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SDI-12 Technical Training

ALERT Users Group: Flood Warning Systems
Training Symposium & Preparedness Workshops

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Background

What is SDI-12?

Serial Data Interface at 1200 baud

A standard communications protocol which provides a means to transfer measurements taken by an intelligent sensor to a data recorder.



SDI-12 Advantages

- Great for long cable lengths
- Complexity related to measurement circuitry, calibration, processing, etc. contained in sensor
- Multiple values per sensor
- Multiple sensors per recorder input / bus
- Knowledge highly transferable to all sensors



Resources

- ▶ SDI-12 Specification Document
... is a quick read, easy to understand
<http://www.sdi-12.org/specification.php>
- ▶ Your SDI Recorder Manual
- ▶ Your SDI Sensor Manual



SDI-12 Bus

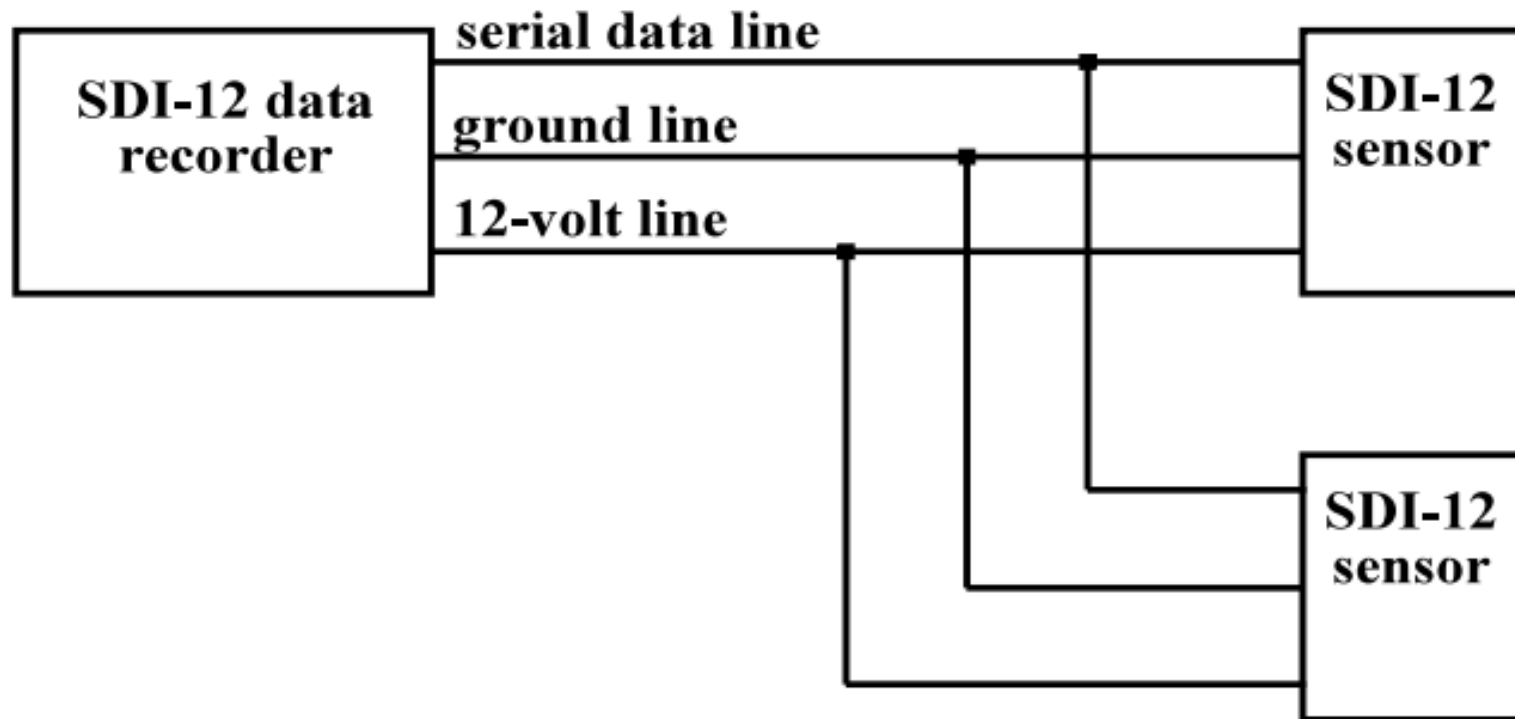
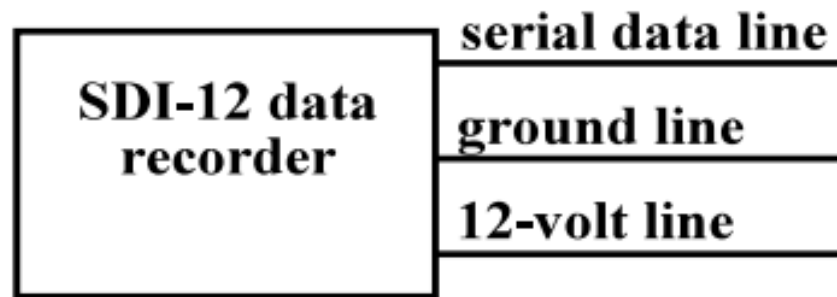


