Sensorex

UVT-LED

Process and Handheld UVT Monitors

Installation and Operation Manual

UVT-LED- PW

UVT-LED-H

Rev: A

Sensorex UVT-LED

Warning

To avoid risk of damage to monitor, do not open the device. Refer servicing to qualified personnel only.

Do not place device in a location near heat sources, or in a place subject to direct sunlight, excessive dust or mechanical shock.

Do not operate sensor above 55°C because this can damage the UV Light source

Batteries or battery installed apparatus shall not be exposed to excessive heat such as fire sunshine or the like.

Monitor contains a UV LED emitting device. Do not look at the probe of an operating monitor without wearing proper eye and skin protection.

Install unit so that power cord is protected from mechanical damage and can be easily unplugged from device.

Do not use the provided power/data cord if it is damaged. Use of a damaged cord may result in damage to the device or fire.

Do not pinch the power/data cord between heavy objects

Device should only be used with provided 24V DC power supply or used with a site supplied 24V DC source.

Any changes or modifications not expressly approved in this manual could void the warranty.

Introduction

The Sensorex UVT-LED is the world's first family of UV-T monitors that uses a UV-C LED instead of a mercury-based lamp as a light-source. The use of a UV-C LED in the UVT-LED ensures extremely stable readings in all conditions, over an extended lifetime.

This manual covers two models:

Model	Description
PW	Used for all on-line applications. Unit is wiped using patented technology. Use in water with a higher concentration of dissolved and suspended solids.
H	Used for benchtop and off-line field measurements. Unit comes standard with a battery for cordless operation.

Contents

UV Transmittance Theory

UV Transmittance Theory

The use of UV light to treat fluids involves generating UV light with the desired germicidal properties and delivering (or transmitting) that light to pathogens. As UV light propagates from its source, it interacts with the materials it encounters through absorption, reflection, refraction, and scattering. When assessing water quality, UV absorbance or UV transmittance (UV-T) is the parameter that incorporates the effect of absorption and scattering.

UV- T is a measure of the amount of UV energy remaining after passing through a
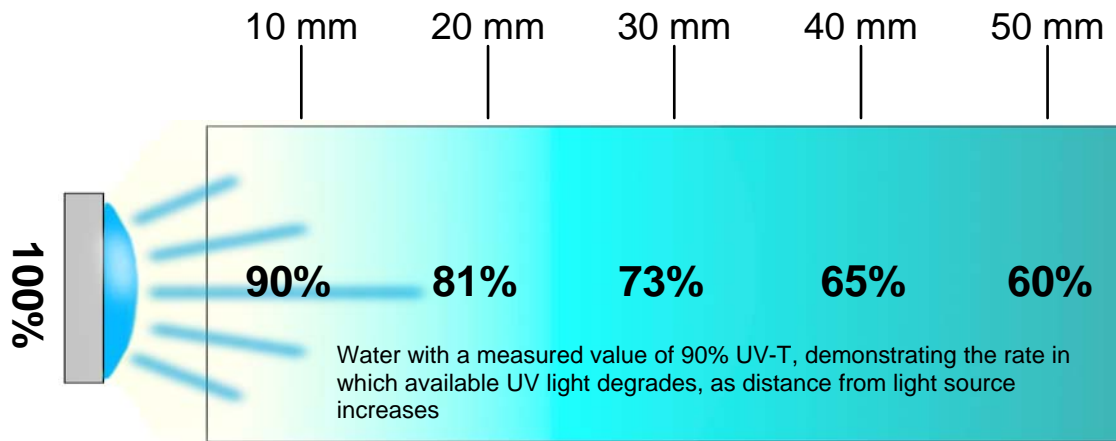
material (e.g., water sample or quartz) over a specific distance. UV Absorbance is a measure of the amount of UV light that is absorbed by a substance (e.g., water, microbial DNA, lamp envelope, quartz sleeve) at a specific wavelength (e.g., 254 nm). UV-Transmittance is related to UV Absorbance by the following equation (for a 1- cm path length): **% UVT = 100 x 10^{-A}.**

UV-Transmittance is typically;
- measured at 254 nm, corresponding to the peak output of mercury-based UV lamps
- measured over a path length of 1-cm
- represented as a percentage

UV-T has a strong effect on the dose delivery of a UV treatment system. As UV-T decreases, the intensity throughout the reactor decreases, which reduces the dose the treatment system delivers. UV treatment systems are sized to deliver the required UV dose under specified UV-T conditions for the application. UV-T will typically vary over time due to changing concentrations of compounds, seasonal effects and changes in biological activity of microorganisms within the water source.

