
AbioWire

1-Wire Card for BCM2835-based computer

User Manual

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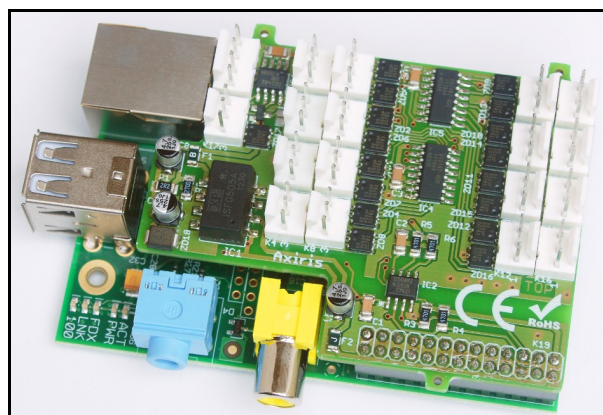
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Revision History

Date	Authors	Description
2013-04-13	Peter S'heeren	First release.
2013-07-09	Peter S'heeren	Second release.

1 Features

- Three 1-Wire controllers providing a total of seventeen 1-Wire channels.
- Connector for I2C bus operating at 5 V.
- Battery backed up real-time clock and calendar with integrated temperature compensated crystal oscillator and a 32.768 kHz quartz crystal.
- Compact footprint due to the use of SMD components.
- Free software.
- Works with the Axiris ows software package.
- Works with the owfs software package.



Applications include:

- Weather station.
- Home automation.

2 Technical Specifications

Dimensions	73 mm x 60 mm x 22 mm (W x D x H)
Weight	27 g (without battery)
RTC backup power	10 years

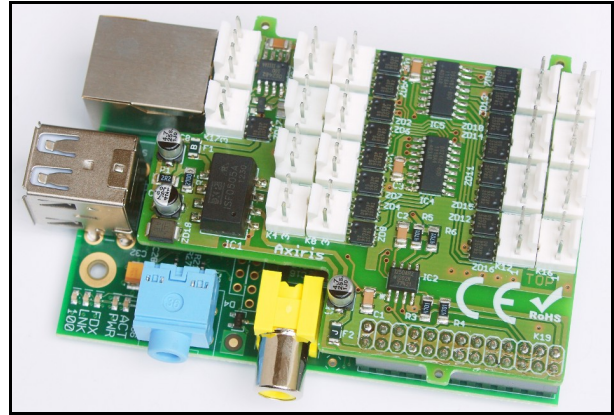
3 Installation

AbioWire

First of all, place a CR2032 battery in the battery holder on the backside of the AbioWire.

Note that when no battery is present, the AbioWire will work except the real-time clock won't keep the time when the system is powered down.

The AbioWire has a 2x13 pin female header that fits perfectly on your BCM2835-based computer. Be sure you connect the AbioWire in such a way it hovers over the computer as shown in the picture to the right.



A dedicated enclosure for the combo is available. The enclosure ensures the AbioWire fits correctly on the computer.

If you decide to provide your own enclosure, or no enclosure at all, then be sure to fix the AbioWire in such a way its backside can't touch the computer.

Enclosure

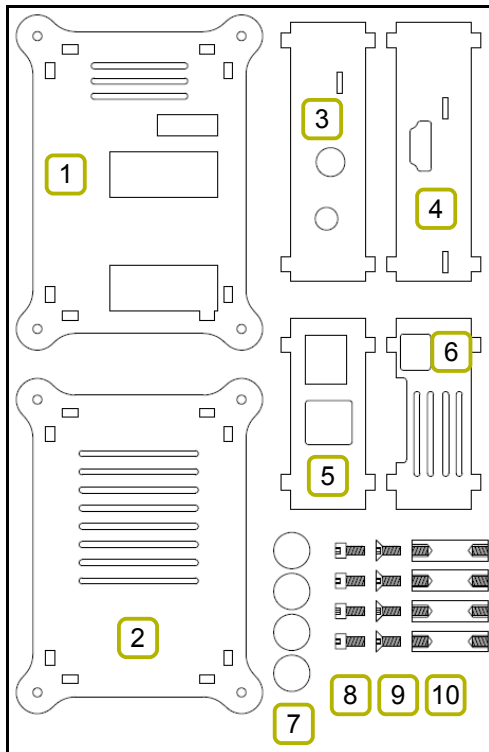
An enclosure specifically designed for the combo is available.

