

INSTALLATION AND MAINTENANCE SUITCASE FOR SOLAR THERMAL SYSTEMS

OVERVIEW

This suitcase is specifically designed for installing and performing maintenance on solar thermal systems.

The suitcase contains:

- A digital pH-meter complete with screwdriver and calibration solution (pH 7@25°C)
- A handheld refractometer complete with screwdriver, plastic dropper and prism cleaning cloth
- A digital thermometer with 2 inputs for Tc-K probes
- Two Tc-K clamp temperature probes with fiberglass 3M sticking tape.
- A pressure gauge (range 0+4.5 bar)
- A clinometer compass
- A package of litmus paper strips



HOW TO USE THE DIGITAL PH-METER

Technical features

Power supply:	9VDC
Measuring range:	0.00÷14.00 pH
Resolution:	0.10 pH
Accuracy:	±0.20 pH
Calibration:	1 point
Electrode:	pull-out electrode, max. 8 cm
Operating temperature range:	0°C to ~50°C
Dimensions:	40x158x34 mm (W x H x D)
Weight:	~120 g

Preparation

- Insert the 9V battery (supplied) and press the ON/OFF button to turn on the instrument.

1 Point manual calibration

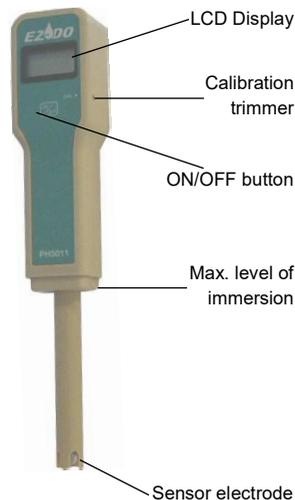
- Remove the protective cap and pull out the electrode; if necessary adjust the electrode's length (max. 8 cm).
- Rinse the electrode with clean water and dry it. Dip the electrode in the test solution (supplied), which has a known pH of 7 (25°C). Gently stir the solution for a few seconds until the value on the display stabilizes.
- Set the pH to 7.0 (25°C) by using the screwdriver (supplied) to turn the trimmer, located on the right-hand side of the instrument and indicated by CAL ► on the front.
- After calibrating the instrument, wash the electrode in clean water and dry it.

Operation

- Note:** The instrument does not need to be calibrated before every use. Calibrate the instrument the first time you use it and then recalibrate it every two weeks or after every 10 measurements.
- Dip the electrode in the solution to be measured. Stir the solution and wait a few seconds for the value on the display to stabilize.
 - Wash the electrode after every use and put on the protective cap. The sponge material inside the protective cap must be kept moist at all times; add some clean water if necessary.

Changing the battery

- If the instrument does not turn on or the display shows the values incorrectly, the battery needs to be changed.
- Remove the cover of the battery compartment on the back of the instrument.
 - Replace the 9VDC battery with a new battery.
 - Put back the cover.



WARNING:

If some instability is noticed in the measurements reading and/or if the instrument has not been used for a long time, or anyway periodically, it is necessary to perform the REACTIVATION of the instrument sensible bulb, according to the following procedure:

- Extract the instrument internal wire.
- Put it in a recipient with tap water (NOT DISTILLED!) at room temperature and leave it in the water for at least 8 - 10 hours.
- Pull out the instrument and perform the zero calibration (pH 7) as the instruction reported before (liquid provided with the instrument).
- When inserting the cap, check that the sponge on the inside is constantly wet.

NOTE: it is a permanent and indeleteable feature of the applied technology the fact that the sensible bulb can be dry if not constantly kept wet.

HOW TO USE THE DIGITAL THERMOMETER (MODEL 301)**INTRODUCTION**

This instrument is a digital thermometer for use with any K-type thermocouple as temperature sensor.

Temperature indication follows National Bureau of Standards and IEC584 temperature/voltage table for K-type thermocouples.

SPECIFICATIONS**Numerical Display:**

4 digital liquid crystal display

Measurement Range:

-200°C ~ 1370°C -328°F ~ 2498°F

Resolution:

-200°C~ 200°C 0.1°C; 800°C ~1370°C 1°C

-200°F~ 200°F 0.1°F; else 1°F

Maximum Voltage at Thermocouple Input:

60V DC, or 24Vrms AC

Environmental:

- ✓ Operating Temperature and Humidity:
0°C ~50°C (32°F ~ 122°F) ; 0 ~ 80% RH
- ✓ Storage Temperature and Humidity:
-10°C to 60°C (14°F ~ 140°F) ; 0 ~ 80% RH
- ✓ Altitude up to 2000 meters.

