Instruction Guide

PHOTON SYSTEMS INSTRUMENTS

PlantPen/N-Pen N 110

Please read the Guide before operating this product

Manual Version: 2021/12

www.psi.cz

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.

TABLE OF CONTENT

1 INFORMATION BEFORE USING N-PEN 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.

Always follow corresponding manuals while working with the N-Pen device or doing the maintenance.

It is forbidden to interfere with the hardware or software of the N.Pen 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.
ℹ	Complementary and additional information.

Tab. 1 Used symbols.

2 GENERAL DESCRIPTION

N-Pen N 110 is a light-weight, battery-powered reflectance-based instrument that provides a convenient, cost-effective method for effective nitrogen management in plants throughout their growing season. Essentially, the N-Pen characterizes nitrogen amount by means of reflectance and by the concept of a close link between chlorophyll content and nitrogen content in plants.

Rugged and compact N-Pen can be used for plant biology research or for education. Due to an inbuilt GPS module and splash-proof cover is N-Pen suitable for field experiments. The measurement is non-destructive and permits quick, repeated monitoring throughout the growing season. The device is equipped with rechargeable Li-ion battery.

Measured data are sequentially stored in the internal N-Pen 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.

2.1 Technical Specification

Protocols	Normalized Difference Greenness Index	NDGI = (R780 – R560)/(R780 + R560)
	Nitrogen content	- Correlated with NDGI - Measured in percentage - Calibration for maize, wheat and barley
LED emitter	565 nm and 760 nm	
Detector	PIN photodiode with bandpass filters From 500 to 800 nm	
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 N-Pen device package consists:

- N-Pen N 110
- Carrying Case
- FluorPen software and driver (on a USB flash disc)
- Operation Manual (PDF on a USB flash disc)
- USB Cable
- Other Accessories or Optional Features (according to your specific order)

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).

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.

For customer support, please write to: support@psi.cz

3.2 Care and Maintenance

N-Pen

- 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

Based on reflectance measurement at 565 nm and 760 nm, the N-Pen calculates NDGI (normalized difference greeness index) and predicts relative nitrogen content (N-content) in dry matter. As leaf structure specifically influences plant reflectance profile, N-content quantification was calibrated for three separate crops: wheat, barley and corn.

4.1 LEAF OPTICAL PROPERTIES AND NITROGEN

The N-Pen assesses N amount by means of spectral reflectance and by the concept of a close link between chlorophyll content and N content in soil and plants (Evans, 1983, 1989; Penuelas et al., 1994; Schlemmer et al., 2005). Since the presence of chlorophyll affects reflectance properties of leaves, optical methods based on spectral reflectance have been suggested to detect chlorophyll concentration (Yoder and Pettigrew-Crosby, 1995; Richardson et al., 2002; Gitelson et al., 2003).

Spectral reflectance is one of the optical methods widely used for indirect quantification of crop physiological status, which can be influenced by various factors, such as plant nutrients or pathological status. Chlorophyll absorption spectrum contains two absorption bands, one in the red and one in the blue region of visible spectrum (Fig. 2). Reflectance spectrum of green leaves roughly complements the absorption spectrum (compare A and B in Fig. 2), indicating that the presence of chlorophyll is critical for optical properties of leaves (Thomas and Gausman, 1977; Gitelson Merzlyak, 1994).

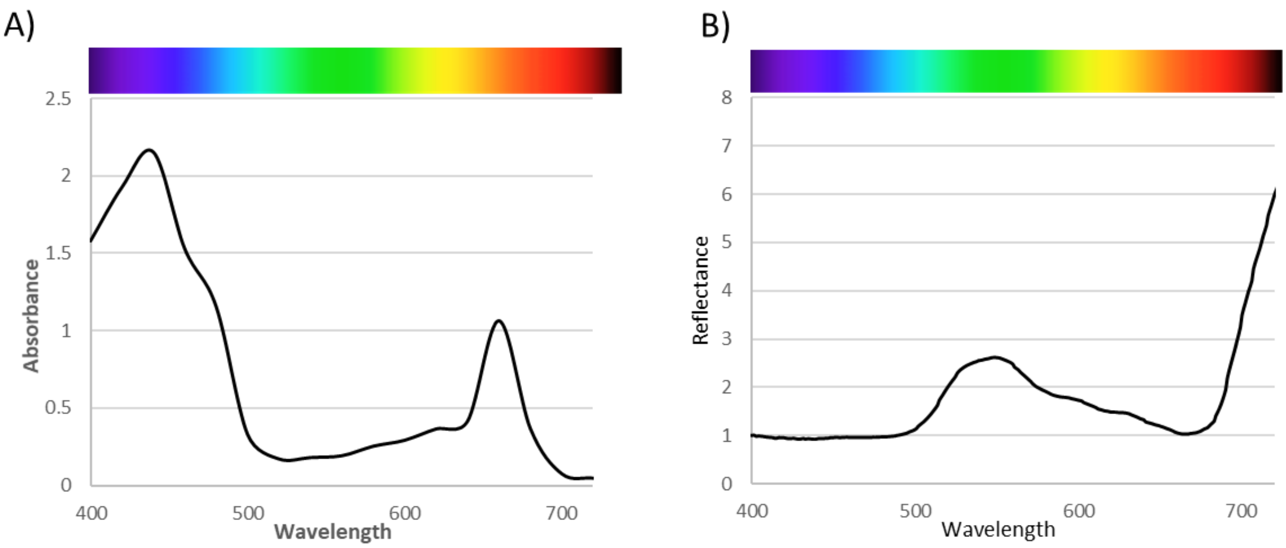


Fig. 2 Absorption and reflectance specrtra (A) leaf pigment extract (B) reflectance of leaf surface.

To determine optimum wavelength for N-content prediction, several experimental plant groups with different levels of N nutrition were examined by measurement of spectral reflectance (Klem 2008). The reflectance values at each wavelength along reflectance spectrum were correlated with N-content in experimental plant groups. Pearson's correlation coefficient was used as a statistical measure of the strength of linear relationship between the paired data (Fig. 3A). The highest correlation was found for reflectance in the ranges 530 – 630 nm and 700 – 720 nm (negative corellation) and in the NIR region 750 – 900 nm (positive correlation). Indices based on reflectance in the green region (around 560 nm) were reported to be more sensitive to N and chlorophyll content (Gitelson et al. 1997) than indices based on reflectance in chlorophyll absorption maxima (e.g. NDVI).

Normalized Difference Greenness Index (NDGI) is calculated from leaf reflectance at wavelength bands 565 nm and 760 nm (equation 1),

$$NDGI = (R760 - R565) / (R760 + R565) \qquad \text{(Equation 1),}$$

where R565 and R760 are reflectance values at indicated wavelengths. Based on a close relationship between NDGI and N-content in barley leaves at mid-tillering stage (Fig. 3B), the NDGI index was proposed to be a convenient tool for determination of N-content and N-nutrition state in barley (Klem, 2008).

Determination of NDGI index is strongly dependent on plant and leaf developmental stage as well as on environmental variability of field cultivation. Especially the first rapidly expanding leaf and the older leaves at the onset of senescence exhibit high variability of NDGI results. The most evident relationship between NDGI and N-content was reported in the second and the third youngest leaf (Klem 2008).

