Oriel® IQE-200™

Newport® Corporation's Oriel ® IQE-200 ™ QE measurement system

- Simultaneous EQE, IQE measurement
- Patent Pending (Quantum Efficiency Measurement System and Method of Use)
- Simultaneous 4 channel Data Acquisition, enables very rapid measurement
- Wavelength Range 300-1100nm (call for extended range)
- Pre-installed dedicated software with single button data acquisition
- Designed for all types of solar cells including Tandem/ Multi-junction designs
- Transmission measurement optional
- Light Bias (white and monochromatic) are available options
- Temperature controlled vacuum chuck available for sample handling
- Manual positioning probe based electrical contacts available
- Motorized X-Y mapping option
- Wavelength dependent IV measurement capable

Newport Experience | Solutions

Newport's Oriel IQE-200 measurement system allows researchers to measure External Quantum efficiency (EQE) also known as Incident Photon to Charge Carrier Efficiency (IPCE) as well as Internal Quantum Efficiency (IQE) for solar cells, detectors, or any other photon-to-charge converting device.

The system utilizes industry standard, durable Oriel components for the light management engine. Each model of the IQE-200 system provides a "turnkey" solution by providing the light source, monochromator, detectors, related electronics, software and PC in a preconfigured, assembled and calibrated format. A variety of accessory modules are available to provide positive sample positioning, temperature control, electrical probing capabilities and light bias. The IQE-200 incorporates a novel detector geometry which splits the beam allowing for simultaneous measurement of EQE and the reflective losses to quantify IQE. In addition, an accessory detector can be mounted which allows for measurement of Transmission through the cell for those samples on a transparent substrate. The unique design of the AC system meets the requirements outlined in ASTM Method E 1021-06.

The IQE-200 accessories customize the system to perform QE measurements incorporating temperature control, light biasing, and even motorized mapping capabilities all controlled by our new QE Commander ™ software system. Adding a source meter also allows for point measurements of the IV response of the cell. In conjunction with motorized mapping, it allows the user to "map" the IV performance of the cell under test in a user definable pattern.

All Oriel components are from Newport Corporation, an industry leader in light sources, spectroscopy products, precision motion control, and continuous wave solar simulators.

WHAT ARE EQE AND IQE?

External Quantum Efficiency (EQE) indicates the ratio of the number of photons incident on a solar cell to the number of generated charge carriers, while Internal Quantum Efficiency (IQE) considers the internal efficiency; that is, the losses associated with photons reflected back from the surface of the cell are also measured to calculate a net efficiency.

The EQE/IQE measurements are critical especially during the materials research and cell design stage to understand the conversion efficiency as a function of the wavelength of light impingent on the cell. The matrix of the solar cells can be altered to optimize the performance of the cells for any given spectral component of the sunlight. The overall efficiency of the cells can be optimized so conversion occurs over a broader spectrum of light, increasing overall performance efficiency of the cell.

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QE APPLICATIONS MATRIX FOR SOLAR CELLS

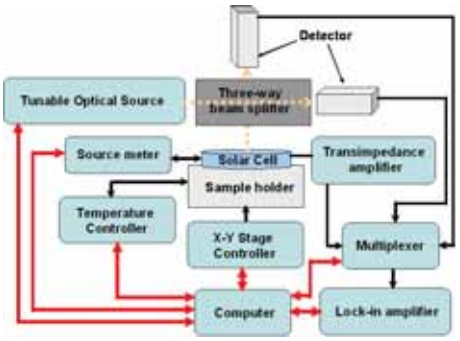
- AC Measurement performed according to ASTM 1021-06
  - All types of cells
  - AC method is preferred where light biasing* is needed
  - Voltage biasing capable with external voltage source (not included)
- Single Junction Cells
  - Si based cells amorphous and mono / poly crystalline
  - Thin film cells
  - CIGS (copper indium gallium diselenide)
  - CdTe (cadmium telluride)
  - DSSC cells at very slow chopper speed where white light bias is needed to excite the cell
- Tandem/Multi Junction Cells
  - A-Si based cells alloyed with Ge, C, O, and N
  - Light biasing option with filters needed to saturate junction not under test
  - Light bias source with adjustable intensity level
  - Color filter(s) needed to DC bias each layer not being tested