The enclosure comes with holes on top for connecting 1-Wire devices and I2C devices to the dedicated pin headers.

The AbioWire has three protrusions that aid in mounting the card in a fixed position. The dedicated enclosure provides the right holes for these protrusions.



Bill of Materials



#	Description
1	Transparent acrylic top panel
2	Black acrylic bottom panel
3	Transparent acrylic side panel (audio, video)
4	Transparent acrylic side panel (HDMI)
5	Opaque acrylic side panel (LAN, USB)
6	Opaque acrylic side panel (USB Micro-B)
7	Rubber feet
8	M3 hex. screws top side
9	M3 countersunk hex. screws bottom side
10	Spacers

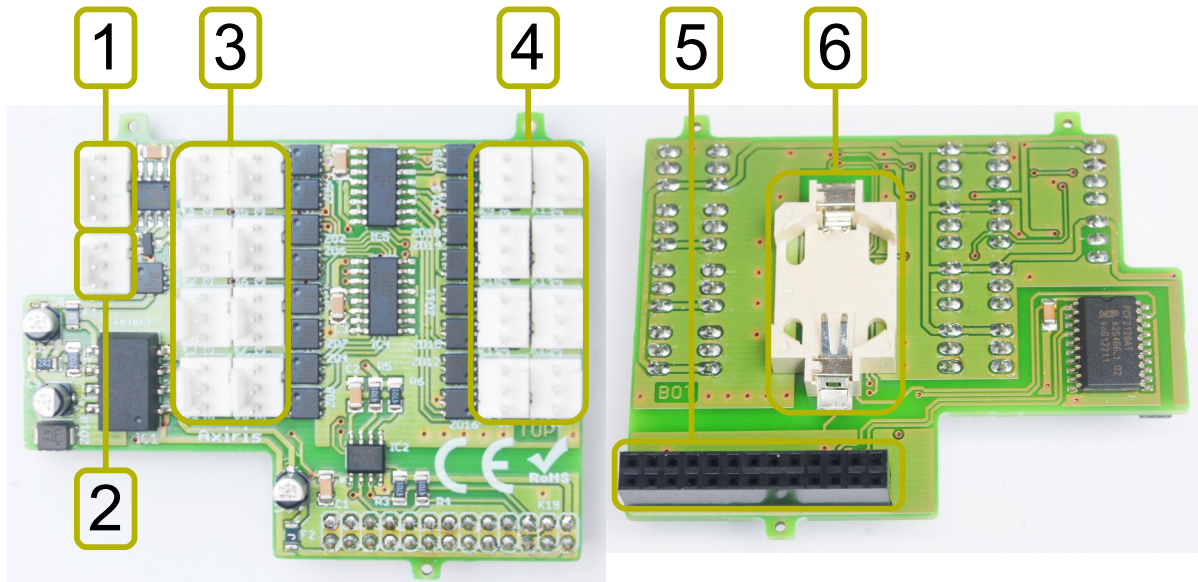
HINT! Did you notice the rubber band that came with the package? You can use it to hold together the assembly when you've completed step 5 of the assembly instructions. In doing so driving the screws will be much easier.

Assembly Instructions

1. Remove the protective films from the acrylic panels.
2. Mount the AbioWire on the BCM2835-based computer as described earlier. 2. You may have to leave a small gap between the card's connector and the base of the computer's GPIO pins in order to fit the card perfectly in the case.
3. Mount the side panels (3, 4, 5, 6) around the combo.
4. Place the assembly on the bottom panel (2). Make sure the air vents are closest to the LAN and USB panel (5).
5. Mount the top panel (1) on top of the assembly.
6. Insert a spacer (10) in each corner between the top panel and the bottom panel. Drive an M3 hex. screw (8) at the top and an M3 countersunk hex. screw (9) at the bottom. DO NOT exert too much force when tightening the screws!
7. Stick a rubber foot on each M3 countersunk hex. screw (9) on the bottom panel.

