



Signal Generator for Valve Control

SiCon

VE 100-1000

Rev. 1.01.15

Read all Safety and Operating Instructions Prior to Installing and Operating the Device!

Note: Illustrations are not always consistent with the original. No legal rights arise from erroneously given information. We reserve the right to make constructional, dimensional and design modifications.

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The device complies with the requirements for CE marking.

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2. Quick Start



2. Quick Start

The following section describes the steps necessary to be performed for the initial operation of the **SiCon** (order number: VE 100-1000). The following components may be used:

1. **SiCon** Manual, download from www.argo-hytos.com
2. Standard lab power supply
3. Cable with banana jacks to connect all components
4. Hydraulic valve conforming to specifications (max. 28VDC, max. 4A), including connector.

A) Positioning the SiCon

1. Place the **SiCon** on a level surface.
2. Push and hold both locks to adjust the position of the handle.
3. Move the handle to the desired position and release both locks.

B) Connection and Operation

1. Connect the valve and, if needed, a measuring instrument as described in the corresponding documentation.
2. Connect SiCon to the power supply unit via banana jacks, as shown in chapter 5.2.
3. Switch on the **SiCon**, using the On/Off switch.
4. After booting the *Start* menu is displayed on screen.

3. Characteristics



3. Characteristics

3.1. General Information

SiCon is a universally applicable signal generator for hydraulic valve control. **SiCon** can be operated with any valve that meets the specifications given in table 1.

The basic design of the **SiCon** is illustrated in Figure 1.



Figure 1: Design of the SiCon

SiCon has a 128 x 32-pixel-LC-display, a power and alarm indicator, an integrated potentiometer for preselecting target values, as well as several operating keys (*Up, Down, Left, Right, Enter, Cancel*).

The electrical connections on the back of the device are described in chapter 5.

SiCon offers a simple option to actuate valves with virtually any parameters (e.g. PWM-frequency and dither), thereby making it easier for you to test a valve and to find out the ideal operating

3. Characteristics



parameters for your application. Since connection is facilitated by banana jacks, **SiCon** can be operated with a multitude of valves, independent of manufacturer.

Moreover, two analog outputs ($\pm 10V$ / $\pm 20mA$) give you the opportunity to use the **SiCon** itself as a target value generator, or you can use the two analog inputs ($\pm 10V$ or $\pm 20mA$) to define target values for the device.

4. Specifications



4. Specifications

4.1. General Technical Data

Device Data	Size	Unit
Power supply Voltage Current consumption	9...28 Max. 4	VDC A
Ambient conditions Temperature, storing Temperature, operation Humidity, storing Humidity, operation (non-condensing)	0...+60 +5...+50 0...95 0...95	°C °C % %
Connections Banana jacks	20	
Operation Membrane keyboard	6	keys
Display Graphical display Brightness	128x32 adjustable	pixel
Analog inputs Voltage (1x) Current (1x) Resolution	± 10 ± 20 12	V mA Bit
Analog outputs Voltage (1x) Current (1x) Resolution	± 10 ± 20 12	V mA Bit
PWM – outputs (2x) Resolution Measuring output	12 1	Bit V / A
Frequency range PWM Dither Signal (sine, triangle,...)	20...9.999 0...500 0...500	Hz Hz Hz

