IC Sentinel® Users Manual

PN 2069 Rev 1.1

Introduction

The *IC Sentinel®* Environmental Monitor is an instrument that measures and records airborne particulates, differential room pressure, air quality (CO_2), relative humidity, light level, and sound level. It can be an integral part of an Infection Control program, as well as both patient satisfaction and facilities management programs.

IC Sentinel® is a fully automated system, powered and connected to the facility IT network via a single Ethernet cable. The IC Sentinel® software suite controls all IC Sentinel® installations facility-wide.

Any number of individual IC Sentinel® sensor units can be installed in the facility, all of which interface with a single IC Sentinel® software suite, which can be installed on a network server or PC. The IC Sentinel® sensor units can be fixed-mounted in key locations, or moved around the facility as needed, to respond to issues or to monitor areas under construction.

Contacting Oberon

To contact Oberon for technical support or calibration/repair, please call 1-814-867-2312. To view, print, or download the latest documentation please visit http://www.ICSentinel.com.

Safety Information

A *Warning* identifies conditions and instructions that are dangerous to the user.

A *Caution* identifies conditions and instructions that can cause damage to the IC Sentinel® system.

Warning

To prevent possible electrical shock, fire, or personal injury:

- The IC Sentinel® sensor unit contains a laser device, as well as an infrared air quality sensor. Do not disassemble the IC Sentinel® sensor unit, it contains no user-serviceable parts.
- Do not use the IC Sentinel® sensor unit if it is damaged.
- Use the IC Sentinel® sensor unit only as specified, or hazardous laser exposure can occur.
- Do not open the IC Sentinel® sensor unit. The laser beam is dangerous to the eyes. Have the IC Sentinel® repaired only by an approved technical service center.
- Do not look directly into the laser with optical tools such as binoculars, telescopes, or microscopes. Optical tools can focus the laser and be dangerous to the eye.
- Do not use the IC Sentinel® sensor unit if it operates incorrectly.
- The electrical protection built into this equipment may not function correctly if this equipment is used in a manner not specified by the manufacturer.
- The maximum PoE supply voltage is 57 VDC, with a maximum PoE wattage of 12.95W.
- Read the entire Users Manual before using the IC Sentinel® system.

Regulatory Information

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This device complies with Industry Canada ICES-003, *CAN ICES-3(A)/NMB-3(A),* and with UL 61010-1/CSA C22.2 No. 61010-1, SGS File Number 710207.

CE   EMC Directive 2004/108/EC, General Product Safety Directive 2001/95/EC,

RoHS2 Directive 2001/65/EU.

Product Components

The IC Sentinel® Model 1984 is shipped with the following components:

1. IC Sentinel® Sensor Unit
2. IC Sentinel® Wall Mount Bracket
3. IC Sentinel® Users Manual

The IC Sentinel® software suite, IC Sentinel® Software Users Manual, and product applications guides are available for download from the IC Sentinel® website.

The following optional accessory components may be purchased to support IC Sentinel® installations:

1. Model 80846-1 Zero Count Filter with Inlet Adapter
2. Model 81119 Remote Inlet Adapter
3. Model MC2203 Quick-disconnect Fitting, 3/16 inch Tubing
4. Model 242901-04 Static Pressure Sensor Tip, 4 inches
5. Model 242901-06 Static Pressure Sensor Tip, 6 inches
6. Model 242901-08 Static Pressure Sensor Tip, 8 inches
7. Model SRPS Static Pressure Wall Mount Plate
8. Model PSW4824-POE Wall Mount PoE Midspan Injector
9. Model PS4820-POE-1 Desktop PoE Midspan Injector
10. Model 1991 Wall Mount Plate (Note: one is supplied with each unit)

Note: It is recommended that at least one or two zero count filters with inlet adapters be purchased on a per facility basis.

IC Sentinel® Front Panel

Located on the IC Sentinel® sensor unit front panel is the isokinetic particle detector inlet. This inlet is removable by hand; gently pull and twist to remove the inlet. It features a 125µm stainless steel mesh screen that can be easily cleaned if needed. Figure 1 shows the Sentinel front panel.

Caution: Ensure that at least one inch of clearance is provided adjacent to the inlet when installing the unit.

Also, the optional inlet adapter (Model 81119) can be fitted (instead of the supplied isokinetic inlet) to attach tubing to the device, allowing for remote sensing or flow rate measurements. The optional zero count filter (Model 80846-1) can be used to verify proper operation and purge the particle detector if needed.

