

SmuView User Manual

Version 0.0.4, dated 2020-02-10

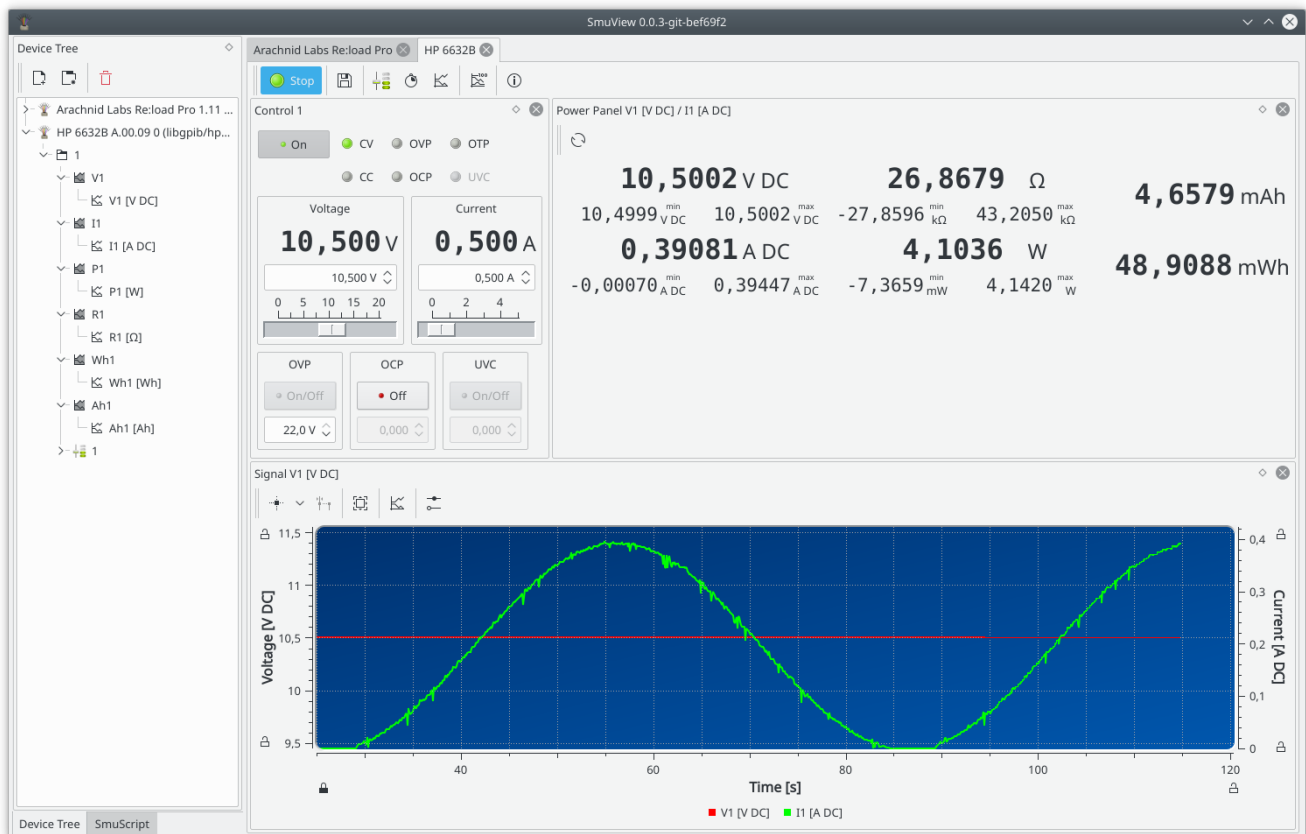
Table of Contents

1. Overview	1
2. Installation	2
2.1. Linux	2
2.2. Windows	3
2.3. Mac OS X	3
3. Devices	4
3.1. Measurement Device	5
3.2. Power Supply	6
3.3. Electronic Load	6
3.4. Oscilloscope	6
3.5. User Device	6
4. Data Visualisation	7
4.1. Value Panel View	7
4.2. Power Panel View	7
4.3. Data Table View	8
4.4. Time Plot View	8
4.5. X/Y-Plot View	9
5. Data Processing	10
6. Device Control	12
6.1. Control View	12
6.2. Sequence Output View	12
7. SmuScript	14
8. Command Line Interface	17
9. License	18

Chapter 1. Overview

SmuView is a graphical frontend for the libsigrok library, permitting access to a wide range of devices to let you record, analyze, process and export analog data. It is part of the sigrok suite, just like the libraries that it makes use of.

The sigrok suite needs some kind of hardware to interface to the signals you want to examine or control. SmuView currently supports devices that can either work as a [power supply](#) or an [electronic load](#). Both of these device types are most of the time controllable. There is also a large number of measurement devices that are supported by SmuView like [multimeters](#), [LCR meters](#), [sound level meters](#), [thermometers](#), [hygrometers](#), [anemometers](#), [light meters](#), [energy meters](#), [tachometers](#) and [scales](#).



The SmuView user interface is geared towards controlling devices and analysis of captured data. From here, you can access all features.