Accuracy: at (23 ± 5°C)

Range	Accuracy
-200°C ~ 200°C	±(0.3% reading + 1°C)
200°C ~ 400°C	±(0.5% reading + 1°C)
400°C~1370°C	±(0.3% reading + 1°C)
-328°F ~ -400°F	±(0.5% reading + 2°F)
-200°F ~ 200°F	±(0.3% reading + 2°F)
200°F ~ 400°F	±(0.5% reading + 2°F)
400°F ~ 2498°F	±(0.3% reading + 2°F)

For T1-T2 Measurement, the accuracy is

±(0.5% T1-T2 reading + 2°C) or

±(0.5% T1-T2 reading + 2°F)

Temperature Coefficient:

For ambient temperatures from 0°C ~ 18°C and 28°C ~ 50°C, for each °C ambient below 18°C or above 28°C add the following tolerance into the accuracy spec.

0.01% of reading + 0.03°C (0.01% of reading + 0.06°F)

Note:

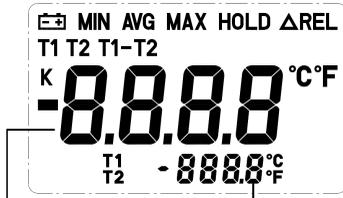
The basic accuracy Specification does not include the error of the probe please refer to the probe accuracy specification for additional details.



Sample Rate: 0.6 times per second
Dimension: 184×64×30mm
Weight: 210g Approx.(7.4oz)
Accessory: K Type Bead Probe, Battery, Carrying Case, Instruction Menu.
Option: Soft Ware Package (Program, RS232 Connection Cable) , AC Adapter.
Power requirement: 9 Volt Battery, NEDA 1604 or JIS 006P or IEC6F22
Battery Life: Approx. 100hrs with alkaline battery
AC Adapter: 9VDC ±15% 100mA ; Plug Diameter: 3.5×1.35mm

SYMBOL DEFINITION AND BUTTON

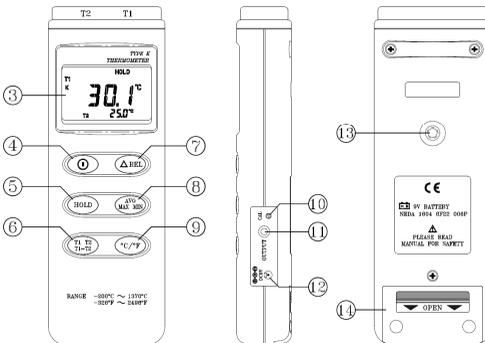
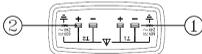
Location:



MAIN DISPLAY

SECOND DISPLAY

- : This indicates that the minus temperature is sensed.
- °C °F : Centigrade and Fahrenheit indication.
- K : Thermocouple Type Indication
- HOLD** : This indicates that the display data is being hold.
- MAX** : The Maximum value is now being displayed
- MIN** : The Minimum value is now being displayed
- AVG** : The Average value is now being displayed.
- ΔREL** : The reading is now under Relative Mode.
- : The Battery is not sufficient for proper operation.



- 1 T1 K type temperature sensor connector
- 2 T2 K type temperature sensor connector
- 3 LCD display
- 4 ON/OFF button
- 5 HOLD button
- 6 T1,T2,T1-T2 control button
- 7 Relative readout button
- 8 MAX MIN Average control button
- 9 °C, °F control button
- 10 Offset calibration screw
- 11 Digital output connector

- 12 AC power adapter connector
- 13 Tripod connector
- 14 Battery cabinet cover

OPERATION INSTRUCTIONS:

4.1 Power-Up

Press the '4' key to turn the thermometer On or OFF.

4.2 Connection the Thermocouples

For measurement, plug the thermocouple into the input connectors.

4.3 Selecting the Temperature Scale

When the meter was first power on, the default scale setting is set at Celsius (°C) scale. The user may change it to Fahrenheit (°F) by pressing " °C/°F " button and vice versa to Celsius.

