

Instruction Guide



PlantPen NDVI & PRI

Please read the Guide before operating this product



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The contents of this manual have been verified to correspond to the specifications of the device. However, deviations cannot be ruled out. Therefore, a complete correspondence between the manual and the real device cannot be guaranteed. The information in this manual is regularly checked, and corrections may be made in subsequent versions.

The visualizations shown in this manual are only illustrative.


This manual is an integral part of the purchase and delivery of equipment and its accessories and both Parties must abide by it.

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1 INFORMATION BEFORE USING PLANTPEN DEVICE



Read this manual carefully before operating the device. If you are not sure about something in the manual, contact the manufacturer for clarification.

	By accepting the device, the customer agrees to follow the instructions in this guide.
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Always follow corresponding manuals while working with the PlantPen device or doing the maintenance.

It is forbidden to interfere with the hardware or software of the PlantPen device in any way without previous agreement with the manufacturer.

The following table presents basic highlight symbols used in this manual:

Symbol	Description
	Important information, read carefully.
	Complementary and additional information.

Tab. 1 Used symbols.

2 GENERAL DESCRIPTION

The PlantPen model **PRI 210** measures **Photochemical Reflectance Index (PRI)** in two narrow wavelength bands centered close to 530 nm and 590 nm. The photochemical reflectance index $((R_{531} - R_{570}) / (R_{531} + R_{570}))^2$ correlates with the epoxidation state of xanthophyll cycle pigments and photosystem efficiency in many studies under diverse conditions, such as different 1. PRI is sensitive to changes in carotenoid pigments that are indicative of photosynthetic light use efficiency, the rate of carbon dioxide uptake, or as a reliable water-stress index. As such, it is used in studies of vegetation productivity and stress.

The PlantPen model **NDVI 310** measures **Normalized Difference Vegetation Index**, which is an important indicator of chlorophyll content in plants. The pigment in plant leaves, chlorophyll, strongly absorbs visible light (from 0.4 to 0.7 μm) for use in photosynthesis. The cell structure of the leaves, on the other hand, strongly reflects near-infrared light (from 0.7 to 1.1 μm). The differences in plant reflectance in the visible and near-infrared wavelengths is used to calculate NDVI index as follows: $NDVI = ((NIR - VIS) / ((NIR + VIS)))$, where VIS and NIR stand for the spectral reflectance measurements acquired in the visible (red) and near-infrared regions, respectively. NDVI is directly related to the photosynthetic capacity and hence energy absorption of plant canopies 2. The **NDVI 310** device compares reflected light at two distinct wavelengths, 635 and 760 nm.

PlantPen can be operated as a stand-alone instrument and thus is ideal for field studies. The reflectance signals are detected at the wavelengths of the dual light source 530 nm and 590 nm, which are close to the PRI equation values based on Sellers, P. J. (1985)2. Measured data are sequentially stored in the internal PlantPen memory. Data transfer is via USB or Bluetooth communication. Comprehensive FluorPen 1.1 software provides data transfer routines and many additional features for data presentation in tables and graphs.

1 John Gamon, Josep Penuelas, and Christopher Field (1992). A narrow-waveband spectral index that tracks diurnal changes in photosynthetic efficiency. *Remote Sensing of environment*, 41, 35-44.

2 Sellers, P. J. (1985) 'Canopy reflectance, photosynthesis, and transpiration', *International Journal of Remote Sensing*, 6, 1335-1372.

2.1 TECHNICAL SPECIFICATION

Protocols	PlantPen PRI 210	Photochemical Reflectance Index PRI = $(R531 - R570) / (R531 + R570)$ Reference: Sellers et al. (1985)
	PlantPen NDVI 310	Normalized Difference Vegetative Index NDVI = $(R740 - R660) / (R740 + R660)$ Reference: Rouse et al. (1974)
LED emitter	PlantPen PRI 210	Dual wavelength light source GREEN = 530 nm, YELLOW = 590 nm
	PlantPen NDVI 310	Dual wavelength light source RED = 635 nm, NIR = 760 nm
Detector	PIN photodiode with bandpass filters From 500 to 600 nm (PRI 210) From 620 to 750 nm (NDVI 310)	
Internal memory capacity	Up to 16 Mb	
Internal data logging	Up to 100,000 measurements	
Data transfer	USB cable Bluetooth (transfer up to 3Mbps for distance up to 20m)	
PC software	FluorPen 1.1 (Windows 7 and higher)	
Battery	Li-Ion rechargeable battery Capacity 2000 mAh Max. charging current 0.5 A Charging via USB port - PC, power bank, USB charger, etc. 70 hours typical with full operation Low battery indicator	
Sample holder	Mechanical leaf-clip	
Display	Graphical display	
Keypad	Sealed, 2-key tactile response Turns off after 5 minutes of no use	
Built in GPS module	Ultra-high sensitivity down to -165dBm High accuracy of <1.5 m in 50% of trials	
Size	135 x 65 x 33 mm	
Weight	188 g	
Operating conditions	Temperature: 0 to +55 °C Relative humidity: 0 to 95 % (non-condensing)	
Storage conditions	Temperature: -10 to +60 °C Relative humidity: 0 to 95 % (non-condensing)	
Warranty	1-year parts and labor	

Bluetooth module compliance data:

Category	Country	Standard
Radio	USA	FCC Part 15 Subpart B: 2008 Class B FCC CRF Title 47 Part 15 Subpart C
	FCC ID:	T9J-RN42
	Europe	ETSI EN 301 489-1 V1.8.1 ETSI EN 301 489-17 V2.1.1 ETSI EN 300 328 V1.7.1
	Canada	IC RSS-210 low power comm. device
	Certification number:	6514A-RN42
EMC	USA	FCC CFR47 Part 15 subclass B
	Europe	EN 55022 Class B radiated EN61000-4-2 ESD immunity EN61000-4-3 radiated field EN61000-4-6 RF immunity EN61000-4-8 power magnetic immunity

3 DEVICE DESCRIPTION




Fig. 1 Device description.

3.1 LIST OF EQUIPMENT AND CUSTOMER INFORMATION

Standard version of the PlantPen device package consists:

- PlantPen PRI 210 or PlantPen NDVI 310
- Carrying Case
- FluorPen software and driver (on a USB flash disc)
- Operation Manual (PDF on a USB flash disc)
- USB Cable
- Self-Adhesive Rubber Pads for Optics Protection
- Other Accessories or Optional Features (according to your specific order)

	<p>For data download via USB connection, the USB driver needs to be installed on the PC. It can be found on the installation disk (USB driver folder).</p> <p>If any item is missing, please, contact the manufacturer. Also check the carton for any visible external damage. If any damage is found, notify the carrier and the manufacturer immediately. The carton and all packing materials should be retained for inspection by the carrier or insurer.</p> <p>For customer support, please write to: support@psi.cz</p>
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3.2 CARE AND MAINTENANCE

PlantPen

- Never submerge the device in water!
- The device should not come in contact with any organic solvents, strong acids or bases.
- Keep the optical part clean and dry. If cleaning is needed, use soft, non-abrasive tissue.

Li-ion battery

- Avoid fully discharging of the battery.
- Do not keep the battery at full charge for all the time.
- Keeping at high temperatures shortens battery life.

4 PRINCIPLE OF MEASUREMENT

PlantPen is a reflectance-based device that provides a convenient method of measuring the relative chlorophyll content of a leaf sample.

The **PlantPen** model **PRI 210** (Fig. 2) measures **Photochemical Reflectance Index (PRI)** by comparing leaf reflectance in two narrow wavelength bands centered close to 530 nm and 590 nm. PRI is sensitive to changes in carotenoid pigments that are indicative of changes in photosynthetic light use efficiency, the rate of CO₂ uptake and as a reliable water-stress index. As such, it is used in studies of vegetation productivity and stress.

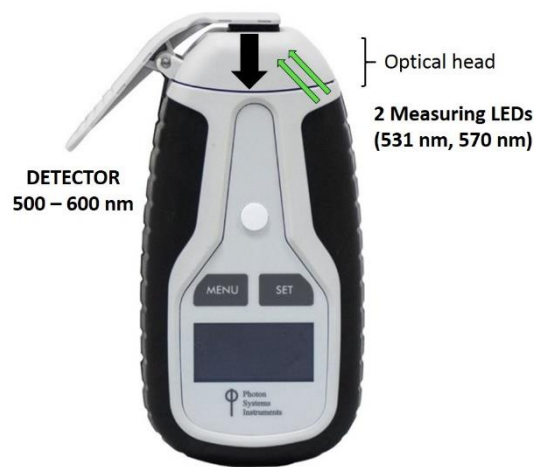


Fig. 2 PlantPen PRI 210.