UV-T monitors are commonly used as an input to a dose control strategy of a UV treatment system, helping to reduce over or under dosing. They are also used to monitor water quality to help diagnose operational problems.

10 mm   20 mm   30 mm   40 mm   50 mm

100%

90%   81%   73%   65%   60%

Water with a measured value of 90% UV-T, demonstrating the rate in which available UV light degrades, as distance from light source increases

Sensorex UVT-LED-PW

Overview (-PW)
The Sensorex UVT-LED-PW can be used in open or closed water systems, for either continuous on-line measurement of a process train, or off-line samples, of any type of water, including wastewater and drinking water. This patented UV-T monitoring device includes a UV-C LED light source, a UV sensor and wipers attached to a rotating measuring head.

It is operated by placing the measurement head into a water sample. The water sample may be stationary or flowing. The water sample flows through the measurement head, in between the UV light source and the UV sensor. The UV sensor measures the amount of UV light that the UV sensor is exposed to, measuring the amount of UV light that passes through the fluid sample. After the UV measurement of the water sample is collected, a quartz cylinder having

a known UVT value is moved in between the UV light source and the UV sensor and another measurement is taken. By subtracting the UV measurement taken through the quartz cylinder and the UV measurement taken through the fluid sample, a UVT value for the fluid is determined. In addition a third measurement is taken with the UV light source powered off providing a zero point calibration measurement for the UV sensor.

When the quartz cylinder is rotated into a position between the UV light source and the UV sensor, a wiper, attached to the rotating mechanism, wipes the windows in between the UV light source and the water sample and the UV sensor and the water sample, thus removing any contaminants or buildup of constituents from the water sample on the windows.
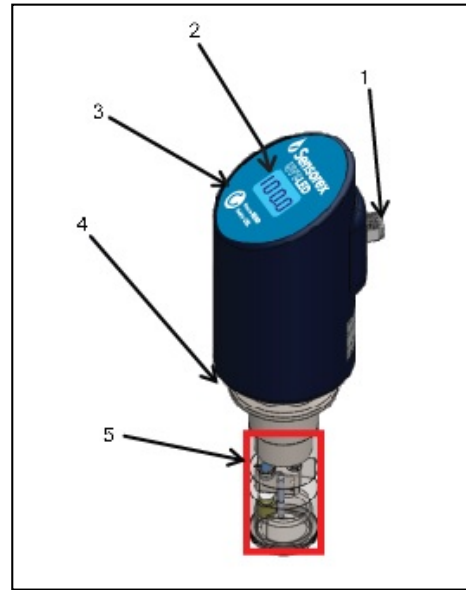
Number	Description
1	5 Pin Connector
2	LCD Display
3	Read/Calibrate Button
4	1.5" Sanitary Connection
5	Measurement Head
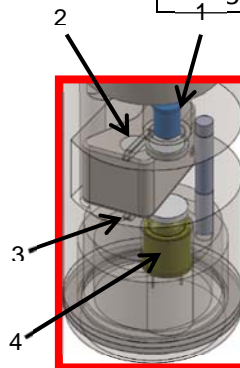
Number	Description
1	UV-C Light Source
2	Quartz Cylinder
3	Wiper
4	UV Sensor

Installation in Carbon Steel Pipe
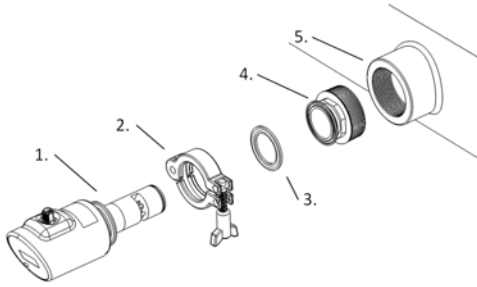
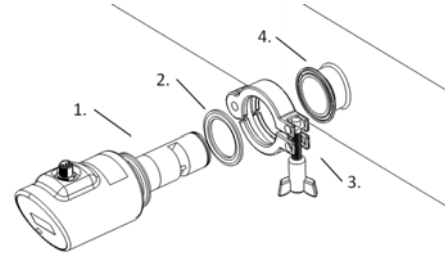| Number	Description
1	UVT-LED-PW
2	Tri-Clamp, Stainless Steel, 1.5" Dia
3	Gasket, Silicone, 1.5" Dia
4	Adapter, Carbon Steel, 2"NPT
5	Female Pipe outlet, 2" FNPT (supplied by others)

Installation order: 4 threads into 5. 3 seats in groove of 4. 1 inserts into 4 with 3 seal. 2 clamps on to mate 1 and 4 using seal (3)

Attach 2" NPT pipe outlet to location where monitor will be installed. The top of the 2" NPT/DIN 158 pipe outlet should rise no more than 1.25" above the surface of the pipe.