4.4 Data-Hold Operation

The user may hold the present reading and keep it on the display by pressing the "HOLD" button. When the held data is no longer needed, one may release the data-hold operation by pressing "HOLD" button again. When the meter is under Data Hold operation, the "ΔREL", and " °C/°F " button are disabled.

4.5 T1,T2,T1-T2 Display Control:

One may select T1,T2 or T1-T2 to show on the main display by pressing button. When T1 or T2 is select to show on the main display, the other temperature will be shown on the second display. When one select T1-T2 to show on the main display, T1 and T2 will be shown on the second display alternately.

4.6 Relative Operation for Main Display:

When one press the "ΔREL" button, the meter will memorize the present reading and the difference between the new reading and the memorized data will be shown on the display. Press the " ΔREL" button again to exit the Relative operation.

4.7 MAX/MIN/AVG Operation for Main Display:

When one press the '  ' button the meter will enter the MAX/MIN mode. Under this mode the maximum value, minimum value and average value of latest 8 data is kept in the memory simultaneously and updated with every new data.

When the MAX symbol is display, the Maximum is shown on the display.

Press again  , then the MIN symbol is on the display and also the minimum reading.

Press again  , the AVG symbol is on the display and also the average reading.

Press again  , MAX, MIN and AVG will blink together. This means that all these data is updated in the memory and the reading is the present temperature.

One may press  to circulate the display mode among these options.

When the meter is under operation, "ΔREL" and " °C/°F " are disabled.

To exit the MAX/MIN mode, one may press and hold  for two seconds.

4.8 Auto Power Off:

By default, when the meter is powered on, it is under auto power off mode. The meter will power itself off after 30 minutes if no key operation or RS232 communication. Key combination at power on or RS232 communication can disable auto power off.

One may press and hold "HOLD" button and then power on the meter and there will be two successive beeps to indicate that auto power off is disabled.

4.9 Low Battery Condition

When the battery voltage is under proper operation requirement, the  symbol will show on the LCD and the battery need to be replaced with new one.

4.10 Calibration Point:

Room Temperature 23 ± 3°C

input	Adjust VR	Tolerance
0 °C	VR1	± 0.1 °C
190 °C	VR2	± 0.1 °C
1000 °C	VR3	± 1 °C
1900 °F	VR4	± 1 °F

Normally, performing offset Calibration with thermal stabled ice water through VR1 will give a very good calibration result.

4.11 Digital Output:

The Digital Output is a 9600bps N 81 serial interface.

The RX is a 5V normal high input port.

The TX is a 5V normal high output port.

The command of Digital Output is list below.

RS232 command	Function	Remarks
K(ASC 4BH)	Ask for model No.	Send 4 bytes
D(ASC 44H)	Ask for main display Range, Data, Unit	Send 22 bytes
B(ASC 42H)	Ask for secondary display Range, Data, Unit	Send 22 bytes
S(ASH 53H)	Ask Status	Send 13 bytes
H(ASC 48H)	Hold button	
T(ASC 54H)	TIMER button	
M(ASC 4DH)	AVG/MAX/MIN button	
N(ASC 4EH)	Exit AVG/MAX/MIN mode	
R(ASC 52H)	REL button	
C(ASC 43H)	C/F button	
A(ASC 41H)	Inquire all encoded data	Send encoded 8 byte

- **Command K:**
Return 4 bytes. For example, when sends command "K" to meter, it will return "3","0","1", ASCII(13).
- **Command D:**
Return data of main window.
Range: T1, T2, T1-T2 (7bytes), the unused characters is left as space ASC(13).
Data: ±9999.9,-OL,OL (7bytes include polarity and decimal point), Unit: C,F(5bytes)
When the meter receive the D command, it will send:
Range, Data, Unit. (where represent space (ASC(20H))
For example:
T1 -199.9 °C
(0x13) represent T1,- 199.9°C, The total byte number should be 7+1+7+1+5+chr(13)=22Bytes
- **Command B:**
Return the contents in the second display.
- **Command S:**
Return the operation mode HOLD, MAX, REL, if the mode is not entered, the related characters will be left as space.
For example:
when the meter is under MAX display, the meter will return: MAX
- **Command T:**
Equivalent to one pushing on the HOLD button.
- **Command M:**
Equivalent to one pushing on the HOLD AVG/MAX/MIN button and no message is returned.
- **Command R:**
Equivalent to one pushing on the REL button and no message is returned.
- **Command C:**
Equivalent to one pushing on the C/F button and no message is returned.
- **Command A:**

1st BYTE:

The first byte is the start byte , it value is 2.

