

AquaPen-P AP-P 100

AquaPen-C AP-C 100

Operation Manual



Please read this guide before operating the AquaPen device

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1. Technical Specification

Measured and Calculated Parameters:

Fo, Ft, Fm, Fm', QY, NPQ 1, NPQ 2, OJIP, LC 1, LC 2, OD₆₈₀*, OD₇₂₀*

Saturating Light:

Adjustable from 0 to 3,000 $\mu\text{mol}(\text{photons})/\text{m}^2.\text{s}$ (0 to 100 %)

Actinic Light:

Adjustable from 0 to 1,000 $\mu\text{mol}(\text{photons})/\text{m}^2.\text{s}$ (0 to 100 %)

Measuring Light:

Adjustable from 0 to 3,000 $\mu\text{mol}(\text{photons})/\text{m}^2.\text{s}$ (0 to 100 %)

AquaPen-C AP-C 100: blue + red measuring light

AquaPen-P AP-P 100: blue measuring light

Detector Wavelength Range:

PIN photodiode with 667 to 750 nm bandpass filters

Wireless Communication:

Bluetooth 1.1 (see the Bluetooth conformity declaration on the next page)

FluorPen Software:

Windows 2000, XP, or higher compatible**

Memory Capacity:

Up to 4 Mb

Internal Data Logging:

Up to 100,000 data points

Display:

2 x 8 characters LC display

Keypad:

Sealed, 2-key tactile response

Keypad Escape Time:

Turns off after 3 minutes of no use

Power Supply:

4 AAA alkaline batteries (single use or rechargeable)

Battery Life:

48 hours typical with full operation

Low Battery Detection:

Low battery indication displayed

Size:

140 mm x 55 mm x 50 mm

5.5" x 2.2" x 2.0"

Weight:

300 g, 10.6 oz

* Only in AquaPen-C AP-C 100.

** Windows is a registered trademark of Microsoft Corporation.

Sample Holder:

4 ml cuvette (AquaPen-C AP-C 100)

Submersible optical probe (AquaPen-P AP-P 100)

Operating Conditions:

Temperature: 0 to 55 °C; 32 to 130 °F Relative humidity: 0 to 95 % (non-condensing)

Storage Conditions:

Temperature: -10 to +60 °C; 14 to 140 °F Relative humidity: 0 to 95 % (non-condensing)

Warranty:

1 year parts and labor (see the last page of this Operation Manual for precise warranty conditions)

The Bluetoothmodule BlueNiceCom III is endowed with a declaration of conformity with the following norms:

EN 300 328 V1.6.1 (2004-11)

EN 301 489-1, -3 V1.5.1 (2003-12)

EN 50371 December 2002

EN60650

FCC Part 15.247

FCC Grantee Code: R7T

Bluetooth Qualified Product Notice:

GRA_013_04

Bluetooth Listing Identifier: B01572

2. General Information

AquaPen is a portable, battery-powered device that measures photosynthetic parameters in algal or cyanobacterial suspensions. Due to its **ultra-high sensitivity - up to 10 ng Chl/l**, the AquaPen can be effectively used for measurements in natural water samples containing low concentrations of phytoplankton.

AquaPen-P AP-P 100 measures samples via an optical probe. It is equipped with a **blue** measuring light that suits investigations in algal suspensions.

AquaPen-C AP-C 100 measures samples that are placed in a cuvette. It is equipped with **red** and **blue** measuring lights and can thus perform measurements both in algal and cyanobacterial suspensions.

The AquaPen device measures the following chlorophyll fluorescence parameters:

Ft - Instantaneous Chlorophyll Fluorescence

Ft is equivalent to Fo if the sample is dark-adapted.

QY - Quantum Yield

QY is a measure of the Photosystem II efficiency. In a dark-adapted sample this is equivalent to Fv/Fm. In a light-adapted sample it is equivalent to Fv'/Fm'.

OD - Optical Density*

Optical density at 680 nm represents light scattering and chlorophyll absorption. Optical density at 720 nm represents light scattering.

NPQ - Non-Photochemical Quenching

The NPQ protocol is the most typically used measuring approach to quantify photochemical and non-photochemical quenching. The measurement should be performed with a dark-adapted sample (see more in Chapter 8.D. of this Manual).

OJIP - Chlorophyll Fluorescence Induction Kinetics

The OJIP curves enable observing major changes that occur during exposure of a sample to high irradiance (see more in Chapter 8.C. of this Manual).

Light Curve

The LC 1 and LC 2 protocols serve to describe adaptation of Quantum Yield to six different light levels (see more in Chapter 8.E. of this Manual).

** Optical density is defined as*

$$OD = -\text{Log}(I/I_0),$$

where "I₀" is the irradiance that is transmitted through the cuvette filled with medium without algae or cyanobacteria. This quantity must be measured as the reference. "I" is the irradiance transmitted through the cuvette with algal or cyanobacterial suspension in which the OD is measured. "Log" is the decadic logarithm of the I/I₀ ratio.

Thus, the optical density OD=1 means that the light at the respective wavelength is attenuated by the algae or cyanobacteria 10 times relative to the reference. With OD=2, the attenuation relative to the reference is 100 times.

Optical density is measured only in the cuvette version - in AquaPen-C AP-C 100.

3. List of Equipment

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

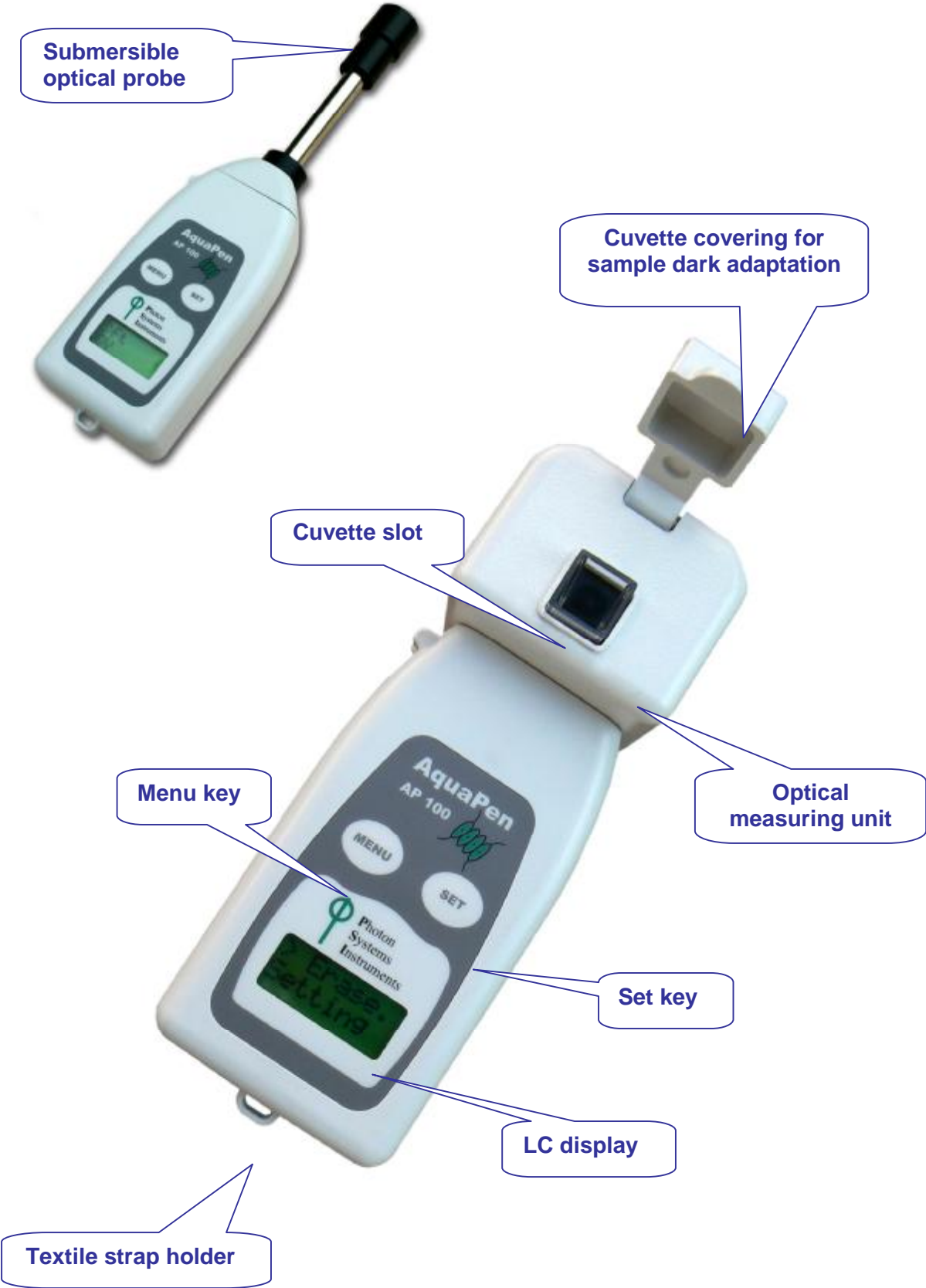
- AquaPen-P AP-P 100 or AquaPen-C AP-C 100
- 4 AAA Alkaline Batteries
- Carrying Case
- Textile Strap for Comfortable Wearing
- 4 ml Volume Cuvette (*AquaPen-C only*)
- This Operation Manual (*on a CD or a printed version*)
- Install CD with the FluorPen software
- Bluetooth, USB, or Serial Communication Module
- Other Accessories or Optional Features (*according to your specific order*)

Note:

If any item is missing, please, contact the manufacturer. Also check the carton for any visible external damage. If you find any damage, 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

4. Physical Features



5. Care and Maintenance

AquaPen-P AP-P 100

- Never submerge the whole device in the measured sample!
 - Keep in mind that only the optical tip can be submerged!
 - Rinse the optical tip of the AquaPen-P in freshwater after each use.
 - Inspect visually the optical window after each deployment. If cleaning is needed, use the soapy water and soft, non-abrasive tissue for cleaning the optical part.
 - The device should not come in contact with any organic solvents, strong acids or bases.
-

AquaPen-C AP-C 100

- Never submerge the device in water!
- To measure samples, use a standard 4 ml volume cuvette. Fill the cuvette half full, i.e., about 2 ml of the volume.
- Keep the optical part clean and dry. If cleaning is needed, use soft, non-abrasive tissue.
- The device should not come in contact with any organic solvents, strong acids or bases.





Batteries

- § Both AquaPen models operate from four AAA single-use or rechargeable batteries.
- § They may be easily replaced by unscrewing the cover of the battery holder on the rear of the instrument.
- § Battery life is approximately 48 hours when the AquaPen is operated continuously.



6. Operation Instructions

The next pages show the structure of the operation scheme, which includes the Main Menu, first-level Sub-Menus and second-level Sub-Menus.

