TRH444
Portable Turbidity Meter
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omega.com

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Approach Directives. OMEGA will add the CE mark to every appropriate device upon certification.

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errors it contains, and reserves the right to alter specifications without notice.

WARNING: These products are not designed for use in, and should not be used for, human applications.
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Instruction Manual
Portable Turbidity Meter
TRH444
## 2. Specifications

### Accessories Supplied with equipment

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<th>Details</th>
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<td>Stabilized Primary Std</td>
<td>1000NTU (Model TRS-444)</td>
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<td>Vial Kit</td>
<td>3 units Model TRV-444</td>
</tr>
<tr>
<td>Carrying Case</td>
<td></td>
</tr>
<tr>
<td>Secondary Standard (Gel)</td>
<td>3vials (0.1, 10 &amp; 90NTU) Model TRSS-444</td>
</tr>
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</table>

### Optional Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
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<td>AC Adapter</td>
<td>CDH-30PW</td>
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<table>
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<th>Application</th>
<th>Read Turbidity</th>
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<tr>
<td>Display</td>
<td>Alphanumeric 2 Lines x 16 Characters</td>
</tr>
<tr>
<td>Turbidity Range</td>
<td>0 to 1000 NTU (automatically)</td>
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<tr>
<td></td>
<td>from 0.01 to 10.00 NTU (selectable Range 1)</td>
</tr>
<tr>
<td></td>
<td>from 0.01 to 100 NTU (selectable Range 2)</td>
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<td></td>
<td>from 0.01 to 1000 NTU (selectable Range 3)</td>
</tr>
<tr>
<td>Sulphate Range</td>
<td>from 0 to 70 mg/L</td>
</tr>
<tr>
<td>Resolution</td>
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</tr>
<tr>
<td>Relative Precision</td>
<td>0.01 % (full scale)</td>
</tr>
<tr>
<td>Calibration Parameters</td>
<td>Automatic / Manual</td>
</tr>
<tr>
<td>Light Source</td>
<td>LED 890 nm (NIR)</td>
</tr>
<tr>
<td>Detector</td>
<td>Photocell</td>
</tr>
<tr>
<td>Case protection</td>
<td>IP-67</td>
</tr>
<tr>
<td>Vial (Ø x h)</td>
<td>24.5 mm x 60 mm</td>
</tr>
<tr>
<td>Minimum Sample Volume</td>
<td>20 mL</td>
</tr>
<tr>
<td>Power</td>
<td>Battery 9 Vcc</td>
</tr>
<tr>
<td>Battery Life</td>
<td>60 hours</td>
</tr>
<tr>
<td>Dimensions (LAP)</td>
<td>103 x 217 x 81 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>569 g</td>
</tr>
</tbody>
</table>
3. Product Description

Description

1 - Display: Alphanumeric 2 Lines x 16 characters
2 - Keyboard: with 3 Tactile membrane keys
   - Key: Select the menu option, flashing option.
   - Key: Turns On the instrument and also confirms the flashing option.
   - Key: goes back one screen for every touch and also allows to access instrument shut down screen.
3 - Vial
4 - AC Adapter inlet, model CDH-30PW (Optional).
5 - Battery compartment cover lid.
6 - 9 VCC Battery (included)
7 - RS-232 Serial Output
8 - Covering caps for classified areas use.
9 - IP-67 Protection lid.

Important:
For IP-67 protection, it is necessary to use lids as shown at above picture, items 8 & 9.

This instrument allows connection thru the power line by an AC Adapter Model CDH-30PW (optional) 90-240Vac (50/60Hz)

- Do not use any other AC Adapter as it may damage the instrument!
- Instrument floats when dropped in water.

Supplied with the instrument: Carrying Case, 3 Glass Vials (TRV-444), 3 Secondary Standard Gel Vials(<0.1, 9 & 90NTU Vials) and 1000NTU Stabilized Standard Solution (100ml).”

Accessories:
- TRV-444 - 3 Glass Vials
- TRSS-444 - Secondary Standards Gel (<0.1, 10, 100 & 800NTU Vials)
- TRS-444 - Primary Standard Bottle of 1000NTU Formazine (250ml)
4. Principles

**Turbidity Method**

The measured Turbidity of a determined sample, is the reading referred by light dispersity and absorption that goes thru the sample.

