enter under "in direction Sensor" as no further repeater is connected with repeater number 6.
- **Example repeater number 3:** Enter under "in direction of Controller" the number 1, as repeater number 3 is connected with the PlantControl central unit via repeater number 1. Enter under "in direction Sensor" the number 7 and then 8.
- **Example repeater number 9:** Enter under "in direction of Controller" the number 2, as repeater number 9 is connected with the PlantControl central unit via repeater number 2. Enter under "in direction Sensor" the number 10 and then 11.

### Testing the connection in the field

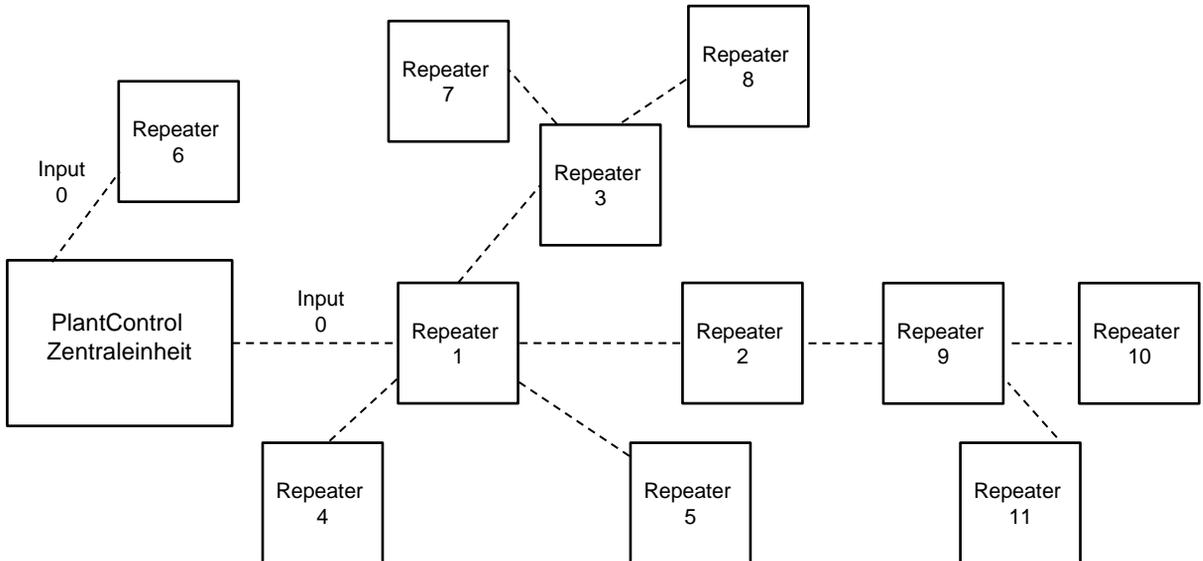
After you have initialized also the sensors, press and release the control button of a sensor. The sensor LED will blink twice, which means that the sensor is connected with the PlantControl central unit via the repeater.

### Replacing a repeater

1. Disconnect the old Repeater from the power supply (also the battery connector inside the repeater must be disconnected from the battery holder).
2. Menu Initialize > Repeater > OK-button. Scroll with the cursor-buttons ◀ - ▶ to the repeater number which you would like to replace
3. Initialize new repeater (see chapter "Initializing a repeater").

## Deactivate a repeater, respectively removing it without replacing

Depending on where a repeater is positioned within the system, deactivating it must be addressed differently. If it is a repeater, which is positioned as the last in a line (i.e. repeaters 4,5,6,7,8,10,11) the effort is relatively low. But must a repeater be disabled, which is surrounded by other repeaters (ie, repeaters 1,2,3,9), it may be more time-consuming. So not only the surrounding repeaters must be re-initialized, but it must also be ensured that the radio range of the surrounding repeaters are not affected by the loss of a repeater. The following are some examples.



### ▪ Deactivating (removing) repeater number 8:

1. Switch off repeater number 8 by removing the battery connector from the battery holder. It is not enough to just pull out the AC adapter or solar cell cable.
2. Deactivate all sensors connected with repeater number 8 (see also chapter "Sensor settings").

### ▪ Deactivating (removing) repeater number 9:

1. Switch off repeater number 9 by removing the battery connector from the battery holder. It is not enough to just pull out the AC adapter or solar cell cable.
2. Deactivate all sensors connected with repeater number 9 (see also chapter "Sensor settings").
3. Go to PlantControl menu Initializing > Repeater > OK-button and scroll with the cursor-buttons to the repeater number 2.
  - Enter under the top line "in direction sensor" repeater number 10.
  - Enter under the second top line "indirection sensor" repeater number 11.
  - Initialize again repeater number 2
4. Scroll with the cursor-buttons to the repeater number 10.
  - Enter under "in direction controller" repeater number 2.
  - Enter under the top line "in direction sensor" the number 0.
  - Initialize again repeater number 10
5. Scroll with the cursor-buttons to the repeater number 11.
  - Enter under "in direction controller" repeater number 2.
  - Enter under the top line "in direction sensor" the number 0.
  - Initialize again repeater number 11.

**CAUTION: Make sure that the radio range of the surrounding repeater is not affected by deactivating a certain repeater.**

## Step 4. Repeater settings

Settings > Repeater > OK-button

**Number of repeaters:** This is automatically assigned based on the number of initialized repeaters. For this reason, the figure should not be changed.