4 AbioWire

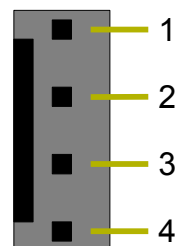
Board Overview



Mark	Label	Description
1	K18	I2C connector
2	K17	DS2482-100 1-Wire controller C connector
3	K1-K8	DS2482-800 1-Wire controller A connectors
4	K9-K16	DS2482-800 1-Wire controller B connectors
5	K19	GPIO female connector
6	B1	RTC backup power battery, 3 V type CR2032

I2C Connector (K18)

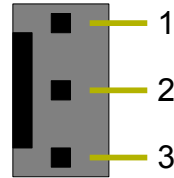
Mark	Description
1	5 V
2	GND
3	SDA
4	SCL



Connection to the I2C bus on the AbioWire. This I2C bus operates at 5 V.

1-Wire Connector (K1-K17)

Mark	Description
1	5 V
2	DQ
3	GND



This connector is typically used to connect a 1-Wire channel to a 1-Wire slave with a similar connector, or a breakout board.

5 I2C Bus

Slave Addresses

The I2C bus on the AbioWire interconnects your BCM2835-based computer with a set of I2C slave devices. The slave addresses are:

Address	Slave Device
1010001b	PCF2129A real-time clock
0011000b	1-Wire controller A, DS2482-800, 8 channels
0011001b	1-Wire controller B, DS2482-800, 8 channels
0011010b	1-Wire controller C, DS2482-100, 1 channel

Real-time Clock

The PCF2129A is a real-time clock and calendar with an integrated temperature compensated crystal oscillator and a 32.768 kHz quartz crystal. The PCF2129A has a backup battery switch-over circuit, a programmable watchdog function, a timestamp function, and many other features.

The board has a holder for a CR2032 battery that functions as backup power for the PCF2129A.

1-Wire Controllers

The three 1-Wire controllers allow software to communicate with three 1-Wire slaves concurrently.

The 1-Wire controllers provide a total of seventeen 1-Wire buses.

6 Software

Overview

The AbioWire is supported by a number of software packages that run on your BCM2835-based computer with Linux for ARM installed.

This document makes the following assumptions:

- You've installed Debian6 Linux or a derivative distribution on the SD card of your BCM2835-based computer.
- You've a personal log in that's not root.
- You know how to run programs as root (**sudo** command, setuid access right flag).
- You know how to log in as root (log in prompt, the **su** command).

This document describes commands entered at the command prompt. When entering a command at the prompt of your personal log in, the document uses the \$ notation. For example:

```
$ sudo ./owsenum
```

A command entered at the prompt of the root log in is written with the # notation. For example:

```
# ./owsenum
```

Accessing I2C from Software

Software has two ways of accessing the I2C hardware on your BCM2835-based computer:

- Direct I/O.
- Using the Linux i2c-dev interface.

Direct I/O

Direct I/O means the programs that run on your BCM2835-based computer directly communicate with the AbioWire from user-mode using the first serial controller (BSC0) or the second serial controller (BSC1) on the BCM2835 application processor.

Obviously using direct I/O is appropriate when no I2C driver is loaded, or at least the BSC that connects to the AbioWire is not under control of any I2C driver.

Direct I/O requires root privileges.

IMPORTANT!

Do not force the programs to use direct I/O if I2C drivers are present. Doing so may disrupt the proper working of the I2C drivers and subsequently hang or crash the operating system.

i2c-dev Interface

I2C driver support in Linux includes a driver named i2c-dev. This driver offers a file interface to the I2C adapters from user-mode through files in the **/dev** directory. These files are named **/dev/i2c-<n>** where **<n>** is a number starting from zero.

If the i2c-dev interface is not present, you can activate it by running the following commands as root:

```
# modprobe i2c-bcm2708
# modprobe i2c-dev
```

The following files will be created:

- **/dev/i2c-0** – i2c-dev interface for BSC0.
- **/dev/i2c-1** – i2c-dev interface for BSC1.

Normally access to these files requires root privileges.

