Instruction Guide

PHOTON SYSTEMS INSTRUMENTS

PlantPen/N-Pen N 110

Please read the Guide before operating this product

Manual Version: 2025/01

www.psi.cz

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.
	Complementary and additional information.

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

N-Pen		
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 a 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 3 Mbps for distance up to 20 m)	
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 -165 dBm 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

Carefully unpack the carton. You should have received the following items:

- N-Pen N 110,
- carrying case,
- textile strap for comfortable wearing,
- N-Pen Operating Manual (on a USB flash disc),
- FluorPen software and driver (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 contact our technical support through the Service Portal: https://psi.cz/support/service-portal/ or 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.
- Battery charge lasts approximately 48 hours when the PlantPen is operated continuously.
- If the battery can no longer be charged, please contact PSI for replacement battery and installation instructions.

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.

Regular service

Regular servicing is essential to ensure reliable and long-term operation of the equipment. For optimal care, maintenance should be conducted by an authorized service center. The recommended service interval is at least once every two years.
For more details or to schedule a service, please contact our technical support through the Service Portal: https://psi.cz/support/service-portal/

4 PRINCIPLE OF MEASUREMENT

Based on reflectance measurement at 565 nm and 760 nm, the N-Pen calculates NDGI (normalized difference greenness 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).

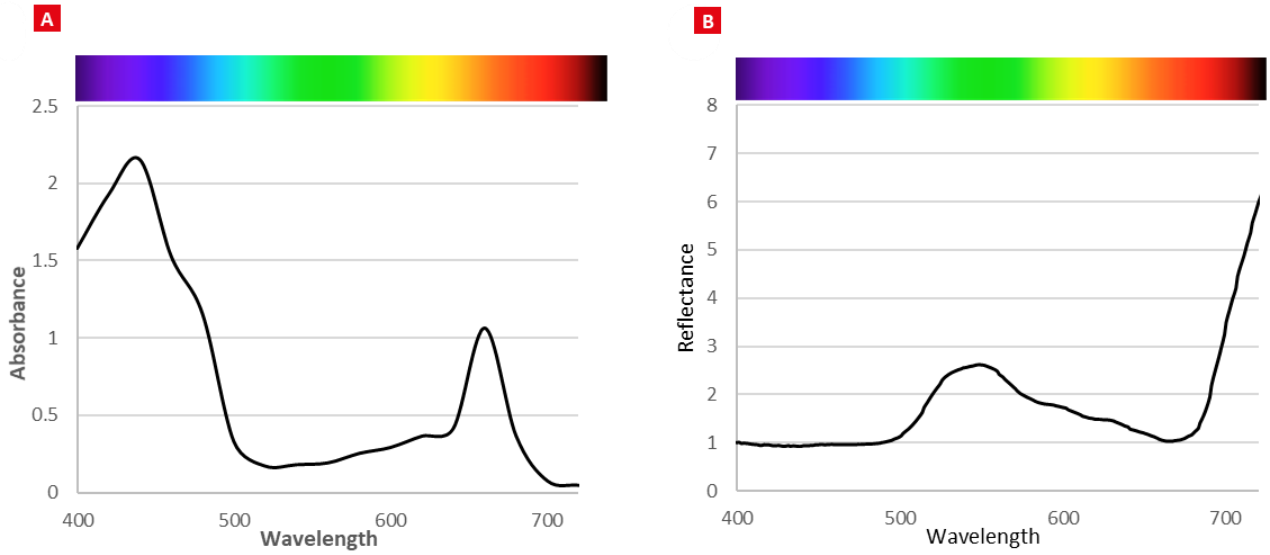


Fig. 2 Absorption and reflectance spectra.

(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 correlation) 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) (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).

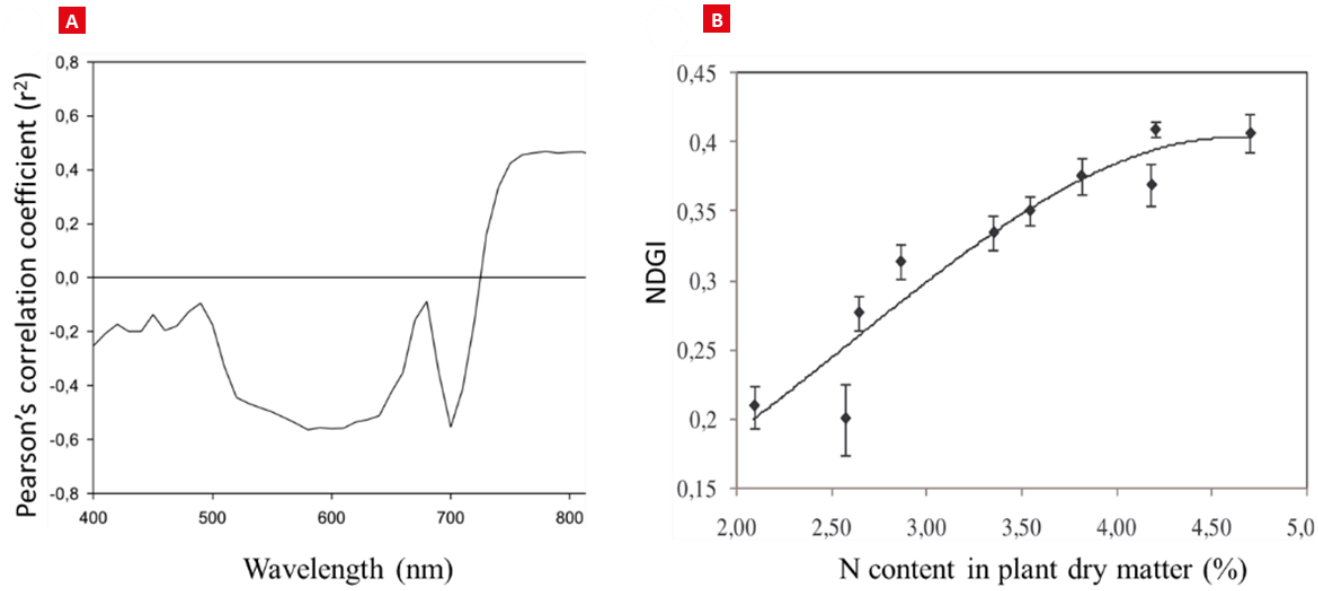


Fig. 3 Correlation between N content in barley dry matter and reflectance at particular wavelengths indicated as Pearsons correlation coefficient along the reflectance spectrum (A). Relationship between NDGI index and N content in barley dry matter (b) can be interpreted as a sigmoid curve. Vertical 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 Ne-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).

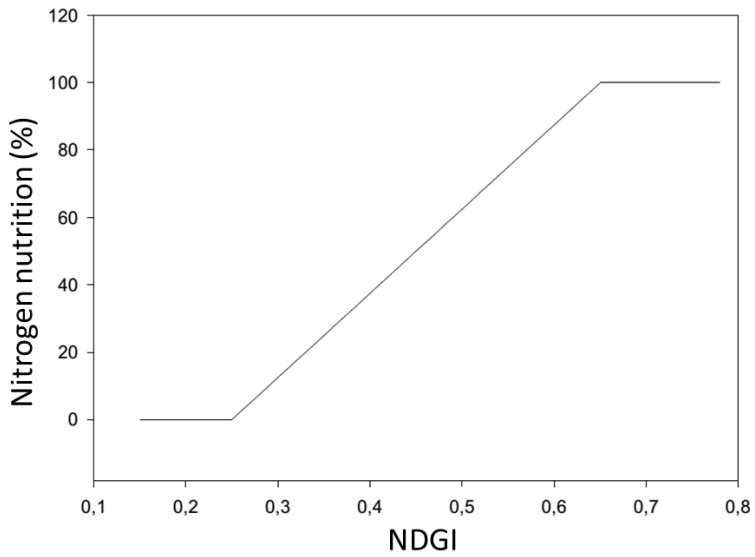


Fig. 5 Prediction of relative N nutrition from NDGI.

