

# PV Cable Assembly Tools

Crimp-on PV cable connectors (See Wire and Cable section) require special tools to properly attach the connectors. Single-purpose tools from **Multi-Contact** and **Tyco** work with only that type of connector and are often the best option for installers who work only with modules that have that same connector type. For those who encounter several different types of connectors, one of the **Rennsteig** tool sets that have a set of dies and positioners can be more convenient and economical than carrying a different tool for each connector type.



## MC4 Tools

The Multi-Contact MC4 **crimping tool** is used to assemble MC4 (Solarline 2) locking connectors with 10 or 12 AWG stranded wire. A set of 2 plastic wrenches is used to tighten the sealing nut in the connector and to unlock the male and female connector.

Multi-Contact MC4 Tools	
Description	Item code
MC Solarline 2 MC4 pin crimper for 10/12 AWG wire	094-00104
MC Solarline 2 open-end spanner set (2-pack)	094-00112



## Tyco SolarLok Crimping Tool

The Tyco SolarLok **crimping tool** is used to assemble SolarLok locking connectors with 10 or 12 AWG stranded wire.

Tyco SolarLok Crimping Tool	
Description	Item code
Tyco crimper for 10/12 AWG wire	094-00114



## Hammer Crimp Tool

This simple, inexpensive crimping tool can be used to crimp connectors on 8 through 4/0 AWG wire. Spring-loaded pin locks are in “up” position for loading connector and cable. When released, the pin holds the connector securely during crimping. Use with a hammer or vice.

Hammer Crimp Tool	
Description	Item code
Hammer crimp tool	094-00013



## Battery Cable Tools

Use the cable crimper to crimp battery terminals, copper lugs, and splices on wire from 8 to 4/0 AWG. Adjustable crimp dies are clearly marked and easy to rotate into position. This UL-Listed, 26-inch tool gives you plenty of leverage for secure crimping.

Use the 22-inch long cutter to cut inverter cables and battery interconnects up to 6/0 AWG. Available in a bench-mount version as well as hand-held, the high-carbon steel blades are removable for sharpening or replacement. All of these tools are made in the U.S.A.

Battery Cable Tool	
Description	Item code
Cable cutter 22-inch bench mount	094-00003
Cable cutter with 22-inch handles	094-00004
Cable crimper with 26-inch handles	094-00011

# Rennsteig

## Crimping Tool Sets and Accessories



These Rennsteig tool sets are helpful for installers who wish to make their own extensions and connections. The tools presented here cover the most popular connectors, including those on REC Group (Hosiden), Suniva (MC4), and Hanwha (H4) modules. All of these tools are made in Germany.

The **Tyco/MC4/H4 Solarkit** comes with 3 die-sets and 3 pin locators for crimping Tyco SolarLok, Solarline 2 (MC4) and Amphenol Helios (H4) pins as well as a cutter and stripper tool, all in a hard shell case.

The **Solar Crimp Sets** come with die-sets and pin locators for the connectors shown in the table below. The sets include the hard shell case, but no additional tools. Additional dies and pin locators can be added to expand the tool.

The **Solar Crimp Tools** include the preassembled tool frame, die, and pin locator, but no case. Additional dies and pin locators can be added to expand the tool. The **Insulation Stripper** strips and removes the insulation in a single motion. The **blades** are replaceable. The **Wire Cutter** features a specially curved set of shears that cuts stranded wire without significant deformation. The **Empty Tool Frame** can be used with separately purchased crimping **Dies** and **Pin Locators**, which are interchangeable.

Note that due to unique design requirements, the **Hosiden Crimp Tool** is only available preassembled and cannot be used with the interchangeable dies.

