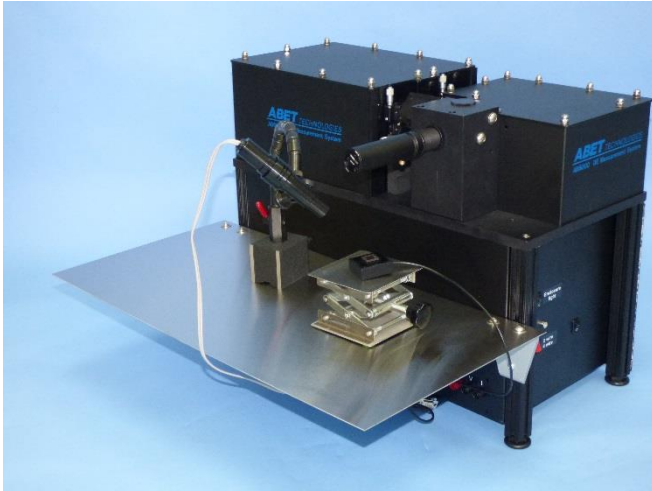


QE (IPCE) IQE LED Powered Spectral Metrology Tools



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. No chopper or order sorting filters are required thus making the system more affordable.

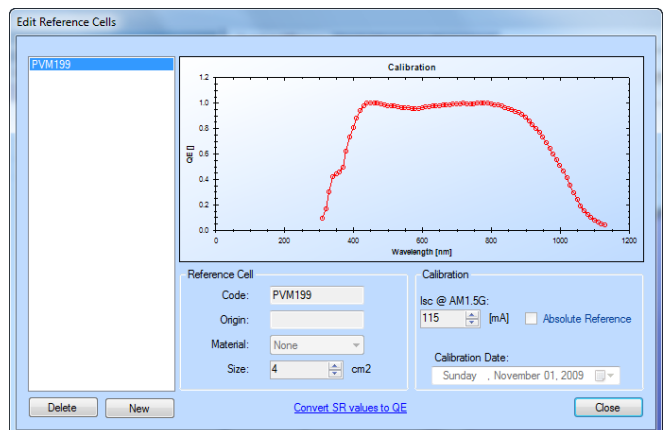
Complete

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.

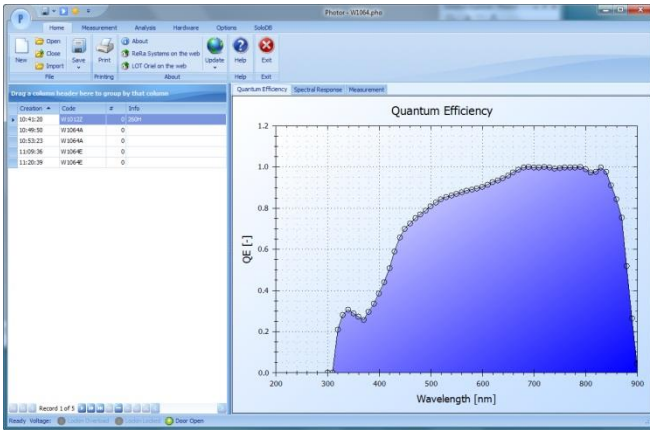
- Complete, Photor driven solutions for spectral characterization
- LED based light engine allows DC to high frequency monochromatic light generation. No chopper or order sorting filters required
- 250 mm focal length, direct drive monochromator offers high scan speed and generous light output
- Software 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)
- ± 10 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.

SPECIFICATIONS

Light is delivered to the dark enclosure through an optical beam tube with a 90° off-axis parabolic reflector on the end. You can use it to deliver light down, up or sideways and, because it is threaded, to also adjust spot distance from enclosure wall.



Standard reflector provides a 35 mm working distance and 2x reduced image of the output slit. This creates approximately a .75x3 mm spot when system is set to the 5 nm resolution slit width.