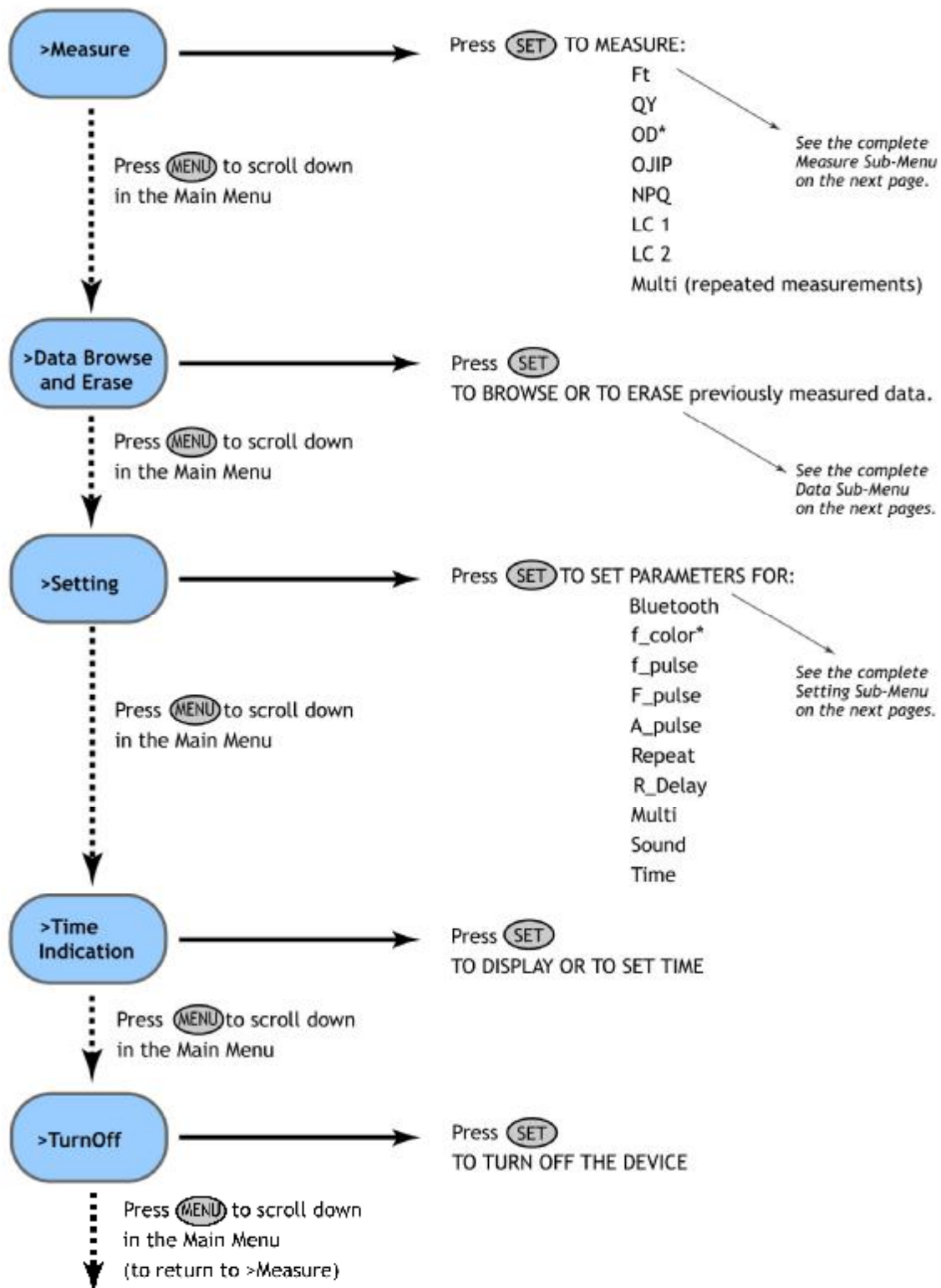
- § The blue color represents the Main Menu and its Options.
- § The yellow color represents the first-level Sub-Menus and their Options.
- § The green color represents the second-level Sub-Menus and their Options.
- § Full-line arrows are used for the **SET** key. 
- § Dashed-line arrows are used for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

In general:

- § 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.

Main Menu

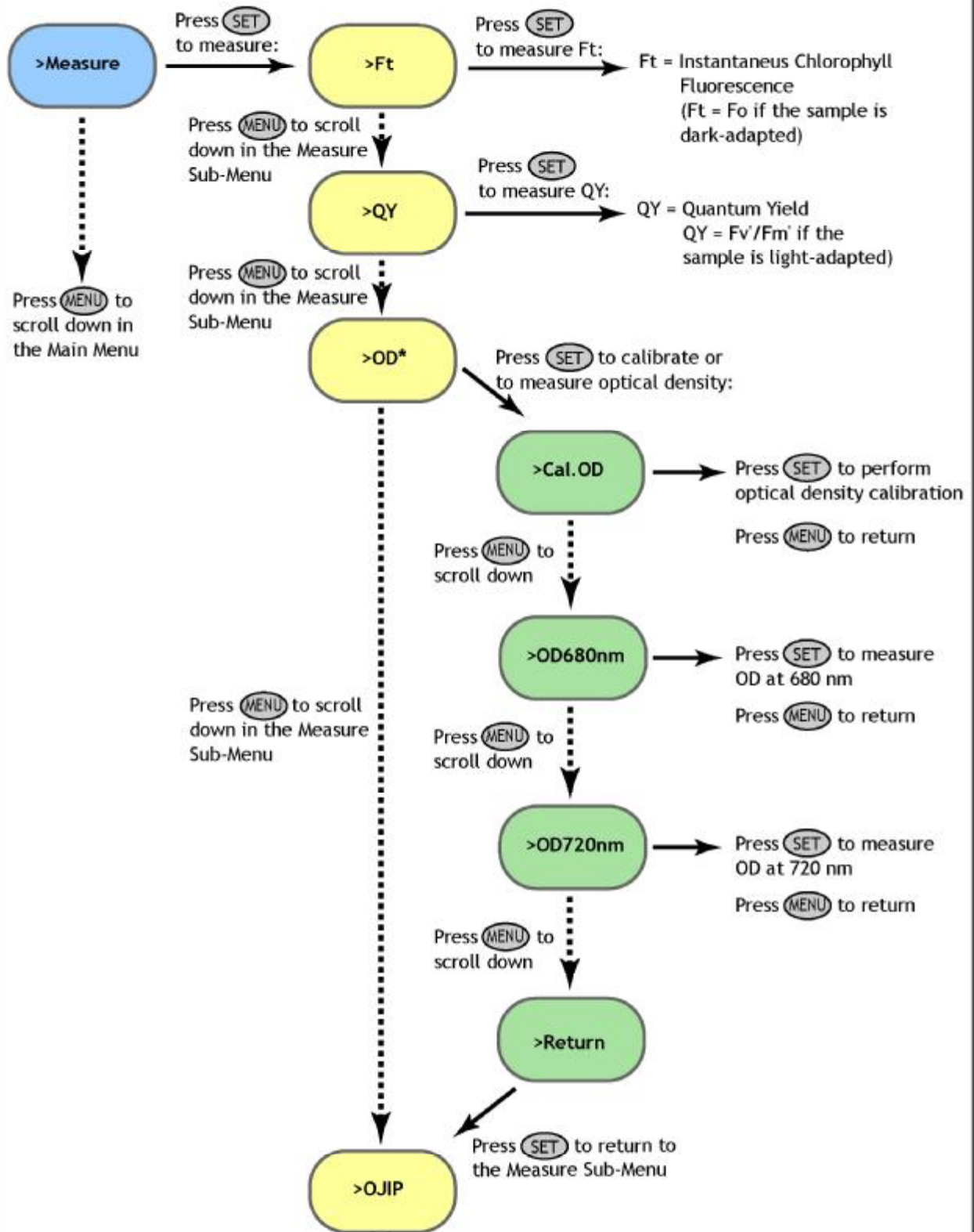
To start hold the SET key for 1 second.



* The function is active only in the AquaPen-C AP-C 100 model

Measure Sub-Menu - Part 1

Use the Measure Sub-Menu when measuring selected parameters.

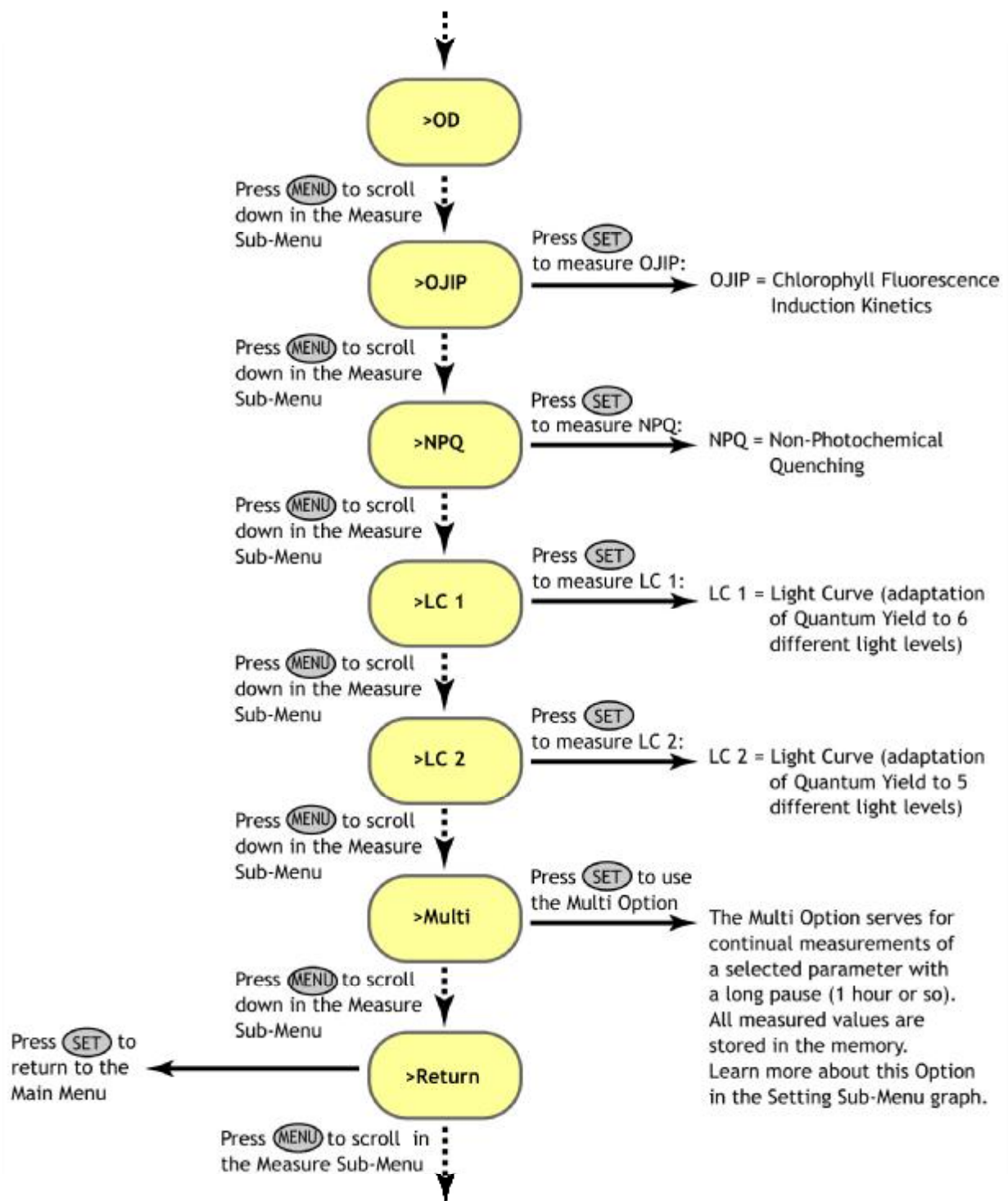


To be continued on the next page

* See page 6 of this Manual for OD definition. OD function is active in the AquaPen-C AP-C 100 model only.

