

# SDI-12 Converter

## SDI-12 Serial Interface

The serial interface of the SDI-12 Converter is configured for SDI-12 operation using the following settings:

- baud rate: 1200 bps
- start bits: 1
- data bits: 7
- stop bits: 1
- parity bits: 1, even parity

## High Volume Binary Data Types

Data Type	Range	Size
0	Indicates an invalid request	No data returned
1	-128 to 127	signed 8 bit integer
2	0 to 255	unsigned 8 bit integer
3	-32768 to 32767	signed 16 bit integer
4	0 to 65535	unsigned 16 bit integer
5	-2147483648 to 2147483647	signed 32 bit integer
6	0 to 4294967295	unsigned 32 bit integer
7	-9223372036854775808 to 9223372036854775807	signed 64 bit integer
8	0 to 18446744073709551615	unsigned 64 bit integer
9	$\pm 1.18 \times 10^{-38}$ to $\pm 3.4 \times 10^{38}$	IEEE 754 32 bit floating point value.
10	$\pm 2.23 \times 10^{-308}$ to $\pm 2.80 \times 10^{308}$	IEEE 754 64 bit floating point value.

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### Default SDI-12 address

At delivery, the SDI-12 Converter default address is set to 0. If required, the address can be changed with the rotary switch. For more details please see the SDI-12 Converter product video.

### SDI-12 Interface Standard

For more information regarding the SDI-12 protocol standard, please refer to this document: "SDI-12 - A Serial-Digital Interface Standard for Microprocessor-based sensors; Version 1.4; January 10, 2019".

This document is based on and quotes from the interface document mentioned above. The SDI-12 Specification is in the public domain.

### Sensor Side: Modbus RTU Serial Interface

The SDI-12 Converter sensor side serial interface (Modbus RTU) is using the following settings:

- baud rate: 9600 bps
- data bits: 8
- stop bits: 1
- parity bits: none

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## SDI-12 Basic Commands

These SDI-12 basic commands are supported by the SDI-12 Converter:

Name	Command	Response
<b>Description</b>		
<b>Acknowledge Active</b>	a!	a<CR><LF>
<p>This command is used to ensure that a sensor is responding to a data recorder or another SDI-12 device.</p> <p>a - the SDI-12 Converter address</p>		
<b>Send Identification</b>	al!	allccccccmmmmmvvxxx...xx<CR><LF>
<p>This command is used to query sensors for their SDI-12 compatibility level, model number, and firmware version number.</p> <p>a - the SDI-12 Converter address            ll - the SDI-12 version number; for example, version 1.4 is encoded as 14            ccccccc - an 8 character manufacturer identification (company name)            mmmmm - 6 characters specifying the SDI-12 Converter model number            vv - 3 characters specifying the SDI-12 Converter version            xxx . . . xx – connected sensor type and serial number</p>		
<b>Address Query</b>	?!	a<CR><LF>
<p>The SDI-12 Converter will respond as if it is being addressed on the SDI-12 bus.</p> <p>? – address wildcard</p>		
<b>Start Measurement</b>	aM!	attn<CR><LF>
<p>This command tells the sensor to take a measurement.</p> <p>a - the SDI-12 Converter address            ttt - the specified time, in seconds, until the sensor will have the measurement(s) ready            n - the number of measurement values the sensor will make and return in one or more subsequent D commands; n is a single digit integer with a valid range of 1 to 9</p>		
<b>Start Wiper Cleaning Cycle</b>	aM9!	attn<CR><LF>
<p>This command will trigger a cleaning cycle.</p> <p>a - the SDI-12 Converter address            ttt - the specified time, in seconds, it will take the wiper to complete a cleaning cycle.            n - the number of measurement values the sensor will make and return in one or more subsequent D commands; n is a single digit integer with a valid range of 1 to 9</p> <p><b>Attention:</b> The SDI-12 converter will not send a service request when the wiper has completed the cleaning cycle.</p>		

<b>Start Measurement and request CRC</b>	aMC!	atttn<CR><LF>
<p>This command tells the sensor to take a measurement and request CRC.</p> <p>For details, refer to “aM!” command.</p>		
<b>Start Wiper Cleaning Cycle and request CRC</b>	aMC9!	atttn<CR><LF>
<p>This command will trigger a cleaning cycle and request CRC.</p> <p>For details, refer to “aM9!” command.</p>		
<b>Start Concurrent Measurement</b>	aC!	atttnn<CR><LF>
<p>This command tells the SDI-12 Converter to take a concurrent measurement. A concurrent measurement is one which occurs while other SDI-12 sensors on the bus are also taking measurements.</p> <p>a - the SDI-12 Converter address            ttt - the specified time, in seconds, until the sensor will have the measurement(s) ready            nn - the number of measurement values the sensor will make and return in response to one or more subsequent D commands</p>		
<b>Start Concurrent Wiper Cleaning Cycle</b>	aC9!	atttnn<CR><LF>
<p>This command will trigger a cleaning cycle. The behaviour is the same as that of a Concurrent Measurement.</p> <p>For details, refer to “aC!” command.</p>		
<b>Start Concurrent Measurement and request CRC</b>	aCC!	atttnn<CR><LF>
<p>This command tells the SDI-12 Converter to take a concurrent measurement and request CRC.</p> <p>For details, refer to “aC!” command.</p>		
<b>Start Concurrent Wiper Cleaning Cycle and request CRC</b>	aCC9!	atttnn<CR><LF>
<p>This command will trigger a cleaning cycle and request CRC. The behaviour is the same as that of a Concurrent Measurement with CRC request.</p> <p>For details, refer to “aC!” command.</p>		