The system comes equipped with micrometer driven adjustable slits to allow setting of monochromator resolution:

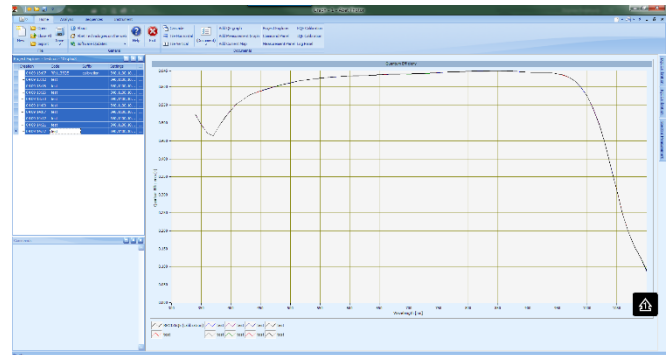
Slits opening (mm)	Resolution for 1200 lpm grating (nm)	Resolution for 2400 lpm grating (nm)	Resolution for 600 lpm grating (nm)
.55	10	4.4	20
1.5	5	2.3	10
3.0	2	1	4

Resolution of the 2400 lpm UV range grating (used up to 499 nm) is about half that of the nominal resolution for the 1200 lines per millimeter grating used between 500 nm and 1100 nm. It is included in every system to allow more accurate metrology in the shorter wavelength region. The 600 lpm grating is used in the extended IR range systems.

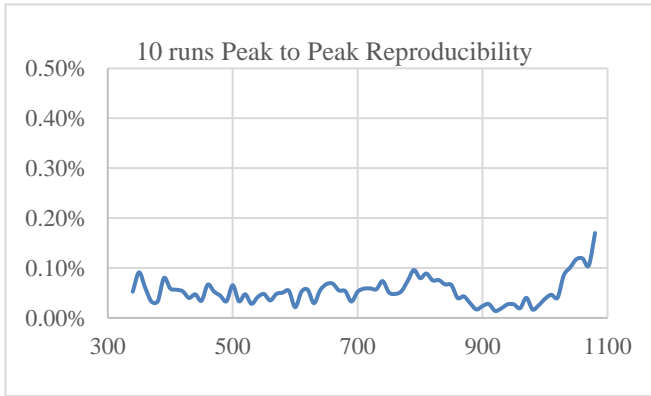
Computer controlled bias light can produce up to one sun of irradiance. Depending on a system it comes mounted on the delivery optics tube or on an articulated arm mount.



Reproducible metrology is assured by a monitor cell. Much better than .5% reproducibility 340-1080 nm on crystalline Si cells with low or no bias light.



10 runs overlaid on the graph



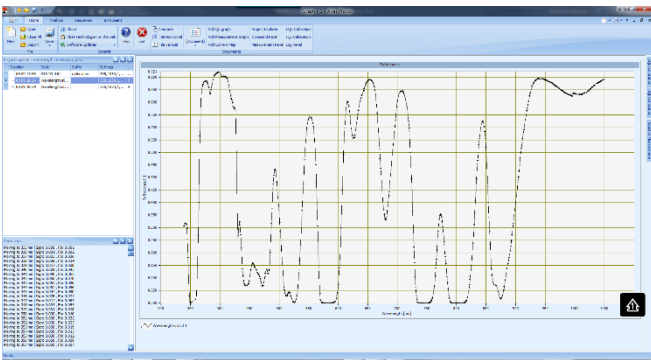
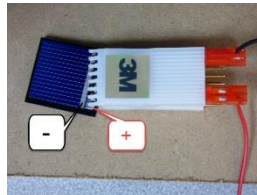
Reference cell accuracy:

Si:
5% (300 - 440 nm)
3% (440 - 980 nm)
7% (980 - 1100 nm)

Ge: 5% (800-1800 nm)

A sample cSi cell and its QE data are included in each shipment to allow system performance check.

A wavelength calibration filter and its scan project allows QE system wavelength calibration check and correction if needed.

