



Applications

- Photovoltaic Solar Cell Testing
- IV Characterization
- Spectral Response
- External Quantum Efficiency-IPCE
- Internal Quantum Efficiency (IQE add-on)
- Photoconductivity Measurement
- Reflectance and Transmittance Measurements Capability

Features

- Spectral Range: 250-2500 nm or 300-5000 nm
- Multiple Source Measure Unit Options
- Lock-in Amplifier
- Light-Tight Sample Chamber, Standard or Extended
- User-Selectable Bias Voltage
- AC and DC Measurement Modes
- SciPV Software
- Manually-Controlled Shutter
- Motorized XY stage, Optional

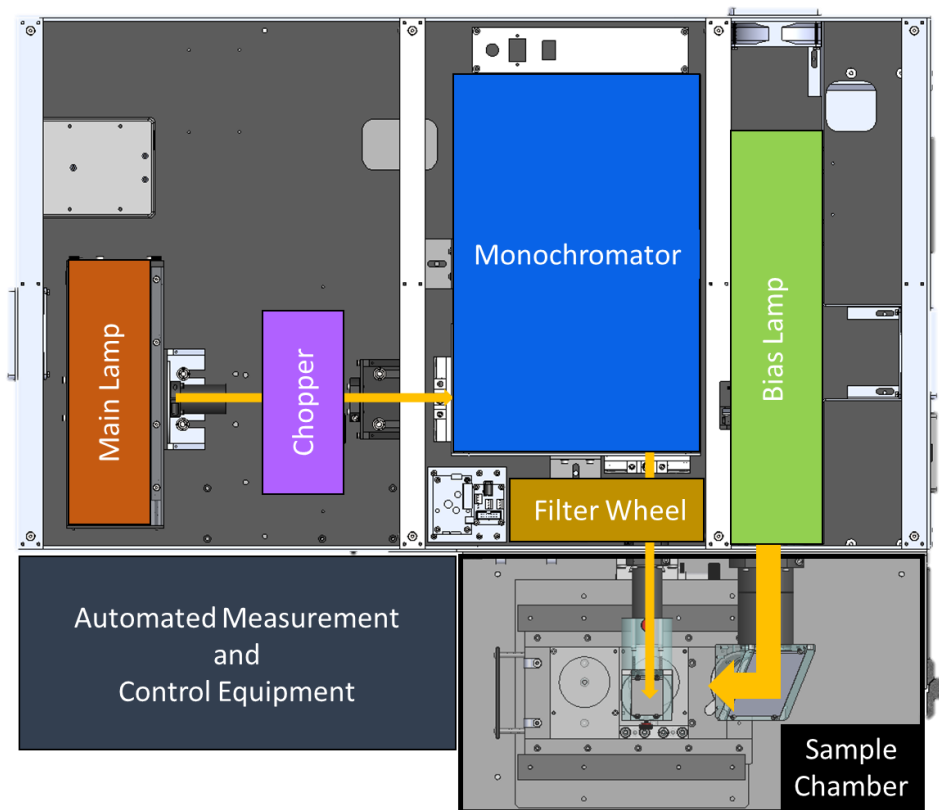
**Quantum Efficiency | IPCE
Measurement System**
Configure your solution with the PTS



QE Measurement Systems

OVERVIEW

The Sciencetech Photovoltaic Testing System (PTS) conducts SR, EQE, IQE and IV measurements with user-friendly software. The system includes a main xenon arc lamp, a monochromator with automated order sorting filters, along with the option for a Class AAA steady-state solar simulator bias light source, measurement electronics, computer, and software required to measure solar cell characteristics. The shielded and light-tight sample chamber has a convenient hinged cover allowing access from the top, front and sides.



Measurement Capabilities		PTS –S (175-9201)	PTS –X (175-9202)
Current-Voltage (IV) Testing	Measures V_{OC} , I_{SC} , J_{SC} , R_{shunt} , P_{max} , efficiency %, and fill factor	Included	
Spectral Response (SR)*	Scanning range	250 - 2500 nm	300-5000 nm
External Quantum Efficiency (EQE)	Incident photon to converted electron ratio (IPCE)	Included	
AC and DC measurement mode	Modulated / Continuous measurement capability	Included	
Internal Quantum Efficiency (IQE)	The ratio of charge carriers collected by the cell to the number of photons absorbed by the cell	Available as an add-on	

