# Set up and Operating Instructions

# smart<sup>PV</sup>

**Efficient technology for today's world**

# Contents

# 1. Introduction

Eco-eye SmartPV is a sophisticated electricity monitor which has been designed specifically for use with domestic solar power and microgeneration installations.

By seeing your overall usage broken down into three distinct elements – power generated, power consumed and net power, you can easily find out:

- How effective your solar installation is,
- How much energy you are sending back to the grid, and,
- If you can make further savings by reducing your grid usage.

The large, uncluttered screen features a single numeric value for each display option – generated, grid and net - and allows you to view usage for each in Kilowatts per hour or day as well as showing the time and temperature. The 'traffic light' indicator shows whether you are generating more, equal or less power than you are using.

Eco-eye SmartPV is a wireless device which utilises cutting edge micro-power technology avoiding the need for mains power connection. It updates every 4 seconds – that's over 20,000 updates a day - yet a pair of standard batteries has an estimated life of 12 -18 months in the transmitter and 12 -24 months in the display. Being battery powered enables you to move freely and seek out those power hungry devices. Optional AC mains adaptors can be used at the transmitter and display if preferred.

Eco-eye SmartPV can be used in conjunction with a computer for more detailed data analysis. You can transfer data to a PC, either in real-time using the USB interface cable or with data logged to the Eco-eye Memory Card. The Eco-eye Memory Card has 10 years' storage capacity at a resolution of 4 seconds and can be analysed in close detail using our open source 'Trax' software.

Eco-eye SmartPV is firmware upgradable by the user and is equipped with transceiver technology enabling bi-directional wireless data transfer ensuring that it is compatible with the evolving Eco-eye energy management product range.

As SmartPV and Trax are continually evolving some of the details in this manual may have been superseded. There will be notes about any changes on your memory card for both SmartPV and Trax.

# 2. Installing Eco-eye SmartPV

## 2.1 Components
Eco-eye SmartPV consists of the following main components:

**Transmitter**



**White Current Sensors for PV Output and Grid**
2 sensors are supplied. These are marked with a green arrow for the PV cable and a red arrow for the grid cable.
The arrow must point towards the inverter and the meter respectively.
Each sensor is in two parts and clips around
*a single core cable upto 13mm in diameter.*
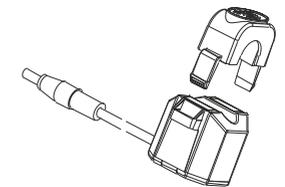


Press the side clips of the sensor to separate the two parts. Place it around the cable.
*Click* shut - Do not force the clip to close around a cable which is too large.
The faces of the sensor on both sides *must* make contact. The sensor is designed to be a loose fit around the cable. If it does not fit around the cable, you may be trying to put it around the wrong one.
The sensor unit may buzz, especially when not connected to the transmitter; this is perfectly normal and is nothing to worry about. Alternative sized sensors are available on request.
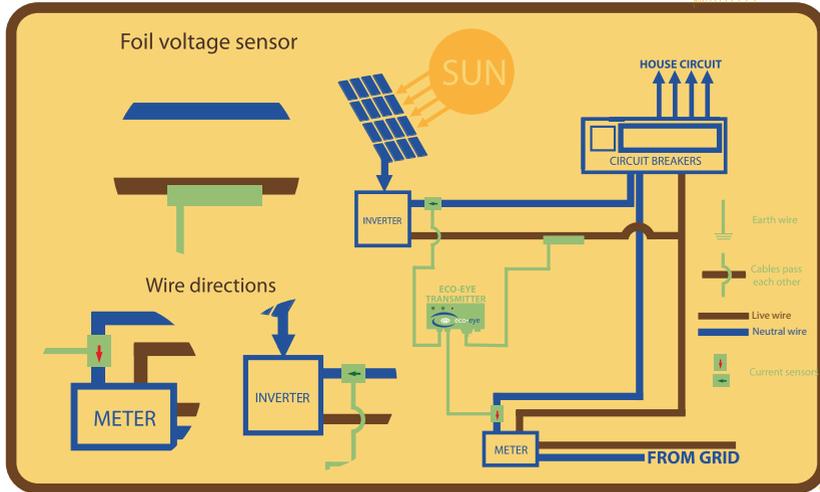
**Voltage sensor**
This should be plugged into the 6 way socket and the brass foil wrapped round a live cable, preferably the cable going to the grid meter.