5 GETTING STARTED

The PlantPen device is powered with built in Li-Ion battery. Before use, make sure the battery is fully charged. You can charge the PlantPen by connecting it to a PC using a USB cable or to an AC outlet via a USB adapter (not included) and the provided cable.

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 operated using two buttons:

- **MENU** key: Navigate through menu options displayed on the screen or turn off the device by holding the button for 3 seconds.
- **SET** key: Turn on the device by holding the button for 3 seconds, or select a menu option indicated by the cursor (>).
- For a detailed overview of the N-Pen's tree menu structure, please refer to Chapter 6.

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.

	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.

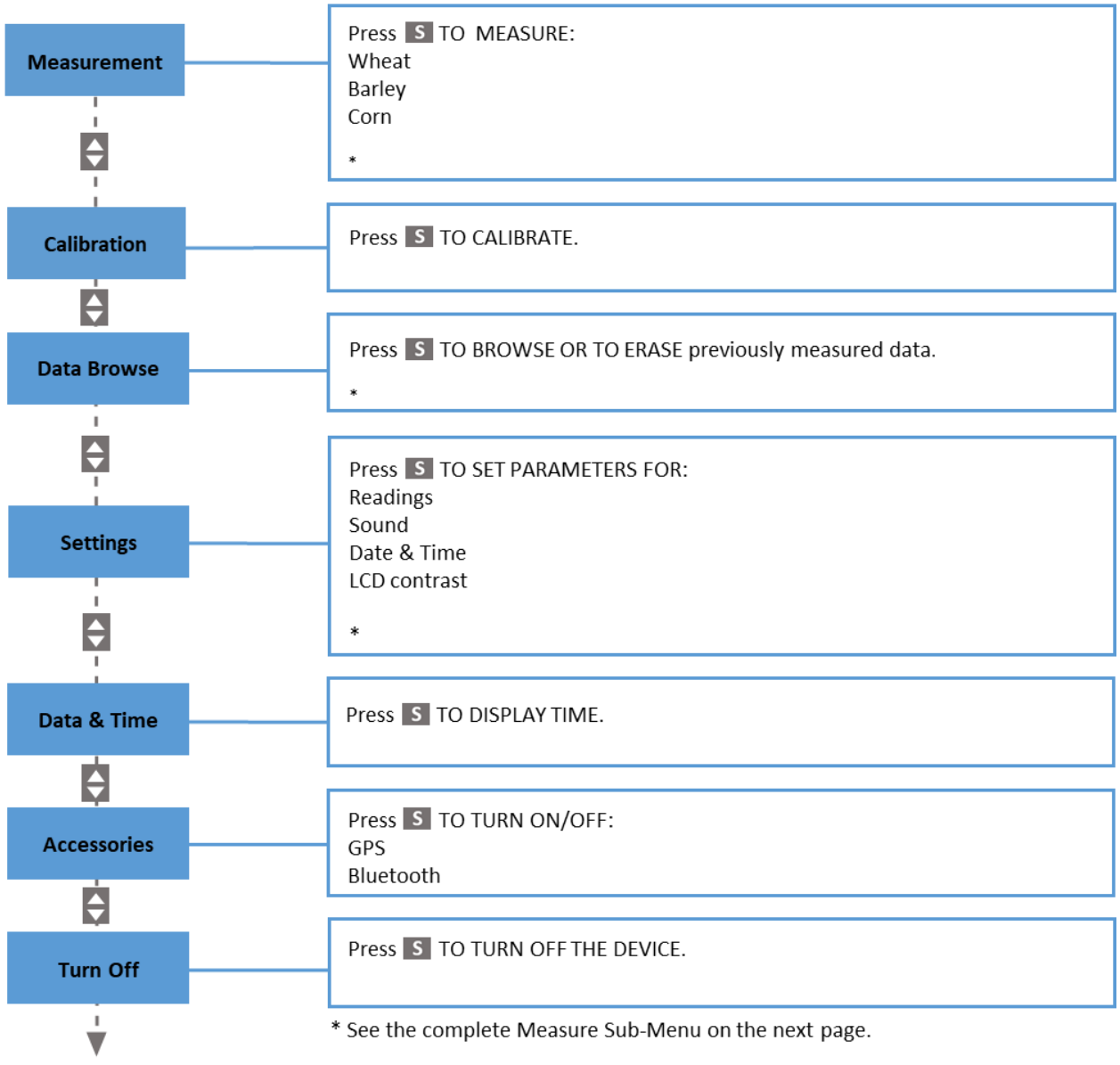
6 CONTROL MENU TREE

The next few pages of this manual show the structure of the menu and explain in a schematic way the operation of the N-Pen. The schematic diagrams show 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 S key for 1 second.

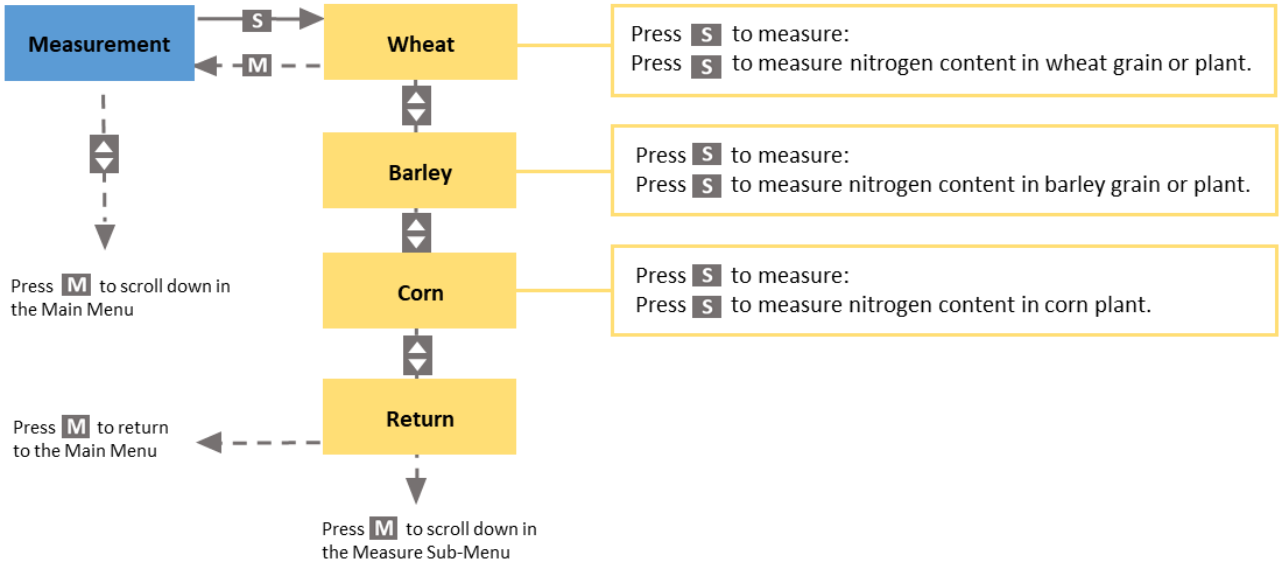


* See the complete Measure Sub-Menu on the next page.