The **PlantPen** model **NDVI 310** (Fig. 3) measures **Normalized Difference Vegetation Index (NDVI)**, which is an important indicator of chlorophyll content in plants. The pigment in plant leaves, chlorophyll, strongly absorbs visible light (from 0.4 to 0.7 μm) for use in photosynthesis. The cell structure of the leaves, on the other hand, strongly reflects near-infrared light (from 0.7 to 1.1 μm). The differences in plant reflectance in the visible and near-infrared wavelengths are used to calculate NDVI index. NDVI is directly related to the photosynthetic capacity and hence energy absorption of plant canopies.



Fig. 3 PlantPen NDVI 310.

5 GETTING STARTED

For more detailed information on steps of PlantPen operation please refer to chapter 6.

The device is powered by built in Li-Ion battery. Ensure that the battery is fully charged by plugging it into a PC via USB cable or the AC outlet via USB adapter (not included) and the cable.

The PlantPen is controlled using two buttons:

- Use the **MENU** key to scroll through sequential menu options shown on the digital display. And to turn the device off (hold for 3 sec).
- Use the **SET** key to turn the device on (hold for 3 sec) and select a menu option based on cursor (>) position.

5.1 CALIBRATION

Calibration assures you that your measurements are accurate within the specification limits that led you to select the instrument in the first place. It is better to calibrate your device before every set of samples. For Calibration of PlantPen use white reflectance standard. The calibration of the white reflectance standard is an indispensable part of a correct calculation of PRI or NDVI.



It is necessary to calibrate PlantPen after every switch ON.

Prior measurement perform the calibration as follows:

- For calibration use white reflectance standard (It is part of leaf clip)
- Turn ON device – hold **SET** button for 1 sec.
- Close the leaf clip (white standard is on bottom part of the leaf clip)
- Go to **Calibration** (“**Insert white sample**” appears on display)
- Press **SET** button to confirm the calibration and wait until the calibration step is completed.
- Calibration is automatically stored into the device memory.
- The device is now ready to measure other samples.

5.2 MEASUREMENT

Please follow these instructions to perform a measurement:

- Insert a leaf sample into the leaf clip. The leaf clip is important for the sample stabilization.
- Go to **Measurement**
- Press **SET** to confirm.
- PlantPen measures predefined index (PRI or NDVI).
- Value of the index appears on display after measuring.
- During the measurement all data are stored into the device memory.

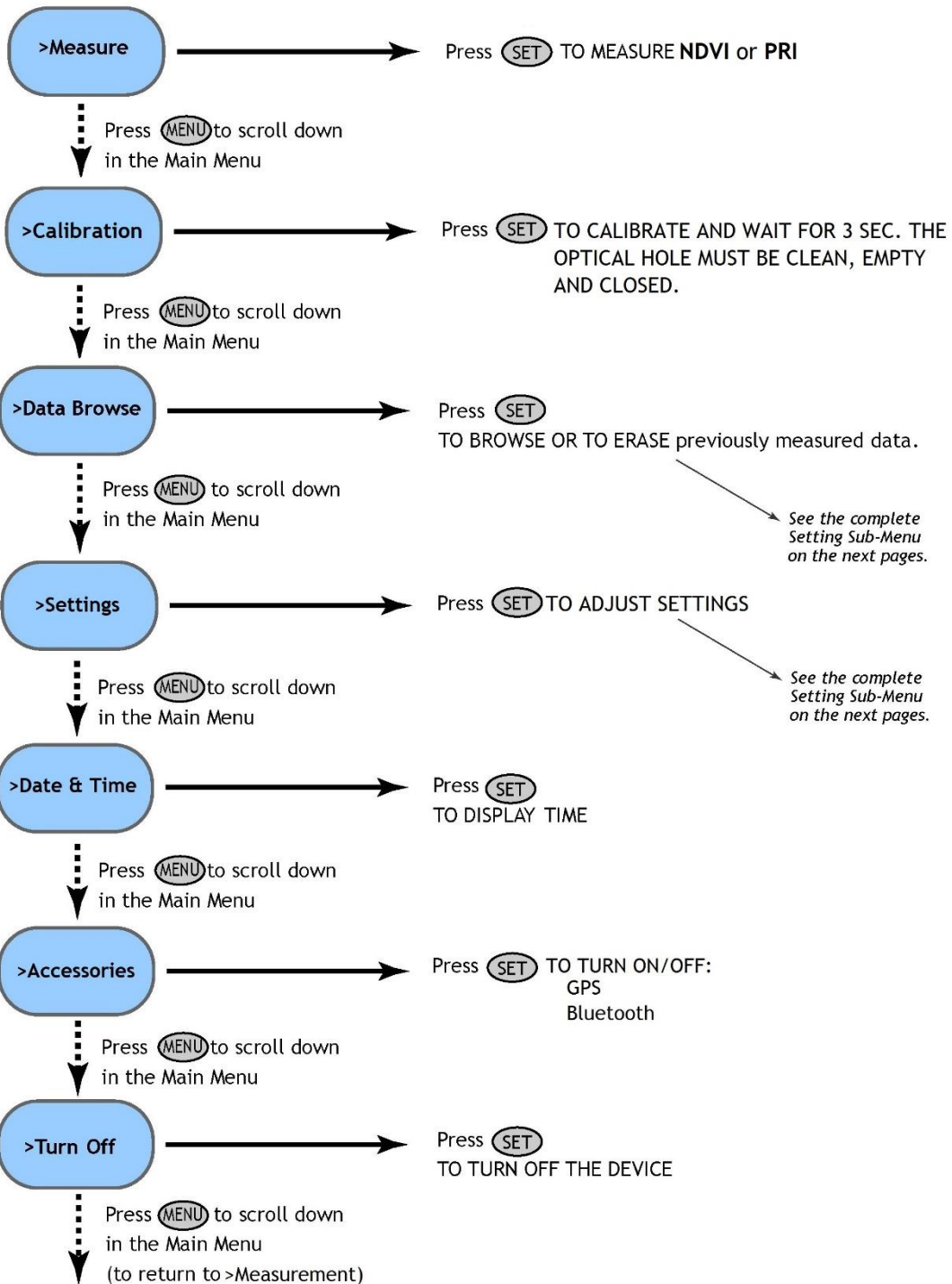
6 CONTROL MENU TREE

The next few pages of this manual show the structure of the firmware menu on the PlantPen device, and explain in a schematic way the operation of the PlantPen. The schematic shows the Main Menu, first-level Sub-Menus and second-level Sub-Menus.

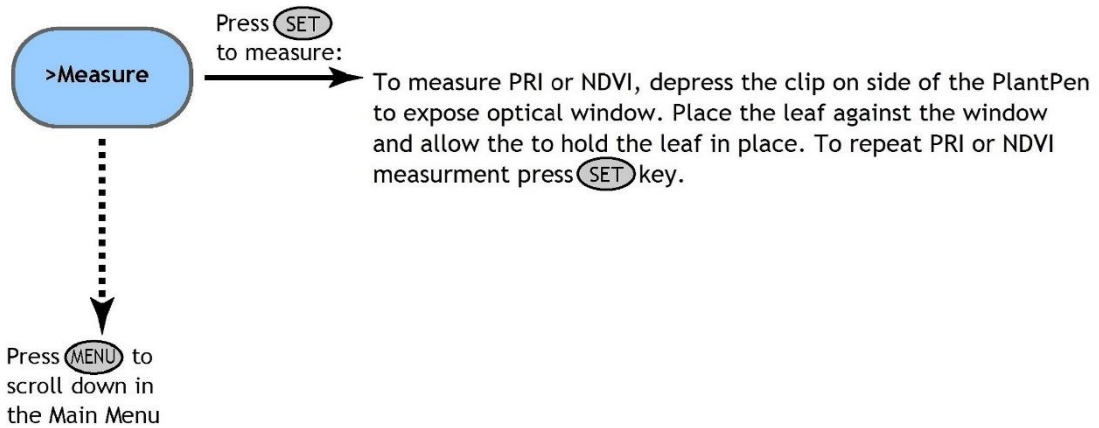
- The blue color represents the Main Menu and its Options.
- The yellow color represents the first-level Sub-Menus and their Options.
- The green color represents the second-level Sub-Menus and their Options.
- Full-line arrows are used to indicate the **SET** key operations.
- Dashed-line arrows are used to indicate the **MENU** key operations.

