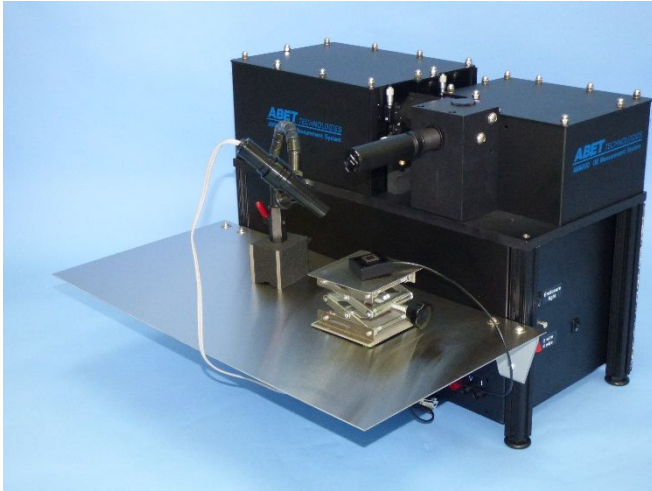


## QE (IPCE) IQE Spectral Metrology Tools



Abet Technologies Model AB6000 Quantum Efficiency measurement tool (dark enclosure not shown)

### AAA: Adaptable, Advanced, Affordable

Abet Technologies Quantum Efficiency tools, updated for 2017, ship in many flavors making them completely adaptable to the customer's metrology needs. The advanced LED based light source offers stable, long life performance. Choose the spectral range of interest to you and the source will be populated to match your needs. Choose the Xe/QTH source for higher output.

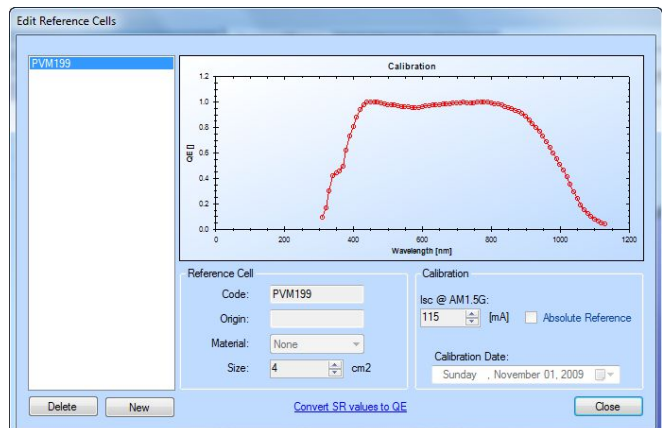
### Complete

Your system ships with all the necessary hardware and software. A built in Windows 10 or higher PC allows full control of test parameter settings and instrument performance. PHOTOR software controls the instrument and offers complete data analysis capabilities.

The high-power LED based light source provides stable, long life, easy to modulate output. A fast scanning 250 mm class direct drive monochromator provides high light output. Micrometer driven slits allow reproducible bandwidth control. Spot size reproducibly adjustable with micrometer driven variable slits.

Also included are the required bias light(s), a bias voltage supply (+/- 10V), a dual channel lock-in amplifier, an I/V converter with 1k to 10M gain ranges, all necessary reference and monitor cells, temperature monitoring electronics, and as ordered cell mounting and contacting hardware, temperature control, XY translation stages for QE mapping, or the Internal Quantum Efficiency option.

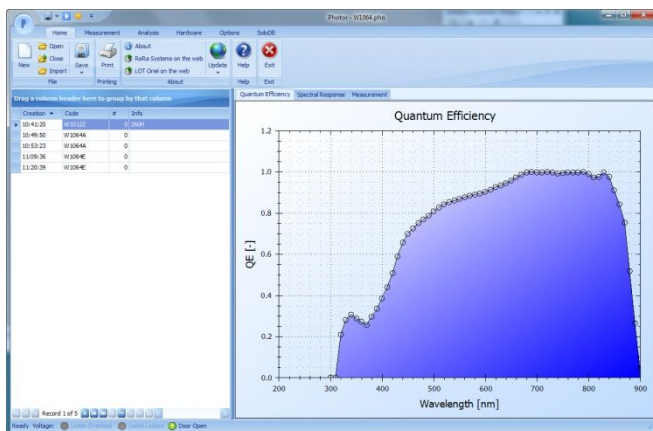
- Complete, Photor driven solutions for spectral characterization
- LED or Xe/QTH based light engines allow DC to high frequency monochromatic light generation.
- 250 mm focal length, direct drive monochromator offers high scan speed and generous light output
- Software included for internal and network database management
- Single and multi-junction devices
- EQE (IPCE) and IQE capabilities
- Spectral ranges 300-1800 nm
- Built-in Windows PC and dual channel lock-in amplifier
- Variable bias light (white or multi-color)
- $\pm 10\text{VDC}$  bias



PHOTOR screen with reference cell data

## PHOTOR Software

The PHOTOR software package provides a complete control of all system functions in all the models of Abet Technologies' AB6000 family of EQE/IQE systems. Photor also offers standards compliant data analysis for QE, IPCE, IQE, Spectral Response, single and multi-junction, Mismatch Factor, and short circuit current for different ASTM standard spectra. PHOTOR has been developed using the latest Microsoft.NET technology resulting in a Microsoft Office look and feel, minimizing the user learning curve. The algorithms used in PHOTOR meet all the current IEC standards for Spectral Response measurements. Relative measurements can be easily scaled to calibrated currents for different spectral irradiances. All such calculations are done using the ASTM G173 Reference Solar Spectral Tables.



