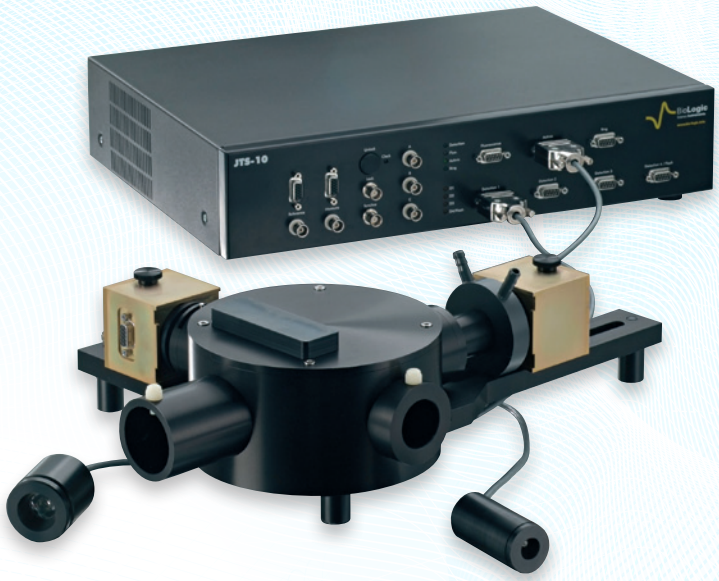
JTS-10

A LED pump-probe spectrometer



BioLogic
Science Instruments

GENERAL SPECIFICATIONS

- Single setup for fluorescence and absorbance changes
- Integrated array of actinic LEDs
- External /interchangeable LEDs (actinic and detection)
- Time resolution: from 10 µs to several minutes
- Sensitivity: 10^{-5} OD with OD ranging from 0 to 2
- Interchangeable sample holder (for leaves and suspensions)
- Optional coupling to a laser or Xenon Flash Lamp

STANDARD APPLICATIONS

- NPQ
- OJIP
- Carotenoid bandshifts
- Transthylakoid pH variations
- Cytochrome f, b, b_6f
- Cyclic vs linear electron flow
- P700 / PC

JTS-10

Joliot Type Spectrometer is a LED pump-probe spectrometer

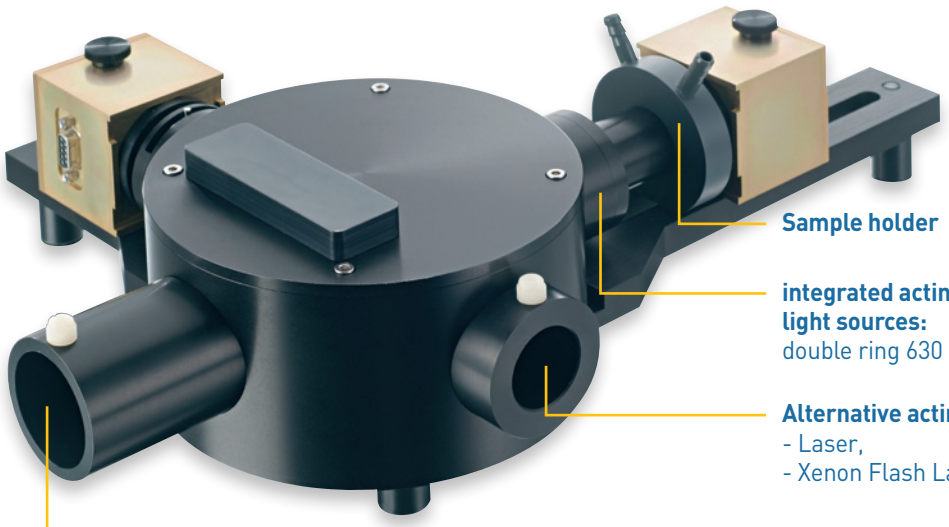
It is designed for electron transfer studies in photosynthetic organisms via fluorescence and absorbance changes.

JTS-10 uses external and **removable actinic LEDs** to excite the sample, and **detection LEDs** to follow the electron transfer, at a specific wavelength. JTS-10 covers a wide range of applications.

A versatile LED spectrometer

Optical device

The optical device offers an incredible versatility. The two light sources, detection and actinic, are external and removable. These are inserted in the provided slots.
An integrated array of actinic LEDs is present in the optical module. This permanent source can be used simultaneously with the other external LEDs for light superimposition.



