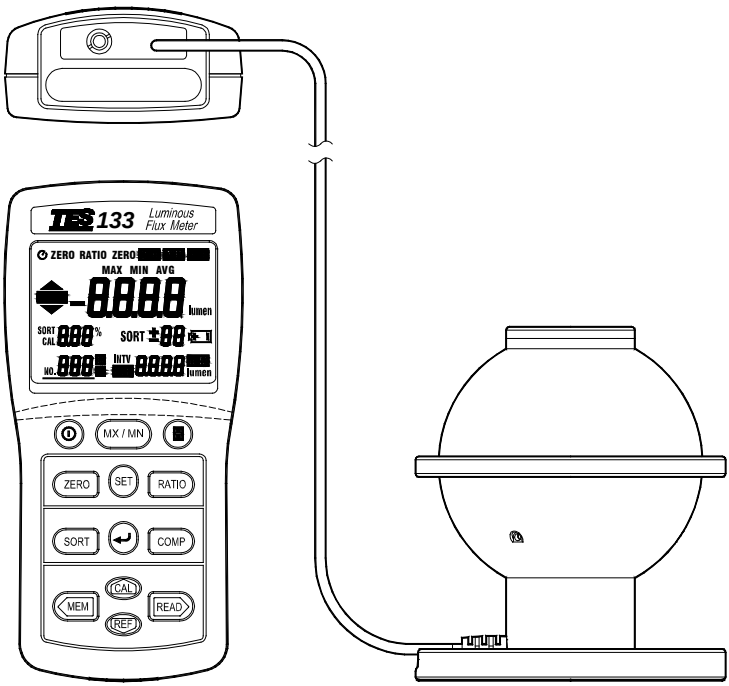
TES Luminous Flux Meter

TES-133

INSTRUCTION MANUAL

※Enclosed CD : Software & Protocol Inside.



TES ELECTRICAL ELECTRONIC CORP.

CONTENTS

1. INTRODUCTION

- The meter is an easy-to-use, precision photometric meter designed for use in the field, laboratory, or production floor. The meter measures luminous flux from source such as LED's, small lamps, and fibre-illuminators. The meter features a 75mm diameter integrating shpere that collects the total light entering the sphere measurement port.
- The integrating is the ideal optical device for measuring luminous flux from a source placed inside the sphere or just outside the sphere sample port.
- It meets CIE photopic spectral response, $f'_1 \leqq 6\%$.
- The meter is compact, tough and easy to handle owing to its construction.
- The light sensitive component used in the meter is a very stable, long-life silicone photo diode and spectral response filter.
- Measure LED's, small lamps, and fibre-illuminators.
- Measure narrowband and broadband sources.
- Measure highly divergent sources.
- Reduced sensitivity to light source alignment.
- Reduced sensitivity to polarization.
- Omits error introduced from detector area non-uniformities.
- **U.S. Pat. No. Des. 446,135**
- **Taiwan Pat. No. M 342502**

2. FEATURES

- ❑ Easy-to-read 4 digit LCD display.
- ❑ Spectral Sensitivity close to CIE photopic Curve.
- ❑ Measuring Level Range: 0.05 to 7000 lumens, Autoranging 4 steps.
- ❑ Accurate and Instant response.
- ❑ Data Hold function.
- ❑ Auto Data Hold function.
- ❑ Data memory and read function.
- ❑ Maximum / Minimum function.
- ❑ Zero function.
- ❑ Ratio function.
- ❑ Sort function.
- ❑ Comparator function.
- ❑ Auto power off function.
- ❑ Auto datalogging & RS-232 interface.

