

## Applications

- Photovoltaic Solar Cell Testing
- IV Characterization
- Spectral Response,
- External Quantum Efficiency-IPCE
- Internal Quantum Efficiency (PTS2-IQE Model)
- Photoconductivity Measurement
- Reflectance measurements capability (upgradable for transmission measurements)

## Features

- Spectral range 250-2500 nm
- 150W Xenon Arc Lamp
- Keithley 2401 source meter
- Lock-in amplifier
- Light tight sample chamber
- User selectable bias voltage
- Manually controlled shutter (upgradable)
- SciPV software for full control of the system

# Quantum Efficiency | IPCE Measurement System

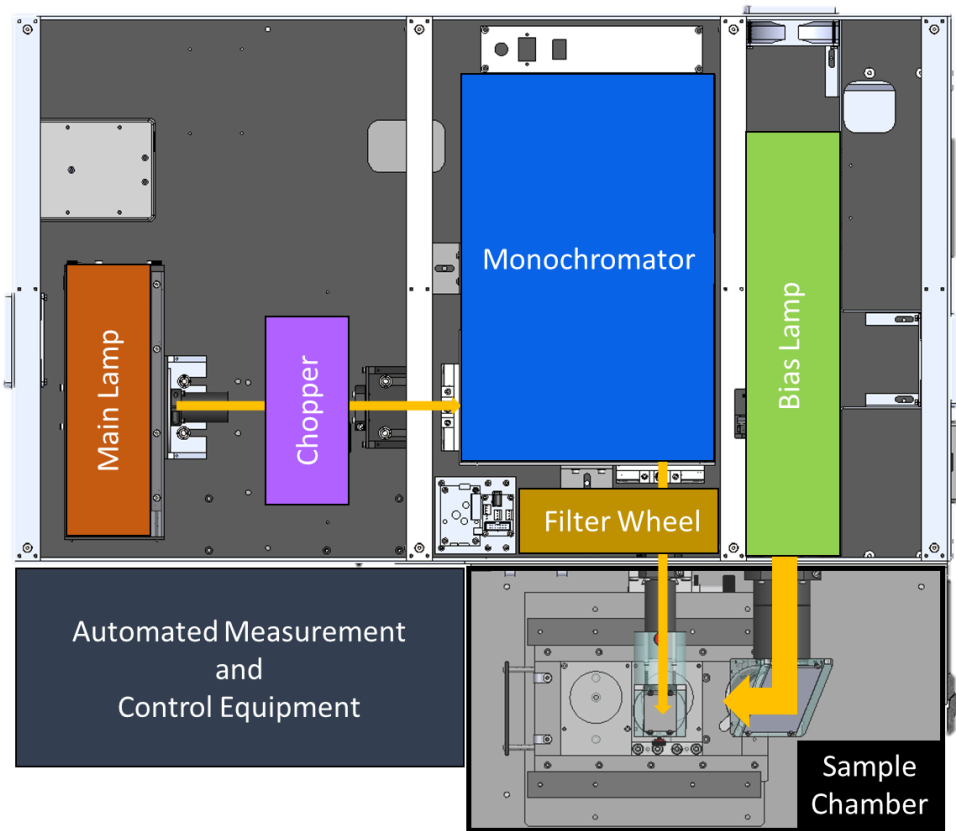
## PTS-Series: EQE and IQE



# QE Measurement Systems

## OVERVIEW

Sciencetech PTS-2 system conducts SR, EQE, IQE and IV measurements with user friendly software. The system includes a main xenon arc lamp (optional QTH lamp), monochromator with automated order sorting filters, a steady-state solar simulator Class AAA bias light source, measurement electronics, computer, and software required to measure solar cell characteristics. The system provides users with a light tight sample chamber for all measurements. Shielded and light tight test area enclosure has convenient removable cover allowing access from top, front and sides.



Measurement Capabilities		PTS 2 QE/IPCE (175-9002)	PTS 2 IQE (175-9008)
Current-Voltage (IV) Testing	Measures $V_{OC}$ , $I_{SC}$ , $R_{shunt}$ , $P_{max}$ , efficiency %, and fill factor	Included	Included
Spectral Response (SR)*	250 - 2500 nm scanning range	Included	Included
External Quantum Efficiency (EQE)	Incident photon to converted electron ratio (IPCE)	Included	Included
Internal Quantum Efficiency (IQE)	The ratio of charge carriers collected by the cell to the number of photons absorbed by the cell.	Upgrade Available	Included
Photocurrent measurement	Resolution up to 10pA at lowest range.	Upgrade Available	Upgrade Available

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

\*Model PTS-2 IQE (175-9008). Allows EQE, IQE and IV Measurements.