Before we dive deeper into how to accomplish things, let's make SmuView available on your system first.

Chapter 2. Installation

SmuView can be run on Linux and Windows. Mac OS X is not tested yet. For Windows we provide installers and for Linux we provide AppImage containers that you can run without the need to install anything. Check the [SmuView download page](#) to see which option is available for your platform.

2.1. Linux

You have two options to install SmuView:

1. [Download](#) and use the AppImage which contains all required files and needs no installation:

```
chmod u+x SmuView-0.0.4-x86_64.AppImage
./SmuView-0.0.4-x86_64.AppImage
```

Please be aware, however, that the AppImages are development releases at the moment, so they always contain the latest development changes. While we do try to keep the code base in a working state, it is sometimes unavoidable to introduce bugs that show up in the AppImage builds. If you encounter something that is odd to you, please download and install the latest release and check if the issue still exists. If it does, feel free to [file a bug](#).

No system files are changed, so if you decide that you no longer want to use SmuView, simply delete the AppImage. If you also want to remove the stored settings, delete `~/.config/sigrok` as well.

2. Uninstall any sigrok packages from your package manager and build SmuView from source:

```
[install dependencies as listed on the wiki]
mkdir ~/sr
cd ~/sr
git clone --branch smuview --single-branch "https://github.com/knarfS/sigrok-
util.git"
cd sigrok-util/cross-compile/linux
./sigrok-cross-linux-smuview
export LD_LIBRARY_PATH=~/sr/lib
~/sr/bin/smuview
```

No system files are changed, so if you decide that you no longer want to use SmuView, simply delete the `~/sr` directory. If you also want to remove the stored settings, delete `~/.config/sigrok` as well.

If you install SmuView using the AppImage or building from source, SmuView will not be able to access USB and serial port devices unless it's run as **root**. Since programs shouldn't be run as **root** unless absolutely necessary, we provide udev configuration files that allows SmuView access to those devices without being **root**.

Here's how you install them:



```
sudo bash
cd /etc/udev/rules.d/
wget -O 60-libsigrok.rules "https://sigrok.org/gitweb/?p=libsigrok.git;a=blob_plain;f=contrib/60-libsigrok.rules"
wget -O 61-libsigrok-plugdev.rules "https://sigrok.org/gitweb/?p=libsigrok.git;a=blob_plain;f=contrib/61-libsigrok-plugdev.rules"
wget -O 61-libsigrok-uaccess.rules "https://sigrok.org/gitweb/?p=libsigrok.git;a=blob_plain;f=contrib/61-libsigrok-uaccess.rules"
sudo udevadm control --reload-rules
```

2.2. Windows

We offer installers for SmuView that contain everything you need to get started. Simply download them from the [SmuView download page](#) and run them as any other Windows installer.

Please be aware, however, that the Windows installers are development builds, so they always contain the latest development changes. While we do try to keep the code base in a working state, it is sometimes unavoidable to introduce bugs that show up in the development builds. If you encounter something that is odd to you, please download and install the latest release and check if the issue still exists. If it does, feel free to [file a bug](#).

After installation, you will find a program called Zadig in the start menu. By default, certain devices recognized by Windows will have drivers installed for them that SmuView cannot use. The purpose of Zadig is to let you change the driver Windows uses for a particular device - for most devices you'll need to choose WinUSB to use them with SmuView or the original proprietary Windows driver to use it with whatever other software you access the device with. More details are available [in the wiki](#).

In case your device doesn't show up in SmuView and you can't find it with a scan either (see next chapter), check with Zadig whether the correct driver is assigned for the device.

2.3. Mac OS X

Cross compilig and packaging for Mac OS X has to be tested yet.

Chapter 3. Devices

SmuView supports a wide variety of analog devices. Because of that, some of the following terms may have a slightly different meaning for different device types.

A device can contain the following objects:

Channel Group

A device can have no, one or more channel groups. Channel groups normally corresponds to a physical channel on the device itself.

A three output channel power supply for example will have three channel groups, probably named 1, 2 and 3.

A multimeter normally doesn't have a channel group.

Channel

A device can have multiple channels. Channels can be in a channel group or belong to the device itself.

A power supply normally has a voltage and a current channel per channel group.

A multimeter probably has one channel for the main display and maybe one for a secondary display.

Signal

A channel can contain one or more signals. A signal represents the samples generated by the device.

Channels of power supplies, electronic loads and math channels always contain only one signal with a fixed quantity and unit.

Channels of multimeters may contain multiple signals, each one with a unique quantity, quantity flags and unit.