The 2" NPT/DIN 158 pipe outlet should be installed at the *3 o'clock* or horizontal position on the pipe to prevent air from becoming trapped around the measurement head of the Sensorex UVT-LED-PW.

Using adaptor, carbon steel, 2" NPT fitting, the sanitary gasket and sanitary clamp, attach the UVT-LED-PW to the pipe as illustrated above.
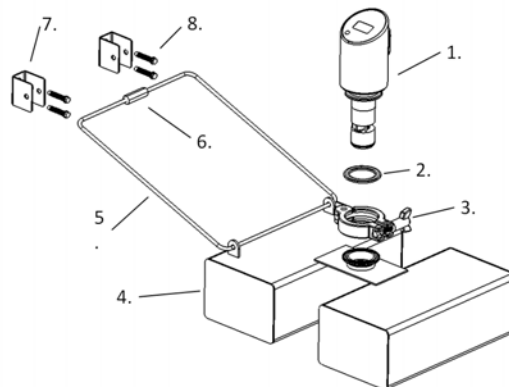
Installation in Stainless Steel Pipe

Number	Description
1	UVT-LED-PW
2	Gasket, Silicone, 1.5" Dia
3	Tri-Clamp, Stainless Steel, 1.5" Dia
4	Sanitary Pipe Fitting, Stainless Steel, 1.5" Dia (welding required)

Weld a 1.5" sanitary fitting to the pipe where the Sensorex UVT-LED-PW will be located. The sanitary pipe fitting, stainless steel, 1.5" diameter, should stand no more the 1.25" above the outside surface of the pipe.

The sanitary pipe fitting, stainless steel, 1.5" diameter should be installed at the *3 o'clock* or horizontal position on the pipe to prevent air from becoming trapped in the fitting.

Attach the Sensorex UVT-LED-PW to the 1.5" sanitary fitting using a sanitary gasket and sanitary clamp as illustrated above

Installation in Open Channel

Number	Description
1	UVT-LED-PW
2	Gasket, Silicone, 1.5" Dia
3	Tri-Clamp, Stainless Steel, 1.5" Dia
4	Float Body, Stainless Steel
5	Swingarm
6	Swingarm Binder
7	Wall Bracket, Stainless Steel
8	Wall Anchors (not supplied)

Using anchors, attach the open channel installation kit to the side of the channel as illustrated above.

Once open channel installation kit is attached to the concrete channel, attach Sensorex UVT-LED-PW to the open channel installation kit by using the 1.5" sanitary gasket and 1.5" sanitary clamp as illustrated above.

External Connections

Wire Color	Wire Function
White	+24V
Black	0V/GND
Red	4-20 mA Signal
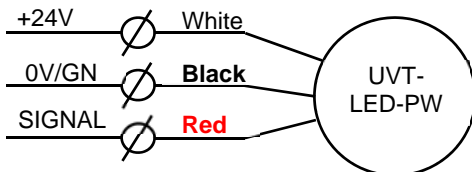
When connecting the Sensorex UVT-LED-PW to an external power source/output,

connect the black and white wire to a 24V power supply as outlined in table above. **The Sensorex UVT-LED-PW will draw 2 peak amps of power and so the power supply must be rated at 2A or higher.**

Connect the red wire as outlined above to receive a 4-20mA output signal.

Note: the 4-20mA signal loop is internally powered by the device.

Connect 5 pin connector to UVT monitor. (See Connection Picture)

Operation - Automatic Measurements
The Sensorex UVT-LED-PW is designed to take a UVT measurement once every minute.

During normal operating mode the UVT of the water measured during the last reading will be displayed on the LCD display as well as being transmitted via a 4-20mA signal.

Operation - Manual Measurements

Sensorex UVT-LED-PW can take a UVT reading at any time by pushing the ↻ button for **1 second.**

Note: The reading takes approximately 10 seconds to display.

Operation - External Calibration
The Sensorex UVT-LED-PW has an internal, self-calibrating function. This internal calibration occurs with each UVT measurement. This function utilizes the built

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March 2015

Patent No,: US 8,927,922 B2
Jan. 6, 2015

in quartz cylinder, which has a known UVT. Additionally, the operator has the option of doing a manual calibration.