Press M to scroll down in the Main Menu
(to return to „Measurement“)

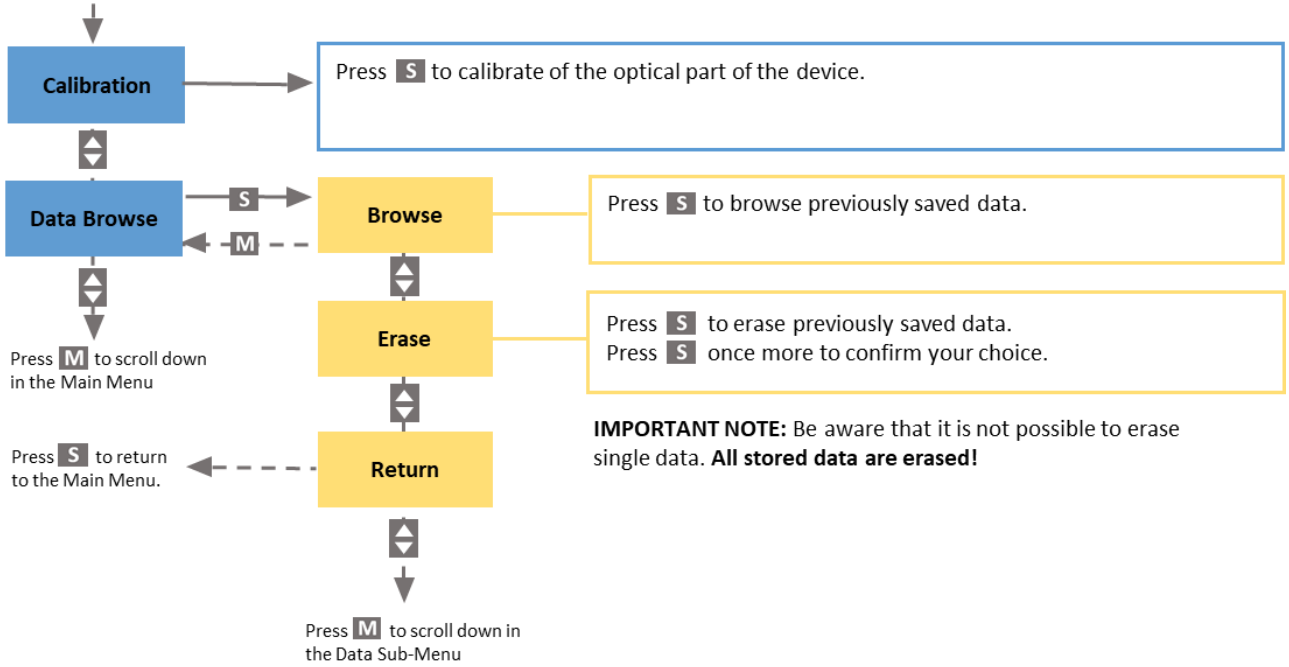
Measurement Sub-Menu

Use the Measurement Sub-Menu when measuring selected parameters.



Calibration and Data Sub-Menu

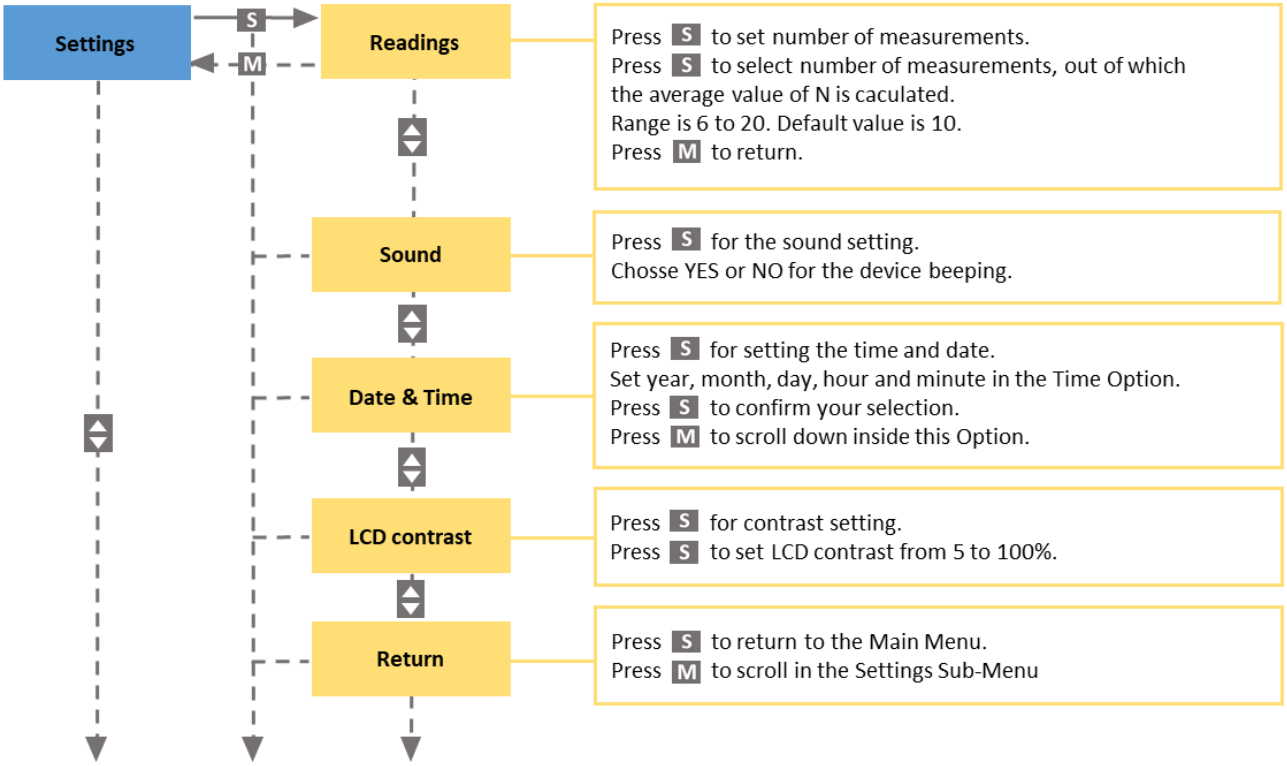
Use the Data Sub-Menu when browsing or erasing previously measured data.



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

Setting Sub-Menu

Use the Setting Sub-Menu to set the numebr 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:

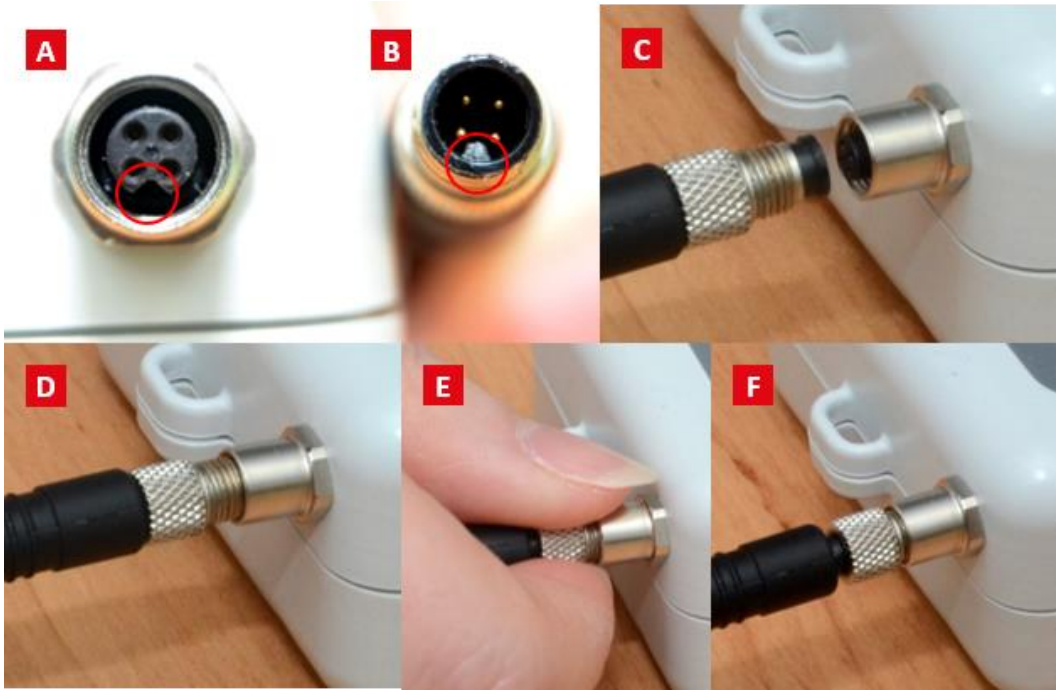


Fig. 6 How to connect N-Pen with PC.