* Our system validation measurements are performed on Silicon from 300-1100 nm

QE Measurement Systems

SPECIFICATIONS

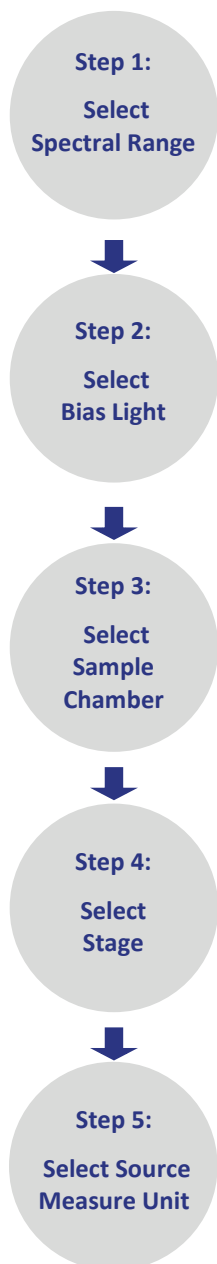
Configuration Description		PTS-S (175-9201)	PTS-X (175-9202)
Tunable Light Source	150 W Xenon short arc lamp (1200 hour lifetime) and /or 250 W QTH lamp (average 50 hour lifetime)	Xe short arc lamp	Xe+QTH lamp
	Tuning/scanning range	250-2500 nm	300-5000 nm
	1/4 m Czerny-Turner monochromator with an adjustable bandpass and motorized triple grating turret system (3 gratings):	0.2-24 nm with 1200 l/mm blazed @ 250 nm	0.4-48 nm with 600 l/mm blazed @ 500 nm
		0.2-24 nm with 1200 l/mm blazed @ 500 nm	0.8-96 nm with 300 l/mm blazed @ 2000 nm
		0.4-48 nm with 600 l/mm blazed @1000 nm	1.6-192 nm with 150 l/mm blazed @ 5400 nm
	Adjustable beam size	0.5-2.4 mm diameter at focal plane with standard optics	
Hard coated order sorting filters		Included	
Bias Light Source	150 W or 300 W Xenon short arc lamp, average lifetime 1200 hours for 150 W, 900 hours for 300 W.	Optional: 150 W with Standard Sample Chamber OR 300 W with Extended Sample Chamber	
	25 × 25 or 50 × 50 mm AAA, (ASTM E927-19) Solar Simulator		
	Includes mounted AM1.5G filter + additional filter slot		
Reference Detector	Broadband pyroelectric detector, Element diameter: 5 mm	Included	
	Calibrated range	250-2500 nm	300-5000 nm
IQE Measurement System	50 mm integrating sphere	Optional, available as an add-on	
	Internal quantum efficiency measurement determined from material reflectance measurement (hardware included) 250-2500 nm range.		
Measurement System	Source meter	Optional	
	Lock-in Amplifier	Included	
	Chopper 4 - 200 Hz	Included	
	Standard auto time constant feature	Included	
	Temperature control (10-60 °C)	Accessory Available ¹	
	AC and DC measurement mode	Included	
Sample Placement	Sample spacer for proper placement of the sample under the monochromatic and bias light beam	A simple 50 × 50 mm sample spacer is included, and various cell chucks are available as add-ons. Includes electrical connections	
Software and Interface	Modern software written in .NET (Windows 11 Operating System)	SciPV Included	
	Data files and automation log exportable as ASCII	Yes	
	Pre-configured and tested control computer included	Yes	
	Built-in microcontroller switches and monitors signals automatically	Included	
	1 USB port	USB-B Interface	
	1 IEC 60320 C14 power entry inlet	Yes	
Compliance	Intended for use in measurements according to ASTM E 1021-15 , ASTM E948, IEC 60904-8, IEC 60904-1	Yes	
Power system	Single phase, configurable for 240 VAC, 50 Hz or 120 VAC, 60 Hz	Yes	

¹ For example, the SCC-3-TE-PTS cell chuck. See accessories page.

QE Measurement Systems CONFIGURATION

Sciencetech offers a selection of Quantum Efficiency (QE) systems designed for various research applications. This brochure highlights Sciencetech's QE systems and guides you through the configuration process. Begin by choosing either the standard or extended wavelength range based on your desired spectral range. Next, select the appropriate source meter and bias light options, add the compatible sample chamber, which includes features such as a cell chuck and movable stage. Finally, explore additional enhancements on the add-ons page to complete your system setup.

Configuration Process in 5 steps



Select PTS Model	Description	Model
Standard Spectral Range (-S)	Single xenon arc lamp with a 250 to 2500 nm spectral range.	PTS-S
Extended Spectral Range (-X)	Xenon arc and QTH lamp with a 300 to 5000 nm spectral range.	PTS-X

Bias Light	Description	Model
No Bias Light	Select this if you plan to use your own bias light.	-NB
Bias Light, Class AAA solar simulator with AM 1.5G Filter + additional filter slot.	1 Sun Illumination, Class AAA (bias illumination area is 25 × 25 mm if the Standard Sample chamber is selected and 50 × 50 mm if the Extended Sample Chamber is selected).	-A1

Sample Chamber	Description	Model
Standard Sample Chamber	This option accommodates up to a 75 mm (3") cell chuck (optional accessory) and a 25 × 25 mm bias light illumination area (if Bias Light option selected). Motorized XY stage not compatible.	- ST
Extended Sample Chamber	This option accommodates up to a 150 mm (6") cell chuck (optional accessory), a 50 × 50 mm bias light illumination area (if Bias Light option is selected), and/or a motorized XY stage (if motorized XY stage option is selected).	- EX

XY Stage	Description	Model
No XY Stage	Choose this option if your measurements are typically in a fixed area, without requiring movement across the sample surface. Manual height adjustment is included on all PTS models.	- NS
XY Stage	Choose this option if you require motorized movement of the sample. The XY stage will allow movement such that every location on a 6" cell can be measured. The XY stage is motorized and controlled through SciPV software ¹ .	- XY

Source Meter Unit	Description	Model
No Source meter	Select this if you plan to use your own SMU or you wish to select a different SMU as an add-on (see next page).	-NSMR
Precise S100	30 V, 1 A	-S100