Controllable

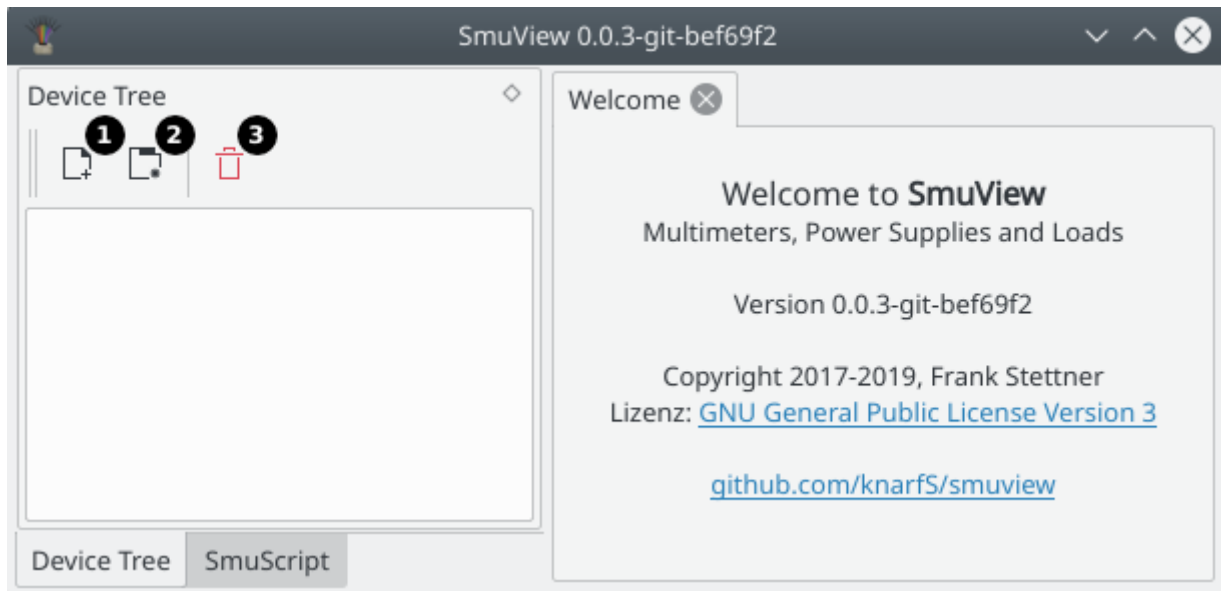
A device can have no, one or more controllables. Up to one controllable can belong to a channel group or to the device itself.

A power supplies channel group controllable can probably control the output voltage and current, enable OVP and OCP and enable the output .

Config Key

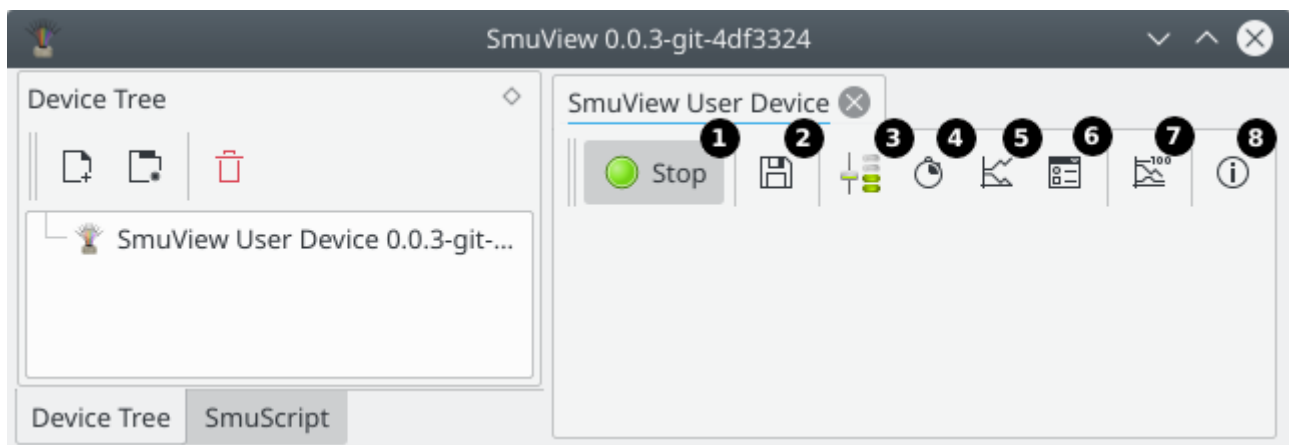
A controllable contains one or more config keys. A config key controls a single property of the device like the sink current of an electronic load or enables the output of a power supply channel group. It may be read- and writeable.

This is the start screen, when you start SmuView without any [command line parameters](#):



- ❶ Connect a new hardware device.
- ❷ Create a new [user device](#).
- ❸ Disconnect and close the selected device. All acquired data will be lost!

When you connect a device, you will get the following functions:



- ❶ Start/Stop data acquisition for this device.
- ❷ Save acquired data to a CSV file.
- ❸ Add a new [control view](#).
- ❹ Add a new [value panel view](#).
- ❺ Add a new [time plot view](#).
- ❻ Add a new [data table view](#).
- ❼ Create a new [math channel](#).
- ❽ Open the about dialog.

3.1. Measurement Device

A measurement device can be everything from a multimeter over a thermometer to a scale.

Most of the measurement devices are not controllable and have no channel groups.

3.2. Power Supply

Most of the supported power supplies are controllable and have one or more channel group with a voltage channel and a current channel. Some power supplies may have additional channels like for power or frequency. The channels contain only one signal with a fixed quantity and unit.