Revision of your BCM2835-based Computer

There are currently two main revisions of the computer. The GPIO pins are not compatible between these revisions. Although the incompatibility doesn't affect the AbioWire hardware, it does affect the software as follows:

- Revision 1: The GPIO header pins 3 and 5 are wired to BSC0 of the BCM2835.
- Revision 2: The GPIO header pins 3 and 5 are wired to BSC1 of the BCM2835.

A number of programs are able to auto-detect the revision of the computer and as such the BSC to use.

If you're using the **ows** package, run the following program as root:

```
# ./owsenum -bscdetect -v
```

There are three possible outcomes:

(a) The program has detected direct I/O:

```
Detecting BSC
Adding i2cbus 0 bsc 1
```

(b) The program has detected the i2c-dev driver is present:

```
Detecting BSC
Adding i2cbus 0 i2c-dev /dev/i2c-1
```

(c) The program has determined it's not running on a BCM2835-based computer:

```
Detecting BSC
BCM2835 not detected, skipping devices for bscdetect
```

Real-time Clock

You can install the **abiortc** package to take advantage of the real-time clock. It's available from the Axiris website.

Package ows

This software package for 1-Wire is provided by Axiris. It's available from the Axiris website.

The **ows** programs support several 1-Wire adapters and run on a variety of systems. This document provides a quick guide for most common tasks for your AbioWire. Refer to the **ows** documentation for more information.

Installation

Unpack the **ows** package in a local directory in your home directory on your BCM2835-based computer.

Run the **install.sh** script in the context of your user account to install the **ows** group of programs in Linux.

Be sure to run the installation script from the command line rather than the file manager. The script will **sudo** and as such the system may ask for the root password.

The **ows** package is installed in directory **/opt/ows**. You'll have to **cd** to this directory to run the programs.

Specifying the Hardware

To see the outcome of the BSC detection procedure, run the following command as root:

```
# ./owsenum -bscdetect -v
```

The **ows** programs accept a standard set of options for specifying 1-Wire adapters.

Options	Description
-bscdetect abiowire	Auto-detect BSC and interfacing type.
-bsc 0 abiowire	Use direct I/O with AbioWire on BSC 0.
-bsc 1 abiowire	Use direct I/O with AbioWire on BSC 1.
-i2cdev /dev/i2c-0 abiowire	Use i2c-dev with AbioWire on BSC 0.
-i2cdev /dev/i2c-1 abiowire	Use i2c-dev with AbioWire on BSC 1.

It's also possible to work with individual 1-Wire controllers of the AbioWire:

Options	Description
-bscdetect ds2482 24	Auto-detect BSC and interfacing type, use the first 1-Wire controller (I2C address is 24).
-bsc 0 ds2482 25	Use direct I/O with the second 1-Wire controller on BSC 0.
-i2cdev /dev/i2c-1 ds2482 26	Use i2c-dev with the third 1-Wire controller on BSC 1.

You don't need to specify the type of 1-Wire controller, the **ows** software will distinguish between a DS2482-800 chip and a DS2482-100 chip.

Enumerating 1-Wire Slaves

To enumerate all 1-Wire slaves connected to the AbioWire:

```
# ./owsenum -bscdetect abiowire
```

Reading 1-Wire Sensors

To read out your 1-Wire sensor devices, you first create a topology file that describes your 1-Wire networks. Once the file has been created, you feed it to program **owsrds** that will read out the actual sensor data. Run as root:

```
# ./owsenum -bscdetect abiowire -hub -topo mynetworks.txt
# ./owsrds -bscdetect abiowire -topo mynetworks.txt
```

The topology file needs to be created only once. You can simply run **owsrds** periodically (using **cron** for example) to read out the sensor data. You should recreate a topology file only when you change the topology of the 1-Wire sensor devices on your 1-Wire networks.

If you reconnect your 1-Wire networks to different channel connectors on the AbioWire, don't worry. The **owsrds** program will detect your networks and access the correct channel for each network.

Package owfs

The AbioWire can be used with **owfs**, the 1-Wire File System. This software package is available from the following website:

```
http://www.owfs.org/
```

The **owfs** software includes programs that expose the 1-Wire hardware in a variety of ways to the system:

- **owfs**: Creates a file system in a specified mount directory. This program requires software package **libfuse**.
- **owhttpd**: Sets up a web server.
- **owftpd**: Sets up an FTP server.
- **owserver**: A server that allows multiple client programs to access the 1-Wire hardware.