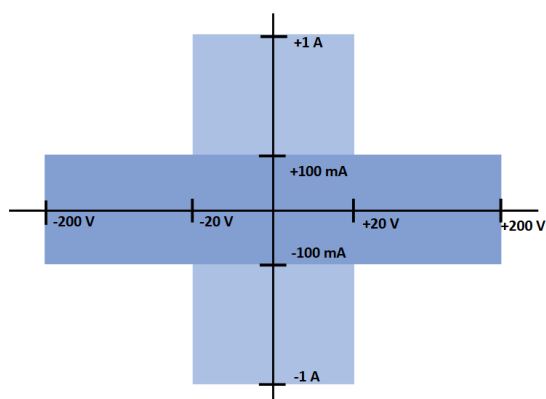
¹ XY stage allows movement in 1 mm steps on both axes, providing high spatial resolution for QE and IV measurements

QE Measurement Systems

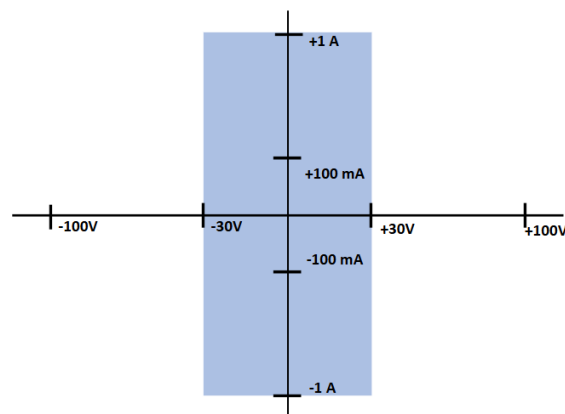
SMU ADD-ON

A source measure unit (SMU) can be selected as an add-on or you can order your PTS without an SMU and incorporate your own. Sciencetech offers three models to choose from. Please enquire if other requirements are needed for your application.

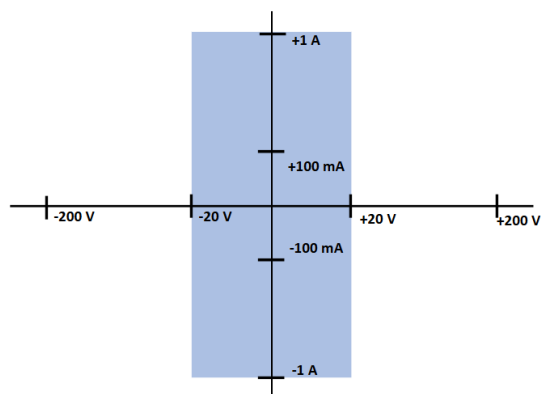
Model	SMU-PTS-2401 175-9401-C01	SMU-PTS-2450 175-9401-C02	SMU-PTS-S100 175-9401-C03
Measured Quantities	V_{OCr} , I_{Scr} , J_{Scr} , V_{max} , I_{max} , P_{max} , FF, R_{series} , R_{shunt} , Efficiency		
Maximum Voltage	20 V	200 V	30 V
Maximum Current	1 A	1 A	1 A
Maximum Power	20 W	20 W	30 W
Voltage Measurement Resolution	100 nV	10 nV	30 μ V
Current Measurement Resolution	1 pA	10 fA	10 pA
Running Mode	Continuous		
Source Measure Unit (SMU) Model	Keithley 2401	Keithley 2450	Precise S100
Touchscreen	NO	YES	YES
Voltage Source Accuracy at Maximum Voltage (1 Year, 23°C $\pm$ 5°C)	0.02% + 2.4 mV	0.015% + 24 mV	0.1% + 3 mV
Voltage Programming Resolution at Maximum Voltage	500 μ V	5 mV	3 mV
Current Measurement Accuracy at Maximum Current (1 Year, 23°C $\pm$ 5°C)	0.22% + 570 μ A	0.03% + 500 μ A	0.1% + 2 mA
Connection	4-wire (Remote) Measurement (In/Out + Sense +/-)		
# of Data Points / Scan	No limit		



SMU-PTS-2450 (Keithley 2450, $V_{max} = 200$ V, $I_{max} = 1$ A)



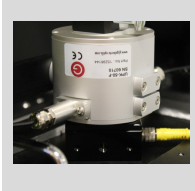
SMU-PTS-S100 (S100, $V_{max} = 30$ V, $I_{max} = 1$ A)



SMU-PTS-2401 (Keithley 2401, $V_{max} = 20$ V, $I_{max} = 1$ A)

QE Measurement Systems

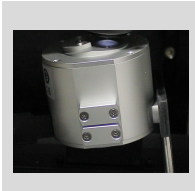
ACCESSORIES



IQE-TR-PTS

(175-9060)

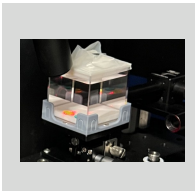
Adding IQE capability with reflectance and transmission measurements covering from 300-2500 nm using a 2" integrating sphere and silicon and InGaAs detector, dependant on variant selection. Only compatible with Gen 5 switchbox for upgrades.



IQE-IS-R

(175-9062)

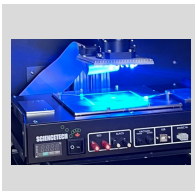
Adding IQE capability with reflectance measurements from 300-1100 nm using a 2" integrating sphere and silicon detector. Compatible with Gen 5 switchbox for upgrade. For Gen 4 switch boxes or earlier, please contact a technical specialist.



PTDS-PTS

(175-9032)

Photothermal deflection spectroscopy add-on. Allows for the measurement of optical absorption and thermal characteristics of a sample.



