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SOLAR
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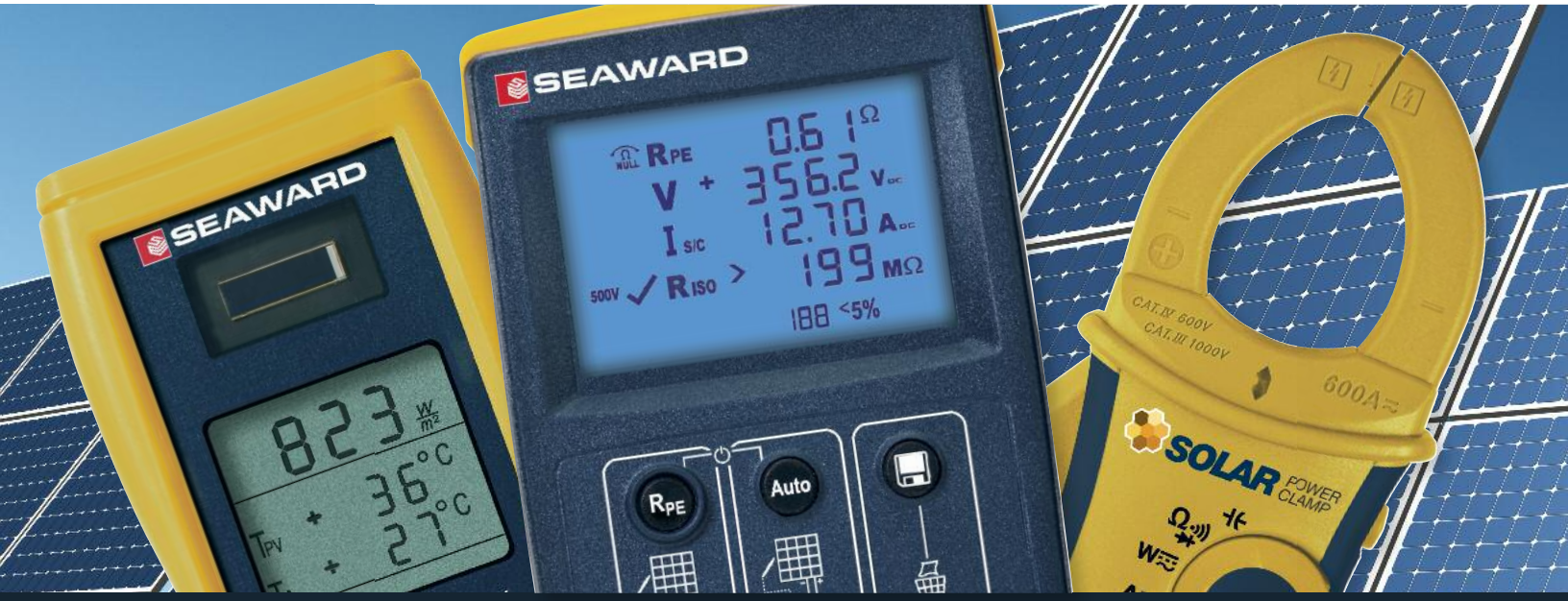

Leading the World in PV Test Solutions

seawardsolar.com/usa

"The PV150 has revolutionized the way we work. Our installers now use one piece of equipment instead of three. We can test a system quickly, simply and we can ensure it's doing what we want it to do."

Martin Cotterell - Sundog Energy and IEC Convenor

SOLAR
From Seaward

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The Seaward Solar range of electrical safety test solutions enables PV installers to meet all testing and certification requirements safely and efficiently.

For an installer to deliver an effective photovoltaic solution the system must be carefully designed and installed to a standard which complies with the relevant State, Federal or International requirements (IEC 62446). The only realistic way to demonstrate this is to rigorously test and document the results.

At Seaward, we have over 75 years' of experience in all aspects of electrical safety testing, not least in product innovation.

Specialized test equipment for photovoltaic installations has been long-anticipated within the industry. Now we have applied our expertize and responded with a product range which helps solar installers to quickly and easily meet the requirements of customers and state or national regulators.

