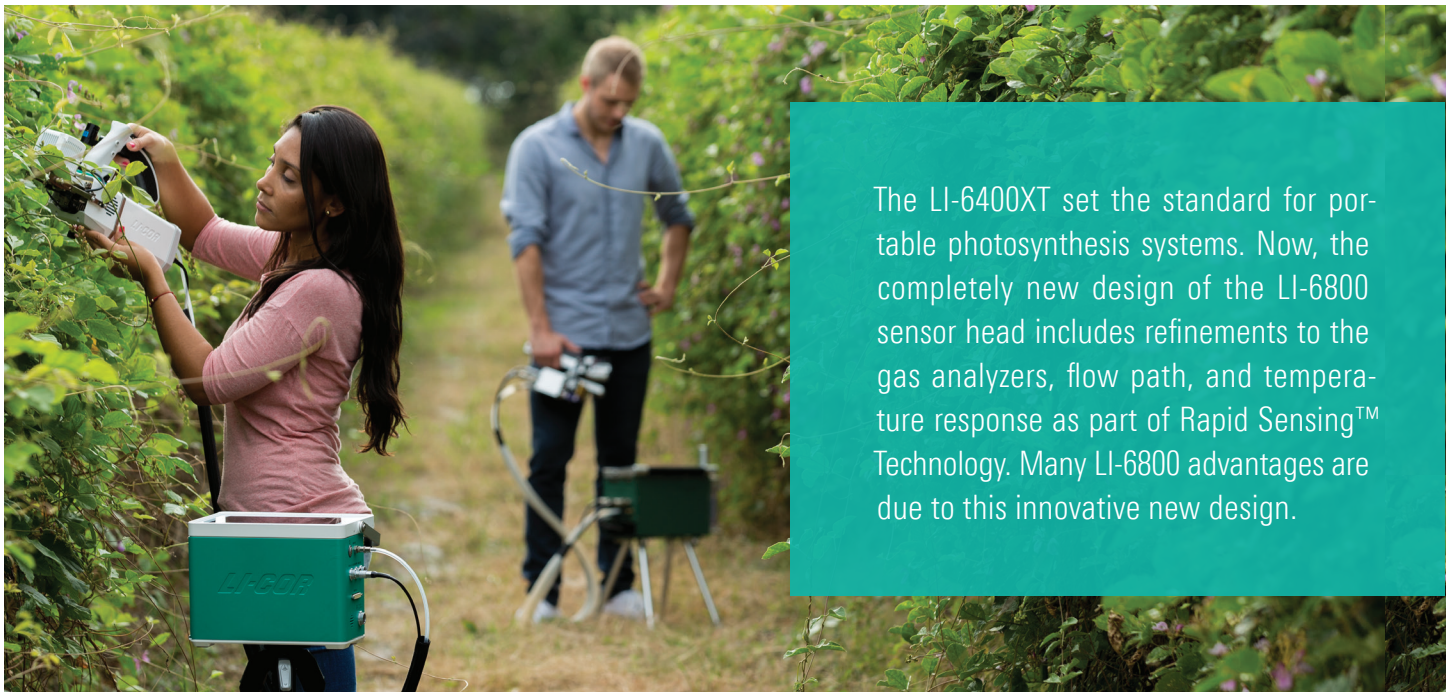
A Comparison of the LI-6400XT and the LI-6800 Portable Photosynthesis Systems



The LI-6400XT set the standard for portable photosynthesis systems. Now, the completely new design of the LI-6800 sensor head includes refinements to the gas analyzers, flow path, and temperature response as part of Rapid Sensing™ Technology. Many LI-6800 advantages are due to this innovative new design.

Performance/Features	LI-6400XT	LI-6800	LI-6800 Advantage
Precision			
▶ Analyzer precision CO_2	Within 0.2 µmol mol^{-1} RMS with 4-second averaging at 400 µmol mol^{-1}	Within 0.1 µmol mol^{-1} RMS with 4-second averaging at 400 µmol mol^{-1}	More repeatable A_{flux} results.
▶ Analyzer precision H_2O	Within 0.017 mmol mol^{-1} RMS with 4-second averaging at 10 mmol mol^{-1}	Within 0.010 mmol mol^{-1} RMS with 4-second averaging at 10 mmol mol^{-1}	More repeatable E_{flux} results.
H_2O Control			
▶ Software automated H_2O control	Yes, but requires manual intervention (knob) and is dependent on flow rate.	Yes—fully automated under software control.	New design facilitates fast, accurate, and precise control at the desired setpoint. More repeatable H_2O flux, conductance, and C_i data.
H_2O control independent of flow control	No	Yes	New chemical column design makes it easier to service the chemicals.
▶ Automatically remove or add H_2O	No	Yes	Allows for humidification of incoming air stream to preserve stomatal aperture during measurements.

