CIRAS-3

Portable Photosynthesis System

Redefining the Boundaries of Life Science Research

- Photosynthesis
- Chlorophyll Fluorescence
- Soil Respiration
- Canopy Assimilation
- Insect Respiration

PP SYSTEMS

ppsystems.com

CIRAS-3 Redefining "portability." Meeting the demands of

Field Fit. Lab

High-Contrast, Full-Color Transflective LCD
+ Outstanding readability, particularly in bright sunlight
+ User-defined presentation of data (numeric, graphical or custom)
+ Optimized 30° viewing angle

User-Adjustable Handle

System Navigation & User Inputs
+ 27 tactile keys for easy user inputs & navigation

Two Internal Rechargeable Li-ion Battery Packs
+ Up to 12 hours of continuous operation

Field-Rugged Enclosure
+ Lightweight aluminum enclosure
+ Easy access battery compartment
+ Shock-absorbing polyurethane base

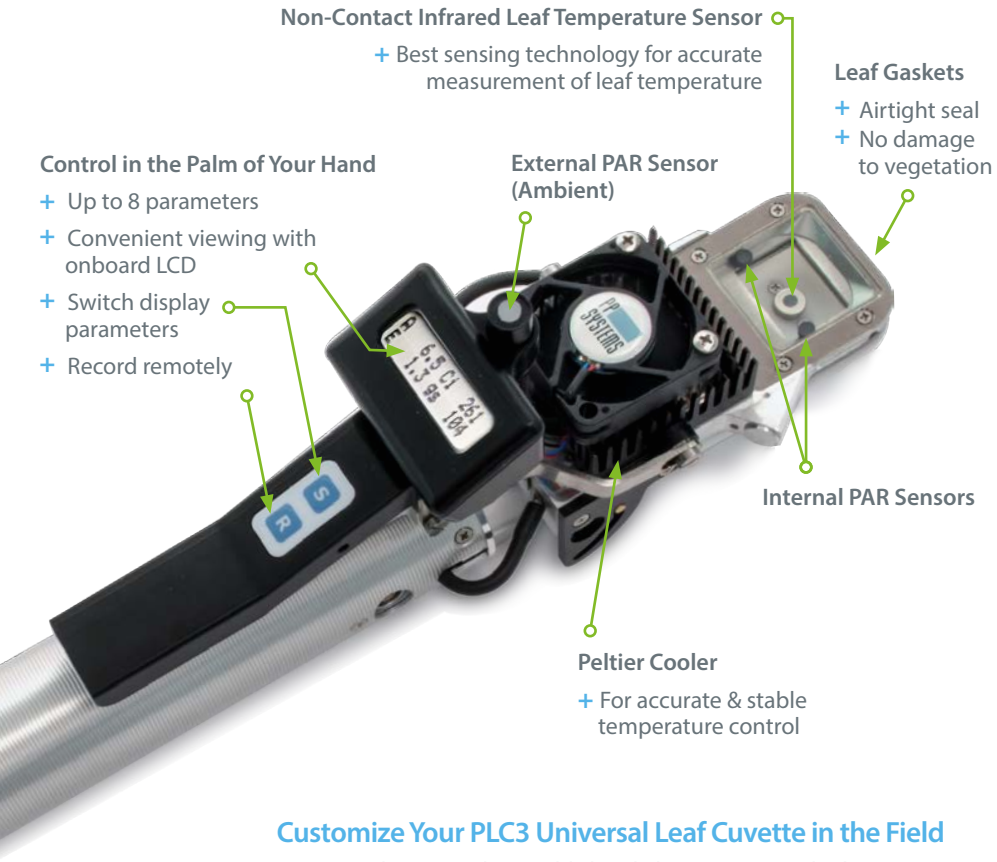
Ambient Temperature Sensor

CIRAS-3 Main Console

Weight: 4.5 kg (including batteries)
Dimensions: 28 cm (W) x 14.5 cm (D) x 24 cm (H)

the serious researcher driving the future of science.

Accurate. Always Reliable.



Customize Your PLC3 Universal Leaf Cuvette in the Field

Three interchangeable head plates come standard, making it the go-to cuvette in most situations.

25 mm x 7 mm | 18 mm Diameter | 25 mm x 18 mm

Works with our CFM-3 Chlorophyll Fluorescence Module, too!

All accessories are field-changeable as well — *virtually plug & play!*

Laboratory Results in a Field-Portable System

+ **Truly mobile!** Lightweight console (4.5 kg) & leaf cuvette (0.75 kg)
+ **True differential gas analyzer** featuring four independent, non-dispersive infrared gas analyzers for both CO_2 & H_2O
+ Small system volume optimized for the **fastest, most accurate measurement of photosynthesis available**
+ **Rapid measurement of A/C_i** with our high-speed CO_2 ramp technology
+ **Fully automatic, independent & programmable control** of CO_2, H_2O, temperature & light
+ **Up to 12 hours of continuous use** with two lightweight, energy-efficient Li-ion battery packs
+ **Collect a full range of data in a single measurement**
+ **Simultaneous measurement of photosynthesis & chlorophyll fluorescence**
+ **Unlimited data storage**
+ **Intuitive user interface**
+ **Powerful, highly customizable software**
+ Versatility at it's best with **lightweight, field-ready plug & play accessories for several applications**

PLC3 Universal Leaf Cuvette

Weight: 0.75 kg

Dimensions: 32 cm (L) x 3.8 cm (Handle Diameter)

Fully Mobile & Fast Response

Eliminating the

Size & Weight Matter

Portability is critical, particularly when field research takes you to remote sites. Having a system that is lightweight with a small footprint results in less site disturbance, greater access to hard-to-reach places and reduced fatigue. At just **4.5 kg** for the CIRAS-3 main console (including both Li-ion battery packs) and **0.75 kg** for the leaf cuvette, field measurements become an entirely new research experience.

Packed with Power

Advanced system electronics coupled with powerful, efficient Li-ion battery packs allow for continuous system operation up to 12 hours. Our batteries have greater power density allowing for longer battery life, eliminating time-consuming and cumbersome battery changes in the field.

