PHOTOSYNQ

MultispeQ v2.0

*Modified: August 23, 2019*
Version: v0.80

MultispeQ v2.0

Getting Started

- **Charging:** Before using your MultispeQ, charge it for 8 hours using the supplied micro-USB cable*. When plugged in, the small green LED next to the micro-USB port lights up. Once the instrument is fully charged, the light will turn off.
- **Turn On:** Press and hold the power/reset button in the rear for 5 seconds.
- **Software:** Go to https://photosynq.org/software and download the Android app or the Desktop app.
- **Check Tutorials:** Before Using Your Instrument Make Sure To Check Out The "Getting Started" Tutorials on how tho connect the Instrument and take the first Measurement.

* Power supply not included. Use a computer or standard USB power supply. Charging time depends on the power output of the power supply.

About
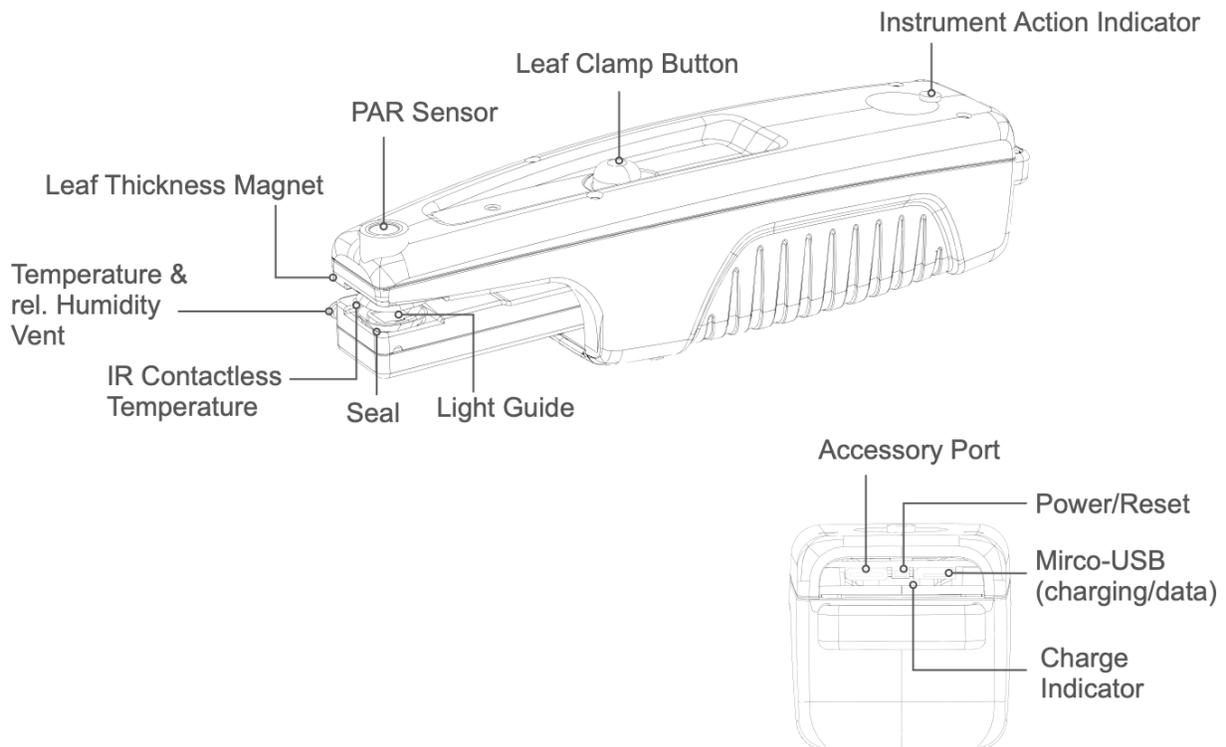
MultispeQ v2.0 side and back view

Leaf Clamp Button

Push down the leaf clamp button to open the leaf clamp. Push and release with an even motion and prevent it from snapping back. In case the open and closing feels a little rough, a small amount of lithium grease can be used to make the open and closing motion more smoothly.

PAR Sensor

The PAR sensor located on top of the instrument. When taking measurements, depending on the measurement protocol, the light intensity measured will be replicated inside the instrument. Make sure not to cover or shade the PAR sensor, to prevent altering the actual intensity. Also prevent the sensor from getting dirty.

Seal

The seal around the light guide on the main body and the clamp is ensuring the area measured is sealed from outside light. The material is Nitrile.

Light Guide

The light guide are made from acrylic. Make sure, it is clean and prevent clamping hard materials which can cause scratches.

> You may need to clean the light guides occasionally. Gently clean the light guides with a damp, soft cloth.