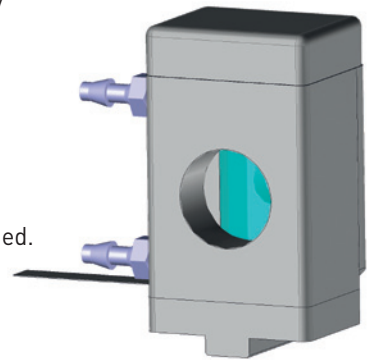
INTERCHANGEABLE SAMPLE HOLDERS

The **Interchangeable Sample Holders** are specially designed to allow temperature to be controlled by a thermostated bath.

For leaves with different geometries, two magnetic plates are used to position and hold the sample.

By introducing a continuous flow of gas (N_2, CO_2...), it is possible to control the chamber's atmosphere.

For suspensions, a holder for cuvette can be provided. Cuvette with different path length can be adapted. A magnetic stirring can be performed.

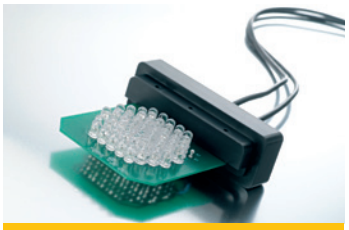


Configuration

A single set up for fluorescence and absorbance changes

Bio-logic's JTS-10 is an integrated system that is capable of performing both absorbance and fluorescence measurements in visible and near-infra red wavelength ranges.

As a result, switching from one configuration to the other is quick and easy.



ABSORBANCE CONFIGURATION

Polychromatic detection light is filtered through a user-selected interference filter to get the wavelength of interest.

FLUORESCENCE CONFIGURATION

The use of our "**Fluo_59**" accessory permits the user to perform experiments such as: OJIP, NPQ, fluorescence decay at 520 nm.

The double ring 630 nm can also be used for fluorescence measurements.

JTS-10 employs essential light sources in combination with the appropriate cut-off filters to cover a wide range of applications:

- a white detection light source (pulsed LED) with an interference filter at 520 nm for absorbance measurements,
- an integrated dual ring of actinic leds 630 nm/720 nm. For cyanobacteria, a single 520 nm leds ring is also available,
- Fluo_59 accessory with green LEDs for fluorescence measurements (OJIP, NPQ).

OPTIONS

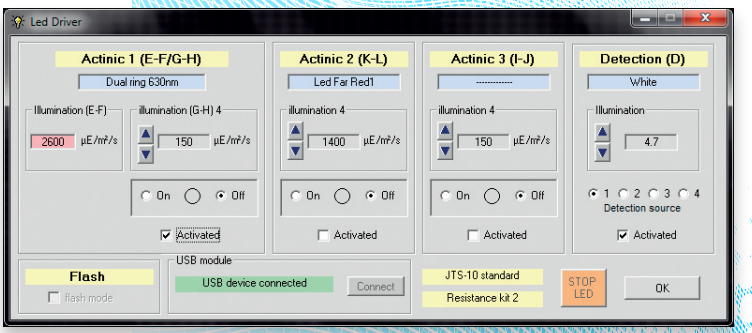
- Besides this basic configuration, JTS-10 can accommodate additional detection or actinic sources suited for specific studies, such as **cytochrome** redox changes, **P700** redox changes, or light-induced absorption changes in **photosynthetic bacteria**.
- The control unit is designed to accommodate additional external light sources (Laser, Xenon Flash Lamp, continuous or pulsed LEDs).

JTS-10 software: Intuitive and user-friendly

The **LED control window** allows users to adjust the light intensity of the source used.

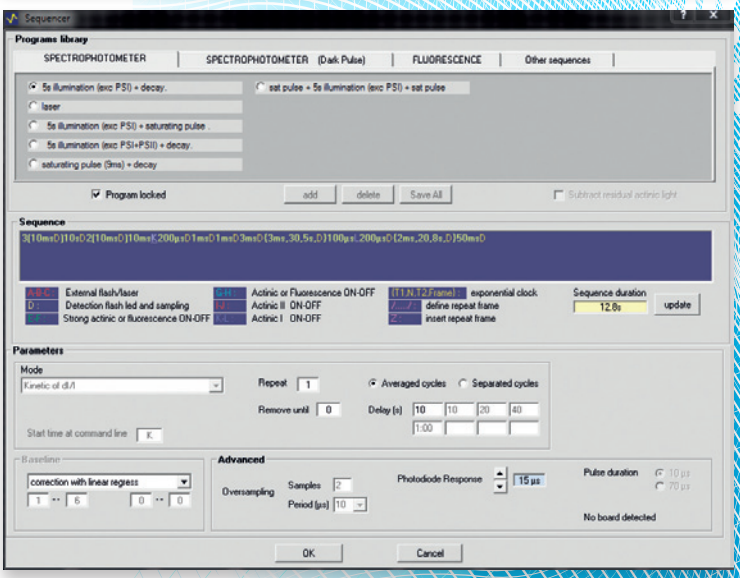
Each intensity is tunable:

- 630 nm leds: 45 to 2,050 µE/m²/s,
- 720 nm leds: 200 to 14,000 µE/m²/s,
- detecting light intensity: by a factor of up to 50,
- fluorescence Channel: 2 to 3,000 µE/m²/s.



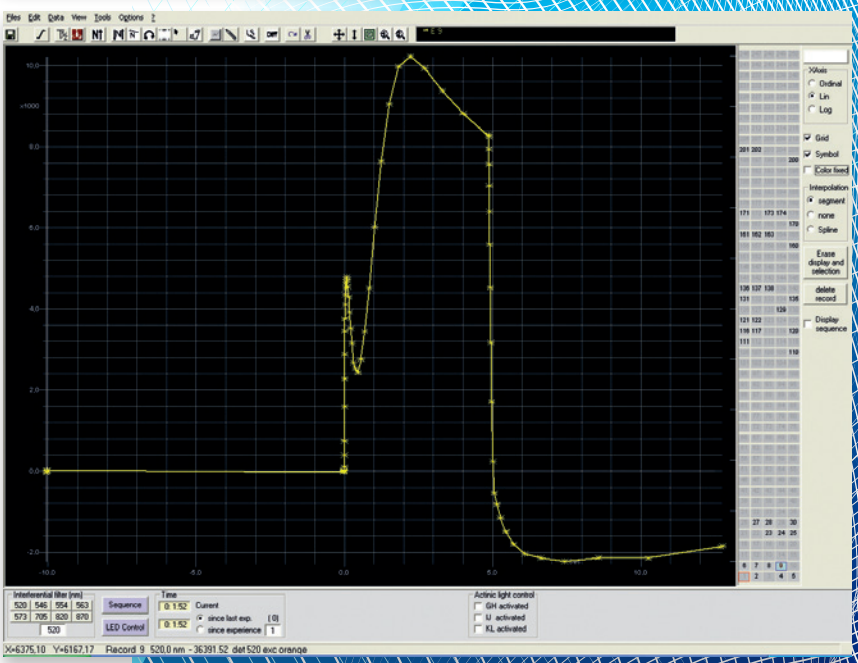
JTS-10 software features a library with pre-programmed sequences in absorbance and fluorescence modes. Users can modify each sequence or create new sequences to add to the library.

When creating a new sequence, the time between two successive **events** can vary from **1 µs** to **several minutes**.



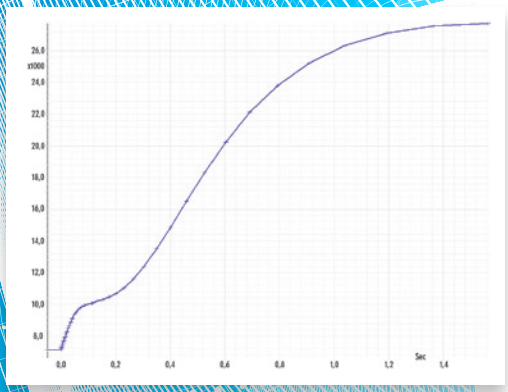
JTS-10 provides a full set of mathematical tools for data treatment and analysis, including the following:

- curve rotation,
- curve normalization,
- ability to track time from the latest experiment using a built-in real-time clock,
- convenient and accessible storage of more than 500 individual experiments with their corresponding comments and configuration used,
- linear, logarithmic, and ordinal scales,
- cytochrome b,f b_6f deconvolution...



Applications in fluorescence

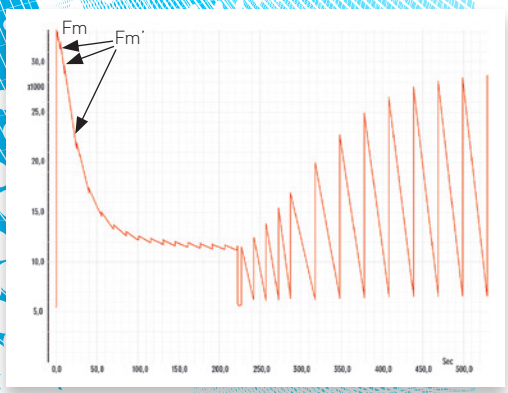
Fluorescence under a continuous illumination



Fluorescence rise induced by a continuous illumination at 520 nm on a dark-adapted leaf (use of Fluo_59 accessory).