Minimal Maintenance Required

No need to concern yourself with routine service or maintenance of any electrical or mechanical components on the CIRAS-3 console – **including the optical bench**. Simply maintain easily accessible desiccants and filters and periodically inspect the leaf cuvette head and gaskets for dust, dirt and any debris from vegetation. Simply put, the CIRAS-3 is remarkably low maintenance!

obstacles while elevating the experience.

Additional Field-Friendly Features

+ **Plug & Play Leaf Cuvettes & Chambers**
  All accessories are elegantly designed to connect directly to the CIRAS-3. *No assembly or disassembly required.*

+ **Two Leaf Cuvettes in One**
  The PLC3 Conifer and Narrow Leaf Cuvettes are convertible by design. Need both styles? Simply change out the top head plate to convert from one style to the other. The PLC3 Narrow/Conifer LED Light Unit is designed to fit both leaf cuvette styles – *an additional value.*

+ **Automatically Control or Create Air Supply Humidity**
  Built into the CO_2/H_2O control air supply, the CIRAS-3's unique **H_2O Vapor Equilibrator** incorporates Nafion® gas tubing to ensure accurate, stable and precise control of H_2O above and below ambient levels.

+ **CFM-3 Chlorophyll Fluorescence Module**
  The CFM-3 can be used as both a fluorometer and as an actinic light source. All light sources and fluorescence detection capability is built into one single, compact module.

+ **Stand-Alone CO_2/H_2O IRGA**
  The CIRAS-3 console can be used independently for accurate, precise and reliable measurement of CO_2 and H_2O. Do you have your own custom chambers that you would like to use? No problem! *Simply connect the gas lines to the CIRAS-3 and begin your measurements.*

+ **Ideal Flow Rates**
  The CIRAS-3 can be programmed to control flow rates up to 500 cc min^{-1} resulting in fast response time, higher differentials and lower signal-to-noise ratio on CO_2 and H_2O, particularly on small vegetation.

"The people working in my lab and I have been extremely satisfied with the CIRAS-3. We have found all of the CIRAS systems (my first was the CIRAS-1) to be easy to use and highly reliable.

In addition, the technical support and service at PP Systems is impeccable."

— Bruce Schaffer, Ph.D.
University of Florida

You're in Control The certainty of automated environ

CO_2 & H_2O Gas Analyzers

The heart & soul of any leaf gas exchange system

The backbone and most critical part of any leaf gas exchange system is the gas analysis system. The CIRAS-3 is a *true differential analyzer* featuring 4 independent, non-dispersive infrared gas analyzers (IRGAs) ensuring the most accurate and reliable measurement and control of CO_2 and H_2O available. For high-level research, this is a critical requirement and a major advantage over gas switching systems. For enhanced reliability, there are no moving parts and the optical bench is temperature controlled and pressure compensated for the most accurate and reliable measurement of CO_2 and H_2O under changing ambient conditions. Each gas analyzer includes an IR source, highly polished gold-plated sample cells, and detectors optimized for CO_2 (4.26 µm) and H_2O (2.60 µm).

Located in the console, the CIRAS-3's optical bench is safely protected and filtered from even the harshest of environmental conditions, virtually eliminating the need for any user maintenance or cleaning. The IRGAs are located close to the internal gas mixing system, providing tight control of gas flow and ultra-fast response to changes in the reference CO_2 and H_2O gas supply.

Our Unique Auto-Zero Technique

No factory recalibration required

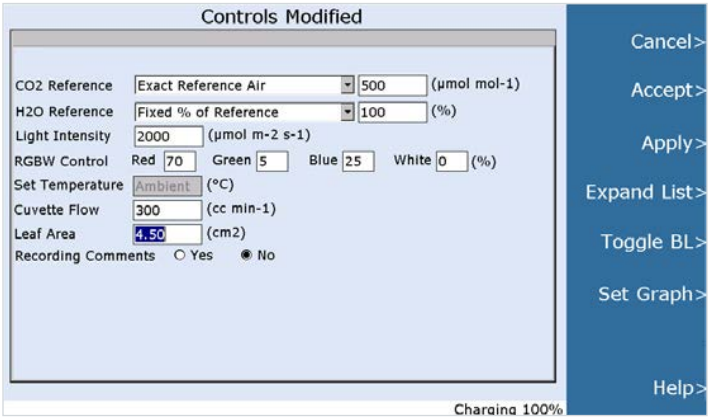
Expect nothing less than the most accurate, reliable and stable calibration of CO_2 and H_2O for many years without the need for inconvenient, time-consuming and costly return-to-factory calibration. Our innovative, proprietary **Auto-Zero** measurement technique ensures an inherent calibration stability that has been confirmed by more than 30 years of experience in gas analysis technology. It allows for very fast warm-up, quick adaptation to changing ambient conditions and excellent long-term stability. Auto-Zero also minimizes effects on span gas sensitivity, IR source aging, as well as changes in detector sensitivity and electronics. Simple, periodic system checks are recommended to confirm system integrity and calibration.

CO_2 Measurement & Control

Automatic and programmable CO_2 control is standard with the CIRAS-3. PP Systems pioneered the method of controlling CO_2 back in 1992 (CIRAS-1) using mini CO_2 cartridges that are commercially available and easily sourced worldwide. Our proprietary gas mixing technology and CO_2 regulator provide accurate, stable and constant flow of CO_2. Each CO_2 cartridge provides at least 12 hours of continuous use in the field and our CO_2 regulator and cartridge holder are maintenance free.

Measurement Range	Control Range
0 – 10000 µmol mol^{-1}	0 – 2000 µmol mol^{-1}

The CIRAS-3 can easily be connected to an external CO_2 source if required. It can also be easily programmed and configured for ambient CO_2 measurements.



Environmental control is fast and easy.

mental controls & the versatility of complete programmability.

H_2O Measurement & Control

PP Systems also pioneered the method of controlling H_2O automatically. Programmable H_2O control is standard with the CIRAS-3. Onboard, self-conditioning desiccants are used for controlling H_2O via user-defined settings. The CIRAS-3 can control H_2O based on a percentage of ambient, VPD (Vapor Pressure Deficit), or to a specific H_2O concentration (mb).

Measurement Range	**Control Range**
0 – 75 mb	0 – Dewpoint

The CIRAS-3 can easily be configured for above and below ambient H_2O measurements.