Math channels for power, resistance, Wh and Ah are automatically generated if not provided by the device.

3.3. Electronic Load

All of the supported loads are controllable and have one channel group with a voltage channel and a current channel. Some loads may have additional channels like for power or Ah. The channels contain only one signal with a fixed quantity and unit.

Math channels for power, resistance, Wh and Ah are automatically generated if not provided by the device.

3.4. Oscilloscope

Oscilloscopes aren't supported yet, but will be in the future!

Oscilloscopes have a channel group for each scope channel and one channel per channel group with a signal for each captured frame. The controllable for a channel group is responsible for the vertical settings of the corresponding scope channel. The controllable for the device itself controls the timebase, the trigger settings and so on.

3.5. User Device

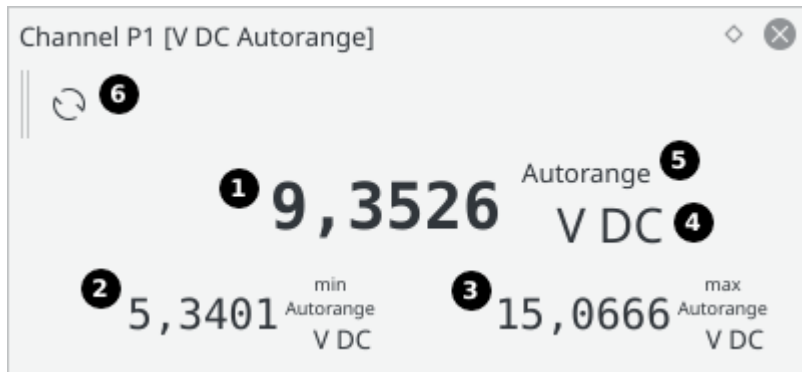
A user devices has no hardware device attached to it and is basically a virtual device. It may contain math channels or visualisation and control views from other devices to build a custom GUI.

Chapter 4. Data Visualisation

SmuView can visualize the captured data in various views. When a device is connected, some common views are automatically displayed, depending on the device type and the available features of the connected device.

You can close views and create new ones via the tool bar of the device tab.

4.1. Value Panel View

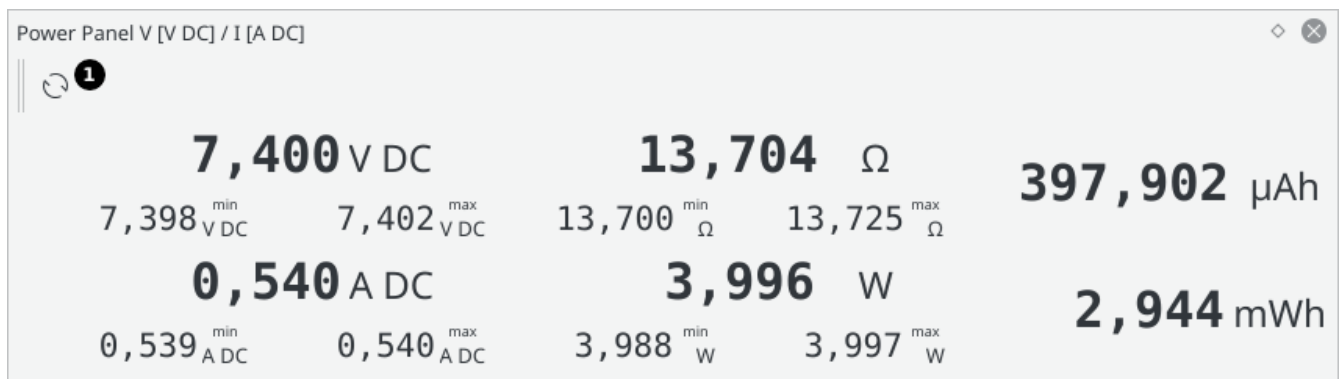


The value panel view displays the actual value (1) of a signal or channel. Also the minimum (2) and maximum (3) values since the last reset are shown.

Each value can have a unit (4) and optional flags (5)

The minimum and maximum value can be reset with the tool bar button 6.

4.2. Power Panel View

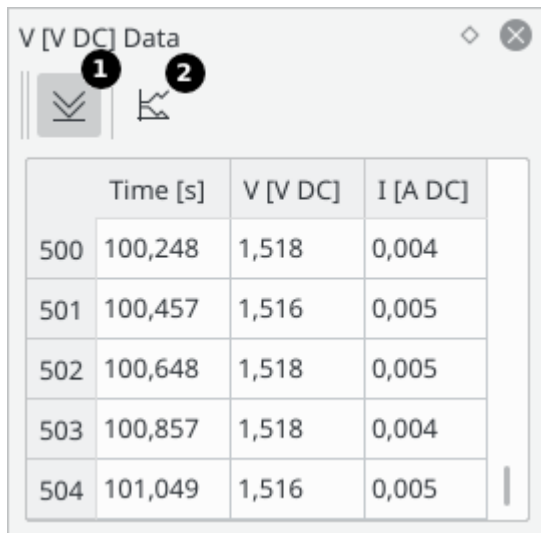


The power panel view is shown for power supplies and electronic loads. This view is using the voltage and current channel for calculating resistance, power, Wh and Ah. Also the minimum and maximum values since the last reset are shown.

