Instruction Manual

ISM 400

Solar Power Meter

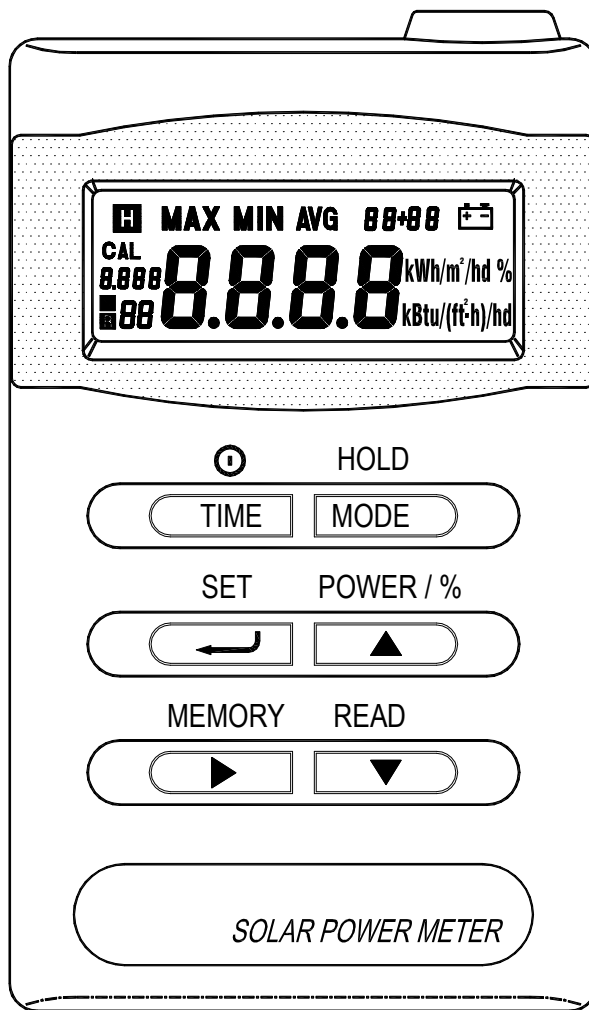EN FR IT DE ES

HOLD

TIME | MODE

SET | POWER / %

MEMORY | READ

SOLAR POWER METER

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1. Introduction

❑ The digital solar power meter is a precision instrument used to measure solar radiation in the field.

❑ It is fully cosine corrected for the angular incidence of solar illumination.

❑ The solar power meter is compact, rugged and easy to operate.

❑ The solar sensitive component used in the meter is a very stable, long-life silicon photovoltaic detector.

2. Features and Applications

Features :

- ❏ 4 digit LCD reading
- ❏ Wide spectral range
- ❏ Excellent long term stability
- ❏ Cosine corrected
- ❏ Automatic transmission measurements
- ❏ Select either power or transmission
- ❏ Solar energy measurement
- ❏ Current time setting function
- ❏ User calibration factor setting function.
- ❏ End-mount light sensor
- ❏ Select either W/m^2 or $Btu / (ft^2 \times h)$ units
- ❏ Data hold/MAX/MIN/AVG modes
- ❏ Manual Data Memory and Read function. (99 sets)
- ❏ Auto power off function

Applications :

The meter can directly measure the solar power radiated from any direction, angle or position, and can be mounted firmly on a tripod. The meter can also calculate the total solar energy against elapsed time or calculate the average solar energy per hour.

1. Solar Power Panel Industry:

The meter can be used to measure the solar power at the installation to determine the best location, angle and direction before fitting the solar panel.

2. Solar Power Research:

The meter can be used for solar power research and development, as a tool of education and to check the efficiency of solar cells.

3. Agriculture:

Vegetables, flowers and plants are influenced by sunlight, especially when cultivated in a greenhouse. The meter can measure the solar power and help optimize plant growth.