# QE Measurement Systems

## SPECIFICATIONS

Configuration Description		PTS 2 QE/IPCE (175-9002)	PTS 2 QE+IQE (175-9008)
Tunable Light Source	· 150 W Xenon short arc lamp, 1200 hour lifetime <sup>(1)</sup>	•	•
	· 250 - 2500 nm tuning/scanning range (Xenon)	•	•
	· 1/4 m Czerny-Turner monochromator with an adjustable bandpass of 0.4 to 48 nm with 600 l/mm grating , 0.2-24 nm with 1200 l/mm grating	•	•
	· Motorized triple grating turret system (3 gratings included)	•	•
	· Adjustable beam size (0.5mm diameter minimum with standard optics)	•	•
	· Includes hard coated order sorting filters	•	•
Bias Light Source	· 150 W Xenon short arc lamp, average lifetime 1200 hours <sup>1</sup>	•	•
	· 25x25mm AAA, (ASTM E927-19) Solar Simulator <sup>(2)</sup> · Includes mounted AM1.5G filter + additional filter slot	•	•
Reference Detector	· Broadband pyroelectric detector with quartz window, Element diameter: 5 mm	•	•
	· Calibrated range 250 - 2500 nm	•	•
Measurement System	· Option of : · Keithley 2401 source meter, maximum 20 W, 20 V, 1 A, or · Keithley 2400 source meter, maximum 20 W, 200 V, 1 A <sup>(3)</sup>	•	•
	· Voltage accuracy 0.015% and current accuracy 0.22%	•	•
	· Measurement time period for 100 IV points is 17s	•	•
	· Voltage bias user settable ±10 V capability	•	•
	· Lock-in Amplifier	•	•
	· Chopper 10 - 200 Hz <sup>(4)</sup>	•	•
	· Standard auto time constant feature	•	•
	· Temperature control (10-60 °C) <sup>(5)</sup>	Accessory Available	Accessory Available
· DC measurement mode	Upgrade Available	Upgrade Available	
IQE Measurement System	· 50 mm integrating sphere	Upgrade Available	•
	· Internal quantum efficiency measurement determined from material reflectance measurement (hardware included) 300 - 1100nm range. <sup>(6)</sup>	Upgrade Available	•
Sample Placement	· 50 mm diameter simple sample spacer for proper placement of the sample under the monochromatic and bias light beam. Includes simple electrical connections.	•	•
Software and Interface	· Modern software written in .NET (Windows Operating System)	•	•
	· Compatible with Windows 10, 32/64bit	•	•
	· Data files and automation log exportable as ASCII	•	•
	· Pre-configured and tested control computer included	•	•
	· Built in microcontroller switches and monitors signals automatically	•	•
	· 1 USB port	•	•
	· 1 IEC 60320 C14 power entry inlet	•	•
Compliance	· Designed for compliance with ASTM E 1021-15 , ASTM E948, IEC 60904-8, IEC 60904-I	•	•
Power system	· Single phase, configurable for 230 VAC, 50 Hz or 110 VAC, 60 Hz	•	•

1) Dual light source (QTH and Xe lamp) available.

2) Bias light Source 50x50 mm target area available

3) Extendable with upgrades

4) With DC Mode upgrade the Chopper range is then set to 0-50Hz range

5) Add SCI-SCC3-TE-PTS cell chuck. See accessories page 5.

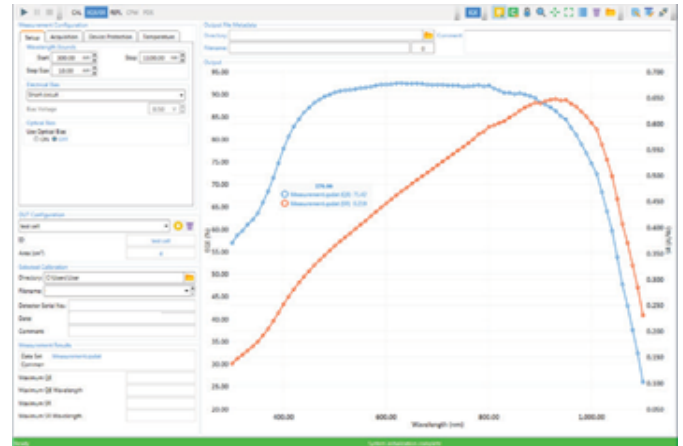
6) Extendable range 1100-2000nm for IQE with additional detector. (Total range 300-2000nm)

