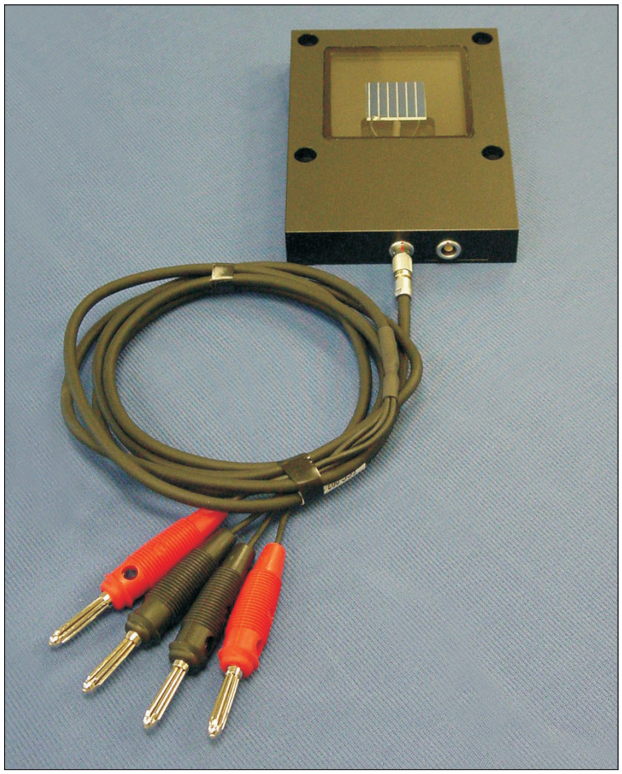
ABET TECHNOLOGIES

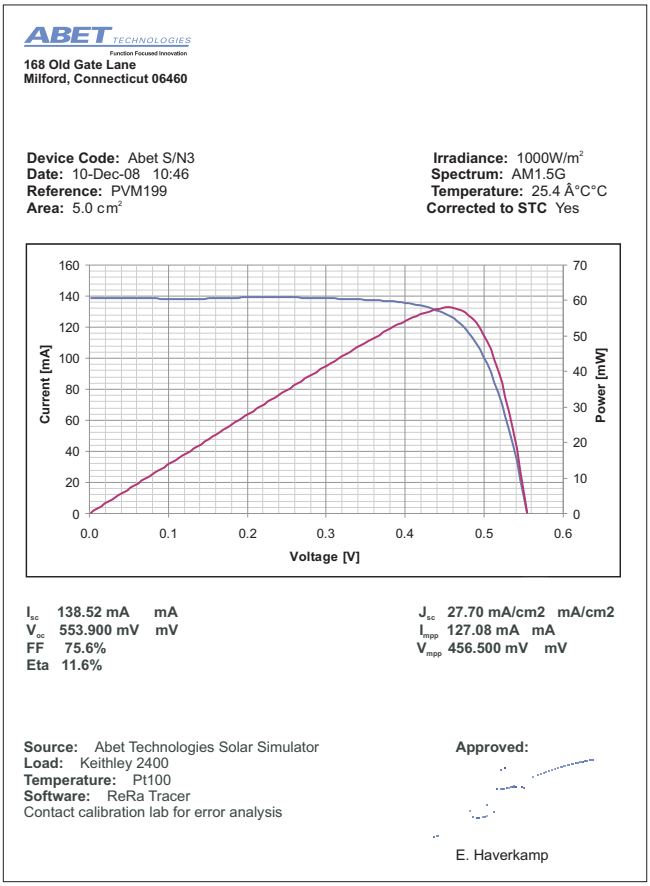
Function Focused Innovation

# Solar Reference Cells

## NIST Traceable Calibration



*Abet Technologies Solar Reference Cell*



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168 Old Gate Lane
Milford, Connecticut 06460

**Device Code:** Abet S/N3
**Date:** 10-Dec-08 10:46
**Reference:** PVM199
**Area:** 5.0 $cm^2$

**Irradiance:** 1000W/$m^2$
**Spectrum:** AM1.5G
**Temperature:** 25.4 Â°C°C
**Corrected to STC** Yes



$I_{sc}$ 138.52 mA mA
$V_{oc}$ 553.900 mV mV
FF 75.6%
Eta 11.6%

$J_{sc}$ 27.70 mA/cm2 mA/cm2
$I_{mpp}$ 127.08 mA mA
$V_{mpp}$ 456.500 mV mV

**Source:** Abet Technologies Solar Simulator
**Load:** Keithley 2400
**Temperature:** Pt100
**Software:** ReRa Tracer
Contact calibration lab for error analysis

**Approved:**

E. Haverkamp

*Calibration report from Radboud University of Nijmegen's calibration lab.*

## NREL calibrated cell used for calibration transfer

The Abet Technologies solar reference cell is a precision instrument for the determination of solar simulator irradiance levels. The sensor is a mono-crystalline silicon solar cell having an area of 2 x 2 cm (4 $cm^2$). The back of the solar cell is attached to the device in such a way that a good heat transfer to the device housing is guaranteed. Below the solar cell a Pt100 RTD temperature sensor is mounted to allow monitoring of device temperature. The device is not shunted allowing the whole IV-curve to be measured. The solar cell is protected by a high quality fused silica window, assuring spectral sensitivity over a 320 - 1100 nm range.

