SDL500R

Radio Data Logger

User Manual

NEXSENS technology

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 SDL500R (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

Figure 1: SDL500R Submersible data logger

The SDL500R 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 SDL500R is truly submersible. The housing and battery compartment are completely sealed and waterproof. The SDL500R 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 radio antenna is also waterproof.

The SDL500R 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.

What's Included

The SDL500R Submersible Data Logger includes the following accessories and spares to get started and keep the unit operational:

- (8) D-Cell alkaline batteries
- Maintenance kit
    - SDL Guard removal tool (3/16" handled Allen wrench)
    - (2) Spare SDL port plugs
    - O-ring lubricant, ½ oz tube
    - (5) Spare O-rings, EPDM 116
- Quick start guide

NOTE

A 4100-BASE radio base station and A44-SDL high gain radio antenna are both required for remote communication via spread spectrum radio with the SDL500R.

Figure 2: Everything included with purchase of an SDL500R data logger

Common Accessories

Table 1: Accessories commonly used with SDL500R data loggers

Part Number	Description	Details
A44-SDL	Radio antenna	Submersible radio antenna for use with SDL500R radio data loggers.
4100-BASE	Radio base station	Used for remote communication to radio data loggers in the field; serves as a central hub for networks of remote data loggers.
A44	Radio antenna	Radio frequency high gain antenna, for use with radio base stations.
A36	RF cable	N-style micro-loss RF cable, used for antenna connection to base station, 6' length.
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 SDL500R.

NOTE

Unique NexSens UW Underwater Connectors are used to interface with the SDL500R.

UW-FL	UW Plug connector to flying lead cable	Used for wiring the SDL500R 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 SDL500R.
MB-100	Data buoy	Lightweight and portable data buoy platform.

Specifications

Table 2: NexSens SDL500R 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 Radio Modem: 6 to 30 VDC
Data Logger Power Consumption	5 mA sleep 10 mA processing 36 mA analog measurement
Radio Modem Power Consumption	86 mA receive 500 mA transmit 21 mA idle <1 mA power off power management available
Radio Frequency Range	902-928 MHz
Radio Transfer Rate	115.2 Kbps standard
Radio Communication Range	1 mile line of sight, extended range with repeater systems
Radio Error Correction	32-bit cyclic redundancy check (CRC); auto retransmit

Getting Started

Powering the SDL500R

The SDL500R 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

WARNING

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

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.

Figure 3: Unthreading the SDL500R 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 SDL500R

Supplying External Power

When powering the SDL500R 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 SDL500R, a UW-FL underwater connector to flying lead cable must be used. Since the communication port on the radio data logger is occupied by a radio antenna, one of the SDL500R 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 SDL500R. Follow the wizard or the iChart manual to install the software.

A radio base station must be used to establish communication between an SDL500R and a computer. To set up the base station, simply install an A44 radio antenna to a 4100-BASE base station using an RF cable. Mount the antenna in a location to maximize signal strength.

NOTE

If the PC does not have an available serial DB-9 port, a USB to serial adapter can be used.

Next attach the supplied PC cable from the MS4 connector on the base station enclosure to the PC. Connect the 12 volt power adapter from the male power jack on the PC cable to an available wall outlet (see Figure 5).

