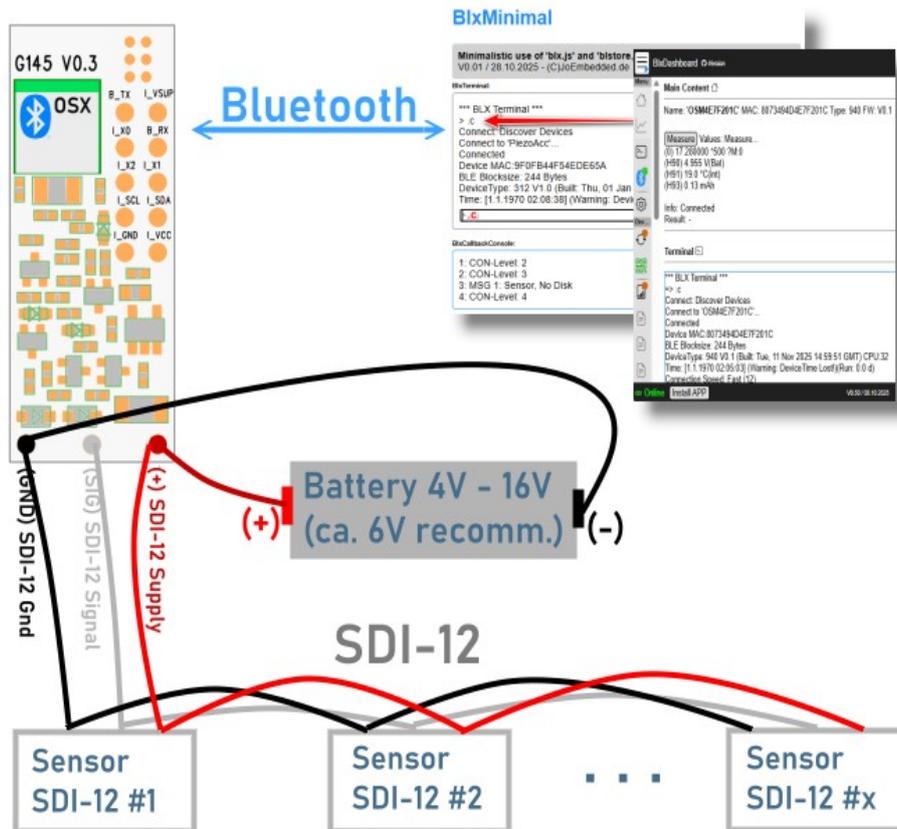


Aquatos BLE



Bluetooth Gateway for SDI-12, Type 940 Data Sheet and Quick Start Guide

1 Overview



“Aquatos BLE” is a small gateway to SDI-12 bus via Bluetooth. Up to 48 measurement channels in full resolution (floating point values) are possible. The complete cloud software and APP are available as a freely available open source solution!

The device requires only a battery (4V to 16V, recommended 6V). The power consumption is only a few μA (plus the power for the sensors, which is normally also negligible), hence it can be powered constantly.

1.1 The system

Aquatos BLE works as aSDI-12 Master and has a memory for a command line how to read the sensors (details below).

1.2 Software

The “BLX Dashboard” app was developed for local communication with AquatOS BLE via Bluetooth. It is a so-called “PWA”, an app that can be started directly from the browser on Android and Windows systems, but can also be used completely offline. Another Software is the “BlueShell”. Both can be used for setup.

- <https://github.com/joembedded/JoEm-Dashboard>
BLX Dashboard, communication app as a real PWA. Based on the same drivers and commands as BLX.JS.
- <https://joembedded.de/x3/blueshell/>
The BlueShell is a third communication APP (only for PC (from Windows 10))

Another open source software is the “BLXMinimal”, that shows how to access the device via BLE. It may be used as launchpad for own applications. Simply send “e” commands via BLE zu get the values.

- <https://github.com/joembedded/BlxMinimal>
BLX Minimal on GitHub

2 Technical setup

The SDI-12 bus is connected via the three lines black, white and red/brown.

The device has BluetoothLE (“BLE”) and can be easily operated using a PC (Windows 10 or later) or a smartphone with Android and BLE. BlueShell, BLX Dashboard or BLX.JS can be used.

Technical information on Low-Voltage-SDI12 and BLE can be found here (currently available only in German): https://joembedded.de/x3/ltx_firmware/GeneralDocus/open_sdi12_1v4_Bericht_DE.pdf

2.1 Commands

The following commands are important via BLE terminal:

- '?': Lists all settings and the MAC of the satellite modem.
Info: The "Signal" value should ideally be above 4000.
- 'c': The SDI-12 measurement command (following section). Default is ""*500 ?M"
(without '!' character)
- 'zCMD': Sends CMD as SDI-12 command (at the end a '!' character)

'z dbg 1' / 'z dbg 0': Activates the SDI-12 debugger, if activated, the used raw SDI-12 commands are written in the terminal window.