The reference solar cell is calibrated at the PV-device calibration facility of the Radboud University of Nijmegen in the Netherlands. This calibration laboratory uses state of the art instruments to characterize solar cells. All reference solar cells are calibrated against an NREL calibrated reference cell. Calibration is performed using a Class A AM 1.5G spectral distribution Abet Technologies Sun 2000 Solar Simulator at near 1000 $Wm^{-2}$ irradiance level and then corrected to the STC of 1000 $Wm^{-2}$ and 25°C.

Each reference solar cell is delivered with a calibration report showing the IV-curve plot and the following parameters: $I_{sc}$, $V_{oc}$, $I_{mpp}$, $V_{mpp}$, Fill Factor and Efficiency.

Relative spectral response measurement is available as one of the options.

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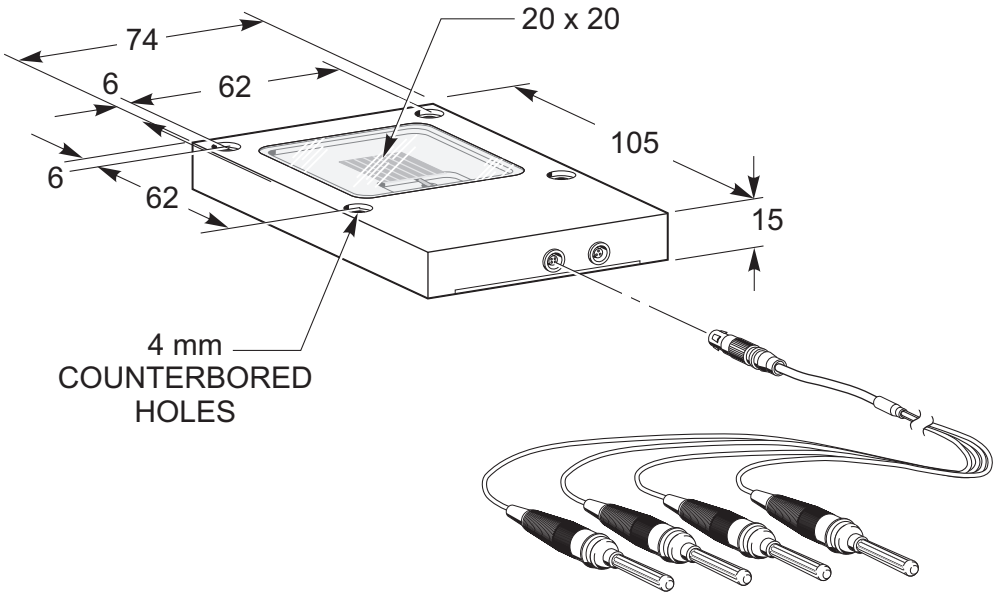


*Dimensional diagram of the Abet Technologies Model 15150 Solar Reference Cell.*

## Using the solar reference cell

The reference cell can be utilized using the PV-IV curve tracer electronics, if they were ordered with your Solar Simulator. It can also be used in a standalone mode using a low input impedance current meter like Abet Technologies 0.1 Ohms input 15158 milliammeter. Four wires are attached to the sensor to make 4-point measurements possible. These wires are terminated with banana connectors (two red and two black). The Pt100 temperature sensor is connected by means of 3 wires. Any 3-wire capable Pt100 readout device can be used to measure the temperature.

Abet Technologies offers an expanding line of ASTM, IEC and JIS standards compliant products for solar cell PV-IV testing, steady state solar simulators, test stations, software, calibrated reference cells and a selection of electronic loads for low and high current cells. Visit www.abet-technologies.com or contact us at sales@abet-technologies.com.

## Specifications

| | |
|---|---|
| Solar Cell | Mono-crystalline silicon |
| Solar Cell Area | 4 $cm^2$ |
| Window | Fused silica |
| Calibration Conditions | 1000 $Wm^{-2}$, AM1.5G, 25°C |
| Irradiance Level Range | 900 to 1000 Wm-2 |
| Spectral Sensitivity | 320 - 1100 nm |
| Parameters Reported | $I_{sc}$, $V_{oc}$, $I_{mpp}$, $V_{mpp}$, Fill Factor and Efficiency |
| Uncertainty in $I_{sc}$ | +/- 3% |
| Temperature Sensor | 3 wire connected Pt100 |
| Cable Lengths | 2 x 1.5 meter |

## Ordering Information

**Reference Cells**

**15150** Solar Reference Cell
**15154** Relative Spectral response calibration option
**15158** 199.9 mA readout, 0.1% accuracy

Abet Technologies, Inc. 168 Old Gate Lane, Milford CT 06460 Tel: 203-540-9990 Fax: 203-301-0059
www.abet-technologies.com sales@abet-technologies.com