LED-PTS

(175-9301)

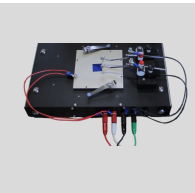
LED bias light add-on. Low-cost add-on that allows for spectral manipulation of the biasing light for a sample. Available with standard or custom wavelength ranges for selective biasing. Attaches to the output of the monochromator.



SCC-3-TE-PTS

(165-8230)

9 x 9 cm (3.5" x 3.5") temperature-controlled cell chuck add-on.



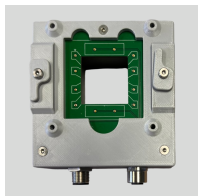
SCC-3-PTS

(165-8231)

9 x 9 cm (3.5" x 3.5") basic cell chuck add-on.

QE Measurement Systems

ACCESSORIES



SCC-MUX

(165-8232)

Customizable multiplexer designed for small device fabricators and testers. Pixels are fabricated onto standardized glass substrates and can be easily mounted into the SCC-MUX device.



IV-MUX

(175-8202)

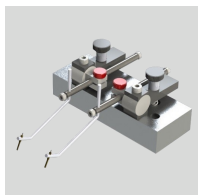
Multiplexer add-on for PTS systems. Supports up to eight (8) independent 4-wire connections for IV measurements, using terminal connectors compatible with AWG 22–16 wiring.



SOL-REF-Q

(125-9060)

Calibrated Reference Cell, Quartz Window, calibration by Sciencetech or NIST/NREL-traceable calibration by third party ISO/IEC 17025 accredited laboratory. 20 × 20 mm monocrystalline silicon device. Includes RTD and IV connections.



SCP-2G

(165-8209)

Probe Station. 2 gold plated spring-tip probes. Others probe types available, see Cell Chuck brochure.



SCC-VP

(165-8217)

Vacuum pump designed for use with Sciencetech's SCC cell chucks. Approximately 10 psi of vacuum, suitable for small cells.



SCC-VPME1

(165-8267)

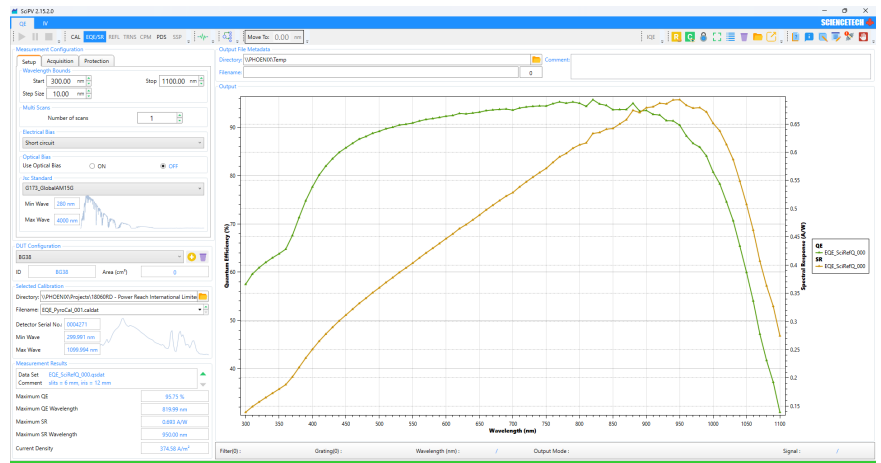
A powerful vacuum pump for holding larger cells, also very quiet at 45 db.

QE Measurement Systems SOFTWARE

SciPV software is provided with the PTS systems. The new SciPV has been improved with many iterations to provide advanced functionality and an excellent user experience.

SciPV Software Features

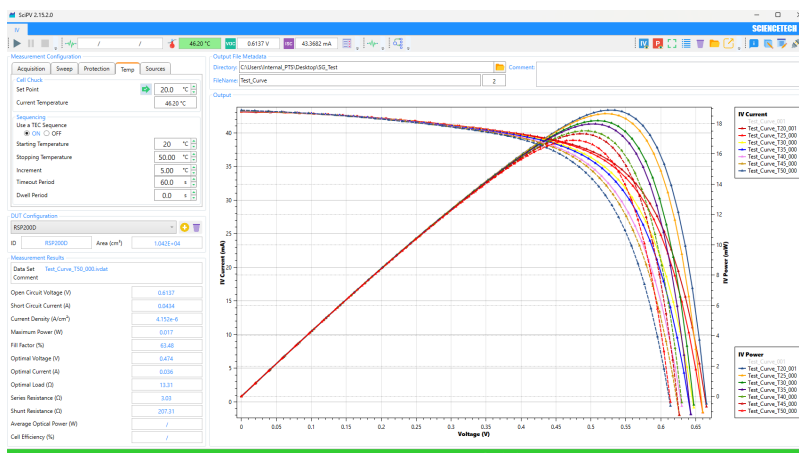
- Spectral response (SR), external quantum efficiency (QE), internal quantum efficiency (IQE)¹, and spectral reflectance measurements
- IV module reporting parameters: Open Circuit Voltage, Short Circuit Current, Current Density, Maximum Power, Fill Factor, Series Resistance, Shunt Resistance, Average Optical Power, Cell Efficiency, Voltage at Maximum Power, Current at Maximum Power and Resistance at Maximum Power
- QE module reporting parameters: Maximum QE, Maximum QE Wavelength, Maximum SR, Maximum SR Wavelength, Total Integrated Power, Maximum Reflectance and Maximum Reflectance Wavelength



External Quantum Efficiency and Spectral Response Measurements

- DC-MODE option for samples that cannot be measured with a chopped monochromatic probe beam
- Sciencetech PTS cell chucks are available for DUT temperature monitoring and control

NOTE: If you wish to upgrade to another measurement mode, please contact our technical specialists.