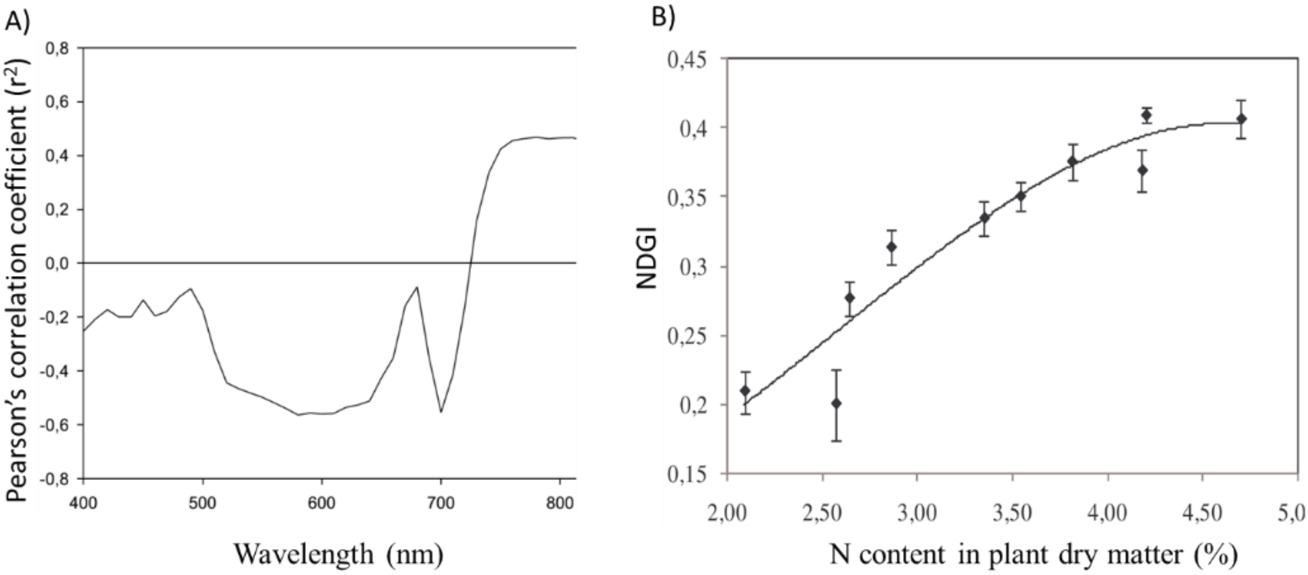


Fig. 3 Correlation between N content in barley dry matter and reflectance at particular wavelengths indicated as Pearsons correlation coefficient along the reflectance spectrum (A). Relationship between NDGI index and N content in barley dry matter (B) can be interpreted as a sigmoid curve. Vertical bars represent 95 % confidence intervals.

4.2 N-PEN CONFIGURATION

The N-pen N 110 is configured to quantify reflectance of the leaf illuminated with two LED light sources (565 nm or 760 nm, Fig. 4), calculate the NDGI index from average reflectance values and to predict the relative N-content in dry matter of plants or the postharvest grain N- content. Due to differences in leaf structure of various crops, formulas for calculation of N content were developed specifically for wheat, barley and corn. Each crop was tested on several varieties with similar results.

The N-Pen is pre-set by the manufacturer for a series of 10 measurements. After completing the series, the instrument calculates average NDGI value and the corresponding nitrogen content in plant dry matter (%). The average value is then calculated as follows: the maximum and minimum values are extracted and the average is calculated of the remaining eight values. If one (or more) of the 8 values significantly differ from the rest (outliers), the device does not accept it (them) and asks you to repeat one or more measurements.

The outliers typically arise with high variability of measured values, eventual leaf damage, disease infection or inproper fixing of leaf to measuring chamber. To exclude the outliers from the measurement the instrument uses Grubbs's test for outliers, where a t value is calculated as the largest absolute deviation from the sample mean. The t value is then compared with critical values stated in the table of Grubbs' critical values. If the calculated t value were higher than the critical value, the value is excluded due to high probability that the value is an outlier.

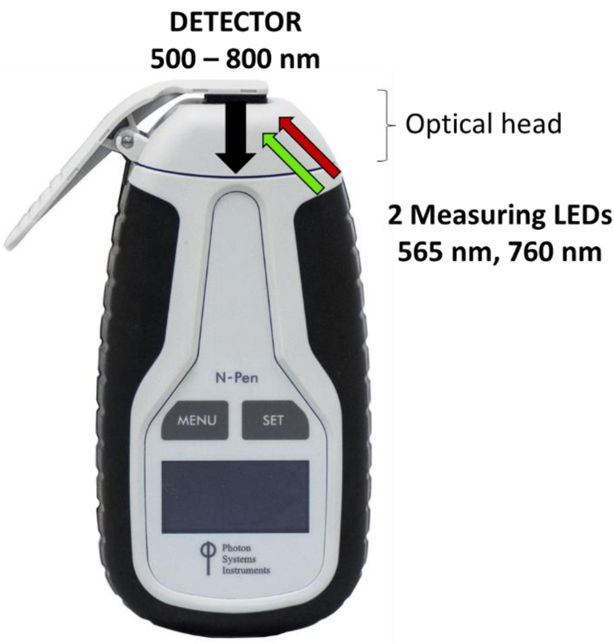


Fig. 4 N-Pen configuration.

4.3 Nitrogen nutrition

The outcome of the measurement with N-pen is formulated as relative N-content in plant dry matter (%). Another practical interpretation of the NDGI value, is the N nutrition state (Fig. 5). The maximum NDGI value is set to 100 % and the minimum reflectance is set equal to 0 % as follows:

1. NDGI > 0.65 indicates 100% N nutrition state (N = 100 %)
2. NDGI < 0.25 indicates 0 % N (N = 0 %)
3. If 0.65 > NDGI > 0.25, then nutrition state is calculated as N (%) = (NDGI - 0.25) * 250

As a general rule, nutrition state at early stages of development characterized by onset of tillering should be maintained at higher levels. Later, during shoot elongation and emerging flag leaf, (Novoa and Loomis 1981).

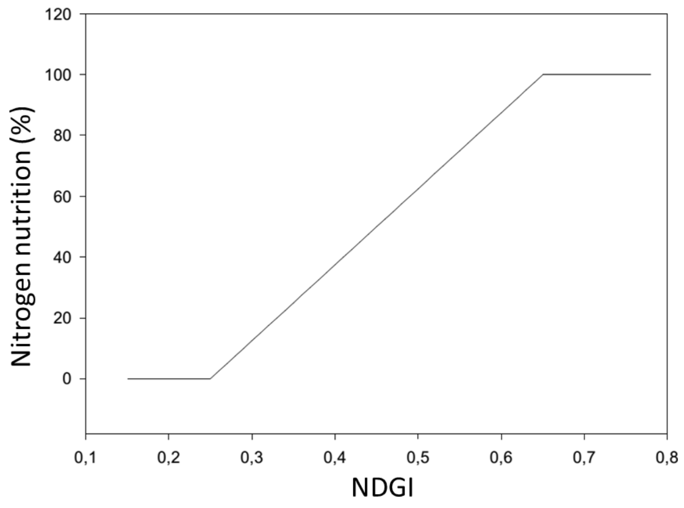


Fig. 5 Prediction of relative N nutrition from NDGI.

5 GETTING STARTED

Define the number of samples per each experimental group. The measurement is performed as a series of measurements, where the number of measurements can be set in range from 6 to 20. The pre-set number 10 can be used, for example, to measure 10 plants (each plant is measured once) or to measure 5 plants (each plant is measured twice). In case of high variability, the user is advised to reconsider the sampling method or to increase the sampling scale.

The N-Pen is controlled using two buttons:

- Use the **MENU** key to scroll through sequential menu options on the digital display.
- Use the **SET** key to 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 N-Pen use white reflectance standard.

	Before calibration, make sure that the optical part of the device, including the inner part of the sample holder, is clean. It is necessary to calibrate N-Pen 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:

- Select **Measurement** in the main menu and select the type of crop (i.e. wheat, barley or corn). Then select the type of prediction, which is either N-content in dry matter of **plant**, or the postharvest **grain** N-content. When ready, the display shows the number of remaining measurements, for instance "Meas. left: 10". You can change the pre-set number in **Settings > Readings**.
- Select the second or the third youngest leaf and clip the leaf in the mid part along the leaf axis to the detector chamber.
- Start the measurement by pressing **SET** to obtain and store the readings. The display shows the number of remaining measurements when ready for the next measurement.
- Repeat the previous step to complete the whole series of measurement.
- When complete, the instrument displays NDGI index value and the nitrogen prediction.
- During the measurement all data are stored into the device memory.