Built by Newport Corporation's Oriel Instruments, an industry leader in light sources and spectroscopy, so you can rely on our expertise to ensure the accuracy of the measurement

Product Detail

To accurately measure the EQE/IQE of a solar cell the system calculates the ratio of current produced by the monochromatic light at a given wavelength to the current generated by reference detectors at the same wavelength. The unique optical design of the IQE-200 allows for simultaneous measurement of the sample, reference detector and a second reference detector for reflected light to produce a precise measurement of EQE and IQE simultaneously without repositioning detectors or sample.

The IQE-200 utilizes a modular design concept which allows for flexibility in light source (QTH or Xenon), a 1/8 m monochromator, order sorting filters in a motorized filter wheel and chopper motor with lock-in amplifier to create a flexible platform for AC type measurements of solar cells.



Typical Detection Configuration

- Using Calibrated Si detectors*
- (1) reference detector
- (1) reference detector for measuring reflected light
- (1) optional detector for measuring transmitted light
- Output optics are downward looking and focus to a 1 x 2.5mm spot size at the focal plane (Speak to your sales engineer for upward or side looking output)
- Light Bias Preamp designed to interface a current generating device to work with the Merlin Digital Lock-in Amplifier under light biasing or electrical biasing conditions.

* Other detectors are available for different wavelength ranges

Typical Light AC Engine configuration

- Light source – uses a 250 W Quartz Tungsten Halogen (QTH) Research Source (Xenon is also available). The light source is coupled to a monochromator to create the scanning monochromatic light.
- Cornerstone (CS130) 1/8m Monochromator provides excellent throughput and resolution and is controlled via USB connection through the QE Commander software.
- Filter Wheel with appropriate order sorting filters to minimize second order artifacts
- Merlin lock-in amplifiers, optical chopper and calibrated detectors
  - A single channel Merlin lock-in amplifier is along with a four channel multiplexer to measure up to four channels during a run. The Merlin lock-in amplifier comes with a built-in chopper controller. An optical chopper with one two-aperture blade is also included in the kit.

Software

The Oriel QE Commander software is written using LabView® and comes pre-installed on a laptop computer included as part of the system. The QE Commander software provides control of the hardware via a simple intuitive interface allowing for simple one button data acquisition for EQE and IQE with future options to measure IV at a specific wavelength*. A mapping option is offered which allows the user to create a map of QE performance over a user defined area of the device under test.

QE Commander controls all the basic system components, including the monochromator, order sorting filter wheel, Merlin lock-in amplifier, chopper and light source power supply. It is also designed to control the Oriel accessory light biasing source, chiller for the temperature controlled vacuum chuck and motion controllers for mapping. The software is designed with software hooks to control external GPIB devices, like an external current/voltage source meter. QE Commander measures up to 4 channels in a

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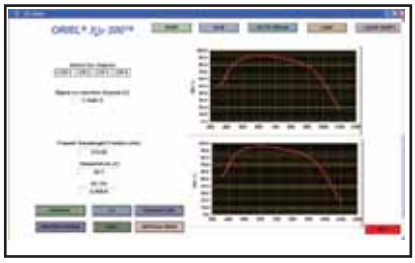
single pass and generates a real time QE curve as a fuction of wavelength being measured. It can provide real time readout of temperature and ISc as well. EQE, IQE, and IV (at a given wavelength) are all calculated in a single pass without the need to reposition detectors or sample, minimizing error in measurement accuracy.

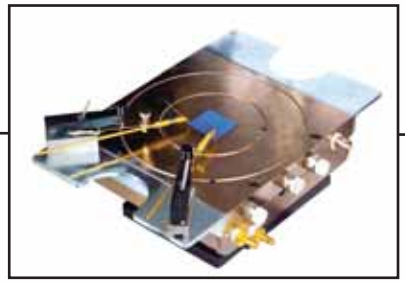


Software also manages the mapping stage allowing for mapping of a cell surface for all parameters.