Temperature Measurement & Control

The CIRAS-3 features the widest range, as well as the fastest and most reliable temperature control in the industry. Each leaf cuvette's integral automatic temperature control is highly accurate and stable. Peltier coolers with heat sink and fan are mounted on all cuvette heads for precise control over a wide range of temperatures. The CIRAS-3 can be programmed to control to a specific leaf temperature, a specific cuvette air temperature or to track leaf to ambient. Temperature control can also be disabled.

Control Limits	**Control Range**
0 – 45 °C	-10 °C below ambient to +15 °C above ambient

Light Measurement & Control

Automatic control of light intensity is achieved with our compact, low-power lightweight LED (RGBW) light units available for each of our PLC3 leaf cuvettes.

Measurement Range	**Control Range**
0 – 3000 µmol m^{-2} s^{-1}	0 – 2500 µmol m^{-2} s^{-1} (PLC3 Universal) 0 – 2000 µmol m^{-2} s^{-1} (PLC3 Conifer & Narrow)

Each light unit features a bank of red, green, blue and white LEDs. In addition to controlling light intensity, you can also control the proportion of light by wavelength, which can be especially useful for research on plant responses to different light types.

Trusted accuracy & reliability provide the freedom to focus on the important work to be done.

Ultra-Fast A/C_i Curves

The game-changing technology & technique that generates the fastest & easiest measurements available.

Our High-Speed CO_2 Ramping Technique

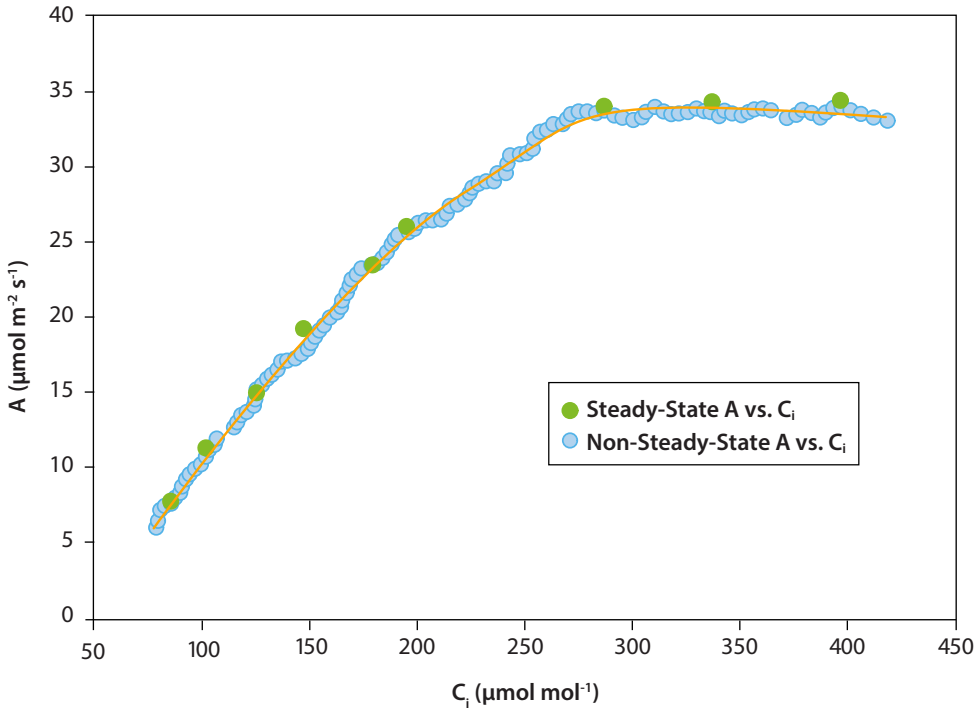
Researchers perform rapid A (Assimilation) vs. C_i (Intercellular CO_2) curves to provide parameters for photosynthetic characteristics of leaves beyond those derived from any single A and C_i measurement including:

- Maximum capacity of the ribulose bis-phosphate carboxylase enzyme (Rubisco-V_{cmax})
- Maximum rate of photosynthetic electron transport (J_{max})
- Maximum rate of triose phosphate utilization (TPU_{cmax})

For years, researchers have optimized survey time without sacrificing accuracy by utilizing our proprietary gas mixing system for performing **Stored Differential Balance (SDB)**. Our unique SDB self-calibration routine lets you accurately measure and store CO_2 and H_2O concentrations over a series of levels, eliminating steady-state response interruptions to balance or match reference and analysis gas analyzers.

This allows you to experience incredibly fast, non-steady-state measurement of A/C_i in a fraction of the time required for steady-state methods thanks to the CIRAS-3's SDB and our innovative high-speed CO_2 ramping technique — *revolutionizing the research experience.*

The process is fully automatic and programmable and post-processing of data could not be any easier — more measurements and data points in a much shorter period of time!



Comparison of a non-steady-state A/C_i curve performed in 7 minutes using our high-speed CO_2 ramping technique to a traditional point-by-point steady-state A/C_i curve performed in 35 minutes for a typical C_3 Bean *(Phaseolus vulgaris)* at 25 °C with PAR of 1800 µmol m^{-2} s^{-1}.

Bunce, J. (2018). Three Methods of Estimating Mesophyll Conductance Agree Regarding its CO_2 Sensitivity in the Rubisco-Limited C_i Range. *Plants, 7*(3), 62. doi:10.3390/plants7030062

Photosynthesis & Chlorophyll Fluorescence

The compact, lightweight & versatile solution for both measurements.

CFM-3 Chlorophyll Fluorescence Module

If your research includes chlorophyll fluorescence, the **CFM-3 Chlorophyll Fluorescence Module** is capable of simultaneously measuring chlorophyll fluorescence and photosynthesis.

MultiPulse™ Technology for Accurate Estimation of F_m'

The CFM-3 is capable of delivering high-saturating pulses up to 10000 µmol m^{-2} s^{-1}. The CIRAS-3 is the only system available that features our innovative MultiPulse™ technology.

MultiPulse™ produces a sequence of user-defined, lower-saturating pulse light levels, avoiding the risk of photodamage to the leaf while accurately estimating apparent F_m'.