The minimum, maximum, Wh and Ah values can be reset with the tool bar button 1.

There is no tool bar button in the device tab to show a power panel view, but it is accesible over the *Add View* dialog in the device tab.

4.3. Data Table View

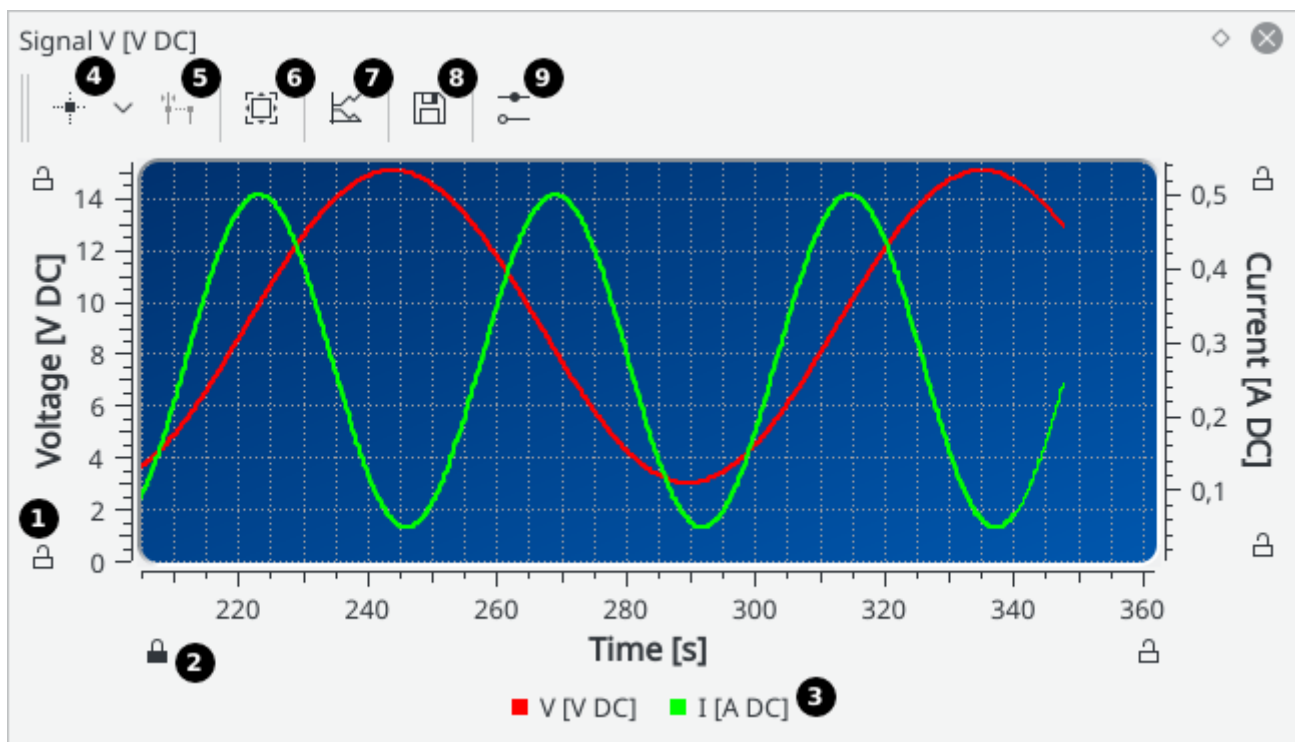


	Time [s]	V [V DC]	I [A DC]
500	100,248	1,518	0,004
501	100,457	1,516	0,005
502	100,648	1,518	0,005
503	100,857	1,518	0,004
504	101,049	1,516	0,005

The data table view shows all available sample points for one or more signals.

You can control if the table scrolls to the bottom or stays at a given position with the tool bar button **1** and you can add new signals to the table via the tool bar button **2**.

4.4. Time Plot View



The time plot view shows one or more channels or signals in a plot over time.

You can move the plot by dragging the plot canvas or by dragging the axis and you can zoom the whole plot by scrolling inside the plot canvas or zooming a specific axis by using the mouse wheel over the axis.

When double clicking an axis, you can manually set the axis boundaries, lock the boundaries and

set an axis scale (linear or logarithmic). With the lock symbols (1 and 2) at the axis, you can also lock a axis boundary. When clicking on a signal label (3), you can change the visibility, color, line type and symbol type of the corresponding signal.

You can add plot markers (4), differential markers (5), resize to best fit (6), and add new signals (7) to the plot via the tool bar.

The plot can be saved (tool bar button 8) to various image formats like SVG, PDF, PNG, etc. At the moment, the image size is fixed.

You can also configure the plot with the tool bar button 9: Change the plot mode (additive, rolling, oscilloscope) and change the display position of the markers info box.