4. Solar transmission measurement:

The meter can measure the solar transmission of glass, heat insulation papers, parasols, sunshades etc.
For example:
Compare the solar power radiation measured before and after a sunshade is installed. The measured readings help determine whether the sunshade material is good at reducing the solar power transmission.

5. Construction:

The meter can check the solar radiation at any angle and any time, which is helpful when installing sheltering systems to control the indoor temperature efficiently and save energy.

Electricity can be produced by combining the building materials with the solar power panel. The meter can measure the solar power radiation to obtain the highest efficiency.

3. Specifications

- **Display**：LCD display, 4 digit LCD reading.
- **Measuring Range**：2000 W/m^2, 634 Btu / (ft^2 x h)
- **Resolution**：0.1 W/m^2, 0.1 Btu / (ft^2 x h)
- **Overrange Display**：LCD will show "OL" symbol.
- **Spectral Response** : 400 to 1000nm
- **Accuracy**：Typically within $\pm$10 W/m^2 [$\pm$3 Btu / (ft^2 x h)] or $\pm$5%, whichever is the greatest in sunlight ; Additional temperature induced error $\pm$0.38 W/m^2/°C [$\pm$0.12 Btu/(ft^{2}xh)/°C] from 25°C
- **Angular Accuracy** : Cosine corrected < 5% for angles < 60°
- **Drift** : < $\pm$2% per year
- **Sampling Rate** : 4 times/sec.
- **Photo Detector**：One silicon photovoltaic detector.
- **Manual Data Memory Capacity**：99 sets.
- **Operating Temperature & Humidity**：
  0 to 50°C（32 to 122°F）& 0% to 80% RH.
- **Storage Temperature and Humidity**：
  -10 to 60°C（14 to 140°F）& 0% to 70% RH.
- **Power Source**：4 X AAA batteries.
- **Battery Life (typical)**：100 hours (carbon zinc).
- **Meter Dimensions/Weight**：H110 x D34 x W64mm / 158g
- **Accessories**：Instruction manual, batteries, Tripod mounted screw.