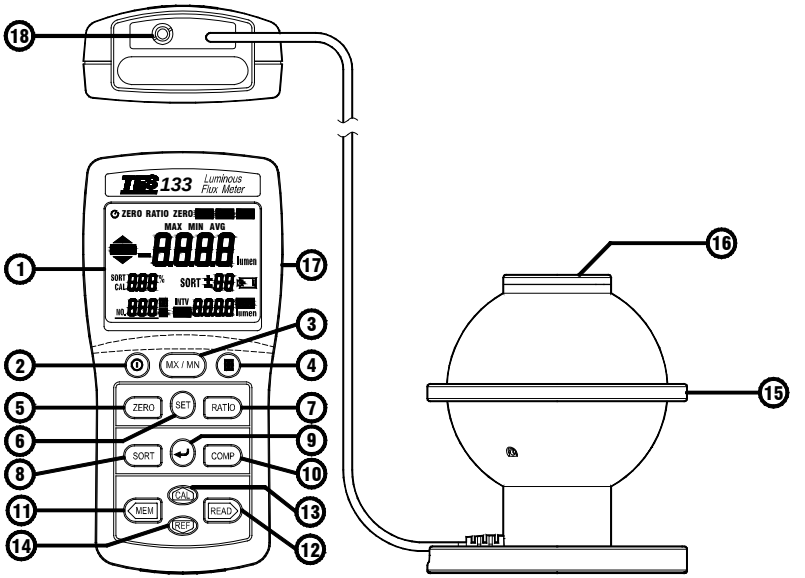
3. SPECIFICATIONS

- **Display** : 4 digit LCD reading.
- **Measuring Range** : 9.999, 99.99, 999.9, 7000 lumens
  (Autoranging 4 steps)
- **Resolution** : 0.05 – 9.999 0.001 lumen
  10.00 – 99.99 0.01 lumen
  100.0 – 999.9 0.1 lumen
  1000 – 7000 1.0 lumen
- **Accuracy**：0.05 to 0.1 ± 7%, 0.1 to 1000 ± 2%, 1000 to 7000 ± 3%
- **Overange Display** : LCD will show “OL” symbol.
- **Spectral Response** : CIE Photopic.
  (CIE human eye response curve).

- **Spectral Accuracy** : CIE Vλ function f '$_1$ ≦6%
- **Integrating Sphere** : Diameter : 75 mm
  Material : $BaSO_4$
  Sample Port : 25 mm dia.
- **Photo Detector** : One silicone photo diode and spectral response filter.
- **Temperature Characteristics** : ±0.1% / ºC.
- **Sampling Rate** : 5 times/sec.
- **Manual Data Memory Capacity** : 999 sets.
- **Auto Datalogging Capacity** : 38000 sets.
- **Operating Temperature & Humidity**：
  0ºC to 50ºC（32ºF to 122ºF）& 0% to 80% RH.
- **Storage Temperature and Humidity**：
  -10ºC to 60ºC（14ºF to 140ºF）& 0% to 70% RH.
- **Power Source** : 6 pcs size AAA battery.
- **Battery life (typical)** : 100 hours (carbon zinc).
- **Integrating Shpere Lead Length** : 80 cm (approx.).
- **Integrating Shpere Dimensions** : 94(D) × 108(H) mm
- **Meter Dimensions** : 150L×72W×35H (mm);
- **Weight** : 470g .
- **Accessories** : Carrying case, instruction manual, batteries, software CD rom & RS232 cable, Port Adaptor kit.

4. PARTS & CONTROLS

4-1 Description of Parts & Control keys



1. LCD Display : 4 digit display with a maximum of 9999 readings and the indicating signs of measured values, unit function symbols and decimal points etc. are displayed.

2. **Power Control key** : The power switch key turns the meter ON or OFF.

3. MX / MN **key** :

① Press MX / MN key to display the Maximum (MAX), Minmum (MIN) and Current (MAX MIN) measured values, press this key for 3 seconds to exit this mode.

② In the READ mode, press MX / MN key to display the manual memorized data value of Maximum (MAX), Minimum (MIN), and Average (AVG), if the manual memorized data all are measured in the same mode.

4.  **Data-Hold key** :

① Press  key to hold data, the D-H annunciator is displayed, press this key again to exit this mode.