Figure 1, IC Sentinel® Front Panel

IC Sentinel® Rear Panel

Located on the IC Sentinel® sensor unit rear panel is the PoE Ethernet jack, the differential room pressure sensor port, and a ventilation exhaust opening. Figure 2 shows the IC Sentinel® rear panel.

Each IC Sentinel® sensor unit should be connected to the facility network using the PoE Ethernet jack. Power to IC Sentinel® must be supplied over this single cable, using a PoE capable switch, or injector.

When using the differential room pressure sensor, connect the tubing which conducts the pressure in the adjacent room or hallway to the differential pressure sensor quick-disconnect port using one of the optional connectors.

Caution: Ensure that at least one inch of clearance is provided adjacent to the exhaust opening when placing the IC Sentinel® sensor unit.
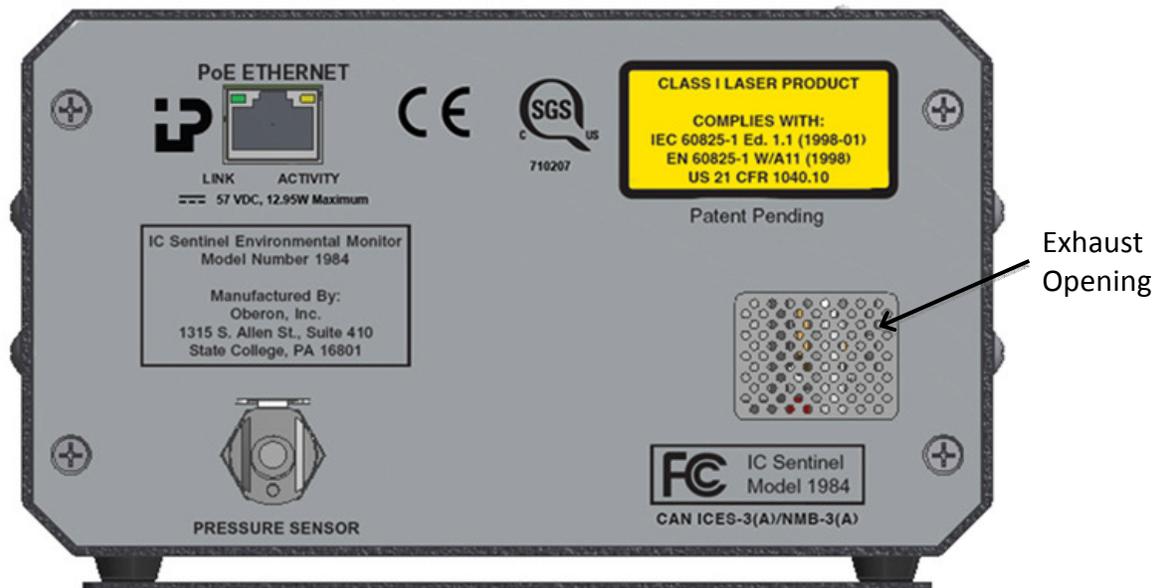

Figure 2, IC Sentinel® Rear Panel

IC Sentinel® Top Panel

The sound and light sensors are located on the top panel of the IC Sentinel® sensor unit.

Caution: Ensure that the top surface of the IC Sentinel® sensor unit is unobstructed, do not place or stack anything on top of the unit, or these sensors will be obstructed.

Figure 3, IC Sentinel® Top Panel

IC Sentinel® Installation

IC Sentinel® sensor units are intended to be installed in a non-condensing indoor environment. They can be fixed-mounted or moved around the facility as needed. IC Sentinel® sensor units can be placed on a desk, table top, or mounted to a wall using the supplied mounting bracket. In the case of wall mounting, it is recommended that the particle detector inlet on the front panel be oriented facing up. Note that one wall mount bracket is supplied with each unit. Additional wall mount brackets can be ordered as an accessory if needed.

Place the IC Sentinel® sensor unit in the desired location, either desk or wall mounted. *Caution:* Ensure that at least one inch of clearance is provided to both the particle detector inlet on the front panel, and the exhaust opening on the rear panel. *Caution:* Ensure that the top surface of the unit is unobstructed; do not place or stack anything on top of the unit, or the sensors will be obstructed.

In an operating room environment, it is recommended that the IC Sentinel® sensor unit is placed as close to the patient as possible, in the protected area provided by the air filtering and circulation system. Although good results can be obtained with the unit positioned in a horizontal manner, vertically positioning the unit such that the particle detector inlet is facing up is recommended if possible.

