



MicroCure® Radiometer and MicroCure® DataReader User Manual



MicroCure® Radiometer and MicroCure® DataReader



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Table of Contents

| | |
|--|----|
| Introduction..... | 1 |
| Product Overview | 2 |
| Establishing a Cure or Process Window/Process Parameters | 4 |
| Handling and Safety Precautions | 6 |
| Operation: | 7 |
| Error Messages | 8 |
| Maintenance..... | 8 |
| Appendix A MicroCure Product Specifications..... | 11 |
| Appendix B DataReader Product Specifications | 12 |
| Appendix C Regulatory Statement | 13 |
| Appendix D Technical Support, MicroCure Disposal and Warranty..... | 14 |

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Introduction

The EIT MicroCure® system addresses UV measurement and process control in areas where using a standard radiometer is difficult due to size and space limitations. The MicroCure's compact size allows it to fit into, and adapt to a variety of demanding physical and thermal environments. This makes it possible to obtain reliable UV measurements in curing applications that would ordinarily be inaccessible to larger radiometers.

Applications for the MicroCure include:

- Narrow conveyor curing such as credit card processing
- Small container curing (bottles, cans, tubes, etc.)
- Batch applications (semiconductor printing, small part bonders, etc.)
- Printing including digital and pad
- Part curing where flood lamps in fixtures are used
- Dimensional fixtures for curing medical products such as catheters
- Different size objects such as furniture edges, headlamps, dashboards or wood moldings
- Flexible light guide systems where the MicroCure can fit in with the part
- Disc Manufacturing (CD/DVD)

Product Overview

MicroCure UV Radiometer

- Small (1.3" x 0.95" x 0.25" / 33 x 24.13 x 6.35 mm) microprocessor based, electro-optical instrument that measures the total energy density (Joules/cm²) and peak irradiance (Watts/cm²)
- Lightweight (0.33 ounces/9.4 grams), battery powered radiometer with a fast sample rate (2048 Hz), adapts to a variety of demanding physical and thermal measurement environments where a larger radiometer will not fit
- Each MicroCure is good for 200 readings or one year; whichever comes first
- Available Bands
 - UVA (320-390 nm)
 - UVV (390-445 nm)



MicroCure showing range (10 Watts) and band (UVA)

NOTE: The responsivity of the EIT MicroCure UVA and UVV bands are similar but are not identical to the UVA and UVV bands used in other EIT instruments.

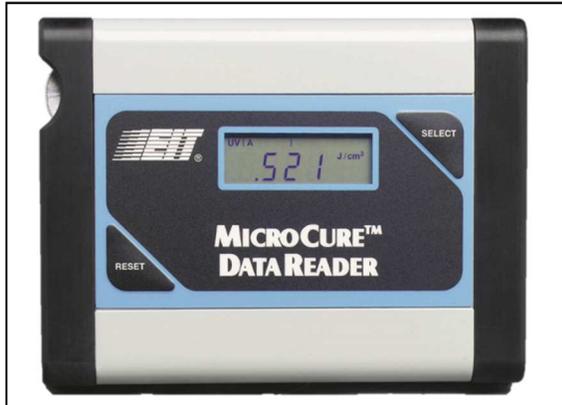
- Available Dynamic Ranges:
 - UVA: 10 Watt, 2 Watt or 200 milliWatt ranges
 - UVV: 10 Watt or 2 Watt ranges
- Suggested Operating Ranges:

| <u>Unit Type</u> | <u>Suggested Operating Range</u> |
|-------------------------|---|
| ○ 10 Watt (UVA or UVV): | 500 mW/cm ² to 10 W/cm ² |
| ○ 2 Watt (UVA or UVV): | 100 mW/cm ² to 2 W/cm ² |
| ○ 200 milliWatt (UVA): | 10 mW/cm ² to 200 mW/cm ² |
- Once activated, the MicroCure should be exposed to UV irradiance in the Suggested Operating Range within four minutes.
- If the MicroCure is not exposed to UV above the start threshold (point at which the MicroCure starts counting UV) within four minutes, it will enter 'sleep' mode and not count the current 'wake-up' session as a 'reading'
 - See Appendix A for the approximate start threshold values needed to start the radiometer
 - For best performance, the MicroCure should be used in the Suggested Operating Range
- The MicroCure utilizes the two halves of the metal case to transfer data. Do not "short circuit" the two case halves on metal. This includes having the cases halves touch metal and/or handling them with conductive coatings and/or moisture on your hands. See the section on Handling and Safety Precautions for further details.