② Press  key for 3 seconds to enter the auto hold mode, the A-H annunciator is displayed, press  key for 3 seconds to exit this mode.

③ Press and hold down  key, then press  key to turn on the meter, the auto power off function will be disabled, and the auto power off symbol "  " will be disappear.

5.  **key** : Press  key to enter the zero mode, the "ZERO" annunciator is displayed, press this key again to exit this mode.

6.  **key** : Press  key to enter the setting mode, press  key to exit this mode.

① Press  key to setting the sort tolerance limits.

② Press  key to setting the comparator High / Low values.

③ Press  key to setting the auto datalogging interval time.

④ Press  key to setting the calibration factor value.

⑤ Press  key to setting the reference value.

7.  **key** : Press  key to enter the ratio mode, the "RATIO" annunciator is displayed, press this key again to exit this mode.

8.  **key** :

① Press  key to enter the sort mode, the "SORT" annunciator is displayed, press this key again to exit this mode.

② Press SET key first then press SORT key to enter the sort tolerance limits setting mode.

9. ↵ **key** :

① Exit a setting mode or store the displayed setting.

② Exit the READ and Auto datalogging mode.

10. COMP **key** :

① Press COMP key to enter the comparator mode, the COMP annunciator is displayed, press this key again to exit this mode.

② Press SET key first then press COMP key to enter the comparator value setting mode.

11. MEM **key** :

① Press MEM key one time to store one set LCD reading to memory.

② Press MEM key for 3 seconds to enter or exit auto datalogging mode.

③ In the reference value setting mode and the comprator value setting mode, press ◀ key to move the decimal point left to the desired position.

④ Press and hold down MEM key then press ⏻ key to turn on the meter to enter the clear manual and auto memorized data mode.

⑤ Press SET key first then press MEM key to enter auto datalogging interval time setting mode.

12. READ **key** :

① Press READ key to enter the read mode, the R annunciator is displayed, press ↵ key to exit this mode.

② Press READ key for 3 seconds to turn on the RS232 interface.

③ In the reference value setting mode and the comprator value setting mode, press ▶ key to move the decimal point right to the desired position.

13. CAL **key** :

① In the setting mode press ▲ key to increase the setting value.

② In the READ mode press ▲ key to increase the memory location.

③ Press SET key first then press CAL key to enter the calibration factor setting mode.

14. REF **key** :

① In the setting mode pess ▼ key to decrease the setting value.

② In the READ mode press ▼ key to decrease the memory location.

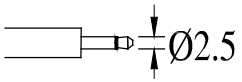
③ Press SET key first then press REF key to enter the SORT and RATIO reference value setting mode.

④ Press REF key to display the reference value, press this key again the reference value is disappeared.

15. Integrating sphere.

16. Port Adaptor kit :

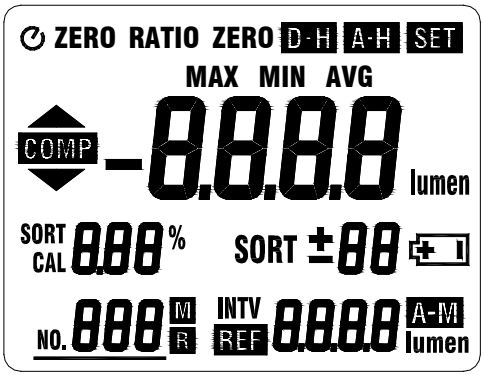
2mm Adaptor size.
3mm Adaptor size – (T1)
4mm Adaptor size
5mm Adaptor size – (T1-3/4)
8mm Adaptor size
10mm Adaptor size – (T3-1/4, T3-3/4)
24mm Adaptor size



17. AC adaptor socket (9V, 100mA).

18. RS232.

4-2 Description of Display



: Auto power off indication.