> Do not submerge in water, do not use solvents or detergents and do not use abrasive or rough cloths to clean the light guides.

IR Contactless Temperature

The leaf Temperature can be measured with the IR Contactless Temperature. When taking a measurement make sure that the leaf is covering the IR sensor. The sensor is inside a little groove and not flush with the clamp surface. The leaf or material should not touch the the sensor, since it can alter the measured temperature reading.

Temperature & rel. Humidity Vent

The two vents allowing air to be exchanged inside the Instrument. There are two sensors inside the clamp, one is close to the vents and the light guide, the other one is located on the other end of the clamp. Tubes can be attached in combination with a pump to provide a constant air flow and/or gas exchange.

Instrument Action Indicator

The Action Indicator has the following

Indicator	Function
🟢 🔋 5s	Instrument is on, and fully charged. The indicator is flashing every 5s
🟠 🔋 5s	Instrument is on, and battery is emptying. The indicator is flashing every 5s
🟠 <1s	Instrument clamp open. The indicator is flashing rapidly.
🔵 ⧗	Instrument is busy (e.g. Measurement). The indicator is constantly on

Power/Reset Button

The button in the back allows the instrument to be turned on as well as been reset.

- Hold the button for at last 5 seconds to turn the Instrument on. Wait for the Action Indicator to start flashing, to confirm the Instrument is on and booted up.
- A short push on the button will reset the instrument, in case a protocol crashes, etc.
- When the Instrument is running, hold the button for 5 seconds, to restart the instrument. Wait for the Action Indicator to start flashing, to confirm the Instrument is booted up again.

> **Tip**
>
> When the rubber port cover is closed, it is easier to push the button.

Micro-USB

The Micro-USB port allows the Instrument to be charged and when connected to a computer for data transfer. When unplugging the cable, make sure not to bend the cable up and down, to not break of the Instrument connector.
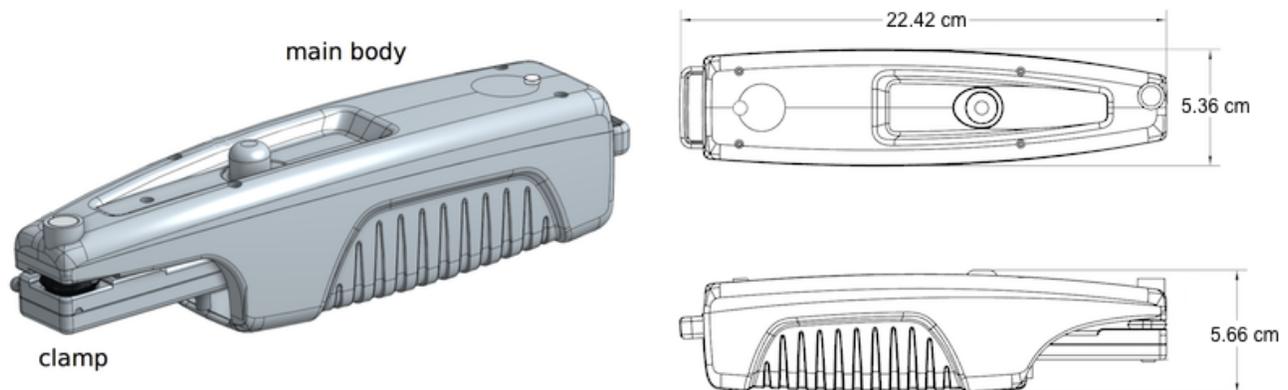
Accessory Port

The USB-c port allows to attach accessory equipment. When unplugging the cable, make sure not to bend the cable up and down, to not break of the Instrument connector.

Charge Indicator

The little LED in the back indicates, when the Instrument is charging. When the battery is fully charged, the LED will turn off.

MultispeQ v2.0 Configuration

MultispeQ v2.0 measurements

Body	Measurements
Size	224.2 mm x 53.6 mm x 56.6 mm (l, w, h)
Total Weight	340 g (incl. battery)
Light Guide Surface	8 mm x 8 mm (64mm²)
Leaf Clamp Opening	13 mm
Safety	Ring for leash
Updates	Firmware updates through Applications

Lights

There are sets of five LEDs each on the **main body** and the **leaf clamp**.