Connect the network Ethernet cable to the rear panel using a category 5e or 6 cable of appropriate length. The link and activity LEDs on the Ethernet jack should illuminate shortly after connecting an active Ethernet cable to the unit. IC Sentinel® is an 802.3af PoE device and requires approximately 4W of injected power.

The IC Sentinel® sensor unit must be powered by the Ethernet connector; there is no separate power input. If a dedicated PoE enabled port is not available, the Model PSW4824-POE Wall Mount PoE Midspan Injector or Model PS4820-POE-1 Desktop PoE Midspan Injector can be used to provide power instead.

If the pressure sensor is used, connect and route the tubing from the outside of the room to the pressure sensor port on the rear panel. A quick-disconnect adapter that mates with the IC Sentinel® port is available, as well as static pressure sensor tips that

can be used to penetrate the room wall. A wall mount plate is also available that can be used in the adjacent hallway/room to allow tubing to be routed back to the unit. The tubing should be Tygon PVC, with a 3/16 in. ID, which will mate with the optional accessories.

Figure 4 shows the optional components available to connect the pressure sensor: the static pressure sensor tip, the quick-disconnect fitting which mates with the port on the IC Sentinel® sensor unit rear panel, and the wall mount plate.

The static pressure sensor tips come in depths of 4 in, 6 in, and 8 in. They can be used to penetrate walls, and could be cut to length if desired. An alternative is to route the Tygon tubing through the wall, and mount the wall mounting plate in the hallway or room external to which the IC Sentinel® sensor unit is located.

For more information regarding the installation and use of the pressure sensor please refer to the IC Sentinel® Differential Pressure Accessories Application Guide available on icsentinel.com.
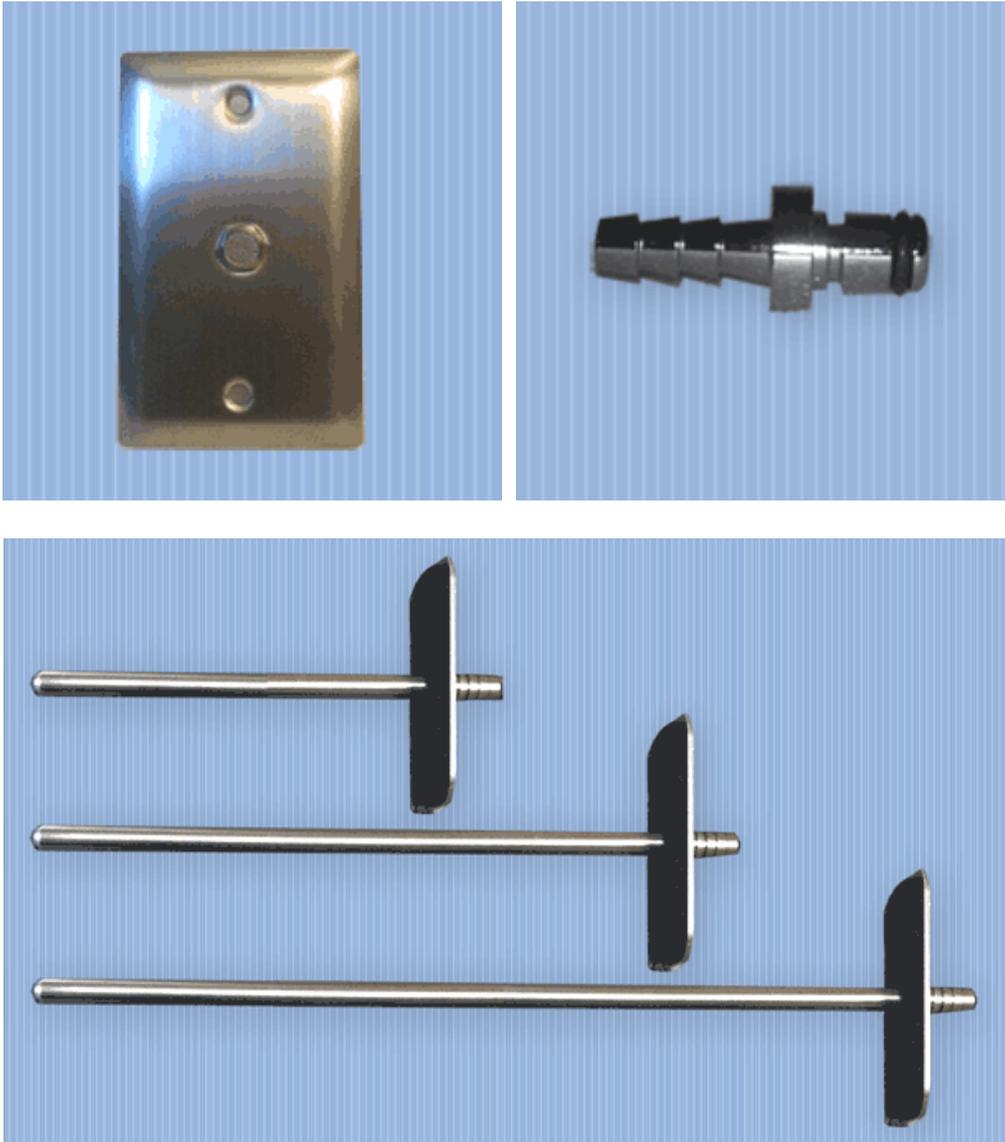
Figure 4, Pressure Sensor Accessories