From site survey through to performance testing and documentation, the range covers all bases. The PV150 photovoltaic installation tester features a comprehensive range of test functions, as well as USB download of results.

The Solar Survey unique range of multifunction survey tools enable irradiance, roof tilt and orientation, module and ambient temperature to be quickly and easily measured using a compact handheld device. Additionally, Solarlink™ wireless connectivity enables the Solar Survey 200R to pair with the PV150 installation tester so that irradiance and temperature measurements can be stored within the PV150 simultaneously to electrical tests being carried out, as required by IEC 62446.

The SolarCert Elements software program enables test results to be downloaded and for professional test reports and certificates to be produced.

A host of accessories complement the solar range, and an advance Solar Power Clamp is ideal for power analysis, troubleshooting and efficiency measurements.

With our complete range of PV electrical test equipment, you can be sure we have a solution for you.

Solar PV Installation.

4 step commissioning process.

1. Solar Site-Survey

Irradiance, orientation and roof tilt must be measured and recorded as part of the solar site-survey which is a requirement of IEC 62446.

Solar Survey 100/200R Irradiance Meters

- Irradiance is measured using a reference cell to offer a more representative reading
- The Solarlink™ feature of the Solar Survey 200R enables irradiance to be measured and displayed on the PV150 tester via wireless connectivity
- Measures inclination and roof pitch
- Measures ambient air and module temperature

2. Commissioning Tests

A series of commissioning safety tests are required by IEC 62446;

- Ground Continuity
- Polarity
- PV String Open Circuit Voltage
- PV String Short Circuit Current
- Array Insulation Resistance
- PV String Operational Current

PV150 Solarlink™ Test Kit /PV100 Test Kit

- Includes the comprehensive PV150 multifunction tester which combines all electrical tests required by IEC 62446
- Connects wirelessly with the Solar Survey 200R to display irradiance measurement on its screen*
- USB port enables direct download of test readings into certification software
- AC/DC current clamp supplied to enable current measurement
- Test adaptors supplied to enable safe and simple connection to most major PV modules

*PV150 Solarlink Test Kit only

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3. System Documentation

There is a requirement to record the results of the commissioning tests along with other system information. For record-keeping and traceability purposes these have to be handed over to the client.

SolarCert Elements

- Manual data entry into professional IEC 62446 certificate and report templates
- Download test results from PV150 and Solar Survey 200R via USB
- Stores system documentation
- Print, email or save documentation

PV Inspection Test Report & Certificate Pads

- High quality carbon copy test report and certificate pads for handwritten certification.

4. Performance Maintenance & Diagnostics

To ensure optimal return on investment and power output, it is important to check the efficiency of inverters as part of system inspection and testing.

Solar Power Clamp

- Advanced AC/DC power analysis tool used for maintenance, troubleshooting and efficiency measurement on PV systems
- Power factor measurement and harmonic analysis up to the 25th harmonic enables analysis of the inverter's performance

Solar Survey 100/200R Irradiance Meters

- These meters help to identify deviations in irradiance and temperature from the module manufacturer's standard test conditions (STC) to determine how this will affect I-V curve tracing.

The Solar Installation PV150.

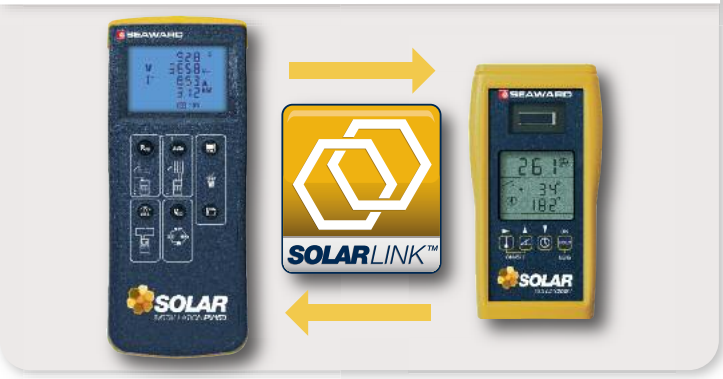
The fastest, safest and easiest to use Solar PV installation tester on the market. Now with USB and wireless Solarlink™ connectivity.