MicroCure DataReader

- The DataReader is a portable device used to communicate download and display UV data collected by the MicroCure radiometer.
- The "SELECT" button toggles the display between Energy Density and Irradiance values.
- The display shows the UV band of the MicroCure radiometer.
- The "RESET" button is used to "activate" a MicroCure unit and place it into "active data collection" mode.
- When activated, the DataReader display indicates the number of resets (r) and the count of subsequent reading above threshold that an individual MicroCure unit has undergone.
- Example: Reset value of 'r 118' is shown below. On the next reset, a reset value of 'r 119' is shown

- The DataReader utilizes a standard user-changeable nine volt battery
- The DataReader has a low battery symbol, auto shut-off and works with all MicroCure units.



Top Left: Data Reader with Display

Bottom Left: DataReader display showing irradiance value of 1.435 W/cm² in UVA

Top Right: Top display shows an 'r' value of 118. After a reading, the next reset will show an 'r' value of 119

Bottom Right: DataReader display showing Energy Density value of 1.197 J/cm² in UVA

Establishing a Cure or Process Window/Process Parameters

A cure, or process window, is a set of parameters that defines the equipment/process/source conditions necessary to ensure proper curing.

Ideally, to establish a process window, a series of tests are run for different combinations of coatings, substrates and UV sources so that a history can be obtained. This history helps establish the baseline parameters for various combinations and provides important information for process control. The operator can compare a current measurement to the established process window and adjust the process to obtain the desired curing results. A cure window assists in troubleshooting when deficiencies in a UV process are found.

By analogy, when baking a cake, two process (oven) variables or process parameters are utilized:

1. Oven temperature
2. Cooking time

Correspondingly, with a UV process, there are three UV source variables or process parameters utilized:

1. Wavelength(s) of the UV source(s). This is controlled by the type of bulb used
2. Power (Irradiance, sometimes called Intensity, measured in W/cm^2)
3. Energy (Energy Density, (sometimes called Dose), measured in J/cm^2)

Each of these parameters can affect the degree of cure at the surface, at the substrate, or throughout the material.

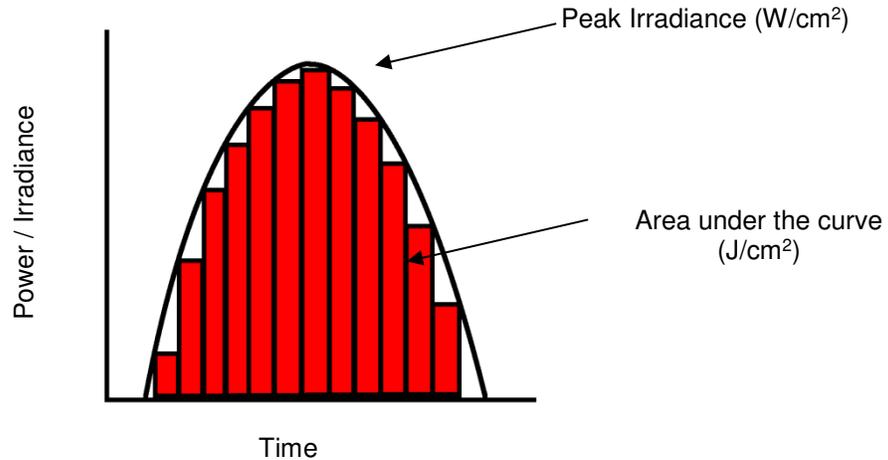
1. **Wavelength:** The wavelength produced by a UV source is based on the source type. UV Broadband Sources are mercury-based and characterized by a “broad” (i.e. wide) output across the UV spectrum. Typical bulb types include mercury (sometimes called ‘H’), mercury-iron (‘D’) or mercury-gallium (‘V’). The actual spectral output can vary from supplier to supplier.
2. **Power/Irradiance:** Irradiance is the “brightness” of the light source. Irradiance is measured in Watts (W/cm^2) or milliWatts (mW/cm^2) per square centimeter. Irradiance is sometimes also called intensity.

Irradiance is important for adhesion of the ink/coating the substrate. Irradiance generally decreases with the square of distance as you move farther from the UV source and/or as the light source output diminishes (reduced power) for any reason. If you move twice as far away from a typical broadband source, you would expect the irradiance to decrease by the square (2^2) of the distance change and be approximately $\frac{1}{4}$ (25%) of the original value. This inverse square law does not always hold true for UV LEDs.