# QE Measurement Systems SOFTWARE

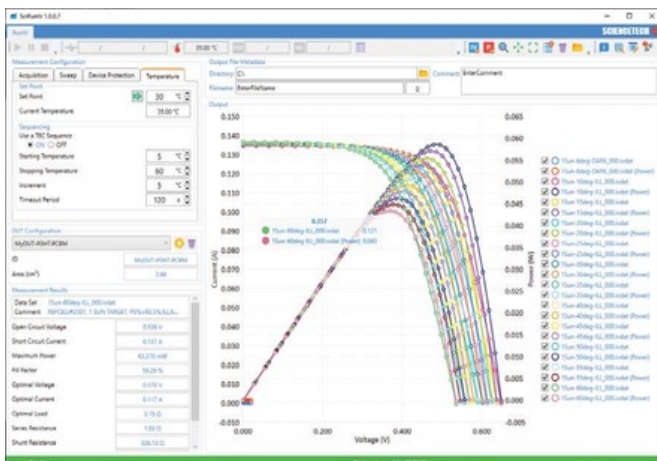
SciPV software is provided with the PTS-2-IQE system. The new SciPV has been improved with many iterations to provide advanced functionality and an excellent user experience.

## SciPV Software Features

- Spectral response (SR), external quantum efficiency (QE), internal quantum efficiency (IQE)\*, and spectral reflectance measurements
- IV module reporting parameters: Open Circuit Voltage, Short Circuit Current, 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



Temperature Sequencing IV and Power Measurements

## Measurement Mode Upgrades Available:

- DC-MODE option for samples that cannot be measured with a chopped monochromatic probe beam
- SCI-SCC3-TE-PTS cell chuck for DUT temperature monitoring and control
- IV-MUX accessory to multiplex up to six 4-wire signals

\*Model PTS-2 IQE. Allows EQE, IQE and IV Measurements.

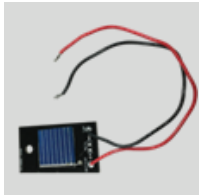
# QE Measurement Systems

## ACCESSORIES

**SOL-METER****(125-9011)**

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Solar Power Meter, a digital meter for use with solar calibrated detectors (e.g. SSIVT-REF or SOL-REF-Q).

**SCI-MO****(125-9040)**

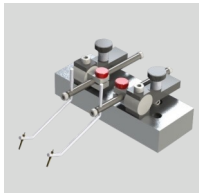
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Sci Monitor, A simple PCB mounted solar cell, as a reference cell. Calibration value provided for 1 sun AM1.5G

**SOL-REF-Q****(125-9060)**

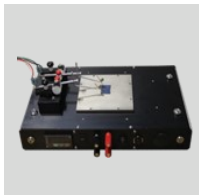
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Calibrated Reference Cell, Quartz Window, calibration by Sciencetech or NIST/NREL-traceable calibration by third party ISO/IEC 17025 accredited laboratory. 20x20mm monocrystalline silicon device. Includes RTD and IV connections.

**SCP-2G****(165-8209)**

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Probe Station. 2 gold plated spring-tip probes. (Others probe types available)

**SCI-SCC3-TE-PTS****(165-8230)**

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3.5" x 3.5" Solar Cell Chuck, TE Cooled (5 to 60 °C), Computer controllable, Vacuum Ready for PTS System (non cooled version also available).

**SCI-SCC3-L-B****(165-8221)**

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3.5" x 3.5" Solar Cell Chuck, Liquid Cooled, Rear Contact. (non cooled version also available, SCC3-B), Temperature range -10 to 80 °C when paired with TC-2000

# QE Measurement Systems

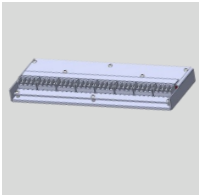
## ACCESSORIES



SCC3-B

(165-8216)

This Cell Chuck is an economical way of providing electrical connection to the back of your test cells.



IV-MUX

(175-8202)

Multiplex up to 6 4-wire measurements. Integrates with PTS system.