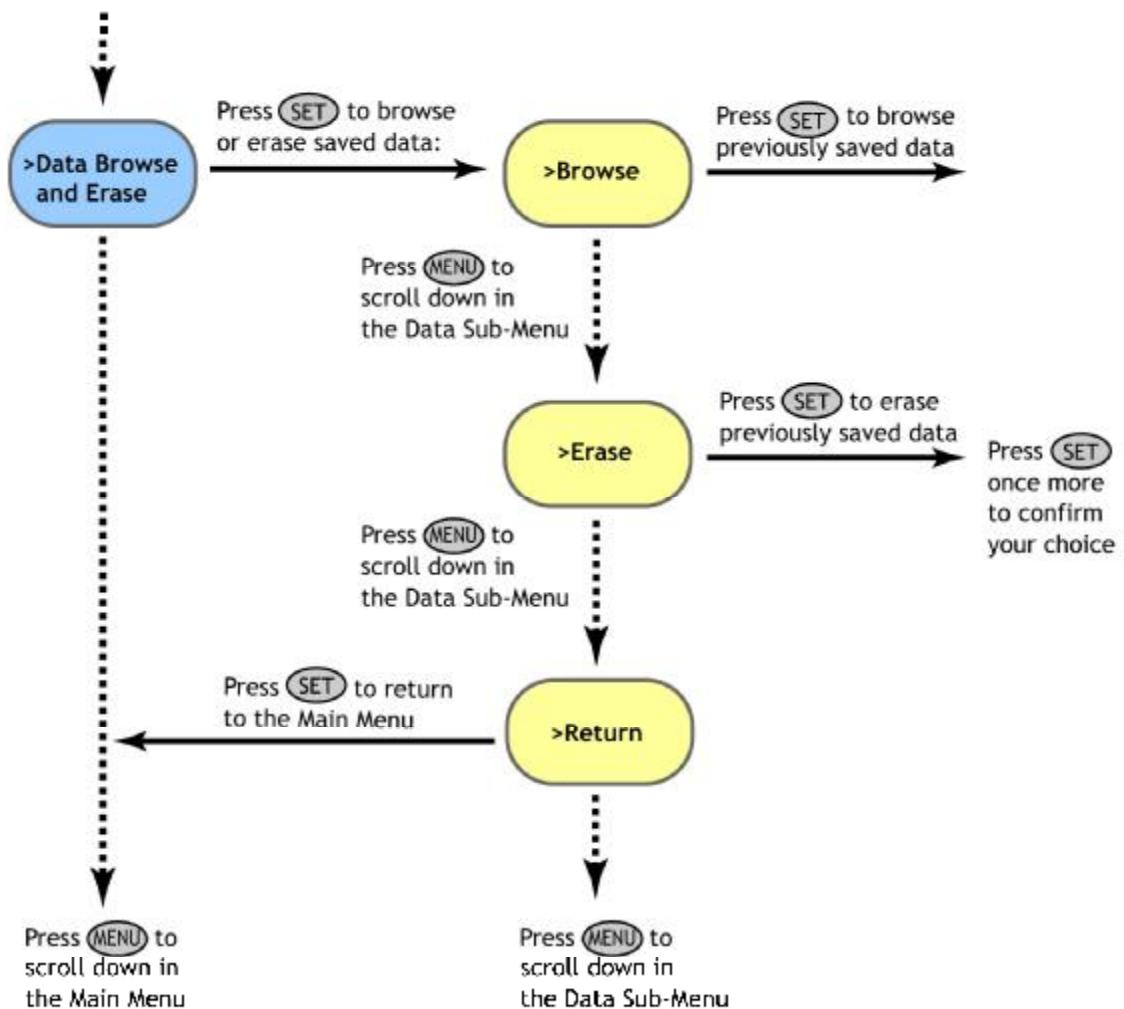
Measure Sub-Menu - Part 2

Use the Measure Sub-Menu when measuring selected parameters.



Data Sub-Menu

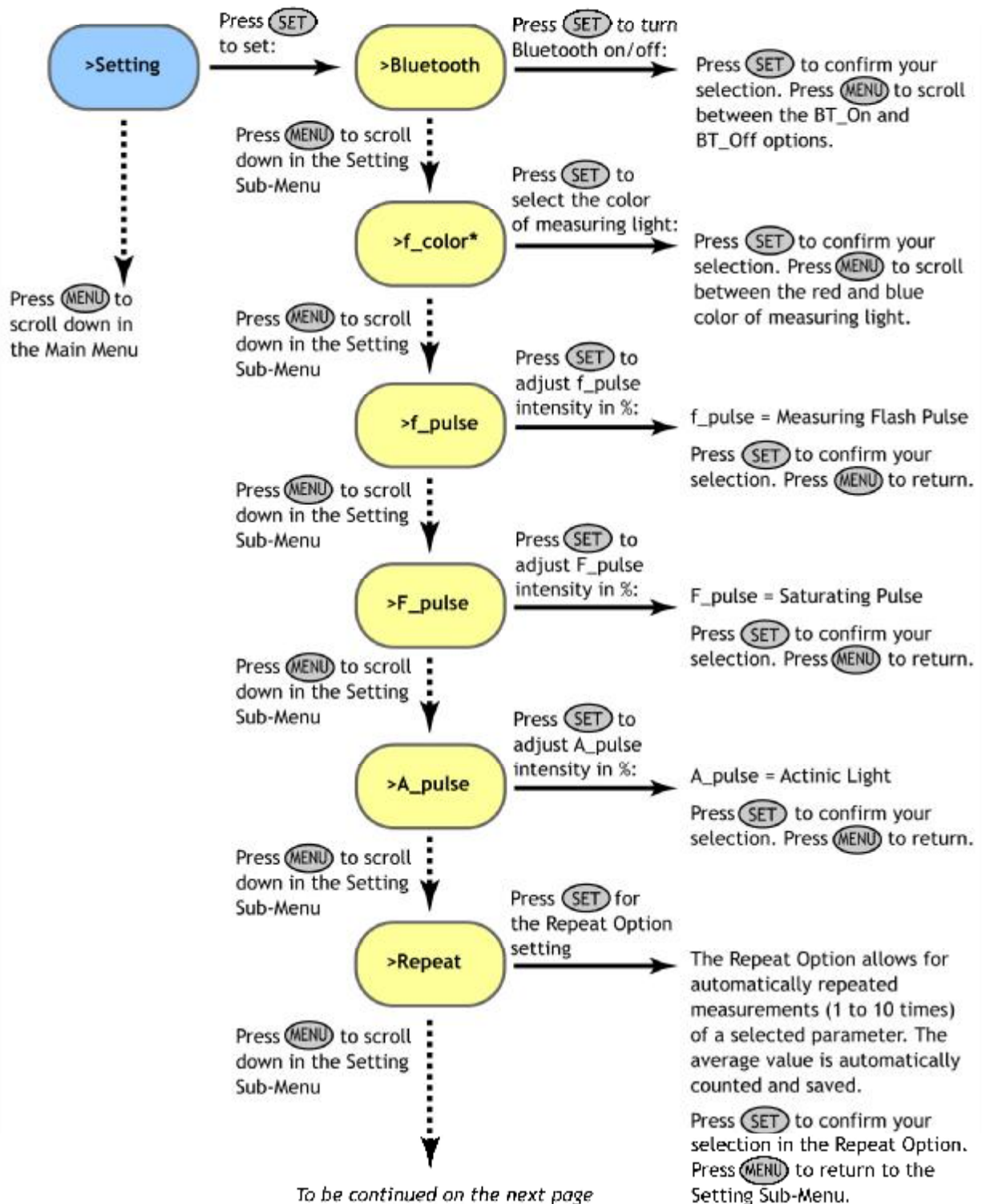
Use the Data Sub-Menu when browsing or erasing previously measured data.



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

Setting Sub-Menu - Part 1

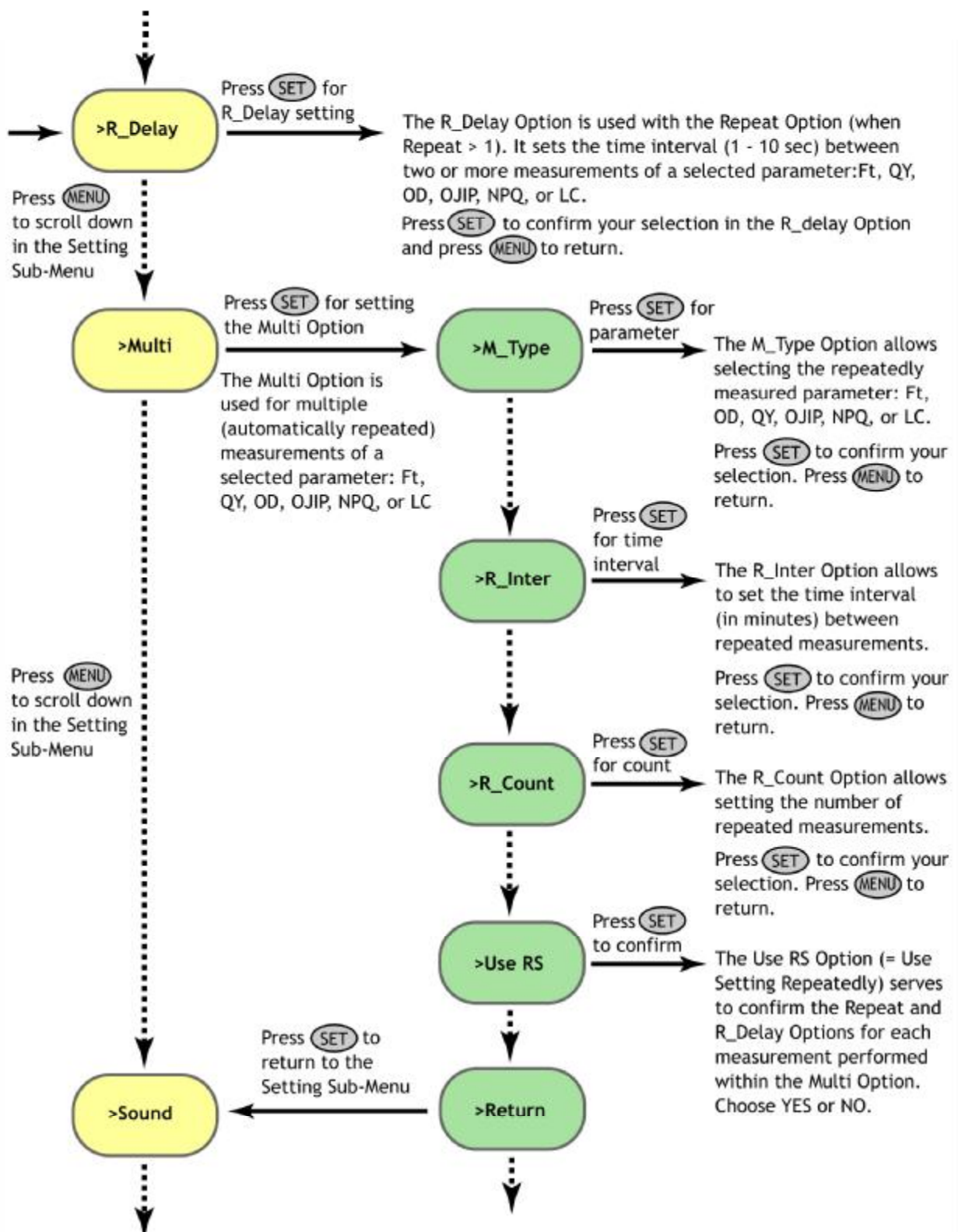
Use the Setting Sub-Menu to set the light color, light intensity, number and frequency of measurements, date, time, or the sound mode.