4. Parts
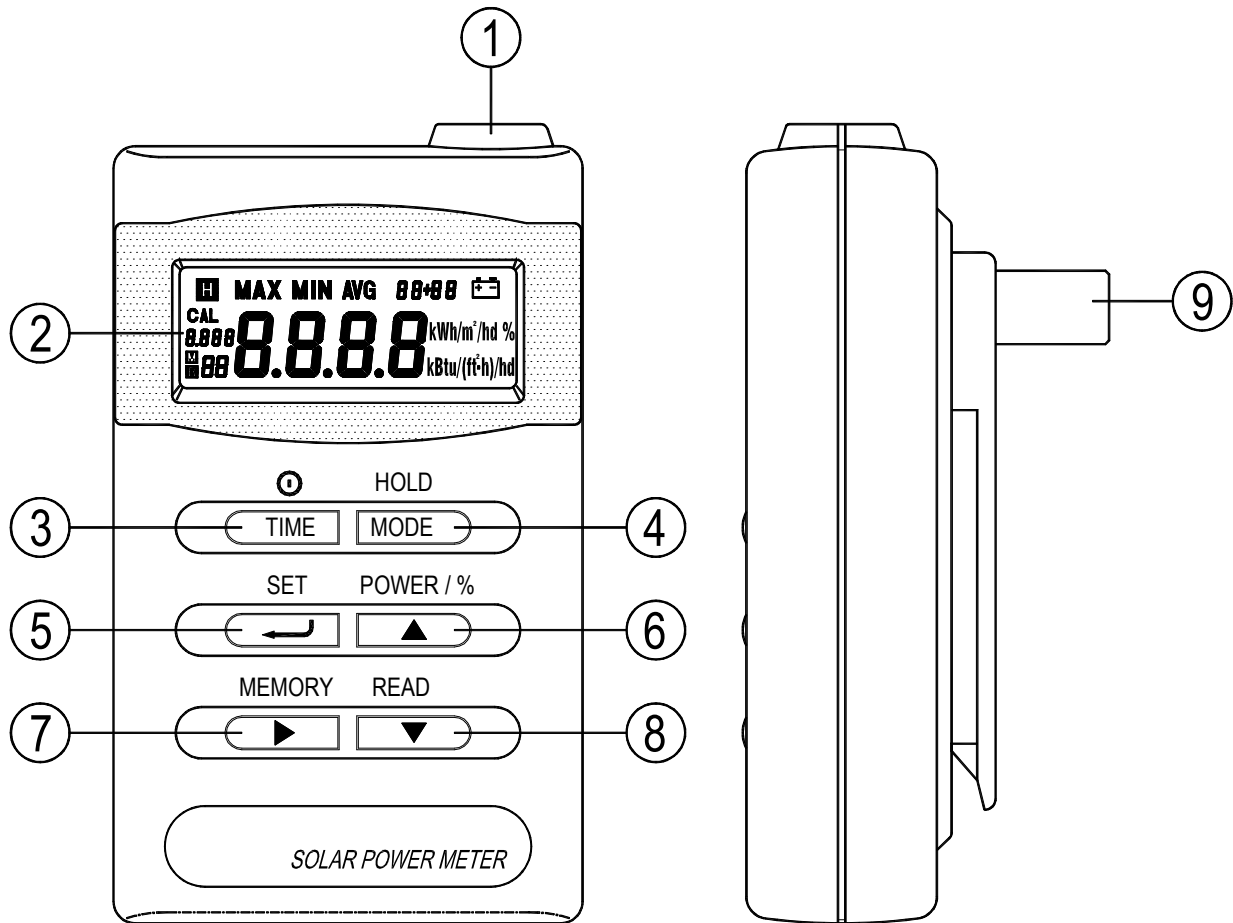
1. Solar sensor.

2. LCD Display：Display 4 digit displays with a maximum reading of 9999, the measured values, unit function symbols, and decimal points etc.

3. ⨀ TIME key :
① Push ⨀ key to turn on the meter, hold it on for 3 seconds to turn off the meter.

② Push **TIME** key to switch between minute : second display and day – hour display. Note: this is effective once the day and time have been set.
(see **5. SET ↵ key**)

4. HOLD/ MODE key :

① HOLD Function : Push this key momentarily to freeze or unfreeze the displayed readings.

② Recording Mode : Push this key for 3 seconds to launch into MIN /MAX / AVG recording mode.

Push this key to select between maximum (MAX), minimum (MIN), average (AVG) and current (MAX MIN AVG) reading. Push this key for 3 seconds to exit.

③ Disable Auto Power Off : Push and hold this key, when turning on the meter, the flashing Auto Power off symbol "÷" will disappear from the LCD.

5. SET ↵ key :

① Unit Select : Push this key to switch the unit between W/m^2 and $Btu / (ft^2 \times h)$.

② **Real Time Setting Mode :** Push this key for 3 seconds to enter the time setting mode.
The display shows " **-** " (Day-Hour)

Push ▲, ▼ and ▶ keys to set the day-hour

Push ▶ again to move to " **:** " (Minutes:Seconds)

Push ▲, ▼ and ▶ keys to set the minutes: seconds

Push ↵ key to store the time settings and start the integrated solar energy measurement.

③ Calibration Factor Setting Mode : Push and hold this key, when turning on the meter. The LCD displays "**CAL**" and one flashing digit.

Push ▲, ▼ and ▶ keys to set up desired calibration factor values. Push ↵ key to store and exit.

6. POWER / % ▲ key :

① Power and Transmission % Function Select : Push this key to select power or transmission (%) function.

② Power and Energy Units Select : In the integrated solar energy mode, push this key to select power or energy units.

③ Zero Adjustment : Push and hold this key for 3 seconds, when turning on the meter, the LCD will show "CAL". Cover the solar detector to zero the reading then push ↵ key, the LCD will momentarily display "MIN" to confirm the zero adjustment.

