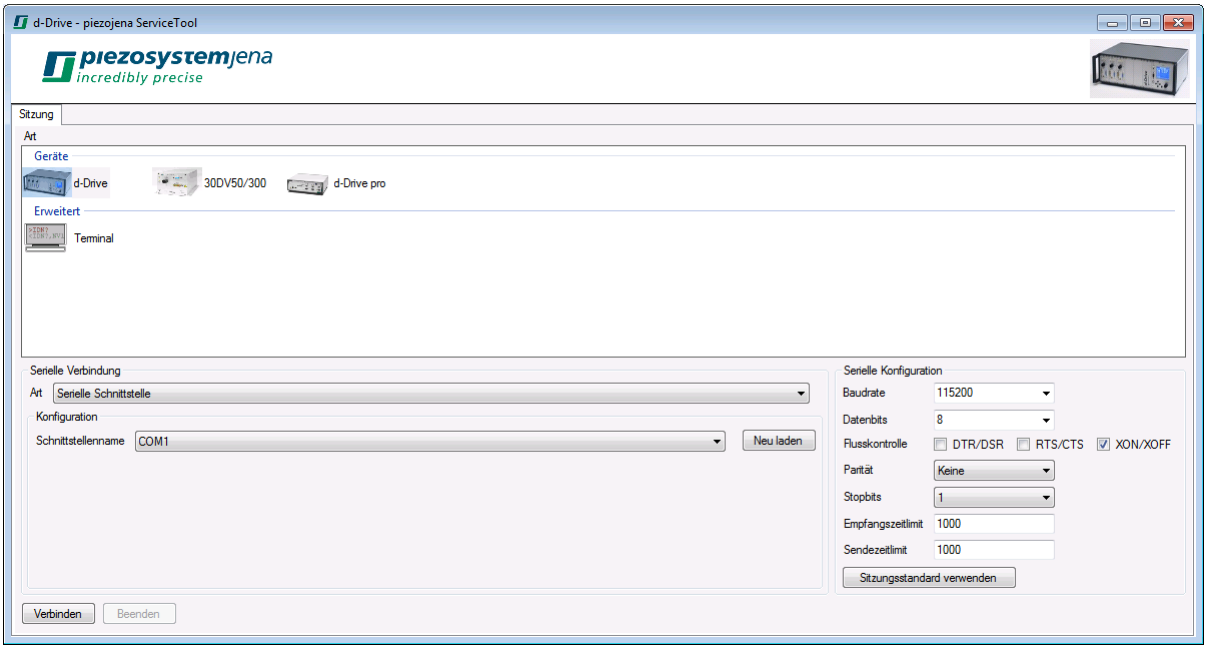
# *Instruction Manual*

# *piezojena ServiceTool 1.4*

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# 1. Introduction

This manual describes the ***piezojena ServiceTool*** from ***piezosystem jena***. The ***piezojena ServiceTool*** is a program that allows handling the first start-up of piezo actuators and piezo amplifiers. It should assist in performing simple service tasks to solve operational problems or manage integration troubles by providing an easy way to check the proper operation of piezo actuators and piezo amplifiers.

The program is based on the .NET Framework 2.0 and supports both 32-bit and 64-bit operating systems.

# 2. Common Use

## 2.1. Graphical User Interface

The graphical user interface is designed for a minimum display resolution of 1024 by 768 pixels.
The default language of the user interface is English (US).
The localization and textual representation of numbers and other values is based on the settings of the current user account of the operating system.
By default, messages are displayed in the language of the user interface of the program. If a message is provided by the operating system then it will be displayed in the language of the operating system.
The user interface uses the concept of an error provider that displays a notification icon next to a graphical element with an error. If the mouse pointer is over the notification icon then a tooltip containing the associated error message is shown.

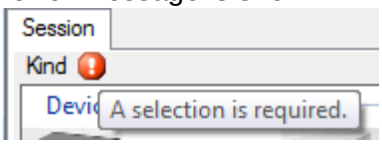



**Figure 1: Error Provider with Tooltip**

An error that interrupts the flow of control of the program is reported by an error dialog.

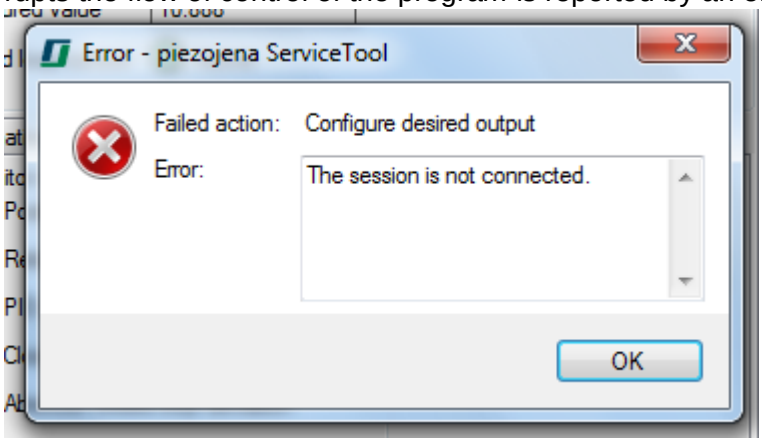



**Figure 2: Error Dialog**

The error dialog has the following members:

- “Failed action” describes the failed action.
- “Error” contains the error message.
- The “OK” button closes the dialog.

## 2.2. Session Configuration

The access to a device is performed in the context of a session. The “Session” tab is used to configure the session. The session configuration involves the following steps:

- Selection of the session kind.
- Selection of the serial connection kind and configuration of the serial connection.
- Optional adaptation of the serial configuration.

The “Session” tab has the following members:

- “Kind” is the list of session kinds. It allows the selection of one of the entries.
- The “Serial connection” group box contains the serial connection configuration.
- The “Serial configuration” group box contains the serial configuration.
- The “Connect” button connects the session.
- The “Terminate” button terminates the session.

Every session kind has a name and a graphical representation. The name and the graphical representation are shown in the list of session kinds.
The title of the main window shows the name of the selected session kind. It contains additional information depending on the state of the session:

- No additional information: The session is terminated.
- “(Connected)”: The session is connected.
- “(Disconnected)”: The session is disconnected but not terminated.

The header of the main window shows the graphical representation of the selected session kind.
The selected session kind is stored into the user settings.
While the session is not terminated, the session configuration can not be changed.
A session has to be terminated explicitly. If the main window should be closed by a user request and the session is not terminated then a closing dialog is displayed.

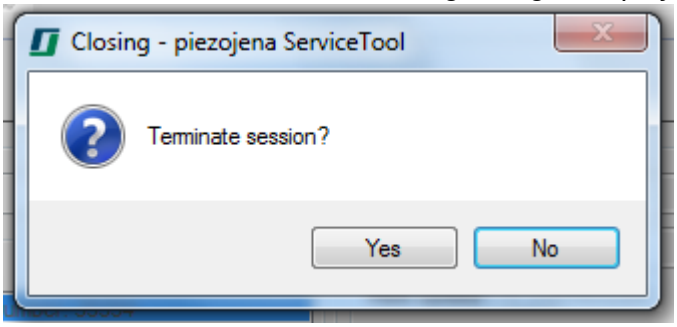



**Figure 3: Closing Dialog**

The closing dialog has the following members:

- The “Yes” button terminates the session and continues the program termination.
- The “No” button cancels the program termination.

## 2.3. Serial Connection

The “Serial connection” group box has the following members:

- “Kind” is the serial connection kind. The combo box contains the list of available serial connection kinds.
- The “Configuration” group box contains the serial connection kind specific configuration of the serial connection.

The selected serial connection kind is stored into the user settings.
The configuration is stored per serial connection kind into the user settings.

### 2.3.1. FTDI-USB

The serial connection kind “FTDI-USB” enables serial connections that communicate directly with the FTDI USB driver. For instance, the communication is faster compared to using virtual serial ports.

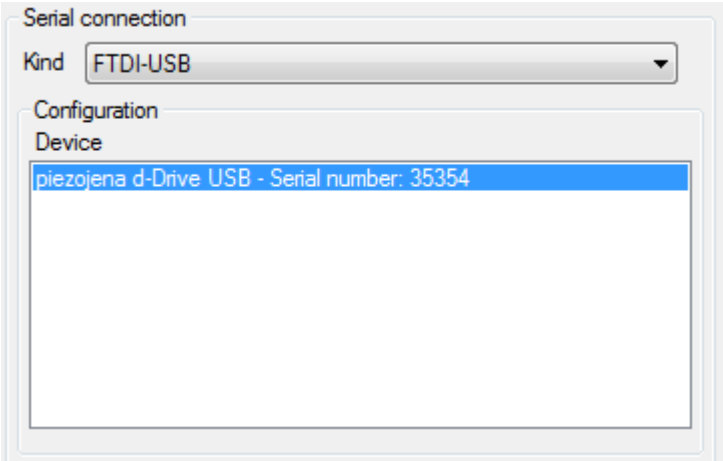



**Figure 4: FTDI-USB Configuration**

The “Configuration” group box has the following members:

- “Device” is the device list of the plugged-in FTDI USB devices. It allows the selection of one of the entries.

If a plugged-in FTDI USB device is accessed by another program then the device list contains no entry for this device. The device list is updated automatically to reflect the availability of devices. The device list is not updated while there exists a session that is not terminated.

A device list entry is shown in the format “<description> – Serial number: <serial>”. “<description>” is the description and “<serial>” is the serial number of the device as reported by the driver. A device is identified internally by its Vendor-ID, Product-ID and serial number.

The internal identification of the selected device list entry is stored into the user settings.

### 2.3.2. Serial Port

The serial connection kind “Serial port” enables serial connections with serial ports that are known to the operating system.

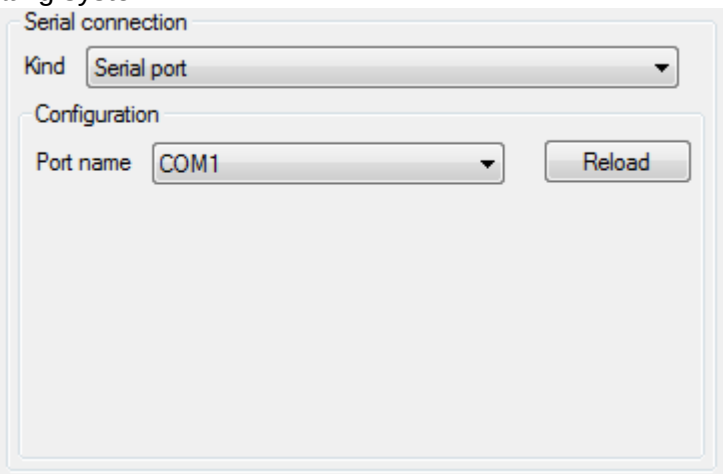



**Figure 5: Serial Port Configuration**

The “Configuration” group box has the following members:

- “Port name” is the serial port name. The combo box contains the serial port name list of known serial ports.
- The “Reload” button reloads the serial port name list.

The serial port name is stored into the user settings.

### 2.3.3. VISA

The serial connection kind “VISA” enables serial connections that use an installation of a VISA communication library. For instance, this enables the remote access to a device that is connected with another computer in the local area network.