3. **Energy/Energy Density:** Energy density (sometimes referred to as “dose”) is a measure of how much power was received over a period of time. Energy is measured in Joules (J/cm^2) or milliJoules (mJ/cm^2) per square centimeter. The Energy Density value is important for the complete cure of the material. It is sometimes the only value shared by a formulator.

Note: In a UV process, variables or process parameters related to the formulation (ink, adhesive, coating, etc.) and substrate must also be tracked and controlled. Examples include can formulation thickness and substrate dyne levels.

If you were to chart irradiance on a vertical (Y) axis against time on the horizontal (X) axis, energy density is equal to the area under the curve (shown in red below) or the mathematical integration of lamp intensity over time. The MicroCure derives this value by measuring the lamps irradiance many times during the data-collection run and then summing these values together.



Energy Density is the total amount of energy exposure over time. It is the mathematical calculation of the area under the irradiance curve. The instrument calculates energy density by adding many irradiance samples together. The numerical irradiance reported is the peak irradiance value recorded by the instrument

Handling and Safety Precautions



UltraViolet (UV) Radiation

- The EIT MicroCure and DataReader are measurement instruments and are **not** a source of UV radiation.
- They are used in an environment where UV radiation is present and Personal Protective Equipment (PPE) should be worn to protect the eyes and skin.
- Leave all shielding and guards in place on the UV source. Do not modify the equipment.
- Refer to the owner's manual for the UV source for more information.

The two halves of the MicroCure metal case is used to transfer information to the DataReader. Therefore, the following precautions should be observed to ensure proper performance:

- Avoid contact between the case and conductive materials, including process chemicals, process vapors, and anti-static mists when handling the MicroCure. Conductive materials may cause the unit to short, reset and/or lose stored data.
- Handle the MicroCure case using gloves to reduce the chances of creating a short circuit or data loss occurring, especially if using coatings with metallics and/or the operator has excessive sweating (hyperhidrosis) in the hands.
- Do not let the MicroCure travel through print stations, die cutters, pinch rollers or other processes which may damage both the radiometer and/or your equipment.
- Do not allow the two case sides of a MicroCure radiometer to contact each other. Doing so will reset the unit and any stored data will be lost.
- Do not allow two MicroCure radiometers to touch each other. Data loss or corruption may occur.
- Do not mark or label the MicroCure radiometer metal case.



Left: Image showing the two MicroCure case halves with the printed circuit board 'sandwiched' between the two halves. The case halves are used to communicate with the EIT DataReader

Right: Non-conductive fixtures to hold two MicroCure units in place during a production test

Operation:

1. Insert the MicroCure radiometer into the slot in the upper left side of the DataReader.
2. Press the RESET button to activate the unit from standby/sleep mode and turn the unit on to active data collection mode.
3. The DataReader will briefly display the software version (e.g., P1.02 or similar)
4. The number of readings taken by the MicroCure is displayed as "r xxx" where "xxx" is the number of unit resets. Then the display will read "0.00" to indicate that the unit is ready to take a reading.
5. Remove the MicroCure from the DataReader and place it in the desired UV process location with the optics window side facing the UV source(s).
6. The MicroCure radiometer must be exposed to UV energy within four minutes after being reset or it will return to a standby/sleep mode. The UV irradiance level be above the start threshold level as described in Appendix A.
7. The MicroCure® it will return to standby/sleep mode if the start threshold is not exceeded. Only runs above threshold are counted towards the limits of 200 readings. The DataReader will automatically shut down after thirty seconds of inactivity.
8. Remove the MicroCure from the UV process environment and place it back into the slot in the DataReader. Press the SELECT button. The DataReader will display the total UV energy in Joules per square centimeter (J/cm^2) or the irradiance in Watts per square centimeter (W/cm^2).
9. To toggle between total energy and irradiance, press and hold the SELECT button
10. To clear the current reading and to reset the MicroCure for its next reading, press the RESET button.



Top: DataReader program version
Middle: Reset "r" number
Bottom: Optics side of MicroCure which needs to be exposed to UV

Error Messages

The DataReader displays error messages to indicate a problem with the Reader or the MicroCure radiometer.

If "---" is displayed, communication between the MicroCure and the DataReader has failed. Re-insert the MicroCure into the DataReader and retry.