④ ▲ key : In READ mode, push this key to increase the memory location.

In setting mode, push this key to increase the parameter.

7. MEMORY ▶ key :

① Memory Function : Push this key momentarily to store a measuring value.

② Clear the stored Data : Push and hold this key, when turning on the meter. The LCD shows "𝐘𝐄𝐒 CLr". Push ▼ key to select "𝐘𝐄𝐒" or "𝐧𝐨". to erase the memory data. Push the ↵ key to confirm the selection.

③ ▶ key : In setting mode, push this key to move cursor to the desired position.

8. READ ▼ key :

① Read Function : Push this key to enter READ mode, then push ▲ or ▼ key to select the desired stored number of data to read. Push ↵ key to exit.

② ▼ key : In the READ mode, Push ▼ key to select decrease the memory location.

In the setting mode, Push ▼ key to decrease the parameter.

9. Tripod mounted screw.

To mount on a tripod, remove the screw and replace with the tripod thread adapter supplied.

5. Operations

❑ The meter uses a silicon photovoltaic detector mounted in a cosine-corrected head to provide solar radiation measurements for solar, agricultural, meteorological, and hydrological applications.

5-1 Solar Power Measurement

In power mode, the meter measures the solar radiation powel level.

1. Push " ⏻ " key to turn on the meter.

2. Push "**SET**" key to select the desired W/m^2 or Btu / (ft^2 x h) unit.

3. Position the meter with the solar sensor facing the sun directly.

4. Read the solar power value from the LCD display.

5. Push "**HOLD**" key, if the displayed value needs to be held.

   Push the "**HOLD**" key again to exit.

APO mark

Calibration factor →

500.0 W /m^2
Btu/(ft·h)
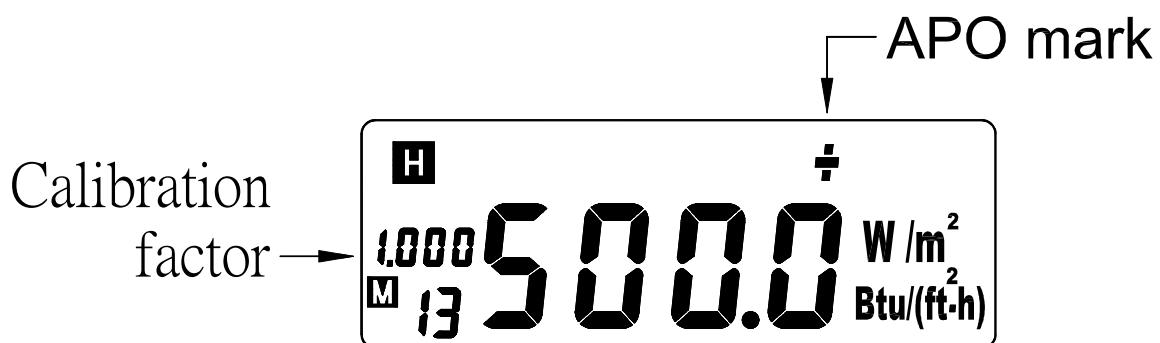
5-2 Using the MAX MIN Recording Mode for Solar Power Measurement

1. Push the " ⏻ " key to turn on the meter.

2. Push "**SET**" key to select the desired W/m^2 or Btu/(ft^2 x h) unit.

3. Position the meter with the solar sensor facing the sun directly.

4. Push "**MODE**" key for 3 seconds to enter MAX MIN Recording mode. The maximum, minimum, and average values are then reset to the present reading, the LCD displays "**MAX**" and the auto power off feature is disabled.

5. Push "**MODE**" key to select between the display of the maximum (MAX), minimum (MIN), average (AVG), and current (MAX MIN AVG) readings. The average reading is the average of the last 4 measured values.

