SDL500

Submersible
Data Loggers

User Manual

SDL500R

SDL500C

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 SDL500 (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: SDL500 Submersible data logger

The SDL500 Submersible 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 SDL500 is truly submersible. The housing and battery compartment are completely sealed and waterproof. The SDL500 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. When fitted for wireless remote communication, the radio, cellular, and satellite antennas are also waterproof.

The SDL500 is powered by eight D-cell alkaline batteries. An optional 5-watt solar power kit provides 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

Each SDL500 submersible data logger includes the following accessories and spares to get started and keep the unit operational:

- SDL500 USB interface cable*
- USB driver CD*
- (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

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

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 SDL500 data logger

*Only included with direct connect SDL500, not with telemetry-enabled models

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

Common Accessories

Table 1: Accessories commonly used with SDL500 data loggers

Part Number	Description	Details
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 SDL500.
UW-FL	UW Plug connector to flying lead cable	Used for wiring the SDL500 to other data loggers or 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

NOTE

Unique NexSens UW Underwater Connectors are used to interface with the SDL500.

		SDL500.
MB-100	Data buoy	Lightweight and portable data buoy platform.
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.
A49-SDL	Celluar antenna	Submersible cellular antenna for use with SDL500C cellular data loggers.

Specifications

General

Table 2: NexSens SDL500 data logger general 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; 13.8 lbs with batteries
Battery	(8) internal D-Cell Alkaline batteries; optional 5-Watt solar power pack with 12 VDC power
Power Requirements	Voltage: 5 to 16 VDC
Power Consumption	5 mA sleep 10 mA processing 36 mA analog measurement

Cellular

Table 3: NexSens SDL500C data logger cellular specifications

Cellular Modem Power Requirements	Voltage: 9 to 28 VDC
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

Radio

Table 4: NexSens SDL500R data logger radio specifications

Radio Modem Power Requirements	Voltage: 6 to 30 VDC
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 SDL500

The SDL500 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 SDL500 battery lid from the communication bulkhead for battery installation

NOTE

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

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.

Figure 4: Installing batteries in the SDL500

Supplying External Power

When powering the SDL500 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 SDL500, a UW-FL underwater connector to flying lead cable must be used. See the Communication Port section of the manual for pin-specific signal information required to supply power externally.

Setting up Communication

iChart Software is used to communicate with the SDL500. Follow the wizard or the iChart manual to install the software. To set up communication, follow the appropriate telemetry specific steps outlined below to establish a connection between the data logger and computer.

Direct Connect

To establish a direct communication with a computer, first connect the data logger using the SDL500 USB interface cable.

NOTE

If USB drivers do not install automatically, insert the USB driver CD provided with the SDL500.

Figure 5: Connecting the SDL500 USB interface cable to a PC running iChart software

Cellular

To establish cellular 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), or with an external 12 VDC source.

Radio

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 below).

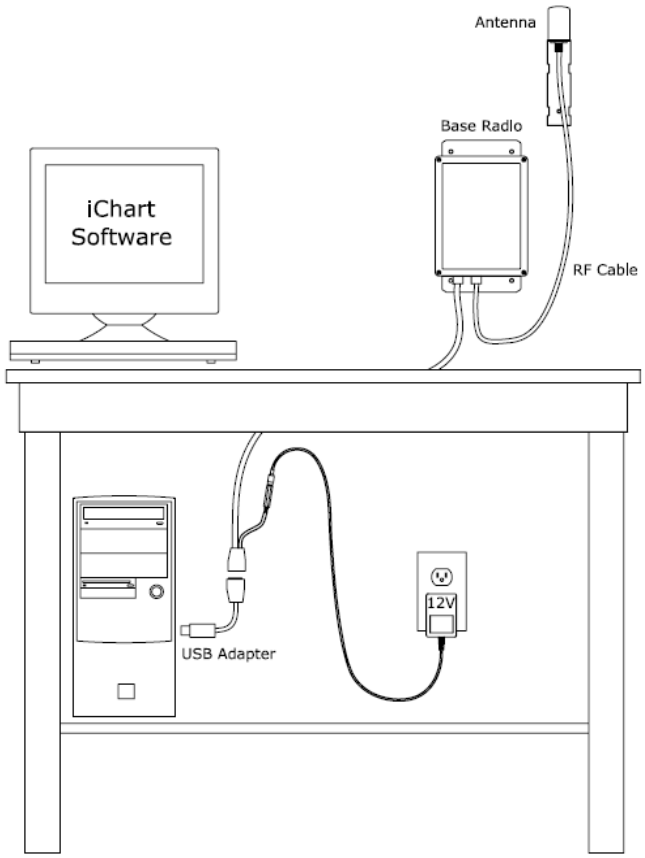

Figure 6: Typical base station setup for NexSens radio data logger networks.

