



## Applications

- Photovoltaic Solar Cell Testing
- IV Characterization
- Spectral Response
- External Quantum Efficiency-IPCE
- Internal Quantum Efficiency (PTS2-IQE Model)
- Photoconductivity Measurement
- Reflectance Measurements Capability

## Features

- Spectral Range 250-2500 nm
- Tunable Light Source
- Source Measure Unit
- Lock-in Amplifier
- Light Tight Sample Chamber
- User Selectable Bias Voltage
- AC and DC Measurement Mode
- Manually Controlled Shutter
- SciPV software for full control of the system

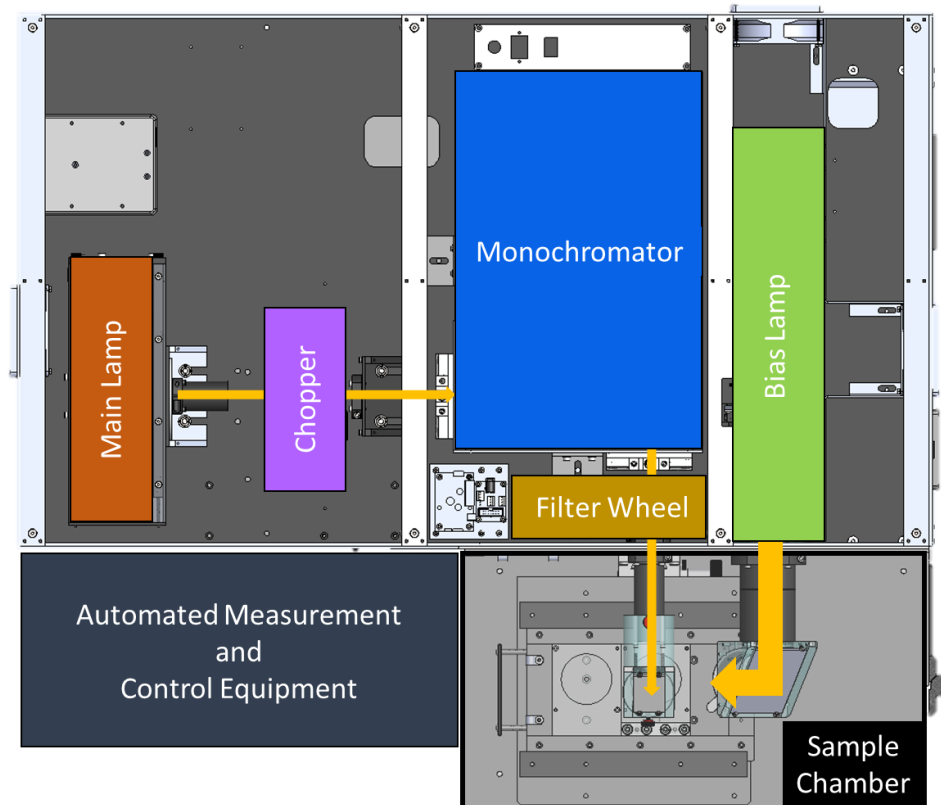


# Quantum Efficiency | IPCE Measurement System PTS-Series: EQE and IQE

# QE Measurement Systems

## OVERVIEW

Sciencetech PTS system conducts SR, EQE, IQE and IV measurements with user friendly software. The system includes a main xenon arc lamp, monochromator with automated order sorting filters, a steady-state solar simulator Class AAA bias light source ( only with PTS-2 ) 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 1 SR<br>(175-9203) | PTS 2 QE/IPCE<br>(175-9204) | PTS 2 IQE<br>(175-9205)   |
|-----------------------------------|--------------------------------------------------------------------------------------------------|------------------------|-----------------------------|---------------------------|
| 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                    | Included                  |
| External Quantum Efficiency (EQE) | Incident photon to converted electron ratio (IPCE)                                               | Included               | Included                    | Included                  |
| AC and DC measurement mode        | Modulated / Continuous measurement capability                                                    | Included               | Included                    | Included                  |
| Internal Quantum Efficiency (IQE) | The ratio of charge carriers collected by the cell to the number of photons absorbed by the cell | -                      | -                           | Included<br>300 - 1100 nm |