## 2.2 Overview

Please take a few moments to look at the diagram below carefully. Your installation may not exactly match this layout but it shows the general principle.



There are **3 sensors which need to be installed and it is vital they are fitted to the correct cables and in the correct direction.** It is important to position the two white current sensors so they are as far away as possible from each other and all other cables, ensuring that the arrows are correctly positioned.
The contact surfaces between the 2 parts must make a good connection.

The white current sensors must be attached to the NEUTRAL and not the live cables.
Identifying the neutral cables can be difficult, the following may help.
- They will not be red!
- They might be black
- They might be blue
- If they are grey, look at the ends of the cable where it goes into a connector. Some grey cables have an inner blue sleeve.
- The neutral cable to the property is usually the third cable from the left under the meter. All neutral cables may ultimately be connected to each other but it is necessary to connect the sensor onto on the cable with a direct connection to the inverter.

## 2.3 Installation

**Transmitter**

Put the 2 x AA batteries into the transmitter. If it is working correctly you will see the GREEN LED flash every 4 seconds.

**Voltage sensor**

Start by attaching the foil Voltage sensor to any live wire, preferably the live wire from the grid meter to the consumer unit. The long tab fits through the slot, secure by folding the tab back on itself and wrapping it round the cable

Now plug the rectangular plug from the Voltage sensor into the socket on the underside of the transmitter. If the Voltage sensor is working the RED light will flash (but not in sync with the green light).

**Smart Display**

Install the 2 x 'C' cell batteries in the Smart display.
All the icons are displayed then Smart will display a currency symbol
Select your currency symbol with the arrow keys and press ▬▬ to continue.
Enter the date and time using the arrow keys and press ▬▬ to continue to the next number.
The display should now show 0.000 and the amber light should be flashing every 4 seconds.
Press the red square button until the PV icon shows but not the HOUSE icon.

**PV Sensor**

Connect the sensor with the green arrow onto the NEUTRAL cable coming from the inverter. It is essential that arrow points towards the inverter. Plug this sensor into the centre socket of the three on the underside of the Eco-eye transmitter.
The Smart display should now be showing the output from your photovoltaic panels (or other generation system).

**Grid Sensor**

Now attach the sensor with the red arrow on to the NEUTRAL cable under the main supply meter with the arrow pointing towards the meter. Plug it into the left hand socket on the underside of the Eco-eye transmitter. Use the red button on the Smart display to show the HOUSE icon ONLY.
The display should now show the total amount of electricity you are currently using.

# 3. The display

## 3.1 The buttons:

The ● changes the display to show:
- ● Kilowatts
- ● Clock, Date, Temperature.
- ● Target

The ▮ modifies the above displays
- ● Kilowatts
  - ◦ Hour
  - ◦ Day
- ● Clock
  - ◦ Hour: Minute
  - ◦ Day
  - ◦ Week
  - ◦ Month
  - ◦ Temperature
- ● Target
  - ◦ Not applicable

The ▮ is used on the Kilowatt display to switch between:
- ● Generated Power
- ● Used Power
- ● Difference between Generated and Used Power (net)

The arrow keys are used:
- ● to access history
- ● to change settings

## 3.2 The red, amber and green traffic light status indicators

The 'traffic light' system shows the status of your generation system.

**Green** (Surplus) You are generating at least 100 Watts more than you are using.

**Amber** (Level) - You are using about the same amount of power as you are generating.

**Red** (Deficit) - You are using more than you are generating.

## 3.3 History

Eco-eye SmartPV stores a 64 day summary which can be viewed in Kilowatts or **%** of target. (Note the graph continues to show today's target.)
The mode button will select generated, used or net.

To view history press ◀▮. You will see that the predictive arrow P disappears and an arrow with H appears.