Actinic Light Source — *Added Versatility & Value*

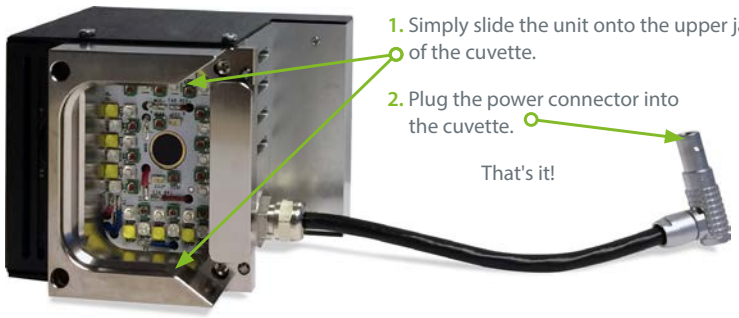
The CFM-3 is elegantly designed with all light sources and fluorescence detection capability built directly into one lightweight, compact unit.

It can act as an actinic light source for leaf gas exchange and as a pulse-amplitude-modulated (PAM) fluorometer for measurement of chlorophyll fluorescence on both dark- and light-adapted vegetation.

Multiple Leaf Head Plates

The compact module is lightweight (**0.3 kg**), truly plug and play, and allows the user to measure chlorophyll fluorescence over the entire leaf area using any of the three leaf head plates that come standard with the PLC3 Universal Leaf Cuvette.

Elegant & Lightweight Design — *Ideal for Field Use*



PLC3 Universal Leaf Cuvette Head Plates

25 mm x 7 mm
1.75 cm^2

18 mm Diameter
2.5 cm^2

25 mm x 18 mm
4.5 cm^2

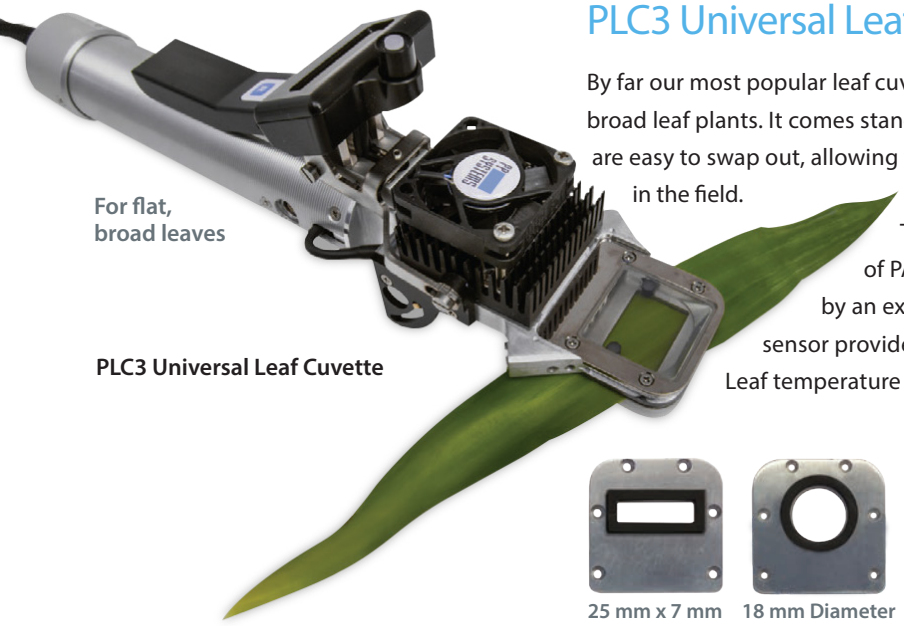
Chlorophyll Fluorescence Parameters

Measured		Calculated	
F	F_v	ΦPSII	qL
F_s	F_v/F_m	J	ΦNO
F_o	F_v'	qP	ΦNPQ-K
F_m	F_m'	qNP	ΦfD
F_o'	F_v'/F_m'	NPQ	ΦNPQ-G

Lightweight & Field-Adaptable Revolutionizing

PLC3 Leaf Cuvettes

Each cuvette is truly plug & play! No need for time-consuming delicate reassembly & adjustment of different heads or sensors. All leaf cuvette materials are carefully selected to minimize influences such as infrared radiation, water sorption, CO_2 effects & leaks.



For flat, broad leaves

PLC3 Universal Leaf Cuvette

PLC3 Universal Leaf Cuvette

By far our most popular leaf cuvette, the **PLC3 Universal Leaf Cuvette** measures most flat, broad leaf plants. It comes standard with three interchangeable window head plates that are easy to swap out, allowing you to accommodate a wide range of different leaf sizes in the field.

Two miniature PAR sensors provide a highly reliable average of PAR inside the cuvette in addition to ambient PAR measured by an external sensor. A technologically advanced Infrared (IR) sensor provides accurate, non-contact measurement of leaf temperature. Leaf temperature can also be determined by energy balance.

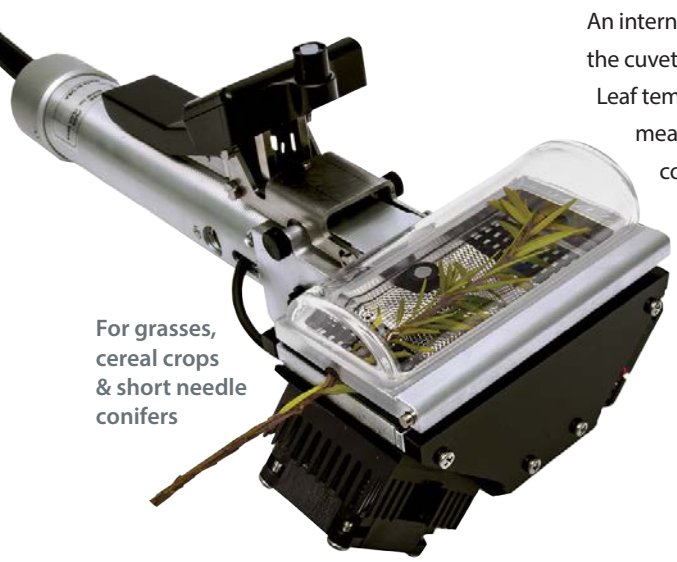
25 mm x 7 mm | 18 mm Diameter | 25 mm x 18 mm

PLC3 Universal Leaf Cuvette Field-Changeable Head Plates

+ Comes standard
+ Easy to swap out in the field
+ Survey multiple types of vegetation

PLC3 Conifer & Narrow Leaf Cuvettes

An internal PAR sensor provides measurement of PAR inside the cuvette in addition to ambient PAR by an external sensor. Leaf temperature is calculated using energy balance or measured directly using a precision thermistor for contact measurement.