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

# QE Measurement Systems

## SPECIFICATIONS

| Configuration Description |                                                                                                                                                                  | PTS 1 SR<br>(175-9203) | PTS 2 QE/IPCE<br>(175-9204) | PTS 2 QE+IQE<br>(175-9205) |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|-----------------------------|----------------------------|
| Tunable Light Source      | . 150 W Xenon short arc lamp, 1200 hour lifetime                                                                                                                 | •                      | •                           | •                          |
|                           | . 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):<br>. 1200 l/mm blazed at 250 nm<br>. 1200 l/mm blazed at 500 nm<br>. 600 l/mm blazed at 1000 nm  | •                      | •                           | •                          |
|                           | . Adjustable beam size ( 0.5mm - 19 mm diameter with standard optics)                                                                                            | •                      | •                           | •                          |
|                           | . Includes hard coated order sorting filters                                                                                                                     | •                      | •                           | •                          |
| Bias Light Source         | . 150 W Xenon short arc lamp, average lifetime 1200 hours                                                                                                        | -                      | •                           | •                          |
|                           | . 25x25mm AAA, (ASTM E927-19) Solar Simulator                                                                                                                    |                        | •                           | •                          |
|                           | . 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        | . Source meter, maximum 30 W, 30 V, 1 A                                                                                                                          | •                      | •                           | •                          |
|                           | . Voltage accuracy 30 $\mu$ V and current accuracy 10 pA                                                                                                         | •                      | •                           | •                          |
|                           | . Measurement time period for 100 IV points is 20s                                                                                                               | •                      | •                           | •                          |
|                           | . Voltage bias user settable $\pm 10$ V capability                                                                                                               | •                      | •                           | •                          |
|                           | . Lock-in Amplifier                                                                                                                                              | •                      | •                           | •                          |
|                           | . Chopper 4 - 200 Hz                                                                                                                                             | •                      | •                           | •                          |
|                           | . Standard auto time constant feature                                                                                                                            | •                      | •                           | •                          |
|                           | . Temperature control (10-60 $^{\circ}$ C) <sup>(1)</sup>                                                                                                        | Accessory Available    | Accessory Available         | Accessory Available        |
|                           | . Ac and DC measurement mode                                                                                                                                     | •                      | •                           | •                          |
| IQE Measurement System    | . 50 mm integrating sphere                                                                                                                                       | -                      | -                           | •                          |
|                           | . Internal quantum efficiency measurement determined from material reflectance measurement (hardware included) 300 - 1100nm range.                               | -                      | -                           | •                          |
| Sample Placement          | . 50 $\times$ 50 mm 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 10/11 Operating System)                                                                                               | •                      | •                           | •                          |
|                           | . Compatible with Windows 10/11, 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                | . Intended for use in measurements according to ASTM E 1021-15 , ASTM E948, IEC 60904-8, IEC 60904-1                                                             | •                      | •                           | •                          |
| Power system              | . Single phase, configurable for 230 VAC, 50 Hz or 110 VAC, 60 Hz                                                                                                | •                      | •                           | •                          |

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

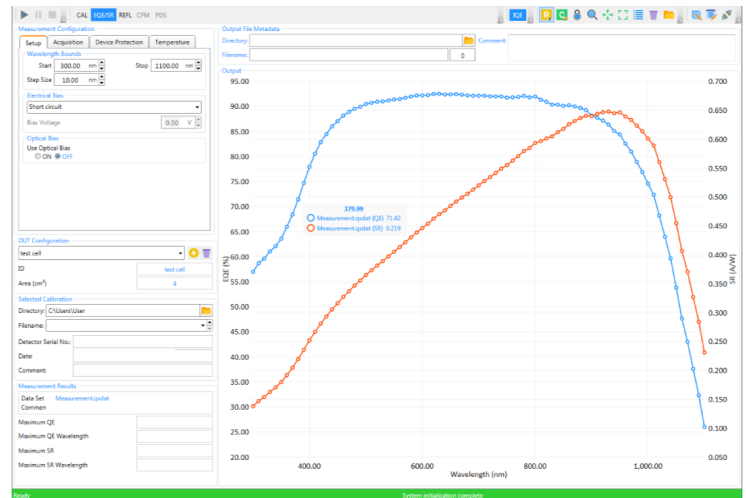
NOTE: If your desired Quantum Efficiency system is not included here, please see the Quantum Efficiency variant model brochure.