# Examples of repeater configurations

PlantControl Central unit --- Repeater 1 --- Repeater 2

```

Repeater initialize
Repeater Number      2
in direction of Contr. 1
in direction of Sensor -
in direction of Sensor █
    
```

```

Repeater initialize
Repeater Number      1
in direction of Contr. 0 = Controll
in direction of Sensor 2
in direction of Sensor -
in direction of Sensor -
in direction of Sensor -
in direction of Sensor █
    
```

PlantControl Central unit --- Repeater 1 --- Repeater 2  
 PlantControl Central unit --- Repeater 1 --- Repeater 3

```

Repeater initialize
Repeater Number      2
in direction of Contr. 1
in direction of Sensor -
in direction of Sensor █
    
```

```

Repeater initialize
Repeater Number      1
in direction of Contr. 0 = Controll
in direction of Sensor 2
in direction of Sensor -
in direction of Sensor -
in direction of Sensor -
in direction of Sensor █
    
```

```

Repeater initialize
Repeater Number      3
in direction of Contr. 1
in direction of Sensor -
in direction of Sensor █
    
```

PlantControl Central unit --- Repeater 1 --- Repeater 2  
 PlantControl Central unit --- Repeater 1 --- Repeater 3  
 Repeater 3 --- Repeater 4

```

Repeater initialize
Repeater Number      2
in direction of Contr. 1
in direction of Sensor -
in direction of Sensor █
    
```

```

Repeater initialize
Repeater Number      1
in direction of Contr. 0 = Controll
in direction of Sensor 2
in direction of Sensor -
in direction of Sensor -
in direction of Sensor -
in direction of Sensor █
    
```

```

Repeater initialize
Repeater Number      3
in direction of Contr. 1
in direction of Sensor 4
in direction of Sensor -
in direction of Sensor -
in direction of Sensor -
in direction of Sensor █
    
```

```

Repeater initialize
Repeater Number      4
in direction of Contr. 3
in direction of Sensor 4
in direction of Sensor -
in direction of Sensor -
in direction of Sensor -
in direction of Sensor █
    
```

## Step 4. Repeater settings

**Settings > Repeater > OK-button**

**Number of repeaters:** This is automatically assigned based on the number of initialized repeaters. For this reason, the figure should not be changed.

## Step 5. Initializing the sensors

### Initialize > Sensors > OK button

Wireless systems must first “recognize” each other if they are to communicate. Initialization of the PlantControl unit with the sensors must therefore be carried out first.

#### **Commissioning of already initialized sensors:**

If the PlantControl unit and sensors have been initialized already at the factory (would be labeled on PlantControl central unit) , then proceed as follows:

1. Switch on the PlantControl
2. Switch on the sensor(s)
3. For an immediate test of the reception strength, briefly press the ON/OFF button of the sensor. Otherwise, depending on the number of sensors, check after approx. 60 minutes the reception strength on the PlantControl display (Status > Sensors).

#### **Commissioning, if frequency band needs to be changed due to legal requirements in your country:**

Proceed as follows, if your system has already been initialized at the factory and you need to change the frequency band. Otherwise start from point 2.

1. First, deactivate all sensors on the PlantControl unit (Settings > Sensors > OK button > Deactivate).
2. Change the frequency band on the PlantControl unit (Settings > Controller > OK button > Frequency band).
3. Change the frequency band on all the sensors (q.v. “Sensor operation”).
4. Initialize the sensors as described below.

#### **Initializing the sensors**

Initialize > Sensors > OK button:

1. Leave the sensor switched off.
2. Ensure that the controller and sensors are set to the same frequency band.
3. Select Initialize > Sensors > OK button.
4. If you use a repeater (range extender), enter now the repeater number with which the sensor shall be connected.
5. Hold the sensor about 1 meter away from the controller and switch on the sensor. As soon as the controller recognizes the sensor, mark it with the sensor number allocated by the system so that clear allocation is later guaranteed between the sensor and the data record. You can then initialize the next sensor. If a sensor is not recognized, “fail” will appear in the display. In this case, repeat the process from step 1.
6. When all the sensors have been initialized, you can return to the menu with the BACK button.
7. Ensure that the number of initialized sensors is correct using Settings > Sensors > OK button.
8. Check reception strength: Using the menu item Status > Sensors, the reception strength will be shown in % for all sensors (Signal). Use the ▼ cursor key to move to the desired sensor as necessary. Do not stand in the transmission path between sensors and Data Logger when checking reception strength. If a sensor has a reception strength of below 10%, briefly pressing the ON/OFF button of the corresponding sensor will trigger radio contact and the reception strength will be displayed again after approx. 2 seconds. If it is still below 10%, the sensor should be repositioned as necessary. Briefly pressing the sensor’s ON/OFF button will show reception strength again.
9. Follow-up check: The sensors do not have an accurate clock and must therefore be synchronized by the PlantControl central unit. This is carried out separately for each sensor in the network and ensures that transmission of the measuring results is well-regulated and reliable.

When the system is switched on, a certain amount of time elapses between the first and last sensors being manually switched on. If moisture measurement is triggered during this time, the last sensors may not yet have been switched on and the PlantControl will miss these sensors. This will then trigger an alarm (flashing red LED on the PlantControl unit). This alarm can be dismissed since it should not reoccur after a few measuring cycles. Recommendation: Only carry out a follow-up check as in menu item Status > Alarms after approx. 3 measuring cycles when system installation has been completed.

## Step 6. Sensor settings

### Settings > Sensors > OK button

This menu item summarizes all the setting parameters for the sensors.

- Number of sensors:** This is automatically assigned based on the number of initialized sensors. For this reason, the figure should not be changed.
- Highest sensor no.:** This states the total number of sensors initialized in the controller. This figure cannot be overwritten.
- \* Moisture in:** Pressing the OK button allows you to choose between 3 readout units:  
**rel %:** Data readout is in relative moisture percentages (factory setting).  
**sec:** Sensor cool-down time in seconds  
**hPa:** Suction pressure (see also chapter 4)  
Note: The stored measurements, for example in rel%, can be read at any time for the same measurement period in hPa and vice versa.
- \* Sensor No.:** Press the OK button to enter up a supplementary designation for the sensor after the sensor no.
- \* Suction pressure:** If you have selected hPa under "Moisture in", then push the OK key and select one of the soil types, which matches best with your soil (see also chapter 4). Alternatively, if your specific soil has been calibrated by PlantCare, the corresponding parameters for converting the measurement data into hPa can be entered here.
- Repeater:** Indicates to which repeater number the sensor is assigned.
- Deactivate:** Proceed as follows if you wish to deactivate a previously initialized sensor:  
**Deactivate > OK button.** Use the ◀ - ▶ cursor keys to move to the next or previous sensor and to deactivate another sensor.  
If you want to initialize again a deactivated sensor, proceed with steps 1 to 8 as described under "Initializing the sensors."