^{*}The function is active only in the AquaPen-C AP-C 100 model

Setting Sub-Menu - Part 2

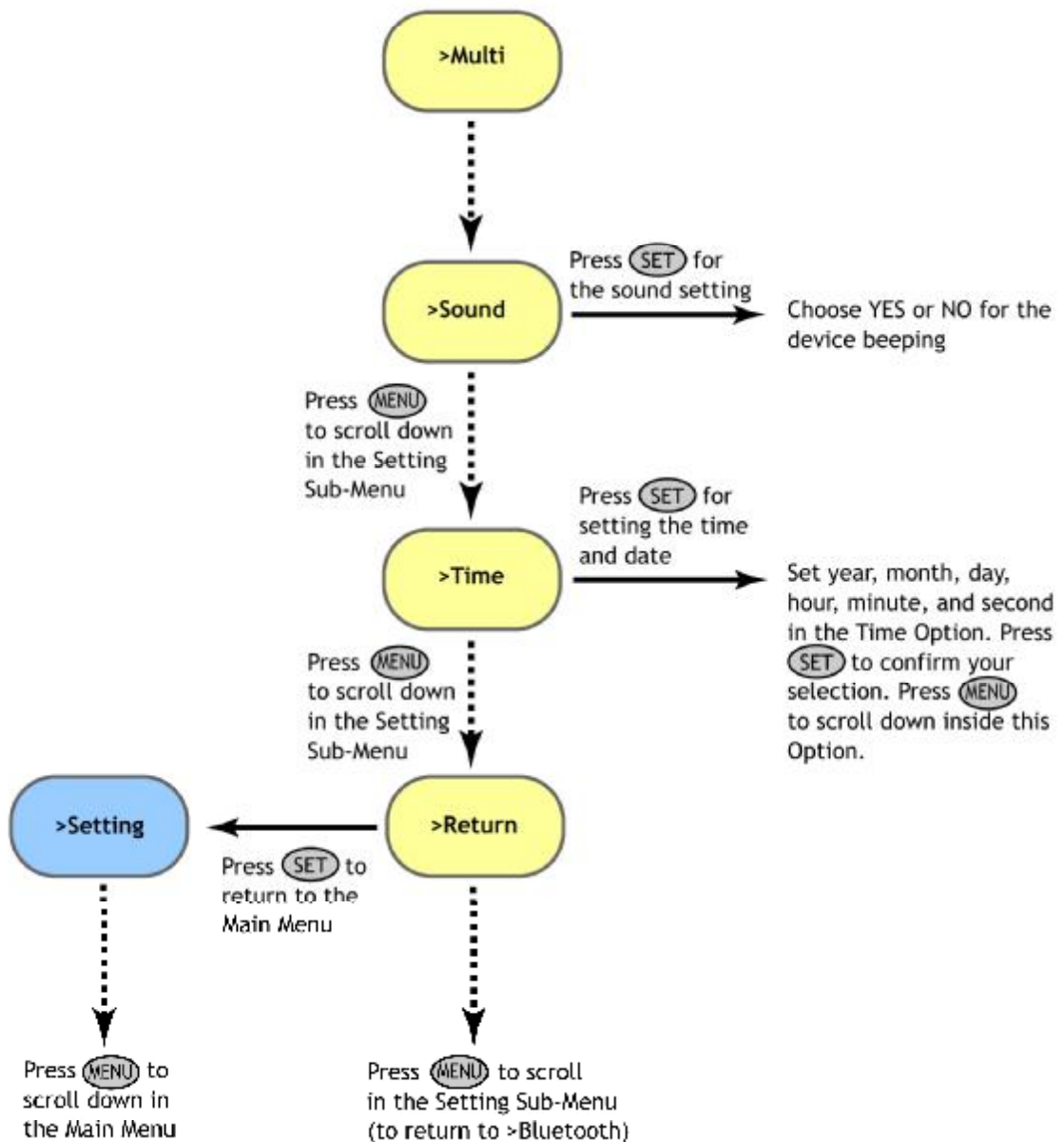
Use the Setting Sub-Menu to set the light color, light intensity, number and frequency of measurements, date, time, or the sound made.



To be continued on the next page

Setting Sub-Menu - Part 3

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



7. Bluetooth Pairing and Connecting

Before you set up the Bluetooth connection between the AquaPen and your PC, make sure you have these components:

1. Bluetooth enabled AquaPen

2. Bluetooth enabled PC

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

3. Bluetooth configuration software properly set up on PC

Before you can exchange files with your PC, you will need to set up the Bluetooth software that came with your PC, or your PC's Bluetooth card. This software varies by manufacturer. Please consult your PC's Bluetooth documentation for more information.

4. Bluetooth must be switched on visible on both devices

To pair the AquaPen with another Bluetooth device, such as a computer, you will need to ensure that Bluetooth is switched on visible on both devices.

7.A. Bluetooth Pairing

Step 1: Enabling Bluetooth in the AquaPen

Switch on the AquaPen (press and hold the SET key).

Scroll to the "Setting" menu (press the MENU key twice, then press the SET key once).

Select "BT_On" to enable Bluetooth (press the SET key).

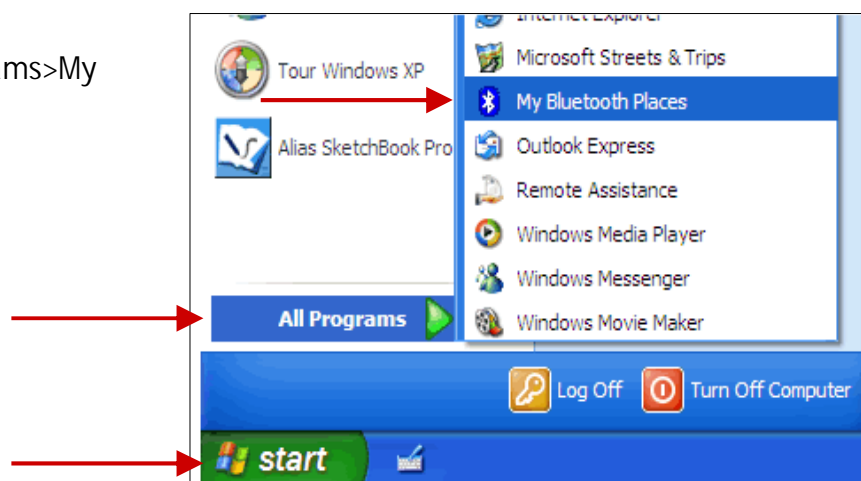
** Keep in mind that the AquaPen turns off automatically after about 3 minutes of no action. Turning off the AquaPen always turns off Bluetooth.*



Step 2: Starting Bluetooth Application on Your PC

Be aware that this description is a general example; some of the steps may be different on your PC.

Select: Start>All Programs>My Bluetooth Places.



You may also start your Bluetooth application via the Control Panel:

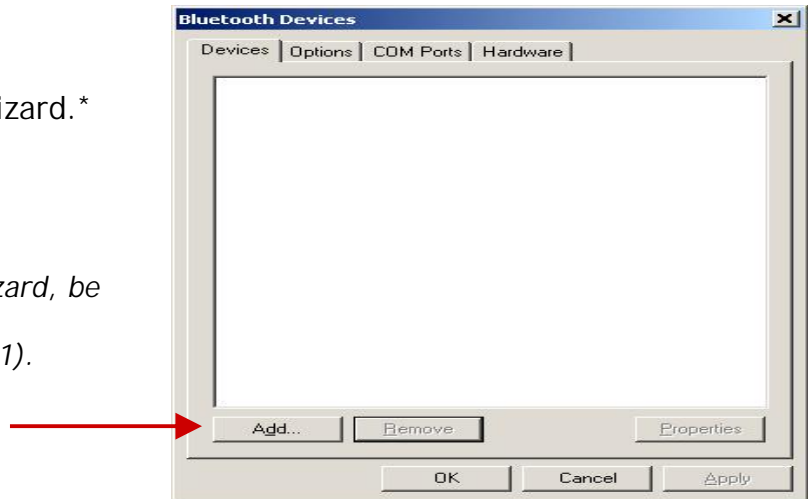
Select: Start>Settings>Control Panel>Bluetooth Devices.



Step 3: Opening the Add Bluetooth Device Wizard

Select: "Add" to start the wizard.*

* Before starting to use the wizard, be sure that the AquaPen is in discoverable mode (see Step 1).



Step 4: Searching for a New Bluetooth Device

Mark the following box: "My device is set up and ready to be found".

Select: Next.

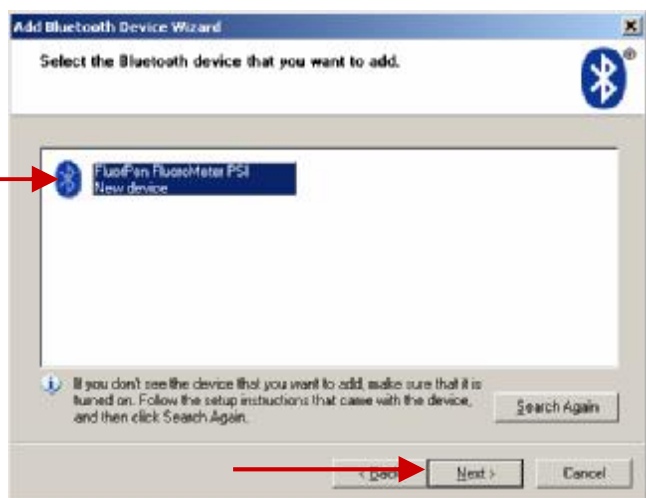


Step 5: Selecting the AquaPen

Select: FluorPen software icon (FluorPen FluoroMeter PSI).*

Select: Next.

* Your display may show more Bluetooth Device icons.