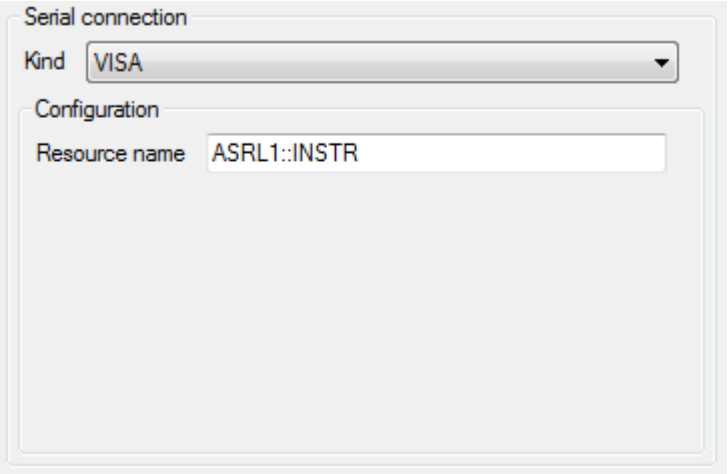



**Figure 6: VISA Configuration**

The “Configuration” group box has the following members:

- “Resource name” is the VISA resource name.

The VISA resource name is stored into the user settings.

## 2.4. Serial Configuration

The serial configuration is shared by the serial connection kinds. On the other hand, it is session kind specific. Therefore, every session kind provides its own default serial configuration. The serial configuration of a selected session kind can be adapted to installation specific needs.

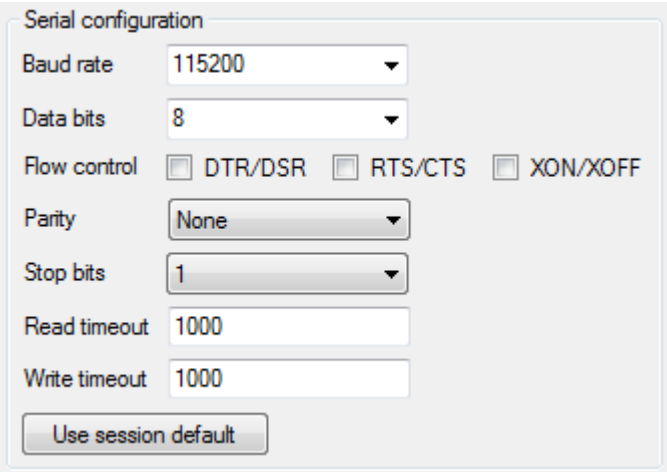



**Figure 7: Serial Configuration**

The “Serial configuration” group box has the following members:

- “Baud rate” is the baud rate.
- “Data bits” is the number of data bits.
- The “Flow control” checkboxes configure the handshake protocols used to control the data flow:
  - “DTR/DSR” enables the DTR/DSR hardware protocol.
  - “RTS/CTS” enables the RTS/CTS hardware protocol.
  - “XON/XOFF” enables the XON/XOFF software protocol.
- “Parity” is the usage of a parity bit. It is one of:
  - “Even”.

  - “Mark”.
  - “None”.
  - “Odd”.
  - “Space”.
- “Stop bits” is the number of stop bits. It is one of:
  - “1”.
  - “1.5”.
  - “2”.
- “Read timeout” is the timeout for read operations in milliseconds.
- “Write timeout” is the timeout for write operations in milliseconds.
- The “Use session default” button resets the serial configuration to the default of the selected session kind and updates the serial configuration view.

The serial configuration is stored per session kind into the user settings.

# 3. d-Drive Session

## 3.1. Overview

The d-Drive session provides a graphical user interface for accessing the digital piezo controller ***d-Drive***® from ***piezosystem jena***.
The d-Drive session adds the “d-Drive” tab to the main window. The “d-Drive” tab is divided into the following sections:

- The slot based information is on the left. Every slot (0 to 5) has its own tab.
- The common information is on the right.

On connecting, static information is queried.
While the session is connected, the following monitoring procedures are active:

- The measured value monitoring queries the measured values of all slots in intervals of approximately 100 milliseconds.
- The status monitoring queries additional status information of all slots in intervals of approximately 2 seconds.

If one of the monitoring procedures fails then the session is disconnected automatically.

## 3.2. Positioning

The “Positioning” group box provides the slot based access to positioning features.

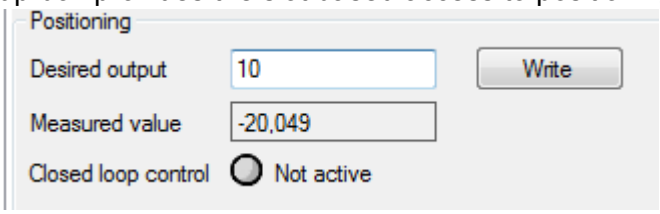



**Figure 8: Positioning**

The “Positioning” group box has the following members:

- “Desired output” is the desired output. The “Configure” button configures the desired output according to the textbox.
- “Measured value” is the measured value as determined by the measured value monitoring.
- “Closed loop control” is the activation state of the closed loop control as determined by the status monitoring:
  - “?”: No information is available.
  - “Not active”: The closed loop control is not active.
  - “Active”: The closed loop control is active.

## 3.3. Information

The “Information” tab provides slot based information.

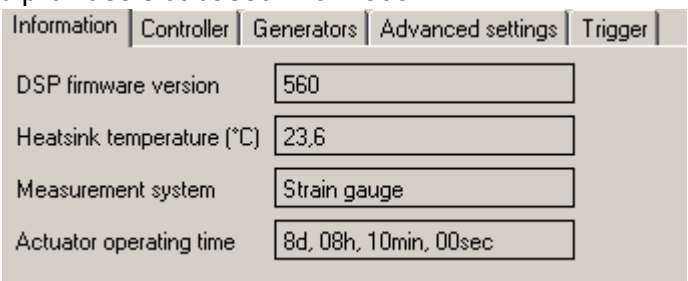



**Figure 9: Information**

The “Information” tab has the following members:

- “DSP firmware version” is the firmware version of the digital signal processor.

- “Heatsink temperature (°C)” is the internal temperature in °C of the amplifier as determined by the status monitoring.
- “Measurement system” is the measurement system of the actuator:
  - “None”: A measurement system is not present.
  - “Capacitive”: The measurement system is a capacitive sensor.
  - “Inductive”: The measurement system is an inductive sensor.
  - “Strain gauge”: The measurement system is a strain gauge.
  - “Unknown”: The measurement system is of an unknown type.
- “Actuator operating time” is the actuator operating time as determined by the status monitoring.

## 3.4. Controller

The “Controller” tab provides the slot based access to the controller.

### 3.4.1. Closed Loop Control

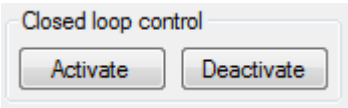



**Figure 10: Closed Loop Control**

The “Closed loop control” group box has the following members:

- The “Activate” button activates the closed loop control.
- The “Deactivate” button deactivates the closed loop control.

### 3.4.2. Modulation Input

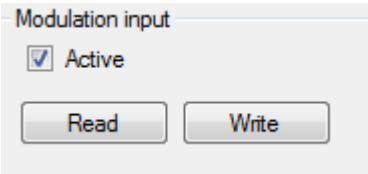



**Figure 11: Modulation Input**

The “Modulation input” group box has the following members:

- The “Active” checkbox is the activation state of the modulation input:
  - Checked: The modulation input is active.
  - Unchecked: The modulation input is not active.
- The “Read” button read the activation state of the modulation input and updates the checkbox.
- The “Write” button write the activation state of the modulation input according to the checkbox.

### 3.4.3. Slew Rate and PID

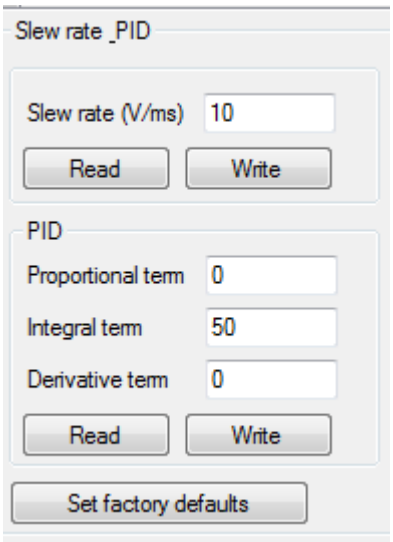



**Figure 12: Slew Rate and PID**

The upper group box has the following members:

- “Slew rate (V/ms)” is the slew rate in V/ms.
- The “Read” button reads the slew rate and updates the textbox.
- The “Write” button writes the slew rate according to the textbox.

The “PID” group box has the following members:

- “Proportional term” is the proportional term of the PID parameters.
- “Integral term” is the integral term of the PID parameters.
- “Derivative term” is the derivative term of the PID parameters.
- The “Read” button readss the PID parameters and updates the textboxes.
- The “Write" button writes the PID parameters according to the textboxes.

The “Set factory defaults” button configures the slew rate and the PID parameters to the factory defaults.

### 3.4.4. Filters

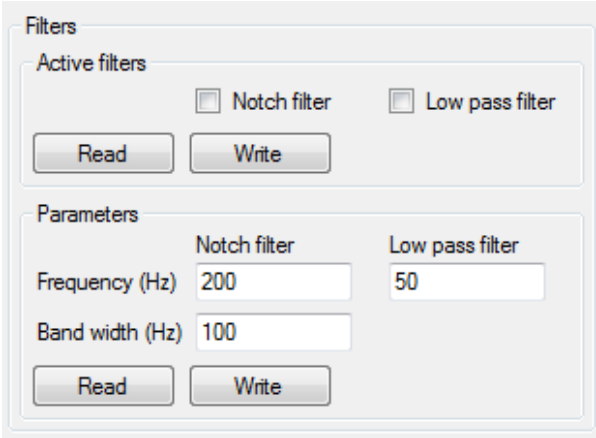



**Figure 13: Filters**

The “Active filters” group box has the following members:

- The “Notch filter” checkbox is the activation state of the notch filter:
  - Checked: The filter is active.
  - Unchecked: The filter is not active.
- The “Low pass filter” checkbox is the activation state of the low pass filter:
  - Checked: The filter is active.
  - Unchecked: The filter is not active.

- The “Read” button reads the activation states of the filters and updates the checkboxes.
- The “Write” button writes the activation states of the filters according to the checkboxes.

The “Parameters” group box has the following members:

- “Notch filter” column:
  - “Frequency (Hz)” is the notch filter frequency in Hz.
  - “Band width (Hz)” is the notch filter band width in Hz.
- “Low pass filter” column:
  - “Frequency (Hz)” is the low pass filter frequency in Hz.
- The “Read” button reads the filter parameters and updates the textboxes.
- The “Write” button writes the filter parameters according to the textboxes.

## 3.5. Generators

The “Generators” tab provides the slot based access to the generators.