Main Menu

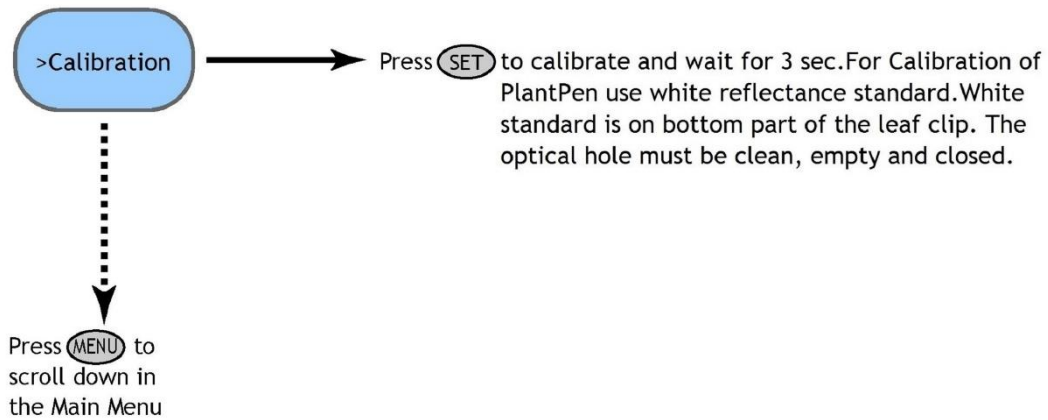
To start hold the SET key for 1 second.



Measure Sub-Menu

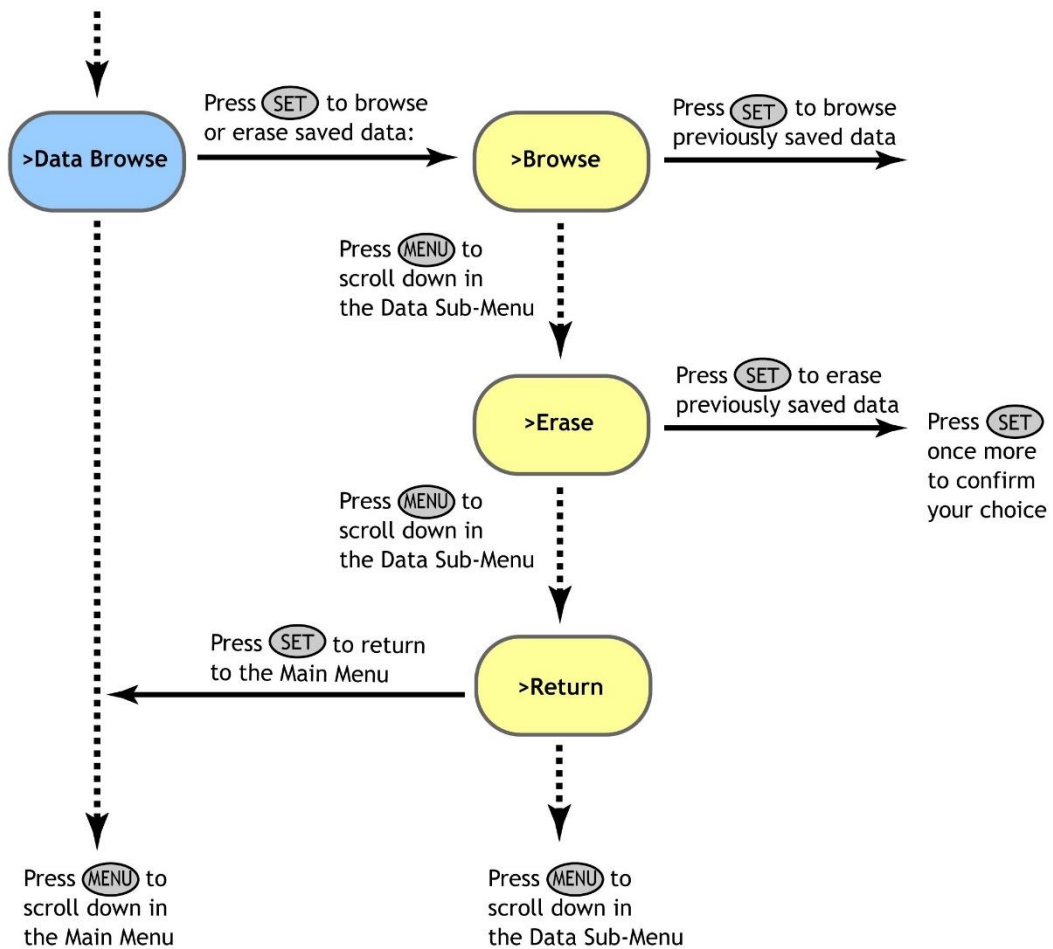


Calibration Sub-Menu



Data Sub-Menu

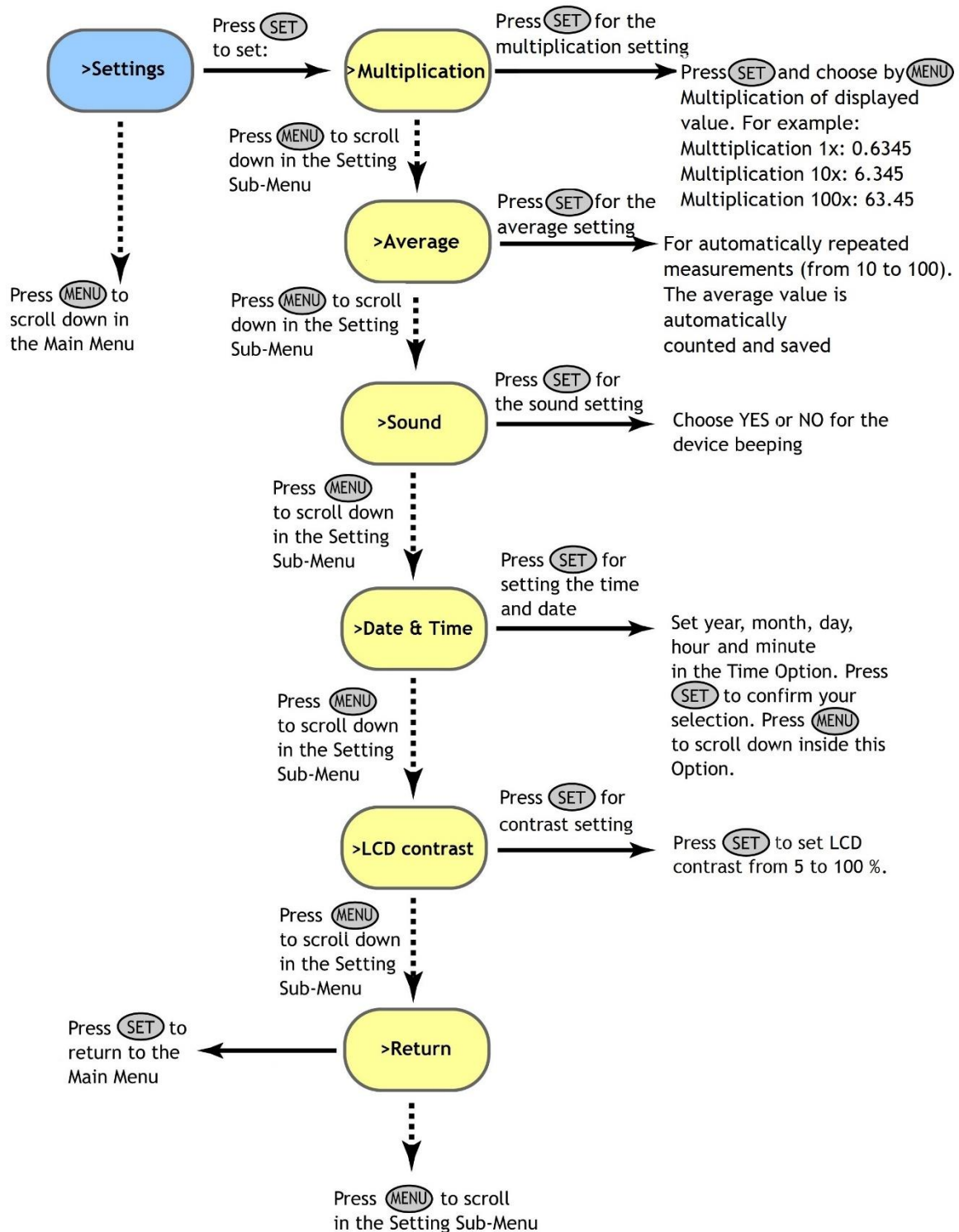
Use the Data Sub-Menu when browsing or erasing previously measured data.