Contact a Newport Sales Engineer to discuss custom configuration/capabilities.

Sample Handling Options:

- Temperature Controlled Vacuum Chuck (Chiller and Vacuum pump ordered separately)
- Temperature controlled circulating water bath
- Electrical Contact probes
- Vacuum pump
- Light Biasing kit to deliver white or colored biasing illumination



Temperature Control Vacuum Chuck with Electrical Probes

Vacuum Pump

Chiller

Light Bias Kit with Optional Filters

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SPECIFICATIONS

Base System Performance Spec

	Standard
Light Source	250W Quartz Tungsten Halogen Lamp
Spot Size	1mm x 2.5mm rectangular
Working Distance	50mm
Wavelength Range	350-1100nm
Pathlength	1/8M
Resolution	5nm (adjustable)
Repeatability	<±0.5%
Accuracy with Si detector	350-900 <±2% 900-1100 <±5%
Order Sorting Filters (Automated Filter wheel)	5 filters max (standard configuration uses 2)
Signal Acquisition	Chopper with Lock-in Amplifier. Modulation frequency 10-1100Hz
Measurement Type	Simultaneous EQE and IQE measurement
Optical Power Output	10.6μW @ 600nm
Computer Included	Dell Latitude

Sample Handling Temperature Controlled Vacuum Chuck

Sample size	156 x 156mm sq. max.
Temperature control range	15-45 °C (Typically at 25° C ambient)
Temperature holding	<0.5 ° C/minute with Newport chiller P/N: PVIV-Chiller
Sample temperature sensing range	-40 to 125 °C
Sample temperature sensing tolerance	±0.1 ° C
Material	Nickel plated Aluminum
Vacuum requirement	150 mm Hg min.
Cold plate size	6" x 6" (152 x 152mm)
Motion	Micro-meter driven X-Y motion, 1" travel. Motorized option available and custom size available
Weight	9.5 lbs

Vacuum Pump Module

Discharge	Oil free
Max vacuum (hg)	25.5"
Free air (cfm)	1.1
Max psi	60
dB rating	68
Horsepower	1/8 HP
VAC @ 60 Hz	115 (1)
Amps	4.2
Size (inches)	7 11/16 x 5 1/4 x 10 15/16
Connection	Barbed for use with 3/8 inch tubing
Temperature Range	32-104 °F
Weight	8.5 lbs

Probe Kit

Probe Quantity Per Kit	1
Probe Base Quantity Per Kit	1
Probe Positioning (coarse)	Magnetic
Probe Positioning (fine)	X-Y joystick
Probe Tip Material	BeCu standard, other materials available
Probe Tip Diameter	125 microns standard, other sizess available
Connector	Pin tip plug, 0.080" (2mm) pin diameter
Recommended Current Level	< 3A per probe (standard probe tip)

Light Biasing Module

Source	QTH
Light Delivery	Fiber
Number of Fibers	1 Bifurcated to dual output.
Filter Holder (slide mount)	up to 3 filters (1" diameter)
Control/Comm.	RS232 via QE Commander
Intensity	Variable
Weight	11.0 lbs

Chiller Module

Operating Range	10-40 °C
Cooling capacity	150 W at 20 °C (20 °C ambient)
Modes	Cool, Heat, Cycle
Precision	< 0.1 oC with a constant load
Operating voltage	12 VDC, 8 A maximum, universal AC adapter supplied
Power consumption	< 100W
Pump	0.5 lpm gear pump at 10 psi, with a magnetically coupled brushless DC motor magnetically-coupled brushless DC motor (10,000 hr MTBF) see pump curves
Tank volume	75 ml, additional coolant needed to fill hoses and cold plate
Size (inches)	7.5 x 5 x 7" (19 x 13 x 18 cm)
Weight	6.5lbs
Communication	Dry contact alarm and RS-232
Connection	1/8" CPC with shut-off valves
Noise	63dB at 3 feet
Certification	CE