If "LO BATT" is displayed, the MicroCure battery is low. If this occurs within a 200-reading/ 1-year period from date of purchase, the unit or battery may be defective. The battery in the MicroCure is not user replaceable. Please contact EIT for assistance.

When the DataReader's battery is low, it will scroll "LO" ten times and then shut down. The battery in the DataReader is user replaceable. Refer to the Maintenance section of this manual for replacement instructions.

If the DataReader displays a numeric error code, contact EIT for assistance.

High Speed Data Collection Applications

The MicroCure uses a sampling rate of 2048 samples per second. This allows the MicroCure to gather a large number of samples while moving or spinning past a UV source.

Unlike radiometers with slower sampling rates, irradiance values collected with the MicroCure should be consistent when consistent data collection techniques are followed.

The irradiance values displayed by the MicroCure® are instantaneous peak irradiance values versus average/RMS irradiance values.

When comparing readings, the irradiance values provided by the MicroCure are similar to the irradiance values collected with EIT instruments used in the "Smooth Off" (instantaneous peak) mode versus "Smooth On" or "Smooth Profile" (average peak) mode.

Contact EIT if you have any questions on samples rates or 'smoothing'

Maintenance

The Following Guidelines are recommended for Cleaning the MicroCure Radiometer Optics

1. Establish a contaminant-free area for cleaning and gather the necessary supplies. Avoid cleaning the radiometer's optics with anything dry or abrasive (such as a cloth, towel or clothing).
2. Visually examine the instrument to determine if it needs cleaning.
3. Fingerprints, oils from your hands, lint, dust, or contamination on the optics window can increase or decrease the UV values reported.
4. Carefully blow or brush loose particles away from the optics.
 - Blowing on the optics with the mouth is not recommended; various components of saliva are extremely difficult to remove from the optics.
 - Handheld air bulbs to blow air are available from camera stores

- Avoid using compressed “shop air” as it often contains oil which can damage the optics or be hard to remove
- Use “Instrument grade” oil free air which has been filtered
- “Canned air” (or de-duster) in very short (< 1 second) bursts from a distance 8-10 inches from the optics can be used. Short bursts from 8-10” away will minimize the transfer of any propellants/additives from the ‘canned air’ to the optics.
- If blowing does not work, clean the optics using isopropyl alcohol (IPA) and a lint free cotton swab
 - Plan to use a minimum of two lint free swabs to clean the optics.
 - The first IPA moistened swab is used to gently apply the IPA solution in a circular motion.
 - Rotate the swab between your fingers as you work your way around the optics window in a circular fashion to clean the optics. Use an additional ‘wet’ swab if additional cleaning is needed.
 - Do not ‘double-dip’ by placing a used swab back into the IPA. This prevents prevent contamination of the IPA from any material picked up from the optics.
 - Use the second clean swab in a gentle circular motion to dry the IPA on the optics. Again rotate the swab between your fingers as you gently move it over the surface.
 - Stop when the majority of the IPA has been absorbed by the swab.
 - Properly dispose of the used swabs.

Additional Tips

- Label the IPA as required & follow the Safety Data Sheet (SDS/MSDS) for IPA.
- Consider a dedicated IPA dispenser to avoid cross contamination from other activities.
- Do not use IPA with detergents or other additives.
- Use lint free cotton swabs. If you see streaking, consider another brand of cotton swab.
- If you “double dip”, the IPA can be compromised from material transferred from the instrument optics via the swab.
- Adhesive use to hold the cotton to the applicator stick may be dissolved by the IPA and transferred to the IPA.

MicroCure Case

- Use isopropyl alcohol and a soft cloth to clean the case of the MicroCure
- Do not open the radiometer's case. There are no user-serviceable parts inside the unit

DataReader

The DataReader requires occasional battery replacement, and will indicate a low battery condition by scrolling "LO" across its display. To change the battery:

1. Remove the two screws from the plate on the left side of the DataReader.
2. Remove the battery and replace it with a new 9-volt lithium or alkaline battery.
3. Reinstall the access plate and screws.

DataReader Display Cleaning Instructions

Clean cotton swabs, lint free wipes, or EIT prepackaged optical wipes are recommended for cleaning the display window. Use of high quality Isopropyl Alcohol is acceptable.

WARNING:

DO NOT USE ACETONE TO CLEAN THE DATAREADER DISPLAY SCREEN AS IT MAY DAMAGE THE DISPLAY.