The new PV150 combines all PV electrical test functions required to meet IEC 62446 into one safe, easy-to-use, hand-held device.
The addition of USB and wireless Solarlink™ connectivity make the PV150 the most versatile PV tester on the market.

Using Seaward Solarlink™, the PV150 can capture and record real-time irradiance, ambient temperature and PV module temperature measurements from the Solar Survey 200R wirelessly. This means you can take all measurements, as required by IEC 62446 standards, simultaneously.

It has increased memory size of up to 200 complete test records and USB download to PC for complete traceability and report/certificate creation. It's also able to measure DC power whilst the PV system

Solarlink™ Connectivity



Key features and functions

- Combines all commissioning tests required by IEC 62446
- Featuring new Seaward Solarlink™
- Increased memory capacity: up to 200 records
- USB download to PC
- Simple, safe, user interface
- Single key testing and measurement
- Safe test connections with energised PV arrays
- Direct connection to PV modules
- Earth continuity measurement
- Earth test lead null (up to 10ohms) for long test-leads
- PV string open circuit voltage measurement up to 1000V DC
- Open circuit voltage polarity indication
- PV string short circuit current measurement up to 15A DC
- PV array insulation test at 250/500/1000V
- Rugged and robust

PV System Electrical Commissioning Tests

SOLAR From Seaward

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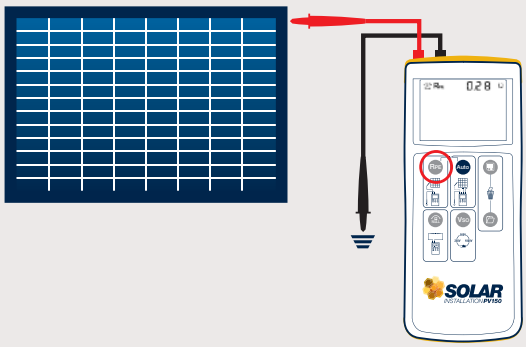
The PV150 enables simple, safe and fast testing of photovoltaic systems to IEC 62446 and various state regulations as shown below

5.4.2 Ground Continuity

Where protective earthing and/or equipotential bonding conductors are fitted, such as bonding of the array frame, the continuity should be tested.

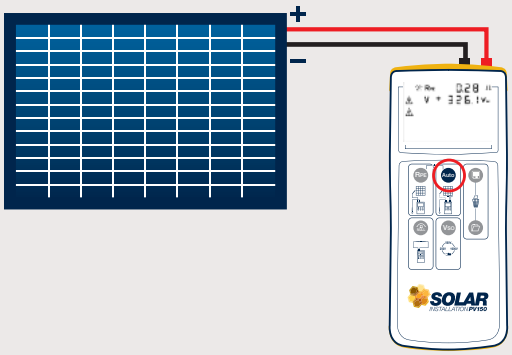


5.4.3 Polarity Test

For reasons of safety and prevention of damage to other equipment in the system, the polarity of all DC cables should be verified before other tests are performed. The PV150 does this automatically as part of the PV String Open Circuit Voltage test.

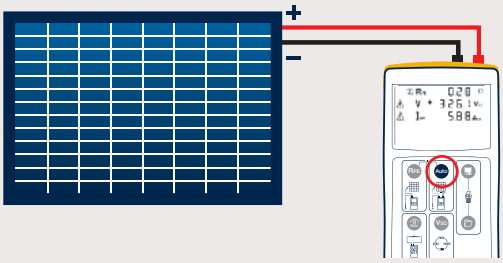
5.4.4 PV String Open Circuit Voltage

Measured to ensure correct installation and operation of each PV string. Measured values should be compared with expected values. For systems with multiple identical strings, values should be within 5% of other PV strings in array.



5.4.5.2 PV String Short Circuit Current

Short circuit of current is measured to ensure correct installation and operation of each PV string. Measured values should be compared with expected values. For systems with multiple identical strings, values should be within 5% of other PV strings in array.