Following the physical setup, open iChart and select **Advanced | iSIC | iSIC**. The *iSIC Setup* dialog box will be displayed.

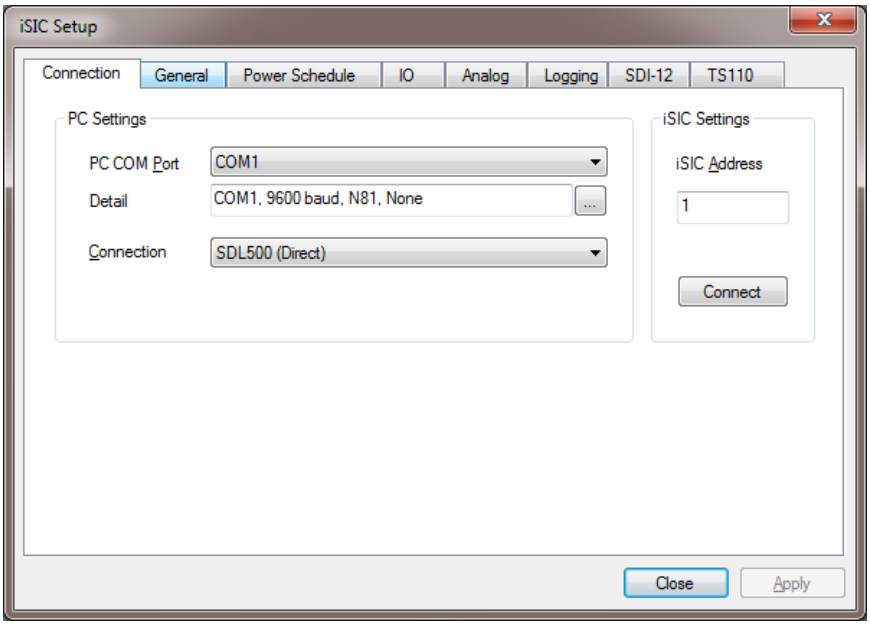

Figure 7: Select **Advanced | iSIC | iSIC** from the menu bar in iChart to connect to the SDL500 using the *iSIC Setup* dialog

NOTE

The default address for a single SDL500 is 1. Address 0 is used as a broadcast address and will attempt to connect to any data logger on the COM port.

Choose the communication (Connection, PC COM Port, and iSIC Address) settings that correspond to the to the data logger and communication method being used.

For direct connect data loggers, make sure the baud rate is 9,600, no parity, 8 data bits, and 1 stop bit.

For radio data loggers, make sure the PC COM Port that the base radio station is connected to is selected.

For cellular data loggers, enter the IP address of the cellular modem and make sure that the IP Port is set to 500 (see Figure below).