Image from "SDI-12 A Serial-Digital Interface Standard for Microprocessor-Based Sensors, Version 1.3"



SDI-12 Recorder

- Responsible for interrogating one or more SDI-12 sensor
- Only one recorder per bus
- Three wire connection to sensor bus



SDI-12 Sensor

- › Digitizes measurement
- › Responds to commands from recorder
- › Multiple sensors can be connected to a single SDI-12 input, generally 10 or less, depends on bus impedance
- › Each sensor has unique address on bus
0-9, A-Z, a-z





Installation

Get to Know ... (your devices)

- ▶ Commands supported by your sensor and how it responds
- ▶ How to access and use the “transparent mode” of your recorder
- ▶ A method to watch / snoop communication between your recorder and sensor



Installation

- Test the sensor in the office first 😊
- If wiring it up yourself ...
 - Use shielded cable, especially for long cables, to minimize noise and aide in surge protection
 - If using twisted pair cable, the data and ground wires should be together on pair
 - Check supply voltage drop over long runs
- On long runs, make sure sensor and recorder mfg have implemented proper surge protection; add external / additional protection between recorder and sensor if needed



Common Commands

- ?! – address query
- a! – send identification
- aAb! – change address
- aM! – start measurement
- aC! – start concurrent measurement
- aDn! – send data
- aRx! – send continuous measurement data
- aXnnn! – vendor/sensor specific extended command



Address Query

- ?! -

Useful when only one sensor is currently attached to the recorder and you are unsure of what its address is

- ▶ ?! – Recorder uses wildcard address (?) to solicit an acknowledgement from whatever sensor is attached
- ▶ a<crLf> – Sensor responds with its address



?! Example

A sensor with address 5 is attached the recorder

Recorder

?!

Sensor

5<*crlf*>



Change Address

- aAb! -

- aAb! – Recorder commands sensor “a” to change its current address to “b”
- b<*crlf*> – Sensor sends an acknowledgement using its new address



aAb! Example

A new sensor with a default address of 0 is being added to an existing SDI-12 data bus, we need to make sure to give it a unique address – the new address will be 5.

Recorder	0A5!
Sensor	5< <i>crlf</i> >



Measurement Command

- aM! -

Commonly seen with sensors like pressure transducers, ultrasonics, and radar level

- ▶ aM! – Recorder commands sensor to start measurement
- ▶ atttn<crLf> – Sensor responds with time until data is ready and how many values will be returned
- ▶ a<crLf> – Sensor sends service request when measurement is complete
- ▶ aD0! – Recorder issues one or more send data commands
- ▶ a[data]<crLf> – Sensor responds with data values



aM! Example 1

Sensor with address 0, within 002 seconds,
returning 1 value

Recorder	0M!
Sensor	00021 <crLf>
<i>[up to 2 secs pass]</i>	
Sensor	0 <crLf>
Recorder	0D0!
Sensor	0+1.11 <crLf>



aM! Example 2

Sensor with address 0, within 030 seconds, returning 9 values

Recorder 0M!

Sensor 00309<crLf>

[up to 30 secs pass]

Sensor 0<crLf>

Recorder 0D0!