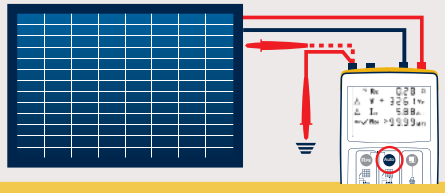


5.4.7 Array Insulation Resistance

Measured from the array positive and negative to ground and compared with minimum acceptable values specified by national requirements and IEC 62446.

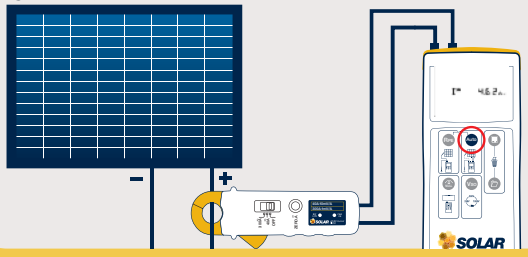
Test voltage is selected according to the PV system voltage (Voc stc x 1.25), this determines the minimum acceptable values:

- 250V is used for systems less than 120V
- 500V for systems between 120V and 500V
- 1000V for systems over 500V.



5.4.5.3 PV String Operational Current

Operational current is measured with the system in normal operation mode and compared with the expected value. For systems with multiple identical strings, values should be within 5% of other PV strings in array.



PV150 Solarlink™ Test Kit.

A complete solution to the testing and measurement requirements for photovoltaic installations.

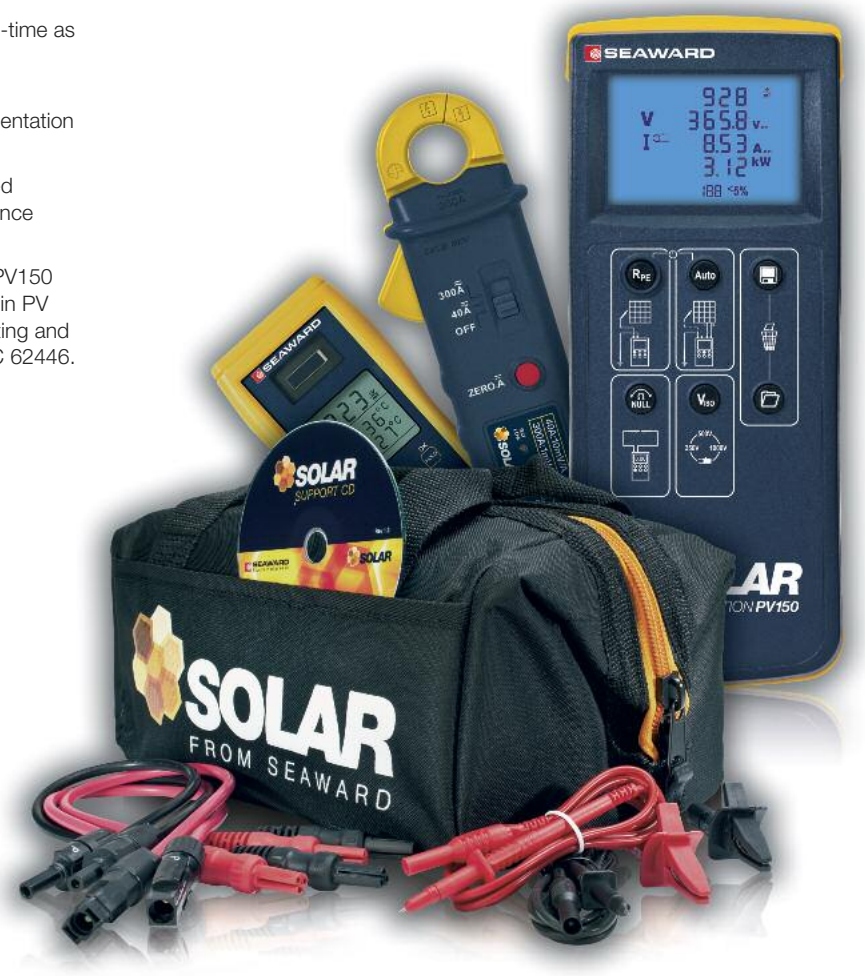
The PV150 Solarlink™ Test Kit meets all of the commissioning test requirements of IEC 62446. It combines the PV150 installation test kit with the advanced Solar Survey 200R irradiance meter; offering the complete solution.