Main Body

#	Emission Peak	Model	Specifications
1	530nm	LED (green), Lumileds, LXZ1-PM01	view
2	655nm	LED (red), Lumileds, LXZ1-PA01	view
3	590nm	LED (amber), Lumileds, LXZ1-PL01	view
4	448nm	LED (blue), Lumileds, LXZ1-PR01	view
5	950nm	LED (NIR), OSRAM, SFH 4441	view

Leaf Clamp

#	Emission Peak	Model	Specifications
6	950nm	LED (NIR), OSRAM, SFH 4441	view
7	655nm	LED (red), Lumileds, LXZ1-PA01	view
8	850nm	LED (NIR), OSRAM, SFH 4451	view
9	730nm	LED (far red), Everlight, ELSH-Q61F1-0LPNM-JF3F8	view
10	820nm	LED (NIR), OSRAM SFH 4786S	view

Emission Spectra for LEDs
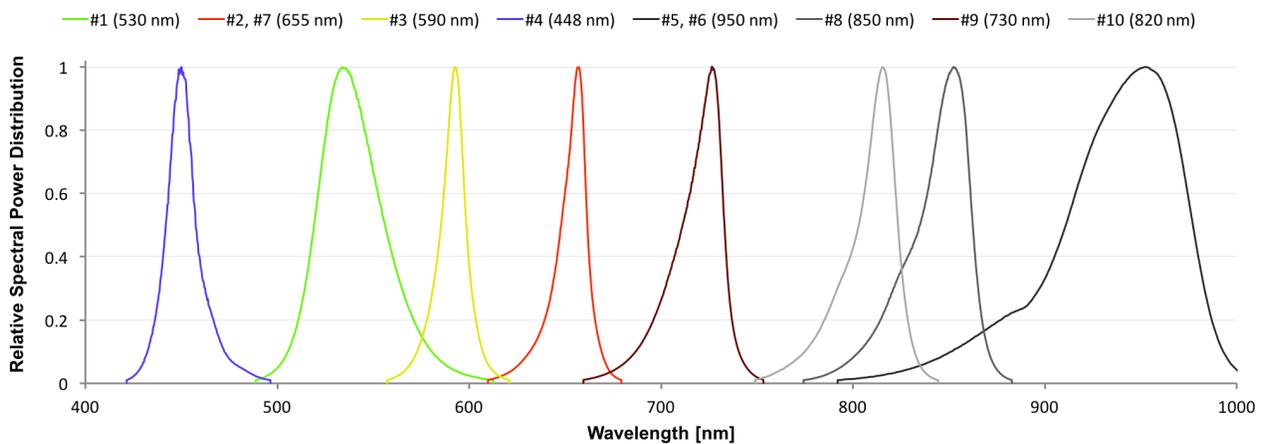
Emission spectra for LEDs build in the MultispeQ v2.0 - Emission normalized to maximum emission peak

Detectors

The MultispeQ v2.0 comes with two detectors. One covering the near infrared on the **main body**, the other covering the visual range on the **leaf clamp**.

#	Detection Range	Model	Specifications
1	700nm - 1150nm	Hamamatsu, S6775-01 (main body)	view
3*	400nm - 700nm	Hamamatsu, S6775 (leaf clamp)	view

*Note

The detector 3 is covered with a BG-18 bandpass filter with a center wavelength around 493 nm. If you are using the detector to detect signals on the edges of the detection range, expect the signal strength to be low.

Sensors

The MultispeQ v2.0 has a set of sensors to measure the environmental parameters

Sensor	Model	Specifications
Ambient Temperature, Humidity, Pressure (2x)	BOSCH, BME280	view
Contactless Temperature	Melexis, MLX90615SSG-DAG-000-TU	view
Accelerometer	Freescale, MMA8653FCR1	view
Magnetometer	Freescale, MAG3110FCR1	view
Hall Effect Sensor	TT Electronics, OHS3150U	view
PAR light sensor	AMS-TAOS USA, TCS34715FN + 700nm low pass filter	view

Filters

The MultispeQ v2.0 has two filters, a Band Pass filter covering the visible light detector (#3) and a Low Pass filter used in the PAR sensor.

Filter	Model	Specifications
Band Pass	Schott, BG-18 1mm thickness	view
Low Pass	UQC Optics, Hot Mirror HM-07	view

Indicator Lights

The MultispeQ v2.0 has now two indicator lights. One to indicate if the device is charging which is located next to the micro-USB port. The second one is located on top to indicate progress or required actions.

LED	Model	Specifications
Charging Indicator		---
Progress/Action Indicator	NeoPixel (RGB), SK6812	view

Battery

The MultispeQ v2.0 has a Li-ion battery which can be charged through the micro USB port.

Battery	Model	Specifications
Main	Soshine Li-ion 26650 Protected Battery: 5500mAh 3.7V	view

References

Kuhlgert, S., Austic, G., Zegarac, R. Osei-Bonsu, I.,Hoh, D., Chilvers, M. I., et al. (2016). **MultispeQ Beta: a tool for large-scale plant phenotyping connected to the open PhotosynQ network.** *R. Soc. Open Sci.* 3, 160592. doi:10.1098/rsos.160592.