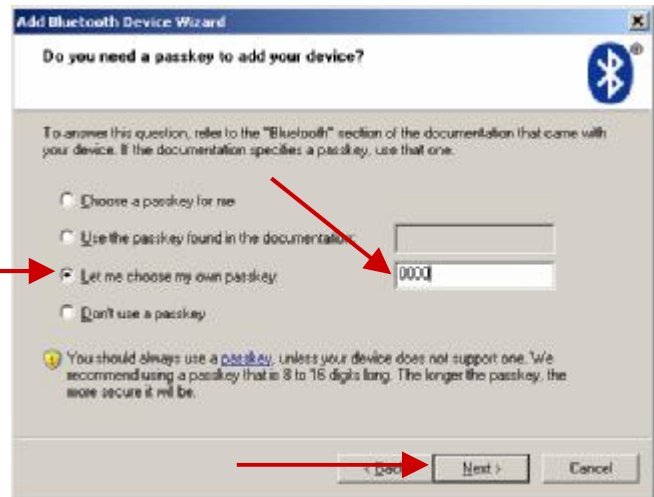
Step 6: Starting the Pairing Process

Your Bluetooth Pairing Passkey is:
0000

Select: "Let me choose my own passkey."

Enter: **0000** (four digits).

Select: Next.



Step 7: Completing the AquaPen Pairing

Select: Finish.



7.B. Bluetooth Connection

Step 1: Installing the FluorPen Software

Install the FluorPen software to your PC. Use the CD that came enclosed with your AquaPen.*

* See Chapter 8 of this Operation Manual for complete information on the FluorPen software.

Step 2: Enabling Bluetooth in the AquaPen

Switch on the AquaPen (press and hold the SET key).

Scroll to the "Setting menu" (press the MENU key twice, then press the SET key once).

Select "BT_On" to enable Bluetooth (press the SET key).*

* Keep in mind that the AquaPen turns off automatically after about 3 minutes of no action. Turning off the AquaPen **always turns off Bluetooth**.



Step 3: Starting Connection

Start the FluorPen software on your PC.

Select: Setup>Device ID (Ctrl+I).

If properly connected, the message "Device: FluorPen/AquaPen" appears on the bottom part of the screen.

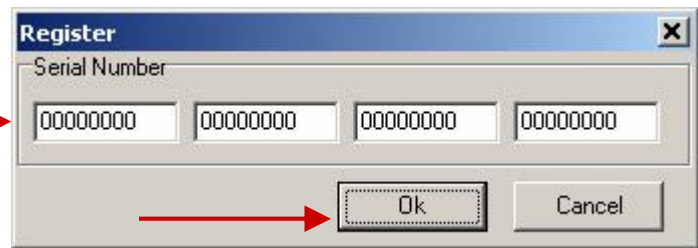


Step 4: Registering the FluorPen Software

Select: Help>Register.

Enter your serial (registration) number.*

Select: OK.



* You will find your serial (registration) number in the file **SN.txt** on the enclosed install CD.

Important Note: How to Reconnect Bluetooth

Disconnection can occur, either when the Bluetooth feature has been turned off in one or both of the devices, or when the units move outside their operating range.

If the devices have been turned off, simply turn them on and enable Bluetooth in the AquaPen again.

If the AquaPen has been moved outside the Bluetooth operational range, bringing it back into range within 90 seconds will allow it to reconnect automatically. If more time elapses, simply turn the AquaPen on and enable Bluetooth again.

8. FluorPen Software

Starting up:

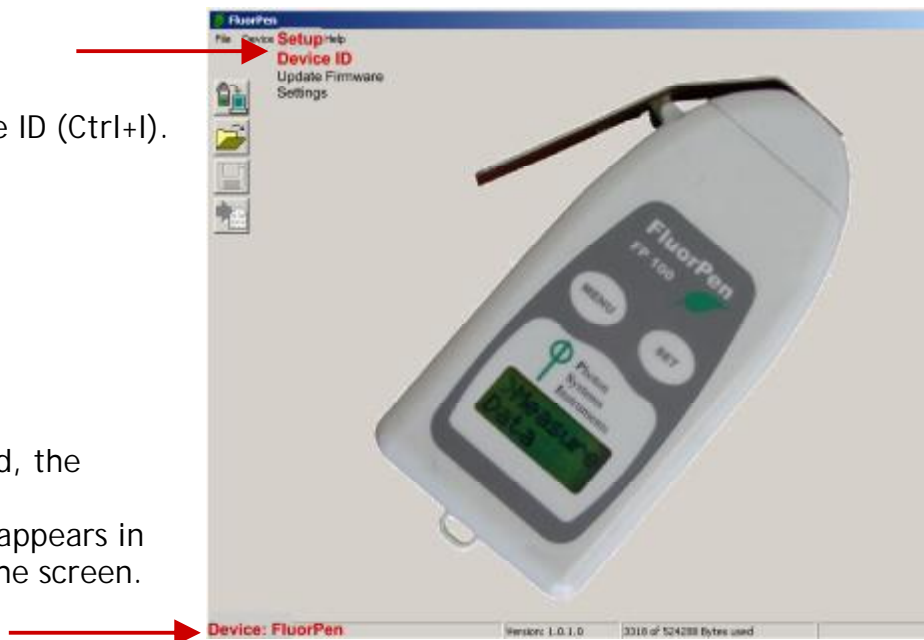
1. Switch on the computer.
2. Switch on the AquaPen and enable Bluetooth.
3. Make sure that your PC and the AquaPen are properly paired.*
4. Start the FluorPen program.

* See Chapter 7 of this Operation Manual for complete information on Bluetooth pairing and connecting.

Connecting:

Select: Setup>Device ID (Ctrl+I).

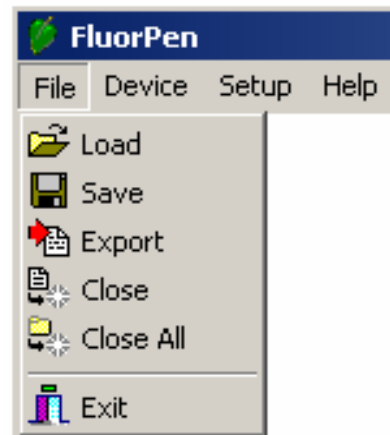
If properly connected, the message "Device: FluorPen/AquaPen" appears in the bottom part of the screen.



8.A. Menu and Icon Explanation

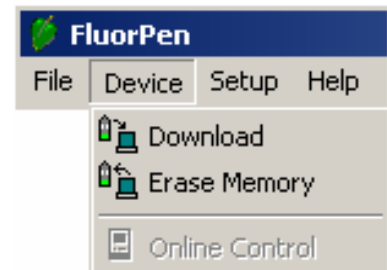
Menu: File

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



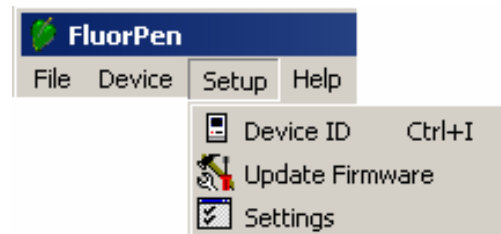
Menu: Device

- Download** Downloads data from the AquaPen to your PC.
- Erase Memory** Erases data from the AquaPen memory.



Menu: Setup

- Device ID** Detects the Bluetooth connected device.
- Update Firmware** Used for software updates.*
- Settings** Used for modification of the program settings.**

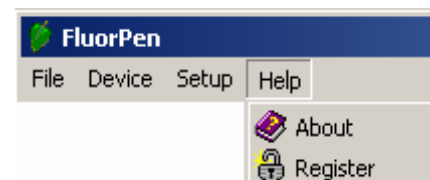


* For more information on software updating, see Chapter 8.E. of this Operation Manual.

** See more information on the next page.

Menu: Help

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



* See Chapter 7.B. of this Manual for more information on software registration.

Menu: Settings

After Download - Memory Erase

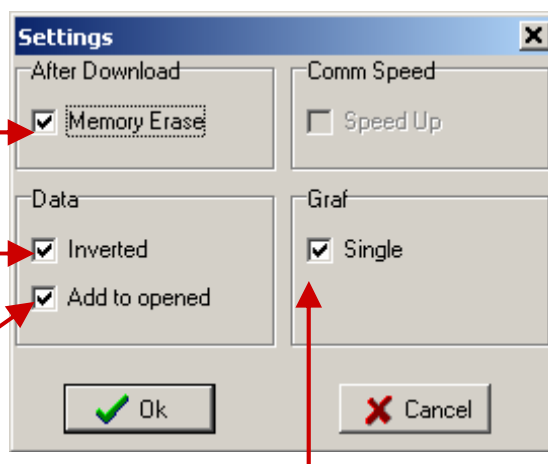
If the box is checked the AquaPen memory is erased after each data download.

Data - Inverted

If the box is checked the polarity of data is inverted, e.g., multiplied by -1.*

Data - Add to Opened

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



Graf - Single

If the box is checked all measured data are visualized in one graph, i.e., the value of each new measurement is added to the currently used graph window.

If the box is not checked a new graph is opened for every new measurement.

* This feature can be helpful for a certain type of experiment when the measured data are undesirably interpreted as negative values.

Icon Explanation:



Download

Downloads data from the AquaPen to PC.

Load

Loads (opens) previously saved data files.

Save

Saves data to hard disc.

Export

Exports data in .txt format.

8.B. Example of Data Transfer and Visualization

Step 1: Perform a measurement with your AquaPen.

(Here, we did an OJIP measurement.)

Step 2: Click the "Download" icon or select Device>Download.

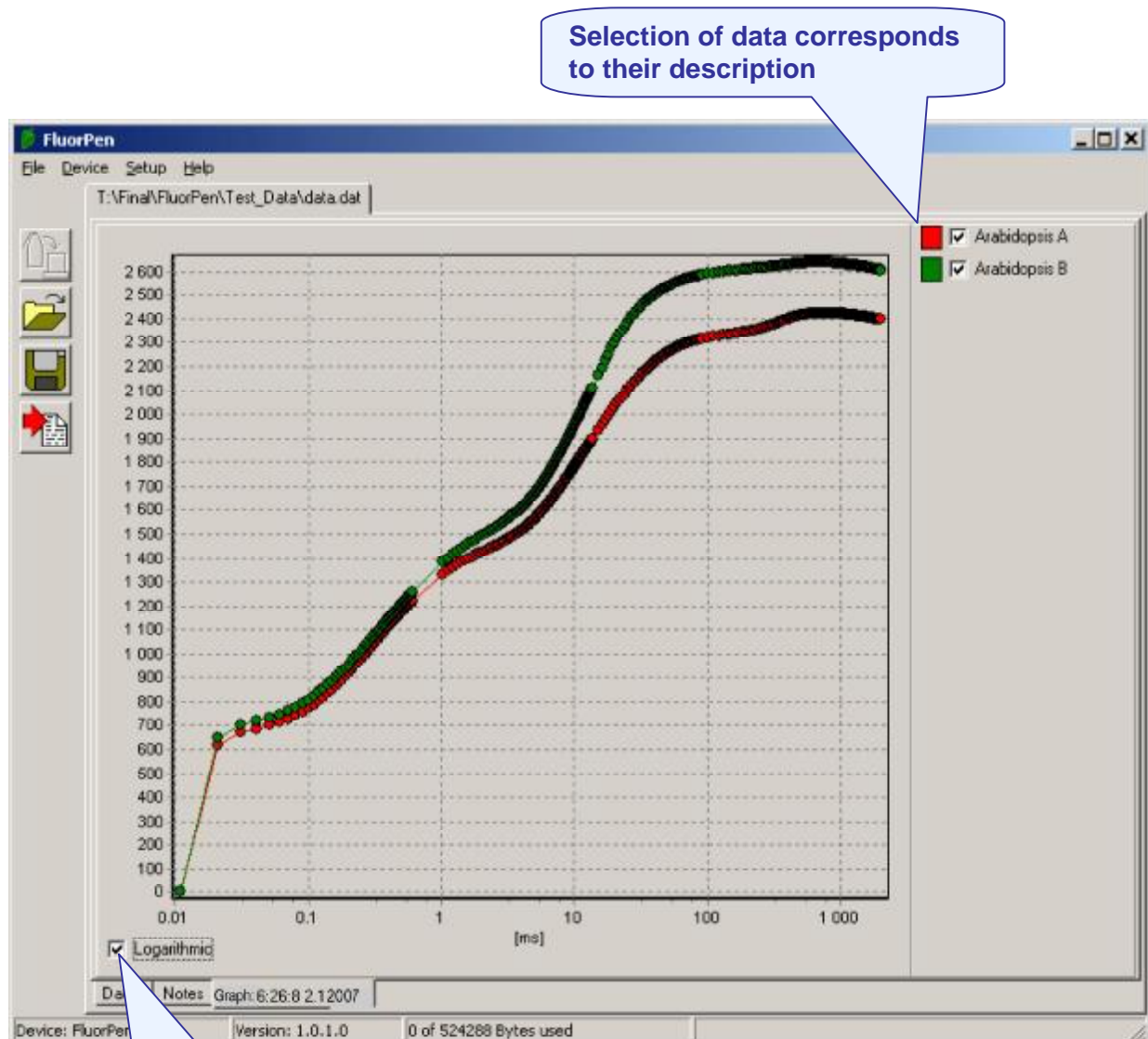
Step 3: The Data table appears.

