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Two-Wire to SDI12 Converter

(Device Revision v2BT)

Manual

Table of Contents

1. Version History

15.3.24:   Initial

2.   Read this first!

This document is for the new device revision "Two-Wire to SDI12 Converter **v2BT**" only.

For the outdated "Two-Wire to SDI12 Converter **v1**"-revision refer to the document "Doku_2W-SDI-Converter_v1_MANUAL".

The quick start-guide "Doku_2W-SDI-Converter_v1+v2BT_SHORT" is valid for both revision types.

To download the documents visit:
https://www.thermistor-string.com/additional-string-information/documentation-thermistor-string/category/3-documentation

With the following SDI-Command you can check the revision type of your device:

```
>>    "?I!!"

<<    "013TT_TN_2W_0410_OSXDCCC4267"
```

→"13TT_TN_2W_0410_OSX"
is displayed for "Two-Wire to SDI12 Converter **v2BT**" device revision.

3. Introduction

The "Two-Wire to SDI12 Converter" is a configurable universal interface to connect up to 48 "Two-Wire sensors" to your SDI12 infrastructure. The converter acts as a SDI12-Sensor (slave) and can be connected to every compatible SDI12- and SDI12-LowPower-recorder or host-interface.

This document guides through the required steps of

- Connecting the sensors.
- Connecting the SDI12-cable to a host.
- Configuration.

➔ Delivery of the converter in combination with a **Thermistor-String**:
   In this case the device **is already configured** for correct operation. Please refer directly to the chapters "Connection" and the measurement-command (and examples) at "List of SDI-commands".

4.   Specification

- SDI-12 and SDI12-LowPower Standard (V1.3), see http://www.sdi-12.org for more
  information

- 3.6V … 14V supply voltage

- Power consumption during measurement: <30 mA

- Power consumption idle: <100 µA

- Power up wait time for first command: 800 ms

- Overvoltage protection by TVS-Surge Absorber 400 Watt

- Up to 48 Two-Wire Sensors can be connected to one Interface

- Bluetooth 5 wireless connectivity for easy configuration

- IP69 enclosure

- Operating Temperature Range: - 40°C … + 85°C

5. Connection

Two-Wire sensors:

Electrical interface: M8 industrial 3 pole connector.

The following schematic shows the pin-usage at sensor-side (cable with male plug).
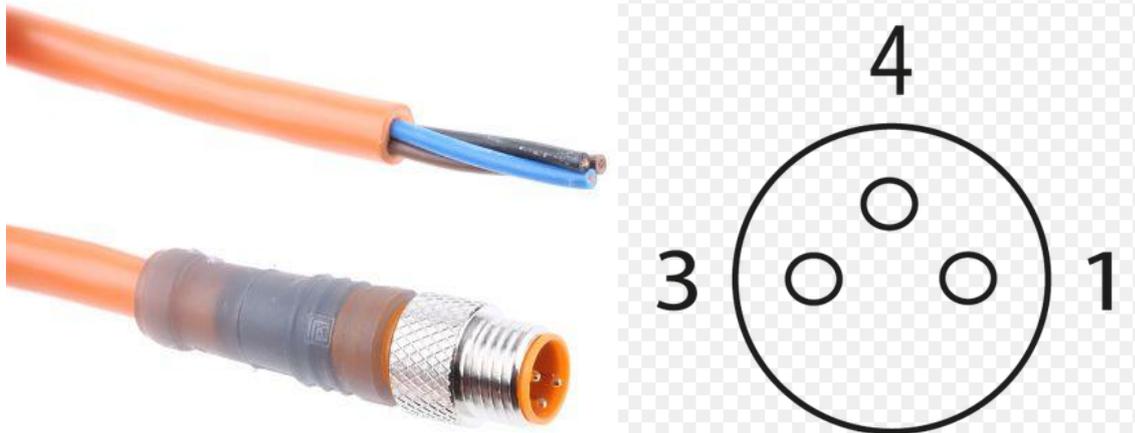
Brown (1):   Data

Black (4):   GND (-)

Blue (3):   not connected

The connection "Two-Wire-Sensors" follows the "BUS-topology". Each sensor is electrically connected to the same Data- and GND-line!