A) Connector of the N-Pen. B) The USB cable connector with pins. C – E) Place the cable horizontally and line up the red 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 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 hardware installed on the computer

The PC must support Bluetooth wireless technology, either through integrated hardware or a Bluetooth card. Make sure that the PC's Bluetooth is set to "discoverable" mode, allowing it to appear in the list of available devices during a Bluetooth search. Refer to the user guide for your PC or Bluetooth card for instructions on enabling this setting.

Setting up Bluetooth configuration software on the PC

The Bluetooth software included with your PC or Bluetooth card must be activated to enable proper functionality. As this software differs depending on the manufacturer, refer to the Bluetooth documentation provided with your PC for specific setup instructions.

Activating and making Bluetooth visible on both devices

To pair the N-Pen with another Bluetooth device, such as a computer, ensure that Bluetooth is switched on and set to visible mode on both devices.

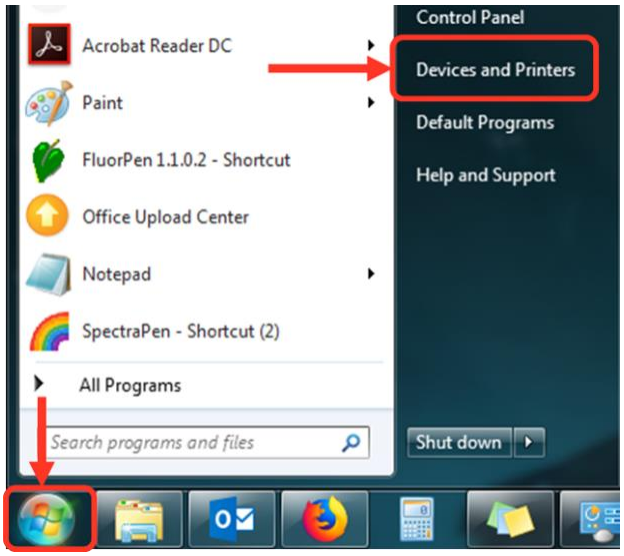
8.1 BLUETOOTH PAIRING

Enabling Bluetooth in the N-Pen

- Turn **ON** the N-Pen by pressing and holding the **SET** key for 1 s.
- Scroll to the Accessories menu by pressing the **MENU** key, then select **Accessories** by pressing the **SET** key.
- Locate Bluetooth in the menu. Press the **MENU** key to select it, then enable Bluetooth by pressing the **SET** key.

⚠	Keep in mind that the N-Pen turns off automatically after approximately 8 minutes of inactivity. When the N-Pen powers off, Bluetooth is also automatically disabled.

Starting Bluetooth Application on the PC



The following steps outline how to set up the Bluetooth connection between the PC and the device. These instructions may vary for other Windows versions:

- **Windows 7:**
  Go to: **Start > Devices and Printers** (Fig. 7).
  Alternatively, access the Bluetooth application through the Control Panel: **Start > Control Panel > Hardware and Sound > Devices and Printers**.
- Windows 11:
  Open **Settings > Bluetooth & devices > Devices**.
  Ensure that Bluetooth is enabled (Fig. 8Fig. 8 Starting the Bluetooth application – Windows 11.). Then modify the Bluetooth devices discovery from **Default** to **Advanced** (Fig. 9).

Fig. 7 Starting the Bluetooth application – Windows 7.

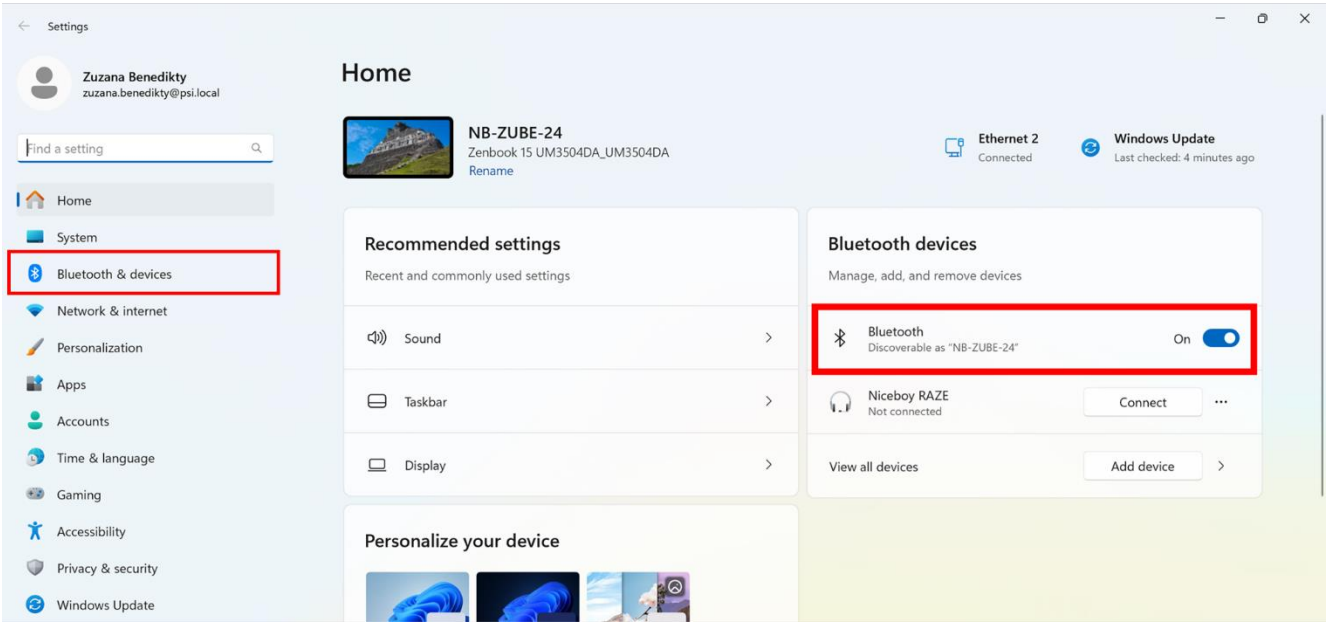


Fig. 8 Starting the Bluetooth application – Windows 11.