Rennsteig Kits, Sets and Crimping Tools				
				Item code
Solarkit	Tyco, MC4, H4	Varies by connector	624 105-H4M4TE	<b>094-00148</b>
Solar Crimp Set	Tyco Solarlok	16/14/12/10 AWG	624 105 1 3	<b>094-00124</b>
Solar Crimp Set	Hosiden	14/12/10 AWG	625 511903 1 RT	<b>094-00149</b>
Solar Crimp Tool	MC4 Solarline 2	12/10/8 AWG	624 1193 3 1	<b>094-00144</b>
Solar Crimp Tool	Amphenol H4	14/12/10/8 AWG	624 1194 3 1	<b>094-00135</b>
Solar Crimp Tool	Tyco Solarlok	16/14/12/10 AWG	624 817 3 1	<b>094-00145</b>
Solar Crimp Tool	Hosiden	14/12/10 AWG	624 1190 3 1	<b>094-00150</b>
Rennsteig Tools and Components				
				Item code
Insulation Stripper	NA	16/14/12/10 AWG	707-226-1-6US	<b>094-00128</b>
Replacement Blades			708 226 1 3 0	<b>094-00138</b>
WireCutter			700-016-36	<b>094-00129</b>
Empty tool frame	(Use with pins & dies )	NA	624 000 3	<b>094-00146</b>
Die only	MC4 Solarline 2	12/10/8 AWG	624 570 3 0	<b>094-00126</b>
Pin Locator only			624 194 0 01	<b>094-00132</b>
Die only	Amphenol H4	14/12/10/8 AWG	624 1194 3 0	<b>094-00130</b>
Pin Locator only			624 1194 0 01	<b>094-00131</b>
Die only	Tyco Solarlok	16/14/12/10 AWG	624 817 3 0	<b>094-00127</b>
Pin Locator only			624 817 0 01	<b>094-00133</b>



## Why Measure Shade

When a solar PV module is even slightly shaded, it is severely impacted. For example, the module shown to the left has 2% of its cell area shaded. The power output of the module is reduced by 33% – a 17:1 impact factor! This is true even if a microinverter or power-optimizer is used. When a solar hot water module is shaded, its output energy is reduced proportional to the % of shaded area.

## Solmetric

### Solmetric SunEye 210 Site Analysis Tool

The **Solmetric SunEye 210** assesses total potential solar energy given the orientation and shading of a particular site. Data provided by the SunEye can dramatically improve the speed and accuracy of energy production estimates, which are increasingly required by financiers and incentive programs.

The SunEye 210 is useful for PV and solar thermal hot water systems, whether roof- or ground-mounted. It quickly and easily provides shading analysis that can be used to optimize new systems for maximum production, troubleshoot under-production, and identify specific shade-causing obstructions and quantify their effects.

The SunEye 210 uses a calibrated fish-eye lens digital camera and electronic compass to measure roof tilt and azimuth and to simulate removal or addition of shading objects or structures. It works anywhere in the world, providing easy measurements and instant feedback for quick estimates and accurate system designs. Data can also be stored for later review. The SunEye interfaces to the USB port of a PC or laptop using the included SunEye Desktop software. A Solar Access and Shading Report summarizes the data from each session. The SunEye also outputs data files that are compatible with various simulation and design programs, including PV Designer.

The GPS version automatically finds the latitude and longitude ( $\pm 3$  m) for sun path calculations and displays, and each skyline reading can be automatically geo-tagged with the coordinates, enabling the locations and data to be output to Google Earth. This feature is especially useful for larger projects with multiple skylines, or for quickly accessing data from multiple sites.

The **SunEye Desktop** software works on PCs with Windows 7, Windows XP SP2, or Windows 2000 SP4. Currently, the SunEye software requires a Windows emulator to run on Mac OS.

### Solmetric SunEye Extension Kit

The **SunEye Extension Kit** enables accurate measurements up to 5.4m (~18 ft) above ground level without a ladder. A cradle at the top of a telescoping extension pole holds the SunEye 210 securely without obstructing its field of view. When using the Extension Kit, SunEye skylines are captured by rotating the pole. The SunEye provides audio feedback to indicate a successful capture or error. The SunEye will automatically correct the measurements for azimuth and tilt using inputs from the on-board sensors. The extension kit is particularly helpful for assessing shading on structures that do not yet exist, such as carports or tall ground mount systems, or when an existing roof cannot be safely accessed.