4.5. X/Y-Plot View

The X/Y-plot view shows two signals in X/Y-mode. It has the same functionality as the time plot view.

Chapter 5. Data Processing

SmuView can process and combine channels via math channels.

The screenshot shows the 'Add Math Channel' dialog box. It has a title bar with a question mark, a dropdown arrow, and a close button. The main content area is divided into several sections. The first section is 'Name', which has a text input field with a circled '1'. The second section is 'Measured Quantity', which contains a 'Quantity' dropdown menu set to 'Voltage' (circled '2'), a 'Quantity Flags' list box containing 'AC', 'DC', and 'RMS', and a 'Unit' dropdown menu set to 'V'. The third section is 'Add to...', which contains a 'Device' dropdown menu set to 'HP 6632B A.00.09 0 (libgpib/hp6632b)' (circled '3') and a 'Channel Group' dropdown menu set to '1'. The fourth section is a tabbed interface for math operations (circled '4'). The tabs are 'S1(t) * S2(t)', 'S(t) * f', 'S1(t) / S2(t)', 'S(t) + c', '∫ S(t) * dt', and 'Moving Average'. Below the tabs are two columns, 'Signal 1' and 'Signal 2'. Each column contains three dropdown menus. In the 'Signal 1' column, the first dropdown is set to 'HP 6632B A.00.09 0 (libgpib/hp6', the second to '1', and the third to 'V1 [V DC]'. In the 'Signal 2' column, the first dropdown is set to 'HP 6632B A.00.09 0 (libgpib/hp6', the second to '1', and the third to 'V1 [V DC]'. At the bottom of the dialog are two buttons: 'OK' and 'Abbrechen'.

- ❶ Name of the new math channel.
- ❷ Selection for the quantity, the quantity flags and the unit of the new math channel.
- ❸ Selection to which device and channel group the new math channel should be added to.
- ❹ Various types of math channels.

One example this could be used is, when you measure a current via the voltage drop over a shunt resistor with a DMM. With the multiplication of a constant factor and the voltage signal of the DMM

you can generate a current channel with the correct values in the correct unit (Ampere).

This types of math channels are currently implemented:

1. Multiplication of two signals.
2. Multiplication of a signal and a constant factor.
3. Division of two signals.
4. Addition of a signal and a constant value.
5. Integration of a signal over time.
6. Moving average of a signal.

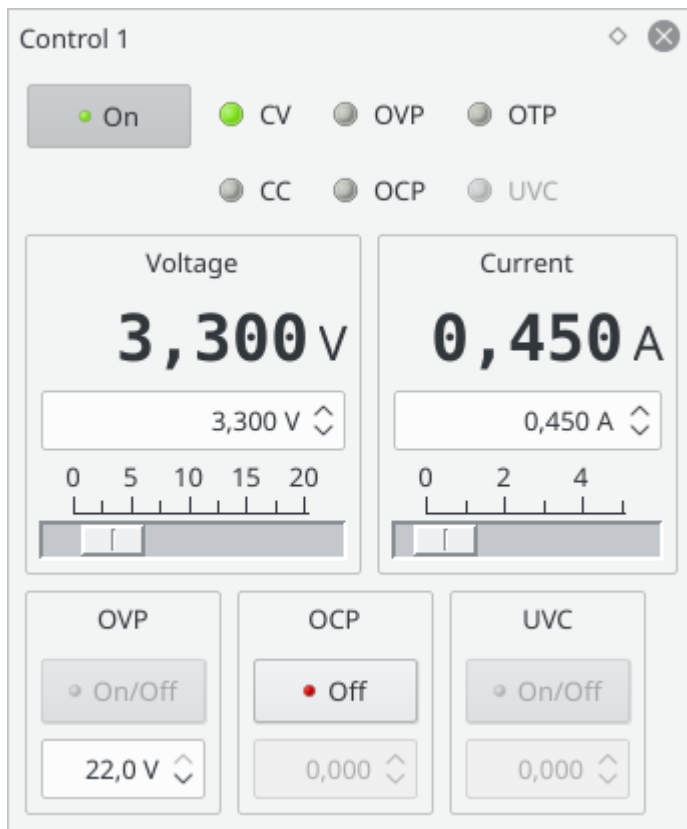
As an alternative to math channels, you can use [SmuScript](#) to do far more complex signal processing.

Chapter 6. Device Control

SmuView can control devices, depending on the device type and the available features of the connected device. When a device is connected and it is controllable, control views are automatically displayed.

You can close control views and create new ones via the tool bar of the device tab.