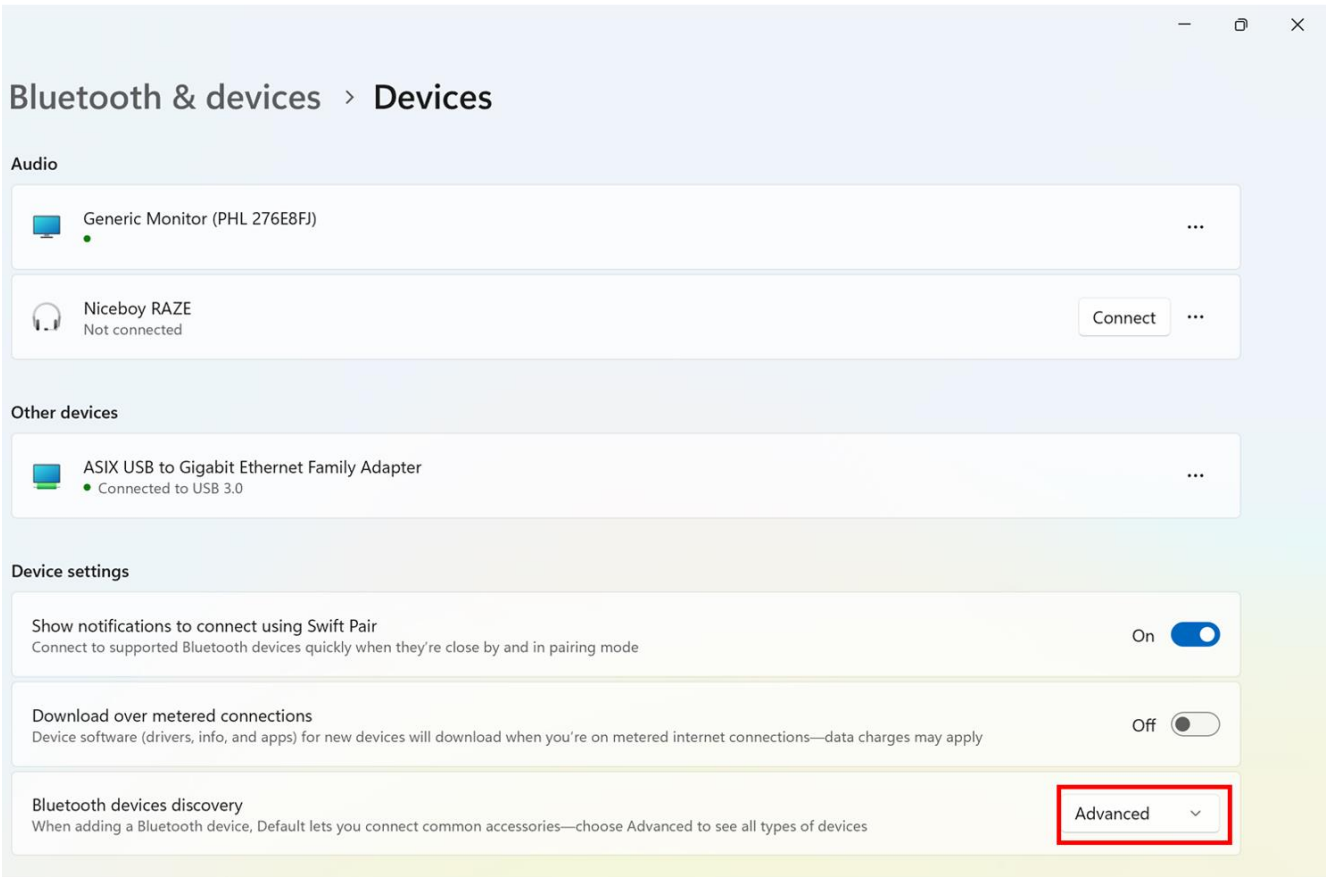


Fig. 9 Windows 11 – Advanced Bluetooth devices discovery.

Adding a Bluetooth device to the computer

- Click "**Add a device**" to begin searching for new Bluetooth device (Fig. 10, Fig. 11).
- Ensure the N-Pen is set to discoverable mode before proceeding.
- Select: PSI N-Pen icon.
- Click: Next (Fig. 12).

Fig. 10 Bluetooth – add a device.

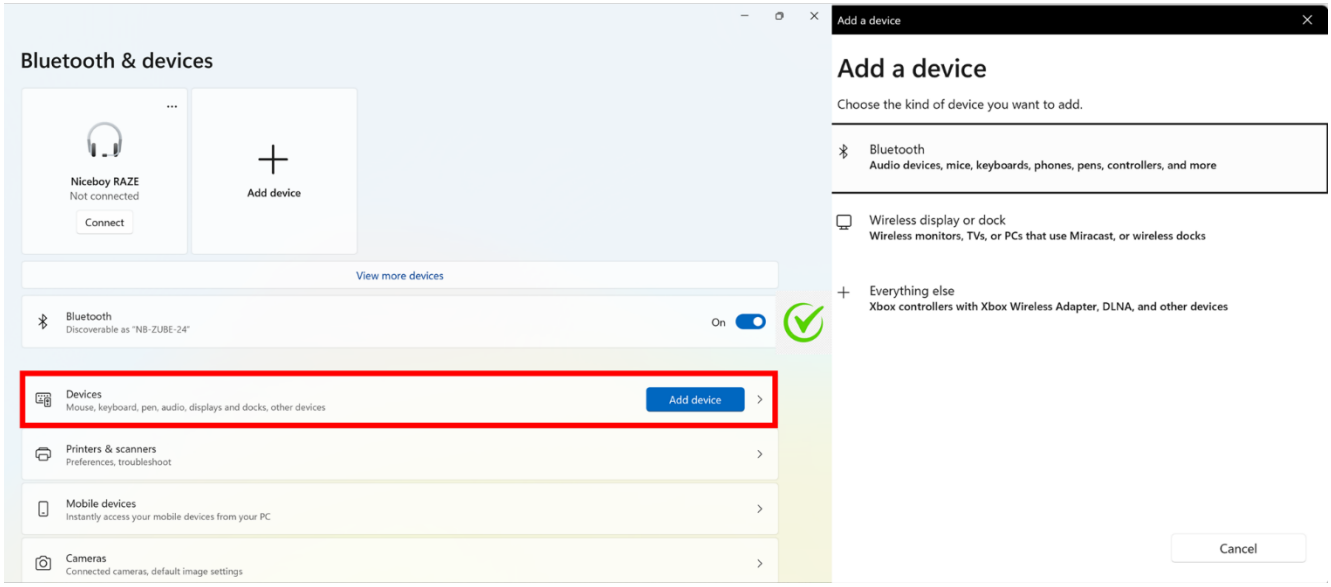


Fig. 11 Bluetooth – add a device for Windows 11.

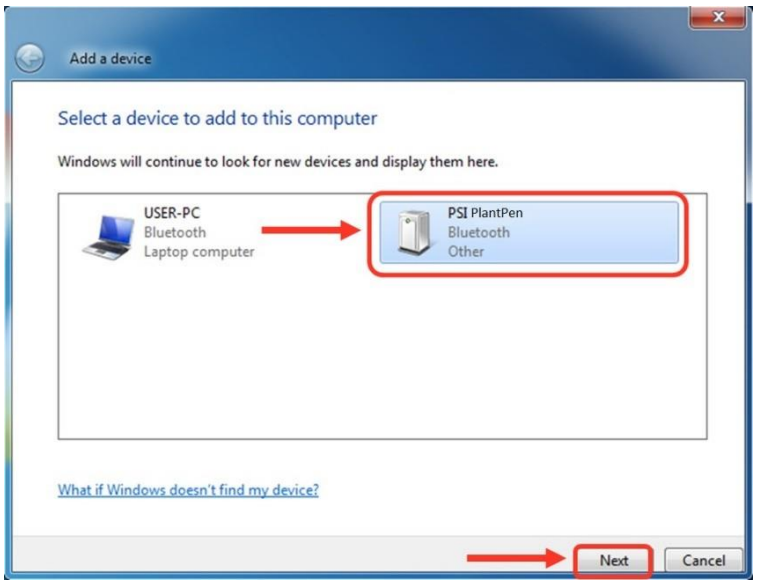


Fig. 12 Bluetooth – N-Pen selection.

Starting the Pairing Process

The steps to start pairing differ between the older and newer versions of the N-Pen, as they are equipped with different Bluetooth modules.

Old version of N-Pen N 100:

The Bluetooth Pairing Code is 0000.

- Select: “Enter the device’s pairing code”.
- Enter: 0000 (four digits).
- Click: Next (Fig. 13).