The kit includes all of the necessary equipment to measure the electrical safety and performance of PV systems as well as irradiance.

Key features and functions

- The comprehensive PV150 tester conducts all of the required electrical tests at the touch of a button.
- Solarlink™ connectivity between the PV150 tester and the Solar Survey 200R irradiance meter enables irradiance to be displayed and for irradiance, module and ambient temperature to be recorded within the PV150 in real-time as electrical tests are conducted.
- USB download of stored test results and irradiance measurements speeds up the completion of documentation and improves traceabilityof results.
- Solar Survey 200R uses a temperature compensated reference cell for accurate and representative irradiance measurements.
- If combined with SolarCert Elements software, the PV150 Solarlink™ Test Kit represents the complete solution in PV commissioning, containing all that is needed for testing and documenting installations to the requirements of IEC 62446.

- **PV150 solar installation tester**
- **Solar Survey 200R irradiance meter**
- **AC/DC current clamp**
- **Rugged carry bag**
- **2 x MC4 test lead adaptors**
- **Red and Black Test leads, with test probe with detachable alligator clips**
- **Quick Start Guides**
- **Support CD-Rom including instructional video guide**
- **Calibration certificates for PV150 and Solar Survey 200R**



Part No: 388A917

Specification:

GROUND CONTINUITY

Display Range	0.00Ω to 199Ω
Measuring Range	0.01Ω to 199Ω
Resolution	0.01Ω maximum
Open Circuit Test Voltage	4VDC, nominal
Short Circuit Test Current	>200mA (as per IEC 61557-4)
Test Lead Compensation	Null out up to 10Ω
User Protection	Warning and test inhibited if ≥ 30V AC/DC detected at inputs

INSULATION RESISTANCE

Display Range	0.05MΩ to 199MΩ
Measuring Range	0.05MΩ to 199MΩ
Resolution	0.01MΩ maximum
Open Circuit Test Voltage	250V, 500V, 1000VDC (as per IEC 61557-2)
Short Circuit Test Current	>1mA, <2mA s/c as per IEC 61557-2
Visible Warning	≥ 30V AC or DC at inputs

OPEN CIRCUIT VOLTAGE

Display Range	0.0VDC to 1000VDC
Measuring Range	5.0VDC to 1000VDC
Resolution	0.1V maximum
Enunciators	DC voltage polarity correct or reversed

SHORT CIRCUIT CURRENT

Display Range	0.0A – 15.00A
Measurement Range	0.5A – 15.00A
Resolution	0.01A

OPERATING CURRENT (USING AC/DC CURRENT CLAMP)

Display Range	0.0A – 40A
Measurement Range	0.5A – 40A
Resolution	0.1A max

DC OPERATING POWER

Display range	0.0kW – 40.0kW
Measurement ranges	0.1kW – 40.0kW
Resolution	0.1kW

DATALOGGING AND CONNECTIVITY

Datalogging	Up to 200 complete test datasets Download utility software included Compatible with SolarCert Elements software (version 1.1)
Connectivity	USB download to PC Wireless 'Solarlink™' to Survey 200R (range c. 100m / 330 ft)

GENERAL SPECIFICATIONS

Display	Custom LCD with backlight
Power Supply	6 x 1.5V Alkaline LR06
Battery Life	>1000 test sequences
Auto Power Down	After 1 minute

ADDITIONAL INFORMATION

Warranty Period	2 years
Calibration Interval	1 year

Calibration Certificate supplied

See page 14 for the Survey 200R Irradiance Meter specification

Solar Survey 100/200R Multifunction Irradiance Meters.

The ultimate solar site survey tools.

Survey 100 Part No: 396A910
Survey 200R Part No: 396A916

The Solar Survey series of multifunction irradiance meters are the perfect tools for conducting comprehensive solar site surveys.