6. Push "**MODE**" key for 3 seconds to exit.
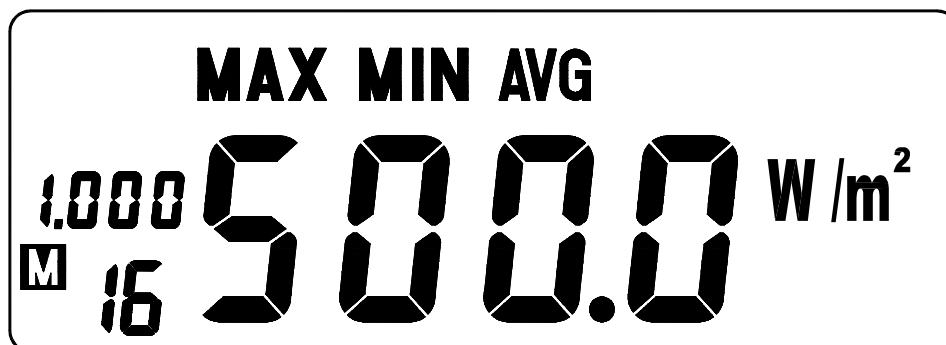
5-3 Solar Power Transmission Measurement

In transmission mode, the meter is able to calculate the solar transmission percentage associated with a given material such as glass, film or other transparent materials.

1. Push the " ⏻ " key to turn on the meter.

2. Push "**SET**" key to select the desired W/m^2 or Btu / (ft^2 x h) unit.

3. Position the meter with the solar sensor facing the sun directly.

4. Push "**POWER / %**" key to transmission mode, LCD then shows " **%** " mark.

5. Push "↵" key to store the solar power measured value as a reference, LCD then shows "100.0%".

6. Put the glass or film material between the solar source and the meter solar sensor.

7. Read the LCD display.

8. Push "**HOLD**" key, if the displayed value needs to be held. Push "**HOLD**" key again to exit data hold mode.

9. Remove the sample material and confirm the meter returns to 100.0%. If the meter does not display 100.0% with the sample removed, ignore the reading and begin the test process again.
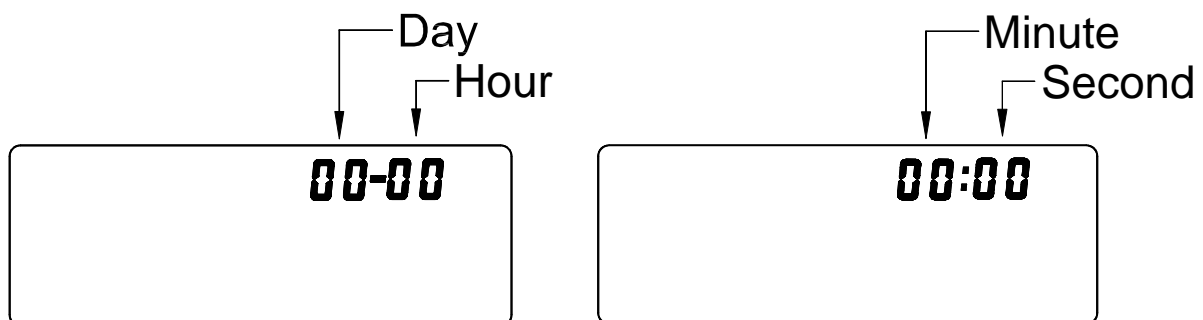
10. Push "**POWER / %**" key to exit.
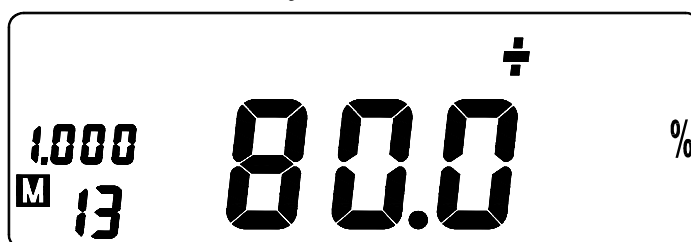
5-4 Integrated Solar Energy Measurement

The meter can measure the amount of sunlight available at the installation site of a PV system. The meter can calculate the total solar energy against elapsed time or calculate the average solar energy per hour.