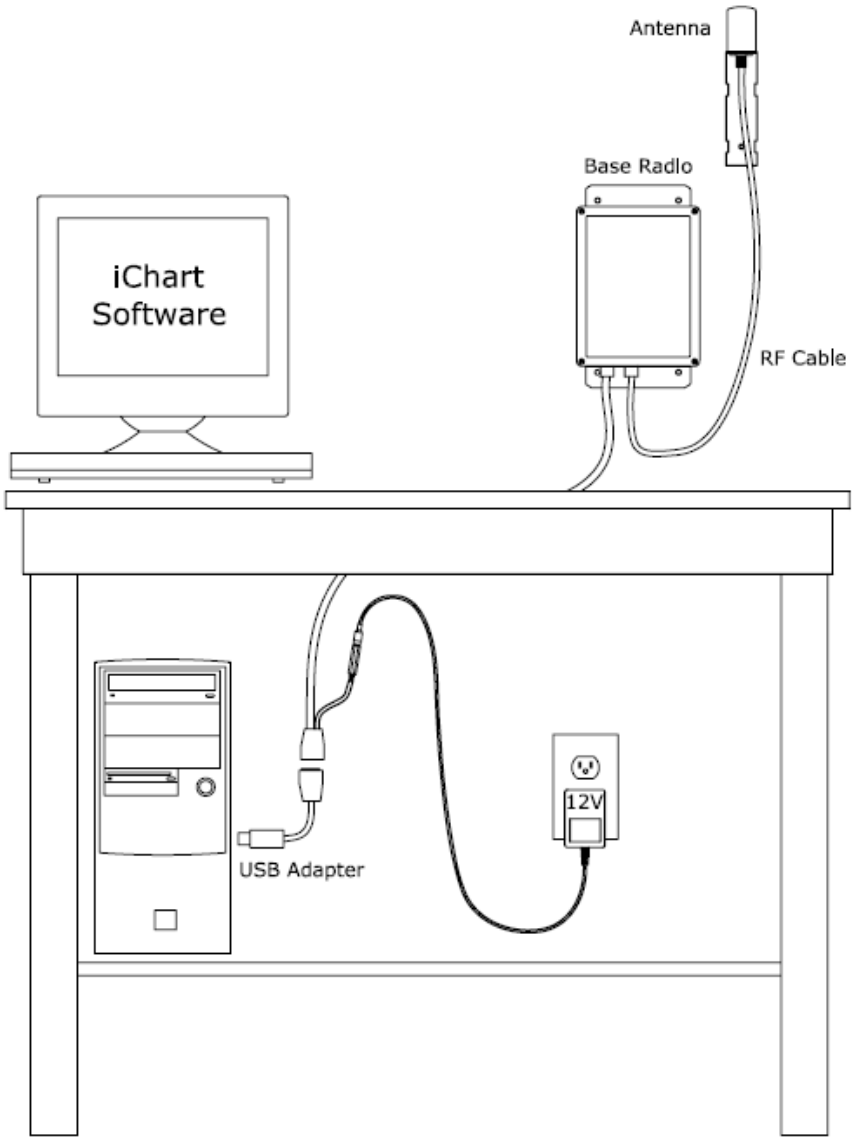

Figure 5: Typical base station setup for NexSens radio data logger networks.

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

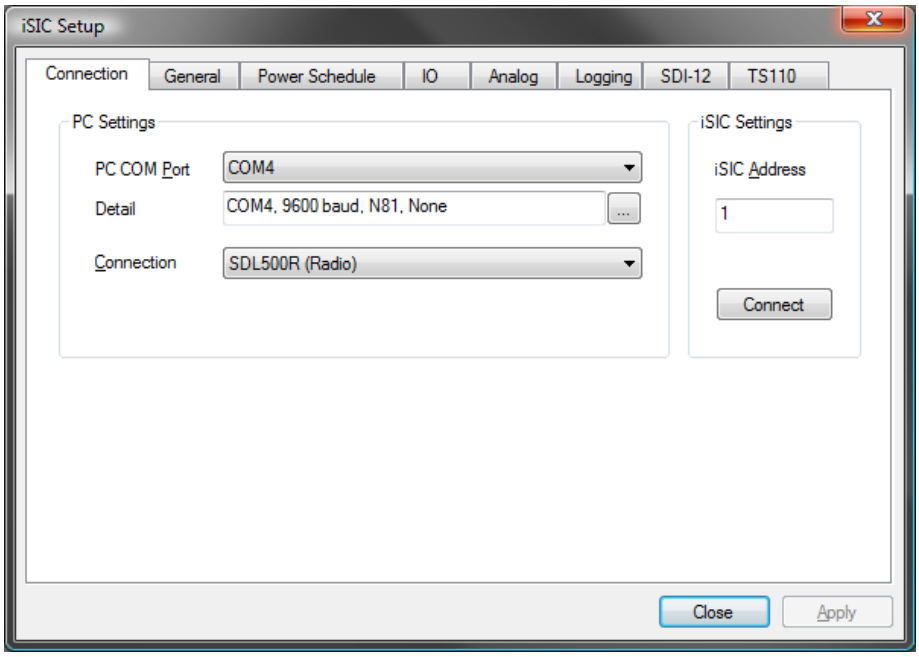

Figure 6: Select **Advanced | iSIC | iSIC** from the menu bar in iChart to connect to the SDL500R using the *iSIC Setup* dialog

NOTE

The default address for a single SDL500R is 1. Address 0 is used as a broadcast address and will attempt to connect to any data logger communicating with the radio base station.