**\* ONLY THESE ADJUSTMENTS MAY BE MADE!**

## Step 7. Commissioning the GPRS Modem

### Settings > GSM/GPRS > OK button

**Disregard this step, if you have not purchased any of the optional functions such as remote data retrieval or SMS-Alarm function.**

#### Working principles

The GPRS modem is used for the optional functions such as remote data retrieval and SMS-Alarm function. When transmission is set to automatic, the data is sent to the e-mail address entered in the corresponding menu field. In addition, the data required can be sent to any e-mail address by sending an SMS to the GPRS Modem.

Please note that for proper function of the modem minimum receiving power of 50% should be available. Check the current GSM receiving power on your PlantControl under the menu "Status> Controller".

#### SIM-Card

A GPRS-enabled SIM-Card is required for your GPRS Modem to be able to transmit data. We recommend purchasing a SIM-Card from a local supplier with excellent network coverage. A GPRS-enabled, prepaid SIM-Card can also be used.

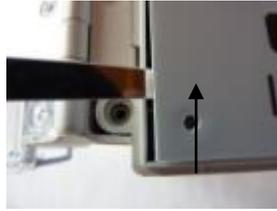
#### Unlocking the SIM-Card

Insert the SIM-Card in a mobile phone and follow the instructions in your mobile phone operating instructions. The SIM-Card is correctly unlocked when no PIN code entry is requested after switching off and switching on your mobile phone.

## Inserting the SIM-Card



Unscrew the 4 screws on the front panel.



Lift the front panel with the help of a small screwdriver



Tilt the front panel 90° forward and slide into the slots

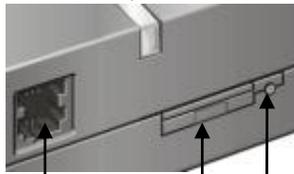


Remove the SIM-Card holder place the SIM-Card properly and push the holder back again (see details below).

## GPRS Modem

LED:

- Flashes every second when GPRS is searching the network
- Flashes every 3 seconds when network connection is established

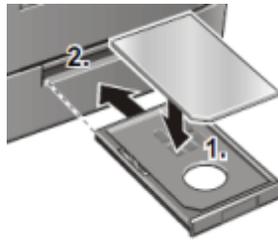


Audio Interface (not needed)

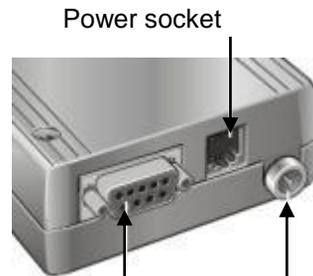
SIM-Card holder

SIM -Card holder

unlocking pin



SIM-Card holder



RS232 Interface

Antenna socket

Unlock the SIM-Card holder by pressing the small button to the right of the SIM -Card holder with the tip of a ballpoint pen or similar. Put the **unlocked SIM-Card** into the card holder and push it gently into the GPRS Modem. Reattach the front panel and tighten the 4 screws.

## Switch on your PlantControl D central unit and select

MENU > Settings > GSM/GPRS. Set now the following parameters:

### 1. Terminal operation

Activating/deactivating the GPRS Modem: select **Terminal operation** and then the **OK-key**.

Note: If you have purchased the SMS-Alarm function, the modem will be, if deactivated, activated automatically for a short time for transmitting alerts.

### 2. Email Data output

Choose between Data File or Status: select **Email Data output** and then the **OK-key**.

### 3. Email send

To test your settings or to manually initiate a transmission, select **Email send** followed by the **OK key** (only after entering all the parameters). The GPRS Modem will immediately transmit an e-mail to the e-mail address specified under "Recipient".

### 4. Power switch-on

For automatic data transmission or transmission in response to an SMS request, the GPRS Modem can be left permanently switched on (not recommended when used with a solar cell) or temporarily once a day at the specified time.

Select **Power switch-on** followed by the **OK key**. Now choose between the following options: **0** (permanently switched on) or, for example, **16** (= 4 p.m.), which is recommended when the Terminal is used with a solar cell – and the GPRS Modem will be switched on every day at 4 p.m. for 30 minutes.

### 5. Send email every (transmitting interval)

Here, you must specify the interval at which the e-mail address entered under "Recipient" is to receive the data automatically. If you do not require this option, the data can be also retrieved remotely by SMS

Select **Send email every** followed by the **OK key**. Now choose between the following options: **0** (never) or, for example, **5 days** (the GPRS Modem will send data every 5 days).

### 6. Credit query:

In the event of a GPRS-enabled, prepaid SIM-Card being used, the data file transmitted will contain information on your residual credit. Select **Credit query** followed by the **OK key**. Then enter the code given to you by your SIM-Card provider (not all provider support this function).

7. **APN** (not required, if the modem is only used for sending and receiving SMS)  
To enter the APN (Access Point Name), select **APN** followed by the **OK key**. Now enter the APN given to you by your SIM-Card provider.
8. **E-mail account settings** (not required, if the modem is only used for sending and receiving SMS)  
To ensure that your GPRS modem can send email messages, it requires an email account. You can use the existing Plant Care Account settings (recommended) or create a new account.
  - 8.1 **Mail Server** (Incoming mail server)  
Select **Mail Server** followed by the **OK key**. Now enter the name of the incoming mail server.  
→ recommended setting = pop.plant-care.ch
  - 8.2 **User Name**  
Select **User Name** followed by the **OK key**. Now enter the user name.  
→ recommended setting = gprs@.plant-care.ch
  - 8.3 **Password**  
Select **Password** followed by the **OK key**. Now enter the password.  
→ recommended setting = plantcare
9. **Recipient** (not required, if the modem is only used for sending and receiving SMS)  
Select **Recipient** followed by the **OK key**. Now enter the e-mail address to which the data is to be automatically transmitted in accordance with the interval defined (q.v. "Send e-mail every").  
If you do not require this option, the data can also be remotely retrieved by SMS.

### Configuration example

Terminal operation	activated
Email Data output	Data File
Email send	now execute
Power switch-on	14 o'clock
Send email every	7 days
Credit query	.130# ( <i>differs depending on the SIM card provider</i> )
APN	gprs.swisscom.ch ( <i>differs depending on the SIM card provider</i> )
* Mail Server	pop.plant-care.ch
* User Name	gprs@plant-care.ch
* Password	plantcare
Recipient	info@plant-care.ch

\* For a proper function, it is recommended not to change this PlantCare settings.