The 200R now features a wireless link to the Solar PV150 installation tester, called Seaward Solarlink™.

Seaward Solarlink™ allows the Solar Survey 200R to give the PV150 real-time irradiance, ambient temperature and PV module temperature measurement results simultaneously to commissioning tests being conducted as required by the IEC 62446 standard. Results can be downloaded from the PV150 into the SolarCert Elements software.

Both 100 and 200R incorporate a display hold feature which enables readings to be captured in difficult locations. The Solar Survey 200R has the added benefit of a large internal memory, real-time clock for data logging purposes and USB interface for download to a PC.

With their high specification, these irradiance meters measure the sun's energy simply and quickly. They display the information in either W/m^{-2} or BTU/hr-ft^2 making them ideal for both solar photovoltaic and thermal applications.

Irradiance measurements are made using a photovoltaic reference cell giving a more representative measurement of solar energy and greater accuracy and repeatability compared to irradiance meters which use simple photo-diodes.

What distinguishes the compact, rugged Solar Survey 100 and 200R as truly versatile and indispensable instruments are their unique additional features of digital compass, digital tilt meter and dual channel temperature measurement.

These features let the operator rapidly identify the best location for harnessing the sun's energy. Dual channel temperature allows the installer to accurately and quickly measure ambient and module temperature, which are used to identify deviations from standard test conditions and thus ensure accurate I-V curve tracing.

Key features and functions

- Suitable for both photovoltaic and solar thermal installations
- Measures irradiation as required by IEC 62446
- 200R features Seaward Solarlink™ for simultaneous measuring
- Built-in compass and inclinometer measure roof orientation and pitch
- Dual channel temperature measurement
- Built-in data logger and USB interface (Solar Survey 200R model only)
- Rugged, robust and hand-held

Specification:

IRRADIANCE

Display Range	100 – 1500 W/m^{-2} or 30 – 500 BTU/hr-ft^2
Measurement Range	100 – 1250 W/m^{-2} or 30 – 400 BTU/hr-ft^2
Resolution	1 BTU/hr-ft^2 / 1W/m^{-2}

TEMPERATURE

Display Range	-30°C to +125°C
Measurement Ranges	-30°C to +125°C
Resolution	1°

COMPASS BEARING

Display Range	0° to 360°
Measurement Ranges	0° to 360°
Resolution	1°

INCLINOMETER

Display Range	0° to 90°
Measurement Ranges	0° to 90°
Resolution	1°

DATALOGGING AND CONNECTIVITY (SURVEY 200R ONLY)

Datasets	5000
Sample Rate	1 to 60 minutes (user definable)
Datalogging	Download utility software included
	Compatible with SolarCert Elements software (version 1.1)
Connectivity	USB download to PC
	Wireless 'Solarlink™' to PV150 (range c. 100m / 330 ft)

GENERAL SPECIFICATIONS

Display	Custom LCD
Power Supply	2AA Alkaline Batteries
Battery Life	>20,000 Readings
Auto power down	After 2 minutes

SERVICEABILITY

Warranty	2 years
Calibration	1 year

Calibration Certificate supplied

Solar Power Clamp.

Advanced power analysis tool for fast and easy efficiency measurements.

Part No: 396A961

The Solar Power Clamp is a feature-packed Power Analyser designed to enable maintenance, troubleshooting and efficiency measurements on photovoltaic systems.

The Power Clamp simplifies and speeds up the process of determining the efficiency of PV systems. It can quickly measure current and voltage at both the AC and DC sides of the inverter, giving a true RMS reading of the power whilst the system is operational.

The Solar Power Clamp can be used when installing a PV system to ensure the inverter is operating correctly or for maintenance and troubleshooting on the PV system after commissioning.