# QE Measurement Systems SOFTWARE

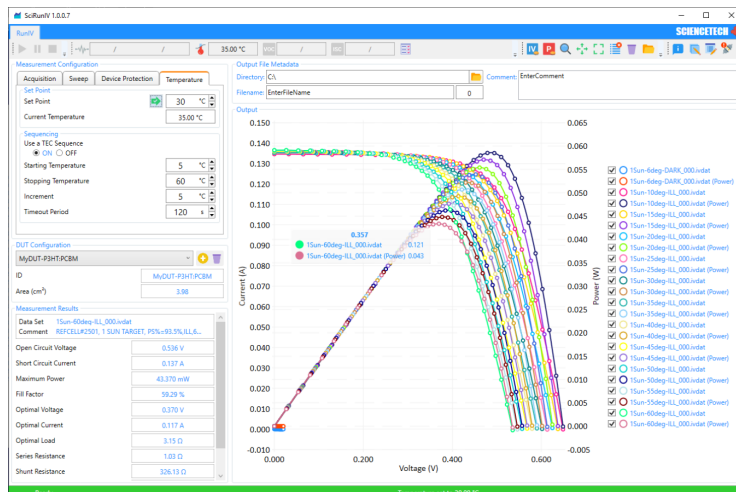
SciPV software is provided with the PTS systems. The new SciPV has been improved with many iterations to provide advanced functionality and an excellent user experience.

## SciPV Software Features

- Spectral response (SR), external quantum efficiency (QE) , internal quantum efficiency (IQE)\*, 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

- 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

NOTE: If you wish to upgrade to another measurement mode, please refer to the Quantum Efficiency variant model brochure

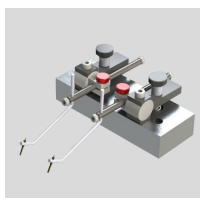
\*Model PTS-2 IQE. Allows EQE, IQE and IV Measurements.

# QE Measurement Systems

## ACCESSORIES

**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. 20×20mm monocrystalline silicon device. Includes RTD and IV connections.

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

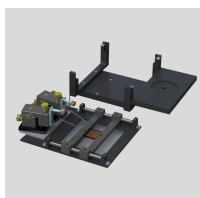
Probe Station. 2 gold plated spring-tip probes. (Others probe types available)

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

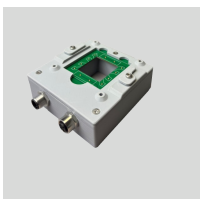
3.5" x 3.5" Solar Cell Chuck, TE Cooled (5 to 60 °C), Computer controllable, Vacuum Ready for PTS System (non cooled version also available).

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

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

**SCC3-B****(165-8216)**

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

**DUT Multiplexing****(Contact a Sciencetech technical specialist)**

Multiplex up to 8 4-wire measurements from a single or multiple devices. Integrates with PTS system. See the PTS variant Brochure.

# QE Measurement Systems

## ACCESSORIES



### SCC-VP

(165-8217)

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



### SCC-VPME1

(165-8267)

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

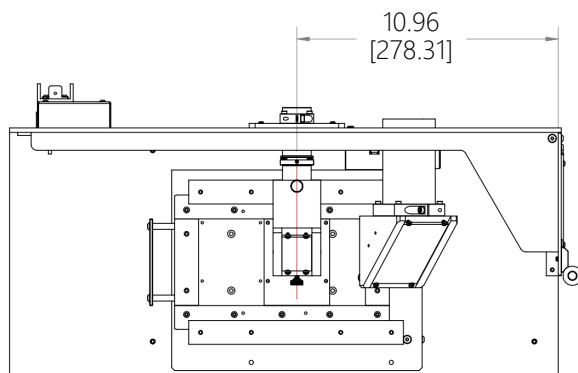
## QE Measurement System PTS Models

| PTS Models | Description                       | SKU      |
|------------|-----------------------------------|----------|
| PTS-1-QE   | PTS with SR and EQE               | 175-9203 |
| PTS-2-QE   | PTS with EQE / IV Measurement     | 175-9204 |
| PTS-2-IQE  | PTS with EQE/IQE / IV Measurement | 175-9205 |