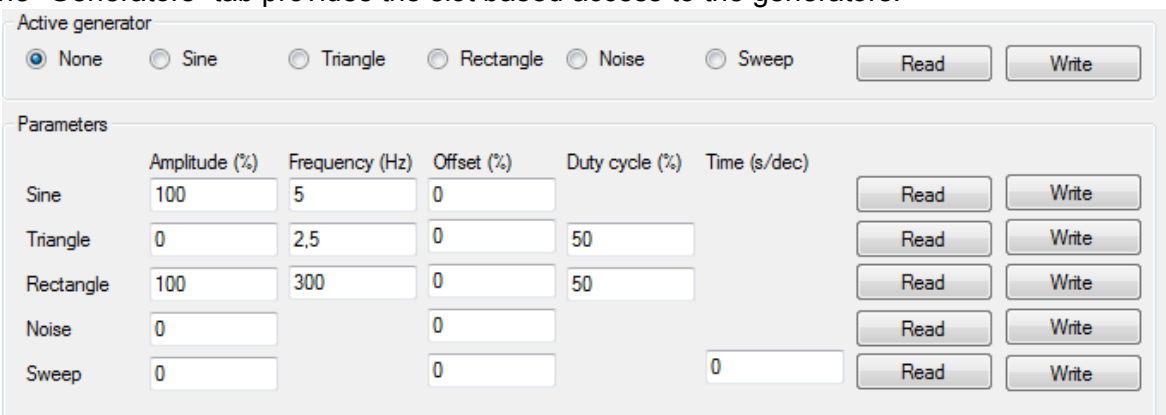



**Figure 14: Generators**

The “Active generator” group box has the following members:

- Every radio button is one of the possible generator activation states:
  - “None”: No generator is active.
  - “Sine”: The sine generator is active.
  - “Triangle”: The triangle generator is active.
  - “Rectangle”: The rectangle generator is active.
  - “Noise”: The noise generator is active.
  - “Sweep”: The sweep generator is active.
- The “Read” button reads the generator activation state and updates the radio button selection.
- The “Write” button writes the generator activation state according to the radio button selection.

The “Parameters” group box is organized as a table. Every generator has a column. The horizontal position of the column corresponds to the horizontal position of the generator activation state radio button in the “Active generator” group box.

The sine generator column has the following members:

- “Frequency (Hz)” is the frequency in Hz.
- “Amplitude (%)” is the amplitude expressed as a percentage.
- “Offset (%)” is the offset expressed as a percentage.
- The “Read” button reads the sine generator parameters and updates the textboxes.
- The “Write” button writes the sine generator parameters according to the textboxes.

The triangle generator column has the following members:

- “Frequency (Hz)” is the frequency in Hz.
- “Amplitude (%)” is the amplitude expressed as a percentage.
- “Offset (%)” is the offset expressed as a percentage.
- “Duty Cycle (%)” is the duty cycle expressed as a percentage.
- The “Read” button reads the triangle generator parameters and updates the textboxes.

- The “Write” button writes the triangle generator parameters according to the textboxes.

The rectangle generator column has the following members:

- “Frequency (Hz)” is the frequency in Hz.
- “Amplitude (%)” is the amplitude expressed as a percentage.
- “Offset (%)” is the offset expressed as a percentage.
- “Duty Cycle (%)” is the duty cycle expressed as a percentage.
- The “Read” button reads the rectangle generator parameters and updates the textboxes.
- The “write” button writes the rectangle generator parameters according to the textboxes.

The noise generator column has the following members:

- “Amplitude (%)” is the amplitude expressed as a percentage.
  - “Offset (%)” is the offset expressed as a percentage.
  - The “Read” button reads the noise generator parameters and updates the textboxes.
  - The “Write” button writes the noise generator parameters according to the textboxes.

The sweep generator column has the following members:

- “Amplitude (%)” is the amplitude expressed as a percentage.
- “Offset (%)” is the offset expressed as a percentage.
- “Time (s)” is the time in seconds.
- The “Read” button reads the sweep generator parameters and updates the textboxes.
- The “Write” button writes the sweep generator parameters according to the textboxes.

## 3.6. Advanced Settings

The “Advanced settings” tab provides the slot based access to advanced settings.

### 3.6.1. Monitor Output Source

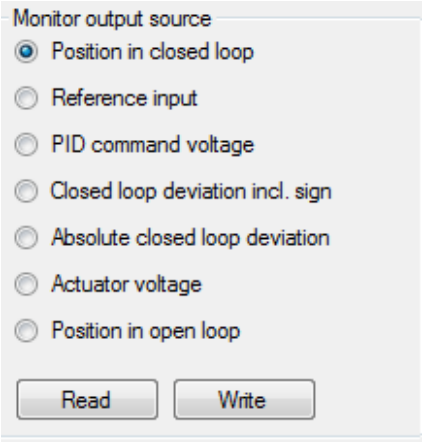



**Figure 15: Monitor Output Source**

The “Monitor output source” group box has the following members:

- Every radio button is one of the possible monitor output sources:
  - “Position in closed loop”.
  - “Reference input”.
  - “PID command voltage”.
  - “Closed loop deviation incl. sign”.
  - “Absolute closed loop deviation”.
  - “Actuator voltage”.
  - “Position in open loop”.
  - The “Read” button reads the monitor output source and updates the radio button selection.
- The “Write” button writes the monitor output source according to the radio button selection.

### 3.6.2. Actuator Formatting

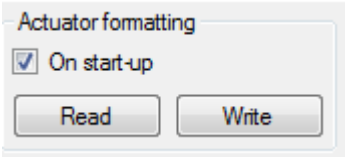



**Figure 16: Actuator Formatting**

The “Actuator formatting” group box has the following members:

- The “On start-up” checkbox is the activation state of the actuator formatting on device start-up:
  - Checked: The actuator is formatted on device start-up.
  - Unchecked: The actuator is not formatted on device start-up.
- The “Read” button reads the activation state of the actuator formatting and updates the checkbox.
- The “Write” button writes the activation state of the actuator formatting according to the checkbox.

## 3.7. Trigger

The “Trigger” tab provides the slot based access to the generators.

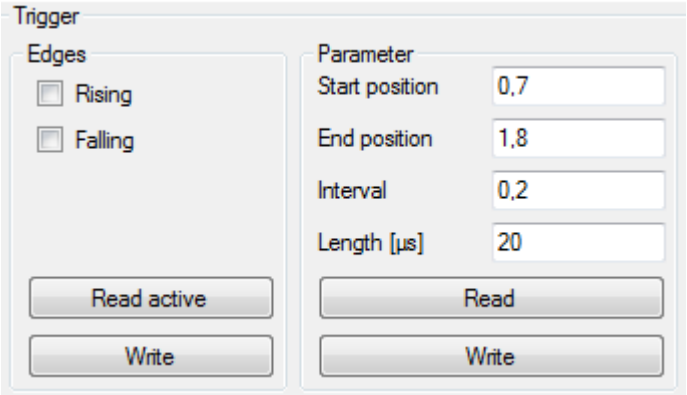



**Figure 17: Generators**

The “Edges” group box has the following members:

- “Rising” trigger generator at rising edges.
- “Falling” trigger generator at falling edges.

If both check boxes are checked both trigger are selected and vice versa.

- The “Read active” button reads the trigger edges state and updates the check box selection.
- The “Write” button writes the trigger edges state according to the check boxes.

The “Parameter” group box has the following members:

- “Start position” is the trigger generator stroke position start.
- “End position” is the trigger generator stroke position end.
- “Interval” is the trigger generator position interval.
- “Length [µs]” is the duration of the trigger impulse.
- The “Read” button reads the trigger edges parameter and updates the text boxes.
- The “Write” button writes the trigger edges parameter according to the text boxes.

## 3.8. Common Information

### 3.8.1. Measured Value Graph

The measured value graph is the combined graphical representation of the measured values of all slots as determined by the measured value monitoring. Samples are used for drawing. A sample consists of:

- The measured value.
- A timestamp that is determined after the measured value has been recorded.

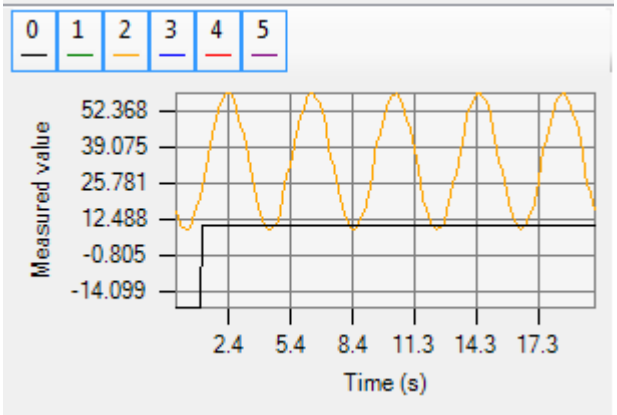



**Figure 18: Measured Value Graph**

The measured value graph has the following members:

- A list of tool buttons at the top. Every slot has a tool button. The tool button displays the slot number and the line color. The slot identifier is displayed as a tooltip. The checked state of the tool button is the visibility of the slot:
  - Checked: The slot is visible. This is the default on equipped slots.
  - Unchecked and Disabled: The slot is not visible. This is the default on not equipped slots.
  - Unchecked: Equipped slots can be marked unchecked and become not visible.
- The “Measured value” left axis is scaled to the range of measured values of the cached samples of all visible slots.
- Every visible slot has a drawing. Two consecutive samples in a drawing are connected by a straight line.
- The “Time (s)” bottom axis is fixed to the range of 20 seconds. The oldest sample in the cache defines the zero position. Old samples are shifted to the left and new samples are added to the right.

### 3.8.2. Device Information

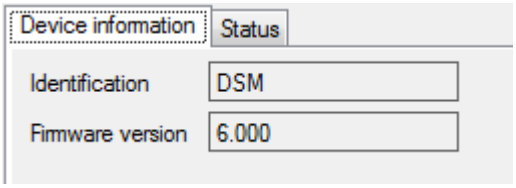



**Figure 19: Device Information**

The “Device information” tab has the following members:

- “Identification” is the device identification string.
- “Firmware version” is the firmware version of the device.

### 3.8.3. Status

The “Status” tab gives an overview of the status of all slots as determined by the status monitoring.

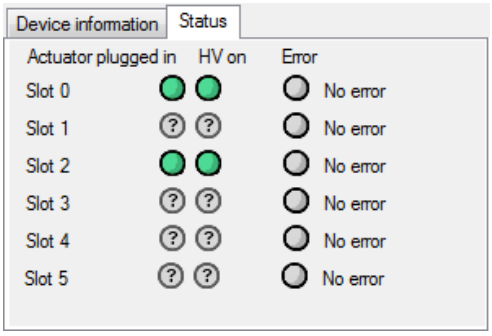



**Figure 20: Status**

The “Status” tab is organized as a table. Every slot has a row. The row has the following members:

- The left -most column is the slot identifier.
- “Actuator plugged in” column:
  - “?”: No information is available.
  - “”: No actuator is plugged in.
  - “”: An actuator is plugged in.
- “HV on” column:
  - “?”: No information is available.
  - “”: The high voltage is switched off.
  - “”: The high voltage is switched on.
- “Error” column:
  - “?”: No information is available.
  - “ No error”: There is no error.
  - “”: There is an error. Additional information describing the error source is provided as a list to the right of the error symbol. The list contains one or more of the following entries:
    - “DSP communication error”.
    - “EVD not ready”.
    - “I²C error”.
    - “Overload”.
    - “Temperature out of range”.
    - “Underload”.
    - “Unknown error”.

### 3.8.4. Amplifier

The “Amplifier” tab gives an overview of all amplifier versions.