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<b>Send Data Command</b>	aD0! .. aD9!	a<values><CR><LF> or a<values><CRC><CR><LF>
<p>This command is used to get groups of data from the SDI-12 Converter. D0! is issued after an M, MC, C, CC, V, or HA command. The SDI-12 Converter responds by sending the data. If the expected number of measurements is not returned in response to a D0! command, the data recorder issues D1!, D2!, etc. until all measurement values are received. (The expected number of measurements is given in the response to an M, C, or V command.)</p> <p>a - the SDI-12 Converter address          &lt;values&gt; - pd.d (see details below)            p - the polarity sign (+ or -)            d - numeric digits before the decimal place            . - the decimal point (optional)            d - numeric digits after the decimal point.</p> <p>&lt;CRC&gt; - 3 character CRC code, appended if data was requested with the aMC!, aMC1! ... aMC9!, aCC!, or aCC1! ... aCC9! commands</p>		

## SDI-12 Metadata Commands

### Identify Measurement Commands

The metadata commands provide a means to get the response to a command without actually initiating a measurement or other action.

The identify measurement commands are formed by placing the capital letter I into the measurement commands immediately after the address. The response is identical to having issued the command without the capital letter I following the address.

Command	Response
aIM!	atttn<CR><LF>
aIM9!	atttn<CR><LF>
aIMC!	atttn<CR><LF>
aIMC9!	atttn<CR><LF>
aIC!	atttnn<CR><LF>
aIC9!	atttnn<CR><LF>
aICC!	atttnn<CR><LF>
aICC9!	atttnn<CR><LF>
aIHA!	atttnnn<CR><LF>

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### Identify Measurement Parameter Commands

The identify measurement parameter commands provide details about the parameters returned by a particular command. The form of the command is an expansion of the Identify Measurement Commands. An underscore character ("\_") plus a three-digit decimal number is placed immediately before the exclamation point ("!"). The decimal number is the data value of interest.

Command	Response
aIM_001! ... aIM_009!	a,field1,field2,field3;<CR><LF> ... a,field1,field2,field3;<CR><LF>
aIM9_001! ... aIM_009!	a,field1,field2,field3;<CR><LF> ... a,field1,field2,field3;<CR><LF>
aIMC_001! ... aIMC_009!	a,field1,field2,field3;<CRC><CR><LF> ... a,field1,field2,field3;<CRC><CR><LF>
aIMC9_001! ... aiMC9_009	a,field1,field2,field3;<CRC><CR><LF> ... a,field1,field2,field3;<CRC><CR><LF>
aIC_001! ... aIC_099	a,field1,field2,field3;<CR><LF> ... a,field1,field2,field3;<CR><LF>
aIC9_001! ... aIC9_099!	a,field1,field2,field3;<CR><LF> ... a,field1,field2,field3;<CR><LF>
aICC_001! ... aICC_099!	a,field1,field2,field3;<CRC><CR><LF> ... a,field1,field2,field3;<CRC><CR><LF>
aICC9_001! ... aICC9_099!	a,field1,field2,field3;<CRC><CR><LF> ... a,field1,field2,field3;<CRC><CR><LF>
aIHA_001! ... aIHA_999	a,field1,field2,field3;<CRC><CR><LF> ... a,field1,field2,field3;<CRC><CR><LF>

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The response is a comma separated value (CSV) string with several fields that provide information about the data value of interest.

The SDI-12 Converter will provide three fields of Information:

### Field One

The first field contains a concise identification of the parameter, which is the data value of interest.

### Field Two

Field two contains the units for the parameter.

### Field Three

Field three contains the connected sensor/device type and the associated serial number separated by an underscore ('\_');

Note: The Wiper provides no serial number!

### Example

Metadata for an M command, showing that the M command takes a nitrate Measurement in mg/l by a OPUS photometer sensor with the serial number 7054:

```
0IM!00001<CR><LF>  
0IM_001!0,N-NO3,mg/l,OPUS_7054;<CR><LF>
```