SDI12-connection:

Brown: Supply (3.6 to 14 Volt, >30 mA cont.)

Black: GND (-)

Blue: Data

6. Communication

In case of a preconfigured converter (in combination with a Thermistorstring) directly use the M- and D-commands to start and read a measurement.
Also have a look at the example-code for measurement.

→The converter must stay powered until all operations are finished. In case of a power loss (e.g. between the M- and the D-command) you have to repeat the whole procedure.
→A **power up wait time** of at least 800 ms is required!

6.1 Basic SDI12 commands

The command set is based on extended SDI12 (V1.3) command set.
→'**a**' represents the SDI-address, this might also be '?' (as wild card). Default SDI-address: '**0**'.

aAn!
Change address from 'a' to 'n'.
aI!
Identify Node.
aM! / aM0!
Start measure of **all** configured sensors. All values are stored at the internal cache. This must be always the first "initial" M-command!
Reply: **atttn**. 'ttt' seconds to wait till measurement done (or service reply will be send first) for 'n' values (up to 9).
aDn!
This will read the values from the previous M-command. With n = 0 to 9 to get the number of values announced by the previous M-command.
  → Before requesting the data you have to wait for the service-request send by the converter or n seconds, replied by the previous M-command.

aMn!

Prepare the next set of values. 'n' must be between 1 and 9.

➔ Note: The required number of M-commands depends on the connected number of sensors. So keep in mind: Each M-command responds max 9 values. E.g. a thermistor-string containing 13 sensors requires the M0 and M1 command.

Error codes (all values lower than -90.000):

-98.000: Sensor internal error (probably sensor broken)

-99.000: Communication error

-101.00: No sensor (cable broken?)

-102.00: Short circuit (short circuit on cable)

others: Displayed as text in BLX.JS or BlueShell

6.2 Example commands for measure

The following commands and responds will demonstrate how to measure and read values from the converter. The output depends on the connected and configured Two-Wire sensors.

→At the following example the converter is configured to measure a thermistor-string containing **13** sensors (values).

">>" marks the command to the sensor, "<<" is the response. Each Command and response ends with <CR><LF>. Default address "0" is used.

>>	"1M0!"
<<	"10089"
<<	"1"
>>	"1D0!"
<<	"1[Value 0-2]"
>>	"1D1!"
<<	"1[Value 3-5]"
>>	"1D2!"
<<	"1[Value 6-8]"
>>	"1M1!"
<<	"10014"
<<	"1"
>>	"1D0!"
<<	"1[Value 9-11]"
>>	"1D1!"
<<	"1[Value 12]"

6.3 Example Configuration of a Datalogger

These steps will show you how to configure a GeoPrecision SDI12-Datalogger for the measurement of a thermistor-string with more than one "M-command".
The M1, M2, M3, ... command are necessary for a converter configured for more than **four** 2W-sensors.
The screenshots are taken from the "FG2-Shell", showing the configuration of a datalogger for 6 2W-Sensors connected to the converter.

Channel 1 to 4

Channel 5+6

7. Extended SDI12 X-Commands

The converter can process some extended commands to provide access to advances configuration and information.

To apply SDI12-Commands to the converter you have to connect it to a power-supply and a PC-Interface for your preferred SDI12-Terminal (e.g. **SDI Win** or **SDI Term**). Or your data-recorder provides a command line to send SDI12 commands directly to its interface.

→It must be **continuously powered** during execution of all steps!

The extended commands are not compatible to the SDI12-specification. The detailed input- and output-format of each command is described within the examples below.

→For the following examples ">>" marks the command to the sensor, "<<" is the response. Each Command and response ends with <CR><LF>.

Default address "**0**" is used.

7.1 Overview

aXDevice!

Reply: "0M:70562CF0963757A1,T:410,V0.3,P:162533!"

M: SNO

T: device type

V: Firmware version

P: Blutooth device pin.

aXFactoryReset!

Erases all configurations and resets the device.