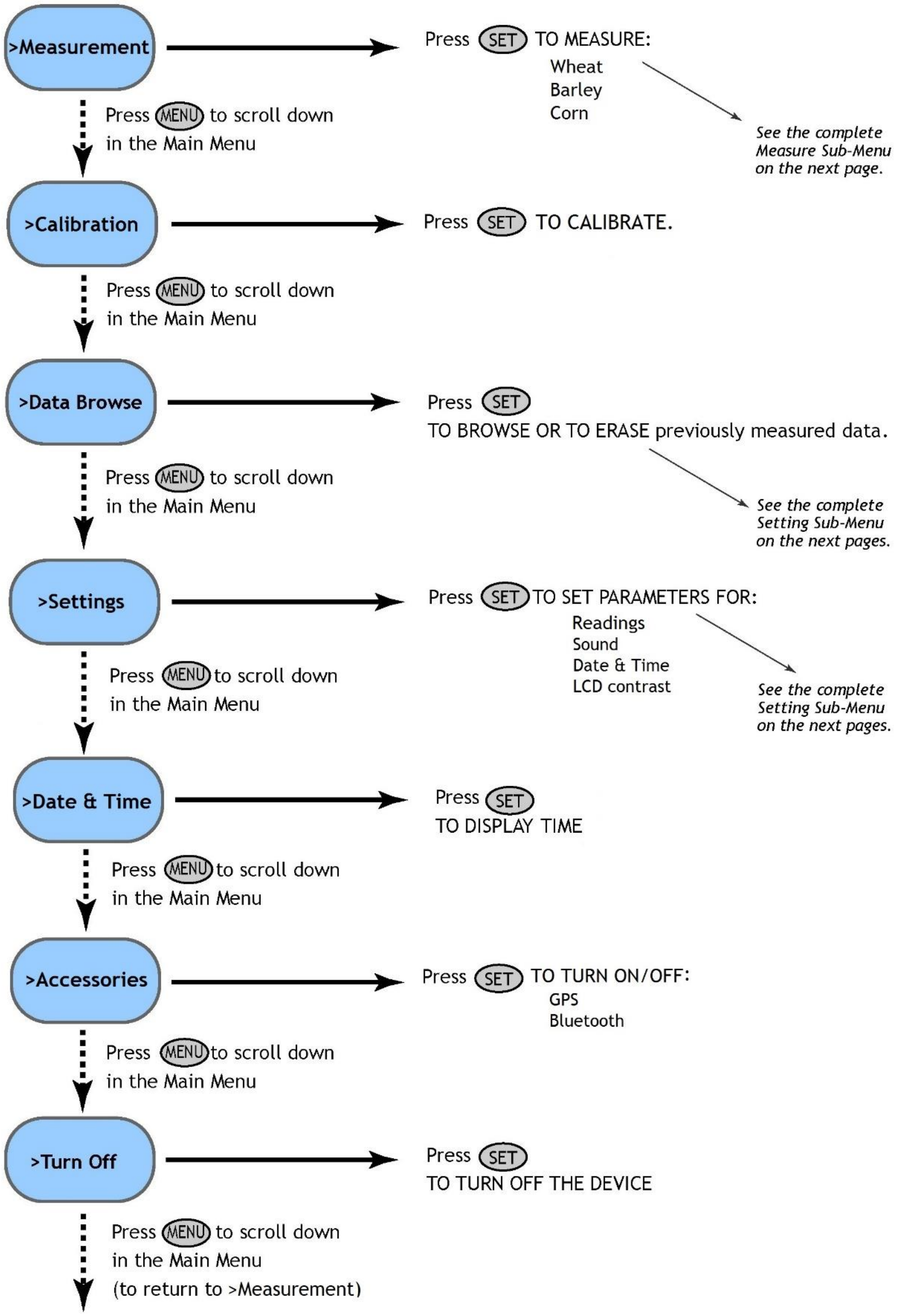
6 CONTROL MENU TREE

The next few pages of this manual show the structure of the firmware menu on the N-Pen device, and explain in a schematic way the operation of the N-Pen. 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.

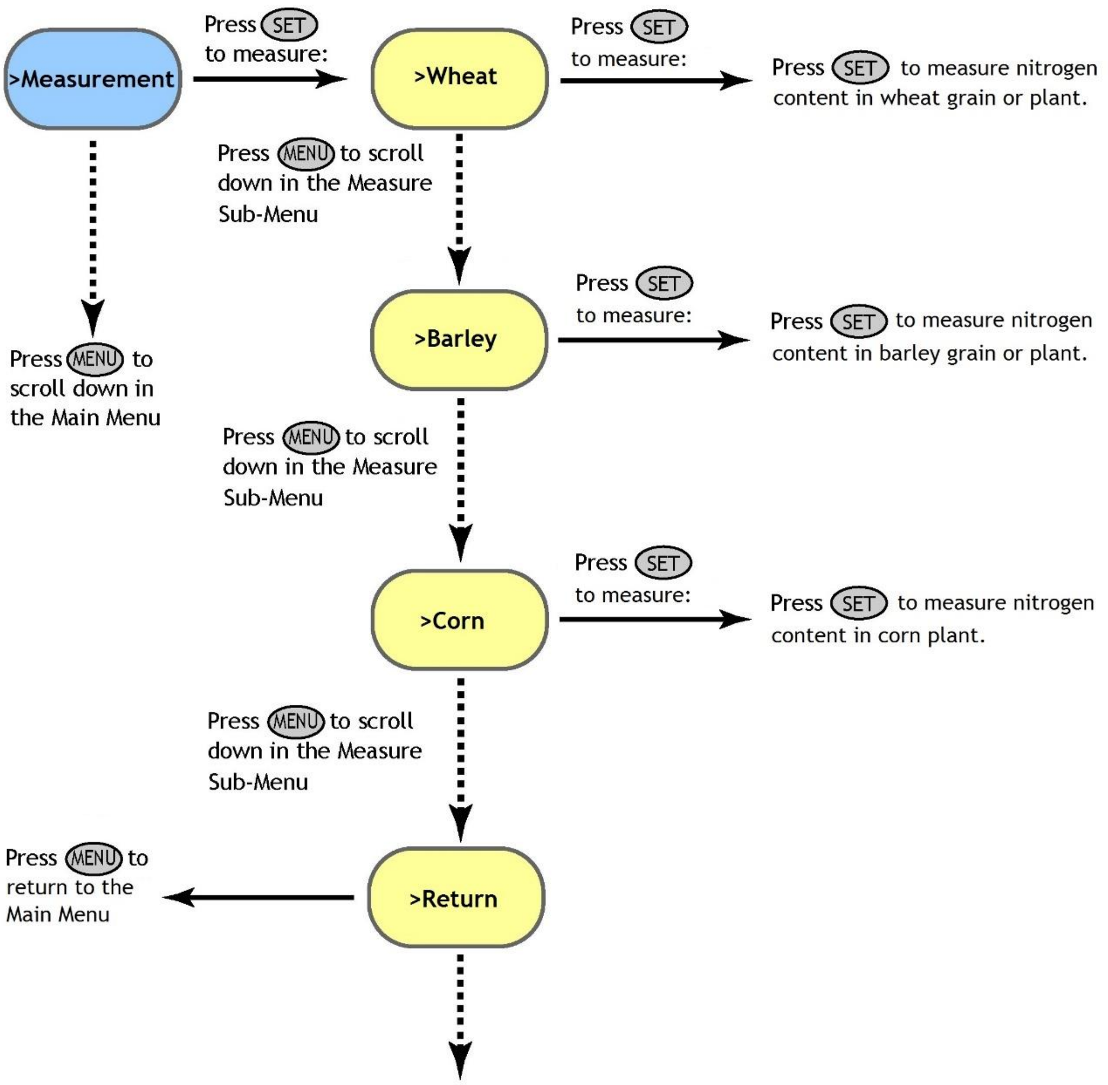
Main Menu

To start hold the SET key for 1 second.