Turbidity does not mean suspended solids measurement, but a effect determination of light refracted through Solids.

To understand turbidity it is helpful to think about the characteristics of mixture between substances. It is defined as Homogenous or Monophase mixtures are any set of substances that presents an unified visual aspect (also called Solutions) and Heterogenous or Polyphase mixtures are those where it is possible to confirm the presence of more than one visual aspect (also called Suspensions). This way, if noticed in a certain liquid a transparency lower than usually know, this is the presence beginning of any solid product in suspension, that defines the system as heterogeneous. The relation to this heterogeneous is how the turbidity concept is established. This turns to be a parameter that describes this quantity of suspended solid material in liquid being bigger as bigger is the suspended solid quantity.

Turbidity consists in evaluation of the quantity of particles presence in such a liquid sample, from the comparison of transparency degree/turbidity with a standard, with a know value, using a light. We denote that hazel liquids are colloidal materials, presenting Tyndall effect, that consists of light spreading when it goes thru a colloid. It is know that the light when hitting a material it can reflect, refract or absorbed.

As reflection is an inevitable phenomenon and common to any optical interaction, we must pay attention to two other phenomena, as absorption is related to color and turbidity alters the refraction thru the working fluid. Digimed turbidimeters are nephelometric type, or simply nephelometric, that evaluate the Tyndall light spacing at 90° of the light hitting the sample.

**Color Compensation**

In order to avoid interference caused by the color components of the mixture being analyzed, the light used at the nephelometric instrument in general presents closes to infra red range, as this range has relatively low Material absorption, increasing the light sensibility. So it is possible an efficient measurement of the liquid turbidity, as the turbidity measure at this instrument is done using the difference between the hitting light and the detected light at a silicium photodiode, placed in right angle to the hitting light, that transforms the transmitted light by the sample, in a tension signal proportional to Tyndal light source, being this light intensity compared to the emitted light by the source (LED).

The color compensation is done by signal conditioning of two photo-cells, transmittance and nephelometric, These area equalized in algorithm that performs the color compensation.

**Sugar Reading**

Internally at the equipment there is a curve for sugar analysis that can be selected during Set Up operation.

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![Diagram of turbidity measurement](image_url)
As the detection involves the difference between the light hitting the vial and the transmitted by the sample located at the vial, it is convenient to minimize the effects that diminish the transmitted light intensity, between some, the most important, is the absorption caused by the sample color.

So it is essential to work in a wavelength range where this absorption is minimum (near infrared), as if we worked at a visible electromagnetical spectrum, this color interference certainly would decisively affect the results of the turbidity quantity, it can be used many types of comparison standard, being the nephelometric Turbidity Unit (NTU) the most usual one, developed from formazine standard suspensions. So, it is possible to have a comparison standard scale between both materials, being possible to evaluate the turbidity with precision.

Fuctuations Compensation at Readings

For signal fluctuations compensation emitted by the photocell caused by any particle with irregular dimension, the Digimed turbidity meter execute the average reading during a time interval of 5s. Considering the last 45 readings average executed during a maximum time interval of 20s., related to the turbidity to be measured.

Biographic References
Bela G. Lipták (editor in chief) Analytical Instrumentation;
5. Turbidity Standards

Instructions on how to prepare the calibration solutions

1. Standard Zero

In order to obtain a turbidity close to Zero, use a good quality deionized or distilled water and filter it twice in a roll, using a 0.2 µm filter and theoretically you will obtain a water with 0.12 NTU, that can be considered Zero (Blank). Note: this water will be used to dilute the standard.

2. Standard Solutions

The instrument is supplied with a 100mL bottle of 1000NTU Stabilized Standard Solution, model# TRS-444, for dilution and calibration purpose.

Attention: if the Standard (DM-S14AK-100) had been stored for some time, shake the bottle strongly to mix the solution, then let it seat for about 15 minutes, then start to manipulate below standards.

1 - Necessary Materials:
   1.1 - 1 Volumetric Flask 100 mL
   1 Volumetric Pipette 50 mL
   2 L Distilled or Deionized Water, Filtered (0.2 µm)

2 - Calibration Solution 500 NTU
   2.1 - In a 100ml Volumetric Flask, using the Volumetric Pipette add 50ml of 1000NTU Stabilized Standard Solution.
   2.2 - Add filtered water up to the mark on the flask.
   2.3 - Before using the solution mix it by gently inverting the flask several times. Avoid creating bubbles.
   2.4 - The Solution is Valid for 15 days.
      Note: For best storage conditions place the solution in a dark bottle and store it in a fresh and dark place.