Limiting intensity for a few seconds results in a large increase of the fluorescence yield, which indicates the progressive reduction of the plastoquinone pool.

Non-Photochemical Quenching



Fluorescence yield changes induced by a continuous illumination at 520 nm and in the dark. The maximum fluorescence yield (Fm and Fm') is assessed by an excess of short, intense green light pulses (7900 µE/m²/s).

Access to Fo, Fm, and Fm' values.
Note: all Fm' values are not represented on the curve.

The associated Genty parameters (ø PSII*) and the Non Photochemical Quenching Parameters (NPQ*) in function of the time can then be easily determined with the software.

This graph shows the evolution of the ø PSII* parameter in function of the time (—).

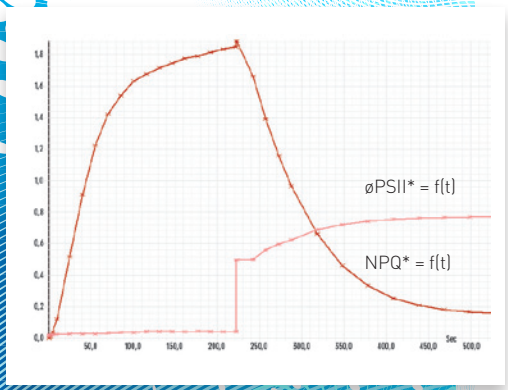
øPSII* is determined with the following equation:

$$\text{øPSII*} = \frac{Fm' - Fo}{Fm'}$$

NPQ evolution is also followed in function of the time (—)

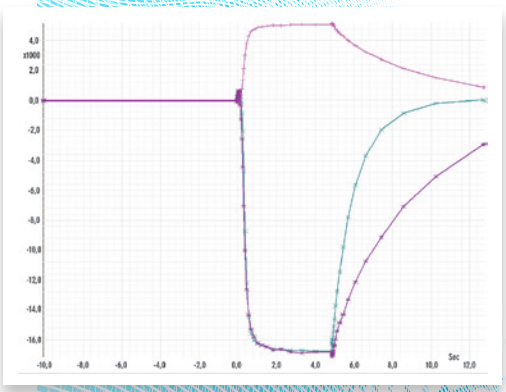
NPQ is calculated with the following equation:

$$\text{NPQ} = \frac{Fm - Fm'}{Fm'}$$



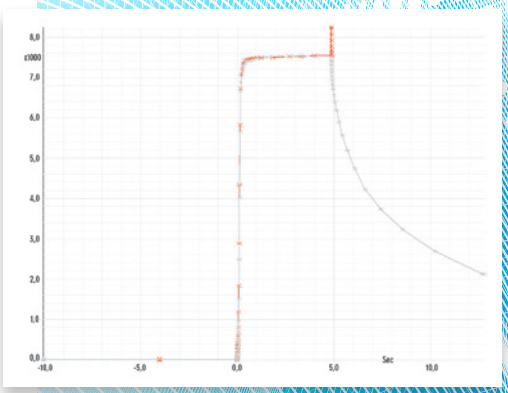
Applications in absorbance mode

P700 and plastocyanin absorption changes



- P700 oxidation induced by a continuous illumination with a 720 nm actinic LED (20 µE/m²/s) followed by its reduction in the dark with a probing light peaking at 705 nm.
- Plastocyanin oxidation induced by a continuous illumination with a 720 nm actinic LED (20 µE/m²/s) followed by its reduction in the dark with a probing light peaking at 740 nm.
- A comparison of the plastocyanin and P700 time-course after normalization. Each curve is the result of a single sweep. The sample was pre-illuminated for 10 minutes.

Saturated pulse method (P700 kit at 810/870 nm)

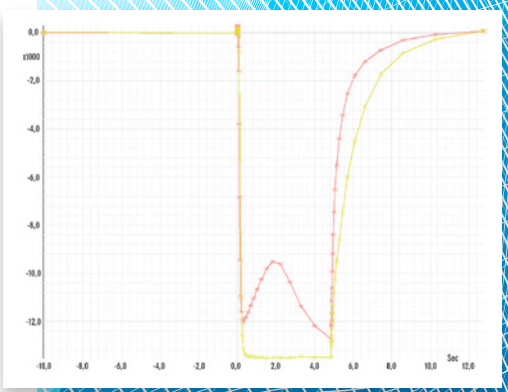


The variety of light sources that can be used simultaneously illustrates the versatility of JTS-10. A saturated pulse can easily be superimposed on a continuous illumination to assess, for example, the maximum signal associated with P700 oxidation.

