

SDL500C

Cellular Data Logger

User Manual



About NexSens

NexSens Technology, Inc. was founded in the late 1990s with a mission to advance the capabilities and simplify the development of environmental monitoring systems. The company specializes in environmental sensors, remote data acquisition and communications technology, easy-to-use computer software, and web based datacenters.

iChart Software is an easy-to-learn, easy-to-use Windows-based software program designed to interface with the industry's most popular environmental monitoring sensors and systems. A large multi-vendor instrument library makes setup quick and easy. iChart automates much of the tedious programming, data collection, and manual data processing common with other environmental data collection systems.

The SDL500C (Submersible Data Logger) and iSIC (Intelligent Sensor Interface and Control) are state-of-the-art data loggers that simplify the collection of real-time data from environmental sensors and monitoring instruments. The data loggers support multi-vendor sensor connections and are specifically designed for environmental data monitoring.

WQData PRO is an enterprise class and business critical web-based software solution for environmental data management. It assists with collecting, storing, analyzing, interpreting, sharing, and publishing environmental data. The datacenter effectively manages a wide variety of biological, physical, and chemical parameters, along with many other environmental observations and project information.

WQSensors smart USB-based sensors include: Temperature, pH, ORP, Dissolved Oxygen, Ammonium, Bromide, Calcium, Chloride, Fluoride, and Nitrate. An integral USB connector on the sensor cable offers a simple, hassle-free connection to a computer without the need for a meter or batteries.

T-Node temperature systems, based on sensorBUS technology, provide a simple, yet effective, plug-and-play solution for developing multi-sensor networks and temperature strings. sensorBUS was developed to replace, expand, and enhance centralized parallel wiring for prevailing analog and digital signal transmissions. With integral 1-wire, SDI-12 and RS-485 interfaces, sensorBUS provides versatile sensor networking capability.

Monitoring Buoys are designed to support offshore monitoring systems. These buoys provide a robust floating platform for inland water monitoring projects.

NexSens products and systems simplify the setup and operation of environmental monitoring networks and help ensure quality data.

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Overview

The SDL500C Cellular Data Logger is configured with five sensor ports for connection to industry-standard digital and analog interfaces, including RS-232, RS-485, SDI-12, 1-wire temp string, 0-2.5 V, pulse count, and more. Each sensor port offers a UW (underwater) type receptacle with double o-ring seal for a reliable waterproof connection. Unlike many data loggers, the SDL500C is truly submersible. The housing and battery compartment are completely sealed and waterproof. The SDL500C allows environmental professionals to deploy monitoring systems near streams, rivers, wetlands, coastal waters, or in sewers and culverts without fear of accidental flooding.

The housing is constructed of impact-resistant PVC and includes two elastomer bumpers for long-term deployment in close-fitting pipes and buoy ports. Internal circuit boards and communication modules are shock mounted and all access ports incorporate redundant sealing. The SDL withstands extreme wave action, drops, floods, periodic & long-term deployment underwater, and more. The cellular antenna is also waterproof.

The SDL500C is powered by eight D-cell alkaline batteries. Up to three optional 5-watt solar power kit can provide long-term continuous operation and solar charging. It incorporates a wide variety of analog and digital sensor interface capabilities. Popular sensor connections include multi-parameter sondes, rain gauges, weather stations, Doppler velocity meters, water level bubblers, radar level sensors, pressure sensors, and temperature strings.



Figure 1: SDL500C Submersible data logger

What's Included

The SDL500C Submersible Data Logger includes the following accessories and spares to get started and keep the unit operational:

NOTE

An A49-SDL high gain cellular antenna is required for cellular communication with the SDL500C.

- (8) D-Cell alkaline batteries
- Maintenance kit
 - SDL Guard removal tool (3/16" handled Allen wrench)
 - (2) Spare SDL port plugs
 - O-ring lubricant, 1/2 oz tube
 - (5) Spare O-rings, EPDM 116
- Quick start guide



Figure 2: Everything included with purchase of an SDL500C data logger

Common Accessories

Table 1: Accessories commonly used with SDL500C data loggers

Part Number	Description	Details
A49-SDL	Celluar antenna	Submersible cellular antenna for use with SDL500C cellular data loggers.
1001	iChart Software	Program which simplifies and automates many of the tasks associated with acquiring, processing, analyzing and publishing environmental data.
UW-CON	UW Cable connectorization	Factory installed connector for user-supplied sensor cables. Pluggable to the SDL500C.
UW-FL	UW Plug connector to flying lead cable	Used for wiring the SDL500C to external power sources.
UW-FLR	UW Receptacle connector to flying lead cable	Used for connecting sensors interchangeably between SDL500 and other data loggers.
SP5	5-Watt solar power pack	Power option featuring a solar panel, regulator, and a 12 VDC battery.
SP5-PH	Solar power harness	Used to connect up to three SP5 solar power packs to the SDL500C.