IMPORTANT NOTE: Be aware that it is not possible to erase single data.
All stored data are erased!

Setting Sub-Menu - Part 1

Use the Setting Sub-Menu to set the light color, light intensity, number and frequency of measurements, date, time, or the sound mode.



7 USB CONNECTION

PlantPen comes with the USB cable that is required for charging of the Li-ion battery and can also be used for data transfer to the PC after completion of measurements. To connect the USB cable with the PlantPen device follow the picture instructions below. Please note that a lock in system is used to secure the USB cable to the PlantPen and extreme caution has to be used when setting up this connection to avoid damage to the cable pins.



When connecting the USB cable take extra caution to prevent damage to the cable connector pins. Ensure correct orientation of the cable as shown in the pictures below so the circled portion of the plug and the cable in photo A and B are perfectly lined up prior to pushing them together. Once this connection is achieved the cable may be secured in position by turning the metal cover of the cable and locking the cable in position.

To connect PlantPen with your computer please follow steps below in Fig. 4:

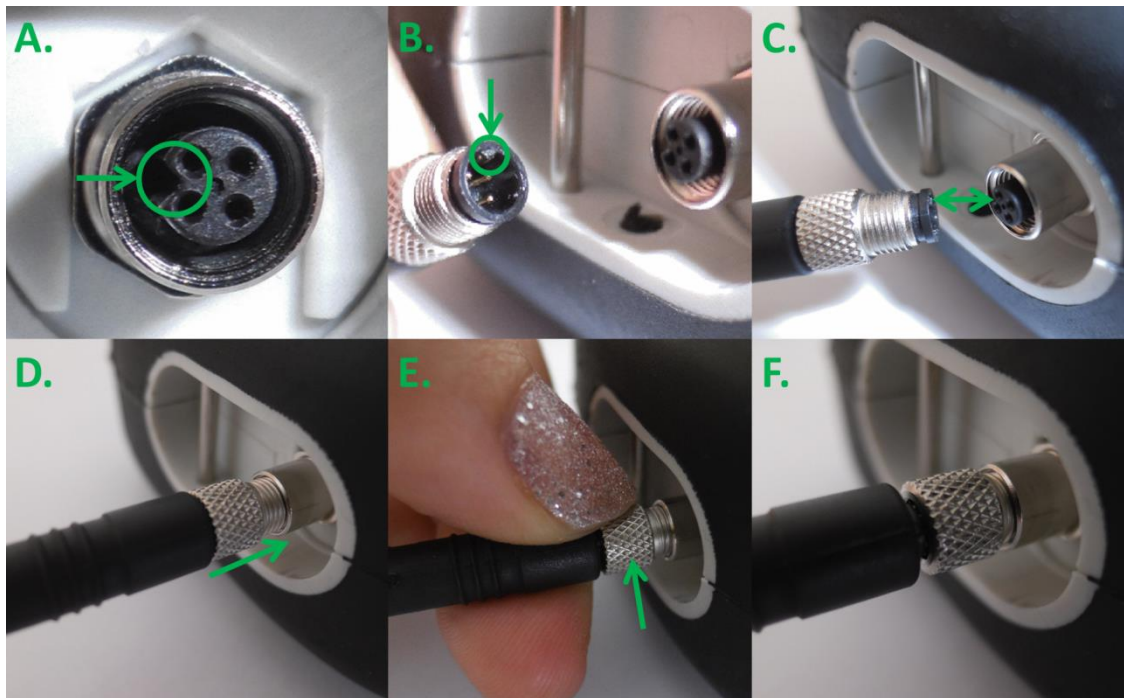


Fig. 4 How to connect PlantPen with PC.

A) connector on the PlantPen device. B) Portion of the USB cable with pins. C – E) Position the cable horizontally and line up the green circled parts of the cable and the connector, plug in the inlet and screw the securing screw. F) Correct connection of the USB cable and Pen device.

Once the cable is securely attached to the PlantPen the other end may be connected to the USB port on a PC. The PlantPen **switches ON** automatically after connecting the cable to the PC. For the USB connection to be successful the USB driver and the FluorPen software need to be installed on the PC. Both may be found on the installation disk (USB driver folder) delivered with the device. Once the USB driver is installed the Device Manager in Windows will list the USB serial port in the device tree. The USB driver may also be downloaded from PSI websites www.psi.cz. Once the driver is installed correctly the connection between the PlantPen device and the computer is initiated by selecting in the software on the computer **Setup > Device ID**.

For more information about FluorPen software see chapter 9.

8 BLUETOOTH CONNECTION

In addition to data transfer via USB the PlantPen may be connected to the software via Bluetooth for data transfer. Before setting up the Bluetooth connection between the PlantPen and the PC, ensure the following components are in place:

Bluetooth enabled PC

The PC must have Bluetooth wireless technology, either built-in or through a Bluetooth card. Ensure that the PC's Bluetooth setting is in "discoverable" mode (meaning that it shows up when other devices search for nearby Bluetooth connections). Consult the user guide for the PC or Bluetooth card to learn how to do this.

Bluetooth configuration software properly set up on the PC

Before you connecting the PlantPen to the PC and downloading data files the Bluetooth software that came with the PC, or the PC's Bluetooth card needs to be activated. This software varies by manufacturer. Please consult the PC's Bluetooth documentation for more information.

Bluetooth must be switched on and be visible on both devices

To pair the PlantPen with another Bluetooth device, such as a computer, ensure that Bluetooth is switched on visible on both devices.

8.1 BLUETOOTH PAIRING

1. Enabling Bluetooth on the PlantPen

- Switch ON the PlantPen (press and hold the **SET** key for 1 s).
- Scroll to the **Accessories** menu (press the **MENU** key) and select Accessories by pressing the **SET** key.
- Select Bluetooth On (press the **MENU** key, then turn it ON by pressings the **SET** key.



Keep in mind that the PlantPen turns off automatically after about 8 minutes of no action.
Turning off the PlantPen always turns Bluetooth off.

2. Starting Bluetooth Application on the PC

- The following description of how to set up the Bluetooth connection between the PC and the device is for Windows 7; some of the steps may be different with different version of Windows.
- Select: Start > Devices and Printers (Fig. 5).
- You may also start your Bluetooth application via the Control Panel: Start > Control Panel > Hardware and Sound > Devices and Printers.

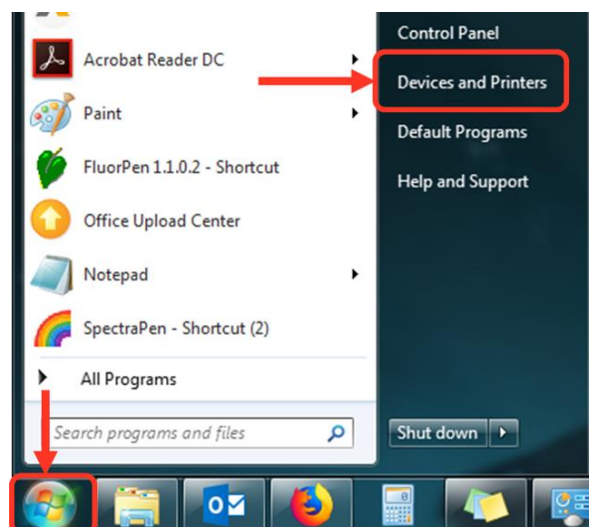


Fig. 5 Start bluetooth application.

3. Opening the Add Bluetooth Device Application

- Select: “Add a device” to start searching for the new Bluetooth device. Be sure that the PlantPen is in discoverable mode (see step 1).



Fig. 6 Add a device.

4. Selecting the PlantPen

- Select: PSI PlantPen icon.
- Click: Next (Fig. 7).