Use caution with chemicals used in inks, coatings, adhesives and resins that may be near or come in contact with the MicroCure.

The customer assumes all responsibility for damage to their EIT instrument as a result of chemical contact with the MicroCure or DataReader.

Customers are advised to obtain and read the SDS/MSDS for any chemical used in either their process or in the cleaning of optics and to take necessary precautions.

The MicroCure radiometer is calibrated prior to shipment from EIT. It is specified to take 200 readings or a period of approximately one year. Once the unit meets one of these conditions, it must be replaced.

The MicroCure Unit contains a battery. Any expired MicroCure units may be returned to EIT for proper disposal of the electronics and battery. Customers are responsible for the return shipping to EIT.

Please return to:

Electronic Instrumentation and Technology (EIT) LLC
Attention EIT Instrument Markets
309 Kelly's Ford Plaza SE
Leesburg VA 20175 USA

Appendix A MicroCure Product Specifications

MicroCure® Radiometer

| | |
|--------------------------------------|---|
| UVA Spectral Response | 320-390 nm |
| UVV Spectral Response | 395-445 nm |
| Spectral Response Note | The MicroCure UVA and UVV bands are similar but not identical to the UVA and UVV bands in other EIT instruments that are 0.5" in height |
| Suggested Operating (Dynamic) Ranges | 10 Watt (UVA or UVV): 500 mW/cm ² to 10 W/cm ² 2 Watt (UVA or UVV): 100 mW/cm ² to 2 W/cm ² 200 milliWatt (UVA): 10 mW/cm ² to 200 mW/cm ² The DataReader display will flash if the unit has over-ranged. Suggested Operating Range provides the best instrument performance. MicroCure units will "turn on" at lower irradiance values as shown below |
| Approximate Start Threshold Values | The values listed below are the approximate required threshold values needed to activate the MicroCure. Use a MicroCure with the correct operating (dynamic) range. 10 Watt (UVA or UVV): +/- 50 mW/cm ² 2 Watt (UVA or UVV): +/- 10-15 mW/cm ² 200 milliWatt (UVA): +/- 1-2 mW/cm ² |
| Sample Rate/Smooth Mode | 2048 samples per second. The MicroCure reports the peak "Smooth Off" irradiance value and not the "RMS" or average irradiance value. |
| Peak Irradiance Accuracy | +/- 7% @ 25°typical -0.2% per 1°C over operating range |
| Total Energy | 0-9999 Joules/cm ² . Display flashes if over-ranged. |
| Calibration | Each MicroCure is supplied with a NIST traceable calibration certificate |
| Spatial Response | Approximately cosine |
| Operating Temperature Range | 15-70°C internal |
| Time-Out Period | 4 minutes after last UV exposure |
| Batteries | Permanent lithium cell Expired units can be returned to EIT for proper battery disposal |
| Battery Life | 200 readings or 1 year, whichever comes first |
| Dimensions | 1.30" long x 1.0" wide x 0.25" high (33.0mm x 25.4mm x 6.4mm) |
| Weight | 0.33 oz. (9.4 grams) |
| Materials | Plated Aluminum/Nylon/ RoHS |

Specifications subject to change without notice

Appendix B DataReader Product Specifications

Data Reader

| | |
|-----------------------------|---|
| User Interface | Push button switches allow user to display Joule/Watt/cm ² data, activate/reset the unit |
| Display | 4 digit LCD, resolution shown to 0.001 Joule/Watt/cm ² 4 digit liquid crystal display |
| Dimensions | 5.77" X 4.38" x 1.45" (139.7 x 108 x 36.8 mm) |
| Weight | 11.75 oz. (333.11 grams) |
| Operating Temperature Range | 0-70°C |
| Timeout | 30 seconds |
| Battery | User changeable 9V battery either alkaline or lithium |
| Materials | Steel, nylon, polycarbonate, RoHS |

Specifications subject to change without notice

Appendix C Regulatory Statement

The MicroCure and DataReader were tested in accordance with EMC Directives of the European Economic Community: 2004/108/EC Amending Directives: 92/31/EEC, 93/68/EEC, 91/263/EEC. The generic product standard was EN 61326-1: 2005 and the specific tests performed were Emissions (EN 55011: 2007), Radiated Immunity (EN 61000-4-3: 2006 +A1: 2008) and Electrostatic Discharge (EN 61000-4-2: 2009)

The MicroCure and MicroCure DataReader are manufactured in the USA.