Predictive      History
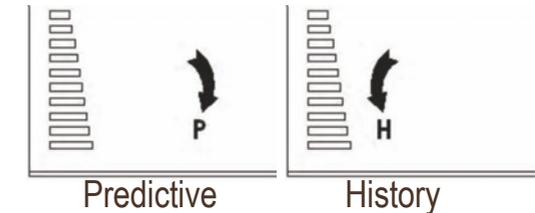
You can now press the ◀▮ and ▮▶ to move through the history.

Use ▮ to select Generated, Used or Net.

As you press ◀▮ and ▮▶, the display will show you which day you are looking at. i.e. – 1 day(yesterday), -2 day(2 days ago), -3 day(3 days ago) etc. followed by the total for that day.

When you have finished using History, press the green right hand rectangular button ▮ to return to predicted mode.

## 3.4 Daily Usage Target Graph.

The Daily Usage Target Graph is an easy way to track how much electricity you are using over a whole day and provides an instant visual aid to help you make savings. Unlike most targets, this one is not something you are aiming to reach. Choose a target for how much electricity you think you should use each day - you are aiming to keep within this. The bar graph on the left of the display shows your progress to (or over) this target.

Eco-eye Smart uses a default daily target of 12 Kilowatt hours which is an average amount for many households. This may be too high or too low but can be changed to make the graph realistic to your own situation.
As the graph needs to show under and over target, the middle of the graph is 100% - all of your target. Over the middle, you are over target.
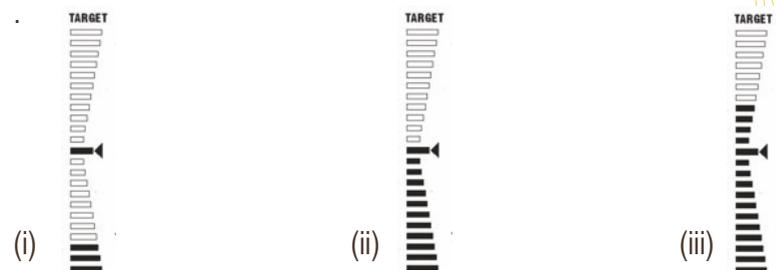


(i) The bars fill up from the bottom and the long bar midway flashes to show your target is **under** the 100% threshold.

(ii) When the long midway bar stops flashing you have **reached** your total daily target. You may want to think of ways you can modify your usage pattern to avoid reaching this limit in future.

(iii) When **TARGET** flashes on screen (and the bars fill up over the 100% mark) you have **exceeded** your total daily target – the bars will continue to fill up to the top 200% mark (double your target). At this point the **whole graph** and word **TARGET** will flash. You should review your targets and/or usage. If you have already taken steps to be as energy efficient as possible, you should reset your target to one which is more appropriate.

## 3.5 Making Your Target Realistic.

Eco-eye SmartPV is supplied with a default target value suitable for most households.

The first thing to do is to use History to see your daily usage. Obviously usage on some days will be higher than others. If you are out during the week but at home on Saturdays and Sundays you will probably find that you use more at the weekend. It is best to base the target on weekday usage, maybe setting it a bit higher than Monday to Friday but less than Saturday and Sunday.

For example if you look at your history on a Saturday morning you might see the following

| -1 | -2 | -3 | -4 | -5 | -6 | -7 | -8 |
|---|---|---|---|---|---|---|---|
| Fri | Thurs | Wed | Tues | Mon | Sun | Sat | Fri |
| 10.0 (KWh) | 9.8 | 10.1 | 10.2 | 9.9 | 13.5 | 12.2 | 10.5 |

So, on weekdays you are using about 10 KWh but about 13 KWh at the weekend. If you set your target to 10 KWh you should be able to keep your weekday usage under control but the weekends will be over – but still within the range of the graph. Not a problem but maybe it would help you cut down at the weekends!

# 4. Changing Settings

## Overview

To get the most out of your Eco-eye SmartPV there are a number of things you can modify to make it respond in the best way for your situation. Some of them are mentioned elsewhere in this manual but this section gathers them together.