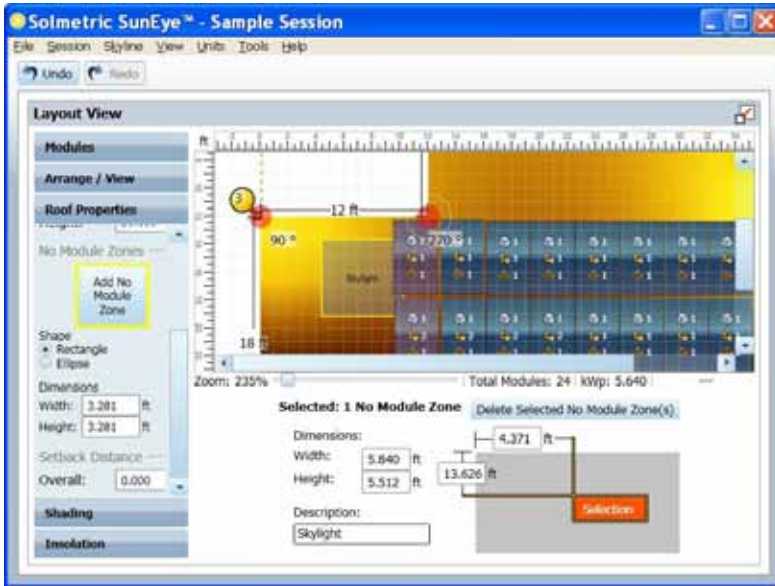


Solmetric SunEye Site Analysis Tools and Accessories	
Description	Item code
Solmetric SunEye 210 Tool with worldwide operation	094-00200
Solmetric SunEye 210 Tool with worldwide operation and GPS	094-00201
Solmetric SunEye Extension Kit	094-00210

# System Design Tools

## PV Designer Software

PV Designer software enables you to draw roof outlines, specify set-backs and keep-out regions, incorporate SunEye shade measurements at specific locations on the roof, drag-and-drop modules, size strings, check inverter limits, and calculate the AC energy production for your system quickly and easily. It includes extensive worldwide databases of modules, inverters, and historical weather. You can easily try different design scenarios and compare their AC kW-h outputs side-by-side to identify the best design. Results can be exported to a PDF and included as part of your project proposals. PV Designer is optimized for designing residential systems but will also accommodate small commercial systems up to 100 kW. The software is easy to learn and easy to use, yet it enables detailed analysis on par with more complicated and expensive engineering tools. PV Designer runs on most MS Windows operating systems.



Solmetric PV Designer Software	
Description	Item code
Solmetric PV Designer software annual license	094-00211