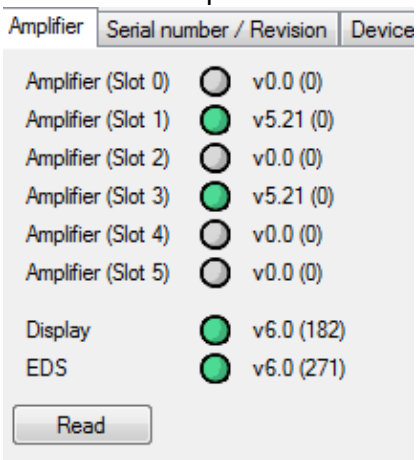



**Figure 21: Amplifier**

The “Amplifier” tab is organized as a table. Every slot has a row. Additional the version for the display and the EDS are shown. The row has the following members:

- The left-most column is the slot identifier.
- “Slot equipped” column:
  - “?”: No information is available.
  - “”: Slot is not equipped.
  - “”: Slot is equipped.
- “Version” column:
  - Consists of “v” [major version]”.”[release version]” (“[build version]”)”
- The “Read” button reads the versions and updates the table.

### 3.8.5. Serial number / Revision

The “Serial number / Revision” tab gives an overview of all plug-in boards versions.

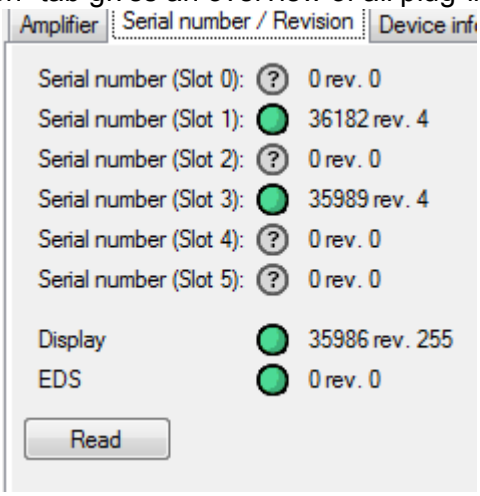



**Figure 22: Serial number**

The “Serial number / Revision” tab is organized as a table. Every slot has a row. Additional the version for the display and the EDS are shown. The row has the following members:

- The left -most column is the slot identifier.
- “Slot equipped” column:
  - “?”: No information is available.
  - “”: Slot is not equipped.
  - “”: Slot is equipped.
- “Version” column:
  - Consists of a serial number and a revision number.
- The “Read” button reads the versions and updates the table.

# 4. d-Drive pro Session

## 4.1. Overview

The d-Drive pro session provides a graphical user interface for accessing the digital piezo controller ***d-Drive pro***® from ***piezosystem jena***.
The d-Drive pro session adds the “d-Drive pro” tab to the main window. The “d-Drive pro” tab is divided into the following sections:

- Device setting like power state, number format and time setting on device tab.
- The channel based information is on the left. Every channel (0 to 2) has its own tab.
- Terminal for additional commands on terminal tab.
- The common information is on the right.

On connecting, static information is queried.
While the session is connected, the following monitoring procedures are active:

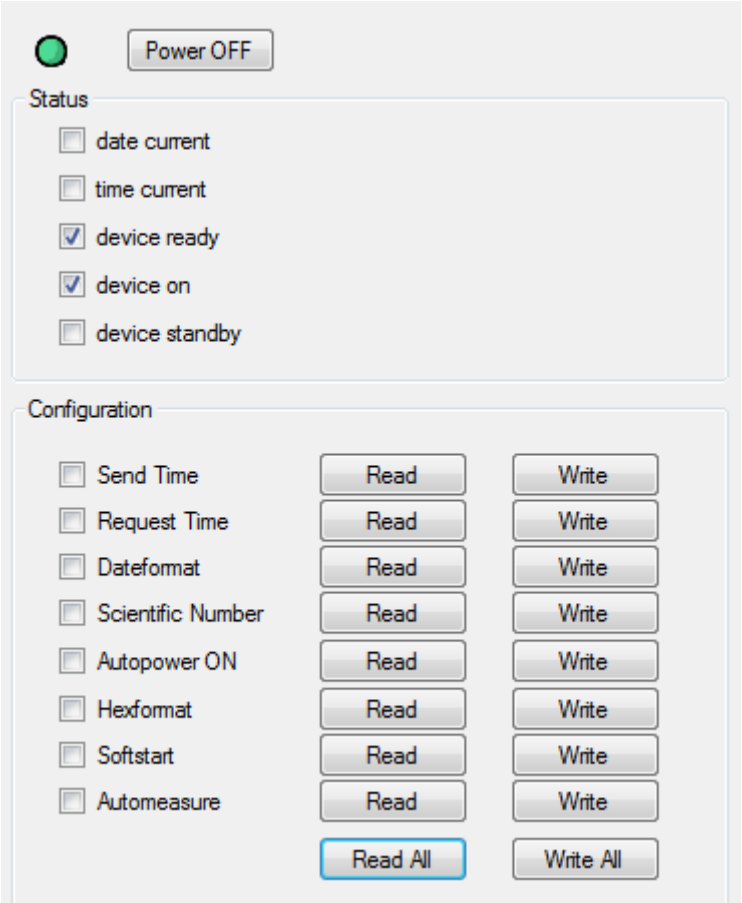
- The measured value monitoring queries the measured values and loop state of all channels in intervals of approximately 200 milliseconds.
- The status monitoring queries additional status information of all channels in intervals of approximately 2 seconds.

If one of the monitoring procedures fails then the session is disconnected automatically

## 4.2. Device state

The device state start with the power.

- “●”: The device is in stand by mode.
- “●”: The device is in on mode.




Status register (User manual capture 11) and config register (User manual capture 12).

## 4.3. Positioning

The “Positioning” group box provides the slot based access to positioning features.

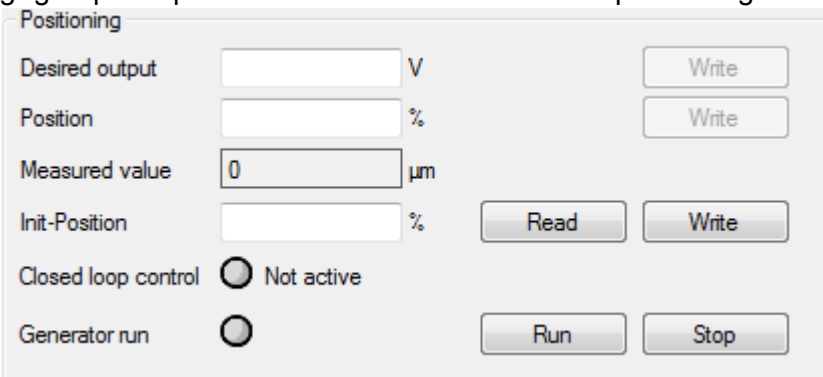



**Figure 23: Positioning**

The “Positioning” group box has the following members:

- “Desired output” is the desired output. The “Write” button configures the desired output according to the textbox. The button is only useable if a valid value is inside.
- "Position" is the way position in percent.
- “Measured value” is the measured value as determined by the measured value monitoring.
- "Init-Position" is the position on the next start from stand-by or turn power on.
- “Closed loop control” is the activation state of the closed loop control as determined by the status monitoring:
  - “?”: No information is available.
  - “ Not active”: The closed loop control is not active.
  - “ Active”: The closed loop control is active.
- "Generator run" is the state of the generator. With the "Run" button can the select channel start.
  - “”: Generator in stop state.
  - “ ”: Generator in run state.

## 4.4. Information

The “Information” tab provides slot based information.

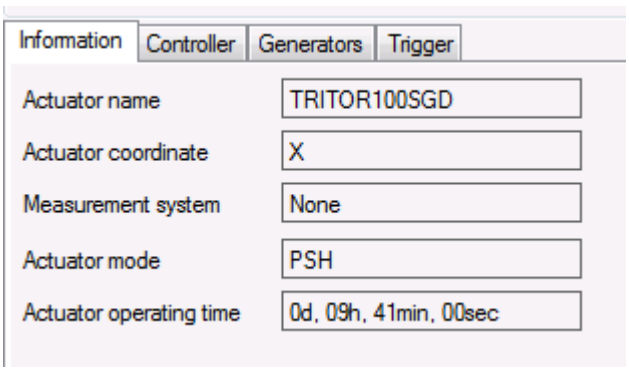



**Figure 24: Information**

The “Information” tab has the following members:

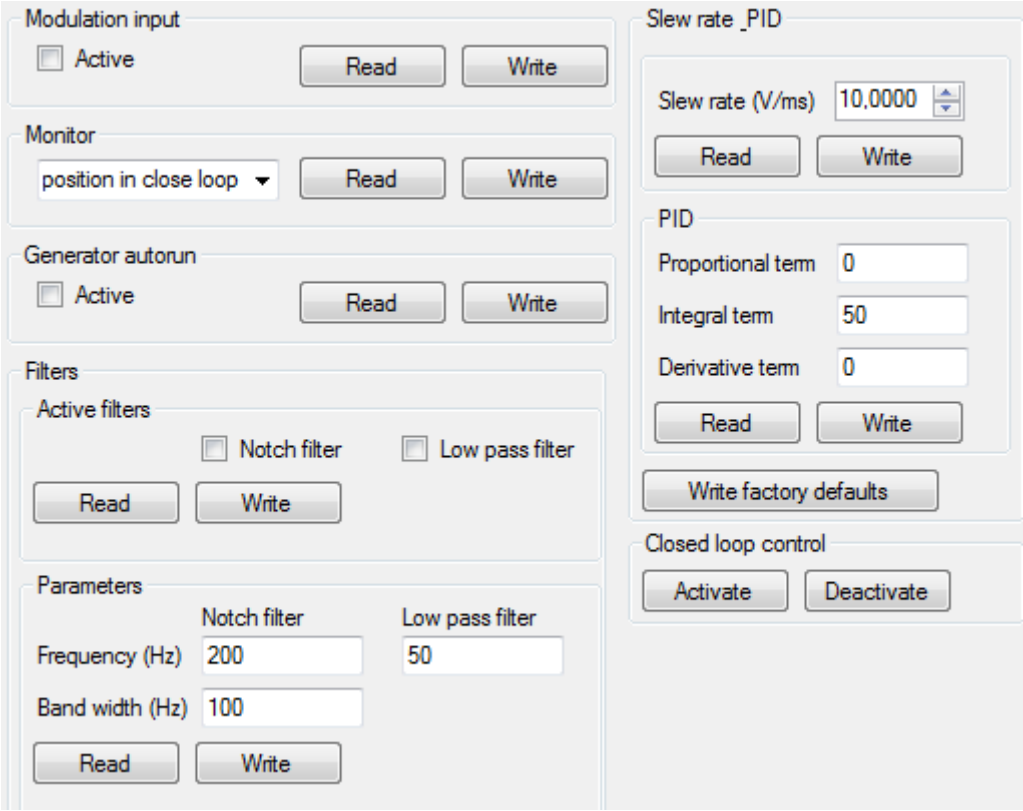
- “Actuator name” is the type name of actuator.
- “Actuator coordinate” is direction of the movement.
- “Measurement system” is the measurement system of the actuator:
  - “None”: A measurement system is not present.

- "Capacitive": The measurement system is a capacitive sensor.
- "Inductive": The measurement system is an inductive sensor.
- "Strain gauge": The measurement system is a strain gauge.
- "Unknown": The measurement system is of an unknown type.