### Data retrieval by SMS

In addition to automatic data transmission, the data required can also be sent to any e-mail address by sending an SMS to the GPRS Modem. Use the following procedure to retrieve the data file or a system status file:

Send an SMS with the following message to the SIM-Card number of your GPRS Modem („pc email d“ or „pc email s“ must be written in small letters):

#### Data File retrieval:

*pc email d example@example.com*

#### Status File retrieval:

*pc email s example@example.com*

### IMPORTANT: Mobile phone settings when using a solar cell and data retrieval by SMS:

To minimize power consumption when powered by a solar cell, the GPRS Modem should only be switched on once every 24 hours (see also "power switch-on"). As soon as your GPRS Modem is switched on, it will send data or receive SMS for 30 minutes. After 30 minutes, the GPRS Modem will be switched off to reduce power consumption.

**This is why you should also change your mobile phone settings for text messages** (used for remote data retrieval by sending a SMS). We recommend setting message validity to the maximum possible time as 24 hours can elapse between sending your SMS for data retrieval and the time when your GPRS Modem is switched on. Please read the section in your mobile phone operating instructions on defining message validity.

With message validity, you specify the length of time that the message centre of your SIM-Card provider will resend your message if the first attempt fails (network service). If the message cannot be sent within this timeframe, the message is deleted by the message centre and your GPRS Modem will not receive your SMS for data retrieval. Generally, you can specify message validity for a single SMS or change the settings in the basic text message settings in your mobile phone. We recommend changing message validity in the basic settings.

## **Prepaid SIM-Card information**

If you use a prepaid SIM-Card, we would like to inform you about legal regulations in some countries regarding the use of prepaid SIM-Card products.

Your prepaid SIM-Card provider is possibly bound by legal regulations and, therefore, must deactivate your SIM-Card number if not used for a certain length of time. In such a case, the GPRS Modem cannot transmit any data. Legal regulations vary according to provider and country. We recommend contacting your provider and asking for the contract details of your prepaid SIM-Card.

For instance, some providers require SIM-Cards to be used within one year for an incoming or outgoing call. In such cases, you may have to periodically remove the SIM-Card from the GPRS Modem, insert it in a mobile phone and make a phone call. Some providers also accept an outgoing message as an outgoing call. If this is the case with your provider, you could periodically send an SMS message to the SIM-Card number of your GPRS Modem (see also "Data retrieval by SMS").

Alternatively, you can have a SIM-Card subscription with a provider instead of a prepaid SIM-Card. However, monthly costs arise in such cases, depending on provider and subscription type.

## **Troubleshooting**

The system fails to send data after configuration:

- Make sure that the GPRS Modem has been activated (see also "Terminal operation")
- Make sure that the SIM-Card has been unlocked and inserted correctly
- Make sure that the system is connected to the GPRS network (The Terminal LED on the PlantControl front panel must flash every 3 seconds when network connection is established).

## Further PlantControl menu items description

### Menu > Status

“Status” provides an overview of the system’s operating condition. Press the ▲-▼ cursor keys to scroll up and down.

#### Status > Controller > OK button:

This displays the following parameters:

Time until next moisture measurement / Free data storage capacity / Battery current / Date-time / Firmware version / Hardware version / Serial number / GSM reception strength / SIM-Card credit

#### Status > Sensors > OK button:

This displays the most recently measured sensor parameters in tabular form and critical deviations can quickly be localized:

Sensor number/Soil moisture/Soil temperature/Radio signal strength/Battery status

### Menu > Sensors

#### Sensors > Identify (also applicable for range extenders)

If an installed sensor or repeater can no longer be allocated to a sensor number or repeater number, this function can be used to clearly identify a sensor or a repeater. Proceed as follows:

**Sensors > Identify > OK button:** Hold the sensor at least 1 yard from the controller and briefly press the sensor’s **On/Off button**. After a few seconds, the PlantControl unit’s display will show the full identification of the corresponding sensor. The same procedure also applies to repeaters.

### Menu > Settings > Alarms

#### Settings > Alarms > OK button

##### Activate/deactivate alarms

Here you can define for each alarm type, in which form it shall be displayed (Alarm-LED, SMS) as well as time intervals in which it is to be displayed (never, always, interval). Regardless of the settings made, all alarms can be viewed on the display by pressing the button "Display Alarm".

AI-LED → Alarm is displayed by blinking alarm LED.

SMS → Alarm is sent via SMS message (requires the optional SMS-Alarm function).

always → Once it is determined by the system, the alarm is displayed immediately or sent via SMS.

never → Alarm is never displayed and is not transmitted via SMS.

alarm interval → After initial display, alarm is displayed in a configurable interval or transmitted via SMS.

Among other cases, an alarm is displayed in the following situations or transmitted by SMS (SMS alarm texts may be shorter). S=Sensor / V=Valve / x=Number:

## Further PlantControl menu items description (cont.)

Among other cases, an alarm is displayed in the following situations or transmitted by SMS (SMS alarm texts may be shorter). S=Sensor / x=Number:

Alarm text	Description	Trouble-Shooting
Sensor "x" temperature alarm	When ambient temperature falls below or exceeds a predefined value .	n/a
Low battery	When PlantControl central unit battery voltage is too low.	Check mains connection. If a solar cell is used, optimize its position.
Low credit	When prepaid SIM card credit is very low (< 5).	Top up credit.
Check Sensor "x"	When an unnatural leap into the dry is determined by a sensor.	Check correct sensor placement.
Sensor "x" no radio connection	When a wireless sensor fails to transmit.	Check reception strength of corresponding sensor. If necessary, reposition the sensor for a improved reception (high position). Eventually, purchase the optional external antenna for your PlantControl unit.
Sensor "x" low battery	When sensor batteries must be replaced.	Change sensor batteries.
Sensor "x" defect	When a sensor is defective.	Replace the sensor (contact your supplier).
Sensor "x" no sensor connected	When the sensor tip is not connected to the sensors main electronics .	Replace the sensor (contact your supplier).

### SMS number 1 / SMS number 2 (requires the optional SMS-Alarm function)

This feature allows alarm messages via SMS to up to two SMS-enabled.