The screenshot shows the FluorPen software interface with a data table. The table has columns for Time, ID, and measured parameters. Callouts point to various features: 'File name' points to the file path, 'Time of experiment' points to the time column, 'Measured parameter' points to the parameter names, 'Save experiment' points to the save icon, 'Measured and calculated values' points to the parameter list, 'Space for written notes' points to the notes tab, 'Switch to graphic visualization of the experiment' points to the graph tab, and 'Experiment description' points to the description field.

Time	6:26:32.1 2007	6:26:8.2.1 2007	6:26:32.2.1 2007	6:27:25.2.1 2007	6:41:9.2.1 2007
ID	QY	OJIP	Fl	QY	OJIP
	0.64		355	0.71	
Fo Backgr	1	Fo 618	Backgr 1	Fo Backgr 1	Fo 646
Fo Flash	351	Fj 1422	Flash 356	Fo Flash 275	Fj 1491
Fm Backgr	1	Fi 2149		Fm Backgr 1	Fi 2438
Fm Flash	964	Fm 2423		Fm Flash 942	Fm 2639
		Fv 1805			Fv 1993
		Vj 0.445			Vj 0.424
		Vi 0.848			Vi 0.899
		Fw/Fo 3.921			Fw/Fo 4.095
		-w/Fc 2.921			-w/Fc 3.085
		Fv/Fm 0.745			Fv/Fm 0.755
		Mo 0.911			Mo 0.831
		Area 4786890			Area 5229888
		Sm 2652.017			Sm 2624.129
		Ss 0.489			Ss 0.510
		N 5422.780			N 5142.671
		Phi_Pn 0.745			Phi_Pn 0.755
		Phi_o 0.555			Phi_o 0.576
		Phi_Eo 0.415			Phi_Eo 0.435
		Phi_Dn 0.255			Phi_Dn 0.245
		Phi_Pav 2857.311			Phi_Pav 2906.289
		ABz/FL 2.745			ABz/FL 2.595
		TRn/RC 2.045			TRn/RC 1.960
		Etc/RC 1.134			Etc/RC 1.129
		Ulo/FL 0.705			Ulo/FL 0.635
Description		Arabidopsis A			Arabidopsis B

Step 4: To visualize measurement in the graphic mode, click the "Graph" field in the bottom bar.

Step 5: The colored Graph of measured data appears.



Choose logarithmic or non-logarithmic graph form

8.C. Explanation of OJIP Parameters

The AquaPen device offers the possibility to capture rapid fluorescence transient - OJIP, which occurs during exposure of photosynthesizing organisms to high irradiance. The FluorPen software enables data downloading to a personal computer and subsequent OJIP analysis. The OJIP protocol includes the following extracted and technical parameters*:

Formula Abbreviation	Formula Explanation
Bckg	Background
F_0	$F_0 = F_{50\mu s}$, fluorescence intensity at 50 μs
F_J	F_J = fluorescence intensity at J-step (at 2 ms)
F_i	F_i = fluorescence intensity at i-step (at 60 ms)
F_M	F_M = maximal fluorescence intensity
F_V	$F_V = F_M - F_0$ (maximal variable fluorescence)
V_J	$V_J = (F_J - F_0) / (F_M - F_0)$
V_i	$V_i = (F_i - F_0) / (F_M - F_0)$
F_M / F_0	
F_V / F_0	
F_V / F_M	
M_0 or $(dV/dt)_0$	$M_0 = TR_0 / RC - ET_0 / RC = 4 (F_{300} - F_0) / (F_M - F_0)$
Area	Area between fluorescence curve and F_M (background subtracted)
Fix Area	Area below the fluorescence curve between $F_{40\mu s}$ and F_{1s} (background subtracted)
S_M	$S_M = Area / (F_M - F_0)$ (multiple turn-over)
S_S	S_S = the smallest S_M turn-over (single turn-over)
N	$N = S_M \cdot M_0 \cdot (1 / V_J)$ turn-over number Q_A
Phi_P ₀	$\Phi_{P_0} = 1 - (F_0 / F_M)$ (or F_V / F_M)
Psi_0	$\Psi_0 = 1 - V_J$
Phi_E ₀	$\Phi_{E_0} = (1 - (F_0 / F_M)) \cdot \Psi_0$
Phi_D ₀	$\Phi_{D_0} = 1 - \Phi_{P_0} - (F_0 / F_M)$
Phi_Pav	$\Phi_{Pav} = \Phi_{P_0} (S_M / t_{FM})$ t_{FM} = time to reach F_M (in ms)
ABS / RC	$ABS / RC = M_0 \cdot (1 / V_J) \cdot (1 / \Phi_{P_0})$
TR ₀ / RC	$TR_0 / RC = M_0 \cdot (1 / V_J)$
ET ₀ / RC	$ET_0 / RC = M_0 \cdot (1 / V_J) \cdot \Psi_0$
DI ₀ / RC	$DI_0 / RC = (ABS / RC) - (TR_0 / RC)$

* Formulas Derived From:

R.J. Strasser, A. Srivastava and M. Tsimilli-Michael (2000): The fluorescence transient as a tool to characterize and screen photosynthetic samples. In: *Probing Photosynthesis: Mechanism, Regulation and Adaptation* (M. Yunus, U. Pathre and P. Mohanty, eds.), Taylor and Francis, UK, Chapter 25, pp 445-483.

8.D. Non-Photochemical Quenching (NPQ) Protocol

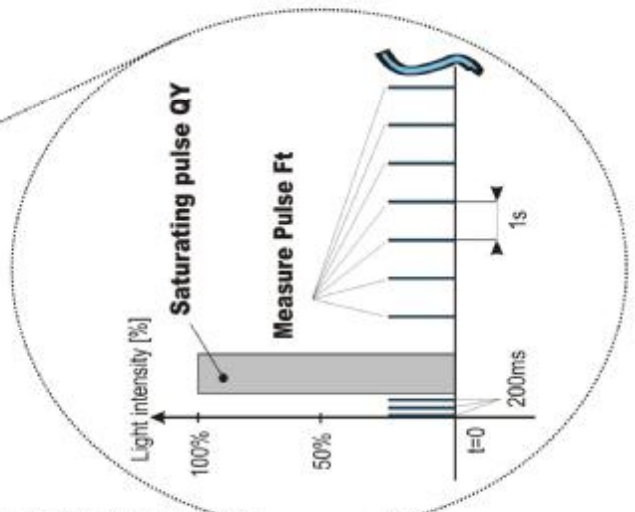
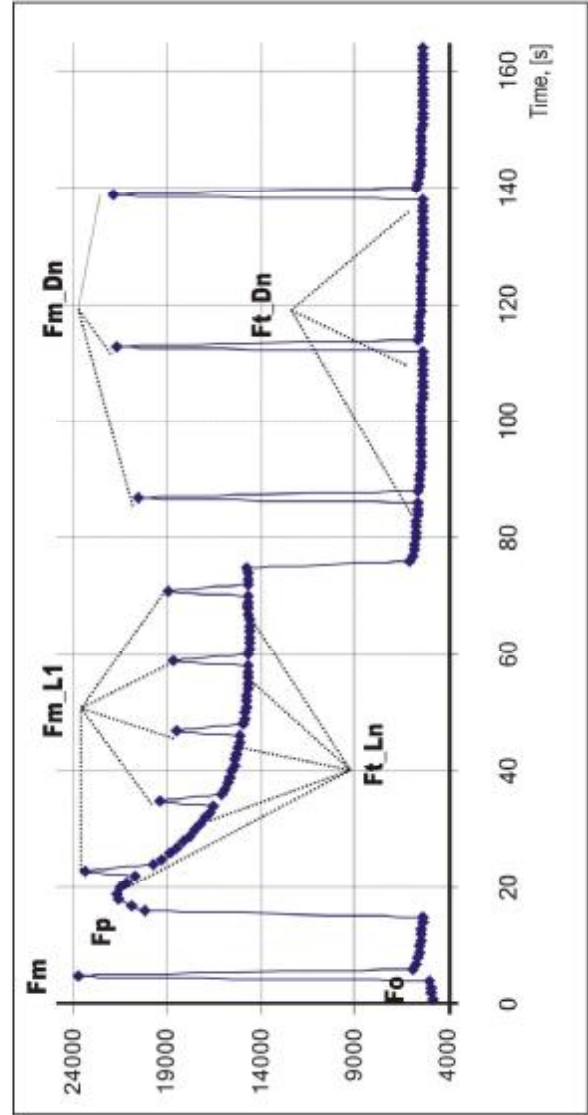
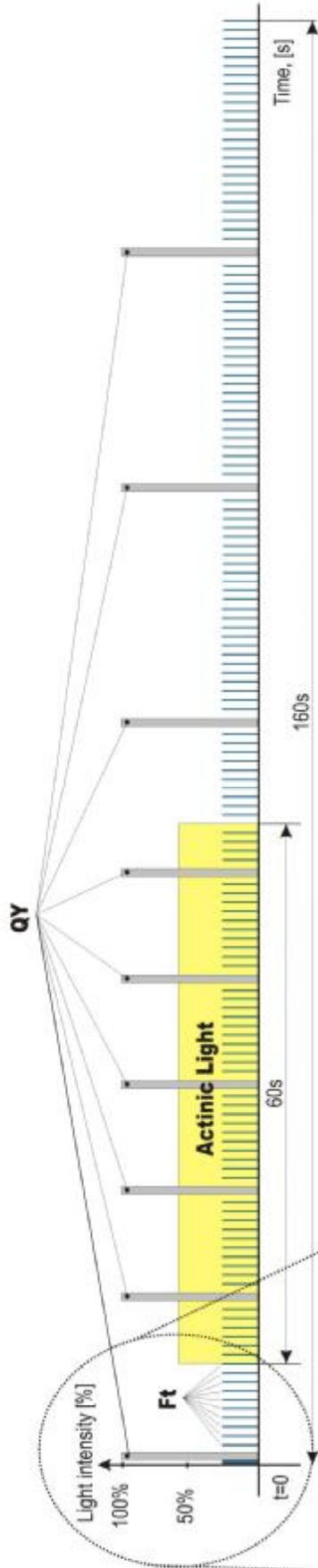
The NPQ protocol is the most typically used measuring approach to quantify photochemical and non-photochemical quenching. The measurement should be performed with a dark-adapted sample. Thereby, it may not be appropriate under field conditions.