## 4.1 Changing the voltage

SmartPV measures energy use in Amps. To get the Kilowatt figure it needs to know the normal voltage of your supply. The default is 240v but this can be changed to help calibrate SmartPV with your meter.
This is changed when Kw and HOUR are on the display. Press and hold ▮▮ until SET is displayed and change the value using ◄◄ and ►► . Press ▮▮ to set.

## 4.2 Calibrating the temperature value

This can be changed when the thermometer is on the display. Press ▮▮ and hold until SET is displayed and change the offset using ◄◄ and ►► . Press ▮▮ to set.

## 4.3 Changing the Target

Whilst in the % **target mode,** press and hold ▮▮ . The value displayed is the total daily KWh target value and can be adjusted as required using ◄◄ and ►► . Press ▮▮ to store.

# 4.4 Changing the radio channel

If the readings on the display seem strange and do not react to you switching electrical equipment on and off, you could be getting interference or be picking up the signal from another Eco-eye nearby.
You should change the channel number on both the transmitter and the display unit – the number must be the **same on both**. The default channel number is ch08 – there are 30 channels to choose from.

**Transmitter:**
The transmitter channel number should be changed before that on the display unit. Remove the batteries. Press and hold the ● whilst at the same time reinstalling the batteries. The green LED will illuminate. Release the button, then immediately press it the same number of times as your chosen channel number e.g. Press 5 times for Channel 5. The red LED will flash (brightly) the same number of times as the channel number selected before emitting a low intensity flash to confirm the process has been completed.



Channel change button

**Display:**
The channel number on the SmartPV display must be changed to match the channel set on the transmitter. Use ▮▮ to scroll to the Kw and DAY screen. Press and hold ▮▮ until ch02 and SET appear.
Use the ◄◄ and ►► to select the same channel number and press ▮▮ to set.

# 5. Using a computer with Eco-eye Smart

**Overview**

Eco-eye SmartPV has two methods of connecting to a computer.

- ● With a specially formatted memory card that logs readings every 4 seconds
- ● With a USB cable that:
  - ◦ streams realtime readings
  - ◦ can download daily history
  - ◦ can upgrade the Smart firmware

**Eco-eye Trax**

Eco-eye Trax is the computer program that is supplied to access these functions.
This program is on the memory card supplied with your SmartPV.
Installation details and full instruction manual are in the Trax folder on your memory card.  Check for updates to Trax  at http://eco-eye.com/traxdownloads/

**Using the Memory Card.**

Although this memory card can be used as normal on a computer it has actually been specially formatted to allow us to get many years of detailed data on to the card while still using very little battery power in the Smart display.
Any other memory cards will run the batteries down quickly and **NO DATA WILL BE RECORDED.**

The card slot in SmartPV is a push to insert, push to release type. The card is inserted into the slot on the side of SmartPV with the contacts facing towards the front. Push it firmly into the slot against the spring and then release it, you should feel it click into place. SmartPV will check the card and, if it is a valid card, the ▇ will come on.
**IF THE ▇ DOES NOT COME ON AND STAY ON (OR FLASH REGULARLY) IT IS NOT WORKING.**

SmartPV stores readings for about 8 minutes and then writes the stored readings to the card. Readings will be lost if the card is not in the slot when Smart needs to write to it. The ▇ will flash for 4 minutes to warn that a write is imminent. Always wait until the ▇ is **not** flashing before removing the card to copy its contents to your computer.

## Transferring the Readings to your Computer

Put the card in the reader on your computer. If Windows offers to "fix" or "repair" DO NOT do this as it may overwrite the special Eco-eye format on the card.



Select the card icon on the TRAX main menu window. The card will be found automatically and as this is the first time the card has been used, the following screen will be displayed.



Enter a name for this card e.g. My House and click on 'New'.
The progress window will be displayed and when transfer is complete you will be told to remove the card and return it to your SmartPV. It is advisable to use the Windows 'eject' command before removing it from the reader. There is no need to close the progress window before removing the card.
The progress window gives details of each block of data from SmartPV (known as sectors). It also displays the current voltage of the batteries in your SmartPV.