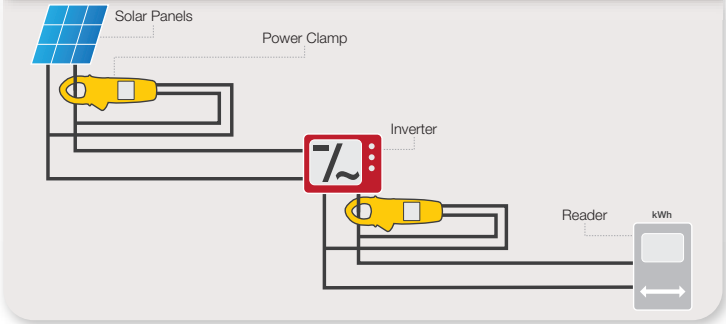
In addition to power and efficiency measurements, the harmonic analysis function of the Solar Power Clamp can be used as a means of detecting faults within the inverter.

As PV systems have a lifetime of over 25 years, periodic inspection and testing is necessary to ensure that they are operating efficiently. Most inverters have a lifetime much shorter than that of the entire system and so require particular attention as part of system inspection, and testing, to ensure optimal system return on investment and power output.

Key features and functions

- High performance instrument for measuring AC and DC power
- Includes MC4 test leads for DC power measurements (others available)
- Power factor measurement and harmonic analysis up to 25th harmonic for inverter performance analysis
- Rugged, robust and handheld, with active backlight and inbuilt cable illuminating torch – ideal for use in confined and/or dark spaces
- Full clamp-on multimeter capabilities

Energy and Efficiency



Specification:

Accuracy is ± (% reading + number of digits) AT 23°C ± 5°C < 80%RH

ACTIVE POWER

Function	Range	Accuracy
ACW / DCW	0.000kW – 599.9kW	A, error*V, reading + V, error *A, reading

VOLTAGE

Function	Range	Basic Accuracy
DCV	0.00 – 999.9V	± (0.7% + 2dgt)
ACV	0.00 – 999.9V	± (1.0% + 5dgt)
LPF (ACV)	0.00 – 999.9V	± (1% + 5dgt) @ 50Hz - 500Hz ± (5% + 5dgt) @ >60Hz - 400Hz
Resolution (all)	0.01 V	

CURRENT

Function	Range	Accuracy
DCA	0.00A – 99.99A	± (1.5% + 0.2 A)
	100.0A - 599.9A	± (1.5% + 5dgt)
ACA	0.10A – 599.9A	± (1.5% + 5dgt) 50Hz - 60 Hz ± (2% + 5dgt) >60Hz - 500 Hz
LPF	0.10A – 599.9A	± (1.5% + 5dgt) 50Hz - 60 Hz
ACA		± (5% + 5dgt) >60Hz - 500 Hz

PEAK HOLD : PEAK MAX / PEAK MIN

Function	Range	Accuracy
ACV	140.0V	± (3.0 % + 15dgt)
	140.0V	
ACA	140.0A	± (3.0% + 15dgt)
	850A	

FREQUENCY

Function	Range	Accuracy
Frequency	20.00Hz - 9.999kHz	± (0.5% + 3dgt)

TOTAL HARMONIC DISTORTION

Function	Range	Accuracy
ACA /ACV	0.1 – 99.9%	± (3.0% + 10dgt)
Resolution	0.1%	

Harmonic Order	Range	Accuracy
H01 ~ H12	0.1 – 99.9%	± (5% + 10dgt)
H13 ~ H25	0.1 – 99.9%	± (10% + 10dgt)
Resolution	0.1%	

INRUSH CURRENT

Function	Range	Accuracy
ACA	0.00A - 99.99A	± (2.5 % + 0.2A)
	100.0A - 599.9A	± (2.5 % + 5dgt)

POWER FACTOR

Range	-1.00 - 1.00
Resolution	0.01
Basic Accuracy	± 3°± 1dgt

RESISTANCE, CONTINUITY & DIODE

Function	Range	Accuracy
Resistance	0.0Ω - 999.9Ω	± (1.0% + 5dgt)
	1.00kΩ - 99.99 kΩ	± (1.0% + 3dgt)
Continuity	0.0Ω - 999.9Ω	± (1.0% + 5dgt)
Diode	0.40 ~ 0.80V	± 0.1V

CAPACITANCE

Function	Range	Accuracy
Capacitance	0.000 µF - 4000 µF	± (1.9% + 8dgt)
Resolution	0.001 µF max	

GENERAL

Safety	**IEC 61010**
Power Requirement	Single 9V battery
Battery life	~ 100 hours (alkaline battery)
Size	87 mm (W) x 239 mm (L) x 51 mm (H)

ADDITIONAL INFORMATION

Warranty Period	2 years
Calibration Interval	1 year

SolarCert Software.