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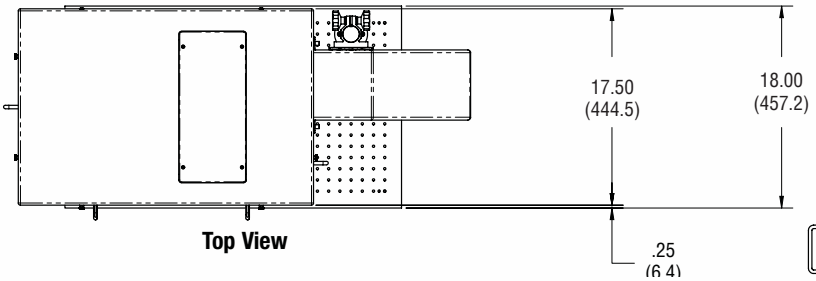
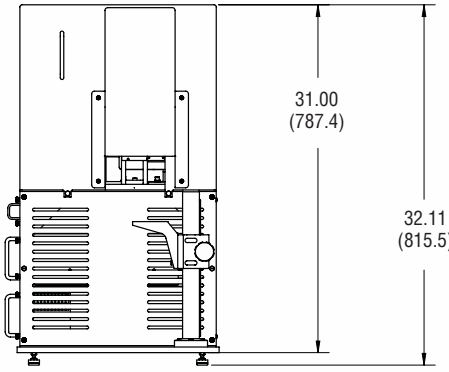
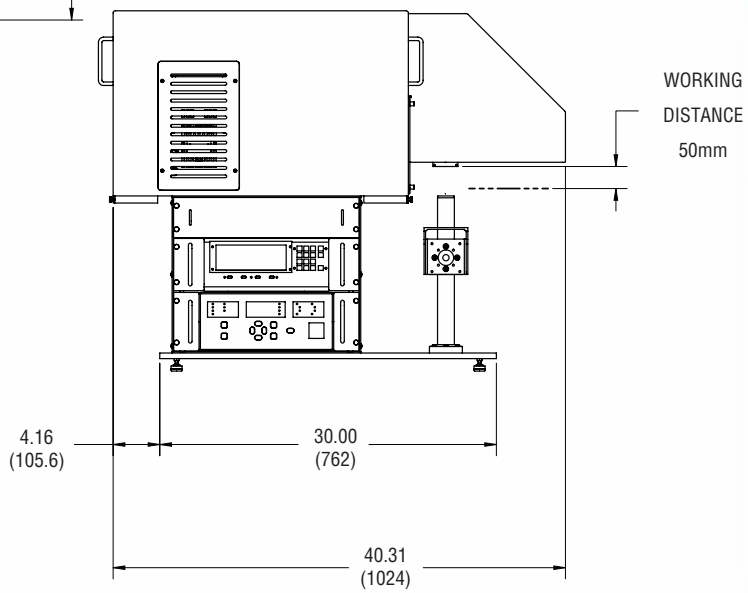
Oriel IQE-200 dimensional drawings



Top View



Front View



Side View

Ordering Information

Model	Description
IQE-AC-QTH-SI	EQE/IQE AC type QTH source based system with Oriel® QE Commander™ software
IQE-AC-QTH-SI-220	EQE/IQE AC type QTH Source based system with Oriel® QE COmmander™ software (220V)
70356.	Calibrated Silicon Detector Package
IQE-TC-VAC	Temperature controlled vacuum chuck assembly for IQE-200 (Chiller and Vacuum pump ordered separately)
PVIV-PROBE-KIT	Magnetic Electrical Probe Kit with X-Y micro control
PVIV-CHILLER	Circulating Water Bath Chiller
PVIV-VAC-PUMP	Vacuum Pump
IQE-LIGHT-BIAS	Light Biasing Kit (Includes External QTH Source, mounting flange and bifurcated fiber optic cable)
CMA-25CCCL	25 mm Travel Closed-loop DC Servo CMA Actuator
SMC100CC	Single-axis motion controller/driver for DC motors
SMC-PS80	Power Supply, SMC100 Series, 80W, 100-240 VAC, 47-63 Hz, 1.9 A max.
6334NS	Replacement Lamp, 250 Watt Quartz Tungsten Halogen

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Newport Experience | Solutions

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