The quantity of sunlight reaching a location is effected by the time of day, the climate (especially the cloud cover, which scatters the sun's rays), and the air pollution in the region.

1. Push the " ⏻ " key to turn on the meter.

2. Push "**SET**" key to select the desired W/m^2 or Btu / (ft^2 x h) unit.

3. Position the meter with the solar sensor facing the sun directly.

4. Push "**SET**" key for 3 seconds to enter the real-time setting. The display shows " **-** " (Day-Hour)

5. Push ▲, ▼ and ▶ keys to set the day-hour

6. Push ▶ again to move to " **:** " (Minutes:Seconds)

7. Push ▲, ▼ and ▶ keys to set the Minutes: Seconds

8. Push "↵" key to store the real-time and start integral solar energy measurement.

Day
Hour

Minute
Second

```
00-00
```

```
00:00
```

9. Push "**POWER / %**" key to select solar power or integrated solar energy units.

10. Push "**TIME**" key to switch between day-hour and minute : second time display.

    In this mode, the "**HOLD MODE**" key and Auto Power Off are disabled.

11. Push and hold " ⏻ " key for 3 seconds to exit and turn off the meter.
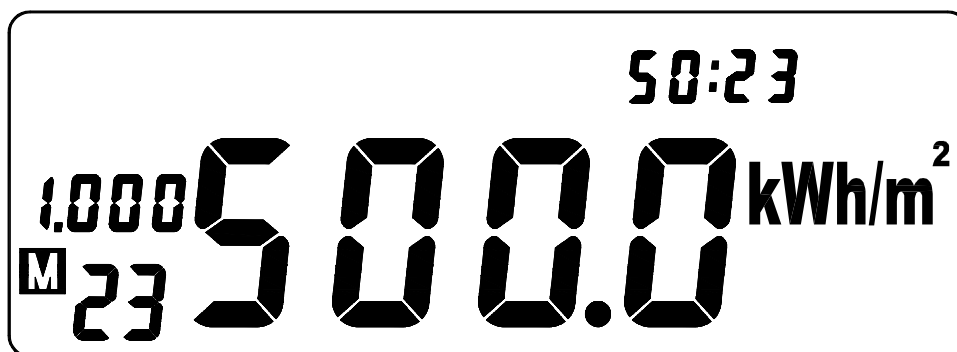
5-5 Manual Data Memory Write and Read Mode

1. Clear the internal stored data

   ① Push " ⏻ " key to turn off the meter.

   ② Push and hold "**MEMORY**" key, when turning on the meter again, LCD will display " YES CLr "

   ③ Push "▼" key to select "YES" or "no" then push "↵" to confirm.

2. Manual data storage
   Push "**MEMORY**" key momentarily to store current LCD reading to the memory. Total memory size is 99 sets.

3. Manual memory data READ

① Push "**READ**" key to read manual recorded data. The LCD then shows " $\boxed{R}$ " mark.

② Push "▲" or "▼" key to select the desired memory address number data for display.

③ Push "↵" key to exit.
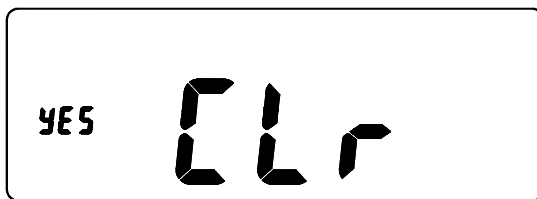
5-6 Disable Auto Power off Function

The meter will turn off automatically if no key is pushed for 10 minutes.