Easy-to-use Software for Solar PV Test Reporting and Certification.

SolarCert Elements is an easy to use, fast and functional software program. It's another Seaward total solution, designed to help you test, report and certificate in virtually every Solar PV testing situation. You can use SolarCert's manual data entry program to record and store data from each Solar PV installation you test. And now, using the PV150 installation tester, you can download the results into the software for added simplicity.

Finding individual pieces of measurement data is easy, as is viewing and printing records. With SolarCert, you can also access professional test and inspection reports as well as produce commissioning and performance verification documents.

Part No: 393A910

How SolarCert software helps your business

- Produces PV system verification report, PV array test reports and PV system inspection reports, as recommended by the international standard IEC 62446
- Generates professional reports and certificates
- Intuitive, easy to use
- Searches, views and prints records
- Saves to PDF format
- Improves efficiency and productivity
- Provides full traceability

PV Inspection Test Reports & PV System Verification Certificate pads for hand written records are also available

SOLAR
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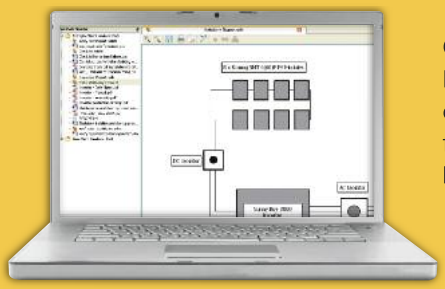
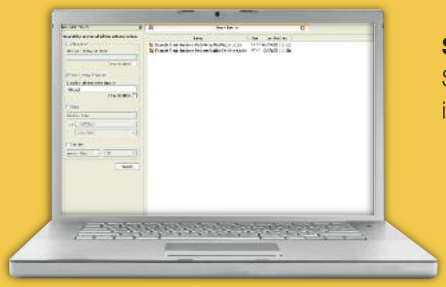
Step-by-step checklist for compiling reports
An easy-to-follow checklist gives installers peace of mind that all items required for a client handover pack are included in each project file, and makes compiling the correct information easier.

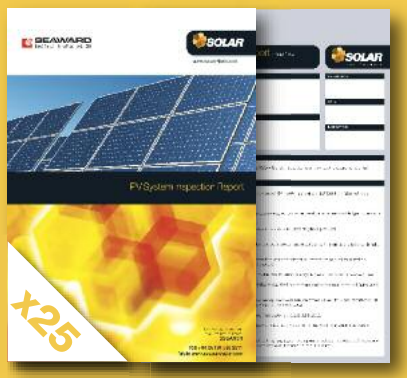


Create installation diagrams
Easily create clear and concise representations of the PV circuit design with the schematic capture feature. Drag and drop components to create bespoke diagrams for each installation.



Search for existing client handover packs easily
Searching for past projects and client handover packs is easy with the built-in search function.

Customise certificates and reports
Within SolarCert Elements, PV test certification and reports can be customised with your company logo. Enabling professional looking documents to be very easily produced.



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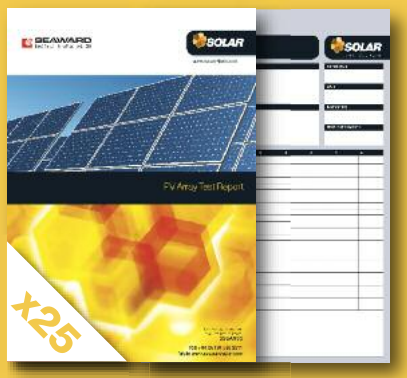

Part No: 396A955

Part No: 396A956

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Rev 1.3