Transient absorption changes induced by a continuous illumination with a 720 nm actinic LED (190 µE/m²/s), with a probing light at 810 nm (—) and with a saturated pulse at the end of the illumination (—).

The sample was preilluminated with a 630 nm actinic light for 3 minutes.

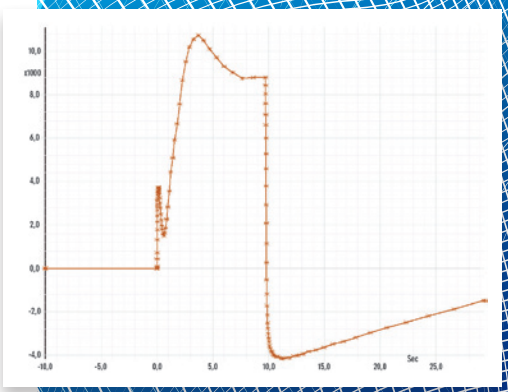
Linear vs. cyclic electron flow using the pulse of dark method (P700 kit at 705/740 nm)



JTS-10 uses a unique "pulse of dark" method. This new technology allows users to cancel the possible contribution of the exciting light when it is too close to the probing light to be cut off by conventional filters.

Transient absorption induced by a continuous illumination with a 720 nm actinic LED (120 µE/m/s) followed by its reduction in the dark.
Detection at 705 nm for a dark adapted leaf (—) and for a light-adapted leaf (preillumination of 3 minutes at 630 nm) (—).

Carotenoid band-shifts



Transient absorption changes induced by a continuous illumination with a 630 nm actinic LED (290 µE/m²/s) followed by their relaxation kinetics in the dark with a probing light at 520 nm.

Configuration

OPTICAL DEVICE

Supplied with the following

Probing light	White pulsed LED: flash duration of **10 µs**. Pulse distribution from 10 µs to several minutes and adjustment of the light intensity
Interference filter	520 nm (FWHM: 10 nm)
Actinic LEDs	Dual ring of 630/720 nm leds: - 630 nm leds tunable from 20 to 2,050 µE/m²/s. - 720 nm leds tunable from 14 to 14,000 µE/m²/s. A single ring of 520 nm actinic leds can be supplied. Light intensity is tunable from 14 to 2250 uE/m²/s
Fluo_59	made with green LEDs for high illumination (7900 µE/m/s) and/or weak illumination (from 2 to 3000 µE/m²/s) at 520 nm
Detection	Si PIN photodiode, spectral wavelength range from 320 to 1120 nm
Sensitivity	10^{-5} OD with samples with OD ranging from 0 to 2
Dimensions	50 x 35 x 13 cm (L x W x H)
Weight	3.9 kg
Sample Holder	Temperature control using a waterbath: - Leaf: Area of the leaf illuminated: 2 x 6 mm², with flowing gas capability, - Suspension: holder for hellma cuvette with 1cm path length or shorter. Magnetic stirring is a standard

CONTROL UNIT

Data acquisition	ADC 16-bit resolution
PC interface	USB and PCI high-speed board
Connection	Laser and flash lamp xenon
Weight	5.8 kg
Dimensions	44 x 35 x 13 cm (L x W x H)

OPTIONAL UPGRADE

Actinic LEDs

Xenon Flash Lamp

Laser with optical fiber (not supplied by Bio-Logic)

Kits

Cytochrome eukaryote	Interference filter of 546, 554, 563, 573 nm (FWHM: 6 nm)
P700 at 705/740 nm	Combined detection LED at 705 and 740 nm and associated interference filters at 705 and 740 nm (FWHM: 6 nm and 10 nm respectively)
P700 at 810/870 nm	Detection LED at 810 and 870 nm with appropriate cut-off filters
Bacteria	- Absorbance: actinic LED 880 nm and interference filter of 525 nm (FWHM: 6 nm) for the detection of the carotenoid bandshift. - Fluorescence: 470 nm LED
Cytochrome bacteria	Detection LED at 400 and 450 nm with interference filters: 550, 560, 605, 420 and 430 nm (FWHM: 6 nm)

Pictures and specifications subject to change

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