Temperature Sequencing IV and Power Measurements

¹ With the addition of IQE-TR-PTS or IQE-IS-R, or using -IQE variants

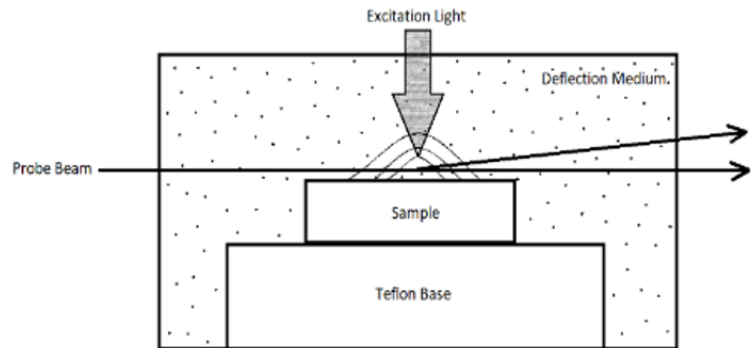
QE Measurement Systems

ADVANCED TECHNIQUES

Sciencetech offers a number of PTS systems employing more advanced techniques to study devices and materials. Contact Sciencetech if you are interested in learning more about these approaches.

PTDS

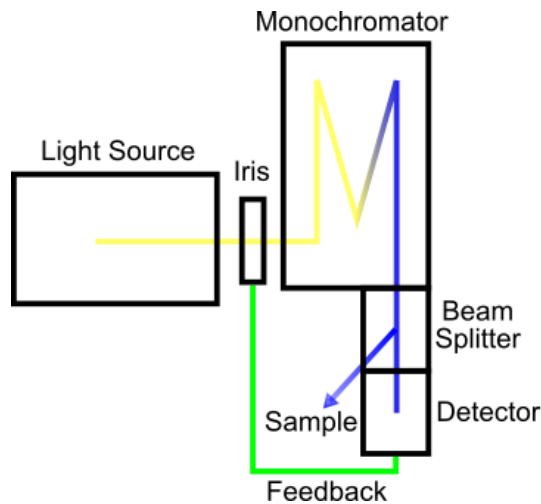
Sciencetech's PTDS system uses the transverse photothermal deflection spectroscopy technique to measure the relative absorbance of a material. When an absorptive sample is placed in the cuvette containing a thermofluid, the incident excitation light is turned into heat which changes the refractive index of the thermofluid due to heat transfer by convection. This results in deflection of the probe beam from its initial path which is received by a position-sensitive detector.



Photothermal Deflection Spectroscopy Setup

CPM

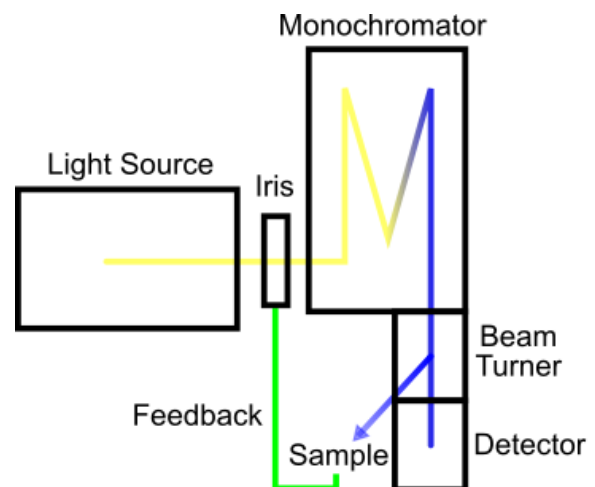
Sciencetech's constant photocurrent method (CPM) actively maintains a constant power of the monochromatic light source across wavelengths. Bias light illumination is optional. This method allows for accurate measurements of a material's optical absorption coefficient to precisely measure defect density and light-induced material degradation.



Constant Photocurrent Method Setup

SSP

Sciencetech's steady-state photoconductivity (SSP) method places a bias voltage across a sample while illuminating it at a specific wavelength and measuring the resulting device current. Depending on the situation, a bias light may also be used simultaneously. This technique allows for the characterization of defects and trap states within a material's bandgap.