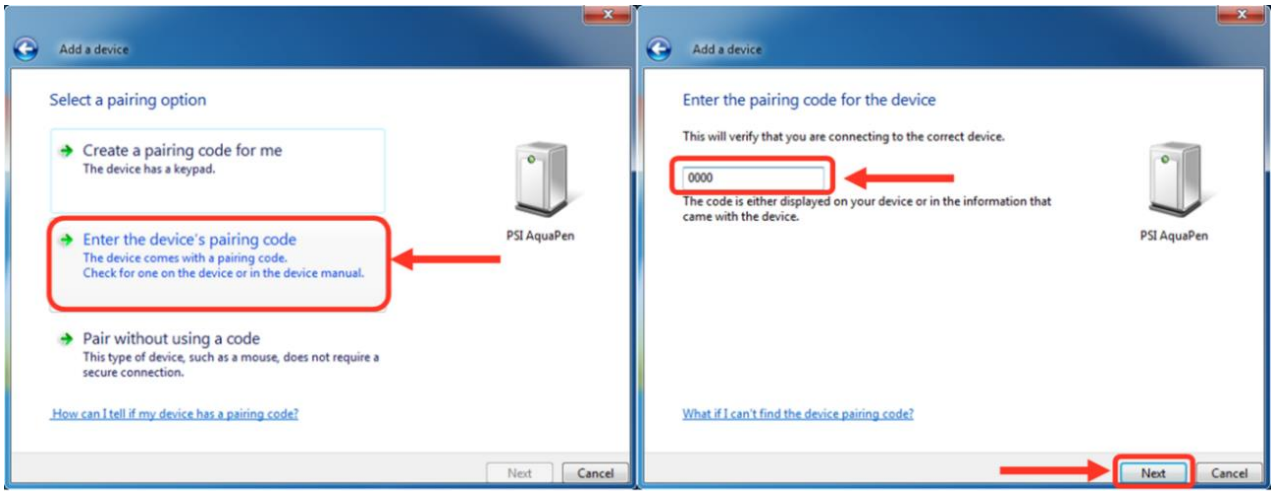


Fig. 13 Bluetooth - pairing process.

New version of N-Pen N 110:

- Select: Yes (Fig. 14).

Please note that the N-Pen device does not display the verification number. The verification code is not important for the Bluetooth connection.

- Select: Next to proceed.

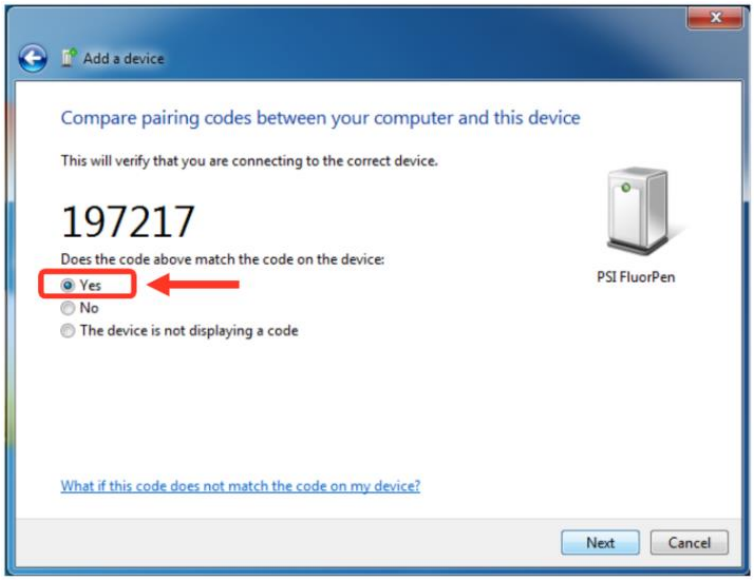


Fig. 14 Bluetooth – pairing verification.

Completing the N-Pen Pairing

- Click: Close (Fig. 15) to finish the Bluetooth pairing process.

The Bluetooth pairing is now complete, and the next step is to open the FluorPen software (included on the delivered USB flash disk). For detailed information on using the FluorPen software, refer to Chapter 9.

Fig. 15 Bluetooth – pairing completion.

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. 16).

- 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. 16 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. 17). 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.

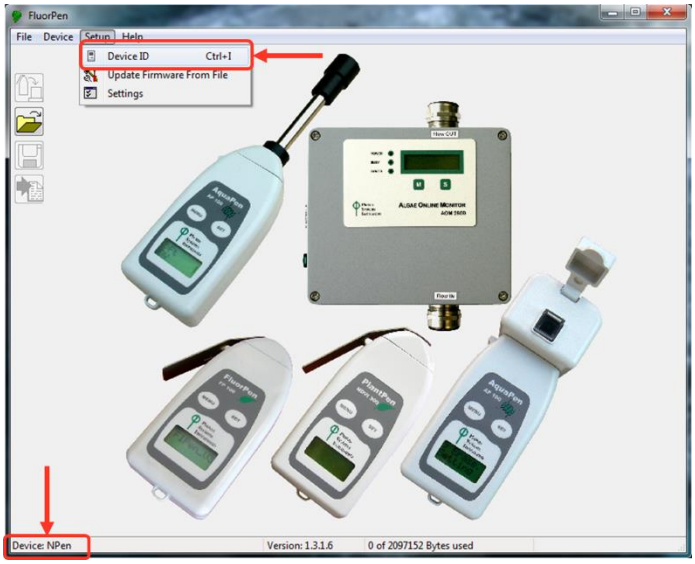


Fig. 17 Connecting N-Pen with software.

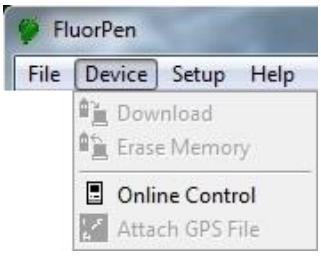
9.2 MENU AND ICONS EXPLANATION

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 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:

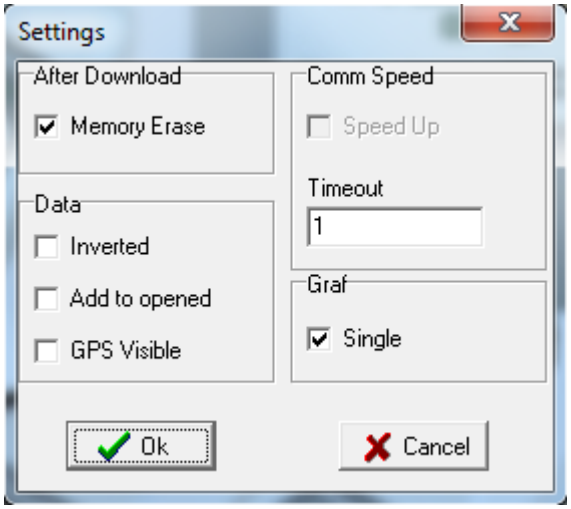
Download	Downloads data from the N-Pen to PC.
Load	Loads (opens) previously saved data files.
Save	Saves data to hard disc.
Export	Exports data in .txt format.

9.2.2 MENU SETTINGS

MENU > Setup > Settings (Fig. 18)

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 versions the GPS data are automatically downloaded and paired with protocol measurements.

Graf – Single
This function is not available for N-Pen.

Fig. 18 Settings.

9.2.3 MENU: ONLINE CONTROL

The Online Control feature allows remote management of the N-Pen device via a PC connection.

Online Control – Switches

Access this function through the following path:
MENU > Device > Online Control > Switches (Fig. 19)

Sound On/Off
This option enables or disables the device beeping sound when the MENU and SET buttons are pressed.