The NPQ protocol starts by giving a measuring light to acquire minimal level of fluorescence F_0 . A short saturating flash of light is then applied to reduce the plastoquinone pool and measure maximum fluorescence in the dark adapted state, F_m . After a short dark relaxation, the sample is exposed to actinic irradiance for tens to hundreds of seconds to elicit a transient of the Kautsky effect. Moreover, a sequence of saturating flashes is applied on top of the actinic light to probe the non-photochemical quenching NPQ and effective quantum yield of photosynthesis QY in light adapted state. After exposure to continuous illumination, the relaxation of non-photochemical quenching is determined by means of saturating pulses applied in dark.

Two NPQ protocols, NPQ1 and NPQ2 are predefined. The protocols differ in the duration of the light exposure and the dark recovery phase, in the number and interval between pulses. See table below.

	Phase	Duration	# of pulses	1st pulse	Pulse interval
NPQ1	Light	60s	5	7s	12s
	Dark recovery	88s	3	11s	26s
NPQ2	Light	200s	10	10s	20s
	Dark recovery	390s	7	20s	60s

NPQ Protocol



Abbreviation	Explanation
Fo	minimum fluorescence in dark-adapted state
Fm	maximum fluorescence in dark-adapted state, measured during the first saturation flash after dark adaptation
Fp	fluorescence in the peak of fast Kautsky induction
Fm _L , Lss, D, Dss ¹	maximum fluorescence
QYmax ²	maximum quantum yield of PSII in dark-adapted state - Fv/Fm
QY _L , Lss, D, Dss ^{1,3}	effective quantum yield of PSII
NPQ _L , Lss, D, Dss ^{1,4}	non-photochemical chlorophyll fluorescence quenching
Qp _L , Lss, D, Dss ^{1,5}	coefficient of photochemical quenching, an estimate of open PSII reaction centers

¹ L - indicates light adapted parameters; D - refers to dark recovery phase after switching of the actinic illumination; n - represents a sequential number of light phase; ss - steady state

² Calculated as $(F_m - F_o) / F_m$

³ Calculated as $(F_{mLn} - F_{tLn}) / F_{mLn}$ or of corresponding steady state or dark recovery parameters

⁴ Calculated as $(F_m - F_{mLn}) / F_{mLn}$ or of corresponding ss, Dn or Dss parameters

⁵ Calculated as $(F_{mLn} - F_{tLn}) / (F_{mLn} - F_{oLn})$ or of corresponding ss, Dn or Dss parameters

8.E. Light Curve (LC) Protocol

The protocol called Light Curve (LC) was designed to acquire parameters for construction of Light Response Curve relating the rate of photosynthesis to photon flux density. The method is based on successive measurements of the sample exposed to a stepwise increase of light intensity. The effective quantum yields of photosynthesis are determined under various light intensities of continuous illumination. Measurement is based on pulse modulated fluorometry (PAM).

Several LC protocols are predefined in FP. These differ in number and duration of individual light phases and light intensities.

	# of phases	Phase duration	Light intensities, [mol m ⁻² s ⁻¹]
LC1	6	60s	10; 20; 50; 100; 300; 500
LC2	5	30s	100; 200; 300; 500; 1000
LC3	7	60s	10; 20; 50; 100; 300; 500; 1000

The protocol includes following measured and calculated parameters:

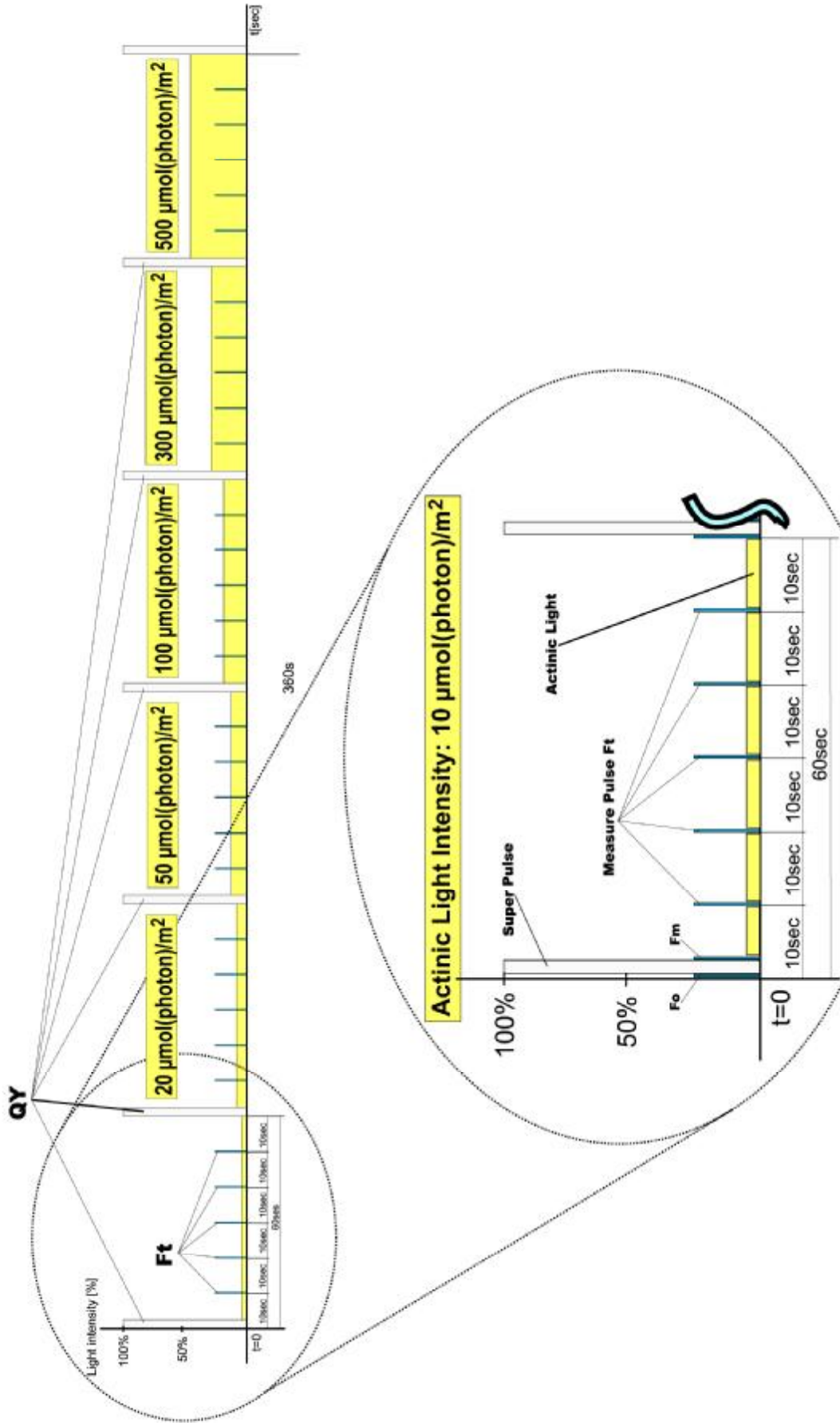
Abbreviation	Explanation
Fo	minimum fluorescence in dark-adapted state
Fm	maximum fluorescence in dark-adapted state
Fm_Ln [†]	maximum fluorescence in light adaptation state
Ft_Ln [†]	instantaneous fluorescence during light adaptation
QYmax*	maximum quantum yield of PSII in dark-adapted state - Fv/Fm
QY_Ln ^{†**}	instantaneous PSII quantum yield induced in light

[†] n represents a sequential number of light phase

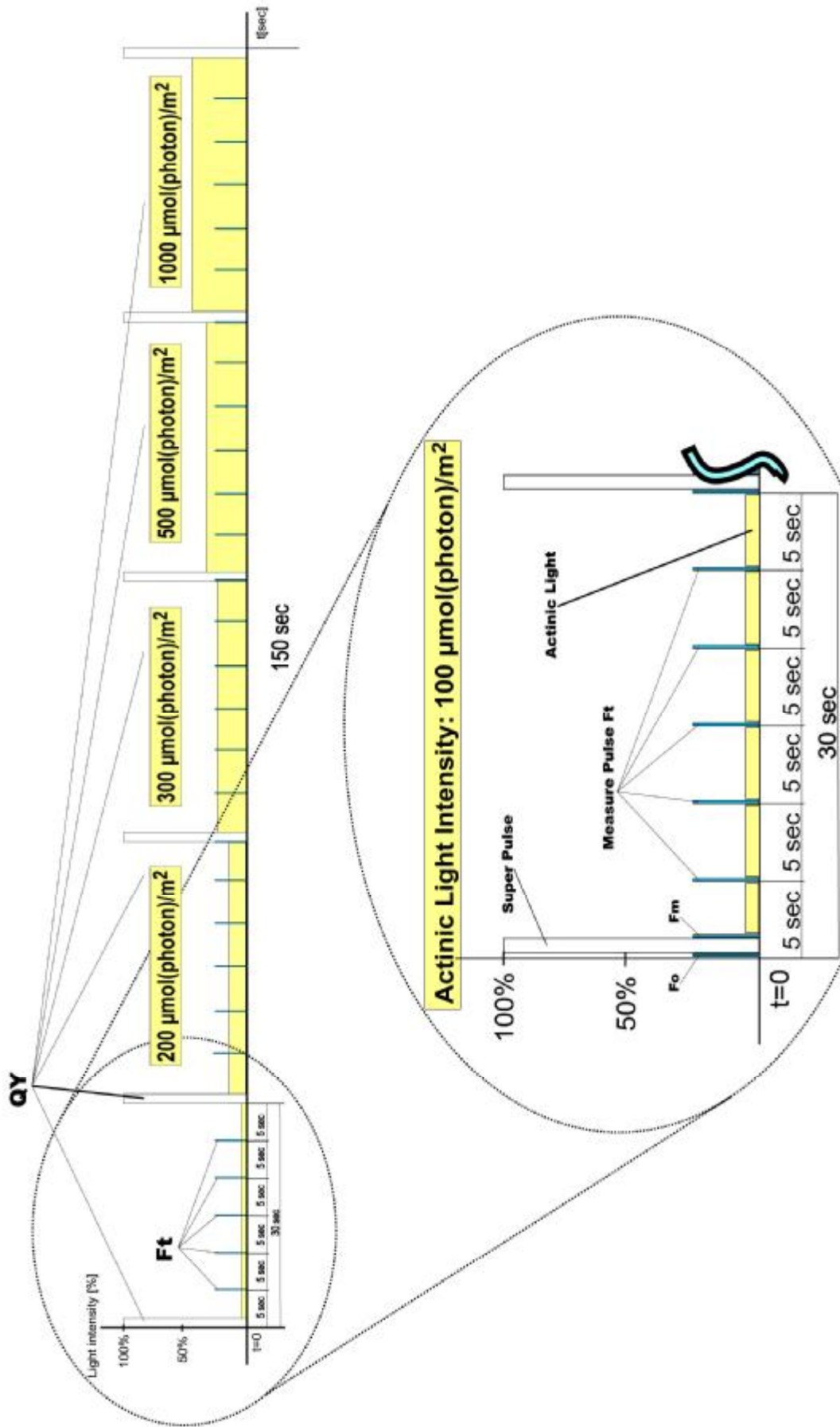
* Calculated as (Fm - Fo) / Fm

** Calculated as (Fm_Lx - Ft_Lx) / Fm_Lx

Light Curve 1 Protocol



Light Curve 2 Protocol



8.F. Software Update

Very important!