2nd BYTE:

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
C/F	Low Bat	Hold	REL	K/J	MAX/AVG/MIN		

bit 2	bit 1	bit0	
0	0	0	→ normal mode
0	0	1	→ MAXIMUM mode
0	1	0	→ MINIMUM mode
1	0	0	→ AVG mode
1	1	1	→ calculate MAX/MIN/AVG in back-ground and lcd "MAX""AVG""MIN" will flash.

bit3:1→ 0→ K TYPE 1→ J TYPE

bit4:1→ REL

bit5:1- HOLD 0→ not HOLD

bit6:1→ LOW BATTERY 0→ BATTERY NORMAL

bit7:1→ C 0→ F

3rd BYTE:

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
		point	minus	OL	point	minus	OL

bit0:1→ main window value is OL 0→ not OL

bit1:1→ main window value is minus, 0→ main window value is plus.

bit2:1→ 4th byte and 5th byte represent ##### 0→ 4th byte and 5th byte represent ####.#

bit3:1→ sub window value is OL 0→ not OL

bit4:1→ sub window value is minus, 0→ sub window value is plus.

bit5:1→ 6th byte and 7th byte represent ##### 0→ 6th byte and 7th byte represent ###.#

bit7 bit6:

00→ Main window is T1-T2,sub window is T1

01→ Main window is T1-T2, sub window is T2

10→ Main window is T1, sub window is T2

11→ Main window is T2, sub window is T1

4th BYTE: first two BCD code of main window value.

5th BYTE: last two BCD code of main window value

6th BYTE: first two BCD code of sub window value.

7th BYTE: last two BCD code of sub window value.

8th BYTE: The last byte is the end byte , it value is 3, first and last byte are used to check frame error.

HOW TO USE THE HANDHELD REFRACTOMETER

Handheld refractometers can be used to find the freezing point of antifreeze fluids (water/propylene glycol, water/ethylene glycol solutions) or windscreen cleaning liquids or the specific gravity of battery fluids.

Operation

Focusing

a. Point the instrument towards a light source; look into the eyepiece and adjust the dioptre ring to focus on the graded scale.

Calibration

b. Open the cover plate, put a few drops of common water on the blue glass prism using the plastic dropper (supplied), close the plate and press it lightly to spread the water evenly over the surface of the prism without leaving air bubbles or dry areas.

c. Leave the water on the prism for about 30 seconds to let it adapt to the temperature of the refractometer.

d. Hold the instrument towards the light and look into the eyepiece. You should see a graduated circle with a dark upper part and a light lower part.

e. If the border between the dark part and the light part does not fall on the zero of the graded scale (marked "WATERLINE"), the instrument needs to be calibrated.

f. Take off the protective cap and, using the screwdriver supplied, adjust the calibration screw so that the dividing line between the dark and the light parts in the eyepiece coincides with the zero on the graded scale marked "WATERLINE".

Note: The zero setting and the subsequent readings should be done at the same temperature. If there are considerable changes in temperature, reset the zero every 30 minutes.

Readings

g. Open the cover plate, clean the surface of the prism with a soft cloth (supplied) and put a few drops of the solution to be tested on the blue glass prism using the plastic dropper. Close the plate and press it lightly to spread the solution evenly over the surface of the prism without leaving air bubbles or dry areas.

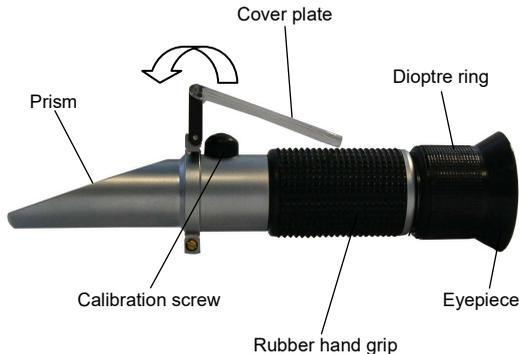
h. Looking through the eyepiece, find the dividing line between the dark and light parts and read the corresponding value on the graded scale.