3 - Calibration Solution 100 NTU
   3.1 - In a 100ml Volumetric Flask, using the Volumetric Pipette add 10ml of 1000NTU Stabilized Standard Solution.
   3.2 - Add filtered water up to the mark on the flask.
   3.3 - Before using the solution mix it by gently inverting the flask several times. Avoid creating bubbles.
   3.4 - The Solution is Valid for 10 days.
   3.5 - After its use, discharge the solution.
      Note: For best storage conditions place the solution in a dark bottle and store it in a fresh and dark place.

4 - Calibration Solution 10 NTU
   4.1 - In a 100ml Volumetric Flask, using the Volumetric Pipette add 1ml of 1000NTU Stabilized Standard Solution.
   4.2 - Add filtered water up to the mark on the flask.
   4.3 - Before using the solution mix it by gently inverting the flask several times. Avoid creating bubbles.
   4.4 - Stir it manually for before using it.
   4.4 - The Solution is Valid for 5 days.
   4.5 - After its use, discharge the solution.
      Note: For best storage conditions place the solution in a dark bottle and store it in a fresh and dark place.

Attention: for TURBIDITY, this instrument MUST BE calibrated using Formazine Standard and cannot be calibrated using Polymers!!!
For the most accurate results follow the steps below:

a. Use vials extremely clean on the inside and outside.

b. Fill the vial to the top to eliminate any bubble. Fill carefully to avoid creating bubbles and to insure that the sample is homogeneous.

c. After filling the vial, dry it with a soft, lint-free absorbent paper to remove external condensation caused by variation in temperature.

d. Using one drop of silicone oil, clean the external portion of the cuvette, this will eliminate any small scratches (this is necessary for low Readings ONLY, below 20NTU).

Note: Instructions to apply: place one drop of silicone oil on the outside of the vial, using a cloth spread the oil, creating an uniform oil film at the surface.

e. Observe cautiously for the presence of bubbles and micro bubbles in the sample. Bubbles are not desired! Bubbles will not disperse if the sample is allowed to rest, the particles in the sample will settle, altering the real turbidity value, so do not leave the sample to rest!
6. Techniques (cont.)

1. Zero Turbidity

A. It is very difficult to locate a water without turbidity. What is done on practice is to filter 2 times (2x) a deionized or distilled water using a 0.2 µm (0.2 micro meter) paper filter. So we can consider this water with turbidity of 0.12 NTU.

B. The water used as Zero, is used to dilute standards up to 40 NTU. Above this value, use can use normal deionized water.

2 - Technical Measurement Considerations for Low Turbidity Readings - Range 0 to 10 NTU

A. Use an extremely clean vial (inside and outside). After its use, never leave any solution inside the vial.

B. Fill the vial, do not overfill! Fill the most possible, this procedure avoids bubbles formation.

C. After filling it and closing the cap, dry the external surface of the vial using a lint free absorbent paper in order to avoid a possible condensation caused by temperature variation. DO NOT touch the vials with your fingers!!!!!!

D. Always use matching Vials. When one of the vials break or needs to be replaced, it is necessary to replace the hole set! DO NOT replace only one vial of a set!

E. Verify for bubbles or micro bubbles presence inside the sample, as they are not desired. In case they are Noticed, try to eliminate them.

Note: Never let the sample to rest, as the particles will decantate and this will alter the real turbidity value.

F. If obtained low values, below the expected between 0.12 to 10.0 NTU, the vial could be dirty. Remove it, clean and repeat the reading.

G. Keep the vial always at the same position, paying attention to the its direction, from calibration until the reading. Note that the vial has a vertical white line mark and when inserting the vial at the compartment, make sure that this mark matches the mark trace located at the vial compartment!