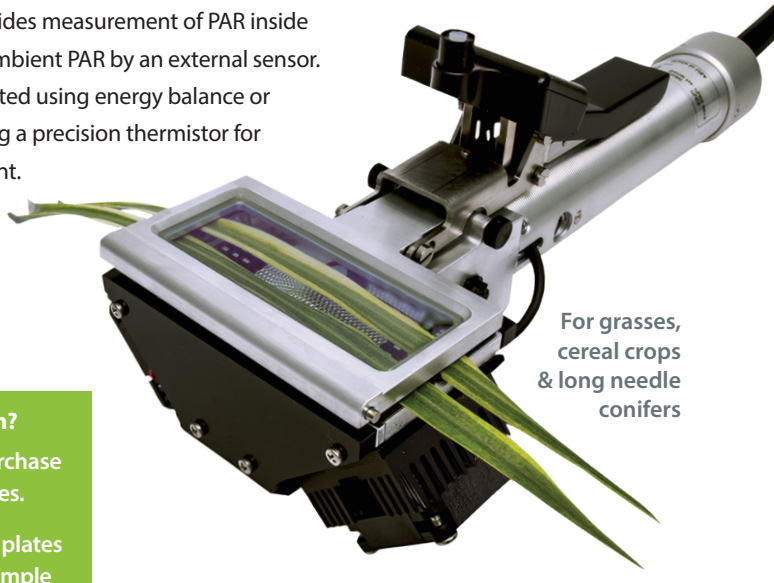
For grasses, cereal crops & short needle conifers

PLC3 Conifer Leaf Cuvette

Need both?

No need to purchase two cuvettes.

Optional head plates provide the simple conversion between "narrow" and "conifer".



For grasses, cereal crops & long needle conifers

PLC3 Narrow Leaf Cuvette

the research experience.

LED Light Units

Automatically control both light intensity & proportion of light by wavelength

Optional light units are available for automatic control of light for all PLC3 leaf cuvettes. Each light unit features a bank of red, green, blue and white LEDs (RGBW), allowing for automatic control of both light intensity and proportion of light by wavelength. All light units are designed to ensure uniform light distribution over the entire leaf area for accurate results.

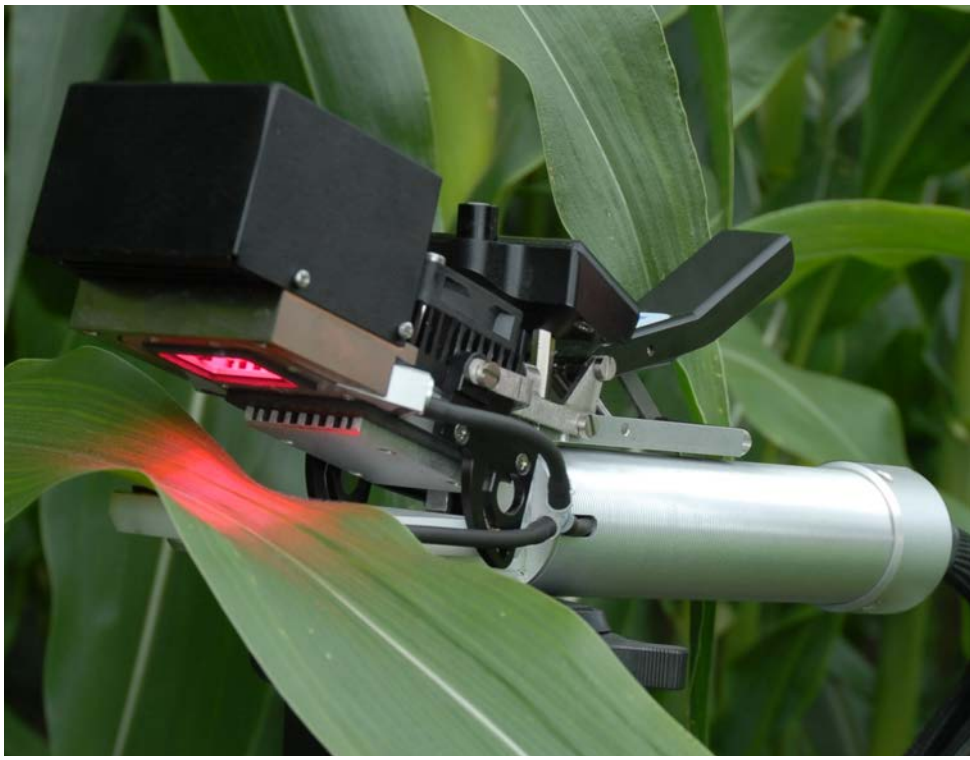
Effortlessly connect our light units to the corresponding leaf cuvette head for use on cloudy days or for controlled light experiments, or remove for ambient measurements.

Wavelength (RGBW)

Color	*Peak*	*Full Width at Half Max*
Red	625 nm ± 5 nm	15 nm
Green	528 nm ± 8 nm	40 nm
Blue	475 nm ±10 nm	28 nm
White	425 – 700 nm	

Light Control Ranges

Universal	0 – 2500 µmol m^{-2} s^{-1}
Narrow/Conifer	0 – 2000 µmol m^{-2} s^{-1}



PLC3 Universal Leaf Cuvette with PLC3 Universal LED Light Unit

PLC3 Conifer & Narrow LED Light Unit

A single light unit for both — an added savings in cost, space & weight in the field

This PLC3 LED Light Unit is uniquely designed as an interchangeable RGBW light source for both the PLC3 Conifer and Narrow Leaf Cuvettes.

PLC3 Conifer & Narrow LED Light Unit

Powerful, Customizable & Intuitive Software

Outstanding Readability Under All Lighting Conditions, Particularly High Sunlight

The CIRAS-3 features a large, full-color 7.0" transflective display offering unsurpassed readability even under high sunlight conditions. The brighter the sun, the higher the contrast! The console is ergonomically designed to offer a 30° viewing angle to comfortably view the display from just about any position in the field. A 27-key tactile keypad is available for all user inputs and system navigation.