ZERO : Zero mode indication ($\phi = \phi_{in} - \phi_d$)

ZERO RATIO : Zero – Ratio mode indication
[RATIO = $(\phi_{in} - \phi_d)/ (\phi_R - \phi_d)$]

RATIO : Ratio mode indication (RATIO = ϕ_{in} / ϕ_R)

RATIO ZERO : Ratio – Zero mode indication
[RATIO = $(\phi_{in} - \phi_d)/ \phi_R$]

D-H : Display data hold mode indication.

A-H : Display Auto data hold mode indication.

SET : Setting mode indication.

SET **SORT** 10% : Sort tolerance limits setting mode indication (10% to 100%).

SET COMP 1.100 lumen : Comparator High limit value setting indication.

SET COMP 0.900 lumen : Comparator LOW limit value setting indication.

SET **INTV** □□.□**1** **A-M** : Auto datalogging interval time selection mode indication (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 30, 40, 50 seconds or 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 30, 40, 50, 60 minutes).

SET **CAL 1.** □□ : Calibration factor setting mode indication (0.01 to 9.99).

SET **REF** **1.** □□□ **lumen** : Reference value setting mode indication.

MAX : Maximum reading display.

MIN : Minimum reading display.

MAX MIN : Current reading display.

AVG : Manual data memory average value display.

COMP : Comparator function on indication.

: Over comparator high limit indication.

: Below comparator low limit indication.

lumen : luminous flux unit.

SORT 1 □□ % : Sort tolerance limit percentage display.

CAL 1. □□ : Calibration factor value display ($\phi = \phi_{in}$ x CAL)

SORT ±  : Sort class display (-10 to +10 classes).

Each class is a tenth part of the tolerance limit.

SORT + OL : Over sort tolerance limit.

SORT – OL : Low battery indication.

 : Low battery indication.

: Last manual data memory address.

M : Manual data memory indication, M appears one time store one set data into memory.

R : Recall manual data memory address number indication, the memory data display for read.

REF : Reference value display.

A-M : Auto datalogging indication, A-M disappears one time store one sets data into the memory.

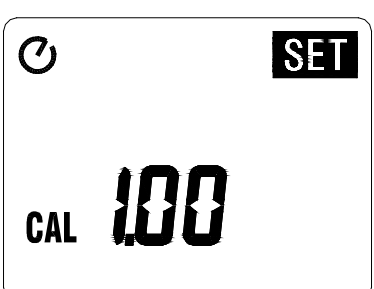
5. OPERATING INSTRUCTIONS

When press ⏻ key to trun on the meter, the various settings depend on the condition the meter was in before it was last turned off.

5-1 Setting the Calibration Factor

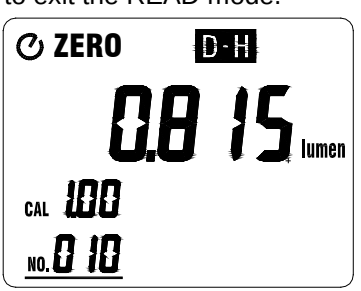
Because the meter of the photopic filter is not perfect and small adjustments to the collected radiation profile are needed to improve the meter accuracy when measuring LED's. These adjustments are dependent on the peak wavelength and spectral bandwidth of the test LED emission. The meter frimware makes corrections to the photometric data through a user entered calibration factors. If the test source is not an LED, the calibration factor entry should be "1.00".

1. Press ⏻ key to turn on the meter.
2. Press SET key first then press CAL key to enter the calibration factor setting mode.
3. Press ▲▼ key to set to the desired calibration factor value.
4. Press ↵ key to store the value and exit this mode.