H. Recalibrate the equipment when the reading is lower than the first calibration point (0.12 NTU).

3 - Technical Measurement Considerations for Turbidity Readings - Range 0 to 100 NTU

A. Prepare the calibration standards (Standard 10 NTU and Standard 100 NTU) as indicated on page 7.

B. In order to obtain better precision results it is recommended to calibrate using above standards.

4 - Technical Measurement Considerations for Turbidity Readings - Range 0 to 1000 NTU

A. Prepare the calibration standards (Standard 10 NTU, Standard 100 NTU and Standard 500NTU) as indicated on page 7.

B. In order to obtain better precision results it is recommended to calibrate using above standards.

Vials

The turbidity instrument TRH444, leaves the factory with 3 matching vials. This allows to use them for calibration or reading, any of the vials.

NOTE: in case one of the vials breaks it is necessary to purchase a new vial kit (TRV-444) do not mix the old vials with the new set, as they can present differences at reading values.
7. Equipment Operation

Basic Operations

1 - The software offers self-explanatory menus with easy user interaction. The menu flashes at selected option (represented at this manual in Blue Color).
Use <SELECT> key to alter the flashing option of the menu then press <ENTER> key to confirm the option.

2 - In case of a mistake, or to change data or to return to prior menu, press <ESCAPE> key. At every touch the screen will be moved back to prior screen. But in order to exit the reading mode, user must press and hold <ESCAPE> key so the program can understand that the user really desires to exist this mode.

3 - The equipment stores all configurations in a non-volatile memory (E²PROM). Even when turned off, the last stored characteristics established for your work will be sustained.

4 - The equipment automatically monitors the battery charge. In order to save battery, the instrument will turn itself off after 2 minutes of inactivity. After the reading is completed, user must press <ENTER> to proceed to the next reading, otherwise the equipment will turn itself off after 2 minutes.

Turning On the equipment

1 - Turn on the equipment by pressing <ENTER> key. The display will show the main menu.
The instrument allows the user to choose the Range (programable) and also to pick the calibration values for the Standard Solutions, that can be programmed while at Set Up Operation. See below table for possible calibration values based on each calibration point ranges:

<table>
<thead>
<tr>
<th>Calibration</th>
<th>Minimum Value</th>
<th>Maximum Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Point</td>
<td>0.01NTU</td>
<td>1.00NTU</td>
</tr>
<tr>
<td>2nd Point</td>
<td>8.00NTU</td>
<td>10.00NTU</td>
</tr>
<tr>
<td>3rd Point</td>
<td>80.0NTU</td>
<td>100NTU</td>
</tr>
<tr>
<td>4th Point</td>
<td>200NTU</td>
<td>900NTU</td>
</tr>
</tbody>
</table>
7. Equipment Operation - Turbidity Set Up

Set Up Procedures

Press <ENTER> key in order to turn on the instrument and to access the main menu as shown. Press <SELECT> key until option Set Up flashes, then press <ENTER> key to Confirm option chosen.

Press <SELECT> key until desired language option flashes, then press <ENTER> key to confirm the option chosen.

Press <SELECT> key until desired option flashes (Turbidity), then press <ENTER> key to confirm the option chosen.

Press <SELECT> key until desired option flashes, then press <ENTER> key to confirm the option chosen. This instrument can read turbidity in water or sugar.

Press <SELECT> key until desired unit flashes, then press <ENTER> key to confirm the option chosen.

Select the Reading Range mode by pressing <SELECT> key until desired option flashes then press <ENTER> key. Auto range will work the instrument full range.

Ranges Value:
- Range 1 - 0 to 10 NTU
- Range 2 - 0 to 100 NTU
- Range 3 - 0 to 1000 NTU

Press <SELECT> key until desired resolution option flashes, then press <ENTER> key to confirm the option chosen.

NOTE: The Manual CALIBRATION function allows the user to calibrate the instrument based on a known value. ATTENTION: This calibration does not replace the calibration using Formazine Standards. It allows small adjustment of the turbidity curve, after the reading operation is performed. Refer to Page 21.