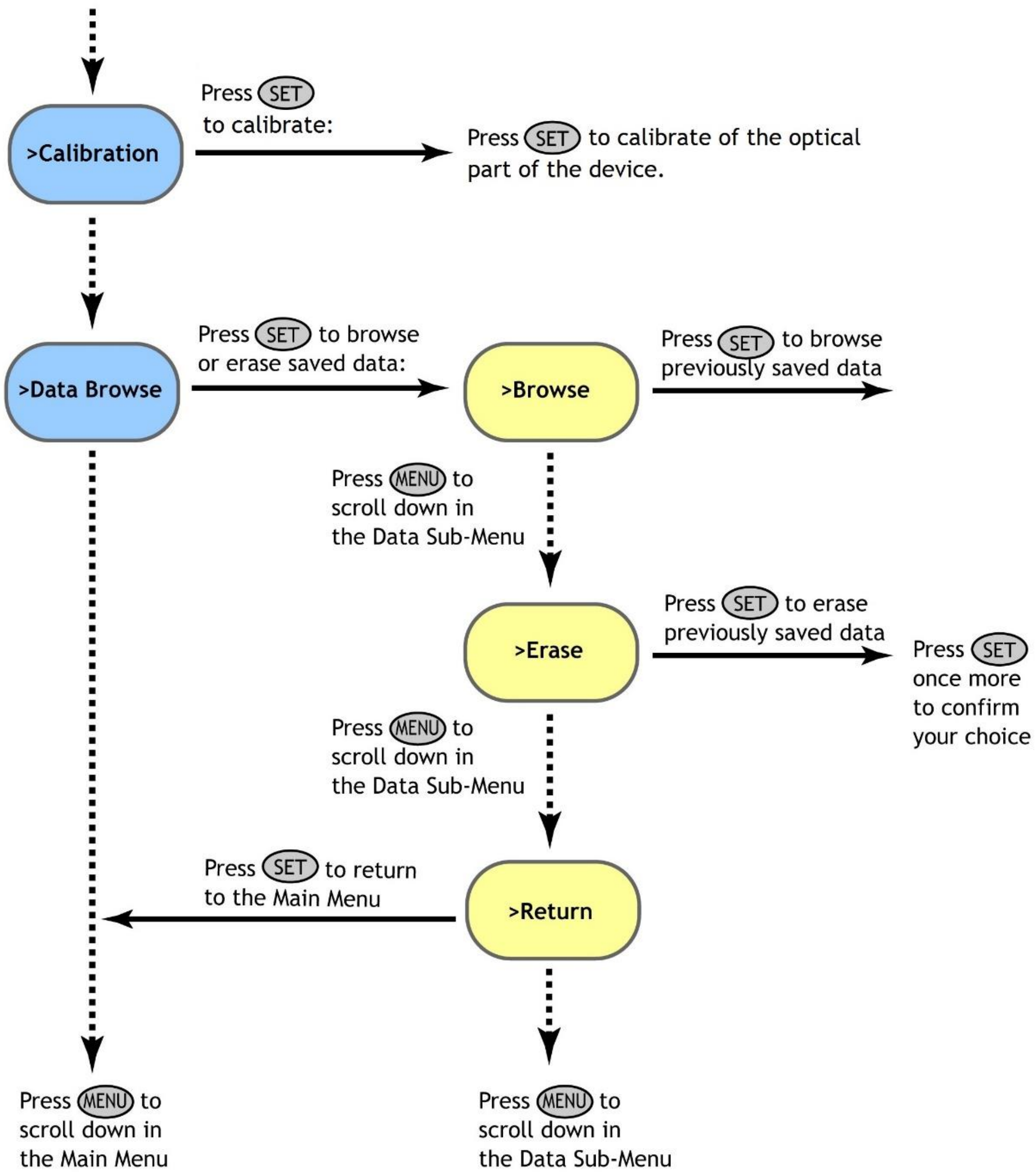
Measurement Sub-Menu

Use the Measurement Sub-Menu when measuring selected parameters.



Calibration and Data Sub-Menu

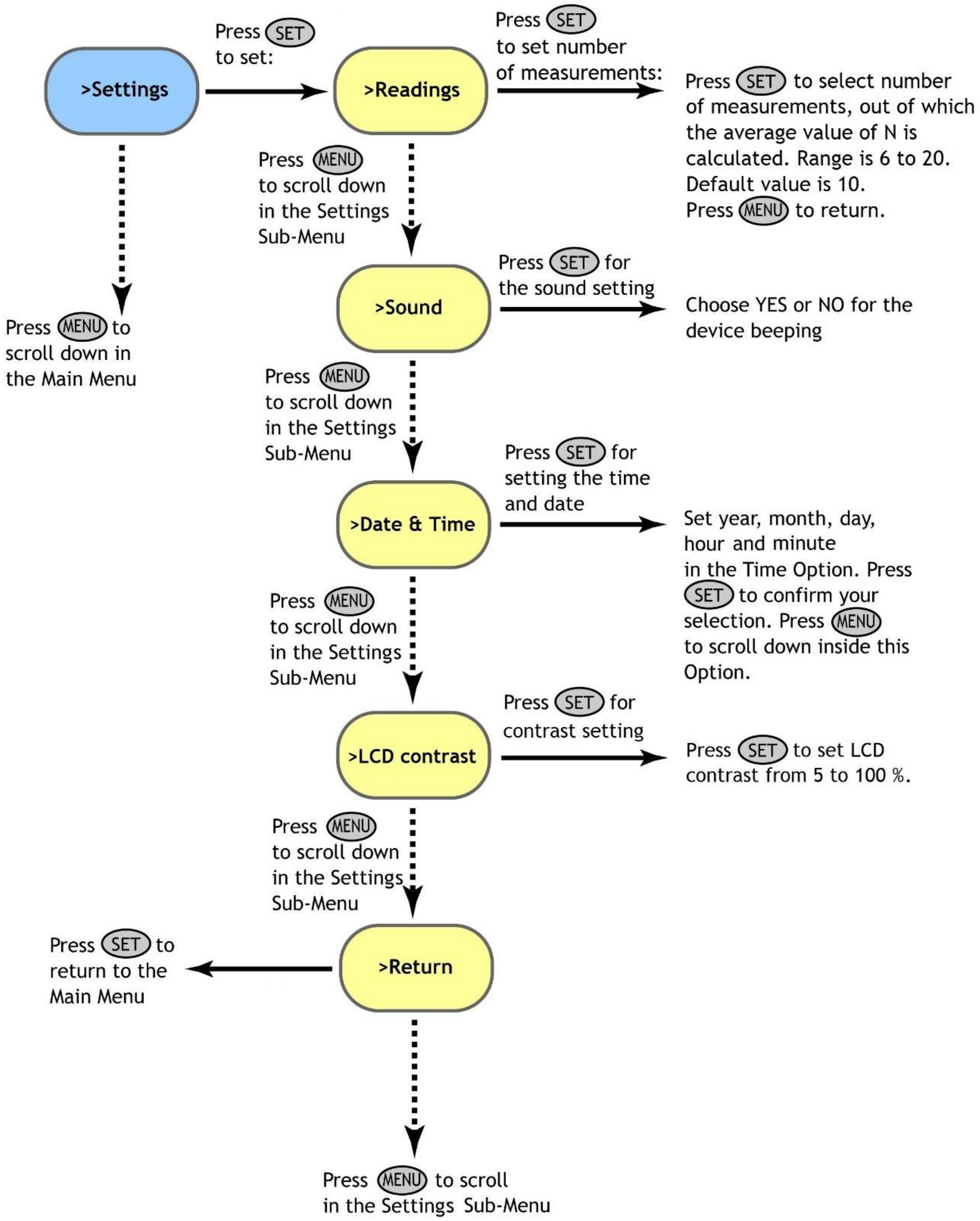
Use the Data Sub-Menu when browsing or erasing previously measured data.



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

Settings Sub-Menu

Use the Settings Sub-Menu to set the number of measurements, date, time, or the sound mode.