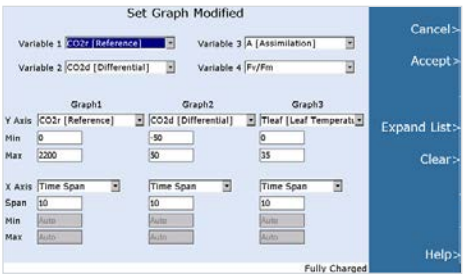
Your First Measurements in Minutes

Begin collecting data shortly after your system arrives. Built-in system help and user tutorials are designed to guide even the most inexperienced user every step of the way.

Details with Your Data

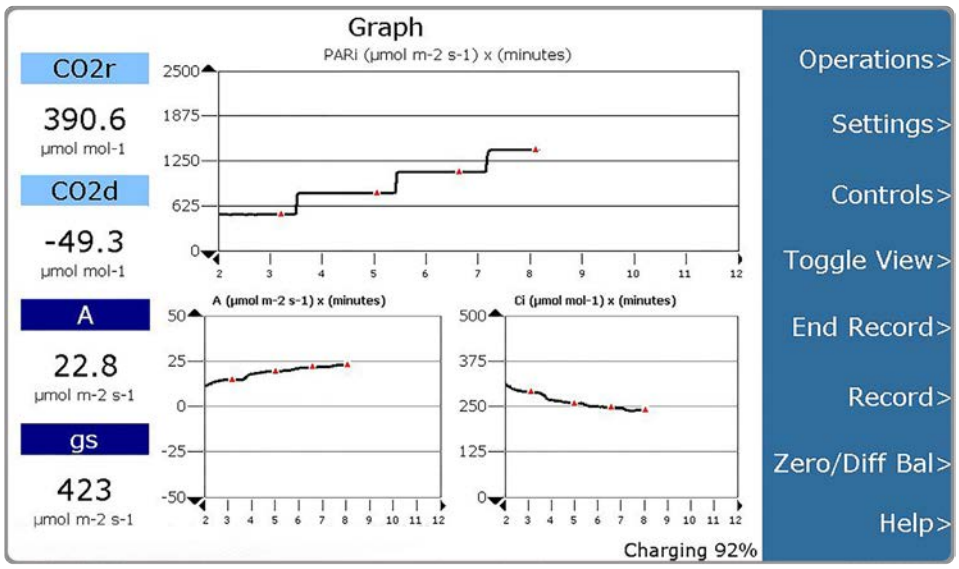
Easily include that detailed, alphanumeric information needed for analysis and post-processing your stored data using the CIRAS-3's virtual keyboard.

RecType	ExcelTime	Comment	CO2r	CO2
R	5/23/18 1:19 PM	Drought Exp 1A	395.1	3
R	5/23/18 1:23 PM	Drought Exp 1A	395.1	3
R	5/23/18 1:29 PM	Drought Exp 2B	395.1	3
R	5/23/18 1:33 PM	Drought Exp 2B	395.1	3
R	5/23/18 1:36 PM	Drought Exp 2B	395.1	3



Data Presentation

Customize the information that you would like to be presented on the LCD under your system preferences. Many displays, as well as presentation of data, are user-definable including numeric display of information, numeric and graphical presentation of data or customized data for your specific parameters.



"The CIRAS-3 is accurate, reliable, easy to use and extremely robust in greenhouse as well as field conditions. We look forward to continuing to work together to discover new innovations in agriculture."

— Dr. Jeremy Pattison
Driscoll's Research & Development

with a user interface that's quick to learn & easy to use.

Data Collection & Transfer

Measurements can be performed manually or automatically based on user-defined time intervals or programmable response curves.

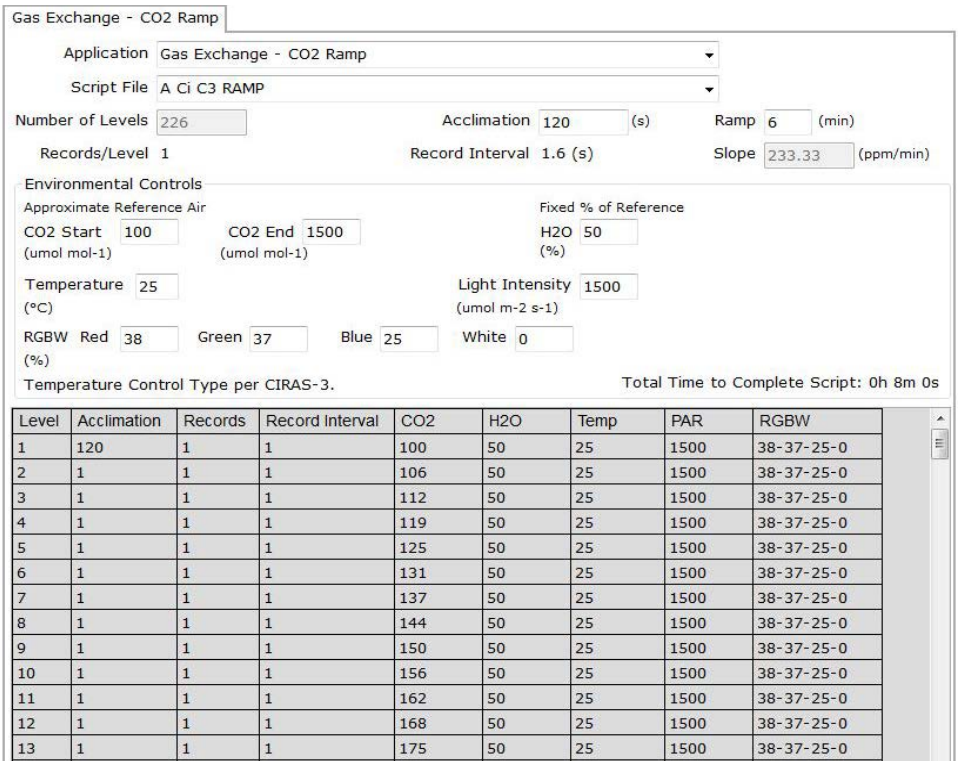
Response scripts can be programmed directly on the CIRAS-3 console or by using our PC Utility.

Data storage is flexible & virtually unlimited. Data can be stored to internal memory or directly to a USB flash drive and is easily transferred to your PC for further analysis in your spreadsheet program of choice.