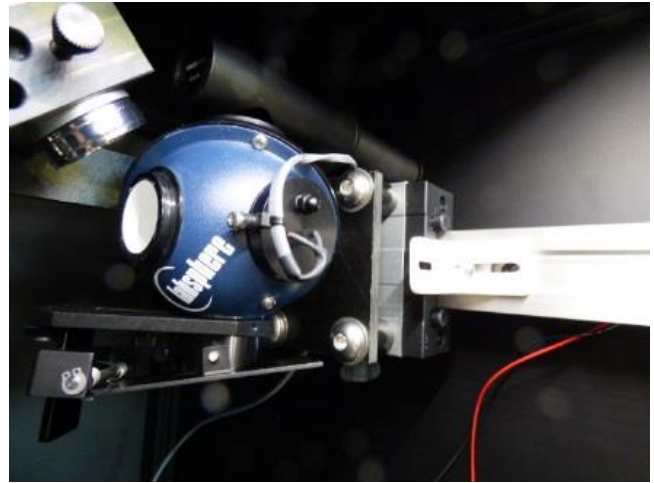


System dimensions (mm):

781W x 621D x 472H
(without the PC Monitor)

System without the dark enclosure:

270W x 546D x 425H



8° Hemispherical IQE option

The IQE total reflectance option includes a 75-mm integrating sphere to collect both specular reflected and diffuse scattered signals from the cell surface. Simply slide it into position to take measurements – no need for output optics modifications.

For systems with the IQE total reflectance option an 85 mm working distance reflector is used, creating a 1:1 imaging system for the output slit. Spot dimensions are approximately 1.5x6 mm at 5 nm nominal bandwidth.

Sample positioning is assisted by the built-in camera bringing spot position picture to your PC screen.



System comes equipped with a standard, highly flexible design sample mount.



Custom designed sample mounting adapters are offered for small or special geometry samples.

Ordering Information

Please use this ordering information as a starting point and contact Abet Technologies or her distributors for any additional product selection guidance. The extensive number of spectral options, and available chucks and probes greatly exceeds the available space on this page.

AB6000 QE Measurement System includes

Installed Photor software package
340-1100 nm LED light engine and drive/modulation electronics DC to 300 Hz
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
temperature metrology 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
Wavelength calibration standard for system check
Set of alligator clip cables for basic device connectivity.

Please order probes and chuck to match your cells separately.

AB6001 QE Measurement System, UV Option includes

All the components and features of AB6000 system and extends the operating range down to 300 nm with a selection of additional LED emitters.

AB6002 QE Measurement System, UV-IR Option includes

All the components and features of AB6001 system and extends the operating range up to 1800 nm with a selection of additional LED emitters as well as:
Ge reference cell
Ge monitor cell
250 mm class triple grating direct drive Monochromator
Computer controlled Tungsten halogen bias light and two additional customer selected color bias lights

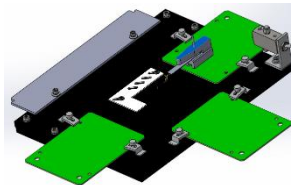
Accessories and Options

AB2160	300-1100 nm IQE total reflectance option
AB2161	300 nm - IR 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
15280	Vacuum pump, QE, low noise
15285	Heating/Cooling Recirculator, dew point to 70C

Reference Cells

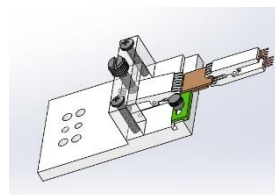
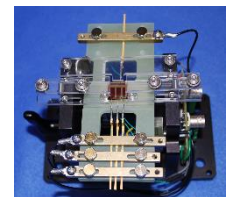
AB2152-1	Si reference cell, 300-1100 nm NIST traceable calibration
AB2152-2	Ge reference cell, 700-1800 nm NIST traceable calibration

Many additional test stations and accessories available – please inquire.



15090 Vacuum hold down Universal test platform, metal base standard and insulating version optional, allows up to three possible locations for the magnetic bases

Standard 15545 test station for up to three device superstrate cells, manually multiplexed; a number of additional variants available for different cell geometries and device counts with manual or electronic multiplexing options



15114 DSSC test station, 2.54 mm contact spacing, for single or multiple sandwich, top-top or top-bottom devices