- " Actuator mode" is the actuator movement system.
- "Actuator operating time" is the actuator operating time as determined by the status monitoring.

## 4.5. Controller

The "Controller" tab provides the slot based access to the controller.




### 4.5.1. Closed Loop Control

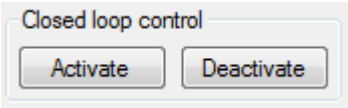



**Figure 25: Closed Loop Control**

The "Closed loop control" group box has the following members:

- The "Activate" button activates the closed loop control.
- The "Deactivate" button deactivates the closed loop control.

The state can above in the positioning see.

### 4.5.2. Modulation Input

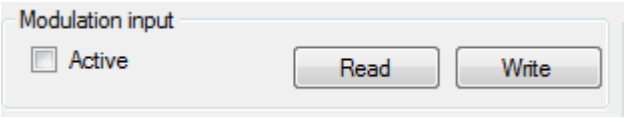



**Figure 26: Modulation Input**

The "Modulation input" group box has the following members:

- The "Active" checkbox is the activation state of the modulation input:
  - Checked: The modulation input is active.

- Unchecked: The modulation input is not active.
- The “Read” button reads the activation state of the modulation input and updates the checkbox.
- The “Wrie” button writes the activation state of the modulation input according to the checkbox.

### 4.5.3. Monitor

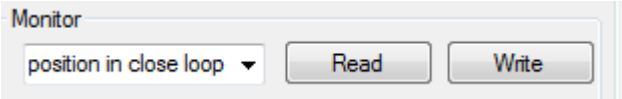



**Figure 27: Monitor**

The “Monitor” combo box has the following members:

- “Position in closed loop”.
- “command value”.
- “controller output voltage”.
- “relative error”.
- “absolute error”.
- “position in open loop”.
- “actuator voltage”.
- "actuator currency”.
- "actuator voltage nanoX”.

- The “Read” button reads the monitor output source and updates the radio button selection.
- The “Write” button writes the monitor output source according to the radio button selection.

### 4.5.4. Slew Rate and PID

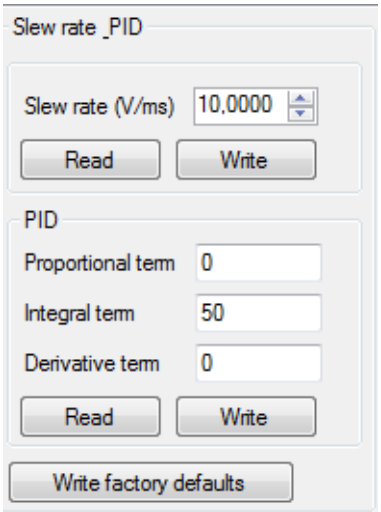



**Figure 28: Slew Rate and PID**

The upper group box has the following members:

- “Slew rate (V/ms)” is the slew rate in V/ms.
- The “Read” button reads the slew rate and updates the textbox.
- The “Write” button writes the slew rate according to the textbox.

The “PID” group box has the following members:

- “Proportional term” is the proportional term of the PID parameters.
- “Integral term” is the integral term of the PID parameters.
- “Derivative term” is the derivative term of the PID parameters.
- The “Read” button reads the PID parameters and updates the textboxes.

- The “Write" button writes the PID parameters according to the textboxes.

The “Write factory defaults” button writes the slew rate and the PID parameters to the factory defaults.

### 4.5.5. Filters

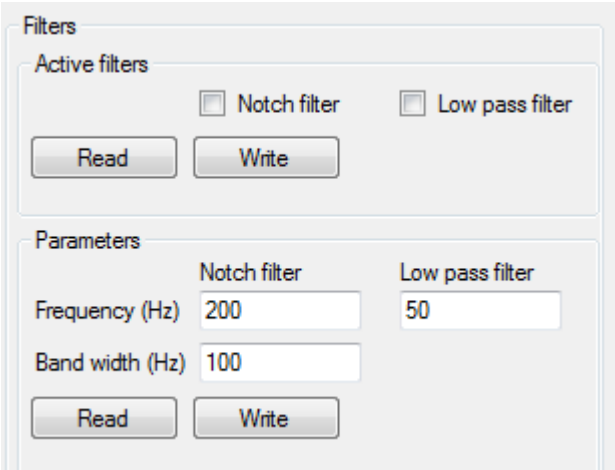



**Figure 29: Filters**

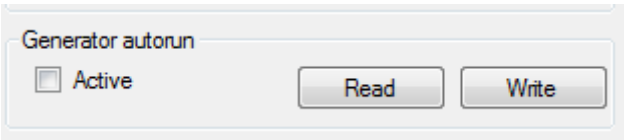
The “Active filters” group box has the following members:

- The “Notch filter” checkbox is the activation state of the notch filter:
  - Checked: The filter is active.
  - Unchecked: The filter is not active.
- The “Low pass filter” checkbox is the activation state of the low pass filter:
  - Checked: The filter is active.
  - Unchecked: The filter is not active.
- The “Read” button reads the activation states of the filters and updates the checkboxes.
- The “Write” button writes the activation states of the filters according to the checkboxes.

The “Parameters” group box has the following members:

- “Notch filter” column:
  - “Frequency (Hz)” is the notch filter frequency in Hz.
  - “Band width (Hz)” is the notch filter band width in Hz.
- “Low pass filter” column:
  - “Frequency (Hz)” is the low pass filter frequency in Hz.
- The “Read” button reads the filter parameters and updates the textboxes.
- The “Write” button writes the filter parameters according to the textboxes.

### 4.5.6. Generator autorun




With the autorun of generator you can start the generator with the power on without a command or connection. The autorun can only start sinus, triangle and rectangle. Abitrary is not possible because the values must load first at start.

## 4.6. Generators

The “Generators” tab provides the slot based access to the generators.

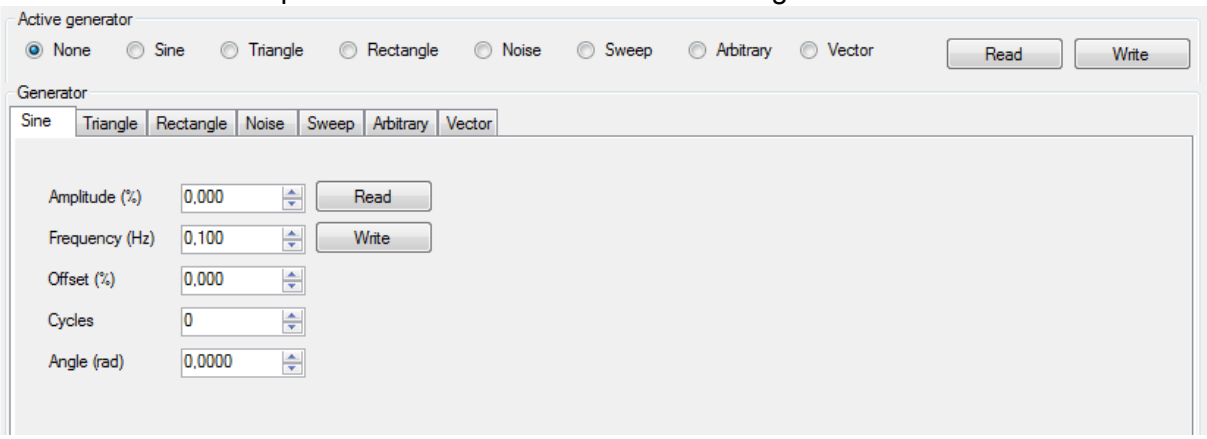



**Figure 30: Generators**

The “Active generator” group box has the following members:

- Every radio button is one of the possible generator activation states:
  - “None”: No generator is active.
  - “Sine”: The sine generator is active.
  - “Triangle”: The triangle generator is active.
  - “Rectangle”: The rectangle generator is active.
  - “Noise”: The noise generator is active.
  - “Sweep”: The sweep generator is active.
  - "Arbitrary": The abitrary generator is active:
  - "Vector": The vector generator is active.
- The “Read” button reads the generator activation state and updates the radio button selection.
- The “Write” button writes the generator activation state according to the radio button selection.

The Parameters are organized in tabs. Every generator has a own tab. The new tab layout should give lesser information for more overview because the more possibilities

The sine generator tab has the following members:

- “Frequency (Hz)” is the frequency in Hz.
- “Amplitude (%)” is the amplitude expressed as a percentage.
- “Offset (%)” is the offset expressed as a percentage.
- "Cycles" is the number of repetition. Zero is for endless.
- "Angle (rad)" is the start angle of the function.
- The “Read” button reads the sine generator parameters and updates the textboxes.
- The “Write” button writes the sine generator parameters according to the textboxes.

The triangle generator tab has the following members:

- “Frequency (Hz)” is the frequency in Hz.
- “Amplitude (%)” is the amplitude expressed as a percentage.
- “Offset (%)” is the offset expressed as a percentage.
- “Duty Cycle (%)” is the duty cycle expressed as a percentage.
- "Cycles" is the number of repetition. Zero is for endless.
- "Angle (rad)" is the start angle of the function.
- The “Read” button reads the triangle generator parameters and updates the textboxes.
- The “Write” button writes the triangle generator parameters according to the textboxes.

The rectangle generator tab has the following members:

- “Frequency (Hz)” is the frequency in Hz.
- “Amplitude (%)” is the amplitude expressed as a percentage.

- “Offset (%)” is the offset expressed as a percentage.
- "Cycles" is the number of repetition. Zero is for endless.
- "Angle (rad)" is the start angle of the function.
- “Duty Cycle (%)” is the duty cycle expressed as a percentage.
- The “Read” button reads the rectangle generator parameters and updates the textboxes.
- The “Write” button writes the rectangle generator parameters according to the textboxes.

The noise generator column has the following members:

- “Amplitude (%)” is the amplitude expressed as a percentage.
- “Offset (%)” is the offset expressed as a percentage.
- The “Read” button reads the noise generator parameters and updates the textboxes.
- The “Write” button writes the noise generator parameters according to the textboxes.

The sweep generator tab has the following members:

- “Amplitude (%)” is the amplitude expressed as a percentage.
- “Offset (%)” is the offset expressed as a percentage.
- “Time (s)” is the time in seconds.
- "Startfrequency (Hz)" is the frequency on the start of generator in hertz.
- "Endfrequency (Hz)" is the frequency on the end of generator in hertz.
- "Startmarkerfrequency (Hz)" is the frequency on the trigger go from low to high in hertz.
- "Endmarkerfrequency (Hz)" is the frequency on the trigger go from high to low in hertz. NOTE: The trigger function MUST off (trgedge = 0)
- "Cycles" is the number of repetition. Zero is for endless.
- The “Read” button reads the sweep generator parameters and updates the textboxes.
- The “Write” button writes the sweep generator parameters according to the textboxes.

The arbitrary generator tab has the following members:

- “Startindex” is the first index of the arbitary/vector value storage.
- “Endindex” is the last index of the arbitary/vector value storage.
- "Cycles" is the number of repetition. Zero is for endless.
- "Sampleoffset" is the first value relativ to startindex at start of generator.
- “Divisor” is the time factor for new values multiple with 20µs.
- The “Read” button reades the rectangle generator parameters and updates the textboxes.
- The “Write” button writes the rectangle generator parameters according to the textboxes.