PC Utility

Response Scripts Editor

Programming experiments from a PC is effortless with PP Systems' **PC Utility**. Easily create, edit and modify your own response curve scripts. Once created, simply upload to the CIRAS-3 console for execution or share with colleagues that may want to replicate your experiment.



Level	Acclimation	Records	Record Interval	CO2	H2O	Temp	PAR	RGBW
1	120	1	1	100	50	25	1500	38-37-25-0
2	1	1	1	106	50	25	1500	38-37-25-0
3	1	1	1	112	50	25	1500	38-37-25-0
4	1	1	1	119	50	25	1500	38-37-25-0
5	1	1	1	125	50	25	1500	38-37-25-0
6	1	1	1	131	50	25	1500	38-37-25-0
7	1	1	1	137	50	25	1500	38-37-25-0
8	1	1	1	144	50	25	1500	38-37-25-0
9	1	1	1	150	50	25	1500	38-37-25-0
10	1	1	1	156	50	25	1500	38-37-25-0
11	1	1	1	162	50	25	1500	38-37-25-0
12	1	1	1	168	50	25	1500	38-37-25-0
13	1	1	1	175	50	25	1500	38-37-25-0

Remote Operation & Display

Presenting information or utilizing the CIRAS-3 as a teaching tool? Operating the CIRAS-3 remotely on a PC is a popular feature for those particular applications, and more.

Parameters

Measured

- CO_2 Reference
- CO_2 Analysis
- CO_2 Differential
- H_2O Reference
- H_2O Analysis
- H_2O Differential
- Air Temperature
- Cuvette Temperature
- Leaf Temperature
- PAR Internal
- PAR External
- Relative Humidity
- Flow And Leaf Area

Calculated

- Assimilation (A)
- Intercellular CO_2 (C_i)
- Stomatal Conductance (gs)
- Evaporation/Transpiration (E)
- Vapor Pressure Deficit (VPD)
- Water Use Efficiency (WUE)

Valuable Versatility

A single instrument capable of multiple applications.

Expand your measurement capabilities with field-ready plug & play accessories. All CIRAS-3 accessories are lightweight & designed to connect directly to the console, further enhancing the process of discovery.

Soil CO_2 Efflux

The popular **SRC-2 Soil Respiration Chamber** is the industry standard for rapid, accurate survey measurement of soil CO_2 efflux. The lightweight chamber is constructed of rugged PVC with a convenient handle for placement on the soil surface. A stainless steel ring provides a good seal on the soil surface or on collars.* A built-in temperature sensor measures air temperature near the soil surface.

Dimensions	150 mm (H) x 100 mm (D)
Volume	1171 ml
Area	78 cm^2
Cable Length	1.5 meters
Weight	0.9 kg

Temperature Sensor (Precision Thermistor)	
Range	-5 to 50 °C
Accuracy	± 0.5 °C at 25°C

** Optional collars are available for the CPY-5 Canopy Assimilation Chamber & the SRC-2 Soil Respiration Chamber from PP Systems.*

Net Canopy CO_2 Flux

The **CPY-5 Canopy Assimilation Chamber** is ideal for measurement of net canopy CO_2 flux on low-lying vegetation and fruit. Constructed of rugged polycarbonate, the interior of the transparent chamber includes a user-adjustable PAR (Photosynthetically Active Radiation) sensor and an air temperature sensor near the soil surface. An aluminum ring provides a good seal on the soil surface or on collars.*

Dimensions	145 mm (H) x 146 mm (D)
Area	167 cm^2
Cable Length	1.5 meters
Weight	1.05 kg

Temperature Sensor (Precision Thermistor)	
Range	-5 to 50 °C
Accuracy	± 0.5 °C at 25°C
PAR Sensor	Fully cosine corrected
Range	0-3000 µmol m^{-2} s^{-1}
Accuracy	± 5 µmol m^{-2} s^{-1}
Precision	1 µmol m^{-2} s^{-1}

Insect Respiration

Our **Insect Respiration Chamber** can be used to measure CO_2 respiration from small insects.

Chamber Dimensions	15.1 cm (L) x 25 cm (D)
Chamber Volume	33 cm^3 (not including gas tubing)
Chamber Weight	65 g

Custom Chambers? No Problem.

The CIRAS-3 console can be used as a stand-alone CO_2 and H_2O differential gas analyzer. Custom chambers are easily integrated in the laboratory or field.

Training & Technical Support

With you in the field & for the life of your system.

We want you to have the best possible experience & fully utilize your instrument's capabilities from day one.

Hands-On Training

Our goal with any of our instruments is that you not only understand basic operating procedures, but that you use the instrument to its fullest capacity.

We will get you up to speed quickly as well as provide valuable tips and tricks to further enhance your user experience.

Our instructor-to-student ratio is intentionally kept low to guarantee personalized attention. True hands-on training ensures the maximum benefit of attending the course.

"The training provided by PP Systems was exceptional. The training covered aspects ranging from basic setup to advanced techniques of chlorophyll fluorescence. The step-by-step instruction made disseminating the knowledge gained with my other lab members quite easy."

— Lauren Pile
Clemson University

Technical Support

Prompt service and support is paramount and we are highly responsive to all requests.

Direct technical support is available from our U.S. headquarters as well as through our extensive network of certified factory-trained distributors.

"Whenever we had issues or concerns, the team at PP Systems has been very responsive and helpful troubleshooting and providing solutions."

— Dr. Alan N. Lakso
Cornell University

Pioneering the Field Research Experience

The exception has become the rule

Innovation has always been synonymous with CIRAS Portable Photosynthesis Systems. Our introduction of automatic and programmable CO_2 and H_2O control as well as the use of 8g CO_2 cartridges — features that have been standard on all CIRAS systems dating back to 1992 — have since become the industry standard and we wouldn't have it any other way.

Our constant innovation is centered around designing scientific instruments that eliminate obstacles and elevate the research experience.

The CIRAS-3 Experience

With the CIRAS-3, you collect highly accurate data at a rapid pace with the most advanced and mobile instrument of its kind. That makes for an exciting research experience that ignites the desire to explore further and we're with you every step of the way.

Trusted & Tested Technology

Since 1984

PP Systems has proudly designed and manufactured instrumentation to meet the technology needs of plant and soil scientists since 1984.