Note A: Every time you see the symbols “>” or “<”, that means that the user can adjust the displayed value up or down.
To increase the value press <SEL> key until “>” flashes, then press <ENT> to confirm, then press <SEL> key and at every touch the value will increase by one unit.
To decrease the value press <SEL> key until “<” flashes, then press <ENT> to confirm, then press <SEL> key and at every touch the value will decrease by one unit.
If a mistake is made, press <ESC> key to return and correct the value!
If user press and holds <SEL> key, the units will move faster, but be careful when gets closer to the desired number, as you canmiss it and if that happens, press <ESC> key to move back and correct the mistake.
Press <SELECT> key until desired option flashes, then press <ENTER> key to confirm the option chosen. This option is offered to user, so the instrument can be calibrated as when it left factory. Say user is in a location where it is not possible to work with Standards or does not have the standards, choose Yes and confirm it and the instrument will calibrate as when left the factory.

User can activate or not the RS 232 output. Press <SELECT> key until desired option flashes, then press <ENTER> key to confirm the option chosen.

User can choose between PC or Printer. Press <SELECT> key until desired option flashes, then press <ENTER> key to confirm the option chosen.

Statistics calculation can be chosen or not. Press <SELECT> key until desired option flashes, then press <ENTER> key to confirm the option chosen.

If user desires to store data into memory (up to 99 points), Yes must be selected. Press <SELECT> key until desired option flashes, then press <ENTER> key to confirm the option chosen. Refer to page 22 for further details.
# 7. Equipment Operation - Turbidity Calibration

## Calibration Procedures

Press `<SELECT>` key until option **Read** flashes, then press `<ENTER>` key to confirm option chosen.

Press `<SELECT>` key until option **Calibrate** flashes, then press `<ENTER>` key to confirm option chosen.

User will still have the option to accept every calibration point chosen during Set Up Operation. Press `<SELECT>` until desired option flashes, then press `<ENTER>` key to confirm it.

Press `<SELECT>` until desired option flashes, then press `<ENTER>` key to confirm it.

Place vial with Standard 0.17 NTU at compartment, then press `<ENTER>` key.
Make sure the white vertical line of the vial matches the mark at the vial compartment then push slowly the vial into the compartment, all the way to the end.

The instrument program, verifies if the standard is within conformance. Press `<ENTER>` key. Then user can proceed with operation or go back and replace the standard.

Note: if any problem occurs during the Reading operation, the display will show: **ATTENTION ! VERIFY VIAL** `<ENTER>`

User will still have the option to accept every calibration point chosen during Set Up Operation. Press `<SELECT>` until desired option flashes, then press `<ENTER>` key to confirm it.

Press `<SELECT>` until desired option flashes, then press `<ENTER>` key to confirm it.

Place vial with Standard 10.0 NTU at compartment, then press `<ENTER>` key.
Make sure the white vertical line of the vial matches the mark at the vial compartment then push slowly the vial into the compartment, all the way to the end.

The instrument program, verifies if the standard is within conformance. Press `<ENTER>` key. Then user can proceed with operation or go back and replace the standard.

Note: if any problem occurs during the Reading operation, the display will show: **ATTENTION ! VERIFY VIAL** `<ENTER>`
User will still have the option to accept every calibration point chosen during Set Up Operation. Press <SELECT> until desired option flashes, then press <ENTER> key to confirm it.

Press <SELECT> until desired option flashes, then press <ENTER> key to confirm it.

Place vial with Standard 100NTU at compartment, then press <ENTER> key. Make sure the white vertical line of the vial matches the mark at the vial compartment then push slowly the vial into the compartment, all the way to the end.

The instrument program, verifies if the standard is within conformance. Press <ENTER> key. Then user can proceed with operation or go back and replace the standard.

Note: if any problem occurs during the Reading operation, the display will show: **ATTENTION ! VERIFY VIAL** <ENTER>

**Attention: for TURBIDITY, this instrument MUST BE calibrated using Formazine Standard and cannot be calibrated using Polymers!!!**
User will still have the option to accept every calibration point chosen during Set Up Operation. Press <SELECT> until desired option flashes, then press <ENTER> key to confirm it.

Press <SELECT> until desired option flashes, then press <ENTER> key to confirm it.

Place vial with Standard 500NTU at compartment, then press <ENTER> key. Make sure the white vertical line of the vial matches the mark at the vial compartment then push slowly the vial into the compartment, all the way to the end.

The instrument program, verifies if the standard is within conformance. Press <ENTER> key. Then user can proceed with operation or go back and replace the standard.

Note: if any problem occurs during the Reading operation, the display will show: ATTENTION ! VERIFY VIAL <ENTER>

If user is ready to measure the sample, place vial with sample at compartment, then press <ENTER> key.