#### Alarm upper temperature

Enter a temperature at which a temperature alarm should be triggered. If this feature is not used, be sure to enter the maximum temperature value (60), to avoid unwanted alarms.

#### Alarm Lower temperature

Enter a temperature at which a temperature alarm should be triggered.

### Menu > Initialize

#### Initialize > Erase logbook > OK button

This function is used to delete the memory.

#### Initialize > System reset > OK button

This function reinstates the default settings, including the deletion of the network number. If you have previously initialized the sensors, make a note of the network number before carrying out a system reset (Settings > Controller > Network number) and re-enter it after the system reset so that the sensors will not require initializing again.

#### Initialize > Code Input > OK button

Enter here the code obtained from the manufacturer for the activation of additional functions.

### 3. Installation

- Before installing the entire system in the field, commissioning should have been completed in accordance with chapter 2.
- The system's transmission range in an open space and line of sight (no obstacles) is a maximum of 200 meters. For this reason, the PlantControl D central unit should be located as centrally as possible to the sensors.
- If a solar cell is used, position the PlantControl central unit so that the solar cell ideally faces the sunlight.
- If an external antenna for enhanced signal reception is used (for the PlantControl central unit or GPRS Modem), then the antenna should be positioned as high up as possible for an optimum reception strength.
- Before inserting the sensor into the soil, check signal quality at the insertion site: Menu Status> Sensors: Is the displayed signal strength below 10%, we recommend to place the sensor main electronics higher and/or closer to the central unit.

#### Inserting the sensor into the soil - quicke guide (see also next pages)

1. Select a correct location for the soil moisture sensor
  - If used in combination with an irrigation system, the soil moisture sensor must be positioned at a location in the watering area which is exposed to the same climatic conditions as the plants (sun, wind, rain, etc.).
  - The sensor should not be covered by neighbouring plants. Areas of shade should be avoided.
  - To avoid erroneous measuring results caused by water logging, the sensor should not be positioned in dips in the ground.
  - If a sprinkler system is used, ensure that the sensor is placed within the watered area. If a drip system is used, the sensor has to be installed directly below a drip head.
  - Avoid locations, where the radio communication between sensor and PlantControl is disturbed by obstacles.
  - For an improved radio communication, the electronic housing of the sensor should be positioned as high as possible from the soil surface.
2. Immerse entire sensor tip in water for about 30 seconds (felt must be wet).
3. Insert the sensor tip in the root zone. It is recommended to pre-drill a appropriate hole into the soil, in which the sensor with the protection cap can be pushed down. The sensor tip must be in full contact with the soil on all sides.
4. Avoid or prevent the formation of a preferential water path along the sensor channel.
5. Water the area around the sensor with sufficient water. Depending on the soil and position of the sensor it may take several hours until the sensor measures the actual soil moisture.

#### Caution!

- The tip of the sensor will only measure the soil moisture correctly if the sensor tip is in full contact with the ground on all sides! Entrapped air in the surrounding of the sensor may cause false measuring results.
- Never rotate the sensor when inserting or pulling out as this may unscrew the yellow sensor tip.



Sensor with protection cap



## Guide for the correct placement of the soil moisture sensors

### Placing at the right depth

The sensors should measure the moisture there, where the plants absorb the water, namely in the root zone (Fig. 1). As the size of the root ball change significantly during the growth phase, it is recommended to re-place the sensors deeper after the initial growth phase.

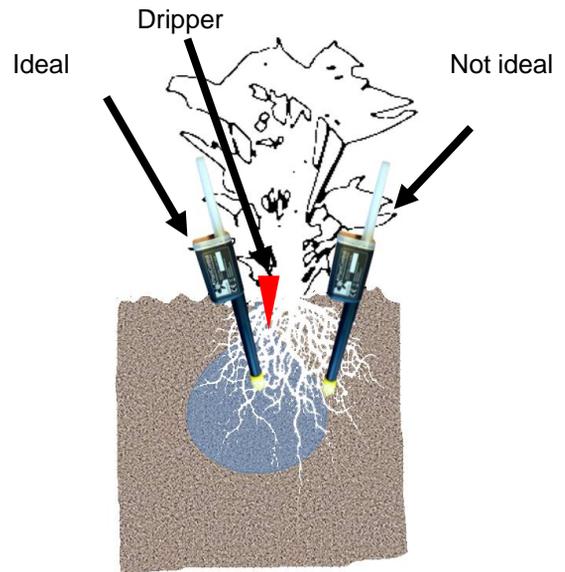


Fig. 1

### Sensors in stick version

1. For longer sensors in stick version, drilling of a hole is reasonable. Use an auger or a drilling machine with a bore diameter of 16 mm.
2. If the soil is dry, moisten.
3. Immerse entire sensor tip (yellow part) in water (felt must be wet).
4. Insert the sensor cautiously. Never rotate the sensor when inserting or pulling out as this may unscrew the yellow sensor tip.
5. Water the area around the sensor with sufficient water.

### Sensors in cable version

Depending on the placement depth, the installation of sensors in cable version requires a different approach.

If the sensor is placed in turf, it is virtually impossible to accommodate the electronics within the lawn, as this would disrupt the use of the lawn. In this case, sensors with extension cable are available. This allows to embed just the sensor tip in the lawn. The electronics on the other hand is placed on the edge of the lawn (Fig. 2).

If the sensor has to be buried deeper in the soil, it is inevitable to excavate soil first.



Fig. 2

## Placing the sensor in drip irrigation applications

The following recommendations are particularly important when the Plant Control D data logger is used within an irrigation system. However, this section also contains important information when the system is used for general moisture investigations.

The sensors must be placed in a way that it can register the water. This is more or less critical, depending on the type of irrigation. If sprinklers are used, the distribution uniformity is usually homogeneous enough, unless the root zone and thus the sensor is not shielded by leaves.

If a drip irrigation is used, the water is supplied very locally and it will diffuse more or less evenly and quickly within the soil over a certain volume range. Therefore, especially in drip irrigation it is important to pay attention to the following points:

Depending on the permeability of the soil or substrate, differently shaped moisture zones are formed (Fig. 3).