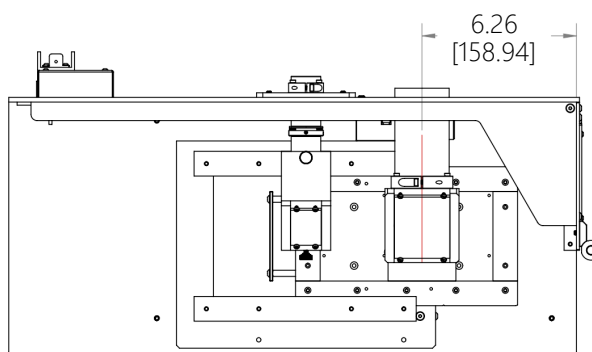
# QE Measurement Systems

## DIMENSIONS

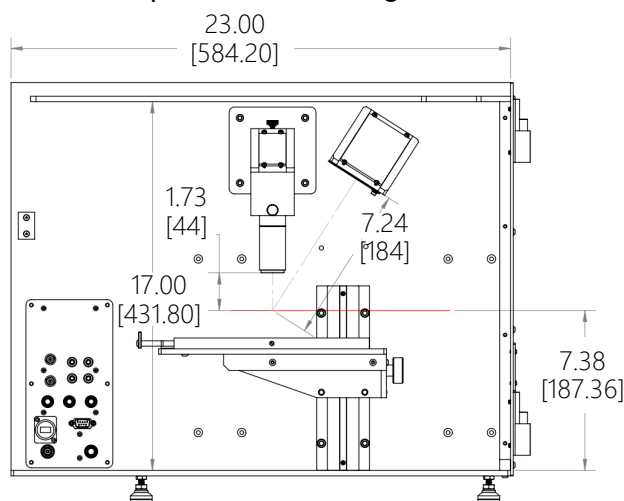
Dimensions are in inches [mm].