The vector generator tab has the following members:

- "Cycles" is the number of repetition. Zero is for endless.
- The “Read” button reads the rectangle generator parameters and updates the textboxes.
- The “Write” button writes the rectangle generator parameters according to the textboxes.

Vector generator values can load over the intern terminal with " gvecload,ch,xxx.txt"

You can start every chanel separate over the run button above.
For a syncron start stop all gererator and start with "grun,1,1,1" over terminal tab.

## 4.7. Trigger

The “Trigger” tab provides the slot based access to the generators.

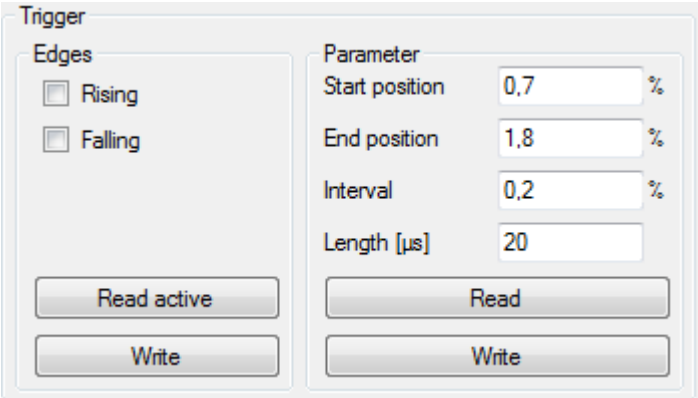



**Figure 31: Generators**

The “Edges” group box has the following members:

- “Rising” trigger generator at rising edges.
- “Falling” trigger generator at falling edges.

If both check boxes are checked both trigger are selected and vice versa.

- The “Read active” button reads the trigger edges state and updates the check box selection.
- The “Write” button writes the trigger edges state according to the check boxes.

The “Parameter” group box has the following members:

- “Start position” is the trigger generator stroke position start.
- “End position” is the trigger generator stroke position end.
- “Interval” is the trigger generator position interval.
- “Length [µs]” is the duration of the trigger impulse.
- The “Read” button reads the trigger edges parameter and updates the text boxes.
- The “Write” button writes the trigger edges parameter according to the text boxes.

## 4.8. Common Information

### 4.8.1. Measured Value Graph

The measured value graph is the combined graphical representation of the measured values of all slots as determined by the measured value monitoring. Samples are used for drawing. A sample consists of:

- The measured value.
- A timestamp that is determined after the measured value has been recorded.

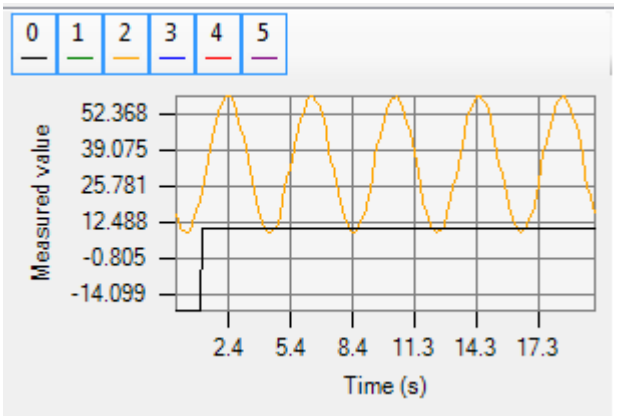



**Figure 32: Measured Value Graph**

The measured value graph has the following members:

- A list of tool buttons at the top. Every slot has a tool button. The tool button displays the slot number and the line color. The slot identifier is displayed as a tooltip. The checked state of the tool button is the visibility of the slot:
  - Checked: The slot is visible. This is the default on equipped slots.
  - Unchecked and Disabled: The slot is not visible. This is the default on not equipped slots.
  - Unchecked: Equipped slots can be marked unchecked and become not visible.
- The “Measured value” left axis is scaled to the range of measured values of the cached samples of all visible slots.
- Every visible slot has a drawing. Two consecutive samples in a drawing are connected by a straight line.
- The “Time (s)” bottom axis is fixed to the range of 20 seconds. The oldest sample in the cache defines the zero position. Old samples are shifted to the left and new samples are added to the right.

### 4.8.2. Device Information

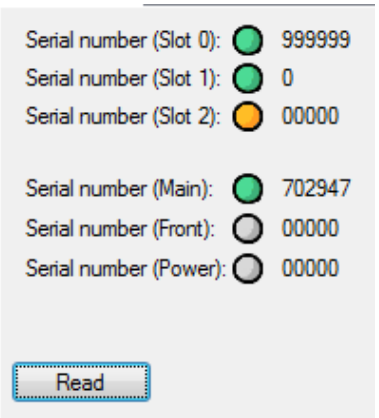



**Figure 33: Device Information**

The “Serial number” tab has the following members:

- “Serial number (Slot x)” is the serial number of the actuator.
- “Serial number (Main)” is the serial number of the main controller.
- “Serial number (Front)” is the serial number of the front controller.
- “Serial number (Power)” is the serial number of the power controller.

### 4.8.3. Firmware

The “Firmware” tab gives an overview of the installed Firmware of all controller.

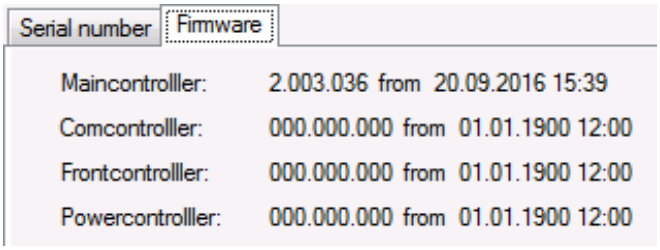



**Figure 34: Status**

The “Firmware” tab is organized as a table. Every controller has a row. The row has the following members:

- The left-most column is the controller name.
- Firmware number column: major.minor.build
- Build date column:
  - Date.
  - Time

# 5. 30DV50/300 Session

## 5.1. Overview

The 30DV50/300 session provides a graphical user interface for accessing the digital piezo controller ***30DV50***® and ***30DV300***® from ***piezosystem jena***.
The 30DV50/300 session adds the “30DV50/300” tab to the main window.
On connecting, static information is queried.
While the session is connected, the following monitoring procedures are active:

- The measured value monitoring queries the measured value in intervals of approximately 100 milliseconds.
- The status monitoring queries additional status information in intervals of approximately 2 seconds.

If one of the monitoring procedures fails then the session is disconnected automatically.

## 5.2. Positioning

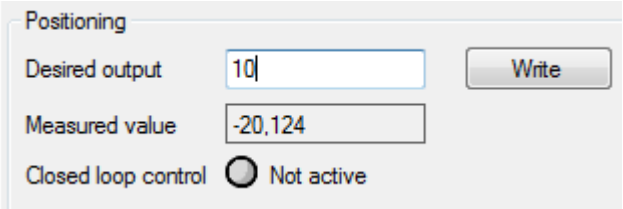



**Figure 35: Positioning**

The “Positioning” group box has the following members:

- “Desired output” is the desired output. The “Write” button writes the desired output according to the textbox.
- “Measured value” is the measured value as determined by the measured value monitoring.
- “Closed loop control” is the activation state of the closed loop control as determined by the status monitoring:
  - “?”: No information is available.
  - “Not active”: The closed loop control is not active.
  - “Active”: The closed loop control is active.

An additional member of the “Positioning” group box is the measured value graph on the right. The measured value graph is the graphical representation of the measured values as determined by the measured value monitoring. Samples are used for drawing. A sample consists of:

- The measured value.
- A timestamp that is determined after the measured value has been recorded.

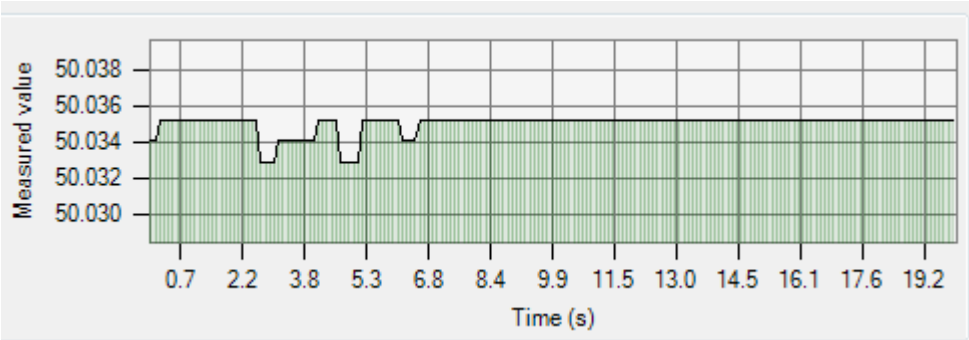



**Figure 36: Measured Value Graph**

The measured value graph has the following members:

- The “Measured value” left axis is scaled to the range of measured values of the cached samples.
- The drawing of the samples has the following properties:
  - Two consecutive samples are connected by a straight line.
  - Every sample is represented by a vertical line between the measured value and the zero position of the left axis.
  - The region between two consecutive samples is filled towards the zero position of the left axis.
- The “Time (s)” bottom axis is fixed to the range of 20 seconds. The oldest sample in the cache defines the zero position. Old samples are shifted to the left and new samples are added to the right.

## 5.3. Information

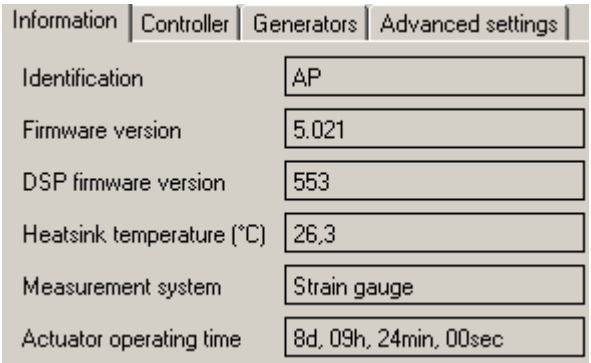



**Figure 37: Information**

The “Information” tab has the following members:

- “Identification” is the device identification string.
- “Firmware version” is the firmware version of the amplifier.
- “DSP firmware version” is the firmware version of the digital signal processor.
- “Heatsink temperature (°C)” is the internal temperature in °C of the amplifier as determined by the status monitoring.
- “Measurement system” is the measurement system of the actuator:
  - “None”: A measurement system is not present.
  - “Capacitive”: The measurement system is a capacitive sensor.
  - “Inductive”: The measurement system is an inductive sensor.
  - “Strain gauge”: The measurement system is a strain gauge.
  - “Unknown”: The measurement system is of an unknown type.
- “Actuator operating time” is the actuator operating time as determined by the status monitoring.

## 5.4. Controller

The “Controller” tab provides the access to the controller.

### 5.4.1. Closed Loop Control

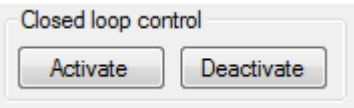



**Figure 38: Closed Loop Control**

The “Closed loop control” group box has the following members:

- The “Activate” button activates the closed loop control.
- The “Deactivate” button deactivates the closed loop control.