➔ Attention: all information for the connected thermistor-string or sensor is blanked! Whole new configuration is required!

8.   Sensor Configuration

To configure the converter for the connected sensors /thermistor-string, the Blutooth 5 wireless interface of this device is used.

The device must be **continuously powered** during execution of all steps by an external power-supply.

Requirements:

- PC or Notebook with Blutooth Version 4 (or higher).
- Properly installed "BlueShell" software:

    https://www.thermistor-string.com/additional-string-information/downloads/category/2-software

Alternative:

You can use the webbrowser based "BLX.JS" on every device (like smart phone, tablet, MAC, Notebook, ...) that runs a Blutooth compatible webbrowser.

- Blutooth Version 4 (or higher).
- Compatible webbrowser like Chrome or Safari.

To start BLX.JS open: https://joembedded.github.io/ltx_ble_demo/ble_api/index.html

➔ "BlueShell" is used for the following document. All steps can be processed in a similar way with "BLX.JS".

➔ A converter delivered with a connected sensor/thermistorstring **is already configured** for correct operation.

8.1 Connect to the device

Start the BlueShell application. After a few seconds a list of devices is shown on the right side.
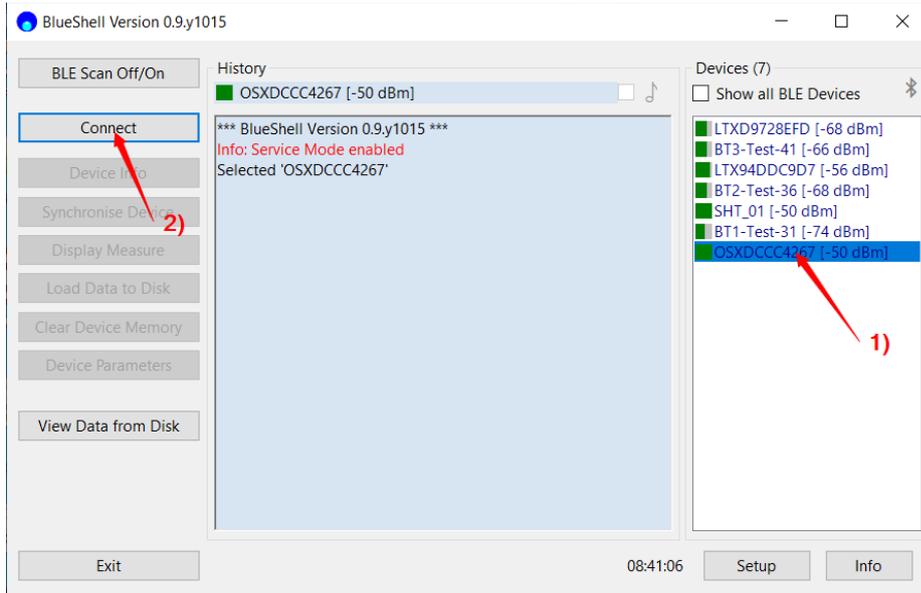
1) Select your device in the list. The name equals to the MAC /SNO printed on the label.
2) Click connect.
3) On first connect the specific device pin, also printed on the label, must be entered.
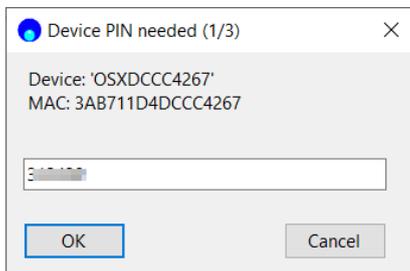
For all commands the "BlueShell Terminal" is used. Type the command and hit "Return" to send. The results are shown in the "big" box.
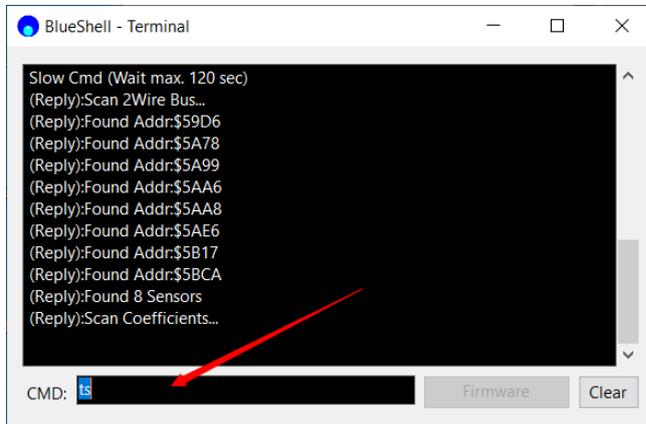
8.2 Commands