# Measure and Maximize your **Return on Irradiance**™



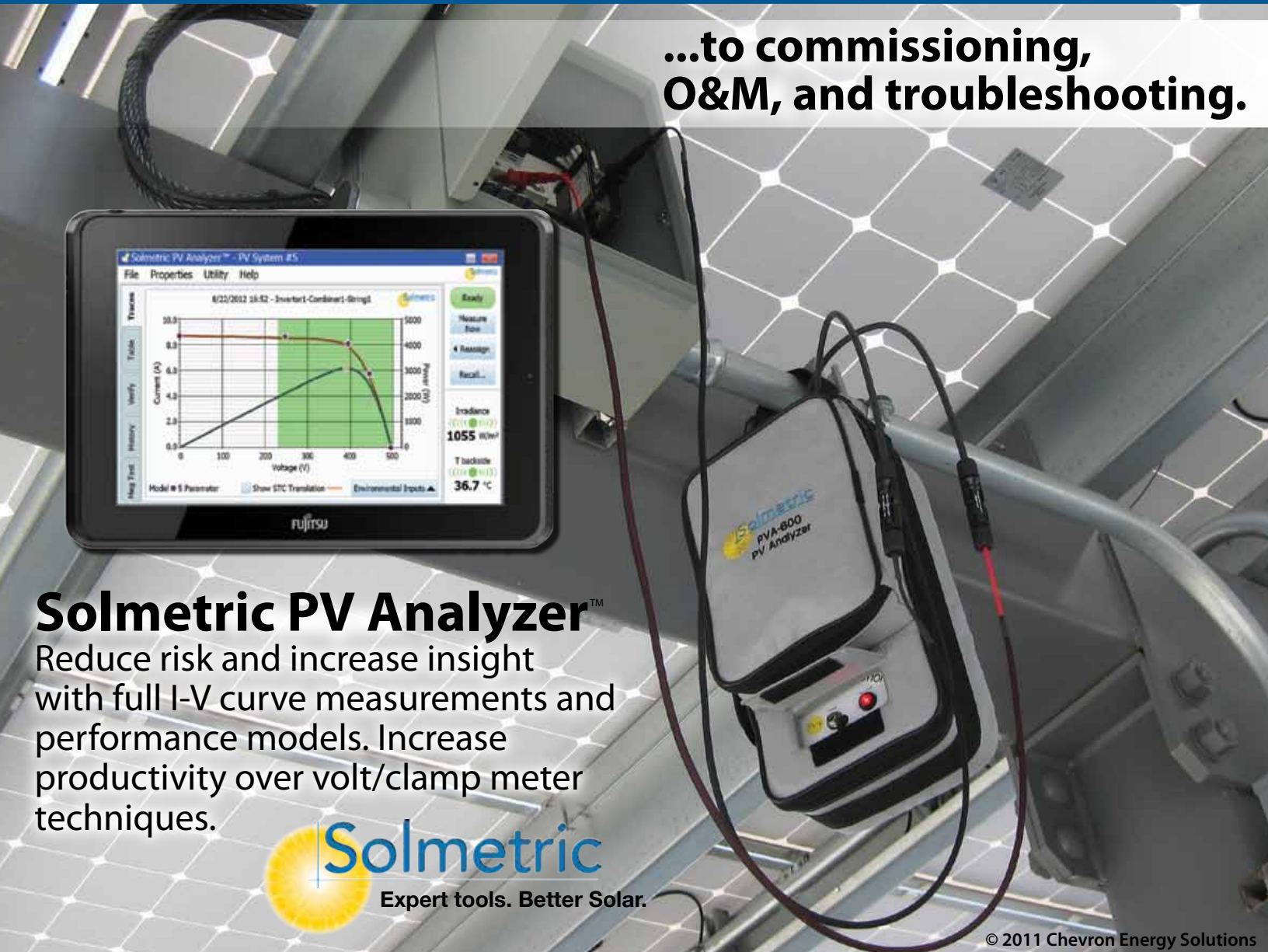
## Solmetric SunEye®

Predict and maximize the ROI of your solar designs with fast and accurate shade measurements.



**From site evaluation...**

**...to commissioning, O&M, and troubleshooting.**



## Solmetric PV Analyzer™

Reduce risk and increase insight with full I-V curve measurements and performance models. Increase productivity over volt/clamp meter techniques.



# System Commissioning Tools

Commissioning a PV system is an important final step in the installation process, and it's worth doing properly and consistently. The recent development of system commissioning standards, such as IEC 62446 and related NABCEP guidelines, provide visual and physical inspections as well as electrical tests that should be performed prior to activating a new PV system. Common electrical tests made during commissioning include: continuity, phasing, and voltage for AC circuits; continuity of grounding conductors; DC circuit polarity verification; string I-V curves; string open-circuit voltage; string short circuit current; insulation resistance testing of PV source and output circuits; and, finally, a full-up system functionality test. With proper documentation, these same tests can be repeated periodically as systems age to ensure that they are operating efficiently.