Select the PC COM Port that the base station is connected to and specify the correct iSIC Address. Set the Connection type to **SDL500R (Radio)**. Click **Connect** and then switch to the **General** tab.

The SDL500R will send its current status (time, operating battery voltage, real-time clock battery voltage, firmware version, hardware version and ID) to iChart via the radio base station. If this information is displayed, communication has been established.

Proceed with connecting sensors.

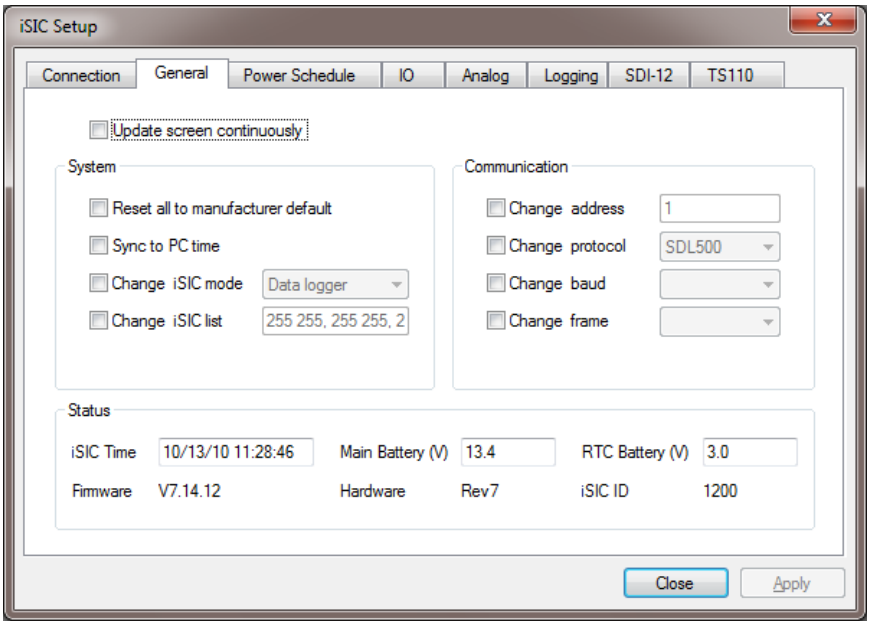

Figure 7: The General tab displays the data logger configuration as well as the status parameters (battery voltage, firmware version, etc.) determined during connection

Connecting Sensors

The SDL500R 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.

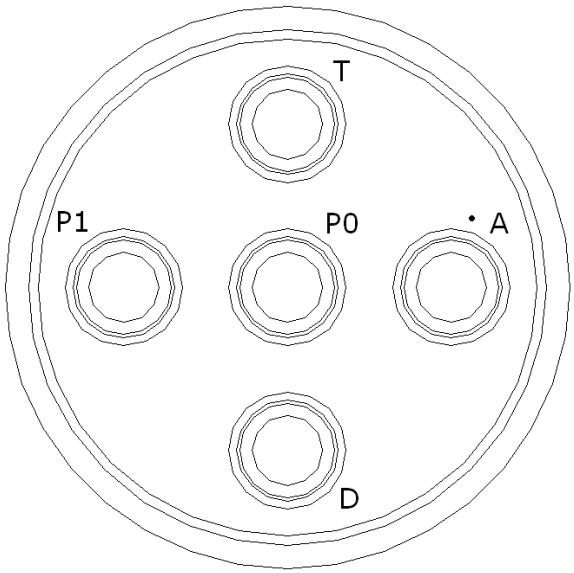

Figure 8: SDL500R sensor bulkhead with ports P0, P1, A, T, and D

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

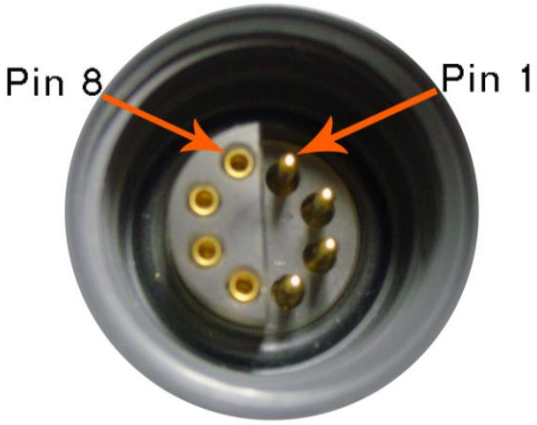

Figure 9: Typical bulkhead port

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 10: ConnectingT-Node to SDL500R sensor bulkhead

Recommended Port Connections

Table 3: Port recommendations for connecting common environmental sensors to SDL500R

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	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.