▶ Key differentiating features of the LI-6800

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Performance/Features	LI-6400XT	LI-6800	LI-6800 Advantage
CO_2 Control			
CO_2 cartridges	12g	8g	Readily available worldwide and less likely to be contaminated by oil. No filtering required.
Lowest CO_2 control point (other than zero) without system modification	About 50 ppm	About 1 ppm Lowest CO_2 control point dependent upon no buffering of CO_2 in humidification or desiccant source.	More precision and broader range of operation results in more accurate determination of CO_2 compensation point.
Flow, Leaks, and Matching			
▶ Flow	Split in console	Split in sensor head	Reduces potential for differential diffusion and sorption rates that can result in systematic biases.
Maximum flow	750 µmol s^{-1}	1400 µmol s^{-1}	More latitude in larger chamber designs.
▶ Chamber overpressure	Manual	Automatic/measured/ user controlled	Creates small outward flow from chamber to counteract inward diffusion leaks.
Matching	Air goes from leaf chamber to reference analyzer	Reference air goes directly to both analyzers	Faster and more accurate matching.
Temperatures			
Operating temperature range	0 – 50 °C	0 – 50 °C	Wide operating range for both instruments.
Leaf temperature control range	± 6 °C from ambient	± 10 °C from ambient	Expanded range of temperature control adds experimental flexibility to the instrument.
Leaf temperature sensor	Type E fine wire thermocouple	Type E fine wire thermocouple (more robust design with capability to do 2X measurements)	Maintains low thermal mass of fine wire while improving reliability of sensor.
T_{leaf} derived from energy budget	Available	Available	Non-contact determination of T_{leaf} from energy budget calculation due to accurate, more uniform characterization of light on leaf, and more precision on H_2O measurement.
Software			
▶ Console display	No touch screen or color display	Large color touch screen	Interactive and easy to view.
Sensor head display	None	Three lines of variables	Ability to view data when console display is not in view.

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Performance/Features	LI-6400XT	LI-6800	LI-6800 Advantage
Software, continued			
▶ Graphical display of environmental control setup	None	Many	Intuitive and easier to learn.
System alerts	A few	Many	Warnings and alerts help guide user to optimal performance and data collection.
System tests	Limited	Automated	Easy to check instrument functionality.
Power			
Ah per battery (when new)	3.4 (3.4 X 2 = 6.8 Ah per charge)	6.8 (6.8 X 2 = 13.6 Ah per charge)	
▶ Battery power density (Ah/kg)	2.1 Ah/kg	15.1 Ah/kg	Provides more power in a smaller battery.
Weight/Ergonomics			
▶ Total system weight, fully configured	12.69 kg	9.98 kg	Easier to carry.
Wheeled carrying case	No	Yes	Roll, rather than carry, instrument case.
Dedicated accessories case	No	Yes	Ergonomic foam inserts for organization of accessories.
Tripod for console	No—sensor head mount only	Yes	Can be used to support either the sensor head or console.
Monopod (available)	No	Yes	Allows for easy adjustment of sensor head height.
Carrying harness	No	Yes	Can be used to support either the sensor head or console.
Fluorometer			
Leaf aperture	2 cm^2	6 cm^2	Larger chamber aperture results in lower perimeter to area ratio and a more even measurement of leaf-level gas exchange.
▶ Saturating flash	7000 µmol m^{-2} s^{-1}	16000 µmol m^{-2} s^{-1}	The LI-6800 is capable of much higher flash intensities, which can be useful in some studies.
Multiphase™ Flash fluorescence capable	Yes	Yes	Multiphase Flash fluorescence protocol estimates maximum light-adapted chlorophyll fluorescence (Fm') without high intensities that potentially damage the photosystems.

▶ Key differentiating features of the LI-6800

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Performance/Features	LI-6400XT	LI-6800	LI-6800 Advantage
Fluorometer, continued			
Induction kinetics	No	Yes	High-frequency modulation provides high-resolution transient measurements for induction kinetics.
Modulation frequency	Choice of four: 0.25, 1, 10, and 20 kHz	Choice of X: 1 Hz to 250 kHz	
DC PSII fluorescence	No	Yes	Continuous measurement of chlorophyll fluorescence.
Leaf Chamber			
Standard leaf chamber aperture size	2 x 3 cm = 6 cm^2	3 x 3 cm = 9 cm^2	Larger standard area results in lower perimeter to area ratio, more representative measurements and better measurements when the leaf flux is small (e.g. respiration and isotopic measurements).
Data and Communications			
Console memory	128 mb operation and 64 mb data storage	512 mb operation and 8 GB flash data storage	Significantly more memory for faster operation and storage of data.
Ethernet	Yes	Yes	
Miscellaneous			
Chamber latching mechanism	Manually adjusted pressure	Constant pressure	More uniform, consistent pressure on leaf.
Improved chemical columns	No	Yes	Easier to fill, seal, and attach to the console. Fewer maintenance issues.
Console maintenance	Many internal replaceable fuses and a filter	Internal resettable fuses and one console filter	Resettable fuses; external access to filter.

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