7 USB CONNECTION

N-Pen 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 N-Pen device follow the picture instructions below. Please note that a lock in system is used to secure the USB cable to the N-Pen 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 N-Pen with your computer please follow steps below in Fig. 6:

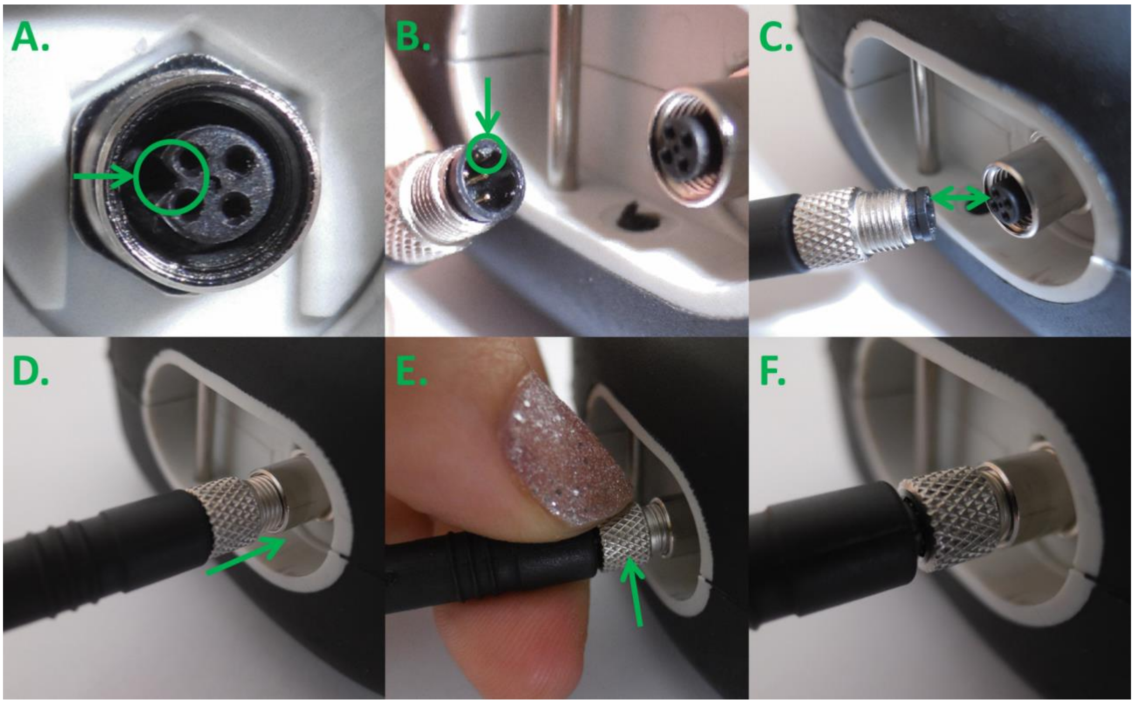


Fig. 6 How to connect N-Pen with PC.

A) connector on the N-Pen 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 N-Pen the other end may be connected to the USB port on a PC. The N-Pen **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 N-Pen 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 N-Pen may be connected to the software via Bluetooth for data transfer. Before setting up the Bluetooth connection between the N-Pen 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 N-Pen 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 N-Pen 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 N-Pen
   - Switch ON the N-Pen (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 N-Pen turns off automatically after about 8 minutes of no action. Turning off the N-Pen 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. 7).
   - You may also start your Bluetooth application via the Control Panel: Start > Control Panel > Hardware and Sound > Devices and Printers.

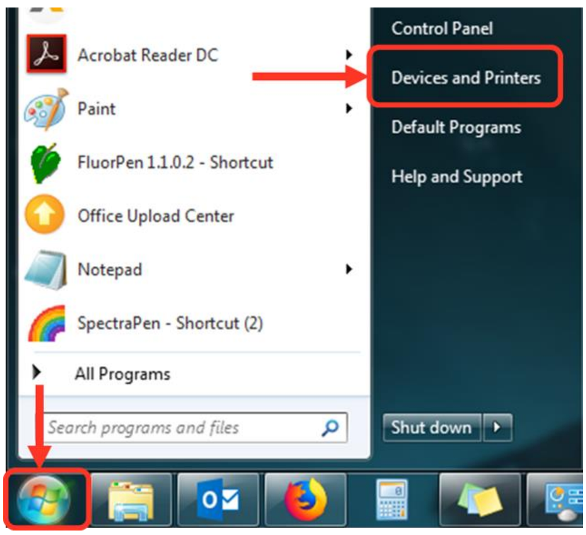


Fig. 7 Start bluetooth application.

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

Fig. 8 Add a device.

4. Selecting the N-Pen
   - Select: PSI N-Pen icon.
   - Click: Next (Fig. 9).

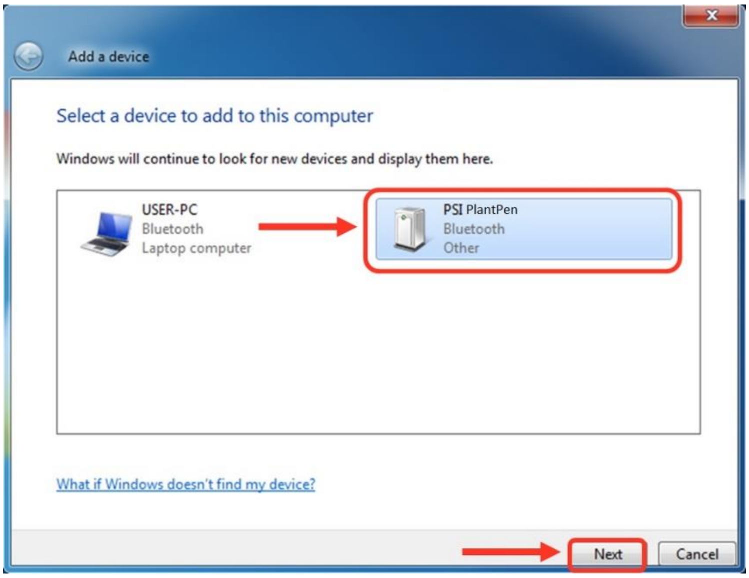


Fig. 9 Select the N-Pen.

5. Starting the Pairing Process

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

Old version N 100:

Your Bluetooth Pairing Code is: 0000

- Select: “Enter the device’s pairing code”.
- Enter: 0000 (four digits).
- Select: Next (Fig. 10).

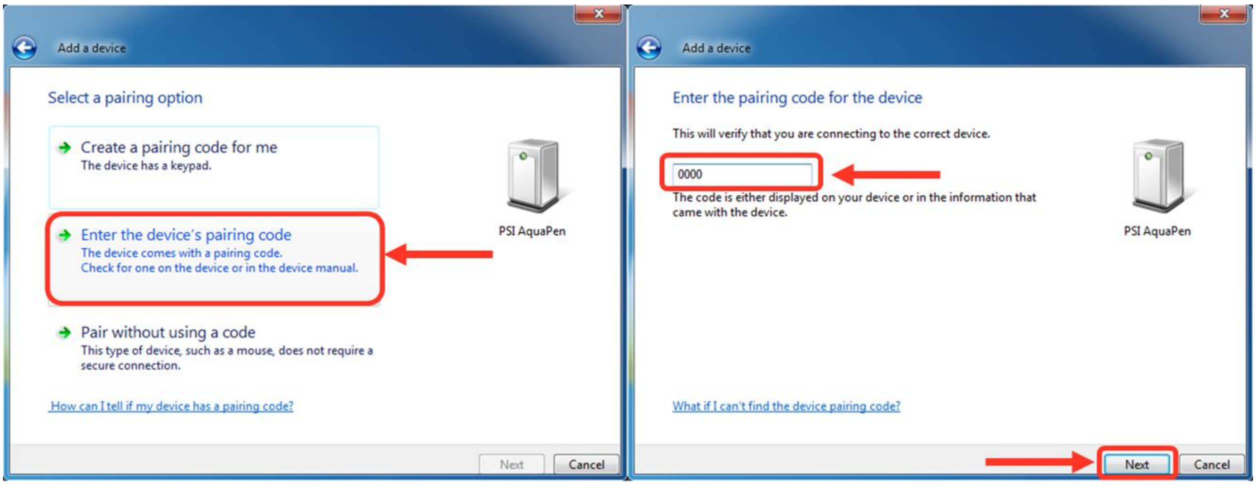


Fig. 10 Pairing process.