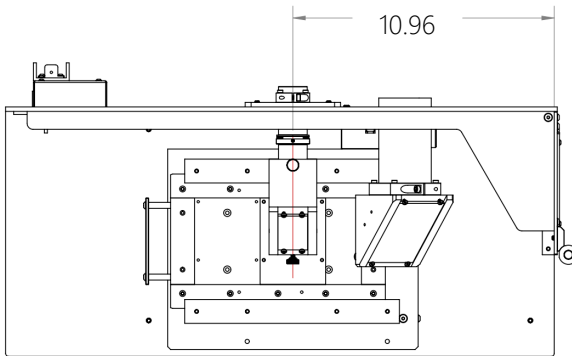
Steady State Photoconductivity Setup

QE Measurement Systems

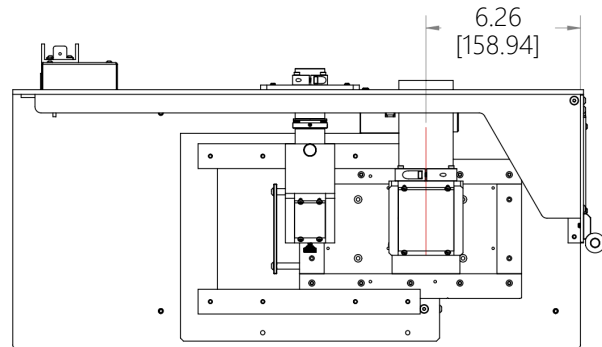
DIMENSIONS

Standard Sample Chamber

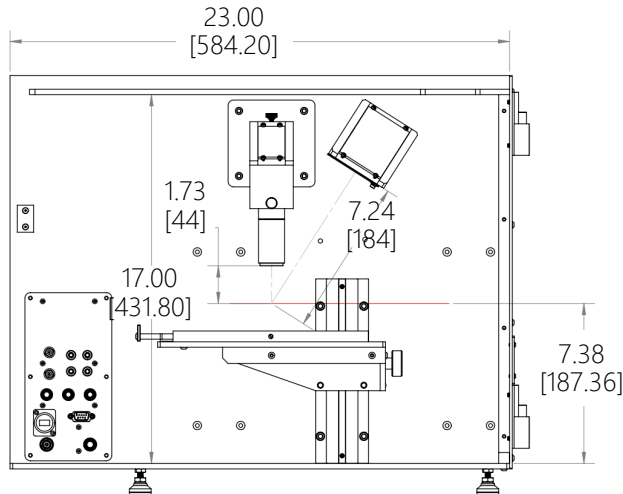
Dimensions are in inches [mm].