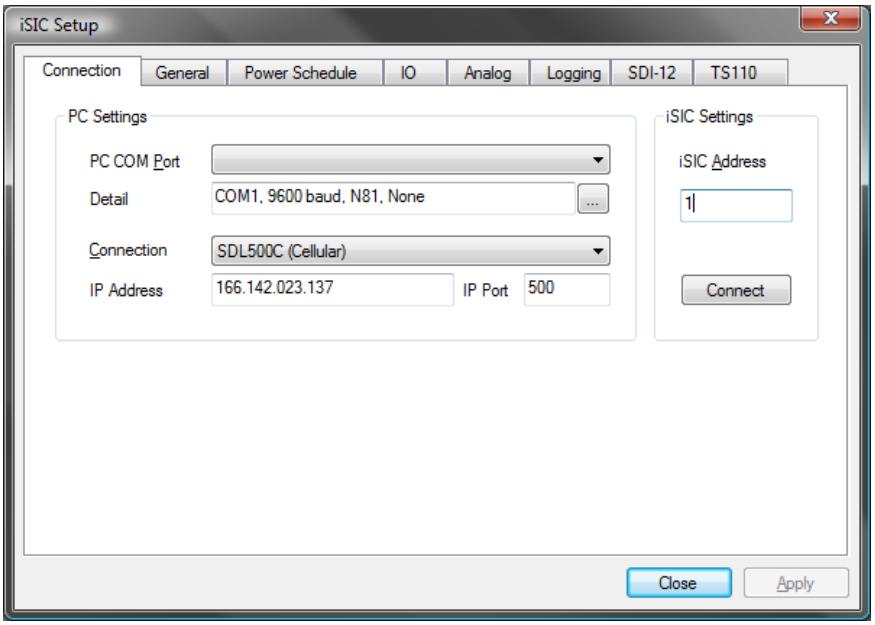

Figure 8: Select **Advanced | iSIC | iSIC** from the menu bar in iChart to connect to the SDL500C using the *iSIC Setup* dialog

The SDL500 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.

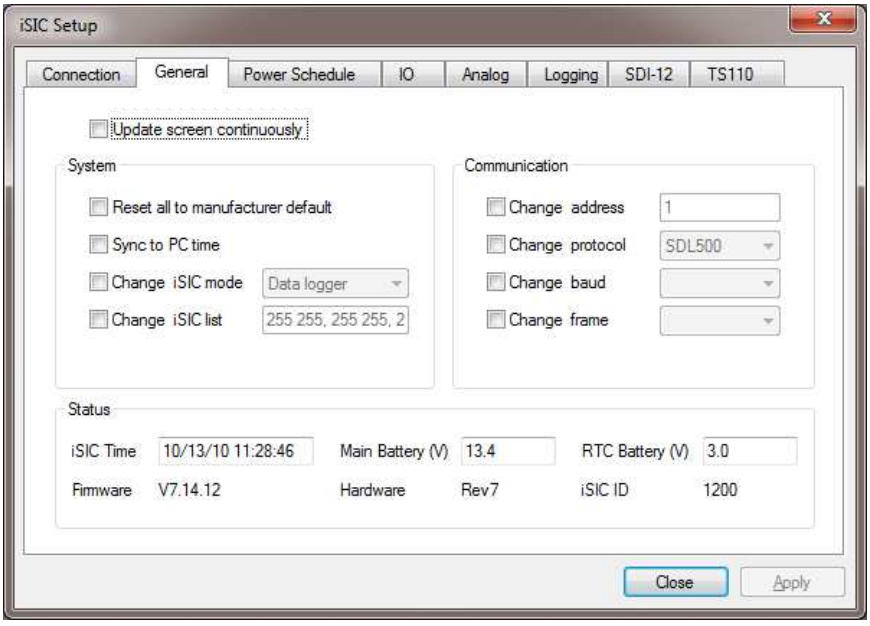

Figure 9: The General tab displays the data logger configuration as well as the status parameters (battery voltage, firmware version, etc.) determined during connection

Connecting Sensors

The SDL500 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 be connectorized user supplied sensor cables.

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

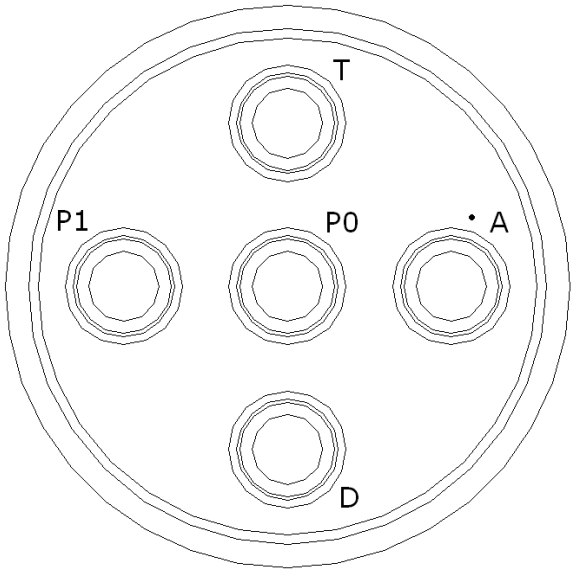

Figure 10: SDL500 sensor bulkhead with ports P0, P1, A, T, and D

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

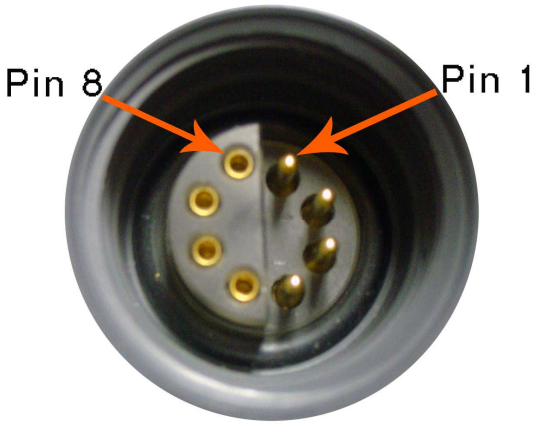

Figure 11: Typical bulkhead port

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 12: Connecting a T-Node temperature sensor to SDL500 sensor bulkhead