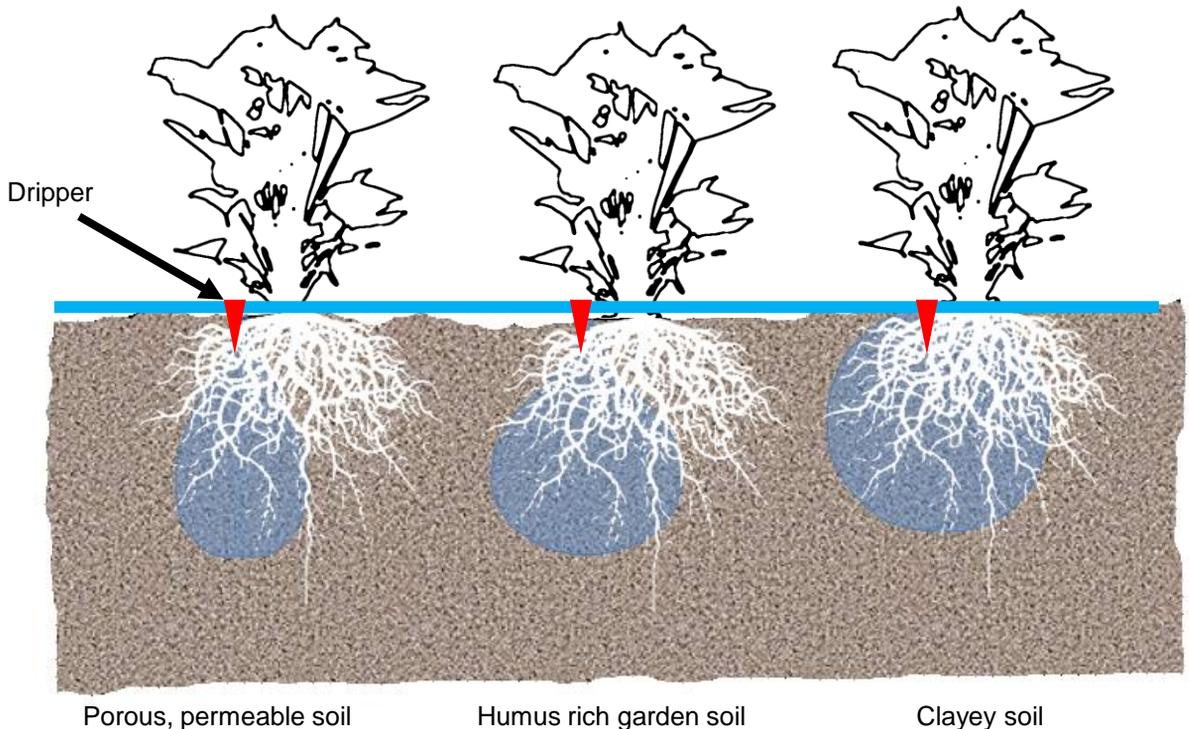


Fig. 3

If the soil is porous and permeable, it is advisable to use several dripper with a correspondingly lower water outlet per plant, in order to achieve a better distribution of water. Plants are very adaptive and the roots will grow into those areas, where water is available. However, the yield respectively the health of a plant is improving, the bigger a water saturated soil volume is available for the roots. Using this type of soil - especially in pot cultures - may result in the formation of so-called preferential water paths. This will always occur, whenever a dripper with a high water output is used. Since the water in the substrate runs off quite rapidly downward, fine particles are washed out, resulting in a preferred water path. In such a case, the water barely has time to spread horizontally, and this inevitably leads to an insufficient water supply to the plants. Once such a water path is formed, an initially correct placed sensor may not be able to register the applied water.

To avoid this problem, you can use drippers with a lower water output rate. However, such drippers may clog faster or calcify. The best remedy against the formation of preferred water paths is to use a piece of felt which is laid onto the substrate, so that the water drops first onto the felt and is distributed horizontally.

### Proper placement of the sensor electronics

When using a wireless sensor, the radio link between the sensor and Plant Control D / CX or FA central unit should not be disturbed. Since the radio transmission can be disturbed by the water in the leaves or any other obstruction, the electronics should be placed as high as possible (preferably higher than the plant).

Placement of electronics at ground level is only advisable if there is just a short distances to the central unit (<20 m).

Wireless sensors are available with extension cables in various lengths, making it possible to mount the electronics on a pole at a height of 1-2 m (Fig. 4).

### Proper placement of the repeater (range extender)

The same recommendations apply as described in "Proper placement of the sensor electronics."



Fig. 4

### Check

To verify the correct placement of the sensors, it is advisable to check the soil moisture readings after an irrigation cycle or a rainfall.

### Status> Sensors> OK:

A table of the last measured sensor parameters is displayed and critical deviations can be quickly located: Sensor number / soil moisture / soil temperature / signal strength of the radio / battery status.

If a sensor does not show the expected moisture increase, the position should be checked.

## 4. Moisture output in hPa suction pressure

**Note: Only applicable for sensors with a hard felt or part-number endings "H".**

The PlantCare moisture sensor technology is based on a micro-thermal measuring principle. A cooling time is measured, which allows a statement about the water content of the soil.

To permit a conversion to a suction pressure (hPa), a calibration must therefore be made. This can be achieved by parallel measurements with a tensiometer. Here, a soil sample at different moisture levels is measured with both sensors, the PlantCare sensor as well as with a tensiometer and the measured values are set into a relation according to the accepted van Genuchten equation. However, such a calibration is valid for the used soil type only.

As there can also occur quite large variations in moisture measurements between two tensiometers, a tensiometer-independent calibration was performed by the Zurich University of Applied Sciences (ZHAW) in Wädenswil. For the calibration, a pF-pressure chamber was used.

To cover the most important soil types, 6 standard soils were obtained from the "Agricultural Research Institute (LUFA) Speyer" in Germany. The data from these standard soils can be seen on the table below.

The results are primarily two parameters, alpha and n, which have to be inserted into the van Genuchten equation, in order to convert from the measured time to hPa. Moreover, a scaling factor K can be entered.