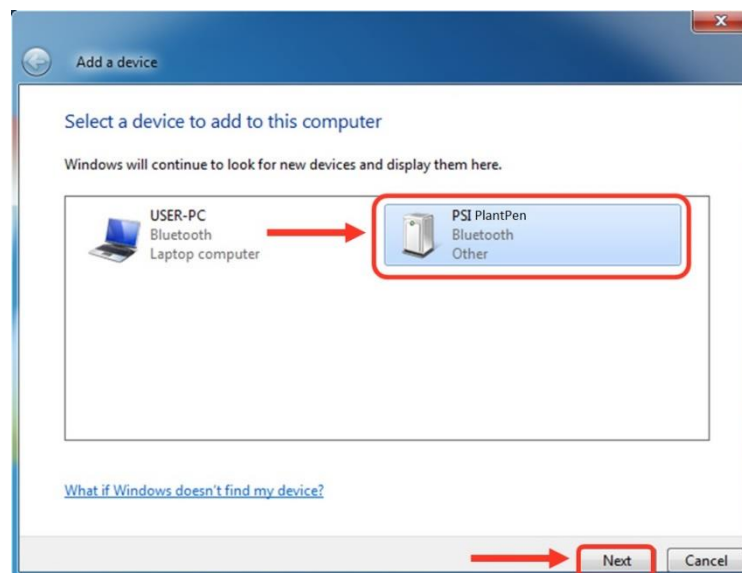


Fig. 7 Select the PlantPen.

5. Starting the Pairing Process

This step is different for old and new version of the PlantPen, that are equipped with disparate Bluetooth module.

Old versions PRI 200 and NDVI 300:

Your Bluetooth Pairing Code is: 0000

- Select: “Enter the device’s pairing code”.
- Enter: **0000** (four digits).
- Select: Next (Fig. 8).

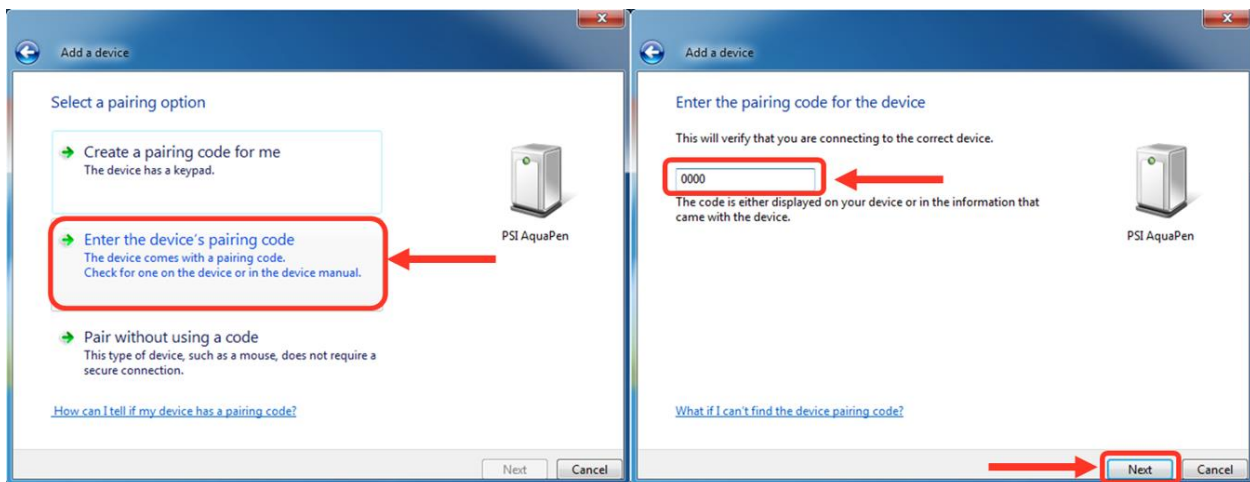


Fig. 8 Pairing process.

New versions PRI 210 and NDVI 310:

- Select: Yes (Fig. 9). Please note that the PlantPen device does not display the verification number. The verification code is not important for the BT connection.
- Select: Next.

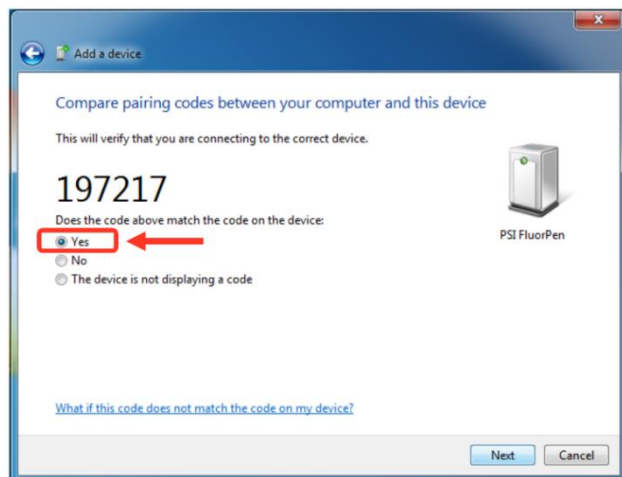


Fig. 9 Verifying of the Bluetooth pairing.

6. Completing the PlantPen Pairing

- Select: Close (Fig. 10).

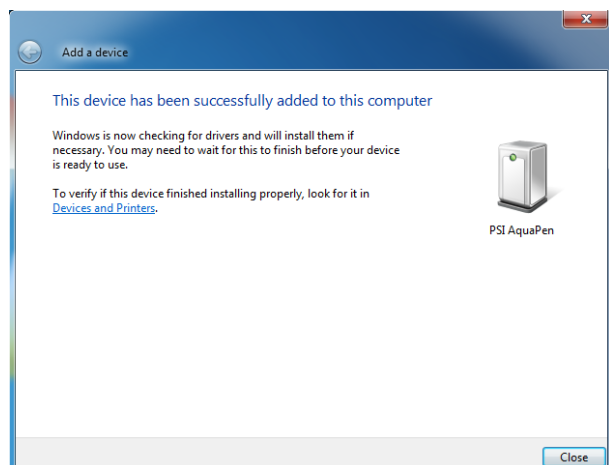


Fig. 10 Finishing.

The Bluetooth pairing is now complete, and the next step is to open the program FluorPen 1.1 (included on the USB flash disk) For more information about FluorPen software see chapter 9.

9 FLUORPEN SOFTWARE

9.1 SOFTWARE INSTALLATION

1. Copy the FluorPen software provided on the USB flash disk to your computer and launch the FluorPen program.
2. To connect and recognize the PlantPen device in the FluorPen software, proceeds first with the registration of the FluorPen software (Fig. 11).
 - Select: Help > Register
 - Enter: your serial registration number (found in a text file on the USB flash disk drive included with the device).
 - Select: OK

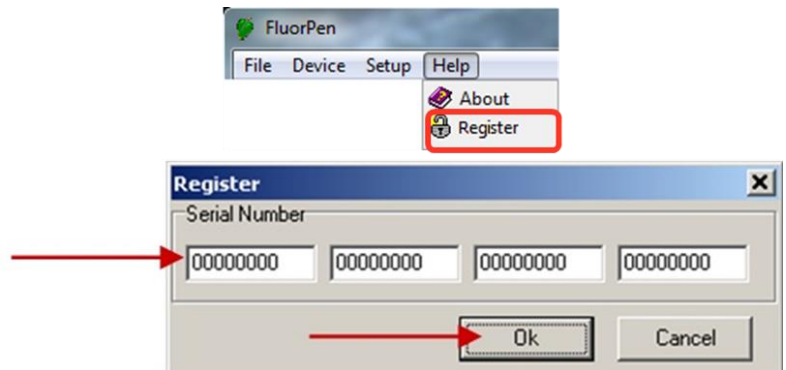


Fig. 11 Software registration.



Please note that the serial (registration) number for the PlantPen may be found in the file **SN.txt**, which is included on the enclosed USB flash disk.

Please Note: it is not possible to download data from the PlantPen device without software registration.

3. Switch on the PlantPen and enable Bluetooth or connect USB cable to the PC.
4. Ensure the PC and the PlantPen are properly paired (see chapter 7 and 8 for complete information on USB and Bluetooth pairing).
5. In the software select: **Setup > Device ID (Ctrl+I)**. If properly connected, the message "Device: PlantPen" appears in the bottom part of the screen (Fig. 12). If the connection is not successful then message "Device not found" will appear. In the latter case check all the connections (USB) and Bluetooth pairing.