SCC-VP

(165-8217)

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



SCC-VPME1

(165-8267)

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

## QE Measurement System PTS 2 Models

PTS 2 Models	Description	SKU
PTS-2-QE	PTS with EQE / IV Measurement	175-9002
PTS-2-IQE	PTS with EQE/IQE / IV Measurement	175-9008
PTS-2-QE-DUAL	PTS with dual sources (Xe and QTH), EQE/IV Measurements	175-9010
PTS-2-IQE-DUAL	PTS with dual sources (Xe and QTH), EQE/IQE/ IV Measurement	175-9011

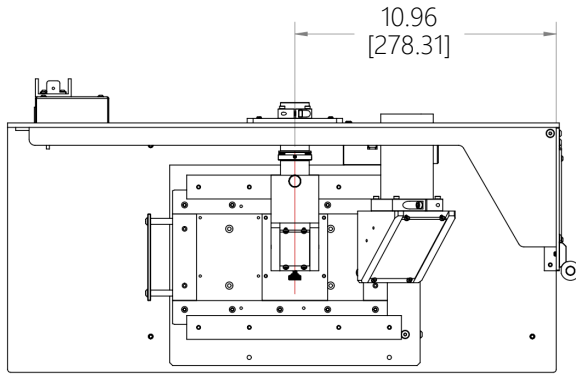
## Optional Add-Ons

PTS 2 Add-ons	Description	SKU
IQE-IS-R	IQE add-on for PTS-2-QE and PTS-2-DUAL, 300-1100nm	175-9052
IQE-R-EXT	Adds an InGaAs detector to IQE systems for extended range IQE, 1100-2000nm, can be added to all IQE models.	175-9009
DC-MODE	DC-Mode add-on for PTS-2	175-9014

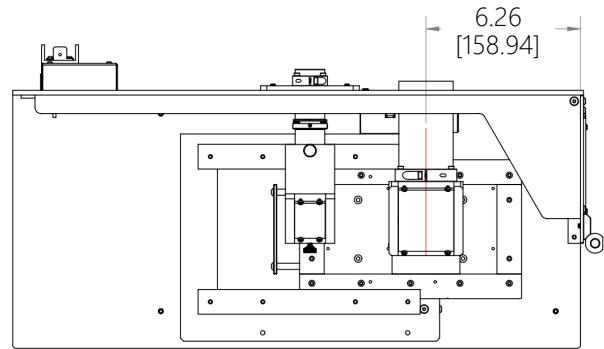
# QE Measurement Systems

## DIMENSIONS

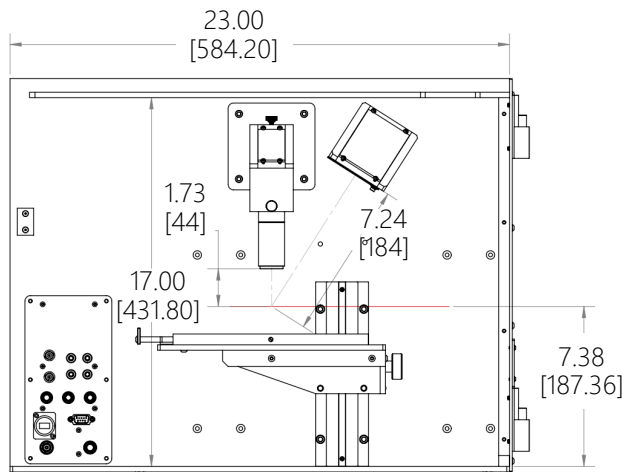
Dimensions are in inches [mm].