### 5.4.2. Modulation Input

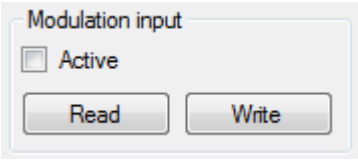



**Figure 39: Modulation Input**

The “Modulation input” group box has the following members:

- The “Active” checkbox is the activation state of the modulation input:
  - Checked: The modulation input is active.
  - Unchecked: The modulation input is not active.
- The “Read” button reads the activation state of the modulation input and updates the checkbox.
- The “Write” button writes the activation state of the modulation input according to the checkbox.

### 5.4.3. Slew Rate and PID

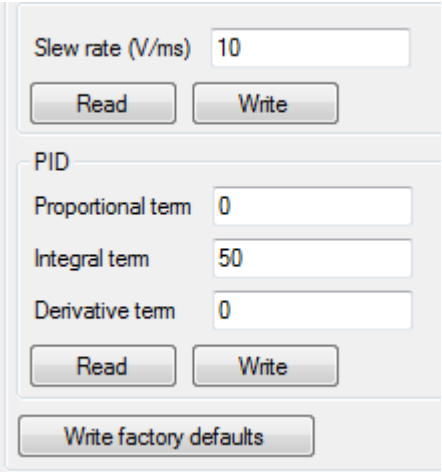



**Figure 40: Slew Rate and PID**

The upper group box has the following members:

- “Slew rate (V/ms)” is the slew rate in V/ms.
- The “Read” button reads the slew rate and updates the textbox.
- The “Write” button writes the slew rate according to the textbox.

The “PID” group box has the following members:

- “Proportional term” is the proportional term of the PID parameters.
- “Integral term” is the integral term of the PID parameters.
- “Derivative term” is the derivative term of the PID parameters.
- The “Read” button reads the PID parameters and updates the textboxes.
- The “Write button writees the PID parameters according to the textboxes.

The “Write factory defaults” button writes the slew rate and the PID parameters to the factory defaults.

### 5.4.4. Filters

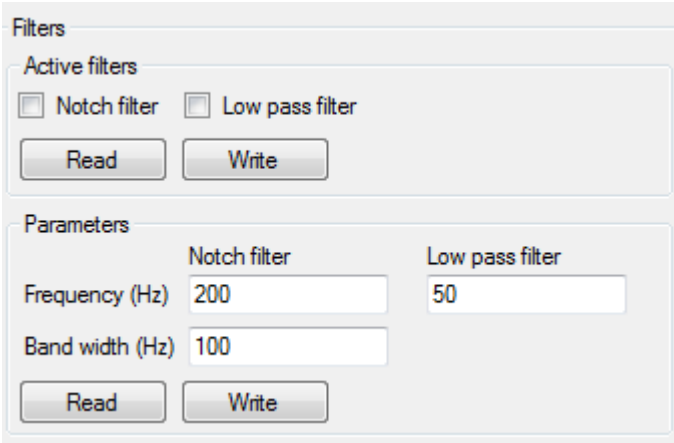



**Figure 41: Filters**

The “Active filters” group box has the following members:

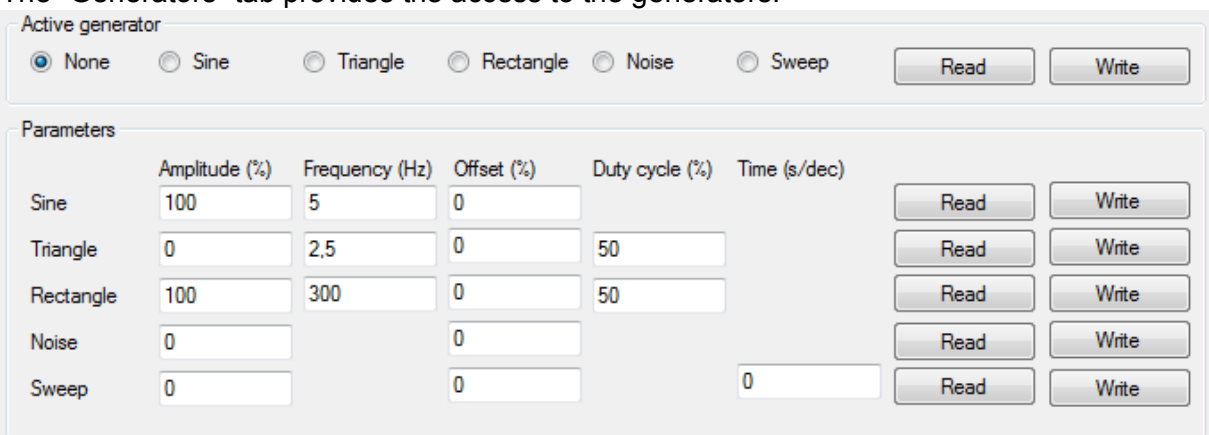
- The “Notch filter” checkbox is the activation state of the notch filter:
  - Checked: The filter is active.
  - Unchecked: The filter is not active.
- The “Low pass filter” checkbox is the activation state of the low pass filter:
  - Checked: The filter is active.
  - Unchecked: The filter is not active.
- The “Read” button reads the activation states of the filters and updates the checkboxes.
- The “Write” button writes the activation states of the filters according to the checkboxes.

The “Parameters” group box has the following members:

- “Notch filter” column:
  - “Frequency (Hz)” is the notch filter frequency in Hz.
  - “Band width (Hz)” is the notch filter band width in Hz.
- “Low pass filter” column:
  - “Frequency (Hz)” is the low pass filter frequency in Hz.
- The “Read” button reads the filter parameters and updates the textboxes.
- The “Write” button writes the filter parameters according to the textboxes.

## 5.5. Generators

The “Generators” tab provides the access to the generators.




### 5.5.1. Active Generator

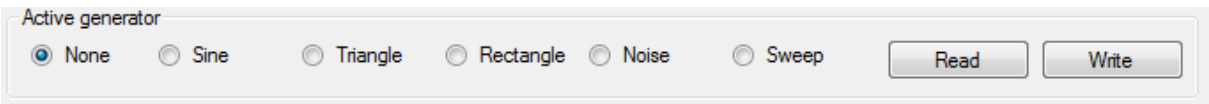



**Figure 42: Active Generator**

The “Active generator” group box has the following members:

- Every radio button is one of the possible generator activation states:
  - “None”: No generator is active.
  - “Noise”: The noise generator is active.
  - “Rectangle”: The rectangle generator is active.
  - “Sine”: The sine generator is active.
  - “Sweep”: The sweep generator is active.
  - “Triangle”: The triangle generator is active.
- The “Read” button reads the generator activation state and updates the radio button selection.
- The “Write” button writes the generator activation state according to the radio button selection.

### 5.5.2. Parameters

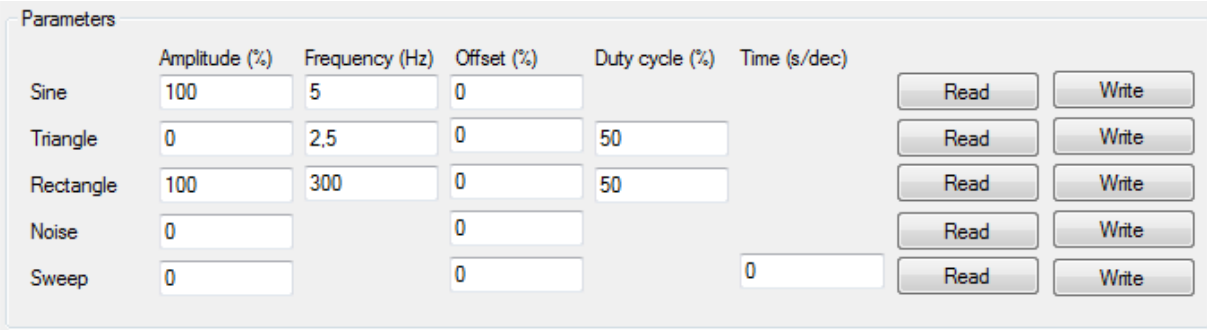



**Figure 43: Generator Parameters**

The “Parameters” group box has the following members:

The sine generator has the following parameters:

- “Frequency (Hz)” is the frequency in Hz.
- “Amplitude (%)” is the amplitude expressed as a percentage.
- “Offset (%)” is the offset expressed as a percentage.

The Triangle generator has the following parameters:

- “Frequency (Hz)” is the frequency in Hz.
- “Amplitude (%)” is the amplitude expressed as a percentage.
- “Offset (%)” is the offset expressed as a percentage.
- “Duty Cycle (%)” is the duty cycle expressed as a percentage.

The rectangle generator has the following parameters:

- “Frequency (Hz)” is the frequency in Hz.
- “Amplitude (%)” is the amplitude expressed as a percentage.
- “Offset (%)” is the offset expressed as a percentage.
- “Duty Cycle (%)” is the duty cycle expressed as a percentage.

The noise generator has the following parameters:

- “Amplitude (%)” is the amplitude expressed as a percentage.
- “Offset (%)” is the offset expressed as a percentage.

The sweep generator has the following parameters:

- “Amplitude (%)” is the amplitude expressed as a percentage.
- “Offset (%)” is the offset expressed as a percentage.
- “Time (s)” is the time in seconds.

- The “Read” button reads the parameters of the selected generator and updates the textboxes.
- The “Write” button writes the parameters of the selected generator according to the textboxes.

## 5.6. Advanced Settings

The “Advanced settings” tab provides the access to advanced settings.

### 5.6.1. Monitor Output Source

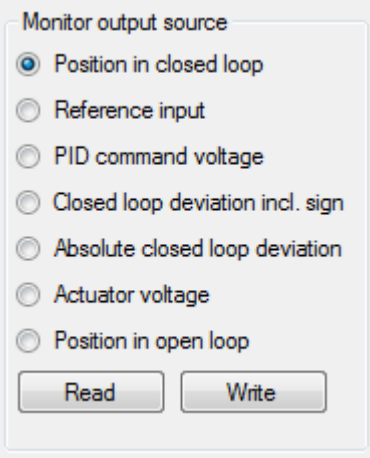



**Figure 44: Monitor Output Source**

The “Monitor output source” group box has the following members:

- Every radio button is one of the possible monitor output sources:
  - “Position in closed loop”.
  - “Reference input”.
  - “PID command voltage”.
  - “Closed loop deviation incl. sign”.
  - “Absolute closed loop deviation”.
  - “Actuator voltage”.
  - “Position in open loop”.
- The “Read” button reads the monitor output source and updates the radio button selection.
- The “Write” button writes the monitor output source according to the radio button selection.

### 5.6.2. Actuator Formatting

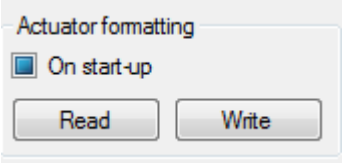



**Figure 45: Actuator Formatting**

The “Actuator formatting” group box has the following members:

- The “On start-up” checkbox is the activation state of the actuator formatting on device start-up:
  - Filled: State is undefine
  - Checked: The actuator is formatted on device start-up.
  - Unchecked: The actuator is not formatted on device start-up.
- The “Read” button reads the activation state of the actuator formatting and updates the checkbox.
- The “Write” button writes the activation state of the actuator formatting according to the checkbox.