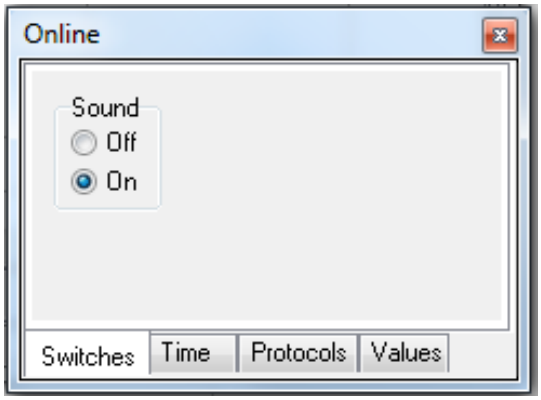
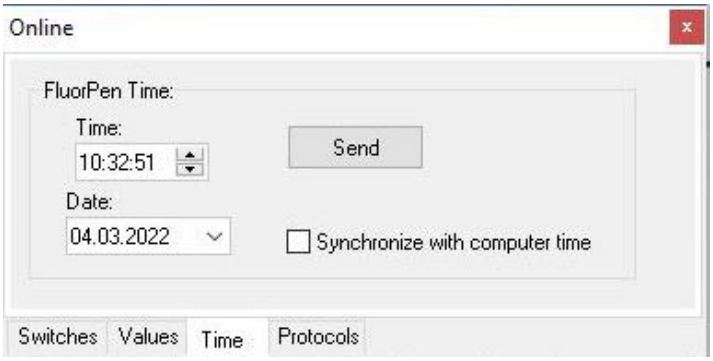


Fig. 19 Online control – Switches.

Online Control – Time

MENU: Device > Online Control > Time (Fig. 20)



The window allows you to configure the N-Pen's time and date settings.
Manual Adjustment: You can manually set the time and date by entering the desired values and saving them.
Automatic Synchronization: To synchronize the N-Pen's clock with your computer, tick the synchronization box.

Note that synchronization occurs only once at the time of selection and does not continuously update the clock.
Proper time and date settings are crucial for accurate GPS data acquisition and are therefore strongly recommended.

Fig. 20 Online Control – Time.

Online Control – Protocols and Values

This function is not available for N-Pen.

9.3 DATA DOWNLOAD 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. 21).

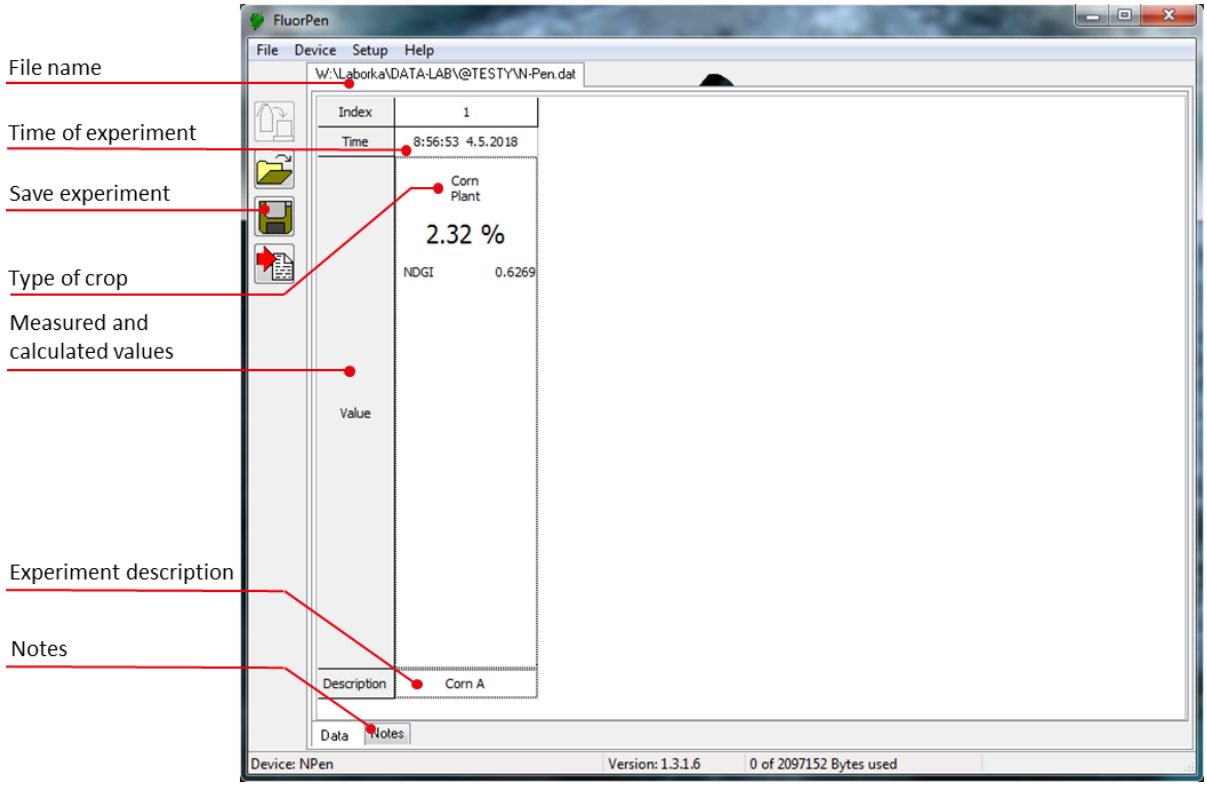


Fig. 21 Example of data transfer.

4. To **export** data from the FluorPen software select **File > Export** or **Export** icon. Select data type to export, see Fig. 22.
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.

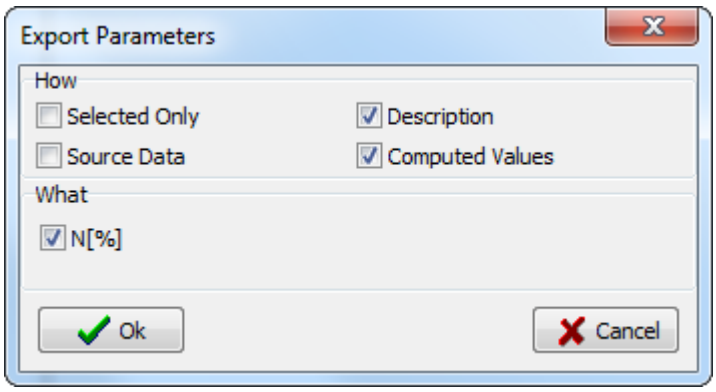


Fig. 22 Data export.

9.4 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. 23).

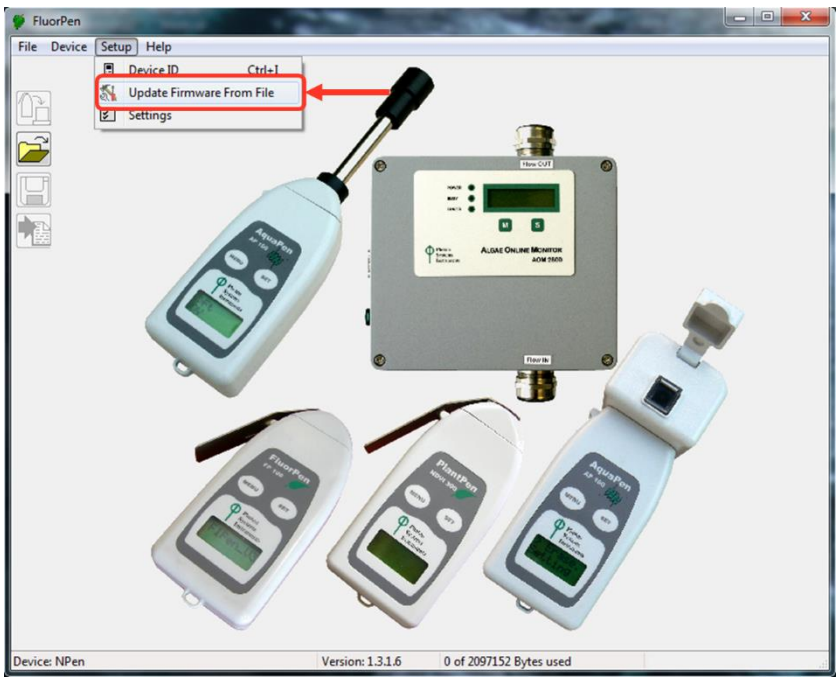


Fig. 23 Firmware Update.