NOTE

Unique NexSens UW Underwater Connectors are used to interface with the SDL500C.

MB-100	Data buoy	Lightweight and portable data buoy platform.
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Specifications

Table 2: NexSens SDL500C data logger general and cellular modem specifications

Compatible Sensors	4-20 mA sensors, 0-2.5 V sensors, SDI-12 sensors, RS-232 sensors, RS-485 sensors, Modbus RTU sensors, NMEA 0183 sensors, 1-Wire temperature sensors, Thermistor sensors, Tipping bucket rain gauges
Analog Inputs/Outputs	0-2.5 V auto range, 12-bit resolution
Pulse Counter	Maximum rate: 12 Hz
Internal Memory Size	2 MB Flash memory, over 500,000 data points minimum
Operating Temp Range	0 °C to 60 °C
Maximum Depth	200 ft
Material	Impact-Resistant PVC
Length	18.25 in
Diameter (OD)	5.50 in
Weight	11 lbs without batteries; 14 lbs with batteries
Battery	(8) internal D-Cell Alkaline Batteries; optional 5-Watt Solar Power Pack with 12 VDC power
Power Requirements	Data Logger: 5 to 16 VDC Cellular Modem: 9 to 28 VDC
Data Logger Power Consumption	5 mA sleep 10 mA processing 36 mA analog measurement

Cellular Modem Power Consumption	350 mA receive/transmit typical 104 mA idle power management available
Cellular Frequency Range	GSM: Dual band 800/1900 MHz CDMA: Quad band 850/900/1800/1900 MHz
Cellular Service Type	GSM/GPRS, EDGE, CDMA
Supported Cellular Providers	AT&T, Verizon, Sprint, Alltel

Getting Started

Powering the SDL500C

The SDL500C can be powered internally with (8) D-Cell batteries or externally with NexSens SP5 5-watt solar power packs or a user-supplied 12 VDC source.

For MB-100 data buoy applications, internal batteries must be used to power the SDL500.

For MB-300 or larger data buoy applications, SP5 solar power packs are typically used to supply power externally. Additional information on SP5 power pack installation can be found in the MB-300/400 data buoy manual.

Internal Battery Installation

The battery lid is designed to be watertight at depths to 200 feet. Tight o-ring seals are required to maintain this pressure rating and may make lid removal difficult.

The lid removal tool (3/16" handled Allen wrench) supplied in the SDL maintenance kit can be used for additional leverage when unthreading the battery lid from the communication bulkhead.

WARNING

The battery lid incorporates two o-ring seals. These seals must be clean and lubricated for watertight integrity in submersible applications.



Figure 3: Unthreading the SDL500C battery lid from the communication bulkhead for battery installation

Eight D-Cell alkaline batteries can be inserted into the SDL500 (see Figure 4). Note the correct polarity shown on the labels just inside the battery tubes.

NOTE
The SDL500 is equipped with reverse polarity protection. No damage will occur if the batteries are inserted incorrectly.



Figure 4: Installing batteries in the SDL500C

Supplying External Power

When powering the SDL500C with NexSens SP5 solar power packs, simply attach the SP5-PH power harness to port D on the sensor bulkhead and mate the MS4 connector(s) on the end of the power harness to the cables on the SP5 power pack(s).

When supplying external power to the SDL500C, a UW-FL underwater connector to flying lead cable must be used. Since the communication port on the cellular data logger is occupied by a cellular antenna, one of the SDL500C sensor

bulkhead ports must be used. A port that contains switch power or battery power must be chosen to supply power externally. Pin-specific signal information can be found in the Sensor Connections section of the manual and corresponding flying lead wire color information can be found in the UW Plug to Flying Lead Cable section.

Setting up Communication

iChart Software is used to communicate with the SDL500C. Follow the wizard or the iChart manual to install the software.

To establish communication with a computer first connect the A49-SDL antenna to the top communication port. Also, power the SDL500 with internal batteries, solar power pack(s), with an external 12 VDC source.