Sensor 0+1.1+2.2+3.3+4.4+5.5<crLf>

Recorder 0D1!

Sensor 0+6.6+7.7+8.8+9.9<crLf>



Send Continuous Measurement

- aRn! -

Commonly seen with shaft encoders and all-in-one weather heads

- aRn! – Recorder requests data
- a[data]<*crlf*> – Sensor responds with data



aRn! Example

Sensor with address 0 immediately responds with 2 measurements when queried using 3rd variation of R command

Recorder 0R3!

Sensor 0+1.11+2<*crlf*>



Extended Commands

- aXnnn! -

Extended commands allow vendors to implement product specific features like changing calibrations, querying data that does not fit the send data mold, etc. Though not a requirement, they often start with “X” followed by a series of characters.

Example:

Recorder 0XCONFIG1=1,3,1,0!

Sensor 0<crLf>





Troubleshooting

Troubleshooting ... It has never worked

- Inspect for proper wiring
- Use “?!” address query command to ensure you are using the proper sensor address
- Issue measurement and send data commands and inspect responses, if any
- If using multiple sensors, disconnect one at a time and see if issue disappears
- Check supply voltage at sensor
- Ask if recorder and sensor vendors if devices pass SDI-12 Verifier tests, ideally assuring compliance



Troubleshooting ... It was working before

- ▶ Check connections and cable, excessive corrosion or water intrusion could be affecting communications
- ▶ Snoop traffic and inspect commands and response for errors and retries
- ▶ Check voltage at sensor or changes in cable resistance
- ▶ Query sensor with another recorder, query another sensor with existing recorder





Additional Applications

Snooping With PC

You can use your PC serial port to listen in on the SDI-12 traffic. Connect the data and ground lines to your PC. Open a terminal using a configuration of 7 data bits, even parity, 1 stop bit (7-E-1).

SDI-12 Line	PC 9 Pin Serial	Note
Data	Pin 2	Rx data transmitted over SDI-12 data line into PC terminal.
Ground	Pin 5	Share ground with sensor power supply
Power	N/C	



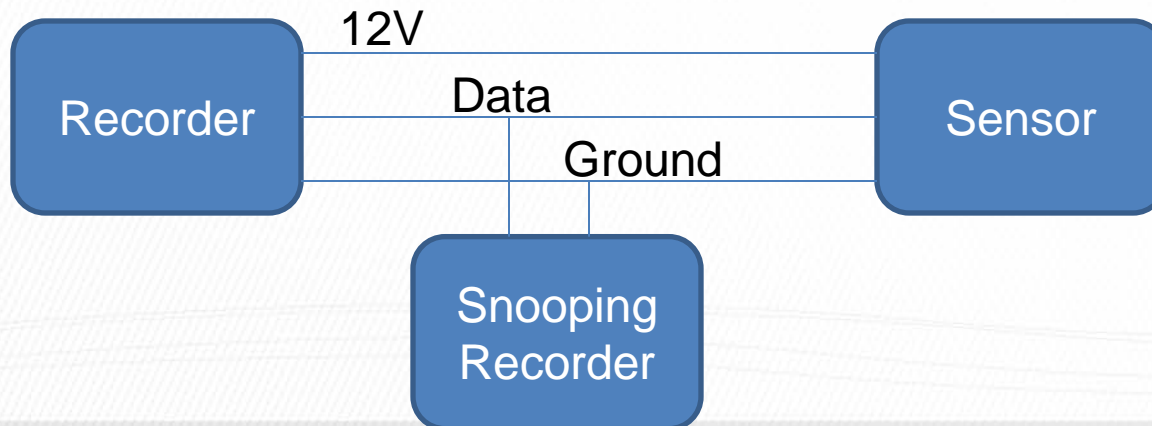
Snooping With PC, cont'd

A DB9 to terminal block or USB to terminal block makes life easier.



One Sensor, Two loggers

There should only ever be one SDI-12 recorder on a bus which makes it hard(er) to connect one sensor to multiple dataloggers. You can snoop the traffic and pick out the data you want either directly or by using a specialized converter.



Sharing Information

SDI-12 can also be used to share information between loggers and transmitters as many on the market can act as both SDI-12 recorders and sensors.





Questions?