On subsequent transfers the window displayed will be a little different as it just needs to update the data store. So, normally, you will just click on 'Update'.

The other options on the card operations window are:
- Link – use this to link a new card to an existing Data store
- New – use this to start a new data store with the contents of the card rather than update an existing data store.
- Initialise – use to empty the readings from the card.

## Important Notes about the Memory Card.

If SmartPV is rebooted for any reason, you will need to transfer all readings to your computer and clear the card with the 'Card Initialise' button in TRAX before SmartPV will write to it again. The computer data store is not affected and will be updated correctly when the next readings are transferred.

The EcoLog.bin file on the card holds the recorded data and is in an exact location on the card. Do not reformat the card or make any changes to EcoLog.bin – it will stop the system from working and you will need to buy a replacement card. Do not allow your system to do anything other than open the card; repairing, scanning etc. could upset the special formatting.

## Viewing the readings on your computer.

Use the Analysis button on the Trax main menu.
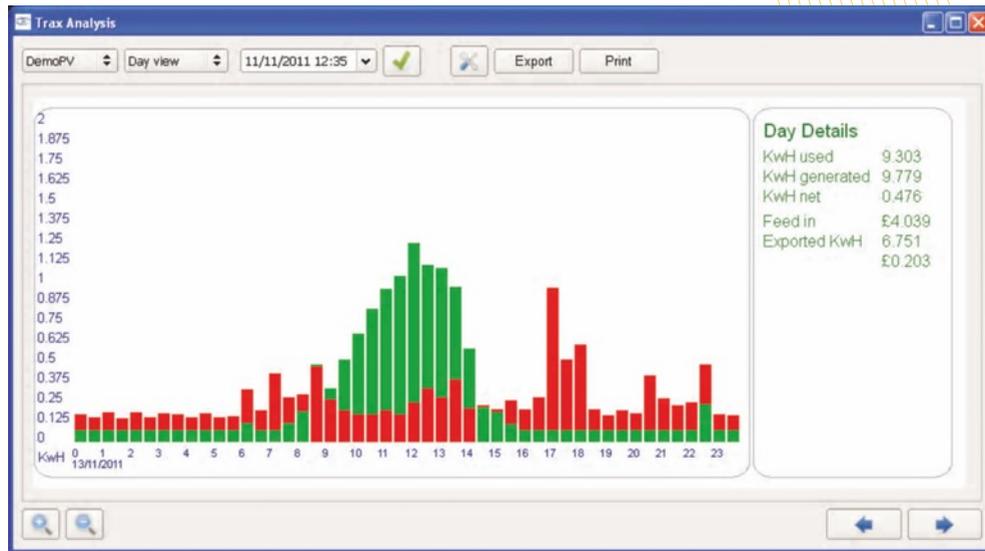


The latest version of Trax and manual can be down loaded from:
**http://eco-eye.com/traxdownloads/**

## 5. Common Questions

**1. The display is blank?**
Check the batteries are correctly fitted.

**2. The big number is 0.00 and the lights are not flashing?**
Check that the transmitter light is flashing every 4 seconds.
Does it work when you take the display closer to the transmitter and press the ▬?

**Check the transmitter and display are the same channel.**

**3. The big number is 0.00 and the lights are flashing?**
Check the sensor with the tester to ensure it is monitoring a live cable. Then, make sure the sensor is plugged into the transmitter.
Have you fitted the sensor to the right cable?

**4. The big number is not 0.00 but is changing, but not when I switch things on and off?**
This could be that you are receiving a neighbours eco-eye or there could be an interference.
Try changing the transmitter and display to a different channel.

**5. Sometimes it works and sometimes it doesn't?**
Try moving the transmitter to a different location and make sure the red wire is extended and upright. Ensure the 📡 is visible and not flashing.
An extension cable is available that allows the transmitter to be mounted further away from the sensor. This can be used to improve radio reception.

**6. I have put my SD card in and Smart is not writing to it?**
The only cards that will work with Smart are specially preformatted Data Storage cards supplied by Eco-eye.
Details of Trax and using Smart with a computer are available separately.