NOTE

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

With iChart running and the SDL500R 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.

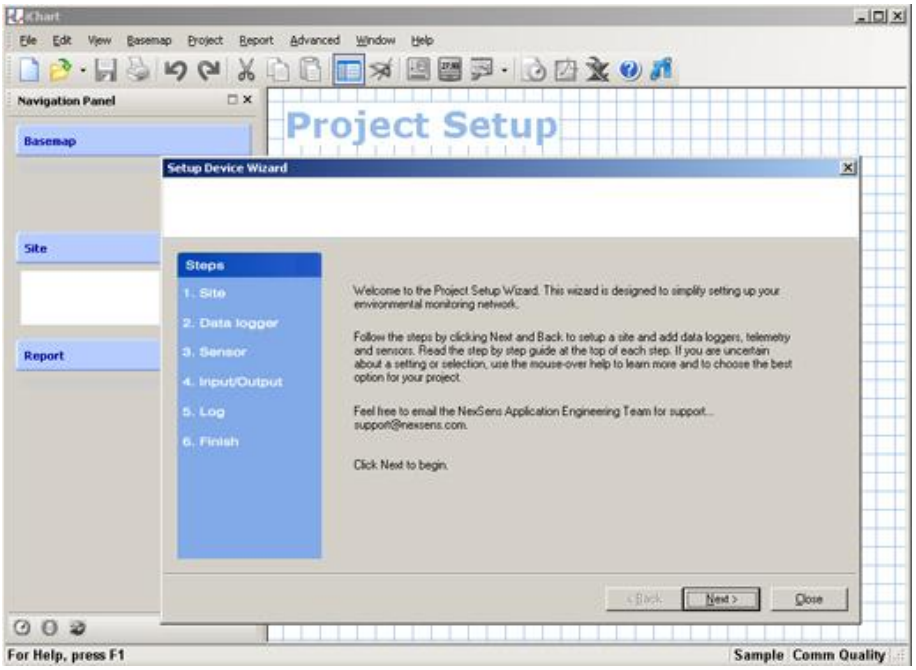

Figure 11: *Setup Device Wizard* dialogue used for setting up projects and programming of data loggers and sensors

Deploying the SDL

The versatility of the SDL500R offers many options for field deployments including:

WARNING

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

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

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 SDL500R will always be plugged with an A44-SDL cellular antenna. This allows for radio telemetry communication and remote data upload.

UW Plug to Flying Lead Cable

The underwater plug to flying lead cable is used for wiring the SDL500R 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

3	Yellow
2	Black
1	Orange

Figure 12: Underwater plug end connector

WARNING

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

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 SDL500R. 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 SDL500R and another external device such as an iSIC data logger or host computer.

Maintenance

There is very little maintenance required for the SDL500R 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.

Storage

While the SDL500R 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 remotely with iChart software. Simply connect to the SDL500R 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 7.5 VDC; spread spectrum radio communication will no longer function at this voltage.

Troubleshooting

Follow the procedure below to isolate and resolve SDL500R communication problems.

Table 10: Common communication problems and resolutions

Symptom	Possible Cause	Corrective Action
Can not communicate with iChart	Incorrect COM port or wrong port settings	Check the COM port the radio base station is connected to and verify the Detail field in the *iSIC Setup* dialog box reads "COM#, 9600 baud, N81, None".
	Low battery voltage	Check battery voltage and replace batteries as necessary in the data logger. Voltage must not be less than 7.5 V for radio to function.
	No power to base station	Confirm the green LED on the power adapter glowing green.
	Bad physical connection (SDL500R)	Make sure the antenna is completely plugged and threaded into the top port on the SDL500R.
	Bad physical connection (4100-BASE)	Make sure the connections from the base station to the antenna and to the PC are secure.
	No line of sight or out of range	Move the SDL500R antenna and/or base station antenna in an effort to achieve a line-of-sight between the two, making sure that they are no more than one mile apart.
	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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