New version N110:

- Select: Yes (Fig. 11). Please note that the N-Pen device does not display the verification number. The verification code is not important for the BT connection.
- Select: Next.

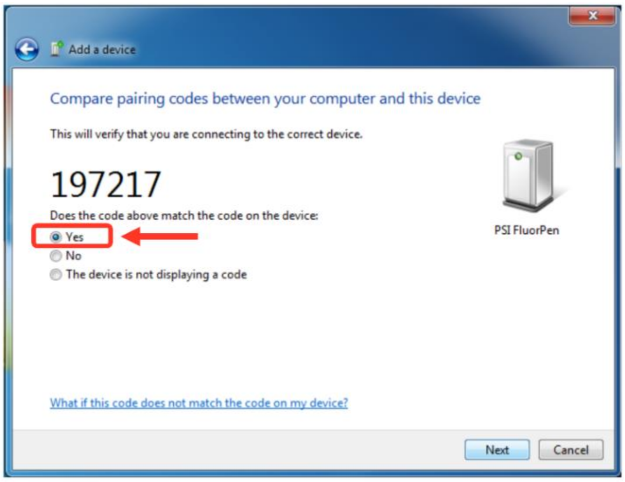


Fig. 11 Verifying of the Bluetooth pairing.

6. Completing the N-Pen Pairing
   - Select: Close (Fig. 12).

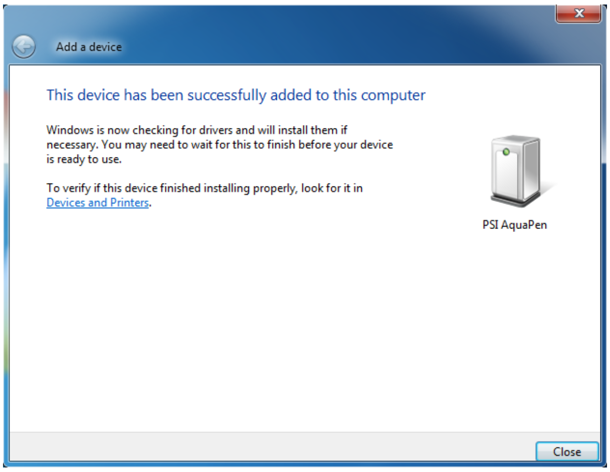


Fig. 12 Finishing.

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 N-Pen device in the FluorPen software, proceeds first with the registration of the FluorPen software (Fig. 13).
   - 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

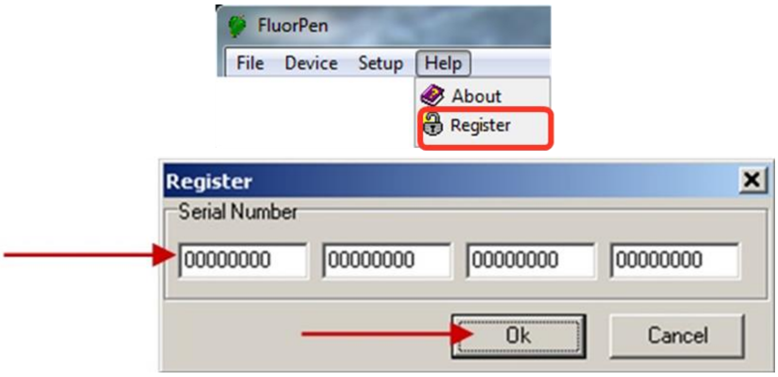


Fig. 13 Software registration.

Please note that the serial (registration) number for the N-Pen 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 N-Pen device without software registration.

3. Switch on the N-Pen and enable Bluetooth or connect USB cable to the PC.
4. Ensure the PC and the N-Pen 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: NPen” appears in the bottom part of the screen (Fig. 14). 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.

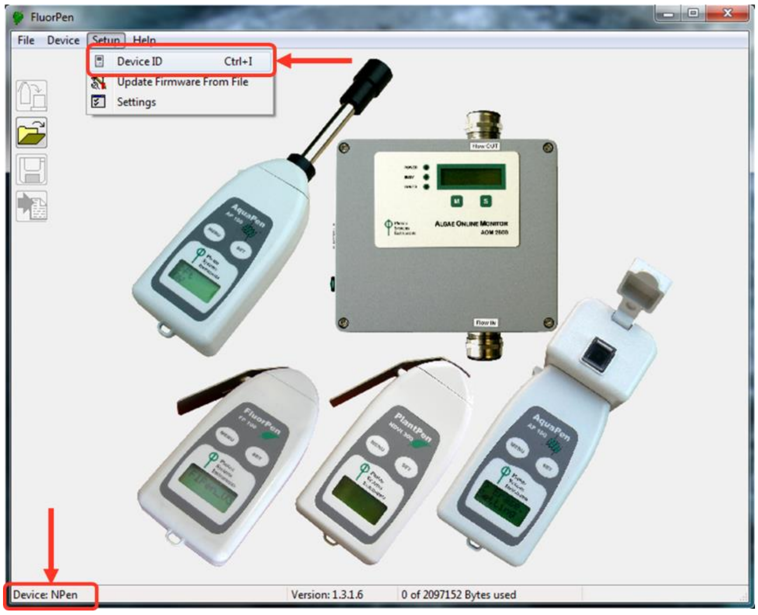


Fig. 14 Connecting N-Pen with software.

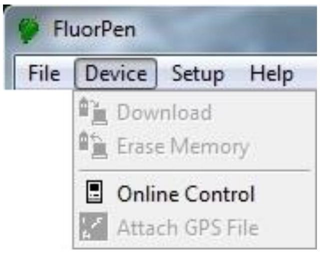
9.2 Menu and Icons Explanation

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 N-Pen to your PC.
Erase Memory	Erases data from the N-Pen memory.
Online Control	Online control of N-Pen device.
Attach GPS File	Used for download data from GPS module (active only in version N-Pen 100).

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:

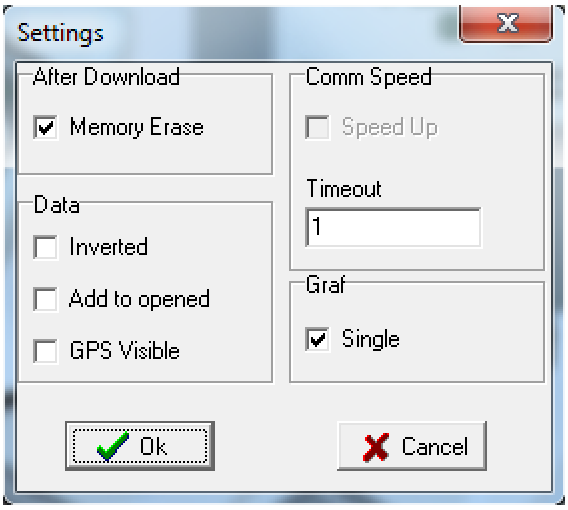
Download	Downloads data from the N-Pen to PC.
Load	Loads (opens) previously saved data files.
Save	Saves data to hard disc.
Export	Exports data in .txt format.

9.2.2 MENU SETTINGS

MENU > Setup > Settings

After Download – Memory Erase

If the box is checked the N-Pen 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 version N-Pen 100. In new version the GPS data are automatically downloaded and paired with protocol measurements.

Graf – Single

This function is not available for N-Pen.

9.2.3 MENU ONLINE CONTROL

This function can be used for Online Control your N-Pen device after connection with your PC.

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

Online Control – Switches (Fig. 15)

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

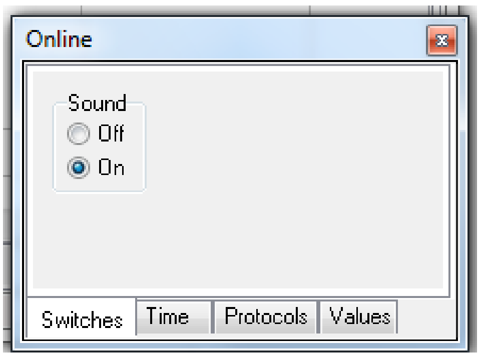


Fig. 15 Online control – Switches.