IC Sentinel® Operation

Each IC Sentinel® sensor unit is controlled by the IC Sentinel® software suite. For detailed information on the operation, please refer to the IC Sentinel® Software Users Manual. An overview of operations is provided here.

Each IC Sentinel® sensor unit is networked back to the server where the Sentinel software resides. A custom DNS entry allows each IC Sentinel® sensor unit to send data back to the IC Sentinel® software database. IC Sentinel® sensor units do not need to reside on a single subnet, and can be located throughout the facility, as long as they can reach the address defined in the DNS table.

Each IC Sentinel® sensor unit comes with a one year factory calibration. An alarm will be generated when calibration is due, and the calibration due date is visible on the user interface.

A new IC Sentinel® installation will need to be configured using the software suite. Alarm limits can be set per measurement, along with email/SMS alert lists in the event of an alarm.

For more information regarding setting alarm limits, please refer to the IC Sentinel® Threshold Setting Applications Guide, available on the website.

The main IC Sentinel® screen shows all IC Sentinel® units in the facility, along with each parameter being measured and alarm status. Select an individual IC Sentinel® screen to obtain more detailed information, along with graphical data. Alarms are cleared in this individual IC Sentinel® screen.

IC Sentinel® Database

Each individual IC Sentinel® sensor unit updates the IC Sentinel® software database once every 15 seconds. Each individual IC Sentinel® database is configurable for the length of time its database should be stored, with a default of one month. If the length of time is set to zero the database is allowed to grow to the maximum allowable size, and then is re-written. There is a global configuration for the maximum database size.

The database can be exported, on a per IC Sentinel® unit basis, in both XML and CSV formats. Advanced users can directly access the Firebird database if desired.

Particle Detector Operation

The particle detector within the IC Sentinel® sensor unit has four channels, with channel sizes of 0.5µm, 1µm, 5µm, and 10µm. It can count particles in a cumulative or differential mode, and can be set to display units of particles per cubic feet (P/CF), particles per cubic meter (P/CM), and particles per cubic liter (P/CL).

The isokinetic inlet adapter has a 125µm stainless steel mesh screen to filter out very large particles. If operated in an environment with high particulates, take care to ensure this screen stays clean. To remove the isokinetic adapter simply twist and gently pull it off. The screen can then be removed for cleaning. Clean the screen by washing it in warm water. After cleaning, replace the screen and gently push the adapter into place.

The cumulative counting mode includes all particles that are equal or greater to the channel size. For example, if a 7µm particle is counted, it would yield one count in each of the 0.5µm, 1µm, and 5µm channels, and a zero count in the 10µm channel.

The differential counting mode includes all particles that are equal or greater than the channel size, *but less than the next greater channel size*. For example, if a 7µm particle is counted, it would yield a zero in the 0.5µm and 1µm channels, a one in the 5µm channel, and a zero in the 10µm channel. The differential mode allows the user to observe the number of smaller particles more easily, particularly in the presence of many larger particles.

Depending on the application, the user may be more interested in particles in the 1u to 5u region, as they are relatively large, but tend to stay airborne. The particle detection is designed to be flexible, to allow the user to choose the desired operating mode and detection limits appropriate to his or her environment.

Alarms can be set for maximum allowable particulate count in each particle detector channel.

To verify particle detector operation, or purge the unit after a high sampling count event, use the optional inlet adapter with zero count filter. Operate the unit with the zero count filter attached until there are no new particle counts detected. The unit is capable of a false count rate of less than one count per five minutes. If this can not be obtained, please return the unit for service.