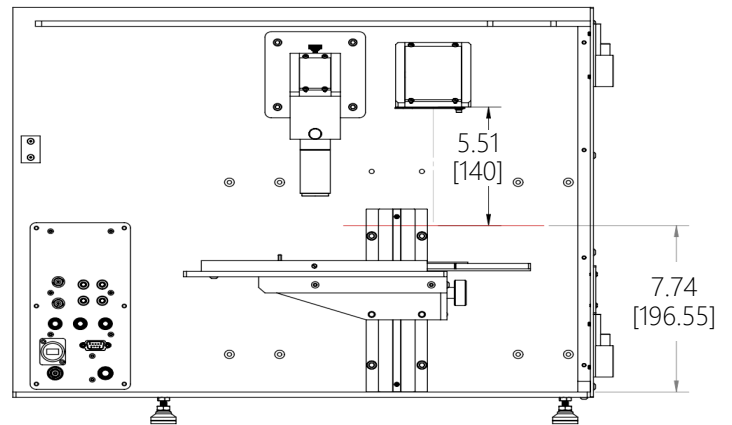
Top View of QE Configuration



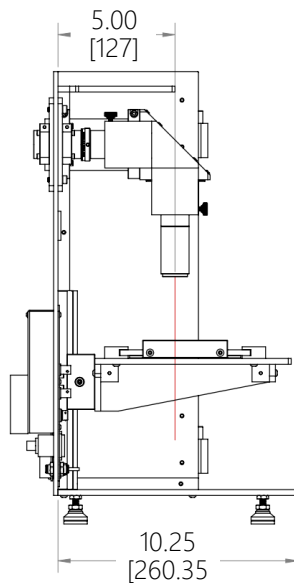
Top View of I-V Configuration



Front View of QE Configuration



Front View of I-V Configuration

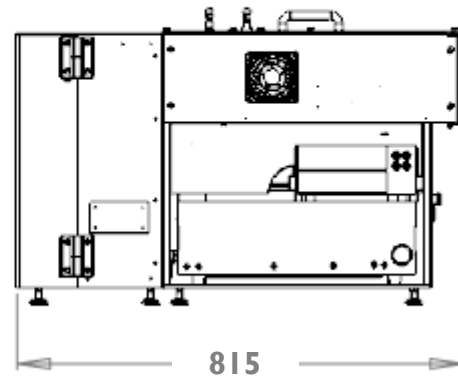
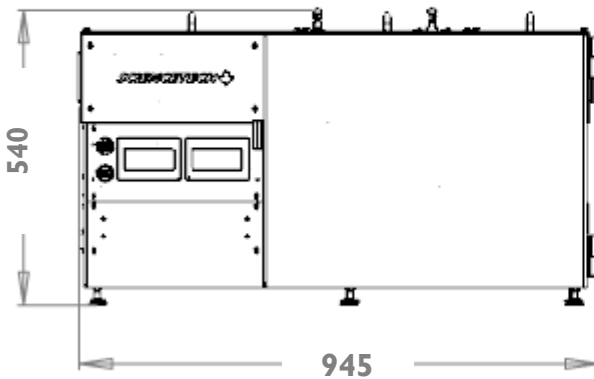
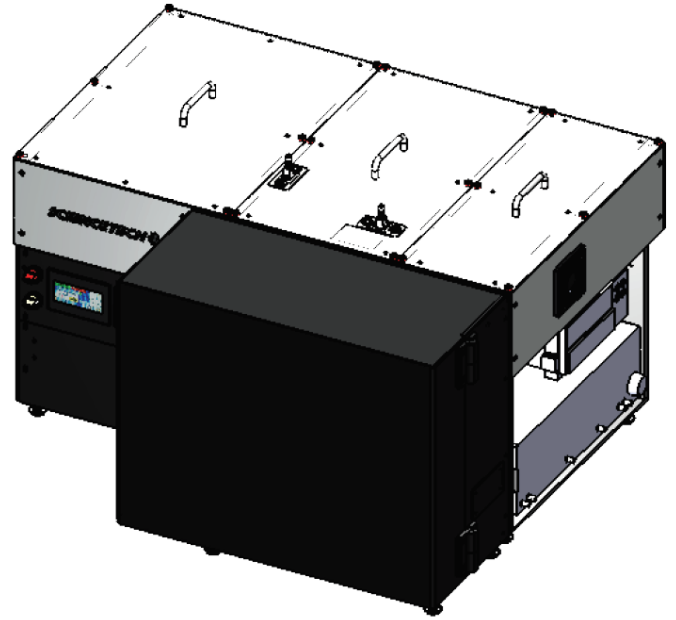
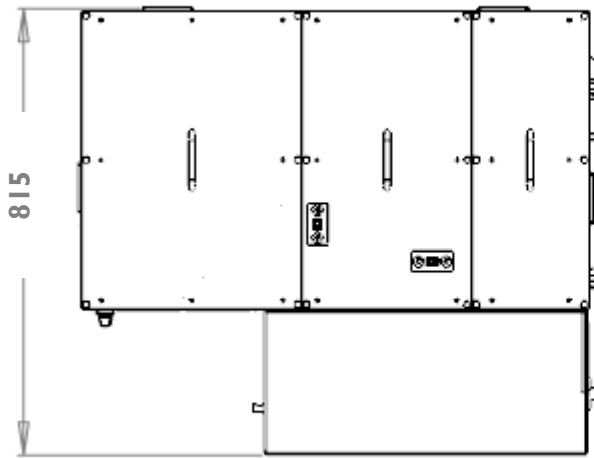


Side View of I-V and QE Configuration

# QE Measurement Systems

## DIMENSIONS

Dimensions are in [mm].



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