**7. How do I check that the battery is ok?**
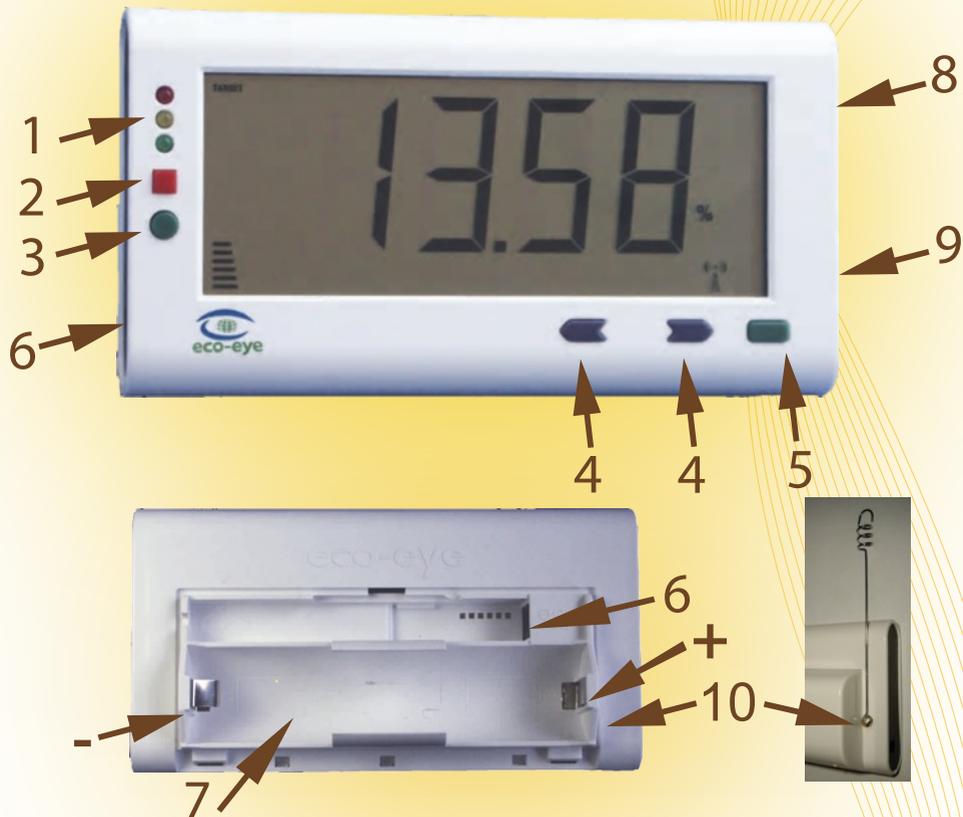On the Smart Display, the low battery indicator will come on.
You can check the battery voltage by going to the temperature display and pressing the ▬
Smart needs the voltage to be over 2.2 volts to operate correctly.

**8. None of those – I need more help?**
Our web site **www.eco-eye.com** has a lot of extra information including contact details.

## 7. Smart Quick Reference



| | |
|---|---|
| 1 Real time load lights | 6 Power adaptor sockets |
| 2 Mode select button | 7 Battery compartment |
| 3 Function select button | 8 Memory card socket |
| 4 Arrow keys | 9 USB data cable socket |
| 5 Time period button | 10 External Antenna screw * |
| or Hold to change settings | + Positive end of batteries |
| (section 4) | - Negative end of batteries |