'e': (or button "Measure" in the APP): Starts and displays a measurement

'Write': Saves the settings non-volatilely

'FactoryReset': Clears all settings, sets 'f' to the value 0 ("Off").

2.1.1 The 'c' command and an example

'cCMD' sends CMD to the SDI-12 bus. If necessary, the SDI-12 power supply is switched on with a wake-up time of 250 msec. Optionally, a wait time of XXX msec can be inserted at any time using '*XXX'.

The 'M' or 'R' commands are suitable as CMDs. The command (without the '!' sign at the end) can be followed by a list of the channels to be measured (not all channels of a sensor are always necessary). If nothing is specified, all channels of the sensor are used.

Some examples (without leading 'c'). Separator is a space or an underscore ('_'):

? M If only a single SDI-12 sensor is connected, all of its channels are measured (SDI-12 V1.2 compatible without CRC).

* 1800 ?MC As above, but the power-up time is 1800 msec and it is measured with CRC (SDI-12 V1.3 compatible). Value range is 0 – 9999 msec.

+ ?MC '+' is identical to '*', leaves the SDI-12 power supply permanently on after the measurement (switches off when the battery is empty). This mode is necessary for sensors with ongoing measurements, such as counters or averaging wind sensors.

0M:0 The 1st value of the sensor with the address '0' is measured.

1MC:1:3 The 2nd and 4th values of the sensor with the address '1' (with CRC) are measured.

1M:0-4 5 measured values from sensor '1' are recorded.

In the following example, two sensors are connected: Address '1' is a 2-channel temperature measuring chain, address '5' is a conductivity sensor (conductivity in $\mu\text{S}/\text{cm}$ and temperature). Both sensors are ready within 200 msec. All channels should always be recorded.

So the SDI-12 measurement command (with CRC) is: “c1MC:0-1 5MC:0-1”. An excerpt from the communication (via the BlueShell terminal, BLX Dashboard or BLX.JS):

```

> ?                                     Check Parameter
: 'Modem MAC:'012345678SKY0123 ''      MAC of the modem
: 'CMD: '*500 ?M''
> z1I!                                   Check ID '1'
: 'SDI CMD: '1I!''
: 'SDI:'113TT_TN_2W_0410_0SX713F9C22<CR><LF>''
> z5I!                                   Check ID '5'
: 'SDI CMD: '5I!''
: 'SDI:'513DECAGON ES-2 385<CR><LF>''
> c1MC:0-1 5MC:0-1                      Set SDI-12 Measure Cmd.
: 'CMD:'1MC:0-1 5MC:0-1''
> e                                       Test Measure
Measure...                               Looks good!
(0)12.545002 1MC:0                       Unit: #0: °C_T0
(1)12.488001 (...):1                     Unit: #1: °C_T1
(2)396.000000 5MC:0                       Unit: #2: µS/cm
(3)13.300001 (...):1                     Unit: #0: °C_H20
(H90)3.799V(Bat)
(H91)14.3 °C(int)
> Write                                  Write Reset-proof
: 'Write OK'

```

Note: There are a number of other, less important commands. If you are interested in more technical details, please ask us, we will be happy to help!

3 Power consumption

Approx. 30 µA BLE unconnected, approx 100 µA BLE connected. Plus power of the sensors.

4 Compliance (Aquatots BLE, Type 940)



4.1 Compliance: CE, RoHS

- EN 55011 – ISM devices
- EN 61000-4-2 – ESD: 4 kV contact / 8 kV air
- EN 61000-4-3 – EMF: 10 V/m (0.1–1 GHz)
- EN 301 489-1 V2.2.3:2019-11 – EMC requirements for radio equipment
- EN 301 489-20 V1.1.1:2019-04 – Radio applications
- EN 62311:2008 – Human exposure
- EN 62368-1:2014 – Safety

4.2 Additional

- Bluetooth SIG listed: ID 138612

The device “Aquatots BLE” complies with:

- The essential requirements of Directive 2014/30/EU (EMC) and Radio Equipment Directive 2014/53/EU (RED) and with Directive 2011/65/EU (EU RoHS 2) and its amendment Directive (EU) 2015/863 (EU RoHS 3).

Manufacturers:

GeoPrecision GmbH
Am Dickhäuterplatz 8
D-76275 Ettlingen

Terratransfer GmbH
Ottostr. 19a
D-44867 Bochum

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A handwritten signature in black ink, appearing to read 'Jürgen Wickenhäuser', is written over a faint, illegible stamp.

Jürgen Wickenhäuser (R&D)