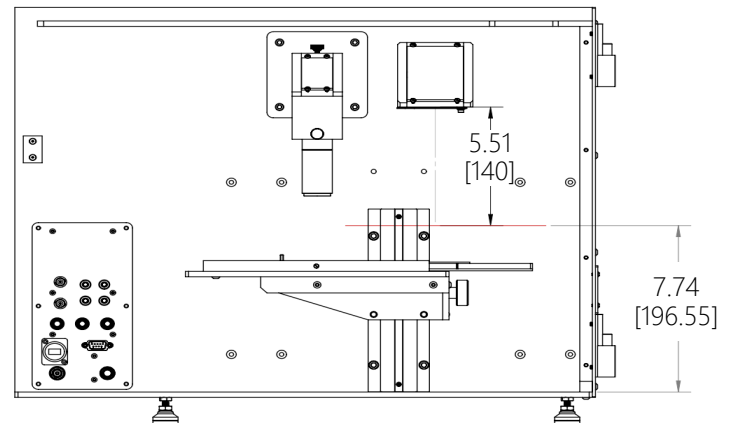
Top View of QE Configuration



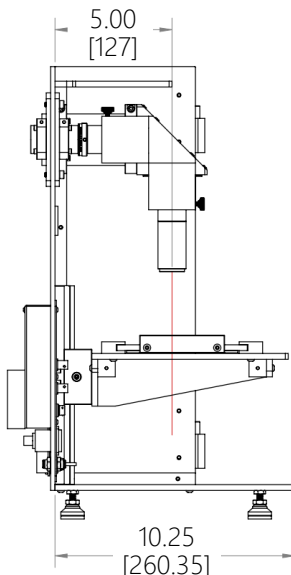
Top View of I-V Configuration



Front View of QE Configuration



Front View of I-V Configuration



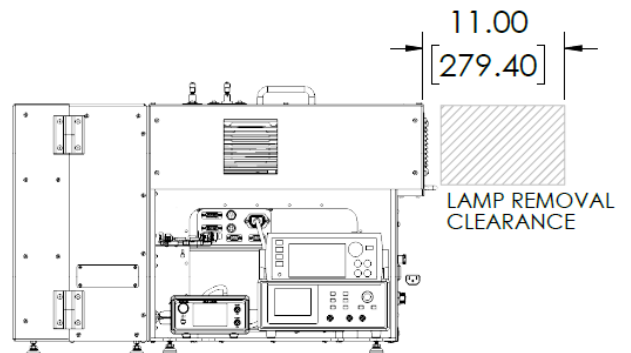
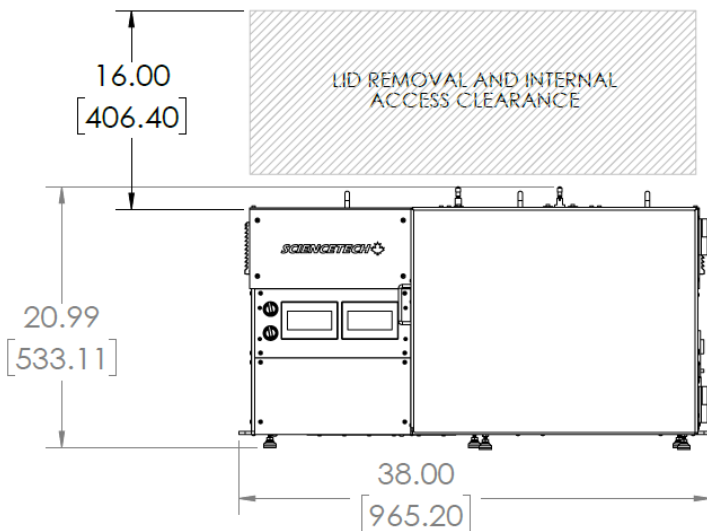
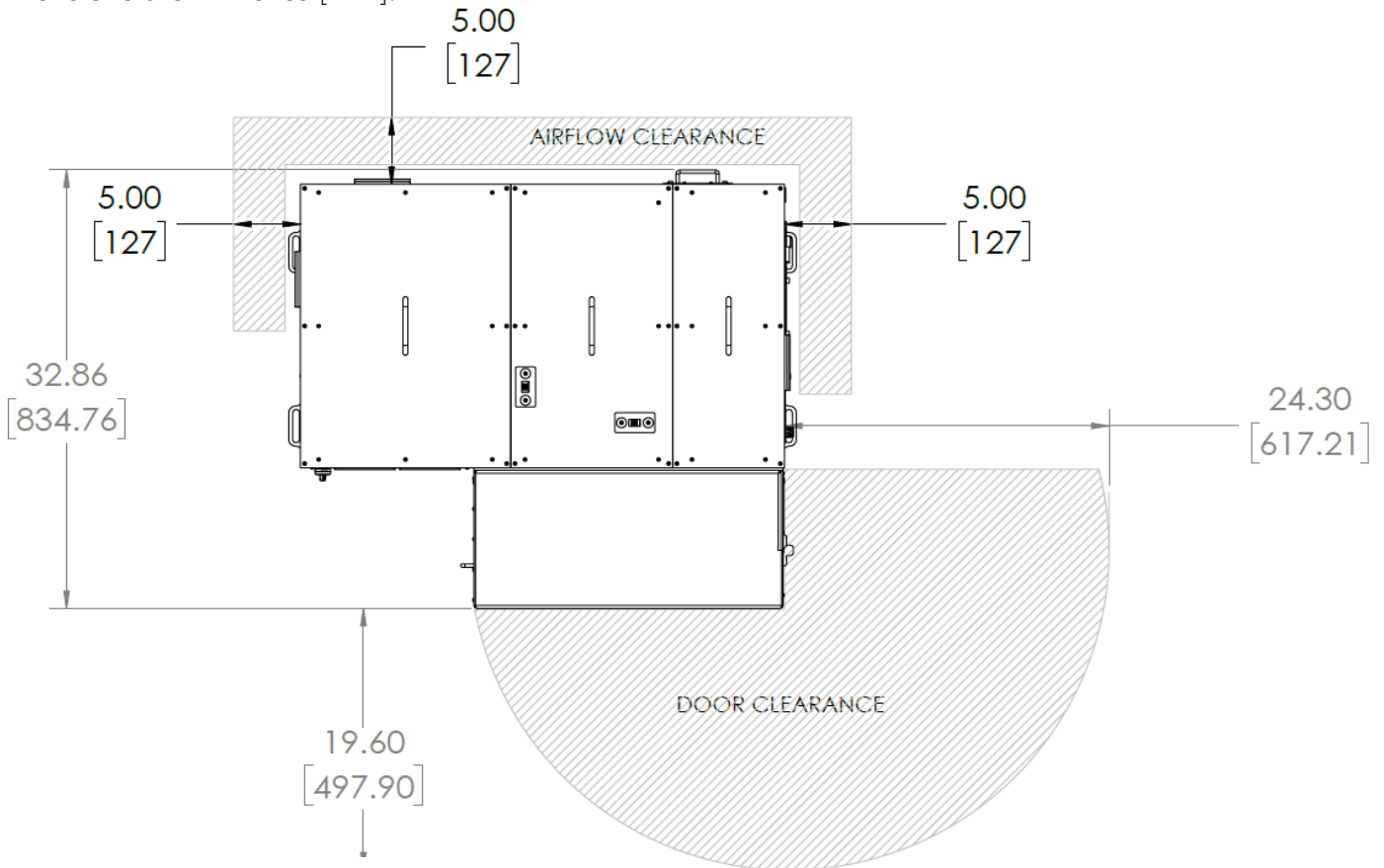
Side View of I-V and QE Configuration

QE Measurement Systems

DIMENSIONS

Standard Sample Chamber

Dimensions are in inches [mm].