Open iChart and select **Advanced | iSIC | iSIC**. The *iSIC Setup* dialog box will be displayed.

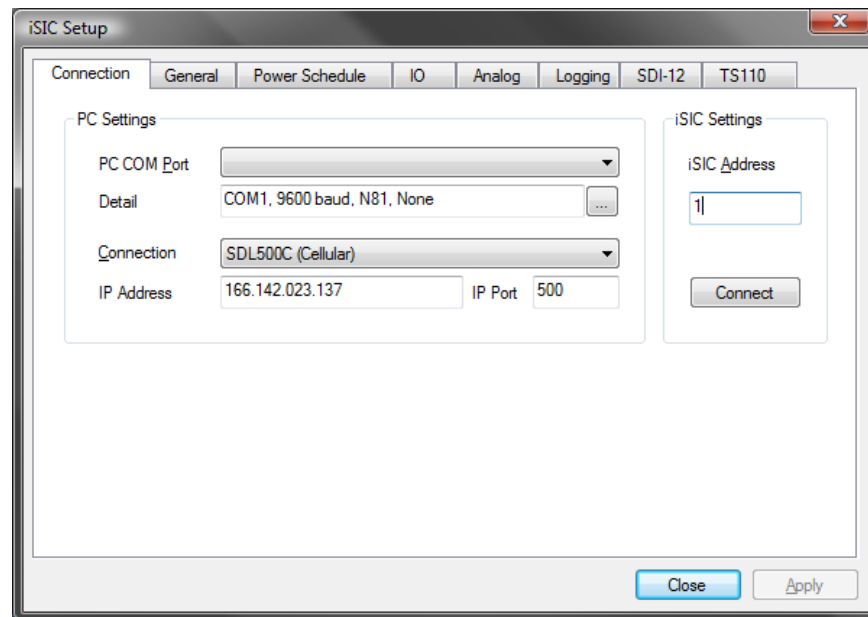


Figure 5: Select **Advanced | iSIC | iSIC** from the menu bar in iChart to connect to the SDL500C using the *iSIC Setup* dialog

Select the appropriate iSIC Address and set the Connection type to **SDL500C (Cellular)**. Enter the IP address of the modem and click **Connect**. Make sure the IP Port is set to 500. Click **Connect** and then switch to the **General** tab.

The SDL500C will send its current status (time, operating battery voltage, real-time clock battery voltage, firmware version, hardware version and ID) to iChart. If this information is displayed, communication has been established.

Proceed with connecting sensors.

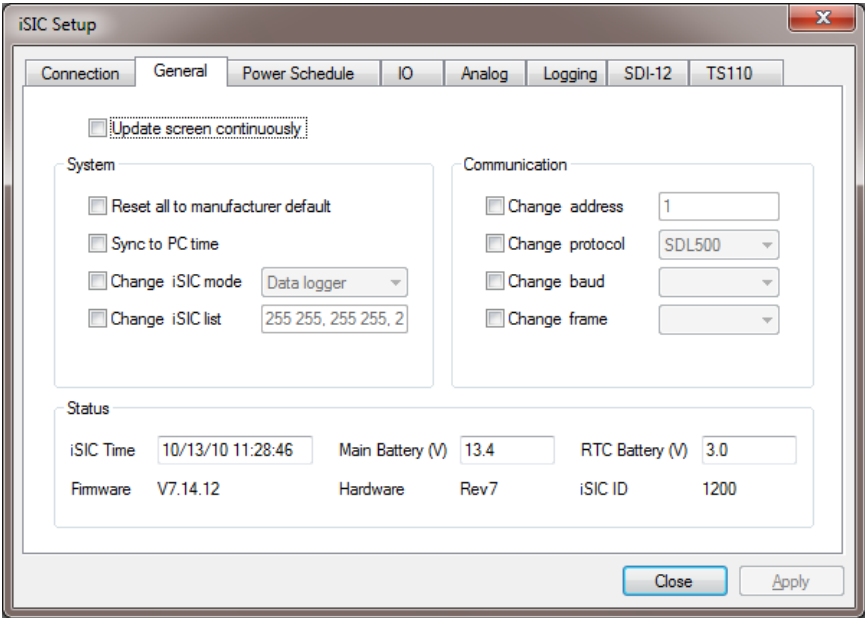


Figure 6: The General tab displays the data logger configuration as well as the status parameters (battery voltage, firmware version, etc.) determined during connection

Connecting Sensors

The SDL500C supports many standard sensor interfaces and protocols through its UW connector ports, including 1-wire temp string, RS-232, RS-485, SDI-12, pulse count, and both analog and digital input/output devices.