6.1. Control View

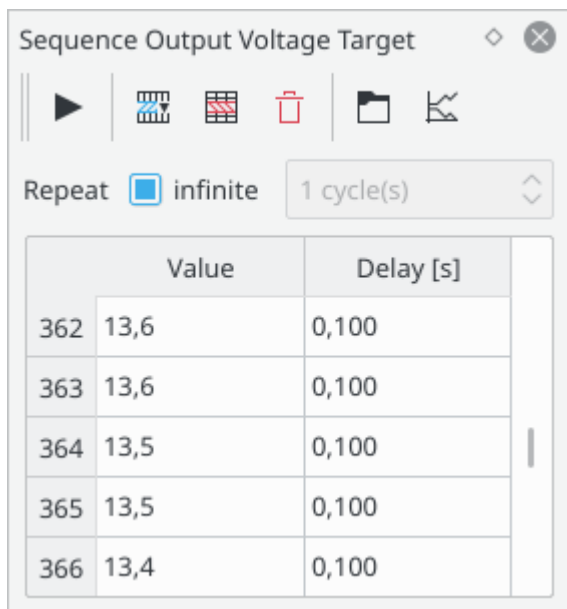


Depending on the device type the control view looks different and functions may be disabled.

Power supplies and electronic loads have a very similar control view, which gives access to all possible functions supported by the sigrok library.

Other controllable devices like sound level meters will have a generic control view.

6.2. Sequence Output View



Some [config keys](#) of a device (for example the output voltage of a power supply) can be set to a sequence of values. The sequence can be played one or more times. You can generate sine, triangle, sawtooth and square wave sequences, load a sequence from a CSV file or enter the sequence manually.

There is no tool bar button in the device tab to show a sequence output view yet, but it is accesible over the *Add View* dialog in the device tab.

Chapter 7. SmuScript

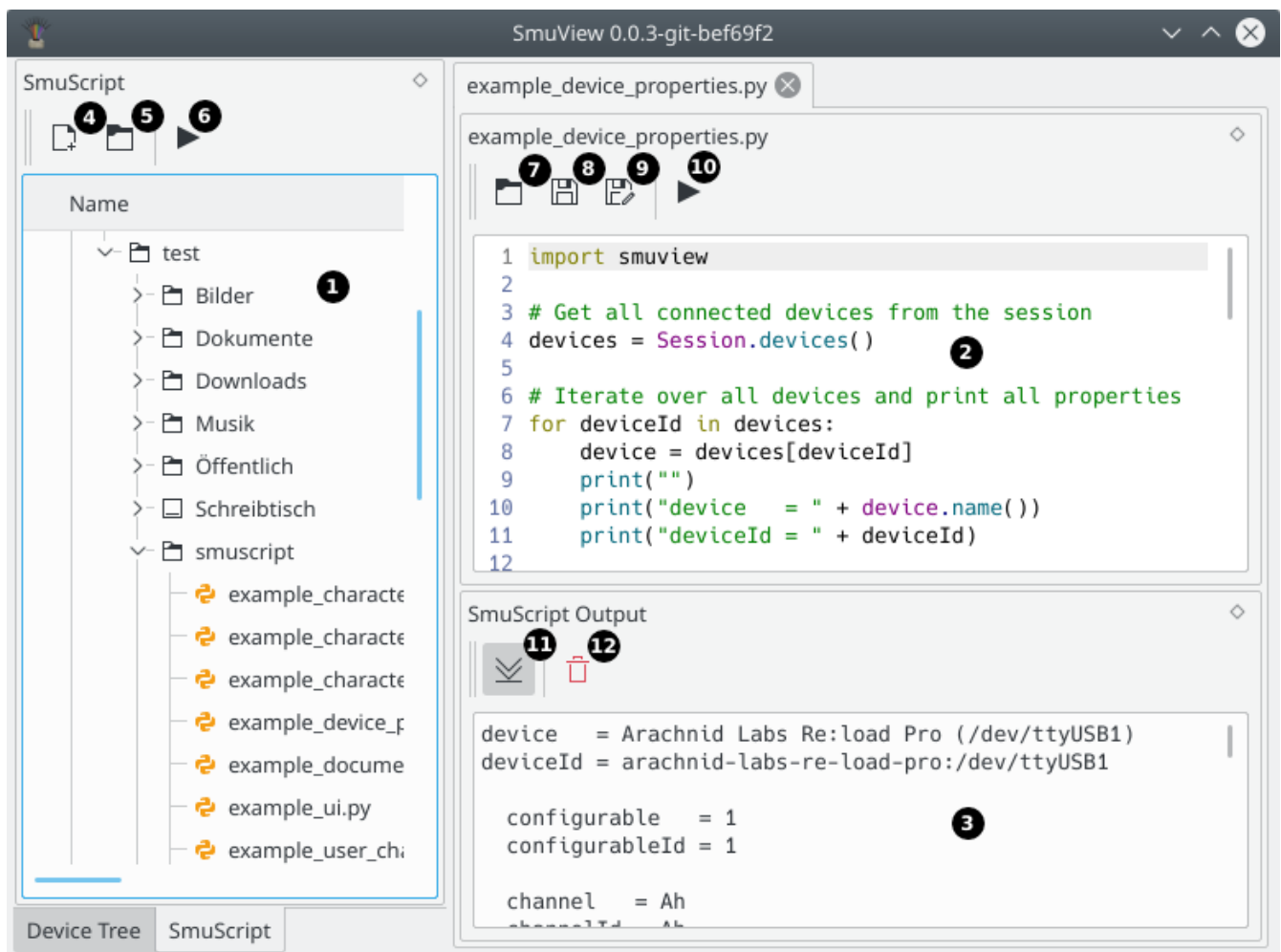
SmuView has a python scripting extension to automate, setup and control complex or repetitive measurements, to process the incoming data and to create a standardized user interface for those measurements.