All data in the AquaPen memory are erased during the software update!

Before starting any software update, export all your data from the AquaPen memory into your computer!

Step 1: Starting Update

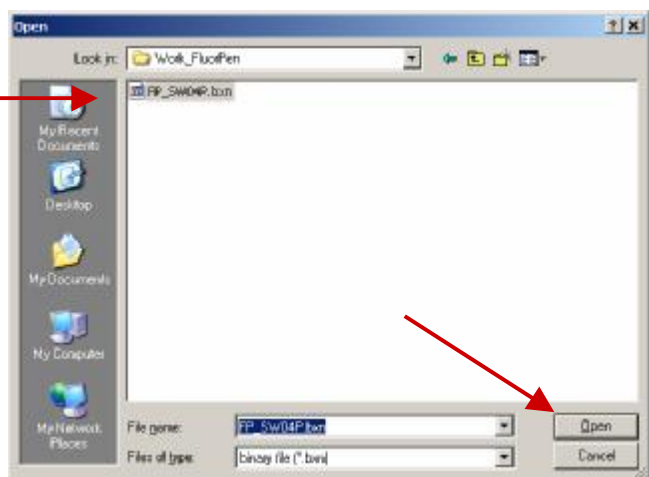
Select: Setup>Update Firmware



Step 2: Selecting .bxn File

Find: Binary file (with the extension .bxn)

Select: Open



Step 3: Finishing Upload

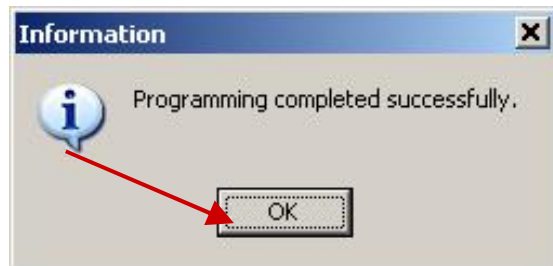
Select: "OK" to start uploading of the update.



The bottom bar indicates the upload progress.



Press: "OK" to finish upload.



9. GPS Module

IMPORTANT INFORMATION:

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

9.A. GPS Module Description



1. GPS Status Indicator

Green LED On/Off (On 1 sec/OFF 2 sec): Acquiring satellites.

Green LED On/Off (flashing 2 sec/2 sec): Position fixed.

2. Memory Storage Indicator

Red LED On: Memory storage full.

Orange LED On: Memory storage full + GPS unfixed.

Orange LED On/Off (flashing 2 sec/2 sec): Memory storage full + GPS fixed.

3. Power Key

Turn On: Press the key once and hold it for 3 sec.

Turn Off: Press the key twice (hold the second press for 3 sec).

4. Battery Status Indication

Red LED On/Off (flashing 1 sec/2 sec): Battery low (turns off after 5 minutes).

Red LED On: Battery charging.

Red LED Off: Battery full or not charging.

Note:

GPS Module is equipped with Lithium-ion rechargeable battery that lasts up to 24 hours of use. Recharging the battery takes about 4 hours.

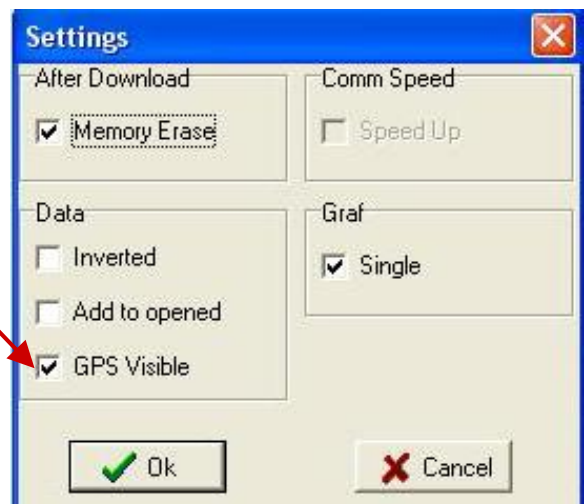
9.B. First Time Installation of the GPS Module

Step 1: Enabling GPS Module in the FluorPen Software

Select: Setup>Settings



Select: Settings>GPS visible



Step 2: Accepting GPS Setting

Close and restart the FluorPen program to accept GPS setting.

9.C. GPS / AquaPen Operation

Step 1: Time Synchronization

Synchronize the AquaPen time with the time of your PC. Time must be set correctly with respect to your time zone.

Step 2: GPS Positioning

Switch the GPS module on and wait until the GPS position is fixed (GPS green LED indicator flashes 1s ON and 2s OFF while tracking the position).

Step 3: Operation

Be aware that while performing field experiments, the AquaPen and the GPS module must be kept close to each other.

9.D. Data Download

Step 1: Enabling Communication

Switch on the computer, the AquaPen, and the GPS module. Set your computer to AquaPen communication: enable Bluetooth or connect to serial or USB port.

Step 2: Downloading Data from the AquaPen

Start: FluorPen program.

Connect: AquaPen device.

Download: Measured data from the AquaPen to your PC.



Be aware that no GPS coordinates are visible at this moment.

The screenshot shows the FluorPen software window with a data table. A red arrow points to the 'GPS' row, which is currently empty. The table has three columns for data points. The status bar at the bottom indicates 'Device: FluorPen', 'Version: 1.2.1.1', and '0 of 524288 Bytes used'.

Index	1	2	3
Time	16:13:03 13.5.2009	16:13:40 13.5.2009	16:14:47 13.5.2009
GPS			
ID	DJP	DJP	DJP
Value			
3ekg	99	80kg	99
4g	3370	Pa	10886
5	3135	Fj	19687
6	3972	Fi	22965
7a	3212	Fa	23828
8a	3842	Fv	12972
9i	1621	Vi	0689
9i	1814	Vi	0427
10aFo	1.843	10aFo	2.184
10aFo	1.843	10aFo	1.184
10aFo	1.458	10aFo	0.542
10a	1.926	10a	1.494
Area	3546077	Area	4942595
10aArea	5177313	10aArea	23695362
Sm	331.062	Sm	381.050
Si	1.671	Si	0.474
Vi	1388.416	N	803.610
Phi_Po	1.458	Phi_Po	0.542
Phi_o	1.379	Phi_o	0.311
Phi_Eo	1.173	Phi_Eo	0.168
Phi_Do	1.542	Phi_Do	0.498

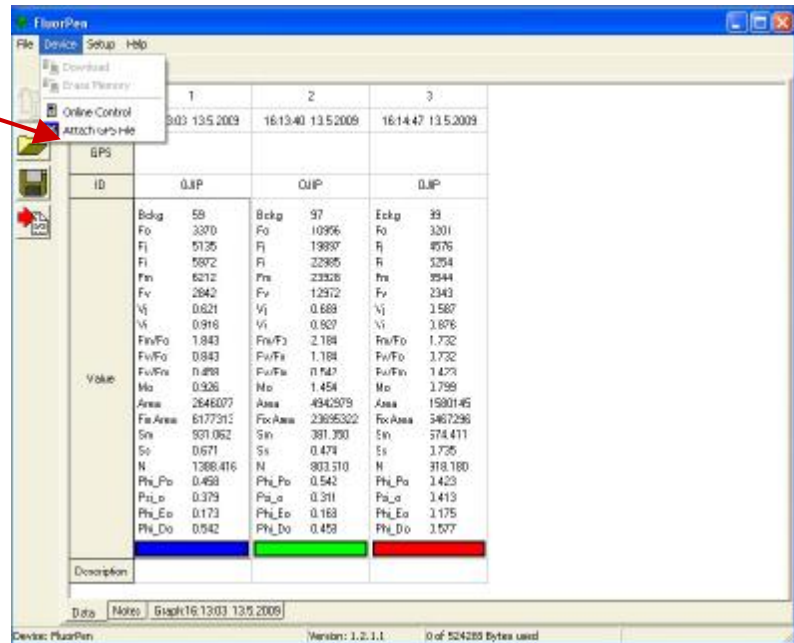
Step 3: Connecting GPS Module

Connect the GPS Module to your PC. Communication is set properly if the hardware is recognized by your PC.

Step 4: Downloading GPS Data

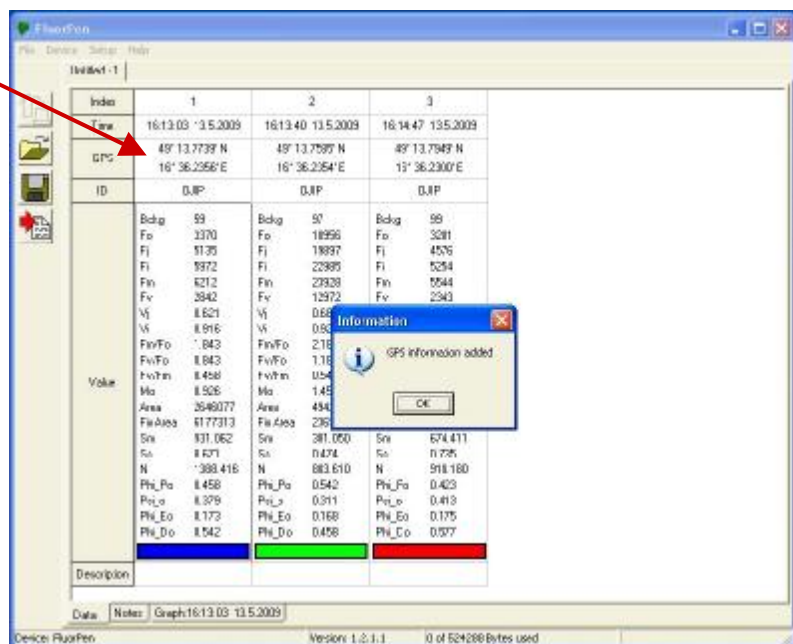
Select:

Device>Attach GPS file
to download data from the
GPS module.



Step 5: Completing the Download

Successfully downloaded
GPS coordinates paired with
AquaPen measured data.



9. Statement of Limited Warranty

- This Limited Warranty applies only to the AquaPen and its accessories (excluding any batteries). It is valid 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.

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

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