Data can be stored in a local or network database. Intuitive data management and comparison is enabled by the built-in database search and measurement selection capabilities of the Photor software package.

## Quick start-up

All systems are shipped completely assembled. Lift yours from the shipping plate to your bench, plug it in and start collecting data within minutes.

## Optimized and Flexible Design

A monitor cell is used in every scan to assure data accuracy and reproducibility.

The included DC mode electronics and completely dark enclosure allow QE metrology on organic cells and other slow response materials.

Computer controlled multi-color bias lights and voltage bias option allows multi-junction cells metrology. System design flexibility allows testing of a wide variety of cell types. A partial listing includes: poly silicon, c-Si, mc-Si, nc-Si, III-V compound cells; thin film: Perovskites, CdTe, CIS, CIGS, Si; 3rd generation: organic polymer, dye.

XY scan and multiplexer options offer automated EQE map generation or multiple devices scanning.

## Ordering Information

Please use this ordering information as a starting point and contact Abet Technologies or her distributors for any additional product selection guidance.

### AB6000 Xe/QTH QE Measurement System includes:

- Installed Photor software package
- 300-1100 nm range
- 100W Xe and 100W QTH bulbs light engine
- DC to 300 Hz chopper
- Order sorting filter wheel
- 250 mm class dual grating direct drive Monochromator
- Dark enclosure with convenience setup light
- Computer controlled Tungsten halogen bias light
- Si monitor cell
- Si reference cell
- Light delivery and spot generating optical assembly capable of down, horizontal and up light delivery
- Micrometer controlled spot size
- Complete electronics bay with
  - voltage and light bias supplies
  - IV converter
  - dual channel digital lock-in electronics
  - monitor cell electronics
  - reference cell electronics
- Intel NUC PC with Windows 10 or higher
- PC monitor, keyboard and mouse
- Sample Si cell with its QE data to allow system check
- Set of alligator clip cables for basic device connectivity.

### AB6000 Xe/QTH QE - IR Measurement System includes:

- All the items above plus
- Germanium reference and monitor cells
- Three color bias lights

Please order probes and chuck to match your cells separately.

### Accessories and Options

- AB2160** 300-1100 nm IQE total reflectance option
- AB2161** 300 nm – 1800nm IQE total reflectance option
- AB2162** IQE total transmittance option; requires either AB2160 or AB 2161
- AB2170** motorized XY table, 160x160 range min
- AB2142** Computer controlled multi-color bias light with selectable LEDs (standard selections 455 nm and 810 nm)
- 15090** Universal test platform
- 15090-M** Magnetic base
- 15250F-R** Micromanipulator, precision, right handed
- 15250F-L** Micromanipulator, precision, left handed
- 15251L** Micromanipulator, low resolution
  - For 50x50 mm or smaller devices
- 15545** Test station, bottom-bottom contact
- 15114** DSSC test station, 2.54 mm contact spacing

## QE Si and Ge Reference cells



Abet Technologies Model AB2152-1 QE Si Reference cell

### QE measurement necessity: Traceable reference cells

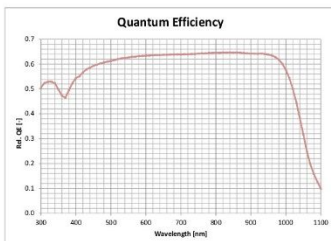
Abet Technologies' NIST traceable Si and Ge reference cells were designed for highly linear response at signal levels typical of QE and IQE metrology.

### Complete

Each cell shipped with a calibration certificate and a .csv file for easy integration with your QE software package.




Device Code: RR1331  
Date: 20-Sep-15



System: SPC2003T  
Load: REQA-TV Converter  
Bias: 0V  
Software: Solar Meter  
Reference: SQe130  
Contact calibration lab for error analysis

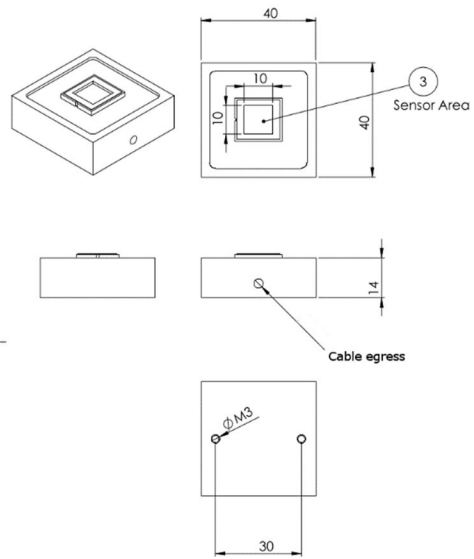
Approved:

E. Haverkamp

RERA SOLUTIONS

A sample calibration certificate

- 280 nm to 1800 nm calibration options
- NIST traceable calibration



Dimensional diagram

### Calibration accuracy

Silicon:

- ±3% (440 - 980 nm)
- ±5% (280 - 439 nm)
- ±7% (200 - 279 nm, 981 - 1100 nm)

Germanium:

- ±5% (700 - 1800 nm)

### Ordering Information

- AB2152-1** Si reference cell, 300-1100 nm NIST traceable Calibration (ask for 280 nm optional calibration)
- AB2152-2** Ge reference cell, 700-1800 nm NIST traceable calibration

These cells are included with the AB6000 QE systems as required for the wavelength range of interest.