* External antenna only on some versions

## 8. Guide To The Screen
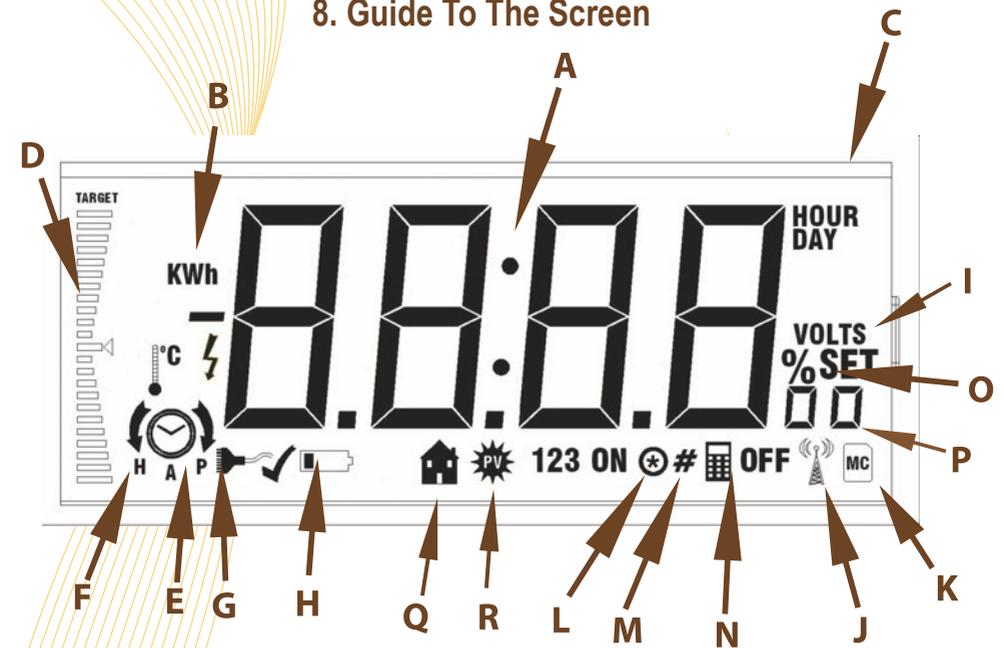


| | |
|---|---|
| **A.** The Big Number | **K.** Memory Card |
| **B.** Modes | **L.** Memory Card -updating |
| **C.** Time Periods | **M.** Memory Card - new |
| **D.** Target graph | **N.** Big number is accumulated |
| **E.** Real-time (predicted) display | **O.** Big number is target % |
| **F.** History display | **P.** Overflow, used when big |
| **G.** Used during firmware upgrade | number goes over 9999 |
| **H.** Low battery indicator | **Q.** Display is used power |
| **I.** Used when setting Voltage | **R.** Display is generated power |
| **J.** Good radio reception | **Q AND R**. The net of generated |
| | and used |

*Some icons are not used in this version of Smart but are on the screen ready for planned upgrades.*

## 9 IMPORTANT - Safety and Care

1. Before attempting to fit your Eco-eye SmartPV, ensure you have read and understood the fitting instructions fully.
2. Do not attempt to carry out any repairs to Eco-eye. Contact your retailer or Eco-eye direct if problems occur.
3. Use of Eco-eye equipment near moisture or liquids; or in extreme temperatures can cause malfunction and damage.
4. Take care when handling and disposing of batteries. They can cause burns to skin or property if in contact with heat, conductive or corrosive materials.
   **Remove batteries when storing** Eco-eye for long periods to avoid corrosion.
5. The LCD screen is glass and should be treated carefully to avoid scratches. Should it become damaged, it may leak crystals which could be harmful to your health. Dispose of with great care.
6. Eco-eye SmartPV should only be cleaned using a damp cloth. – Under no circumstance should any chemicals or cleaning agents be used.
7. Do not subject your Eco-eye SmartPV to any form of impact or shock.
8. **IF IN ANY DOUBT** regarding the installation of this product, consult a qualified electrician before proceeding.

### Guarantee

This Eco-eye product is guaranteed for the period of one year from the date of purchase against defects in respect of both material and workmanship.