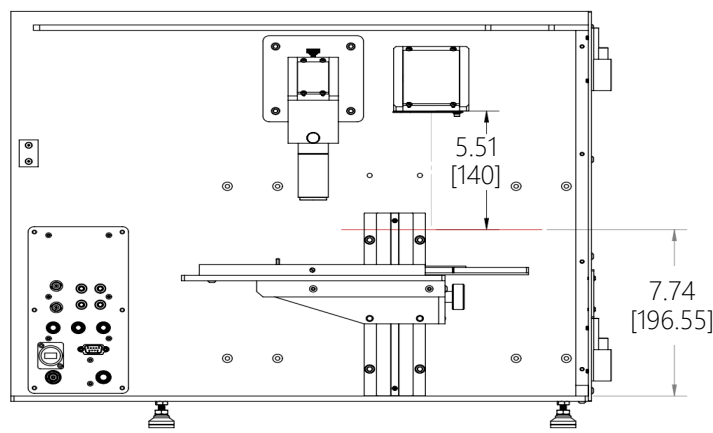
Top View of QE Configuration



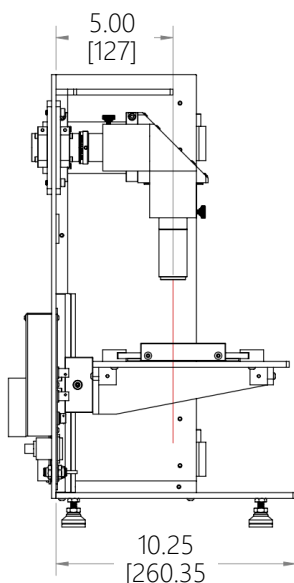
Top View of I-V Configuration



Front View of QE Configuration



Front View of I-V Configuration

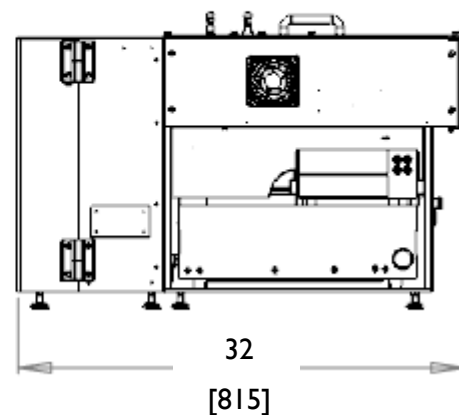
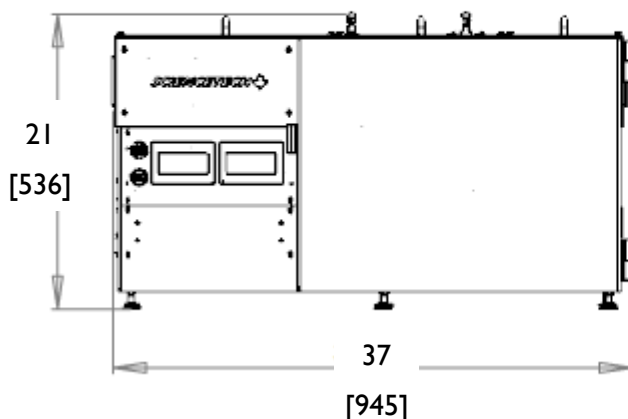
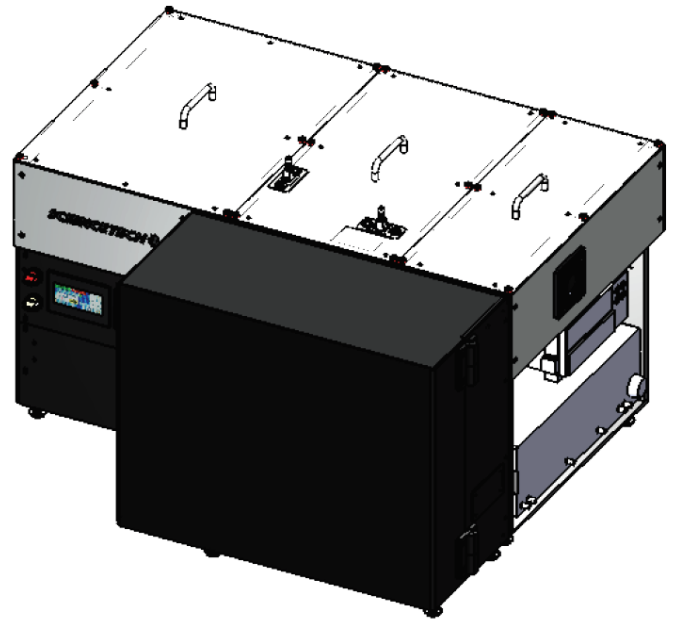
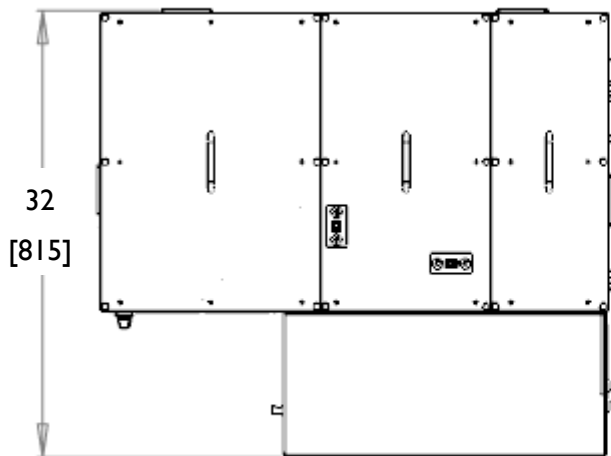


Side View of I-V and QE Configuration

# QE Measurement Systems

## DIMENSIONS

Dimensions are in [mm].



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