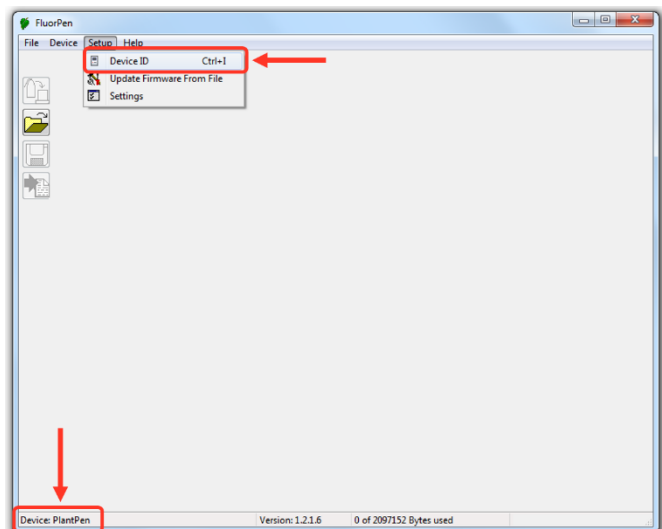


Fig. 12 Connecting PlantPen with software.

9.2 MENU AND ICONS EXPLANATION

9.2.1 MAIN MENU

MENU: File

Load	Loads previously saved data files.
Save	Saves data to hard disc.
Export	Exports data in .txt format.
Export to JSON	Exports data in JavaScript Object Notation.
Close	Closes the current experiment.
Close All	Closes all running experiments.
Exit	Exits the program.



MENU: Device

Download	Downloads data from the PlantPen to your PC.
Erase Memory	Erases data from the PlantPen memory.
Online Control	Online control of AP device.
Attach GPS File	Used for download data from GPS module (active only in PlantPen versions PRI 200 and NDVI 300).



MENU: Setup

Device ID	Detects the connected device.
Update Firmware	Used for firmware updates.
Settings	Used for modification of the program settings.



MENU: Help

About	Offers basic information about the program.
Register	Used for the FluorPen software registration.



Icon Explanation:



Download	Downloads data from the PlantPen to PC.
Load	Loads (opens) previously saved data files.
Save	Saves data to hard disc.
Export	Exports data in .txt format.

9.2.2 MENU SETTINGS

MENU > Setup > Settings

After Download – Memory Erase

If the box is checked the PlantPen memory is erased after each data download.

Data – Inverted

If the box is checked the polarity of data is inverted, e.g., multiplied by -1. This feature can be helpful for a certain type of experiment when the measured data are undesirably interpreted as negative values.

Data – Add to opened

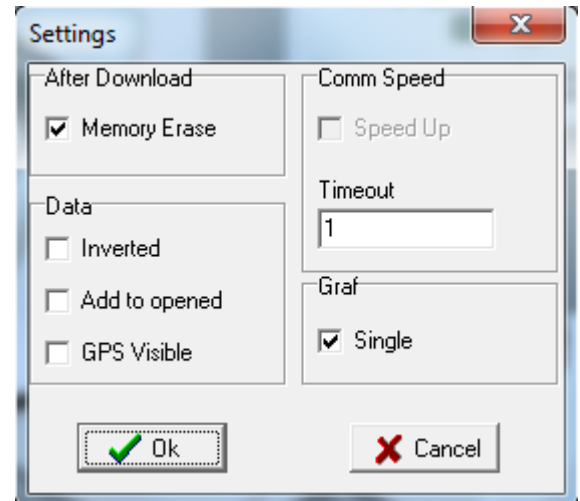
If the box is checked the downloaded data are added to that of the current opened experiment.

Data – GPS Visible

This option is active only in older PlantPen versions PRI 200 and NDVI 300. In new version the GPS data are automatically downloaded and paired with protocol measurements.

Graf – Single

This function is not available for PlantPen PRI or NDVI.



9.2.3 MENU ONLINE CONTROL

This function can be used for Online Control your PlantPen device after connection with your PC.

- Select: **Menu > Device > Online Control**

Online Control – Switches (Fig. 13)

Sound On/Off - choose On/Off for device beeping.

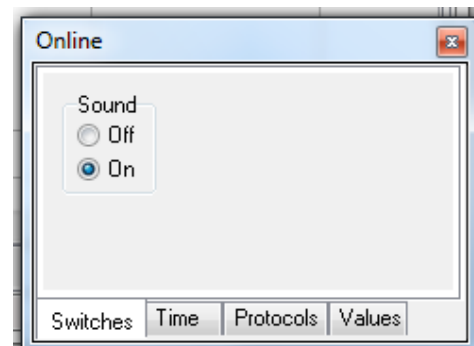


Fig. 13 Online control – Switches.

Online Control – Time (Fig. 14)

The PlantPen time and date can be set in this window. The time and date can be edited either manually by setting and saving it or synchronized with the computer automatically by ticking the box. The synchronization is performed just at once (i.e., the option doesn't synchronize the time continuously). This is essential for correct GPS data acquisition and therefore recommended.

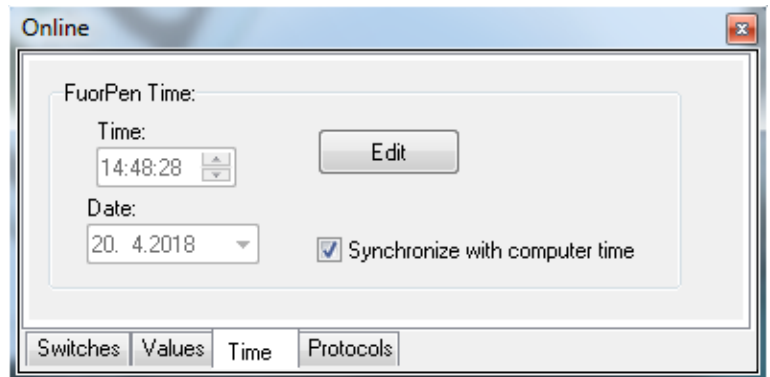


Fig. 14 Online control – Time.

Online Control – Protocols (Fig. 15)

Choose the protocol for measuring. PlantPen device start to measure. After measuring you can download data.

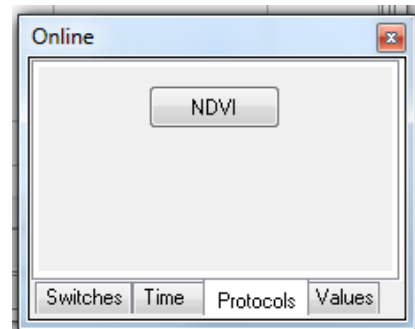


Fig. 15 Online control – Protocols.

Online Control – Values

This function is not available for PlantPen PRI or NDVI.

9.3 DATA TRANSFER AND EXPORT

1. Perform a measurement with your PlantPen. In Fig. 16 we did an NDVI measurement.
2. Click the **Download** icon or select **Device > Download**.
3. The Data table appears.

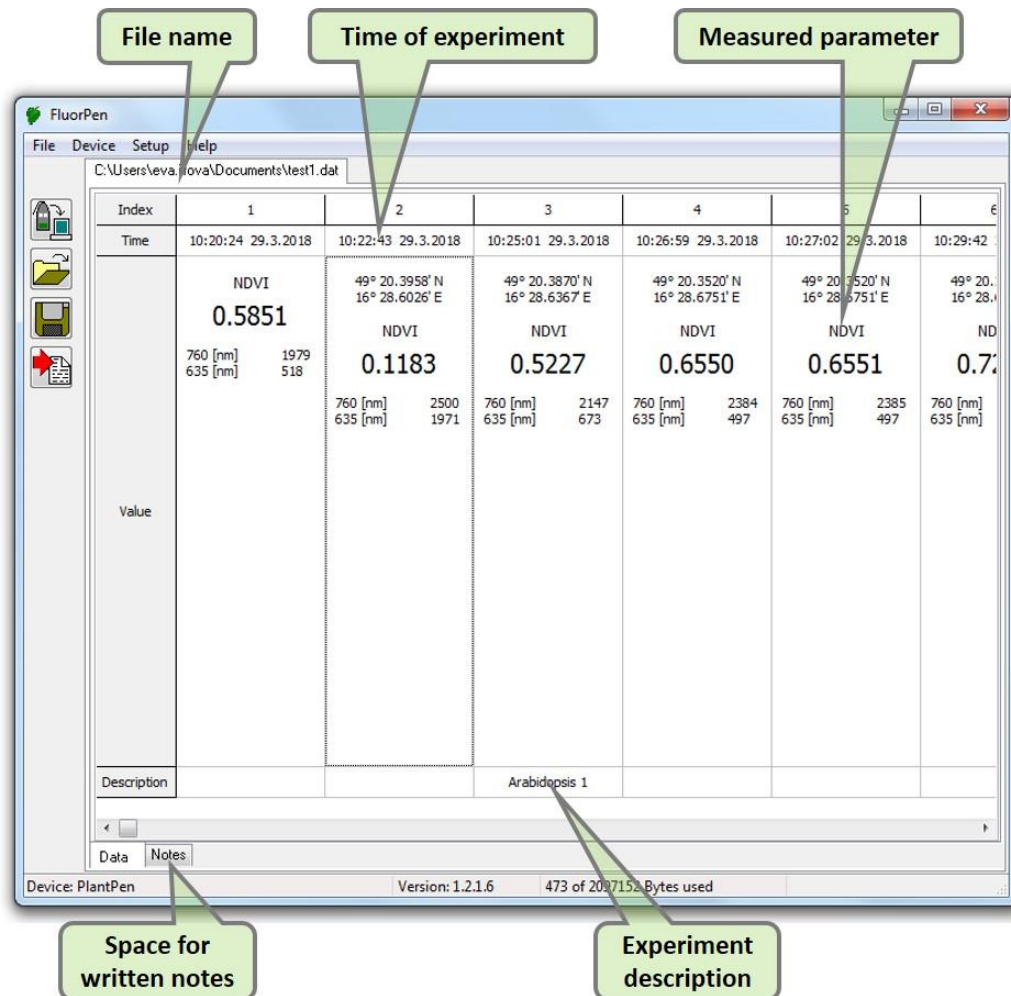


Fig. 16 Example of data transfer.