 Disable auto power off function :

1. Push " $\textcircled{1}$ " key to turn off the meter.
2. Push and hold "**HOLD**" key when turning on the meter again, the auto power off function will be disabled. The auto power off symbol "÷" will disappear.
3. Auto power off function will be actuated every time the meter is turned on.

## 5-7 Setting the Calibration Function (CAL)

The calibration factor CAL serves to calibrate the result display.   The solar power value measured internally is multiplied by the value of CAL that has been entered and the resulting value is displayed or stored.   The CAL setting range is from 0.000 to 9.999.   The calibration factor adjustment method needs a standard solar meter or calibrated light source as a reference.

1. Push & hold "**SET**" key, when turning on the meter to set up the calibration factor, the LCD displays "**CAL**" and the first digit that can be changed starts flashing.

2. Push " ▶" key to select the desired flashing digit.

3. Push "▲" or "▼" key to the desired value.

   Repeat step 2 and 3 for the remaining digits until the displaying value is the same as the standard reference.

4. Push "↵" key to store the new setting value and exit.
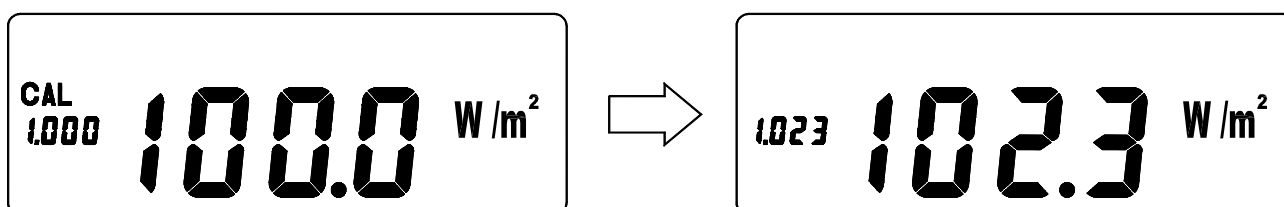
5-8 Zero Reading Adjustment

1. Push & hold "**POWER / %**" key when turning on the meter to zero the reading , the LCD displays "**CAL**".

2. Cover the solar sensor and push the ↵ key to zero the reading, the LCD will momentarily display "MIN" to confirm the zero adjustment.
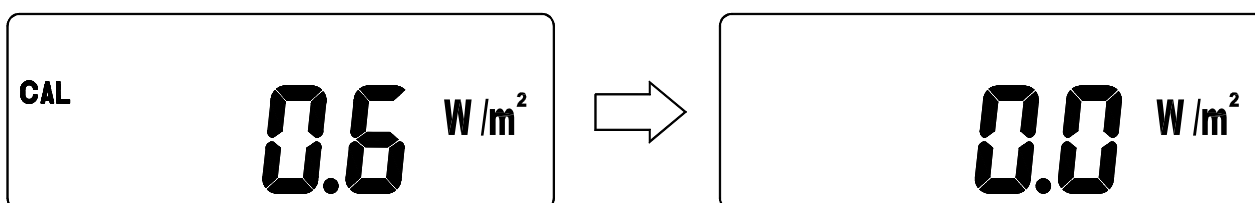
6. Batteries

1. If the battery capacity is low, the LCD will display " ⊡ " ; this requires the batteries to be replace with standard 4 x 1.5V AAA-size batteries.

2. Release the screw on the back of the meter and remove the carrying clip / battery cover.

3. Disconnect the batteries from the instrument and replace them with standard 4 x 1.5V AAA-size batteries and replace the cover.

   Note : Make sure the battery polarity is observed.

7. Maintenance

1. The white plastic plate on the top of the meter should be cleaned with a damp cloth when necessary.

2. Do not put the instrument in a place where temperature or humidity is excessively high.

3. The calibration interval for the solar sensor will vary according to operational conditions, but generally the sensitivity decreases in direct proportion to solar light intensity multiplied by the operational time. Therfore in order to maintain the basic accuracy of the instrument, periodic calibration is recommended.