ts

Scan the thermistor-string for sensors. Coefficients and positions of each sensor retrieved into a temporary list. Each sensor (depending on the version) has a number of coefficients.

➔ This takes a long time, depending on the number of sensors!

tm

Perform a measure of this temporary list. Also the positions (sorted) are displayed.

"**tp #ENTRY,#NEWPOS**"

➔ Handle with care! All thermistor-strings are correctly positioned! Do not change! Assign a new position (range -32768..+32767) to entry number "#ENTRY". The position is stored in the sensor. Then a measure is shown.

tw

Write the temporary list to the SDI12 parameters. After this the measures can be accessed by SDI12 commands M or MC and D, as shown above.

➔ The configurations is written to the devices non-volatile flash-memory!

ti

Inspect the SD12 parameters (positions are not shown or stored).

8.3 Example

Two commands are used for reading all configuration data from a thermistor-string and storing them inside the SDI-Converter.

1) "ts" to scan the connected thermistor-string. This can take a long time!

```
=>ts
Slow Cmd (Wait max. 120 sec)
(Reply):Scan 2Wire Bus...
(Reply):Found Addr:$59D6
(Reply):Found Addr:$5A78
...
(Reply):Found 8 Sensors
(Reply):Scan Coefficients...
(Reply):#0: Addr:59D6 Type:0900 Pos.:8 Coeffs[21]
(Reply):#1: Addr:5A78 Type:0900 Pos.:4 Coeffs[21]
...
(Reply):Measure (scanned) 2Wire...
(Reply):#0: Addr:5AE6 Type:TNode Pos.:1 -> 20.598070 oC
(Reply):#1: Addr:5AA6 Type:TNode Pos.:2 -> 20.461399 oC
...
(End):OK
```

2) "tw" to write the data to devices flash memory.

```
=>tw
(Reply):Write SDI12 Coefficients
(Reply):Inspect SDI12 Coefficients (8 Sensors, Power Wait:200 msec)
(Reply):#0: Addr:5AE6 Type:0900 TNode Coeff[21]: 52 16 aa 1c 7c 3e 9a 58 b5 85 b4 a6 ff ff ff
ff ff ff ff ff ff
(Reply):#1: Addr:5AA6 Type:0900 TNode Coeff[21]: 52 16 aa 1c 7c 3e 8b 58 c7 85 b4 a6 ff ff ff
ff ff ff ff ff ff
```

...

(Reply):Driver X_us:300

(Reply):Sort Direction: 0 (Normal(Up))

(End):OK

9.   Known Issues

I get no reply from my sensor connected to a PC via USB-Serial-Converter.

→Sometimes the delay of a USB converter is too high or it is blocked somehow. Shut down your PC. Disconnect the USB converter and the sensor, disconnect the sensor from power-source. Start your PC and connect everything properly. Now it should work!

The configuration via X-command fails or I get no reply to the X-command.

→Try to send the command again. These commands are not SDI-conform and very complex. So it might happen that the sensor or your PC did not receive everything correctly!

→Be sure the device is powered continuously for the whole sequence of commands.

I cannot measure the connected sensor. The 'M' command always replies with "1000".

→The sensor is not configured or the channel is deactivated. You have to set up each sensor the first time it is connected to the SDI-Converter!

Values lower than -90.000 are displayed:

-98.000: Sensor internal error (probably sensor broken)

-99.000: Communication error

-101.00: No sensor (cable broken?)

-102.00: Short circuit (short circuit on cable)

others: Displayed as text in BLX.JS or BlueShell