The Sensorex UVT-LED-PW can be calibrated at any time by inserting the measurement head into a sample of *de-ionized water*. Once measurement head is inserted into de-ionized water, cycle the wiper 5 times to remove any air bubbles by pressing the ↻ button 5 times and to receive a reference measurement in the DI water. When 5 cycles are complete, press and hold the ↻ button for 3 seconds

When calibration is started the screen on the Sensorex UVT-LED-PW will flash several times. When screen begins to flash release the ↻ button.

When reading shows >**99.9%** on the LCD display, calibration is complete. When calibration is complete, take a manual reading to ensure calibration has been accepted.

Note: Calibration takes approximately 10 seconds

Cleaning Procedure
When fouling of the quartz windows are suspected, The Sensorex UVT-LED-PW should be cleaned according to the following procedure:

1) Remove Sensorex UVT-LED-PW from the process.

2) Fill up small container with 15-20% solution of phosphoric acid (e.g. – Calcium Lime and Rust remover) or food grade citric acid. Fill container high enough to completely submerge the measuring portion of the tip in the 15-20% solution of phosphoric acid or food grade citric acid.

3) ***While the unit is still powered, allow unit to soak for 30 minutes.***

4) After 30 minute soak, rinse measuring tip with de-ionized water to rinse off excess cleaning solution.

5) Fill container with isopropanol, high enough to fully submerge measuring tip.

6) Submerge Measuring tip in isopropanol for 10 minutes while unit is powered on.

7) Using the UVT-LED cleaning swab (part #UVT0011) gently clean the quartz measuring windows in front of the sensor and the UV-C light source.

8) Place unit in de-ionized water high enough to fully submerge measuring tip.

9) Submerge measuring tip in de-ionized water for 10 minutes.

10) Re-calibrate monitor according to recalibration procedure.

Clean In Place (CIP)

When performing a CIP with the Sensorex UVT-LED-PW, the temperature of the water should not exceed 55° C. ***If the temperature exceeds 55° C, then the Sensorex UVT-LED-PW should have power removed***.

Sensorex UVT-LED-H

Overview (-H)

The Sensorex UVT-LED-H is the handheld model from the UVT-LED family. It is designed for use in benchtop and offline UV-T measurement applications only. It can be used to measure various types of water including wastewater and drinking water. The UVT monitoring device includes an LED UV light source and a UV sensor

It is operated by calibrating the UVT-LED-H in de-ionized water. After calibration is complete, place the measurement head into a water sample. The water sample may be stationary or flowing. The water sample surrounds the measurement head in between the UV light source and the UV sensor. The UV sensor measures the amount of UV light that the UV sensor is exposed to, measuring the amount of UV light that passes through the fluid sample. This measurement is then compared internally, in the firmware, to the stored value from the calibration and displayed as a percent relative to the value achieved using de-ionized water.
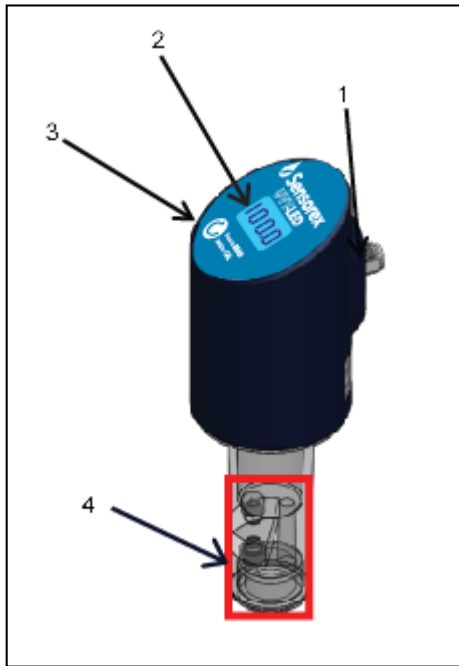
Number	Description
1	5 Pin Connector
2	LCD Display
3	Read/Calibrate Button
4	Measurement Head
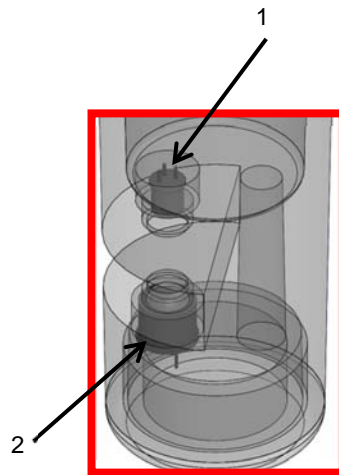
Number	Description
1	UV-C Light Source
2	UV Sensor

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Charging/Battery Power

Connect 5 pin connector to the UVT monitor.