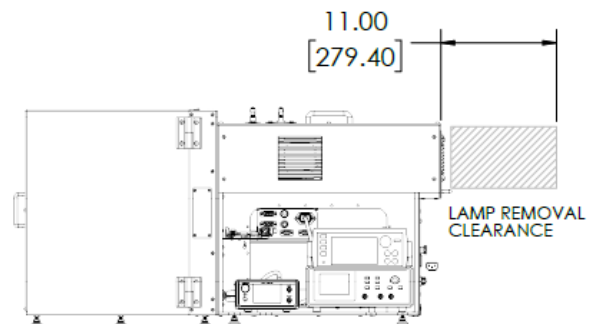
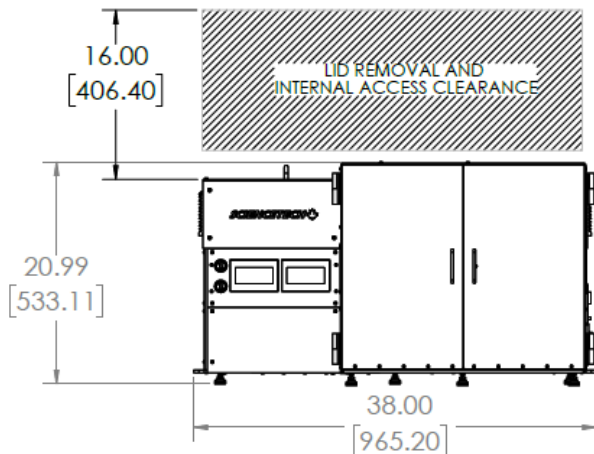
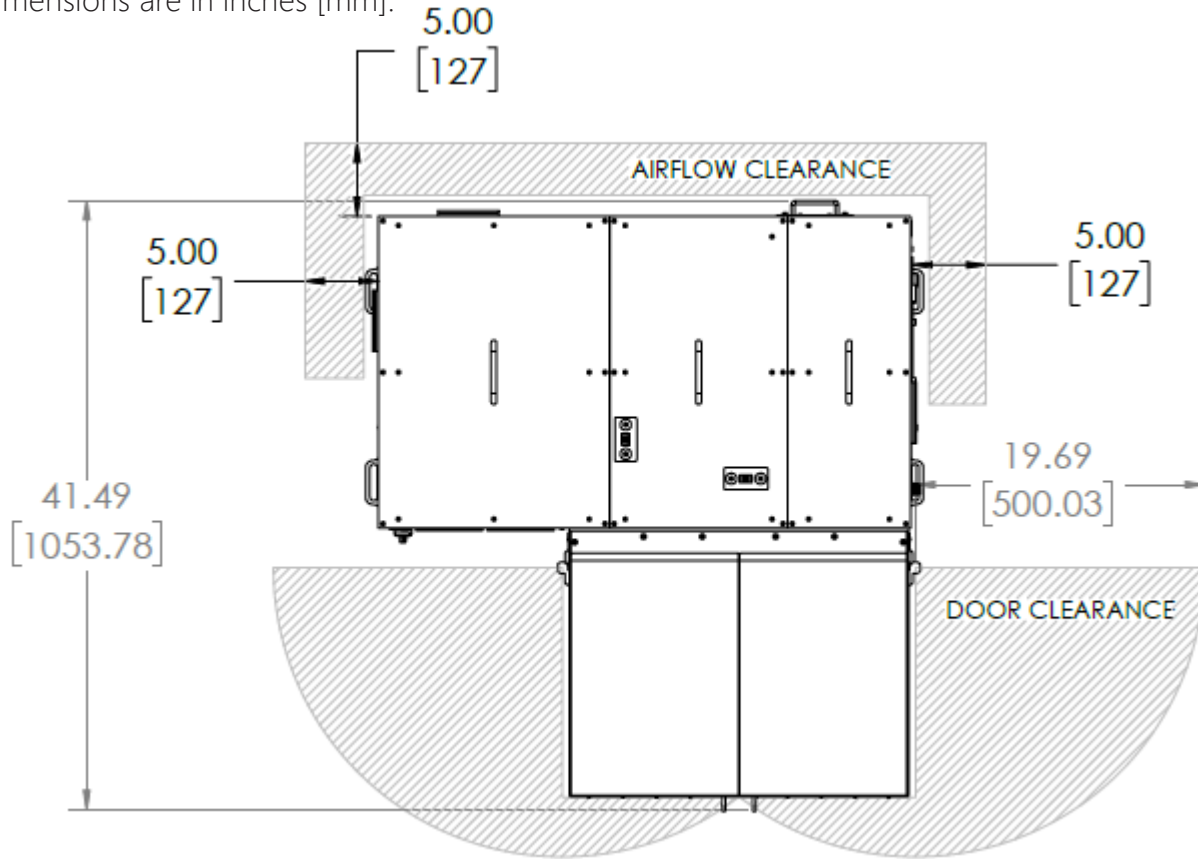


QE Measurement Systems

DIMENSIONS

Extended Sample Chamber

Dimensions are in inches [mm].



QE Measurement Systems

ORDERING INFORMATION

Model	Part Number	Description
Packages		
PTS-S	175-9201	PTS, Standard Range (250-2500 nm, Xe Source)
PTS-X	175-9202	PTS, Extended Range (300-5000 nm, Dual Xe and QTH Source)
PTS-3-PTD	175-9206	PTS with photothermal deflection spectroscopy capabilities
PTS-3-CPM	175-9003	PTS with constant photocurrent method capabilities
PTS-4-SSP	175-9006	PTS with steady-state photoconductivity capabilities
Add-ons		
IQE-TR-PTS	175-9060	Adding IQE capability with reflectance and transmission measurements covering from 300-2500 nm using a 2" integrating sphere and silicon and InGaAs detector
IQE-IS-R	175-9062	Adding IQE capability with reflectance measurements from 300-1100 nm using a 2" integrating sphere and silicon detector
PTDS-PTS	175-9032	Photothermal deflection spectroscopy add-on
LED-PTS	175-9301	LED bias light add-on
SCC-3-TE-PTS	165-8230	9 x 9 cm (3.5" x 3.5") temperature-controlled cell chuck add-on
SCC-3-PTS	165-8231	9 x 9 cm (3.5" x 3.5") basic cell chuck add-on
SCC-MUX	165-8232	Solar Cell Chuck with 8-Channel Multiplexer, Uncooled
IV-MUX	175-8202	Manual multiplexer add-on for PTS systems
SOL-REF-Q	125-9060	Calibrated Reference Cell, Quartz Window
SCP-2G	165-8209	Probe Station. 2 gold plated spring-tip probes (Others probe types available)
SCC-VP	165-8217	Vacuum pump designed for use with Sciencetech's SCC cell chucks
SCC-VPME1	165-8267	A powerful vacuum pump for holding larger cells, also very quiet at 45 db