Recommended Port Connections

Table 5: Port recommendations for connecting common environmental sensors to SDL500

NOTE

Internal batteries are required for communication through iChart software when any sensor that requires more than 5 VDC is connected to the SDL500.

NOTE

If a desired sensor is not listed, refer to the appropriate sensor interface manual or contact NexSens technical support.

Manufacturer	Sensor	Port
Aanderaa	Oxygen Optode 4175	P0, P1
Benthos	PSA-916 Altimeter	P1
FTS	DTS-12	P1
Hydrolab	DS5, MS5 Sondes	P0
In-Situ	Aqua TROLL 100/200	P0
	RDO PRO Optical DO sensor	P0
ISCO	6700 Series samplers	D
	2150 Area Velocity Flow Module	P0
LI-COR	LI-190, LI-192, LI-193, LI-200	A
Lufft	WS Weather sensors	P0

NexSens	AccuStage level sensor	P0
	Long T-Node string	P0
	Short T-Node string (<14 sensors or <15 m length)	T
Nortek	Aquadopp current Profiler	P0
OTT	RLS Radar level sensor	P0
Ponsel	Ponsel Digital Sensors	P0, P1, T
RM Young	05103V, 05103V-45 Wind monitors	A
SonTek	Argonaut SW, SL, XR	P1
Tritech	Micron echo sounder DST	P1
Turner Designs	C3 submersible fluorometer	P1
	C6 multi-sensor platform	P1
	Cyclops-7 submersible fluorometer	A
	SCUFA submersible fluorometer	P0
Vaisala	WXT520 mutli-parameter weather sensor	P0
YSI	6-Series sondes	P0, P1

The above are meant to be recommendations only. In most cases there is more than one port that a sensor can connect to. If the recommended port is already in use, see the Sensor Connection Ports section of the manual to view the pin specific signal information for each port to determine another suitable location to connect and operate the sensor from.

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 a connection from the data logger to the PC established, 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.

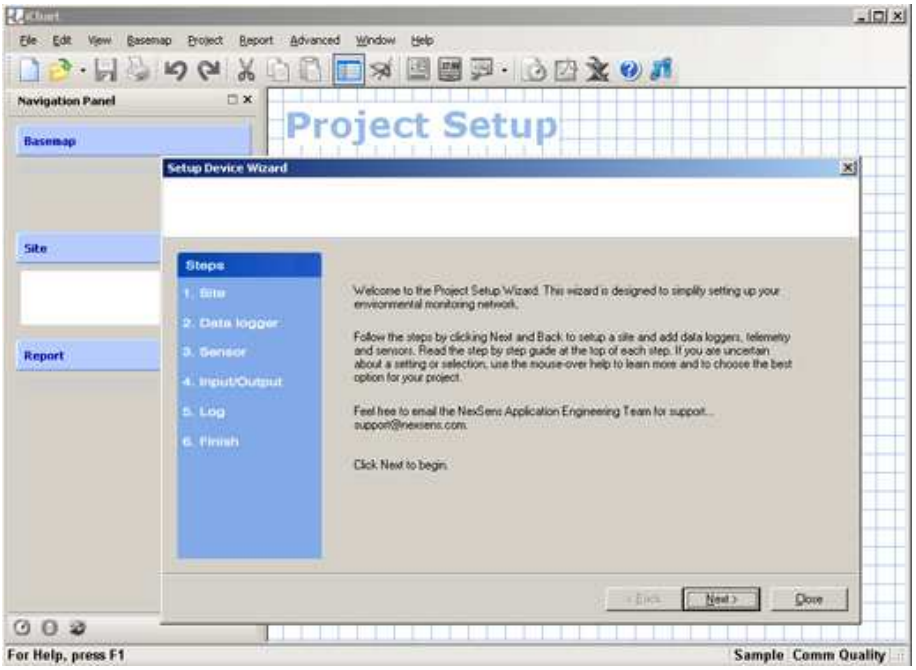

Figure 13: *Setup Device Wizard* dialogue used for setting up projects and programming of data loggers and sensors

Deploying the SDL

The versatility of the SDL500 offers many options for field deployments including:

WARNING

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

- Bottom deployed in lakes, streams and coastal waters
- 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.