Our extensive experience working closely with scientists to provide the best possible research tools, along with our drive to constantly enhance the research and educational experience has afforded us the honor of being one of the most highly referenced global standards in more than 100 countries worldwide.

Technical Specifications

CIRAS-3 Portable CO_2/H_2O Gas Analysis System

Analysis Method

Non-dispersive infrared, configured as an absolute absorptiometer with microprocessor control of linearization. Four independent gas analyzers simultaneously measure absolute CO_2 and H_2O for both the reference and analysis gas streams. All measurements corrected for temperature and pressure.

CO_2 Measurement Range	0 – 10000 µmol mol^{-1} (Optimized for 0-2000 µmol mol^{-1})
CO_2 Precision	0.1 µmol mol^{-1} at 400 µmol mol^{-1}
CO_2 Control Range	0 – 2000 µmol mol^{-1}
H_2O Measurement Range	0 – 75 mb
H_2O Precision	0.01 mb at 10 mb
H_2O Control Range	0-Dewpoint or 0-100% Ambient
Pressure Range	55 – 115 kPa
Air Sampling	User-adjustable from 50 – 100 cc min^{-1} using integral DC pumps. Both analysis and reference pumps fitted with mass flow controllers.
Cuvette Air Supply Unit (Integral)	0 – 500 cc min^{-1} measured and controlled by a mass flow meter.
Auxiliary Port	For connection to the SRC-2 Soil Respiration Chamber and CPY-5 Canopy Assimilation Chamber.
Digital Output	• USB-Mini b (Host) • 2 x USB for use with external devices (USB Flash Drive, USB Mouse, etc.).
Data Storage	512 MB flash memory for programming and data storage. Unlimited data storage using USB Flash Drive (Thumb Drive).
Microprocessor	800 MHz
Display	7.0" WSVGA transflective, color LCD
User Input	• 27 tactile keys • Virtual alphanumeric keypad
Power Supply	Two internal, rechargeable 7.2 V Li-ion battery packs providing up to 12 hours continuous use.
Operating Temperature Range	0 – 50 °C, non-condensing. External air filtration may be required in dusty environments.
Enclosure	Rugged, ergonomic, lightweight aluminum with polyurethane base.
Dimensions	28 cm (W) x 14.5 cm (D) x 24 cm (H)
Weight	4.3 kg (including 1 battery pack) 4.5 kg (including 2 battery packs)

PLC3 Leaf Cuvettes

Construction	• Handle: Aluminum • Leaf Gasket: Closed cell foam • Impeller: Aluminum fan blade
LCD Display	2 x 16 character parameter display
Keypad	2 tactile keys for recording and LCD selection
Dimensions (Handle)	32 cm (L) x 3.8 cm (Diameter)
Leaf Temperature Sensor Accuracy	± 0.5 °C at 25 °C
PAR Sensor (External)	Fully cosine corrected • Response: 400 – 700 nm • Range: 0 – 3000 µmol m^{-2} s^{-1} • Accuracy: ± 5 µmol m^{-2} s^{-1} • Precision: 1 µmol m^{-2} s^{-1}
Air Temperature Sensor	Precision Thermistor • Range: -5 °C to 50 °C • Accuracy: ± 0.5 °C at 25 °C
Temperature Control	-10 °C below ambient to +15 °C above ambient • Control limits: 0 – 45 °C

	Universal	Narrow	Conifer
Window	Glass Calflex™ IR Filter • 7 mm x 25 mm (1.75 cm^2) • 18 mm diameter (2.5 cm^2) • 18 x 25 mm (4.5 cm^2)	Glass Calflex™ IR Filter • 83 mm x 30 mm	Scratch resistant glass • 83 mm x 40 mm
PAR Sensor (Internal)	2 miniature PAR sensors	1 PAR sensor	1 PAR sensor
Leaf Temperature Sensor Type	IR sensor for non-contact measurement	Precision thermistor	Precision thermistor
Weight	0.75 kg	1.0 kg	1.0 kg

PLC3 LED Light Units (RGBW)

LED Specification — **Wavelength (RGBW)**

Color	*Peak*	*Full Width at Half Maximum*
Red	625 nm (± 5 nm)	15 nm
Green	528 nm (± 8 nm)	40 nm
Blue	475 nm (± 10 nm)	28 nm
White	425 – 700 nm	

	Universal	Narrow & Conifer
Automatic Control Range	0 – 2500 µmol m^{-2} s^{-1}	0 – 2000 µmol m^{-2} s^{-1}
Dimensions	6.4 cm (L) x 6 cm (W) x 5.1 (H)	6.5 cm (L) x 10.6 cm (W) x 6 (H)
Weight	0.2 kg	0.3 kg

SRC-2 Soil Respiration Chamber

Dimensions	150 mm (H) x 100 mm (Diameter)
Volume	1171 ml
Area	78 cm^2
Cable Length	1.5 meters
Weight	0.9 kg
Temperature Sensor	Precision Thermistor • Range: -5 to 50 °C • Accuracy: ± 0.5 °C at 25 °C

CPY-5 Canopy Assimilation Chamber

Dimensions	145 mm (H) x 146 mm (Diameter)
Area	167 cm^2
Cable Length	1.5 meters
Weight	1.1 kg
Temperature Sensor	Precision Thermistor • Range: -5 to 50 °C • Accuracy: ± 0.5 °C at 25 °C
PAR Sensor	Fully cosine corrected • Range: 0 – 3000 µmol m^{-2} s^{-1} • Accuracy: ± 5 µmol m^{-2} s^{-1} • Precision: 1 µmol m^{-2} s^{-1}

Insect Respiration Chamber

Chamber Dimensions	15.1 cm (L) x 25 mm (Diameter)
Chamber Volume	33 cm^3 (Not including gas tubing)
Chamber Weight	65 g

CFM-3 Chlorophyll Fluorescence Module

Modulating Beam	625 nm ± 5 nm (Red)
Saturation Light	0 – 10000 µmol m^{-2} s^{-1}
Far Red Light	2 x 750 nm LEDs
Detector	PIN Photodiode with >700 nm filter
Detector Method	Rapid pulse peak tracking
Leaf Area	1.75 cm^2, 2.5 cm^2 and 4.5 cm^2
Dimensions	8 cm (L) x 6 cm (W) x 6.2 cm (H)
Weight	0.3 kg

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