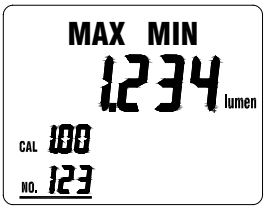
5-2 luminous Flux Measurement

1. Determine an appropriate entry sample port from the port adaptor kit.
2. Press ⏻ key to turn on the meter.
3. Position the light source at the sample port. If you are measuring LEDs and the meter includes a port adaptor, insert the lens into the aperture as far as it will go. If no adaptor is available, position the LED at the sample port so the tip of the lens protudes a few millimeters beyond the outer enclosure of the sphere.
4. Press ZERO key to store the dark current flux.
5. Energize the light source and allow ample time for warm-up.
6. Read the luminous flux value from the LCD display.
7. To freeze a measured value, press H key.
8. Press MEM key each time will store one measured value into memory.
9. Press READ key first then press MX / MN key to display the manual memorized data value of Maximum (MAX), Minimum (MIN) and Average (AVG), if the manual memorized data all are measured in the same mode.
10. Press ↵ key to exit the READ mode.



5-3 Maximum & Minimum Recording Measurement

1. Press MX / MN key to enter the recording mode, the auto power off function will be auto cancelled.
2. Press MX / MN key to display the Maximum (MAX), Minimum (MIN) and Current (MAX MIN) measured values.
3. Press this key for 3 seconds exit this mode.



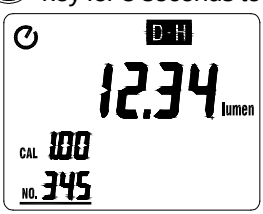
5-4 Hold Function Operation

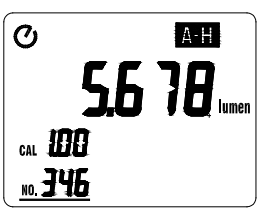
A. Data Hold

1. Press H key to freeze an instantaneous measurement enter to the data hold mode, the " D-H " annunciator is displayed.
2. Press H key again to exit this mode.

B. Auto Data Hold

1. Press H key for 3 seconds to enter auto data hold mode, the A-H annunciator is blink.
2. When the measured reading is stable (± 3 digits), the meter will auto hold the data, the " A-H " annunciator is fixed.
3. Press H key again will repeat itself.
4. Press H key for 3 seconds to exit this mode.



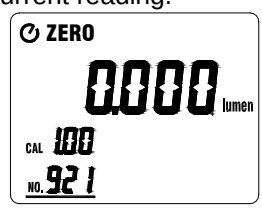


5-5 Zero Function Operation

Used to offset a dark current reading.

1. Press ZERO key to store the dark current reading and enter the ZERO mode, the “ZERO” annunciator is displayed.
2. All subsequent reading on the LCD are relative to the previous reading, the LCD will read : $\phi = \phi_{in} - \phi_d$

   Where ϕ_{in} is the total luminous flux into the sphere at time of measurement and ϕ_d represents the dark current reading.
3. Press ZERO key again to exit this mode.



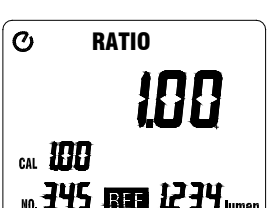
5-6 Ratio Function Operation

Used to display a ratio of flux measurement.

A. Use the current measured value as the reference value.

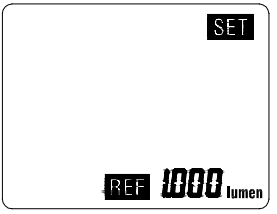
1. Press RATIO key to store the reference value and enter the RATIO mode, the “RATIO” annunciator and the stored reference value are displayed. If the user press RATIO key when the LCD reading is 0.000 lumen, a “RATIO Err” error message will display division by ZERO is not allowed.
2. All subsequent measurements are now displayed as the ratio of the current measurement to the stored reference value, the LCD will read : RATIO = $\frac{\phi_{in}}{\phi_{RATIO}}$ ($0<\phi_{in}<OL$, $0<\phi_{RATIO}<OL$)

   Where ϕ_{RATIO} is the total luminous flux into the sphere when RATIO key is pressed.
3. Press RATIO key again to exit this mode.