## 5.7. Status

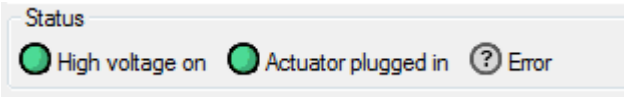



**Figure 46: Status**

The “Status” group box has the following members:

- The symbol “High voltage on” is the status of the high voltage switch as determined by the status monitoring:
  - “?”: No information is available.
  - “”: The high voltage is switched off.
  - “”: The high voltage is switched on.
- The symbol “Actuator plugged in” is the actuator plug-in state as determined by the status monitoring:
  - “?”: No information is available.
  - “”: No actuator is plugged in.
  - “”: An actuator is plugged in.
- The right-most symbol is connected to the automatic error change reporting feature of the device:
  - “? Error”: There is no last error report available.
  - “ No error”: The last error report denotes no error.
  - “”: The last error report denotes an error. Additional information describing the error source is provided as a list to the right of the symbol. The list contains one or more of the following entries:
    - “DSP communication error”.
    - “EVD not ready”.
    - “I²C error”.
    - “Overload”.
    - “Temperature out of range”.
    - “Underload”.
    - “Unknown error”.

# 6. Terminal Session

## 6.1. Overview

The Terminal session provides a user interface that allows a low-level access to a device that is connected with a serial interface. The serial protocol of the device is accessed directly by sending commands and receiving responses as byte sequences.

The Terminal session adds the following tabs to the main window:

- The “Terminal” tab is used to communicate with the device.
- The “Configuration” tab is used to configure additional communication parameters and the data representation.

While the session is connected, the serial connection is monitored. The monitoring checks for received byte sequence responses. If the monitoring fails then the session is disconnected automatically. Receiving no response is not a cause for failing.

### 6.1.1. Byte Sequence as Text

A byte sequence can be represented as text. The following general definitions are used:

- The text encoding is Windows-1252.
- The escape character is a back-slash character (U+005C).
- A control character is a character in the UNICODE category Control (U+0000, ..., U+001F, U+007F, U+0080, ..., U+009F).

Parsing the text on user input uses the following rules:

- An escape character followed by an escape character is interpreted as one escape character that is converted to a byte using the encoding.
- An escape character followed by two hexadecimal digit characters is converted to a byte where the first digit character is interpreted as the higher four bits and the second digit character is interpreted as the lower four bits. The digit character can be a lower case (“01234567890abcdef”) or an upper case (“0123456780ABCDEF”).
- An escape character followed by any other character is an error.
- Every other character is converted to a byte using the encoding.

Building the text without control characters uses the following rules:

- Every byte is converted to an UNICODE character using the encoding.
- If the resulting character is a control character then no character is added to the text.
- If the resulting character is the escape character then two escape characters are added to the text.
- Otherwise, the character is added to the text.

Building the text with control characters uses the following rules:

- Every byte is converted to an UNICODE character using the encoding.
- If the resulting character is a control character then an escape character followed by two upper case hexadecimal digits (“0123456789ABCDEF”) is added to the text where the higher four bits are followed by the lower four bits.
- If the resulting character is the escape character then two escape characters are added to the text.
- Otherwise, the character is added to the text.

### 6.1.2. Byte Sequence as Hexadecimal Text

A byte sequence can be represented as a hexadecimal text.

Parsing the hexadecimal text on user input uses the following rules:

- Any white-space character (U+000A, U+000B, U+000C, U+000D, U+0020, U+0085, U+00A0, U+2028, U+2029) is ignored.
- Every byte is represented by two hexadecimal digit characters where the higher four bits are followed by the lower four bits. The digit character can be a lower case (“0123456789abcdef”) or an upper case (“0123456789ABCDEF”).

Building the hexadecimal text uses the following rules:

- Every byte is converted to two upper case hexadecimal digit characters ("0123456789ABCDEF") where the higher four bits are followed by the lower four bits.
- The digits of two consecutive bytes are separated by a space character (U+0020).

## 6.2. Commands and Logging

The "Terminal" tab provides a communication log, an interface for editing commands and a command history. Editing a command does not use a command terminator. An entry in the command history does not contain a command terminator, too. The command terminator of the current configuration is added to a command before sending. After sending:

- The command with command terminator is added to the command log.
- The command without command terminator is added to the command history.

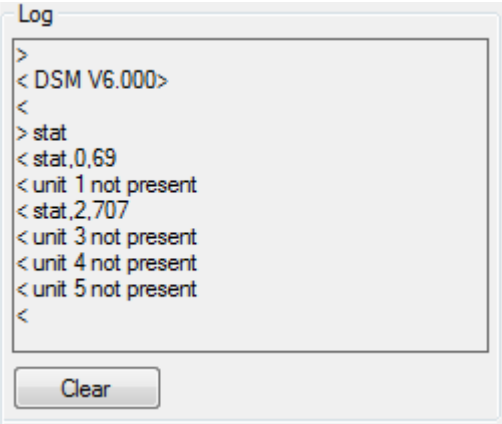



**Figure 47: Log**

The "Log" group box has the following members:

- The textbox contains the communication log. The addition of new log entries depends on the current configuration and has the following characteristics:
  - If both text logging and hexadecimal text logging are enabled for an entry kind then the addition occurs in two consecutive lines. The text is on the first line and the hexadecimal text is on the line below.
  - A new command entry is added on a separate line.
  - If the last entry is a response entry then a new response entry is added to the last entry.
  - If the maximum byte sequence length is exceeded by an entry then a new line is added.
  - A response terminator in a response entry generates a new line.
  - If the configuration changes then the next entry is added on a separate line.
  - If the textbox does not have the input focus and the last entry reaches the bottom of the textbox then the next generated line forces the textbox to scroll one page down. Afterwards, the generated line is at the top of the textbox.
- The "Clear" button clears the log.

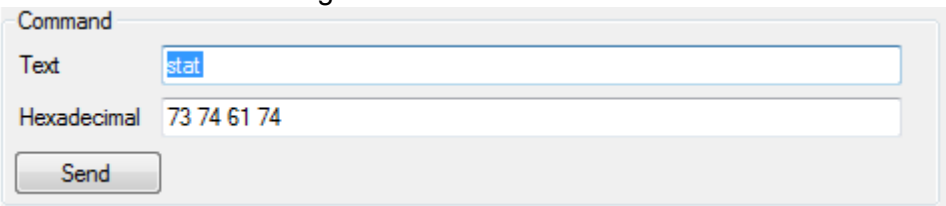



**Figure 48: Command**

The "Command" group box has the following members:

- "Text" is the byte sequence of the current command as text with control characters. On user input, the "Hexadecimal" textbox is updated, too. The following additional keyboard bindings are active:

  - RETURN key: Send the current command.
  - UP ARROW key: Select the previous command from the command history.
  - DOWN ARROW key: Select the next command from the command history.
- “Hexadecimal” is the byte sequence of the current command as hexadecimal text. On user input, the “Text” textbox is updated, too. The following additional keyboard bindings are active:
  - RETURN key: Send the current command.
  - UP ARROW key: Select the previous command from the command history.
  - DOWN ARROW key: Select the next command from the command history.
- The “Send” button sends the current command.

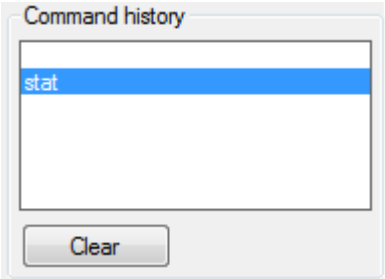



**Figure 49: Command History**

The “Command history” group box has the following members:

- The list contains the command history. Every entry is the byte sequence of a command without the command terminator. The byte sequence is displayed as text without control characters. If a new entry is added to the command history then it is added to the bottom of the list. Furthermore, the new entry becomes the selected entry of the list. If the selection changes then the new selected entry is copied to the current command. The “Text” and “Hexadecimal” textboxes in the “Command” group box are updated, too. The following additional keyboard and mouse bindings are active:
  - RETURN key: Send the selected command entry.
  - Mouse double-click: Send the selected command entry.
- The “Clear” button clears the command history.

## 6.3. Configuration

The “Configuration” tab provides a configuration view. While connecting the session, the current configuration is loaded from the user settings and the configuration view is initialized to the current configuration. On session termination, the current configuration is stored to the user settings.

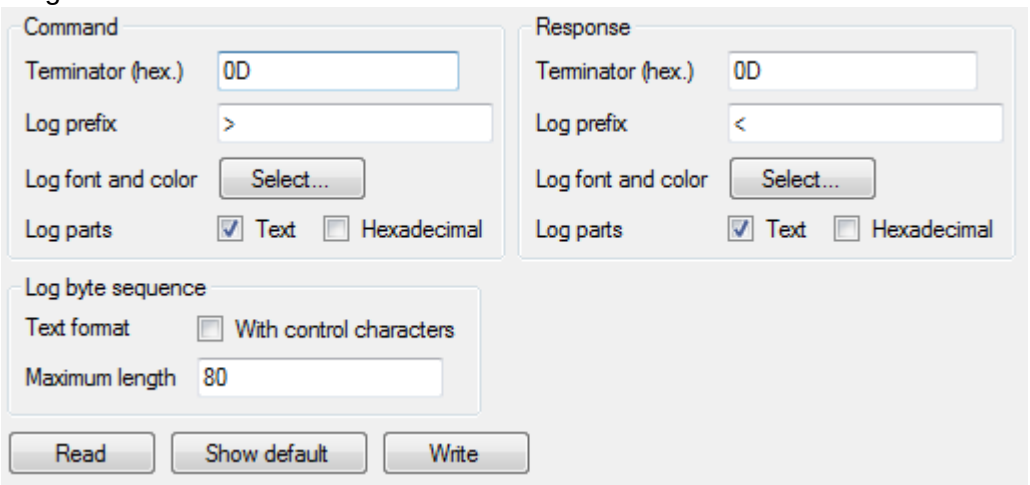



**Figure 50: Configuration**

The “Command” group box is the command specific configuration with the following members:

- “Terminator (hex.)” is the command terminator has hexadecimal text.
- “Log prefix” is the text that is added before each command text log line.
- “Log font and color” defines the visual representation of command log lines. The “Select...” button opens a standard operating system font dialog that views the parameters and allows changing them.
- The “Log parts” checkboxes define the parts that are logged for a command:
  - “Text”: Enables command text logging.
  - “Hexadecimal”: Enables command hexadecimal text logging.

The “Response” group box is the response specific configuration with the following members:

- “Terminator (hex.)” is the response terminator as hexadecimal text used for generating new lines while adding response entries to the log.
- “Log prefix” is the text that is added before each response text log line.
- “Log font and color” defines the visual representation of response log lines. The “Select...” button opens a standard operating system font dialog that views the parameters and allows changing them.
- The “Log parts” checkboxes define the parts that are logged for a response:
  - “Text”: Enables response text logging.
  - “Hexadecimal”: Enables response hexadecimal text logging.

The “Log byte sequence” group box is the shared configuration with the following members:

- “Text format” is the byte sequence text format in the log. The “With control characters” checkbox has the following states:
  - Unchecked: A byte sequence text is logged without control characters.
  - Checked: A byte sequence text is logged with control characters.
- “Maximum length” is the maximum byte sequence length used for generating new lines while adding log entries. A value less than “1” disables the new line generation that tracks the byte sequence length.

The “Read” button reads the current configuration and updates the configuration view.

The “Show default” button queries the default configuration and updates the configuration view.

The “Write” button writes the current configuration according to the configuration view.