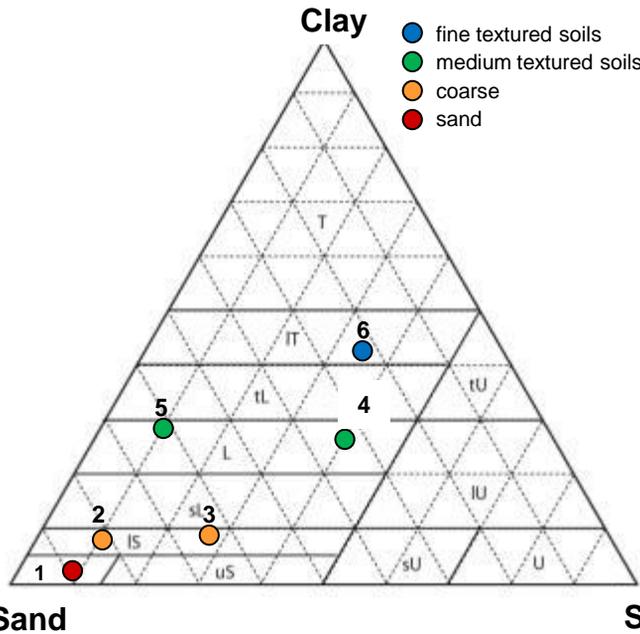
van Genuchten equation:

$$\psi_m = K \frac{1}{\alpha} \left[ (1 - t_n)^{-1/m} - 1 \right]^{1/n} \quad m = 1 - 1/n$$

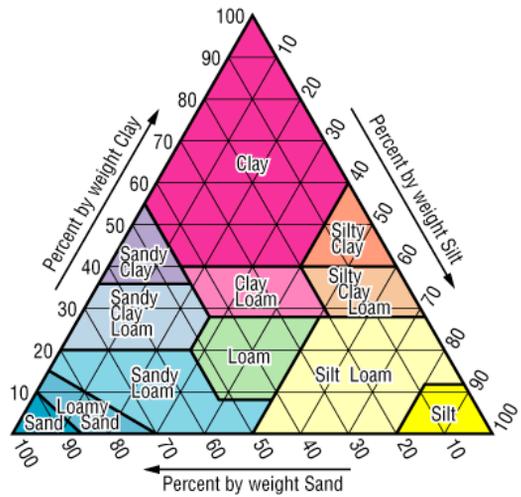
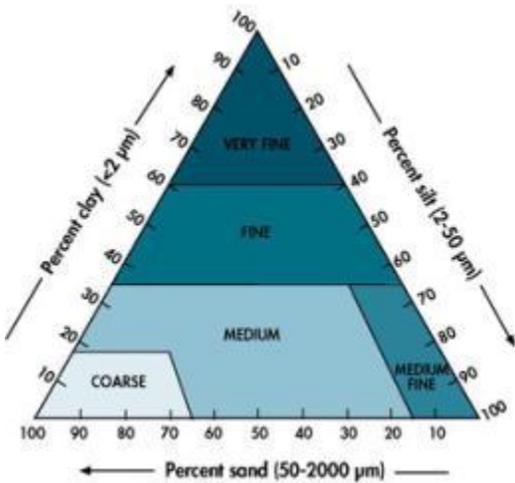
Standard soils from the „Agricultural Research Institute (LUFA) Speyer“:

Standard Soils - Analyses Data Sheet (9/11)						
Mean values of different batch analyses +- standard deviation. All values refer to dry matter						
Standard soil type no.	1	2	3	4	5	6
organic carbon in % C	0,62+- 0,07	1,87 +- 0,20	0,94+- 0,10	2,42 +- 0,5	1,05 +- 0,20	1,64 +- 0,12
Nitrogen in % N	0,05 +- 0,01	0,17 +- 0,02	0,08 +- 0,02	0,20 +- 0,04	0,12 +- 0,03	0,20 +- 0,02
pH-value (0.01 M CaCl <sub>2</sub> )	5,1+- 0,4	5,5 +- 0,2	6,8 +- 0,2	7,1 +- 0,2	7,3 +- 0,1	7,1 +- 0,1
cation exchange capacity (meq / 100g)	4,0 +- 0,7	10,1 +- 0,5	10,3 +- 1,3	30,8 +- 6,2	15,3 +- 2,9	24,5 +- 7,0
Particle size (mm) distribution according to German DIN (%):						
<0.002	2,4 +- 0,4	6,5 +- 0,8	8,7 +- 1,6	27,0 +- 1,9	10,4 +- 1,1	42,1 +- 1,2
0.002 - 0.006	2,0 +- 0,9	3,3 +- 0,7	4,2 +- 0,9	8,7 +- 0,7	5,1 +- 0,5	10,4 +- 1,0
0.006 - 0.02	3,1 +- 0,8	4,1 +- 0,7	8,8 +- 0,8	14,7 +- 1,3	9,1 +- 1,0	12,3 +- 1,4
0.02 - 0.063	6,9 +- 0,5	6,9 +- 0,9	17,6 +- 2,8	23,0 +- 1,3	21,2 +- 1,0	14,3 +- 2,0
0.063 - 0.2	27,4 +- 2,2	34,5 +- 1,9	30,1 +- 4,0	19,1 +- 0,3	38,1 +- 1,2	8,6 +- 0,4
0.2 - 0.63	55,8 +- 3,1	43,9 +- 1,6	27,9 +- 2,1	5,8 +- 0,3	14,7 +- 1,5	8,9 +- 0,5
0.63 - 2.0	2,4 +- 0,6	0,8 +- 0,3	2,7 +- 0,7	1,7 +- 0,3	1,4 +- 0,2	3,4 +- 0,7
soil type	silty sand (uS)	loamy sand (IS)	silty sand (uS)	clayey loam (tL)	loamy sand (IS)	clayey loam (tL)
Particle size (mm) distribution according to USDA (%)						
<0.002	2,7 +- 1,1	6,8 +- 1,3	8,7 +- 1,7	26,9 +- 0,3	11,2 +- 1,0	41,0 +- 1,9
0.002 - 0.05	10,0 +- 1,6	12,6 +- 1,7	27,6 +- 3,8	40,3 +- 1,1	28,5 +- 3,3	36,8 +-2,0
0.05 - 2.0	87,3 +- 1,2	80,6 +- 2,6	63,7 +- 4,4	32,8 +- 1,1	60,3 +- 4,1	22,2 +- 1,6
soil type	sand	loamy sand	sandy loam	loam	sandy loam	clay
water holding capacity (g/100g)	31,2 +- 2,0	44,4 +- 6,0	35,6 +- 3,0	44,1 +- 1,5	40,4 +- 2,7	38,9 +- 4,6
weight per volume (g/1000ml)	1462 +- 39	1257 +- 43	1295 +- 30	1305 +- 12	1280 +- 89	1372 +- 60