These programs support a uniform command line syntax for specifying which 1-Wire adapters to detect and to expose. For the AbioWire, the **--i2c** command line option is of importance.

Suppose you want to set up a web server that listens to port 80. Suppose the AbioWire is connected to BSC1 of the computer. Enter the following command as root in the **bin** directory of **owfs**:

```
# ./owhttpd -p 80 --i2c=/dev/i2c-1:0 --i2c=/dev/i2c-1:1 --i2c=/dev/i2c-1:2
```

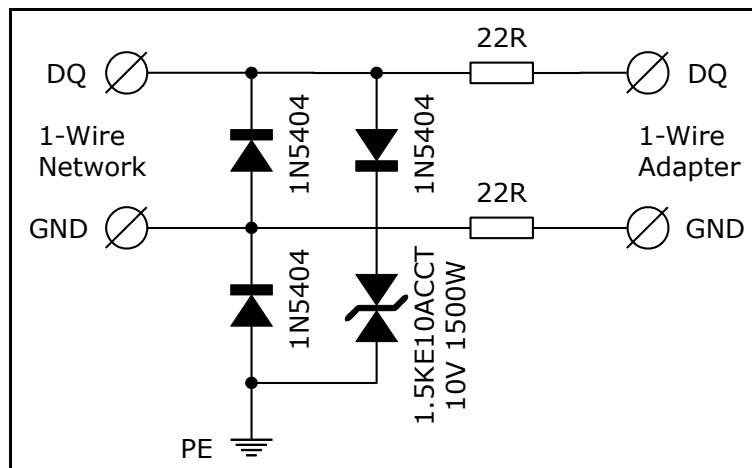
The **/dev/i2c-<n>:<i>** syntax denotes offset **<n>** from I2C address 0011000b on I2C bus of **<i>**. The mentioned command line syntax thus tells **owhttpd** to look for 1-Wire controllers at addresses 0011000b, 0011001b and 0011010b on the I2C bus of BSC1. The type of 1-Wire controller doesn't need to be specified; the **owfs** software will distinguish between a DS2482-800 chip and a DS2482-100 chip.

Refer to the **owfs** documentation for more information.

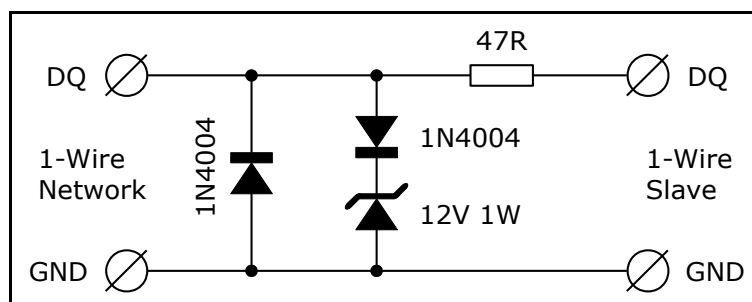
7 ESD/Lightning Protection

When you're planning to expose your 1-Wire network to the open air or an hostile environment, ESD and nearby lightning strikes may hit your 1-Wire network and destroy the AbioWire and 1-Wire slaves in the process.

We strongly advice to protect your AbioWire if such problems are real. Here's an example circuit to protect a 1-Wire adapter. Note that for the correct functioning of the circuit, a reliable earth connection is required (computer chassis, mains earth connector, grounding pin, ...).



You can opt to protect 1-Wire slaves as well. Here's an example circuit to protect a 1-Wire slave from certain destructive discharges on the 1-Wire network:



The diagrams presented here are example circuits. It's the end-user's responsibility to provide the required protection measures to prevent the AbioWire from being destroyed by electrical discharges and similar phenomena.

8 Disclaimer

Axiris products are not designed, authorized or warranted to be suitable for use in space, nautical, space, military, medical, life-critical or safety-critical devices or equipment.

Axiris products are not designed, authorized or warranted to be suitable for use in applications where failure or malfunction of an Axiris product can result in personal injury, death, property damage or environmental damage.

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9 Contact Information

Official website: <http://www.axiris.be/>