4. For **export** press **File > Export** or **Export** icon, select what you want to export (NDVI or PRI) -Fig. 17.

Selected only – exports only one measurement that is selected by mouse, otherwise it will export everything.

Source data – exports raw data.

Description – exports the data description if any.

Computed values – export calculated data

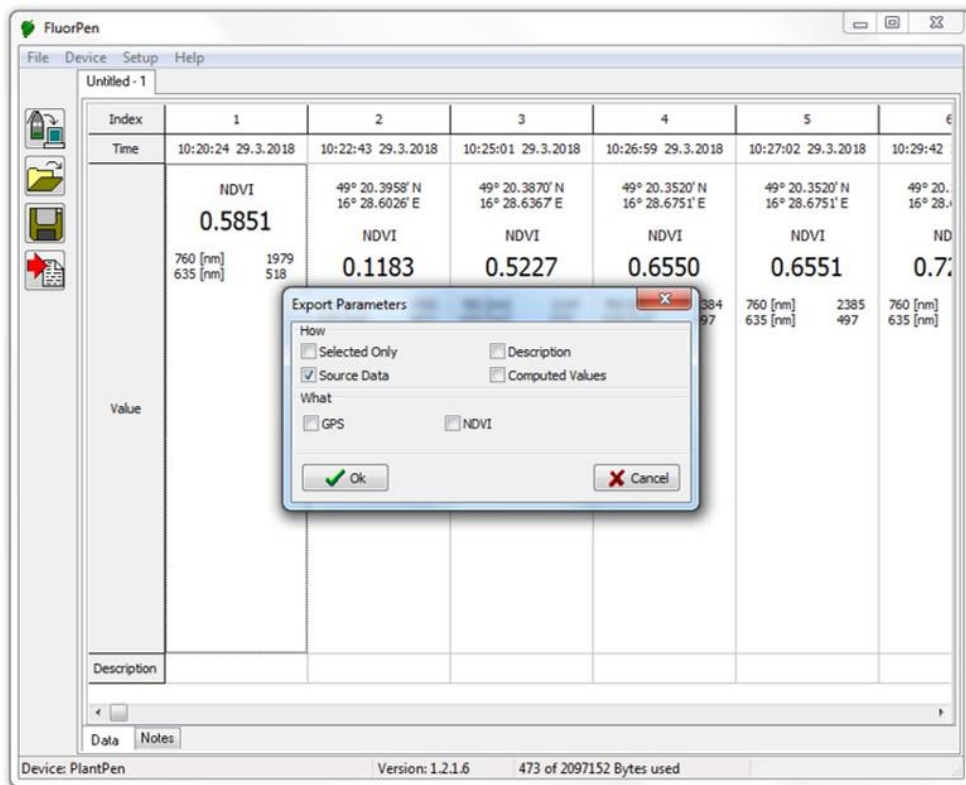


Fig. 17 Data export.

9.4 FIRMWARE UPDATE



All data in the PlantPen memory are erased during the firmware update!

Before starting any firmware update, download all your data from the PlantPen memory to the computer!

1. Starting Update

- Select: **Setup > Update Firmware From File** (Fig. 18).

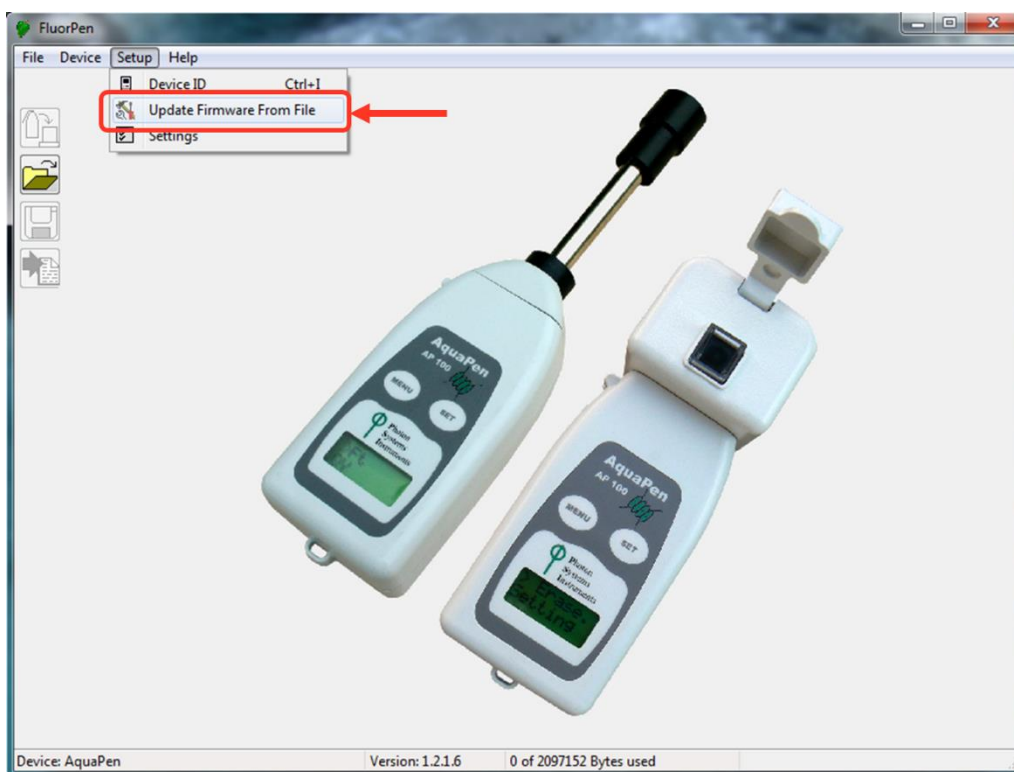


Fig. 18 Firmware Update.

2. Warning

- Select: **OK** to start update (Fig. 19)

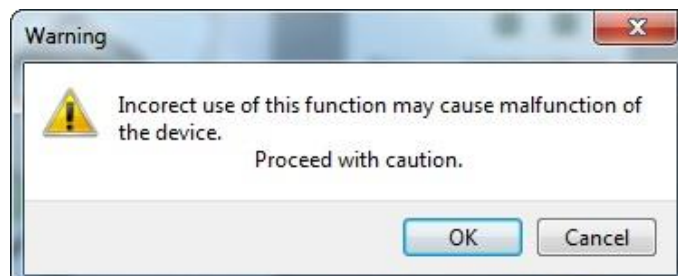


Fig. 19 Warning.

3. Selecting .bxn file

- Find: firmware update file: Binary file (with the extension .bxn) (Fig. 20).
- Select: Open.