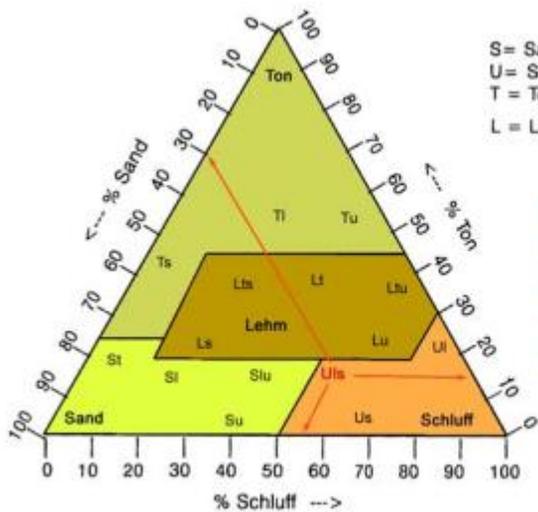
# Swiss soil texture pyramid classification with positioning of the LUFA Speyer standard soils



## European Union soil texture pyramid classification

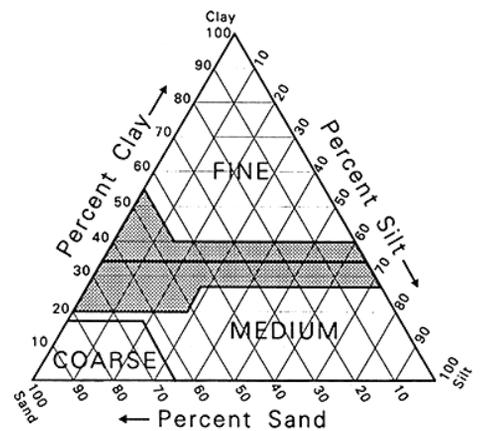


## German soil texture pyramid classification



## FAO soil texture pyramid classification

(Food and Agriculture Organization of the United Nations)



gray area has no significance

## 5. Data readout and firmware update

The PlantControl D offers a USB interface for easy data readout as well as firmware update.

- Insert either a USB stick for data readout or a USB stick, which contains a new firmware from PlantCare, into the corresponding USB interface of your PlantControl CX central unit.
- Press the key USB Imp/Exp and a new menu will appear on the display. Go to your selection with the cursor key and confirm with the "OK" button.
  - **Data output**  
To read out data, select "Data output" and confirm with the "OK" button. The data is automatically loaded onto the USB stick.
  - **Logbook output, last part**  
The logbook is the complete record of all incidents including alarms, setting changes, when the system was switched on and off, etc. The Logbook may be very helpful for troubleshooting. Since a logbook can be quite extensive, reading out just the last 3-4 weeks is recommended. The read out may last for several minutes.
  - **Logbook output**  
With this command, the entire log is read out. This is only necessary, if analysing a long time span is important. The read out may take up to 30 minutes.
  - **Firmware Update (USB)**  
If a new firmware from PlantCare is available, it may be sent to the user by email. The new software can be loaded on a USB stick and inserted into the USB port of the PlantControl central unit. By selecting the command "Firmware update" the firmware is automatically installed. This can take up to 10 minutes.
  - **Firmware Update (GPRS)**  
If a new firmware version is available, it can be directly downloaded from the PlantCare server and installed by selecting the command "Firmware Update (GPRS)" (provided that your Plant Control is equipped with a GPRS Modem) . Alternatively, this process can also be remotely triggered by sending the SMS message **pc exe fwupdate** to the SIM card number of your GPRS Modem. This can take up to 20 minutes.

If you have read out data, insert the USB stick into your computer and open the automatically generated Folder PC-DATA. Select the exported file and open it with a double-click. Providing you have installed the PlantCare DataViewer, the data will be displayed immediately.

**Important:** Disconnect the USB stick only at the end of the process and do not switch off the system during a read out or firmware update.

### Data analyses with PlantCare DataViewer

PlantCare DataViewer software enables the optimal display and analysis of your data. After a short registration process, this software can be downloaded free of charge and used to obtain a graphic view of the moisture and temperature levels of PlantCare sensors as well as data averages.

PlantCare DataViewer analysis software can be downloaded using the following link: [www.plantcare.ch/en](http://www.plantcare.ch/en) → Support



## 6. Troubleshooting

The numbers and values used in this table are only examples.

Content coming soon

## 7. Deactivation / Re-Activation

### Entire system:

1. Switch off the PlantControl unit.
2. Switch off the sensors.

Initialization is not required when re-commissioning. Simply switch on the PlantControl unit and the sensors. For an immediate test of the reception strength, briefly press the ON/OFF button of the sensor. Otherwise, depending on the number of sensors, check after approx. 60 minutes the reception strength on the PlantControl display (Status > Sensors).

### Individual sensors

1. Deactivate first the sensor as in **Settings > Sensors > Deactivate**.
2. Switch off the sensor

Initialization is necessary for re-commissioning (Initialize > Sensors). The PlantControl unit will assign the lowest available sensor number to the first newly initialized sensor. Please make sure that the sensor number assigned matches the number on the sensor cover.

## 8. Warranty

Your dealer will issue a two year warranty for this product (from date of purchase). This warranty covers all substantial defects of the unit that are demonstrably attributable to material or manufacturing faults. It will be implemented either by replacement with a unit in perfect condition or by repair (free of charge) of the returned unit at our discretion if the following conditions are met:

- The unit was treated properly and in accordance with the recommendations in the operating instructions.
- Neither the buyer nor any third party has attempted to repair the unit themselves.

## 9. Disclaimer

No liability is accepted for damage resulting from incorrect handling or a product malfunction.

## 10. Support

If you have any questions, please contact us by e-mail:



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