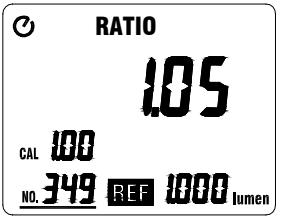


B. Use the setting value as the reference value.

1. Setting the reference value.
   a. Press SET key first then press REF key to enter the reference value setting mode, the " SET REF " annunciator and the previous reference value are displayed.
   b. Press ◀▶ keys to select the desired decimal point position.
   c. Press ▲▼ keys to set the desired reference value.
   d. Press ↵ key stored the value and exit this mode.



2. Press REF key to display the reference value.
3. Press RATIO key to enter the RATIO mode, the "RATIO" annunciator is displayed. All measurements are now displayed as the ratio of the current measurement to the reference value, the LCD will read : RATIO = $\frac{\phi_{in}}{\phi_{REF}}$ ($0<\phi_{in}<OL$, $0<\phi_{REF}<OL$)
   Where ϕ_{RATIO} is the reference value.
4. Press RATIO key again to exit the RATIO mode.
5. Press REF key again the reference value is disappeared.



5-7 ZERO-Ratio Function Operation

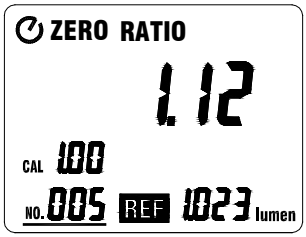
A. Use the current measured value as the reference value.

1. Press ZERO key to store the dark current (ϕ_d), and subsequently takes a measurement (ϕ_{in}), the LCD will read : $\phi = \phi_{in} - \phi_d$
2. Press RATIO key, the LCD will read : RATIO = $\frac{\phi_{in}-\phi_d}{\phi_{RATIO}-\phi_d}$

   Where ϕ_{RATIO} is the total luminous flux into the shpere when RATIO key is pressed.

B. Use the current reference value.

1. Press REF key to display the reference value (ϕ_{REF}).
2. Press ZERO key to store the dark current (ϕ_d), and subsequently takes a measurement (ϕ_{in}), the LCD will read : $\phi = \phi_{in} - \phi_d$
3. Press RATIO key, the LCD will read : RATIO = $\frac{\phi_{in}-\phi_d}{\phi_{REF}-\phi_d}$



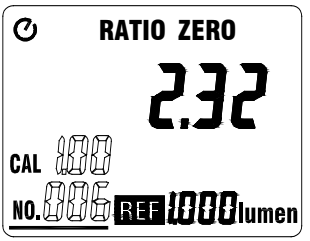
5-8 Ratio – ZERO Function Operation

A. Use the current measured value as the reference value.

1. Press RATIO key, the LCD will read : RATIO = $\frac{\phi_{in}}{\phi_{RATIO}}$
2. Press ZERO key for the dark current ϕ_d and records a measurement, the LCD will read : RATIO = $\frac{\phi_{in}-\phi_d}{\phi_{RATIO}}$

B. Use the current reference value

1. Press REF key to display the reference value (ϕ_{REF}).
2. Press RATIO key, the LCD will read : RATIO = $\frac{\phi_{in}}{\phi_{REF}}$
3. Press ZERO key, the LCD will read : RATIO = $\frac{\phi_{in}-\phi_{d}}{\phi_{REF}}$



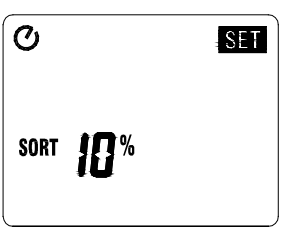
5-9 Sort Function Operation

A. Setting the reference value (see 5-6. B.1).

The reference value can not less than 0.100 lumen in the sort mode.

B. Setting the sort tolerance limits.

1. Press SET key first then press SORT key to enter the sort tolerance limits setting mode, the " SET SORT " annunciator is displayed.
2. Press ▲ ▼ keys to set the desired tolerance limits from 10% to 100%.
3. Press ↵ key to stored the value and exit this mode.