HOWEVER, this warranty does not apply to normal wear and tear and does not cover any parts damaged by misuse or neglect in any way, or by modifications made by any person other than those working for Eco-eye.
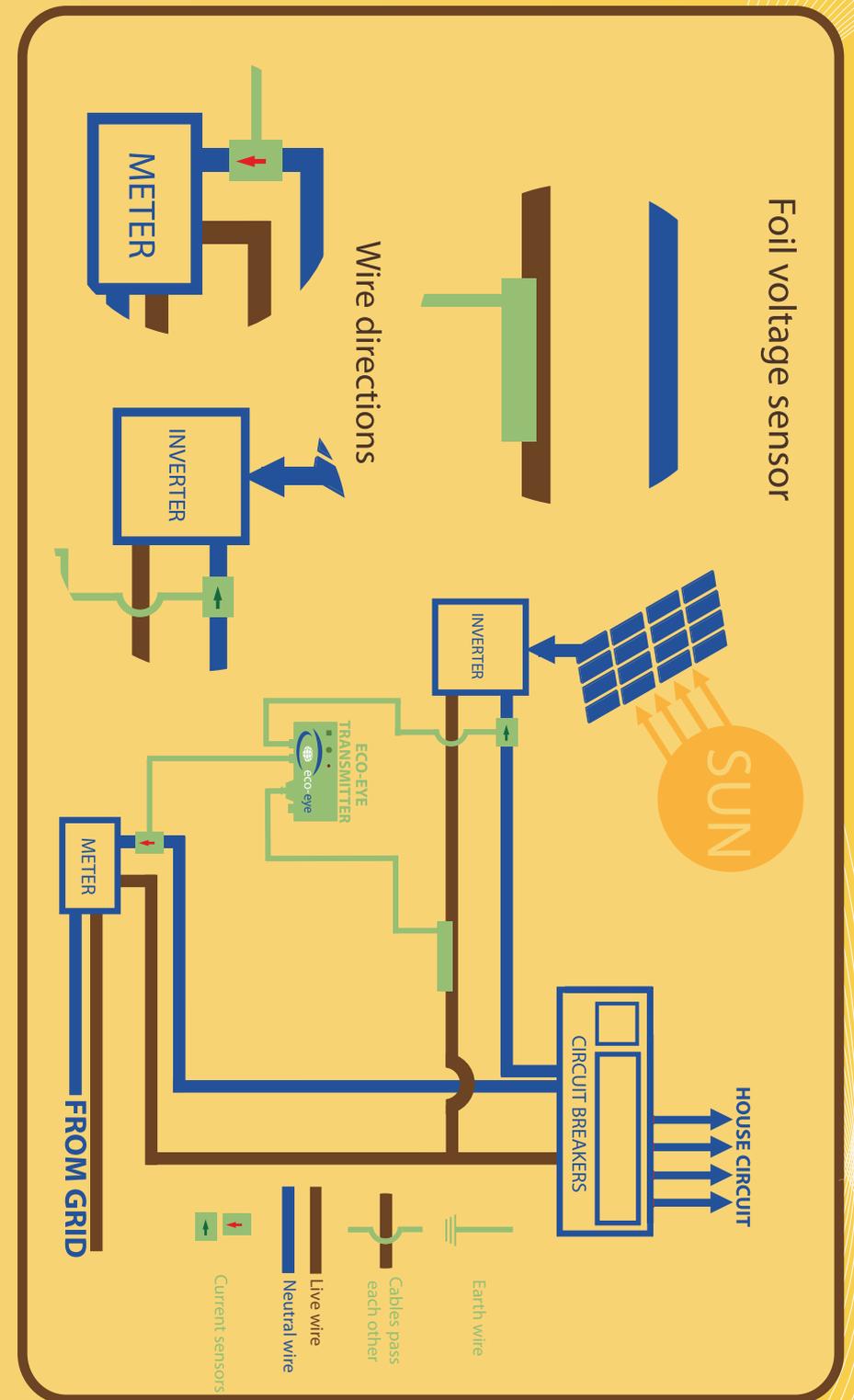
This guaranteed does not cover cracks or scratches to the screen under any circumstance, nor shall Ecoeye be held liable for any direct, indirect, incidental, special or consequential loss or damages whatsoever caused by the use of Eco-eye even if advised of the possibilities of such damages.

In order to validate this guarantee, please ensure you keep your original receipt and read all instructions carefully.

Eco-eye Smart
conforms to quality standards:
CE, PB, RoHS, amendment
2004/108/EC, EN55 022
Class B and EN 55 024 RTTE,
89/336/EEC.

Set-up Diagram