

NexSens SDI-12 Communications

This guide will help you interface with NexSens data loggers configured for SDI-12 output.

Overview

SDI-12 stands for serial/digital interface at 1,200 baud. It is a standard for interfacing data loggers with microprocessor-based sensors designed for environmental data acquisition. All SDI-12 devices use the same electrical interface and communications protocol, and conform to the same timing requirement standards.

SDI-12 output is commonly used to connect NexSens data loggers to data loggers from other manufacturers. This is beneficial when environmental sensors using communication methods not supported by the master device (data logger) must be integrated into a preexisting network, especially when continued use of a particular software interface is preferable. This capability is also convenient anytime multiple sensors with different outputs must be added into an existing environmental monitoring system.

NexSens data loggers function as dedicated pass through devices for the sensors connected to them when set up as SDI-12 sensors (slaves). As a result, internal data logging capabilities are forfeited. Effectively, environmental data from various sensors is collected and converted into a single SDI-12 parameter list.

NexSens iChart software is not required for use with "SDI-12 sensor" data loggers, provided that the sensor(s) to be used with the data logger(s) are present at the factory for the initial setup, testing, and programming of the data logger. This can be accomplished one of two ways:

1. Sensors can be ordered with NexSens systems
2. User supplied sensors can be sent in to the factory for preconfiguration

Customizing Your SDI-12 Sensor

Communication between the customer and NexSens Applications Engineers is critical when a data logger is to be configured (and therefore customized) for SDI-12 output. As an end-user, please note the following recommendation to simplify the process of setting up a NexSens SDI-12 sensor:

- Specify the individual parameters to be logged and the corresponding units of measurement for the data. This will help to minimize the time required for post processing.

NexSens will summarize for the end user custom SDI-12 parameter lists on an individual basis. This facilitates 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.

If no direction is given by the customer as to the parameter listing or units of measurement, parameters will be chosen and displayed using industry standard units (typically metric) based on the experience of the NexSens engineering team.

Additionally, if all sensors to be used with the data logger are not sent to the factory for the initial setup, user programming with iChart software will be required. Contact NexSens technical support for additional information on configuring an "SDI-12 sensor" data logger.

Factory Default SDI-12 Settings

SDI-12 protocol is based on serial communication at 1,200 baud. When used as an output for NexSens data loggers, the data logger acts as an SDI-12 slave device that can be connected to any SDI-12 master device (data logger).

NexSens data loggers configured as SDI-12 slave devices have the following factory default settings:

- **SDI-12 address:** 0
- **SDI-12 compliance:** version 1.3

SDI-12 Command Modifications

NexSens SDI-12 communication is modified slightly from the current version (1.3) of SDI-12 communications protocol. See www.sdi-12.org for additional information on standard SDI-12 commands and responses.

The modifications to the standard deal with the SDI-12 measurement and concurrent



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measurement commands. These modifications are detailed in the following sections.

Measurement Modification

Typically, the response of a sensor from the measurement command is of the form "attn", where:

- a SDI-12 sensor address
- ttn required time in seconds to complete the measurement(s)
- n number of measurement values the sensor will make and return

As defined by SDI-12 v1.3, n must be an integer value between 1 and 9.

However for NexSens data loggers, n can return an ASCII character that signifies a value larger than 9. This capability exists because SDI-12 controllers are typically set up with sensors that output more than 9 parameters (e.g. temperature strings, multi-parameter sondes, etc.)

In cases where n corresponds to a value greater than 9, the number of parameters measured is computed from the following equation:

$$n = \langle \# \text{ parameters} \rangle + \langle \text{decimal value of ASCII } 0 \rangle$$

or

$$\langle \# \text{ parameters} \rangle = n - \langle \text{decimal value of ASCII } 0 \rangle$$

For example, if 20 parameters are being measured, the n value displayed would be "D." Consulting the [ASCII Table](#) shows a decimal value of 68 for ASCII D. Therefore the number of parameters being measured is given by:

$$\# \text{ parameters} = D - 0 = 68 - 48 = 20$$

Note: There is one caveat to this command modification. If your data logger will not accept a result greater than 9 being returned after ASCII subtraction, you must follow the standard protocol to send measurement commands and their corresponding data commands as required (e.g. aM0!, aM1!, aM2!, ..., aMn!). This is typically the case with older data loggers.

Concurrent Measurement Modification

Typically, the response of a sensor from the measurement command is of the form "attnn", where:

- a SDI-12 sensor address
- ttn required time in seconds to complete the measurement(s)
- nn number of measurement values that will be returned from a Send Data command

As defined by SDI-12 v1.3, the maximum number of data values a sensor can return is nn=20.

However for NexSens data loggers the maximum number of data values a sensor can return is nn=99.

Extended Commands

NexSens data loggers have specific setup commands that tell a data logger in SDI-12 mode to do certain tasks. These extended SDI-12 commands are defined in the table below:

Table 1: NexSens extended SDI-12 command set compatible with iSIC and SDL data loggers

Extended SDI-12 Command Set		
Name	Command	Response
Set Communication Mode	XMODE	Changes the data logger from SDI-12 sensor mode to data logger mode
Soft Reset	XRESET	Cycles power to the data logger
Display Number of Parameters	XNUMPARM	Returns the number of parameters; Should be the same number returned by the measurement command
Display Measurement Time	XMEASTIME	Returns the number of seconds it takes to complete a measurement
Set Measurement Time	XMEASTIME=x	Sets the number of seconds it takes to complete a measurement
Display Automatic System Check Interval	XAUTORESET	Returns the number of hours that the data logger runs self diagnostic and system



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		check
Set Automatic System Check Interval	XAUTORESET=x	Sets the number of hours that the data logger runs self diagnostic and system check.
Display Internal Clock Time	XTIME	Returns internal clock time (y/m/d h:m:s)
Set Internal Clock Time	XTIME=y/m/d h:m:s	Sets internal clock time (y/m/d h:m:s)
Reset Rain Counter	XRESETRAIN	Resets the rain counter to 0
Display Switch Power Operation Default Setting	XDEFSW12VA	Returns "x y" if "1 0" is returned then switch power is off (but still active) by default if "0 1" is returned then switch power is on by default
Set Switch Power Operation Default Setting	XDEFSW12VA=x y	Sets switch power to on or off by default x=1 corresponds to off y=1 corresponds to on
Set Switch Power Operation	XSETSW12VA=x	Turns switch power on or off x=1 to turn on x=0 to turn off

Note: Extended commands must be prefixed with a sensor address.

Connecting Additional Sensors

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



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