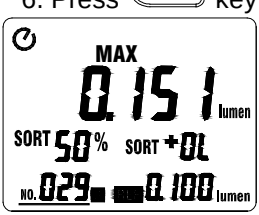
C. Sort Operation

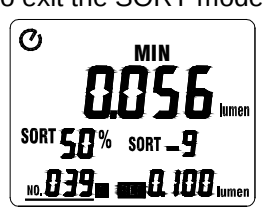
1. Press SORT key to enter the SORT mode, the reference value and the sort tolerance limits is displayed.
2. The sort tolerance limits is divided into ten classes from -10 to -1 and +1 to +10 classes.

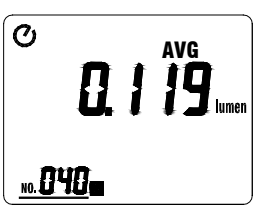
   If the measured value over the tolerance limits, the +OL or -OL will be display.

   Example:

   If the reference valus is 0.100 lumen, the sort tolerance limits is 50%, and the measured value is 0.073 lumen, then “SORT-6” is displayed.
3. Press MEM key each time will store one measured value into memory.
4. Press READ key first then press MX / MN key to display the manual memorized data value of Maximum (MAX), Minimum (MIN) and Average (AVG), if the manual memorized data all are measured in the same mode.
5. Press ↵ key to exit the READ mode.
6. Press SORT key to exit the SORT mode.





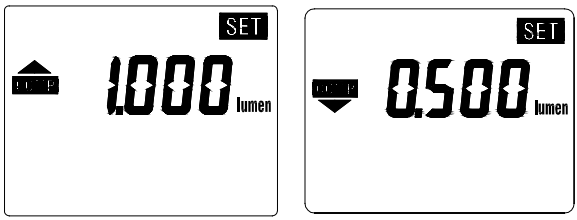


5-10 Comparator Setting and Operation

A. Setting the comparator values

1. Press ⏻ key to turn on the meter.
2. Press SET key first then press COMP key to enter the comparator High limit value setting mode, the “ SET COMP ▲” annunciator is displayed .

3. Press ◀▶ keys to select the desired decimal point position.
4. Press ▲▼ keys to set the desired High limit value.
5. Press ↵ key to enter the comparator Low limit value setting mode.
6. Press ◀▶ keys to select the desired decimal point position.
7. Press ▲▼ keys to set the desired Low limit value.
8. Press ↵ key to exit this mode.



B. Comparatar Operation

1. Press COMP key to enter the comparator mode, the " COMP " annunciator is displayed.
2. If measurement value exceeds the setting value, the "▲" or "▼" annunciator will be displayed and the beeper will sound.
3. Press COMP key again to exit this mode.

5-11 Manual Data Memory and Read Mode

A. To Memorize the reading

Pressing MEM key each time will store one set of reading into the memory. At this moment, LCD will show the " M " mark one time and the memory address number. Total memory size is 999 sets.

B. To Recall and Read Manual memorized reading

1. Press READ key to enter the READ mode, the LCD will show " R " mark and the memory address number.
2. Press " ▲" or " ▼ " key to select the desired memory address number data for display.

3. Press MX / MN key to display the manual memorized data value of Maximum (MAX), Minimum (MIN) and Average (AVG), if the manual memorized data all are measured in the same mode.

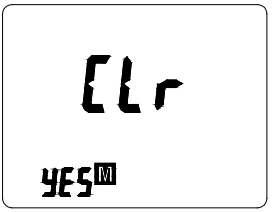
4. Press ↵ key to exit this mode.

C. To clear the manual memorized data

1. Press ⏻ key to turn off the meter.

2. Press and hold down MEM key then press ⏻ key to turn on the meter, LCD will show "**CLr no M** " mark, press ▼ key select " YES " or " nO ", then press " ↵ " key to exit this mode. If you select yes the all manual memorized data will be cleared.