2. Warning: Select **OK** to start update (Fig. 24).

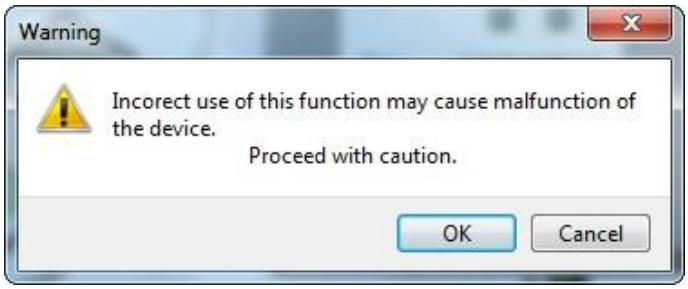


Fig. 24 Warning.

3. Selecting **.bxn file**

Find firmware update file (a binary file with the extension .bxn provided from PSI) and select **Open** (Fig. 25).

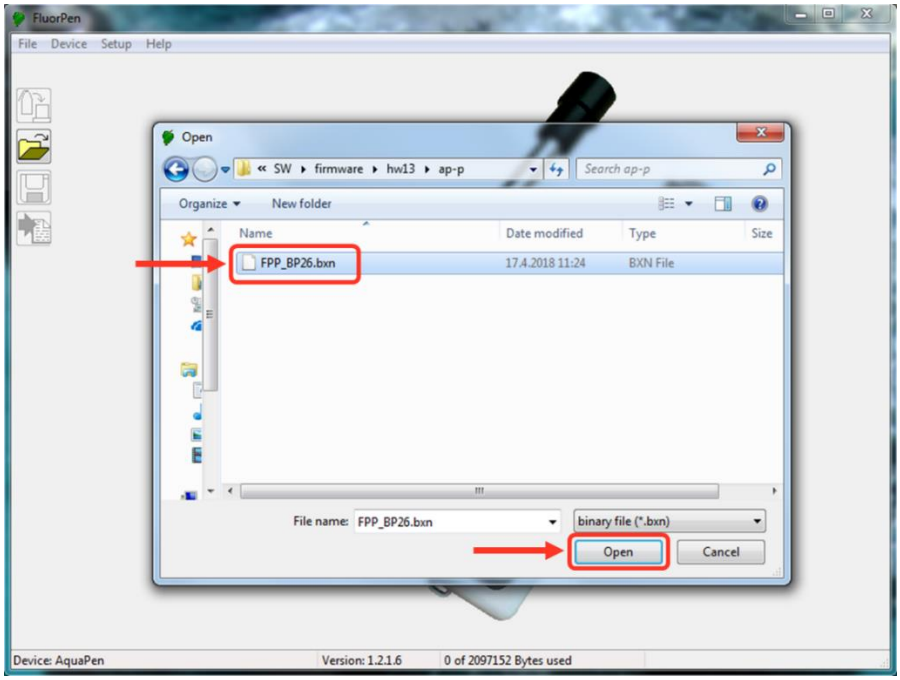


Fig. 25 Selection of the firmware file.

4. Finishing Upload

Select **OK** to start uploading of the update (Fig. 26).

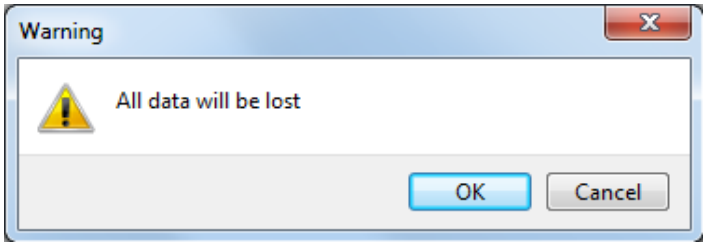


Fig. 26 Data loss warning.

The bottom bar indicates the upload progress (Fig. 27).

Fig. 27 Firmware upload progress.

Press **OK** to finish the upload (Fig. 28).

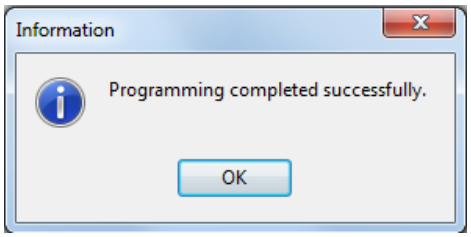


Fig. 28 Firmware upload finishing.

10 GPS MODULE

The new versions of the N-Pen device 110 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 N-Pen 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/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. 29.

Fig. 29 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.

10.2 DATA DOWNLOAD

1. **Enabling Communication**:
- Switch on the computer and the FluorPen software.
- Enable Bluetooth or connect the device with computer via communication cable (see instructions on pg. 17).

2. **Downloading Data** from the N-Pen:
- Start FluorPen program.
- Connect N-Pen device with software: **Setup > Device ID (Ctrl+I).**
- Download data from the N-Pen to your PC by clicking the download icon. Data measured with activated GPS module are downloaded with GPS coordinates (Fig. 30).

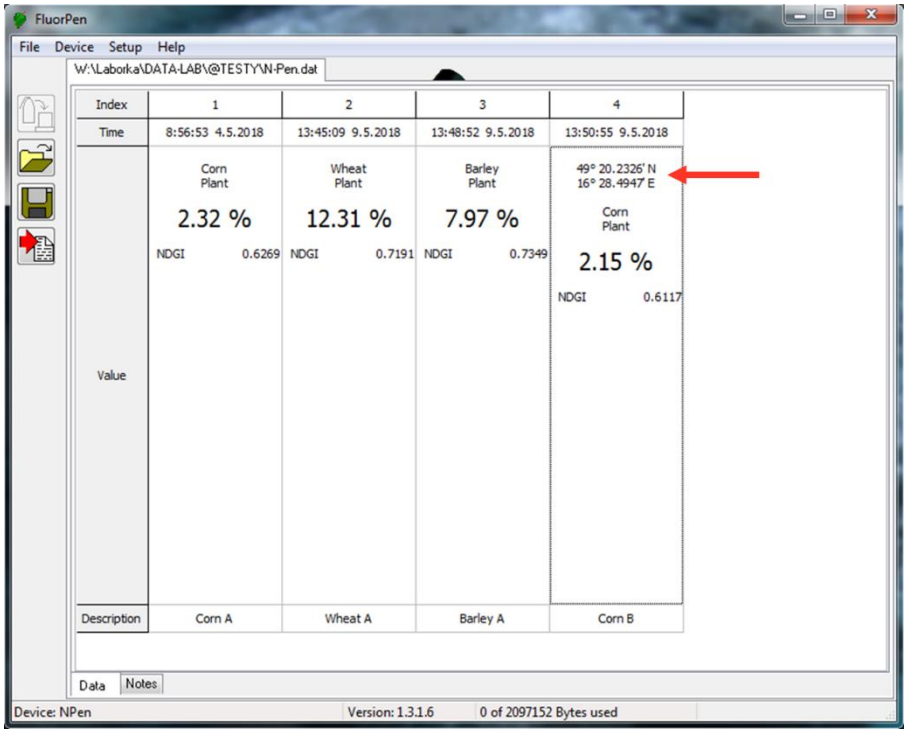


Fig. 30 GPS coordinates.

11 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.

12 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.

13 LIST OF FIGURES