The smuview module offers two default object instances: **Session** and **UiProxy**. The **Session** object gives access to already connected devices or connects new devices. The returned device object can then be used to read data from the device or control the device. The **UiProxy** object instance is used to modify the user interface, for example adding tabs or views.



Only one script can be executed at a time!

You can find an API documentation [here](#) and example scripts in the **smuscript** folder.



- ❶ Directory tree.
- ❷ Script editor.
- ❸ Script output.
- ❹ Create a new script.
- ❺ Open the selected script file.
- ❻ Execute the selected script file.
- ❼ Open new script file.
- ❽ Save script file.

- 9 Save script file with a new name.
- 10 Execute script file.
- 11 Scroll to bottom.
- 12 Clear output window.

The following short example connects the HP 3378A DMM via GPIB, reads a sample and creates the default tab for the device:

```
import smuvview
import time

# Connect device.
dmm_dev = Session.connect_device("hp-3478a:conn=libgpib/hp3478a")[0]
# Sleep 1s to give the devices the chance to create signals
time.sleep(1)
# Get last sample from channel P1
sample = dmm_dev.channels()["P1"].actual_signal().get_last_sample(True)
print(sample)

# Add default tab for the DMM device.
UiProxy.add_device_tab(dmm_dev)
```

The following more complex example script from the `smuscript` folder characterizes a battery and plots the resulting graph:

```
import smuvview
import time

# Connect devices
load_device = Session.connect_device("arachnid-labs-re-load-pro:conn=/dev/ttyUSB1")[0]
load_conf = load_device.configurables()["1"]
dmm_device = Session.connect_device("hp-3478a:conn=libgpib/hp3478a")[0]
dmm_conf = dmm_device.configurables()[""]

# Init device settings
load_conf.set_config(smuvview.ConfigKey.CurrentLimit, .0)
dmm_conf.set_config(smuvview.ConfigKey.MeasuredQuantity, smuvview.Quantity.Voltage)

# Give the devices the chance to create signals
time.sleep(1)

# Add user device
user_device = Session.add_user_device()
# Add channel for measurement values
user_device.add_user_channel("Results", "User")
result_ch = user_device.channels()["Results"]

# Show device tabs and add plot to user device
UiProxy.add_device_tab(load_device)
UiProxy.add_device_tab(dmm_device)
UiProxy.add_device_tab(user_device)
UiProxy.add_plot_view(user_device.id(), smuvview.DockArea.BottomDockArea, result_ch)

# Start test
load_conf.set_config(smuvview.ConfigKey.CurrentLimit, .150)

# Drain the battery until it is below 0.5 Volt
value = 100
while value > 0.5:
    # Take a reading every 2s and write it to the user channel
    time_stamp = time.time()
    value = dmm_device.channels()["P1"].actual_signal().get_last_sample(True)[1]
    result_ch.push_sample(value, time_stamp, smuvview.Quantity.Voltage, set(), smuvview
    .Unit.Volt, 6, 5)
    time.sleep(2)

# Set device settings to a save state
load_conf.set_config(smuvview.ConfigKey.CurrentLimit, .0)
```

Chapter 8. Command Line Interface

Even though SmuView has a graphical user interface, there is also a command line interface that you can make use of. It is meant to provide functions for convenience and debug purposes, not to replace the user interface itself.

Windows only shows output on the command line when the debug build is used.

Running

```
smuview -h
```

gives you a list of all available options.

Since SmuView can't automatically scan for devices connected to a COM port (`ttysx` on Linux) or Ethernet, you can tell it to look for a specific device using the `-d` or `--driver` parameter. Its usage is the same as for `sigrok-cli`. All possible connection parameters are documented in the [sigrok wiki](#). For example:

```
smuview -d arachnid-labs-re-load-pro:conn=/dev/ttyUSB0
```

You also can start smuscripts from the command line with the `-s` or `--script` parameter:

```
smuview -s /path/to/example_script.py
```

The remaining parameters are mostly for debug purposes:

<code>-V / --version</code>	Shows the release version
<code>-l / --loglevel</code>	Sets the libsigrok/libsigrokdecode log level (max is 5)
<code>-D / --dont-scan</code>	Do not auto-scan for devices

Of these, `-D / --dont-scan` can be useful when SmuView gets stuck during the startup device scan. No such scan will be performed then, allowing the program to start up but you'll have to scan for your acquisition device(s) manually before you can use them.

Chapter 9. License

SmuView is licensed under the terms of the GNU General Public License (GPL), version 3 or later. To view a copy of this license, visit <https://www.gnu.org/licenses/gpl-3.0.html>.

This manual is licensed under the Creative Commons Attribution-ShareAlike 4.0 International License. To view a copy of this license, visit <https://creativecommons.org/licenses/by-sa/4.0/> or send a letter to Creative Commons, PO Box 1866, Mountain View, CA 94042, USA.