For a new reading, press <ENTER> or press and hold <ESCAPE> key in order to exit Reading Mode. If instrument is left under Reading Mode, without pressing <ENTER> for another reading, it will turn itself off after 2 minutes, in order to save battery life!

Attention: for TURBIDITY, this instrument MUST BE calibrated using Formazine Standard and cannot be calibrated using Polymers!!!
This option will only be displayed if RS-232 is On (chosen during Set Up operation). If chosen Off for RS-232, this option will not appear. User can adjust the Initial Sample number, refer to below instructions on how to change this number.

If user is ready to measure the sample, place vial with sample at compartment, then press <ENTER> key. Make sure the white vertical line of the vial matches the mark at the vial compartment then push slowly the vial into the compartment, all the way to the end.

For a new reading, press <ENTER> or press and hold <ESCAPE> key in order to exit Reading Mode. If instrument is left under Reading Mode, without pressing <ENTER> for another reading, it will turn itself off after 2 minutes, in order to save battery life!

Note A: Every time you see the symbols “>” or “<”, that means that the user can adjust the displayed value up or down. To increase the value press <SEL> key until “>” flashes, then press <ENT> to confirm, then press <SEL> key and at every touch the value will increase by one unit. To decrease the value press <SEL> key until “<” flashes, then press <ENT> to confirm, then press <SEL> key and at every touch the value will decrease by one unit. If a mistake is made, press <ESC> key to return and correct the value! If user press and holds <SEL> key, the units will move faster, but be carreful when gets closer to the desired number, as you canmiss it and if that happens, press <ESC> key to move back and correct the mistake.
This Meter offers 99 points of datalogging for Readings storage. In order to activate this function, user must choose option **YES** when asked about Option **REGISTER** during **SET UP** operation. If chosen **NO** the Sub menu Reg will not be displayed on the screen.

**Reading Register Procedure**

1. Turn on the instrument by pressing **<ENTER>**
2. Press **<SELECT>** key until Read flashes, then press **<ENTER>** to confirm.
3. Press **<SELECT>** key until Reg. flashes, then press **<ENTER>** to confirm.
4. Press **<SELECT>** key until Read flashes, then press **<ENTER>** to confirm. This procedure will allow Reading value to be stored!

This option will only be displayed if RS-232 is On (chosen during Set Up operation). If chosen Off for RS-232, this option will not appear. User can adjust the Initial Sample number, refer to below instructions on how to change this number.

5. Place the vial into the compartment, then press **<ENTER>** to start Reading operation.
6. The Read value will be displayed, press **<SELECT>** key to memorize the value.
7. Press **<ENTER>** key to start a new Reading.
8. To exit this mode, press and hold **<ESCAPE>** key.

User can also Consult saved Readings, simple choose the option **REGISTER** (see above menu) and press **<ENTER>** key to display every Reading stored!
Erase Register Procedure

Turn on the instrument by pressing <ENTER>

Press <SELECT> key until Read flashes, then press <ENTER> to confirm.

Press <SELECT> key until Reg. Flashes, then press <ENTER> to confirm.

Press <SELECT> key until Erase flashes, then press <ENTER> to confirm. This procedure will erase ALL Registered values!

Press <SELECT> key until Yes flashes, then press <ENTER> to confirm. This is your last chance NOT to erase the stored values!
7. Equipment Operation - Turning Off

Turning Off the Equipment

1 - Press <ESCAPE> key repeatedly until the following message appears:

2 - Press <SELECT> key until Yes flashes then press <ENTER> key to confirm and turn it off.

Follow instructions below to turn the instrument off:

- Press and hold <ESCAPE> key in order to exit the reading mode and access the main menu.
- Press <ESCAPE> key to move back
- Press <ESCAPE> key to move back
- Press <SELECT> key in order to select option Yes (flashing), then press <ENTER> to confirm.

A message will display on the screen and the equipment will turn off.

GOOD BYE !
..............
WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of 13 months from date of purchase. OMEGA'S WARRANTY adds an additional one (1) month grace period to the normal one (1) year product warranty to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA'S WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by the company will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence. The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR WARRANTY RETURNS, please have the following information available BEFORE contacting OMEGA:
1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

FOR NON-WARRANTY REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:
1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

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