NexSens manufactures cables for these common interfaces and can also connectorized user supplied sensor cables.

The sensor bulkhead incorporates ports T, P1, P0, A and D.

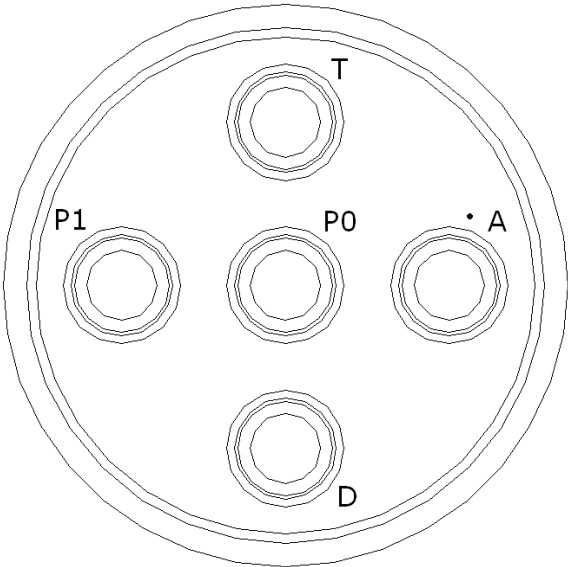


Figure 7: SDL500C sensor bulkhead with ports P0, P1, A, T, and D

Each port includes an 8-pin connector with various signal configurations.

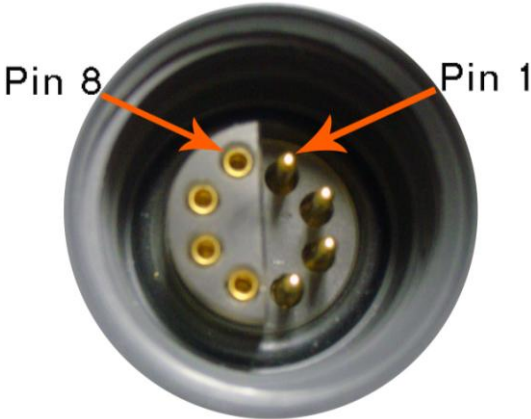


Figure 8: Typical bulkhead port

WARNING
All o-rings must be clean and dry before being used to secure watertight connections.

When purchased with NexSens cables (preconfigured with connectors), knowledge of the port pin outs is not required. Simply follow the recommendations for port connections.

See the appropriate sensor interface manual(s) for additional information on connecting sensors to an SDL500 data logger.



Figure 9: Connecting T-Node to SDL500C sensor bulkhead

Recommended Port Connections

Table 3: Port recommendations for connecting common environmental sensors to SDL500C

Manufacturer	Sensor	Port
NexSens	Short T-Node string	T
NexSens	Long T-Node string	P0, P1
NexSens	AccuStage	P0, P1, T, or D
YSI	6-Series	P0, P1, T, or D
Hydrolab	DS5, MS5	P0, P1, T, or D
In-Situ	9500, RDO PRO	P0, P1, T, or D
SonTek	Argonaut SW, SL, XR	P0, P1, T, or D
Campbell	OBS3	A
Turner Designs	Cyclops-7	A
Turner Designs	SCUFA	P0, P1, T, or D
Li-Cor	LI-193, LI-192, LI-191	A
ISCO	6700 Series	D
Vaisala	WXT520	P0, P1, T, or D
OTT	RLS	P0, P1, T, or D
Tritech	Micron Echo Sounder	P0, P1
Benthos	Sonar Altimeter	

NOTE

If a desired sensor is not listed, contact NexSens technical support.

Pre-Deployment Check

It is recommended that field deployments be carefully planned. It is best to completely configure the system on a lab bench and test it for period of time prior to departing for the field. This will ensure a successful deployment and quality data collection. Additionally, it is much easier to troubleshoot problems in the lab rather than in the field.

With iChart running and the SDL500C powered with the antenna connected, select **File | New Project**. Name the project and follow the step-by-step procedure in the **Setup Device Wizard**. Refer to the iChart manual for additional information.

NOTE
Always setup monitoring systems in the lab and confirm proper function prior to field deployment.