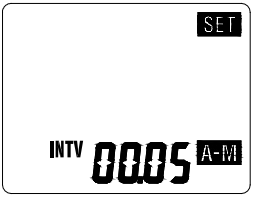
3. Press ↵ again to exit clear auto datalogged memorized data.



5-12 Auto Datalogging Function

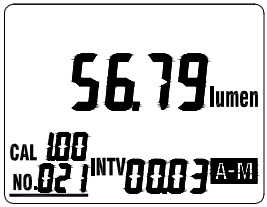
A. To Setting interval time

1. Press the ⏻ power key to turn on the meter.
2. Press SET key, the annunciator " **SET** " is displayed.
3. Press MEM key to enter the interval time setting mode.
4. Press ▲▼ keys to select desired interval time from 1 second to 60 minutes.
5. Press ↵ key to store the setting value.



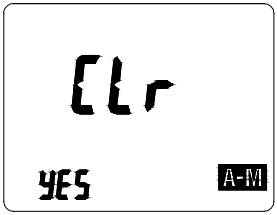
B. To Enter Auto Datalogging mode

1. Press MEM key until the beeper sound to enter this mode. The "**A-M** **INTV**" marks are displayed, when the "**A-M**" mark is disappear one time, one set of reading is stored to the memory.
2. The maximum memory capacity is **38000** sets.
3. Press MEM for 3 seconds or ↵ key to exit this mode.



C. To Clear Auto Datalogged memorized data

1. Press ⏻ key to turn off the meter.
2. Press and hold down MEM key then press ⏻ key to turn on the meter, LCD will show "**CLr no** **M**" mark, press ↵ key one time, LCD will show "**CLr no** **A-M**" mark, press ▼ key select " YES " or " no ", then press ↵ key exit this mode. If you select yes the all auto datalogged memorized data memory will be cleared.



5-13 RS232 Communication

Press READ key 3 seconds the beeper will sound three times to turn on this mode.

5-14 To Disable Auto Power off Function

The meter enters sleep mode if no key is pressed for approx. 15 minutes.

1. Press ⏻ key to turn off the meter.
2. Press and hold down H key then press ⏻ key to turn on the meter and the auto power off function will be disabled.

   The auto power off mark " ↻ " will disappeared.

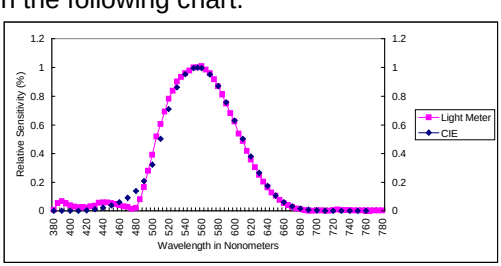
   Auto power off mode is enabled each time you turn on the meter and is automatically disabled in the MX/MN mode mode and auto datalogging mode.

6. BATTERY CHECK-UP & REPLACEMENT

1. As the battery power is not sufficient, LCD will display " 🔋 " ; and, replacement of new batteries type 6×1.5V is required.
2. After turning off the meter remove used batteries from the compartment and replace with new standard batteries (6 ×1.5V).

7. SPECTRAL SENSITIVITY CHARACTERISTIC

- The sensor of this instrument together with its filter gives a spectral sensitivity characteristic close to photopic curve Vλ of C.I.E. (INTERNATIONAL COMMISSION ON ILLUMINATION) as described in the following chart.



8. MAINTENANCE

1. Do not store the instrument where temperature or humidity is excessively high.
2. Cleaning : Periodically wipe the case with a damp cloth and mild detergent.

   Do not use abrasives or solvents. Clean and dry as required.

9. RS-232 INTERFACE, SOFTWARE INSTALLATION and OPERATION

- ❑ For the detailed instruction, please refer to the content of attached CD-ROM, which has the complete instruction of RS-232 interface, software operation and relevant information.
- ❑ RS-232 protocol : are enclosed within the content of CD-ROM, please open the CD-ROM for details.

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