MicroCure units are RoHS compliant and should be recycled.

Units may be sent to EIT for proper disposal, if needed at no charge.

Please return to:

Electronic Instrumentation and Technology (EIT) LLC
Attention: EIT Instrument Markets
309 Kelly's Ford Plaza SE
Leesburg VA 20175 USA



Appendix D Technical Support, MicroCure Disposal and Warranty

Technical Support

Technical support is available through EIT or one of our authorized representatives or distributors

EIT may be reached via email (uv@eit.com) or phone (703-478-0700)

A list of representatives and distributors can be found on our web site: <https://www.eit.com/products/representatives-and-distributors>

MicroCure Disposal

MicroCure units are RoHS compliant and should be properly recycled. Units may be returned to EIT for proper disposal. There is no charge for this service if the MicroCure units are sent prepaid to EIT. Please return units to:

Electronic Instrumentation and Technology (EIT) LLC
Attention: EIT Instrument Markets
309 Kelly's Ford Plaza SE
Leesburg, VA 20175 USA

Warranty

The MicroCure® radiometer is given a one-time calibration before it is shipped from EIT. The MicroCure is designed for 200 readings **or** one year, whichever comes first. Once the MicroCure reaches the first one of either of these two conditions, the EIT warranty is void on the MicroCure and the unit must be replaced. Please refer to the Handling and Safety Precautions stated earlier in this manual.

EIT warrants that all goods described in this manual shall be free from defects in material and workmanship. Such defects must become apparent within six months after delivery of the goods to the buyer.

Any suspected warranty claim for MicroCure must be reported prior to the maximum reading limit of 200 readings.

EIT's liability under this warranty is limited to replacing or repairing the defective goods at our option. EIT shall provide all materials and labor required to adjust, repair, and/or replace the defective goods at no cost to the buyer only if the defective goods are returned, freight prepaid, to EIT Instrument Markets during the warranty period.

EIT shall be relieved of all obligations and liability under this warranty if:

1. The user operates the device with any accessory, equipment, or part not specifically approved, manufactured, or specified by EIT, unless the buyer furnishes reasonable evidence that such installations were not a cause of the defect. This provision shall not apply to any accessory, equipment, or part that does not affect the proper operation of the device.
2. Upon inspection, the goods show evidence of becoming defective or inoperable due to abuse, mishandling, misuse, accident, alteration, negligence, improper installation, lack of routine maintenance, or other causes beyond our control.
3. The goods have been repaired, altered, or modified by anyone other than EIT authorized personnel. MicroCure radiometers are only sold and serviced at EIT and not through any of our authorized service centers.
4. The buyer does not return the defective goods, freight prepaid, to EIT within the applicable warranty period.

There are no warranties that extend beyond the description on the face hereof. This warranty is in lieu of-and is exclusive of-any and all other expressed, implied, or statutory warranties or representations. This exclusion includes merchantability and fitness, as well as any and all other obligations or liabilities of EIT.

EIT shall not be responsible for consequential damages resulting from malfunctions of the goods described in this manual.

No person, firm, or corporation is authorized to assume for EIT, any additional obligation or liability not expressly provided for herein except in writing duly executed by an officer of EIT.

If any portion of this agreement is invalidated, the remainder of the agreement shall remain in full force and effect.

This warranty shall not apply to any instrument or component not manufactured by EIT.

Returning a MicroCure and/or DataReader to EIT

An RMA is not required but each unit should be returned with a Service Request Form that can be found at: <https://www.eit.com/products/customer-service-support>

Please return the equipment in the original (or equivalent) packaging. You will be responsible for damage incurred from inadequate packaging, if the original packaging is not used. The customer is responsible for insuring the unit during transportation to EIT.

Once received, EIT will determine if the issue will be covered under warranty or if the issue is a non-warranty issue

Equipment covered under warranty will be returned to the user with no charge for the repair or shipping.

EIT notify you of any repairs not covered by warranty and their cost prior to performing any work on the equipment.

Ship the unit, freight prepaid, to the address below:

Electronic Instrumentation and Technology (EIT) LLC
Attention: EIT Instrument Markets
309 Kelly's Ford Plaza SE
Leesburg, VA 20175 USA

Include the Service Request Form which should state Company Name, Address, Telephone Number and Email address. We will contact you if any additional information is needed.

EIT Instrument Markets reserves the right to make changes in design at any time without incurring any obligation to install the same on units previously purchased.