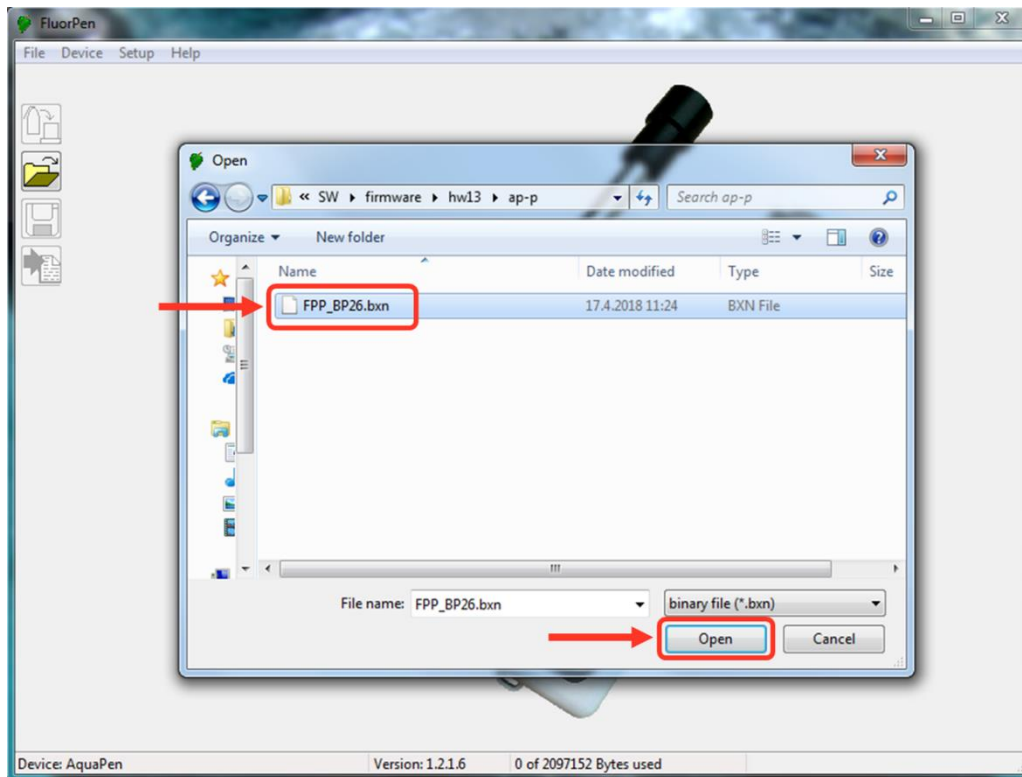


Fig. 20 Select .bxn file.

4. Finishing Upload
 - Select: **OK** to start uploading of the update (Fig. 21).

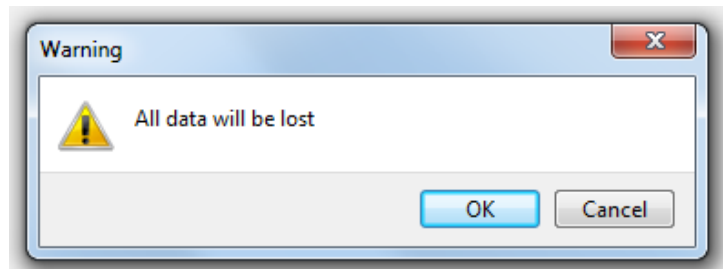


Fig. 21 Data loss warning.

- The bottom bar indicates the upload progress (Fig. 22).

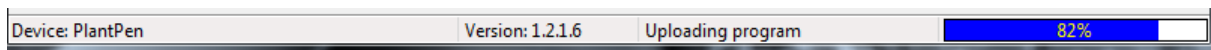


Fig. 22 Uploading process.

- Press: **OK** to finish upload (Fig. 23).

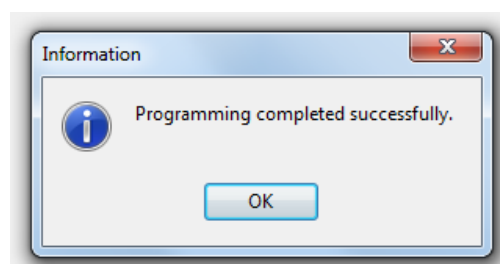


Fig. 23 Finish upload.

10 GPS MODULE

The new versions of the PlantPen device (PRI 210 and NDVI 310) have integrated GPS module which can be turned on during the measurements. When GPS module is turned on the map coordinates will be automatically saved with all collected data and will be downloaded during data download.



For proper GPS reading, the time in your PlantPen and in your computer must be synchronized. Preset time and time zone must correspond to GPS time (time zone) in your location.

10.1 GPS/PLANTPEN OPERATION

1. Check the time setting on the PlantPen device: **Settings > Date & Time**
2. Switch the GPS module "ON" on the PlantPen device by following these steps in the menu:
 - Select: **Accessories > GPS**
 - Press **SET** to confirm.
 - Wait until the GPS position is found – "**Starting GPS**".
 - The GPS module is ready when the icon in upper panel changes as shown on Fig. 24.



Fig. 24 GPS icons.

3. If the picture on the display of the device does not change then proceed to **Accessories>GPS>Location** selection in the menu and manually map the GPS by pressing SET. "**GPS Acquisition**" message will appear followed by coordinate. If the GPS module has difficulties mapping the coordinates, a message stating "**GPS not locked**" will appear on the display. It may be necessary to take the device outside into a location that is easily accessible by the satellite (clear sky view) and repeat the process of mapping.
4. Once the GPS has been turned on and successfully activated proceed to **Measurement** and select required protocol.



For prompt determination of the coordinates use the option **Accessories > GPS > Location**.



The device may need a clear view of the sky to acquire satellite signal.

Keep in mind that the PlantPen turns off automatically after about 8 minutes of no action.

Turning off the PlantPen always turns off GPS module.

10.2 DATA DOWNLOAD

1. Enabling Communication:
 - Switch on the computer and the PlantPen. Set your computer to PlantPen communication: enable Bluetooth or connect to USB port (see instructions on pg. 17).
2. Downloading Data from the PlantPen
 - Start FluorPen program.
 - Connect PlantPen device: **Setup > Device ID (Ctrl+I)**
 - Download measured data from the PlantPen to your PC by clicking the down lad icon (top icon). Data measured with activated GPS module are downloaded with GPS coordinates (Fig. 25).

The screenshot shows the FluorPen software window with a table of measured data. The table has columns for Index, Time, GPS coordinates, NDVI, and sensor readings. A red arrow points to the first data row (Index 3).

Index	3	4	5	6	7	8
Time	10:25:01 29.3.2018	10:26:59 29.3.2018	10:27:02 29.3.2018	10:29:42 29.3.2018	10:32:56 29.3.2018	10:32:59 29.3.2018
Coordinates	49° 20.3870' N 16° 28.6367' E	49° 20.3520' N 16° 28.6751' E	49° 20.3520' N 16° 28.6751' E	49° 20.2904' N 16° 28.6323' E	49° 20.2535' N 16° 28.4932' E	49° 20.2535' N 16° 28.4932' E
NDVI	0.5227	0.6550	0.6551	0.7272	0.5596	0.5127
760 [nm]	2147	2384	2385	1906	2454	2454
635 [nm]	673	497	497	301	693	693
Value						
Description						

Device: PlantPen Version: 1.2.1.6 473 of 2097152 Bytes used

Fig. 25 Measured data with GPS coordinates.

11 WARRANTY TERMS AND CONDITIONS

- This Limited Warranty applies only to the PlantPen device. It is valid for one year from the date of shipment.
- If at any time within this warranty period the instrument does not function as warranted, return it and the manufacturer will repair or replace it at no charge. The customer is responsible for shipping and insurance charges (for the full product value) to PSI. The manufacturer is responsible for shipping and insurance on return of the instrument to the customer.
- No warranty will apply to any instrument that has been (i) modified, altered, or repaired by persons unauthorized by the manufacturer; (ii) subjected to misuse, negligence, or accident; (iii) connected, installed, adjusted, or used otherwise than in accordance with the instructions supplied by the manufacturer.
- The warranty is return-to-base only and does not include on-site repair charges such as labor, travel, or other expenses associated with the repair or installation of replacement parts at the customer's site.
- The manufacturer repairs or replaces faulty instruments as quickly as possible; the maximum time is one month.
- The manufacturer will keep spare parts or their adequate substitutes for a period of at least five years.
- Returned instruments must be packaged sufficiently so as not to assume any transit damage. If damage is caused due to insufficient packaging, the instrument will be treated as an out-of-warranty repair and charged as such.
- PSI also offers out-of-warranty repairs. These are usually returned to the customer on a cash-on-delivery basis.
- *Wear & Tear Items* (such as sealing, tubing, padding, etc.) are excluded from this warranty. The term *Wear & Tear* denotes the damage that naturally and inevitably occurs as a result of normal use or aging even when an item is used competently and with care and proper maintenance.

12 TROUBLESHOOTING AND CUSTOMER SUPPORT

In case of problems with the PlantPen visit [FAQ](#) on our websites (<http://psi.cz/support/faq>) or contact customer support by email to support@psi.cz, or contact your local distributor.