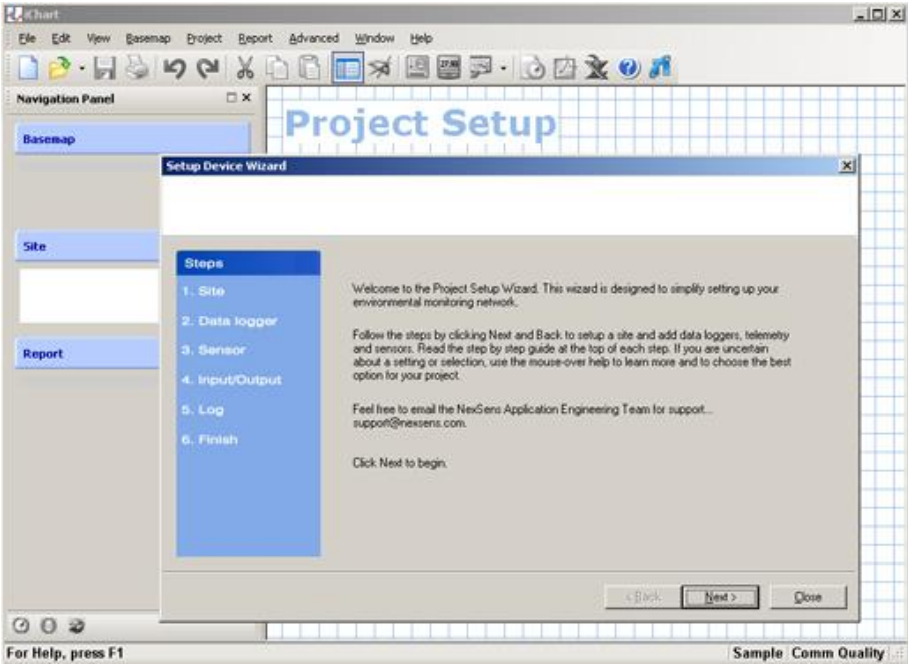


Figure 10: Setup Device Wizard dialogue used for setting up projects and programming of data loggers and sensors

Deploying the SDL

The versatility of the SDL500C offers many options for field deployments including:

- Mounted in buoys
- Deployed in pipes from river banks
- Deployed in sewers and culverts
- Deployed under bridges

WARNING
All connections must be made before allowing the SDL to be submerged, ensuring that any unused ports are plugged.

Get in touch with a NexSens Application Engineer for additional information on configuring a deployment.

Sensor Connections

All five ports on the SDL sensor bulkhead are receptacle-type connections. The mating plug signals are mirrored to the receptacle. For example, pin 1 on the receptacle mates with pin 8 on the plug.

See the tables below for pin-specific signals in each sensor bulkhead port.

Port P0

Table 4: Sensor bulkhead signals on port P0

Pin	Signal	Direction
1	Sensor RS-485A	Input/Output
2	Sensor RS-485B	Input/Output
3	SDI-12 Data	Input/Output
4	Battery	Input/Output
5	Switch 5 V, 100 mA	Output
6	P0.Rx	Input
7	Ground	
8	P0.Tx	Output

Port P1

Table 5: Sensor bulkhead signals on port P1

Pin	Signal	Direction
1	Sensor RS-485A	Input/Output
2	Sensor RS-485B	Input/Output
3	SDI-12 Data	Input/Output
4	Switch 12 V, 100 mA	Output
5	Switch 5 V, 100 mA	Output
6	P1.Rx	Input

7	Ground	
8	P1.Tx	Output

Port T

Table 6: Sensor bulkhead signals on port T

Pin	Signal	Direction
1	Sensor RS-485A	Input/Output
2	Sensor RS-485B	Input/Output
3	SDI-12 Data	Input/Output
4	Switch 12 V, 100 mA	Output
5	Switch 5 V, 100 mA	Output
6	1-Wire	Input/Output
7	Ground	
8	P2.Rx	Input

Port D

Table 7: Sensor bulkhead signals on port D

Pin	Signal	Direction
1	Sensor RS-485A	Input/Output
2	Sensor RS-485B	Input/Output
3	SDI-12 Data	Input/Output
4	Battery	Input/Output
5	Switch 5 V, 100 mA	Output
6	Rain	Input
7	Ground	
8	DIO0	Input/Output

Port A

Table 8: Sensor bulkhead signals on port A

Pin	Signal	D
1	AD12	Input
2	AD13	Input
3	AD14	Input
4	Switch 12 V, 100 mA	Output
5	DA1	Output
6	AD15	Input
7	Ground	
8	Analog Ground	

Communications

Communication Port

The communication port on the SDL500C will always be plugged with an A49-SDL cellular antenna. This allows for cellular telemetry communication and remote data upload.