Plug the Power Supply into wall to begin charging the battery*. Battery will take approximately 15 hours to reach full charge when plugged into wall. DO NOT TAKE MEASUREMENTS WHEN THE UVT-LED-H is charging. REMOVE CHARGING CABLE BEFORE TAKING MEASUREMENTS*. No damage will occur if the unit remains plugged in after the 15 hour charge. Overcharging will not occur.

While on battery power, device automatically powers off if inactive for more than 10 minutes.

Operation - Measurements

Sensorex UVT-LED can take a UVT reading at any time by inserting the measurement head into your sample. Once measurement head is inserted into sample*, verify that there are not air bubbles present on the two measuring windows.* If bubbles are present, *gently shake the measurement head to remove air bubbles*. Once all air bubbles are gone, push the C button for 1 second.

Note: The reading takes approximately 5 seconds. When reading is complete, screen will flash on and off blue once. Another reading cannot be taken until the display flashes 2x (approximately 35 seconds) The Sensorex UVT-LED-H can take 50 readings per day for one week under a single battery charge. *Battery should be charged weekly for correct operation.*

Operation – Calibration

The Sensorex UVT-LED-H should be calibrated prior to initial use. The monitor should be re-calibrated before each day of use and *re-calibrated every 50 measurements.*

Calibrate the Sensorex UVT-LED-H at any time by inserting the measurement head into de-ionized water. Once measurement head is inserted in de-ionized water, inspect the two quartz measuring windows to verify that there are no air bubbles. If bubbles are seen, gently shake the measurement head to remove them. Once all air bubbles are gone begin calibration procedure by pressing C button once to take a reference measurement until the screen flashes blue 1x. Reading should be >99%.   Wait 30 seconds for screen to flash 2x. Then press C button and release. Press and hold C button until the screen on the Sensorex UVT-LED-H flashes several times. When screen begins to flash release the C button.

When reading shows >99% on the LCD display, calibration is complete. When calibration is complete, take a manual reading to ensure calibration is saved LED should read 99%.
Note: Calibration takes approximately 10 seconds.

Cleaning Procedure

Using the Sensorex UVT-LED cleaning swab (part #UVT0011) gently clean the quartz measuring windows in front of the sensor and the UV-C light source.

Place unit in de-ionized water high enough to fully submerge measuring tip. Submerge measuring tip in de-ionized water tor for 10 minutes, according to recalibration procedure.

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Troubleshooting

Fault	Possible Solution
UVT-LED will not switch on	- Check connections in power cabinet to ensure 24V power is being supplied - Check connections in 5-pin connector for connection tightness - On battery powered versions (UVT-LED-H), plug unit in to recharge batteries and **DO NOT RUN unit on line power**.
UVT reading is lower than expected	- During measurement an air bubble may have been present in measurement area. Ensure no air bubbles are present in measurement area and re-do the measurement - On battery operated models, battery is low and unit should be plugged in to recharge battery. Remove UVT-LED-H from charger before taking additional measurements. - Follow cleaning procedure on page 10 to remove materials that can foul the sensor. - Unit needs to be recalibrated according to outlined calibration procedure
UVT reading is higher than expected	- During calibration, an air bubble may have been present in measurement area. Recalibrate according to outlined calibration procedure - Follow cleaning procedure on page 10 - Unit should be recalibrated according to outlined calibration procedure
UVT reading is not being transmitted to plant controls	- Check to make sure the 4-20mA signal loop has an external power source - Ensure signal wires are configured as outlined - Check connections in 5-pin connector for tightness
Analog scaling is incorrect	- Scaling should be set up so that 4mA = 0% and 20mA = 100%
UVT reading is zero	- During measurement an air bubble may have been present in measurement area. Ensure no air bubbles are present in measurement area and re-do the measurement - Follow cleaning procedure in page 10 - Unit should be recalibrated according to outlined calibration procedure - LED or sensor is no longer working. Return to the manufacturer for service (prior authorization is required to return products for warranty claim) - Water has high absorbance and is not letting the UV-C pass through the sample
Unit will not calibrate	- Return to the manufacturer for service (prior authorization is required to return products for warranty claim)
Wiper mechanism does not rotate to opposite position during a wipe cycle	- Return to the manufacturer for service (prior authorization is required to return products for warranty claim)