With this procedure you can find the freezing point of water/glycol solutions or windscreen fluids or the specific gravity of battery fluids.

Precautions and maintenance

- Do not expose the instrument to humidity and do not put it in water — although it is protected against splashes it is not watertight. If the eyepiece fogs up the instrument has been infiltrated by water.
- Do not use this instrument to test abrasive or corrosive substances that might damage the prism's coating.
- Clean the instrument after every reading using the cloth supplied. If the surface of the prism appears dirty because it was improperly dried, clean it with a cloth soaked in alcohol. If the prism is not regularly cleaned the results will be inaccurate and the prism's coating risks being damaged.
- This is an optical instrument. Handle it with care to avoid damaging the optics and casing.

Note: Although the instrument's readings do not depend on temperature, the greatest accuracy is achieved at an average temperature of 20°C.



Technical features

<u>Measuring range:</u>	Battery fluid:	1.10+1.40 kg/l
	Ethylene glycol (G11/G12):	-50 °C+0 °C
	Propylene glycol (G13):	-50 °C+0 °C
	Windscreen fluid:	-40 °C+0 °C
<u>Resolution:</u>	Battery fluid:	0.01 kg/l
	Ethylene glycol (G11/G12):	5 °C
	Propylene glycol (G13):	5 °C
	Windscreen fluid:	-5 °C
<u>Accuracy:</u>	Battery fluid:	±50 kg/l
	Ethylene glycol (G11/G12):	±5 °C
	Propylene glycol (G13):	±5 °C
	Windscreen fluid:	±5 °C
Operating temperature:		20°C
Dimensions:		40x160x40 mm (LxHxD)
Weight:		~175 g

HOW TO USE THE Tc-K CLAMP PROBES

Technical features

Sensor:	TC-K thermocouple
Measuring range:	0°C to +120°C (+32°F to +248°F)
Tube diameter:	6+22 mm
Cable:	Spiral cable, 120 cm long, with 2-pin male mini connector, flat inserts.



HOW TO USE THE PRESSURE GAUGE

This instrument lets you check the initial pressure in the expansion vessel.

The measuring range is 0 to 4,5 bar.

The initial pressure in vessels normally used in the heating sector is 1.5 bar (in the factory); in solar installations the initial pressure varies from 2.5 to 3 bar.

However, accurate adjustments can be performed based on the installation design.

This pressure gauge can also be used to check the tyre pressure on cars, motorcycles or other vehicles.

Before using the instrument make sure the pointer is on 0.5 bar. If it isn't, push the metal button at the top left of the instrument. This will bring the pointer to its starting position. Take the measurement and then press the metal button again.



HOW TO USE THE CLINOMETER COMPASS

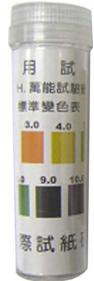
Use the clinometer compass to check the orientation and inclination of flat-plate solar collectors.

Ideally, solar collectors should be installed facing south.



HOW TO USE THE LITMUS PAPER

- Briefly dip a strip of litmus paper in a sample of thermal fluid. If the colour does not stabilize immediately, leave the strip in the fluid until the colour remains stable.
- Take the strip out and compare the colour of the two segments on the strip with the chart printed on the package.



pH	Recommended Action
Above 8.5	The cleaning fluid has not been completely flushed out of the system. It is advisable to empty the system, clean it and fill it with fresh fluid.
7.5 to 8.5	The pH is right.
7.0 to 7.4	The pH is lower than ideal; check the pH more frequently.
Below 7.0	The pH is too low - the thermal fluid is no longer in acceptable working conditions. Empty the system and clean it with a suitable cleaning product, then fill it with fresh fluid.

- After washing with a suitable cleaning product, measure the pH of both the mains water and the final rinse water. **MAKE SURE THE pH IS THE SAME.**

WARRANTY

In the view of a constant development of their products, the manufacturer reserves the right for changing technical data and features without prior notice. The consumer is guaranteed against any lack of conformity according to the European Directive 1999/44/EC as well as to the manufacturer's document about the warranty policy. The full text of warranty is available on request from the seller.