UW Plug to Flying Lead Cable

The underwater plug to flying lead cable is used for wiring the SDL500C data logger to external power devices. Depending on the port to which the cable is plugged on the sensor bulkhead, the signals will vary. However, wire color and corresponding pin information is provided in the table below.

Table 9: Pin and corresponding color for underwater flying lead cables

Pin	Color
8	Green
7	Blue
6	Brown
5	Red
4	White

WARNING

Observe caution when power is supplied to the data logger. All unused flying lead wires must be protected to prevent damage to nearby electronics.

3	Yellow
2	Black
1	Orange



Figure 11: Underwater plug end connector

UW Receptacle to Flying Lead Cable

The underwater receptacle to flying lead cable is used to pass sensor signals through cabling that has been outfitted with an underwater plug end for connection to an SDL500C. It allows a UW connectorized sensor cable to ultimately terminate in flying leads for manual wiring to external power or communication devices.

Essentially, when using this cable with a connectorized sensor cable, it allows the sensor to be connected interchangeably as desired between an SDL500C and another external device such as an iSIC data logger or host computer.

Maintenance

There is very little maintenance required for the SDL500C because it is designed for long term deployments in harsh and/or submersible applications.

Cleaning

Any bio-fouling that accumulates on the exterior of the SDL or antenna should be cleaned using a soft cloth or soft-bristled brush along with soap and water.

WARNING

Do not attempt to gain access to the central chamber which houses the internal workings of the SDL500R.

Storage

While the SDL500C can be stored in any environmental conditions that will not harm or deform the physical construction of the device, it is best to store the unit indoors for controlled temperatures and away from strong UV light.

Before storing the SDL for any length of time, the batteries must be removed. This will eliminate the risk of leakage into the instrument, which may result in damage.

Changing the Batteries

Periodically check SDL battery voltage with iChart software. Simply connect to the SDL500C using the *iSIC Setup* dialog to check the data logger's current status.

Whether internal or external power is being used, the voltage should not be allowed to drop below 9.5 VDC; cellular communication will no longer function at this voltage.

Troubleshooting

Follow the procedure below to isolate and resolve SDL500C communication problems.

Table 10: Common communication problems and resolutions

Symptom	Possible Cause	Corrective Action
Can not communicate with iChart	Low battery voltage	Check battery voltage and replace batteries as necessary. Voltage must not be less than 9.5 V for cellular modem to function.
	Bad physical connection	Make sure the antenna is completely plugged and threaded into the top port on the SDL500C.
	Low cellular strength	Move the SDL500C and antenna to a different location to maximize signal strength.
	Short on sensor cable	Disconnect battery and shorted sensor cable, wait five minutes and reconnect the battery

If the issue persists, visit www.NexSens.com to search the Knowledge Base for FAQs and troubleshooting guides; otherwise please contact NexSens technical support.

Material Safety Data Sheets

Material Safety Data Sheets can be found at:
<http://www.nexsens.com/support/msds.htm>

Warranty and Service

NexSens Technology, Inc. warrants products against defects in materials or workmanship for a period of 12 months from the date of delivery to the original customer. This warranty is limited to the replacement or repair of such defects, without charge, when the product is returned to NexSens Technology, Inc. Damage due to accidents, misuse, tampering, lack of reasonable care, loss of parts, failure to perform prescribed maintenance, or accidents of nature are not covered. This warranty excludes all other warranties, express or implied, and is limited to a value not exceeding the purchase price of the instrument.

WARNING

NexSens Technology, Inc. products are not authorized for use as critical components in any life support system where failure of the product may affect its safety or effectiveness.

Limitation of Warranty

This warranty is not applicable to any NexSens Technology, Inc. product damage or failure caused by (i) failure to install, operate or use the product in accordance with NexSens Technology, Inc. written instructions, (ii) abuse or misuse of the product, (iii) failure to maintain the product in accordance with NexSens Technology, Inc. written instructions, (iv) any improper repairs to the product, (v) use by you of defective or improper components or parts in servicing or repairing the product, or (vi) modification of the product in any way not expressly authorized by NexSens Technology, Inc.

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Revision: 01 **Revision Date:** December 1, 2010



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