## Solmetric

### Solmetric PVA-600 PV Analyzer



The **Solmetric PV Analyzer** is an I-V curve tracer for field-testing PV system performance. The PV Analyzer reduces the contractual and financial risks associated with PV system performance by enabling comprehensive and conclusive test results. It captures the full I-V curve for performance testing during commissioning, O & M, and troubleshooting.

The PV Analyzer measures the I-V curve (current vs voltage) and power curve of a module, string, or sub-array by applying a varying load to the DC circuit being tested. In less than 250ms, it sweeps through every operating point from short-circuit current (ISC) to open-circuit voltage (VOC) and 100 points in-between. Use your existing laptop or tablet (1024 x 600 minimum screen resolution) to wirelessly control the measurements and display the results, providing a large, easy-to-use GUI for quick data capture or in-depth analysis in the field. The SolSensor Wireless PV Reference Sensor captures the module tilt, irradiance, and temperature at the instant the I-V curve is measured. The PVA software is easily configured with the characteristics of the PV system under test. The module is selected from the built-in database, which contains thousands of modules and is updated automatically. The system parameters and sensor readings feed into a PV performance model that displays the shape of the expected I-V and P-V curves. By comparing the measured curves to the expected curves, the user can gain detailed insight into the performance and health of the system. The PVA-600 includes software (Windows XP or newer), a wireless USB interface, MC3 and MC4 cable sets and a 1 year warranty that can be extended to 2 years.

The **SolSensor** wireless PV reference sensor works with the PVA-600 to measure tilt, irradiance, and temperature simultaneous with the I-V curve measurement. The SolSensor replaces the “Wireless Sensor Kit” previously available from Solmetric and is compatible with all PVA-600 models. The new SolSensor integrates a calibrated irradiance sensor, dual-channel temperature sensor, tilt sensor, and extended-range wireless transmitter into a single device. It includes a clamp for attachment to the module rail, two thermocouples, and a shoulder carrying bag.



Solmetric PV Analyzer and Accessories	
Description	Item code
PV-600 Analyzer	094-00220
SolSensor	094-00224
PVA Test Leads	094-00222
I-V Data Analysis Tool	094-00223

## Seaward Solar

### NEW! PV150 Solar Installation Test Kit



The **PV150 Installation Test Kit** includes everything needed to test to the IEC 62446 system commissioning standard as well as the latest NABCEP recommendations. The PV100 all-in-one PV installation tester, using simple direct connections to PV systems, performs open circuit voltage, short circuit current, and insulation resistance tests with a single button press. It can also be used to perform operating current (using the supplied current clamp) and Earth continuity measurements as well as determine voltage polarity.

The connectors feature non-accessible conductive parts for safe use with PV systems that may be energized. The PV150 can also wirelessly receive and record irradiance and temperature measurements from the Solar Survey 200R in real-time as electrical tests are conducted.

The PV150 solar PV tester has memory to store up to 200 complete test records, and USB connectivity enables these to be downloaded to a PC. Seaward’s SolarCert Elements software program (supplied separately) can then be used to automate generation of test certificates and documentation.

The PV150 Test Kit includes: a PV150 solar installation tester, AC/DC current clamp, carry bag, MC4 test lead adaptors, red and black test leads, test probe with detachable alligator clips, Quick Start Guide, support software CD, and calibration certificate.

**NEW! Solar Survey Multifunction Solar Irradiance Meters**

These handheld solar irradiance meters include a built-in inclinometer to measure roof pitch, compass to measure roof orientation, and thermometer to measure ambient air and module temperature. These meters display irradiance measurements in either W/m<sup>2</sup> or BTU/hr-ft<sup>2</sup>, so they work for both solar photovoltaic (Solar PV) and solar thermal applications.

The use of a photovoltaic reference cell provides a more representative measurement of solar energy and greater accuracy and repeatability compared to irradiance meters, which use simple photo diode detectors. The Solar Survey **100** and **200R** irradiance meters both incorporate a display hold feature, which enables the user to easily capture readings in difficult locations.