Ordering Information

Sensor Kits

Part Number	Description
UVT-LED-H-KIT-WD	UVT-LED-H, carrying case, 24V power supply(outside USA), cleaning swab x 1

Spare Parts

Part Number	Description
UVT0005	Power Supply, 110-240VAC Input to 24VDC Output, Wall Plug with adapters (outside North America)
UVT0006	Power Supply, 10-240VAC Input to 24VDC Output, Wall (North America only)
UVT0002	Power/Connection Cable, 5-pin to open wires, 10m (33ft)
UVT0003	Connection Cable, 5-pin to open wires, 20m (66ft)
UVT0004	Connection Cable, 5-pin to open wires, 30m (99ft)

Accessories

Part Number	Description
UVT0001	Carrying Case, UVT-LED-H
UVT0007	Installation Kit, Open Channel, UVT-LED-PW
UVT0008	Installation Kit, Carbon Steel Pipe (2" NPT), UVT-LED-PW
UVT0009	Installation Kit, Stainless Steel Pipe (welding required), UVT-LED-PW
UVT0021	Installation Kit, PVC Pipe (2" NPT), UVT-LED-PW
UVT0015	Installation Kit, 3" sanitary tee, UVT-LED-PW
UVT0011	Sense T Cleaning Swabs – 50 per pack

Contact Details

Service: Support@sensorex.com

Spares: sales@sensorex.com, orders@sensorex.com

Phone: 1-714-895-4344

Address: 11751 Markon Drive, Garden Grove, CA. 92841 USA

Website: www.sensorex.com

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Warranty

This UVT-LED product, as supplied and by Sensorex, or an authorized Sensorex distributor, and delivered new, in the original carton is warranted by Sensorex against manufacturing defects in materials and workmanship for a limited warranty period of:

Two (2) years on all components

The limited warranty commences on the date of shipment. To make a warranty claim, the purchaser must contact Sensorex or distributor for problem determination and receipt of an ***RMA number.*** The serial number must be presented for warranty processing to begin.

Sensorex will repair, or replace, any part found to be defective, in our opinion and at no charge as stipulated herein, with new or reconditioned parts during the limited warranty period specified above. All replaced parts and products become the property of Sensorex and must be returned to Sensorex. Replacement parts and products assume the remaining original warranty, or ninety (90) days, whichever is longer.

This limited warranty covers manufacturing defects in materials and workmanship encountered in normal use of this product, and shall not apply to the following, including but not limited to: wear and tear to quartz window wiper blades, damage which occurs in shipment; delivery and installation; applications and uses for which this product was not intended; altered product or serial numbers; cosmetic damage or exterior finish; accidents, abuse, neglect, fire, water, lightning or other acts of nature; use in applications with water temperature and ambient air temperature over 100 degrees F, with water pressure greater than 150 psi (PW only); use of products, equipment, systems, utilities, services, parts, supplies, accessories, applications, installations, repairs, external wiring not supplied or authorized by Sensorex, or which damage this product or result in service problems; incorrect supply voltage, fluctuations and surges in electrical supply; customer adjustments and failure to follow operating instructions, cleaning and maintenance instructions that are covered and prescribed in the Operations and Maintenance manual.

There are no express warranties other than those listed and described above, and no warranties whether expressed or implied, including, but not limited to, any implied warranties of merchantability or fitness for a particular purpose, shall apply after the express warranty periods stated above, and no other express warranty or guaranty given by any person, firm or corporation with respect to this product shall be binding on Sensorex. Sensorex shall not be liable for loss of revenue or profits, failure to realize savings or other benefits, or any other special, incidental or consequential damages caused by the use, misuse or inability to use this product, regardless of the legal theory on which the claim is based, and even if Sensorex has been advised of the possibility of such damages. Nor shall recovery of any kind against Sensorex be greater in amount than the purchase price of the product sold by Sensorex and causing the alleged damage. Without limiting the foregoing, purchaser assumes all risk and liability for loss, damage or injury to purchaser and purchaser's property and to others and their property arising out of the use, misuse or inability to use this product sold by Sensorex not caused directly by the negligence of Sensorex. This limited warranty shall not extend to anyone other than the original purchaser of this product either from Sensorex directly or through an authorized Sensorex distributor, it is non-transferable and states the exclusive remedy.