Communication Port

The signals available in SDL500 communication ports are not always the same. The direct connect configuration (SDL500) provides different signals than the remote telemetry capable configurations (SDL500C, SDL500R).

Direct Connect Configurations

When configured for direct connection rather than remote telemetry, the SDL500 communication connector (top port) provides SDI-12, RS-485, and RS-232 signals. This allows the data logger to connect to external devices using an optional output. See Appendix A: Optional Outputs for additional details.

The port on the SDL communication bulkhead is a receptacle-type connection that accommodates underwater connectors. This means that the mating plug signals are mirrored to the receptacle. For example, pin 1 on the receptacle mates with pin 8 on the plug.

Figure 14: Underwater plug end connector

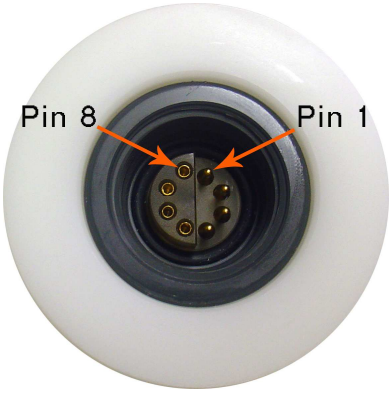

Figure 15: Communication bulkhead port

To access the signals available in the port, an underwater to flying lead cable must be used. Pin-specific signals for the port are shown in the table below.

Table 6: SDL500 top communications port signals; available only on the direct connect configuration of the SDL500

Pin	Signal	Direction
1	Host RS-485A	Input/Output
2	Host RS-485B	Input/Output
3	SDI-12 Data	SDI-12 sensor or master. Firmware configurable.
4	Battery	Connect to external battery or supply power to external sensor.
5	Host RS-232 Tx	Output
6	Power In	Input
7	Ground	Signal and Power reference
8	Host RS-232 Rx	Input

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.

Power can be supplied to the SDL through either pin 5 or pin 3 when no internal alkaline batteries are installed. With the presence of the SDL internal alkaline batteries, external power must be connected to pin 3 to avoid draining the internal batteries.

When a UW to flying lead cable is used to access the signals present in the communications port on a direct connect SDL500, the following color code can be referenced directly for external wiring purposes.

Table 7: Underwater flying lead cable signals corresponding to SDL500 communications port signals

Pin	Color	Signal	Direction
8	Green	Host RS-485A	Input/Output
7	Blue	Host RS-485B	Input/Output
6	Brown	SDI-12 Data	SDI-12 sensor or master. Firmware configurable.
5	Red	Power Out	Fused Power output
4	White	Host RS-232 Tx	Output
3	Yellow	Power In	Connect to external power source.
2	Black	Ground	Signal and Power reference
1	Orange	Host RS-232 Rx	Input

Remote Telemetry Configurations

The communication port on a remote telemetry capable SDL500 must always be plugged with an antenna (based on the communication method). This allows for remote telemetry communication and data upload.

Sensor Connection Ports

All five ports on the SDL sensor bulkhead are receptacle-type connections similar to the top communication port.

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

Port P0

Table 8: 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 9: 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 10: 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 11: 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 12: 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	

Note that an underwater plug to flying lead cable can be used on sensor connection ports to wire an SDL500 to external power devices. This is typically done on remote telemetry models, as they do not have access to external power connections via the top communication port.

In such cases, depending on the port that the cable is plugged in to on the sensor bulkhead, the signals will vary. However, wire color and corresponding pin information is provided in the table below.

Table 13: 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

WARNING

Do not attempt to gain access to the central chamber which houses the internal workings of the SDL500.

Maintenance

There is very little maintenance required for the SDL500 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 should be cleaned using a soft cloth or soft-bristled brush along with soap and water.

Storage

While the SDL500 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

Following deployment, periodically visit the SDL to check battery voltage. That cellular communication does not function below 9.5 VDC, and spread spectrum radio communication does not function below 7.5 VDC.

However, if the remote telemetry capabilities cease to work based on voltage requirements, the data logger can still continue to log data provided that the voltage does not drop below 6 VDC or the smallest sensor input power requirement, whichever is higher.