The optional inlet adapter can also be used to verify the particle detector flow rate, which is 1.5 liters per minute (LPM), or to sample particulates from a remote location.

It is recommended that at least one or two optional inlet adapters with zero count filters be purchased for use on a per facility basis, and be used on a regular basis to ensure proper operation of the particle detector.

Differential Pressure Sensor Operation

The differential pressure sensor within the IC Sentinel® sensor unit is designed to measure the pressure differential between the ambient pressure within the IC Sentinel® sensor unit and an adjacent room or hallway. Both positive and negative pressure differentials can be measured. Pressure is displayed as Pascal (Pa), with a full scale of +/- 24.9 Pa.

Since both positive and negative differential pressure can be measured, **be certain to observe the polarity of the measurement**. Some rooms are configured to be positively pressurized (the room pressure is greater than the adjacent room or hallway), or negatively pressurized (the room pressure is less than the adjacent room or hallway).

The reference port is inside the IC Sentinel® sensor unit and not user accessible. The

measured external port is found on the rear panel. A quick-disconnect fitting is used to simplify this connection. Route the tubing from IC Sentinel® to the adjacent room or hallway. Various static probes and wall plates are available to complete this connection.

The differential pressure sensor is a precision device, capable of measuring very small pressure differentials. The zero pressure point is factory calibrated; however, changes in IC Sentinel® physical installations may cause small shifts in this zero pressure calibration. If desired, the IC Sentinel® software allows the user to re-zero this zero pressure state. *If this option is exercised, be very careful to ensure that the IC Sentinel® unit is stationary, and in its final mounting position, with the external port disconnected, and with little or no airflow over or around this port.* The factory default calibration can be retrieved at any time if needed.

An alarm can be set for the desired minimum room pressure.

Air Quality Sensor Operation

An infrared CO_2 air quality sensor is provided that can detect elevated levels of CO_2. Air quality is displayed in parts per million, ppm, with a detection range of 0 to 10,000 ppm. Air quality can be measured in real-time, STEL (Short Term Exposure Limit), or TWA (Time Weighted Average). Real-time is averaged over 15 seconds, STEL is averaged over 15 minutes, and TWA is averaged over 8 hours.

Warning: The air quality sensor is not intended to take the place of a fire smoke and/or CO/CO_2 detector. It should ***not*** be considered adequate to provide protection for human life. It is intended to provide an indication of high levels of potentially hazardous CO_2.

An alarm can be set for the upper limit of desired air quality. There are many standards that set the upper limit of CO_2 in an indoor environment. ASHRAE 62-1989 sets a limit of 1000 ppm for the CO_2 concentration in an occupied building. OSHA sets limits of 5,000 ppm TWA and 30,000 STEL.

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Relative Humidity Sensor Operation

A relative humidity sensor is provided. The relative humidity is displayed in percent (%). Upper and lower limit alarms can be set for humidity.

Light Sensor Operation

An ambient light sensor is provided that approximates the human eye response to visible light. Rejection to infrared and 50/60 Hz lighting ripple is also provided. The light level is displayed as Lux. The light sensor input port is located on the top of the unit. Ensure that this port is facing the desired source of light for best operation.

An alarm can be set for the desired light level, configurable for both low light or high light thresholds.

Sound Sensor Operation

An audio sound sensor is provided. It features a wide dynamic range logarithmic amplifier, and an A-Weighted audio filter, designed to approximate the human ear response to different sound frequencies. The audio level is displayed as dB sound pressure level (dBA SPL).

This sensor can be used to provide a quantitative baseline of the noise level within a healthcare environment.

An alarm can be set for the maximum sound level desired.

User Control/Alarms

Multiple users can log into the IC Sentinel® software. A password is used for each user. Users can be assigned to any, or all, of three alarm lists. A data alarm list is triggered if any sensor measurement exceeds a set threshold. A calibration alarm list is triggered if the yearly calibration is due. A network alarm list is triggered if a unit is not responsive on the network, or if the maximum configured database size is exceeded. Email and/or SMS alerts can be generated for each user registered on the three alarm lists.

Calibration

The IC Sentinel® unit calibration is valid for one year from the time of calibration. The calibration date is shown on the status screen. A calibration alarm is generated when the unit is due for calibration. It should be returned to Oberon for calibration as soon as possible at this time; however, the unit will continue to function normally (with the CAL alarm set) in this state.

Caution: Continued use of the IC Sentinel® after the calibration date has expired is not recommended. To obtain and schedule calibration service, contact Oberon, Inc.