The **200R** features new Solarlink™ connectivity, which allows it to wirelessly give the PV150 Solar Installation Test Kit real-time irradiance, ambient temperature, and PV module temperature measurement results simultaneous to electrical tests, as required by MCS and IEC 62446 standards. The PV150 can then download the data into the SolarCert Elements software program. The 200R model also includes data logging with a USB interface for data download to a PC. This allows for irradiance and temperature to be recorded at user-defined intervals over a number of hours or days. The collected data can then be downloaded to a PC for analysis of for inclusion in solar installation reports.

**NEW! Solar Power Clamp**

Seaward’s **Solar Power Clamp** is a specialized power meter that clamps over the cable to measure the AC or DC current. If a PV system isn’t generating the expected level of power under known irradiance and temperature conditions, this may indicate a fault with one or more components in the system. 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.

Solar Power Clamp functions include: DC power measurement, AC and AC+DC true continuous power (RMS) reading, power factor, total harmonic distortion and harmonics 1 – 25, phase rotation indication, current and voltage measurement, smart data hold and peak hold, and non-contact voltage indicator.

**NEW! SolarCert Elements Solar PV Software**

The Seaward **SolarCert Elements Solar PV Software** enables solar PV system installers to produce customized client-facing test reports and certificates using user input or data downloaded from the PV150 tester.

The Seaward SolarCert Elements solar PV Software allows PV installers to create customized test certification and inspection reports and installation layout diagrams that can be stored alongside photographs and other information relevant to PV installations, such as datasheets or operating manuals. A checklist feature helps ensure that all of the necessary information is included. Company logos and signatures can be added to the templates for a branded professional image. Once compiled, the complete data package can quickly be searched within the solar PV software and emailed or printed for delivery to the client.

Seaward System Commissioning Tools	
Description	Item code
PV100 Installation Test Kit (10 A, storage for 9 data points)	094-00280
PV150 Installation Test Kit (15 A, storage for 200 data points, SolarLink and USB)	094-00282
Solar Survey 100 Irradiance Meter	094-00290
Solar Survey 200 Irradiance Meter with SolarLink wireless data transfer	094-00291
Solar Power Clamp power analyzer	094-00292
SolarCert Elements software	094-00289
PV Inspection Report Pad, A4 size	094-00285
PV Array Report Pad, A4 size	094-00286
PV System Certification Pad, A4 size	094-00287



## NEW! Portable Sign Printers

The HellermannTyton handheld Portable Sign Printer can print safety labels as well as other signs and markers on the jobsite at over 200 dpi. The printer comes with a manual cutting blade and accommodates up to 2" vinyl. The built in software includes most common electrical pictograms and symbols. The printer package includes a rechargeable battery, charger, white ribbon, and a roll of 2" red vinyl.

Blank self-adhesive Rolls of Vinyl are available in white, red, and white/orange for arc flash labels with widths from 0.5" to 2". Reflective vinyl is also available in red or white. These vinyl rolls can also be used with the TT230MC, but come in much shorter rolls for use with the smaller spool on the portable printer. The vinyl material is UV stable and rated for a minimum of 5 years of outdoor use without significant fading or adhesive degradation.

Portable Sign Printers and Accessories			
Description			Item code
Portable Sign Printer with Battery Pack, Charger, White Ribbon, and Red 2" Vinyl			094-09019
Hard-Shell Case for Portable Sign Printer			094-09020
Black Ribbon for Portable Sign Printer			094-09021
White Ribbon for Portable Sign Printer			094-09022
Blank Vinyl for Desktop Thermal Transfer Printers			
Color	Width	Roll length	Item code
Red	0.5"	30'	094-09026
	1"	30'	094-09023
	2"	30'	094-09028
Red Reflective	1"	20'	094-09024
	2"	20'	094-09029
White	0.5"	30'	094-09027
	1"	30'	094-09025
	2"	30'	094-09030
White Reflective	2"	20'	094-09031
White w/ Orange Bar	2"	30'	094-09032



**Only need a few custom labels?** AEE Solar can print custom safety labels to your specifications. Contact us for details .