Troubleshooting

Follow the procedure below to isolate and resolve SDL500 communication problems.

Direct Connect

Table 14: Common communication problems and resolutions for the SDL500 direct connect data logger

Symptom	Possible Cause	Corrective Action
Cannot communicate with iChart	Incorrect COM port or wrong port settings	Check the COM port the data logger is connected to and verify the Detail field in the *iSIC Setup* dialog box reads "COM#, 9600 baud, N81, None".
	Bad physical connection	Make sure the USB interface cable is completely plugged and threaded into the top port on the SDL500.
	USB drivers not strong enough	Install internal D-cell batteries into SDL500 and try connecting again
	Short on sensor cable	Disconnect battery and shorted sensor cable, wait five minutes and reconnect the battery

Cellular

Table 15: Common communication problems and resolutions for the SDL500C cellular data logger

Symptom	Possible Cause	Corrective Action
Cannot 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

Radio

Table 16: Common communication problems and resolutions for the SDL500R radio data logger

Symptom	Possible Cause	Corrective Action
Cannot 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	Move the SDL500R antenna

	out of range	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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Appendix A: Optional Outputs

NOTE

It is required that the sensor(s) to be used with SDL500 data loggers configured for SDI-12 or Modbus outputs be sent to the factory for the initial setup, testing, and programming of the device.

When set up as a direct connect data logger, The SDL500 submersible data logger can be preconfigured to output environmental data to SDI-12 or Modbus devices. SDI-12 output is typically used for connection to other data loggers, while Modbus output is mainly used for integration into Supervisory Control and Data Acquisition (SCADA) systems.

The SDL500 is used as a dedicated pass through device and can not log data when configured with an optional output. When purchased in this way iChart software is not required for use with the product and the SDL500 USB interface cable does not need to be used during the initial system setup. A UW plug to flying lead cable is the only required accessory, used for wiring the appropriate signals from the SDL500 communication port into a master device.

NexSens will summarize for the end user the required technical data, whether it is an SDI-12 parameters list, or Modbus communication settings and measurement parameter data addresses (i.e. input registers). This is done on an individual basis to facilitate quick and easy setup and deployment. Custom documentation is developed on a case-by-case basis and hard copies of all documents are typically included in the order shipment.

To connect additional sensors following the initial factory configuration, user programming with iChart software will be required. Contact NexSens technical support for additional information.

SDI-12

SDI-12 (Serial Data Interface at 1200 Baud) is a communications protocol developed for instruments that typically monitor environmental data. When configured for SDI-12 output, an SDL500 data logger is set to run as the slave device in a master-slave configuration. This is beneficial when environmental sensors using communication methods not supported by the master device (data logger) must be integrated into a preexisting network.

With this setup the SDL500 acts solely as an SDI-12 sensor. It does not log data, but rather reports the data that it collects to another data logger. The data is output in a predefined SDI-12 parameter list, which the master device is programmed to interpret.

NexSens Technology provides custom SDI-12 parameter lists based on the sensors connected to the SDL500 and end user specifications.

Modbus RTU

Modbus facilitates the sharing of process data, and is commonly used to integrate NexSens data loggers into SCADA systems where they act as sensor controllers.

Modbus remote terminal unit (RTU) protocol is based on serial communication like RS-232 or RS-485 and is the most common implementation of Modbus. When used as an output for NexSens data loggers, the data logger acts as a remote terminal unit that can be connected to a supervisory computer in a SCADA system.

NexSens Technology matches Modbus RTU settings like baud rate, frame, address, command, timeout, and data type to those used in the existing SCADA network. The followings Modbus RTU settings are supported by the NexSens data logger:

- **Serial communication protocol:** RS-232, RS-485
- **Baud rate:** 19,200 or 9,600 at even or no parity, 8 data bits, and 1 stop bit
- **Modbus address:** 1-247
- **Command:** function codes 0x04 (read input registers) and 0x03 (read holding registers)
- **Timeout:** user defined, no restrictions
- **Data type:** 4-byte (32-bit) IEEE float (Big-endian or Little-endian), or 2-byte (16-bit) integer

Big-endian data is represented with the most significant word on the low input register. Little-endian data is represented with the least significant word on the low input register.

For additional information, see the "NexSens Modbus Communications" technical note available on the NexSens Knowledge Base.

Appendix B: UW Receptacle to FL 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 SDL500. 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 SDL500 and another external device such as an iSIC data logger or host computer.

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