Online Control – Time (Fig. 16)

The N-Pen 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.

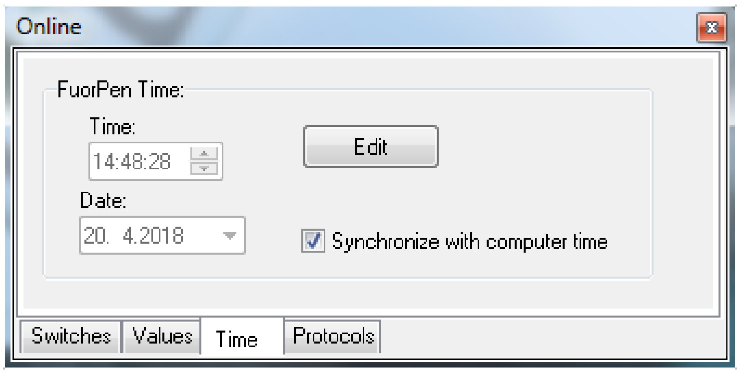


Fig. 16 Online control – Time.

Online Control – Protocols and Values

These functions are not available for N-Pen.

9.3 DATA TRANSFER AND EXPORT

1. Perform a measurement with your N-Pen.
2. Click the **Download** icon or select **Device > Download**.
3. The Data table appears (Fig. 17).

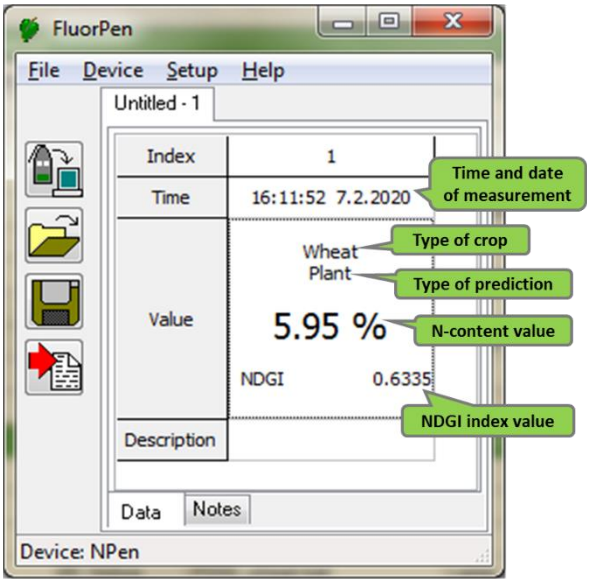


Fig. 17 Example of downloaded data.

4. For **export** press **File > Export** or **Export** icon, select what you want to export (Fig. 18).

   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

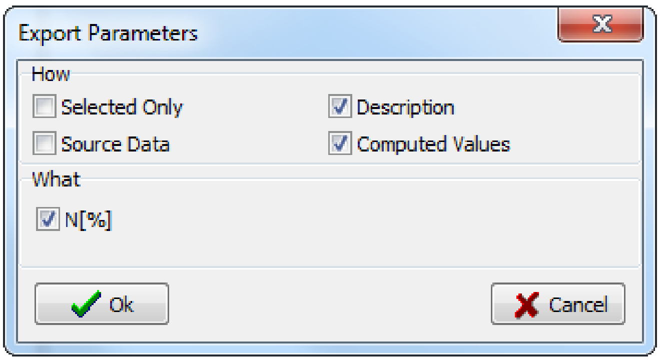


Fig. 18 Data export.

10 FIRMWARE UPDATE

	All data in the N-Pen memory are erased during the firmware update! Before starting any firmware update, download all your data from the N-Pen memory to the computer!

1. Starting Update
   - Select: **Setup > Update Firmware From File** (Fig. 19).

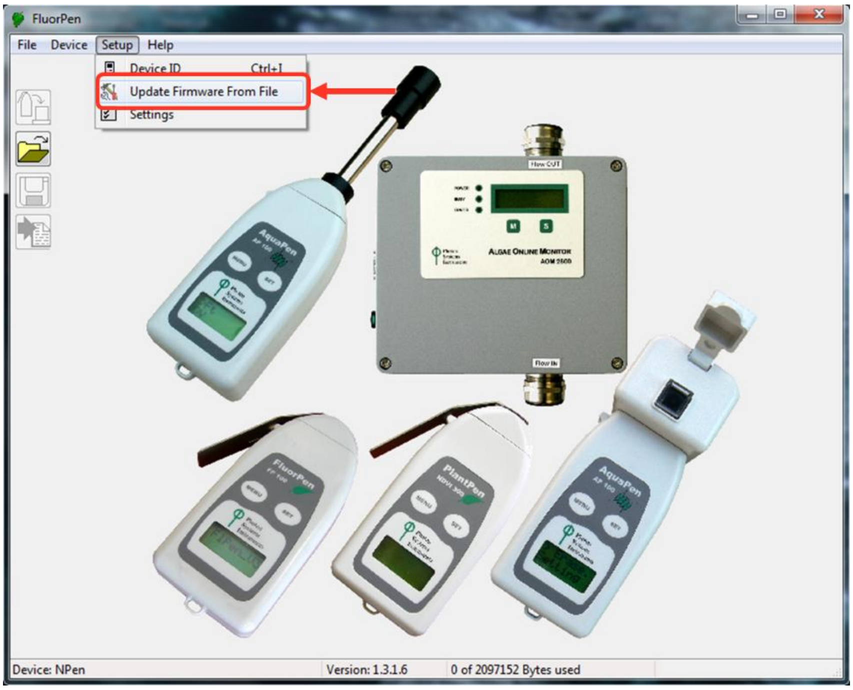


Fig. 19 Firmware update.

2. Warning
   - Select: **OK** to start update (Fig. 20)

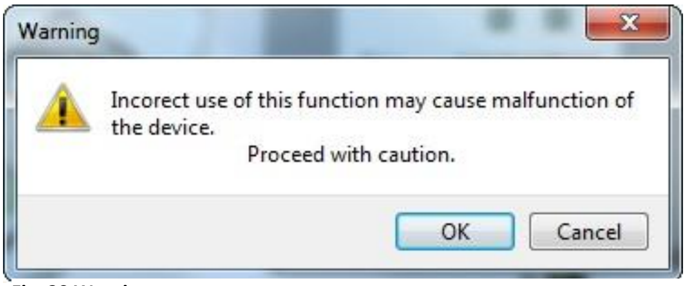


Fig. 20 Warning.

3. Selecting .bxn file
   - Find: firmware update file: Binary file (with the extension .bxn) (Fig. 21).
   - Select: Open.