Built-In Self-Test

The IC Sentinel® unit periodically performs a built-in self-test. If the built-in self-test fails, the unit status changes to "FAIL." If this occurs please contact Oberon, Inc. to schedule repair service.

Software/Firmware Updating

The IC Sentinel® firmware revision for each individual IC Sentinel® unit, as well as the software revision is shown on the configuration screen. The software and firmware can be updated as needed by downloading the latest files and updating instructions on the IC Sentinel® website and software suite.

IC Sentinel® Measurement Specifications

Airborne Particulates

Number of Channels:	4
Channel Sizes:	0.5µm, 1µm, 5µm, 10µm
Count Modes:	ISO Class, Cumulative or Differential, P/CF, P/CM, P/CL
Concentration Range:	0 to 3,000,000 P/CF (ISO 21501-4)
Counting Efficiency:	50% +/- 20% (ISO 21501-4)
	100% +/- 10% (ISO 21501-4)
False Counts:	< 1 count per 5 minutes
Flow Rate:	1.5 LPM
Inlet:	Isokinetic probe with 125µm stainless steel screen
Light Source:	Laser diode, 10 mW, 650 nm
Laser Safety:	Class 1 laser product (safe)

Differential Room Pressure

Mode:	Bi-directional, positive and negative room differential
Full Scale:	+/- 24.9 Pa
Accuracy:	+/- 1% FS
Inlet:	Quick-disconnect fitting

Relative Humidity

Units:	% RH
Accuracy:	+/- 10%

Air Quality

Gas Detection:	CO_2
Modes:	Real-time (15 sec), STEL (15 min), TWA (8 hours)
Units:	ppm
Concentration Range:	0 – 10,000 ppm

Light

Response: Approximates human eye response to visible light
Rejection: Rejects 50/60 Hz lighting ripple and IR
Units: Lux

Sound

Units: dBA SPL
Sound Range: 30 – 100 dB SPL
Weighting: A-Weighted

IC Sentinel® General Specifications

Operating Temperature Range: 0 to +50°C

Storage Temperature Range: -20 to +80°C

Interface: Single RJ-45
                                                   IEEE 802.3 Ethernet
                                                   IEEE 802 3af Power Over Ethernet, < 6W Power

User Programmable Alerts: The user can program alerts for each metric

Data Base: Firebird database with programmable duration

Network Security: AES network encryption

Calibration Cycle: Yearly

Size: 7.000L x 6.850W x 4.125H, inches

Weight: 3.25 Pounds

Note: Specifications subject to change.

Limited Warranty and Limitation of Liability

This Oberon product is warranted to be free from defects in material and workmanship under normal use and service. The warranty period is one year, and begins on the date of shipment. Parts, product repairs, and services are warranted for 90 days. This warranty extends only to the original buyer or end-user customer of an Oberon authorized reseller, and does not apply to any product, which in Oberon's opinion, has been misused, altered, neglected, contaminated, or damaged by accident or abnormal conditions of operation or handling.

Oberon warrants that software will operate substantially in accordance with its functional specification for 90 days. Oberon does not warrant that software will be error free or operate without interruption.

Oberon's warranty obligation is limited, at Oberon's option, to refund of the purchase price, free of charge repair, or replacement of a defective product which is returned to Oberon within the warranty period.

To obtain warranty service, contact Oberon to obtain return authorization information, and then send the product to Oberon, with a description of the difficulty, postage and insurance prepaid. Oberon assumes no risk for damage in transit. Following warranty repair, the product will be returned to Buyer, transportation prepaid. If Oberon determines that the failure was caused by neglect, misuse, contamination, alteration, accident, or abnormal condition of operation or handling, Oberon will provide an estimate of repair costs and obtain authorization before commencing the work. Following repair the product will be returned to the Buyer transportation prepaid, and the Buyer will be billed for the repair and return transportation charges.

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THIS WARRANTY IS BUYER'S SOLE AND EXCLUSIVE REMEDY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. OBERON SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES OR LOSSES, INCLUDING LOSS OF DATA, ARRISING FROM ANY CAUSE OR THEORY.

Since some countries or states do not allow limitation of the term of an implied warranty, or exclusion or limitation of incidental or consequential damages, the limitations and exclusions of the warranty may not apply to every Buyer. If any provision of the Warranty is held invalid or unenforceable by a court or other decision-maker of competent jurisdiction, such holding will not affect the validity or enforceability of any other provision.

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