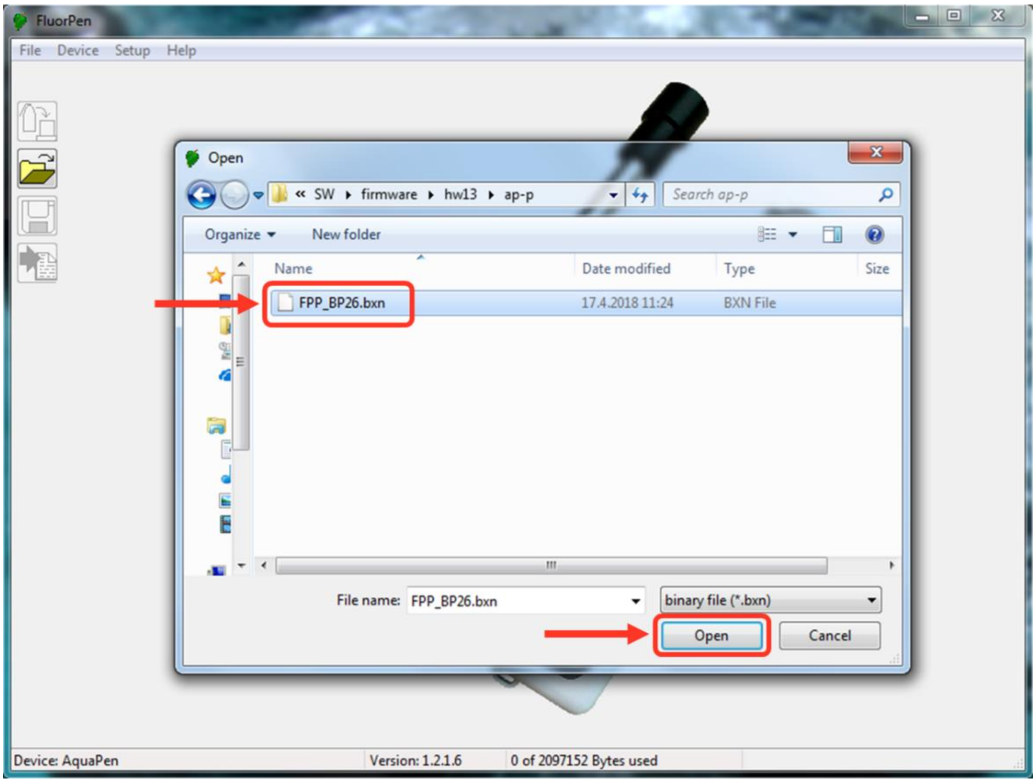


Fig. 21 Select .bxn file.

4. Finishing Upload
   - Select: **OK** to start uploading of the update (Fig. 22).

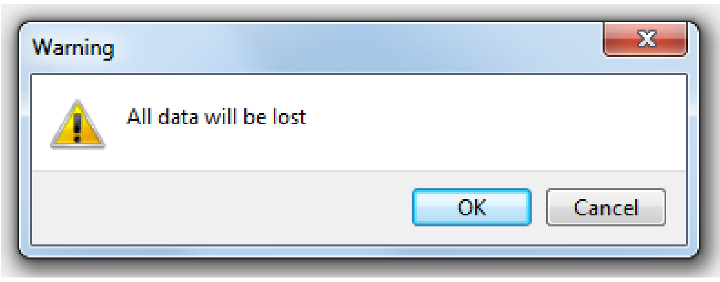


Fig. 22 Data loss warning.

- The bottom bar indicates the upload progress (Fig. 23).

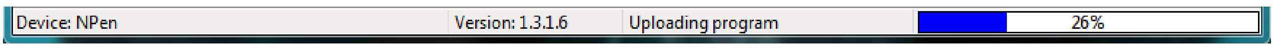


Fig. 23 Uploading process.

- Press: **OK** to finish upload (Fig. 24).

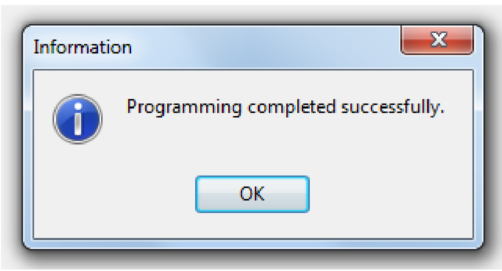


Fig. 24 Finish upload.

11 GPS MODULE

The new version of the N-Pen 110 device has 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 N-Pen and in your computer must be synchronized. Preset time and time zone must correspond to GPS time (time zone) in your location.

11.1 GPS/N-PEN OPERATION

1. Check the time setting on the N-Pen device: **Settings > Date & Time**
2. Switch the GPS module “ON” on the N-Pen 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. 25.

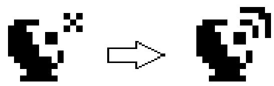


Fig. 25 GPS icons.

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 N-Pen turns off automatically after about 8 minutes of no action.

Turning off the N-Pen always turns off GPS module.

11.2 Data download

1. Enabling Communication:
   - Switch on the computer and the N-Pen. Set your computer to N-Pen communication: enable Bluetooth or connect to USB port (see instructions on pg. 20).
2. Downloading Data from the N-Pen
   - Start FluorPen program.
   - Connect N-Pen device: **Setup > Device ID (Ctrl+I)**
   - Download measured data from the N-Pen to your PC by clicking the down lad icon (top icon). Data measured with activated GPS module are downloaded with GPS coordinates (Fig. 26).

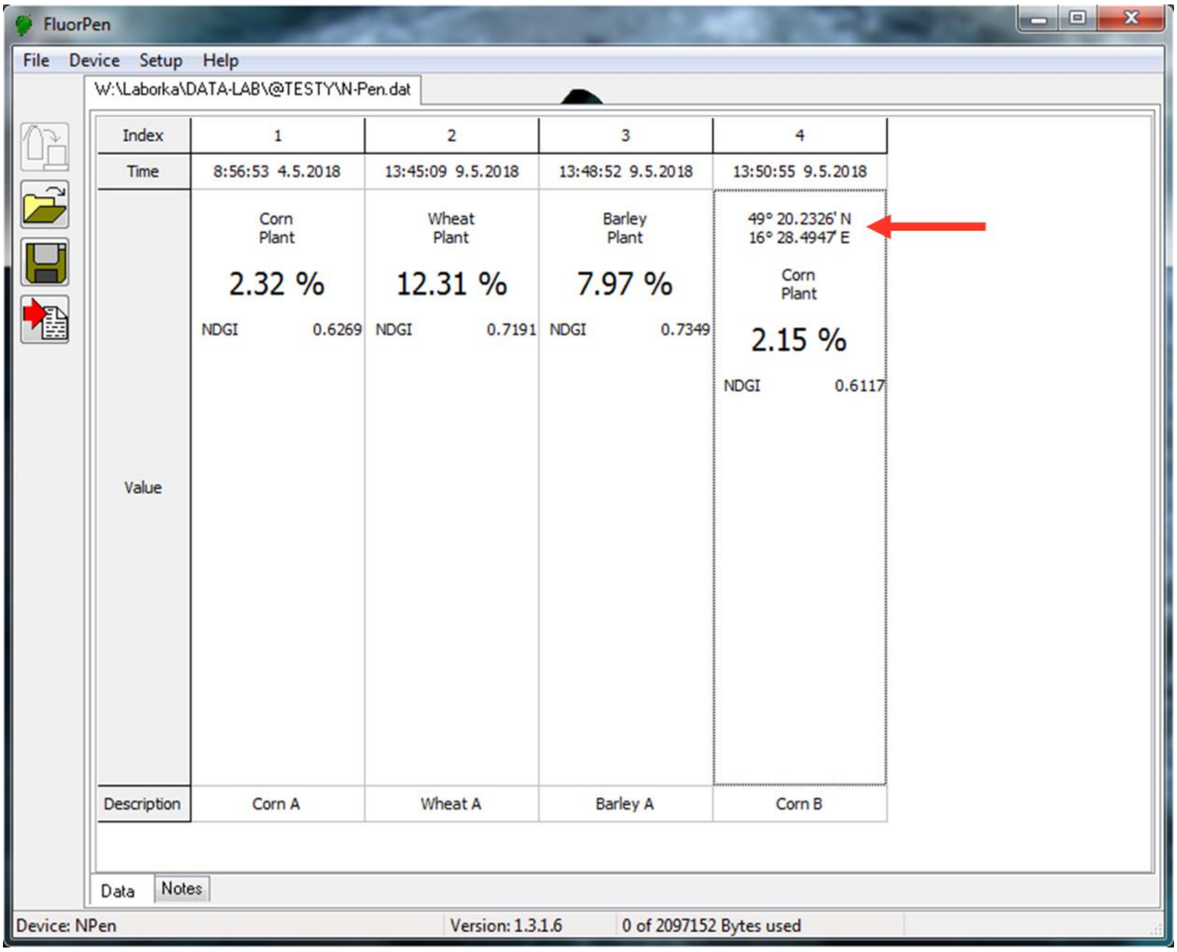


Fig. 26 Data with GPS coordinates.

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13 WARRANTY TERMS AND CONDITIONS

- This Limited Warranty applies only to the N-Pen 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.

14 TROUBLESHOOTING AND CUSTOMER SUPPORT

In case of problems with the N-Pen 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.