Figure 1: Specifications

4. Specifications

4.2. Dimensions

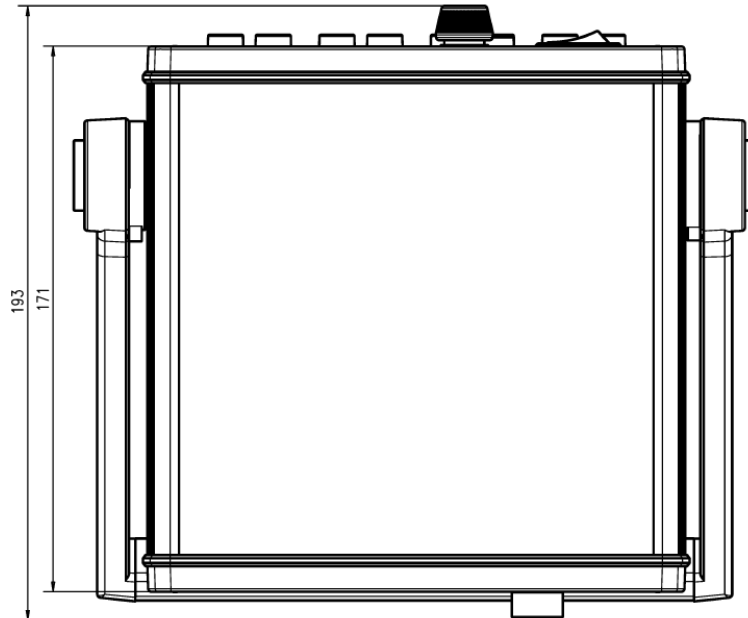


Figure 2: Scale drawing top view

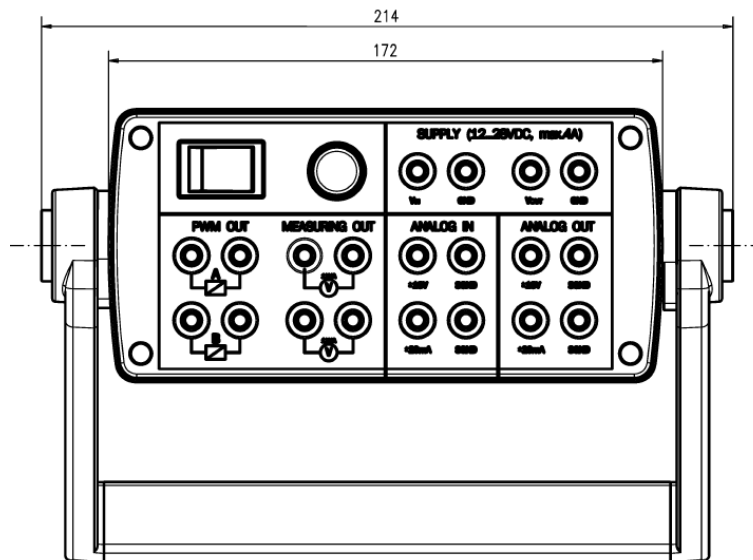


Figure 3: Scale drawing back view

4. Specifications

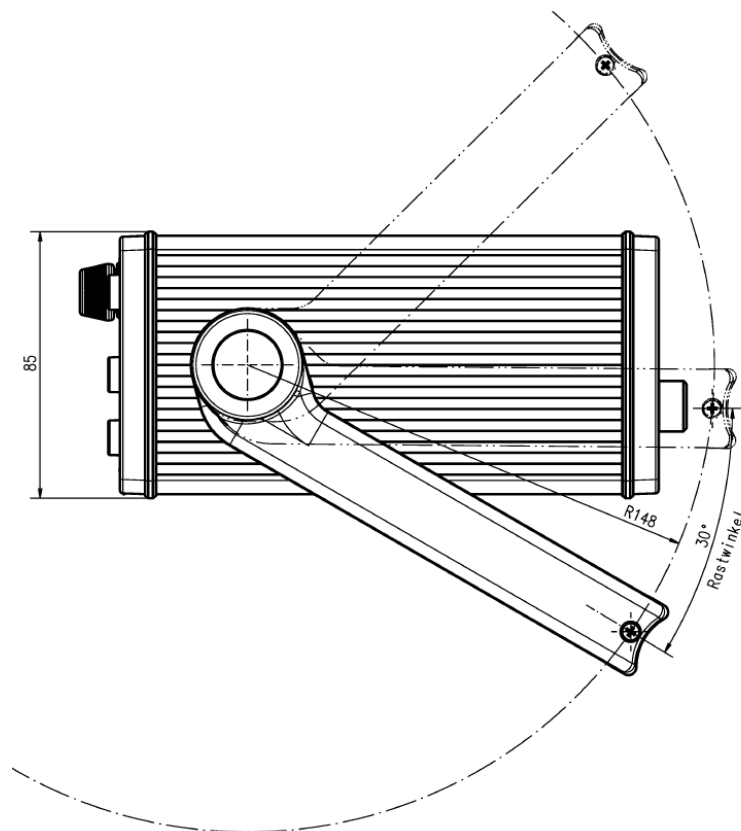


Figure 4: Scale drawing side view

4. Specifications



4.3. Setup

SiCon was designed as a tabletop unit. The setup angles can be adjusted in 30° steps with the integrated handle. To adjust, press down and hold both locks (located where the handle is fixed) and change the position of the handle. Release the locks as soon as you reach the desired setup position. The handle latches in the next fixable position.

5. Electric Connection

5. Electric Connection

5.1. General Information and Safety Indication

Only a qualified electrician may connect the device. The national and international regulations concerning the installation of electrical equipment must be complied with.

Power supply according to EN50178, SELV, PELV, VDE0100-410/A1. Incorrect installation of the device may result in malfunction and/or damages.



Disconnect the system from the supply voltage for setup and connect the device according to the following instructions. Operating voltage must be within a range of 9V and 28V DC. Only banana jacks solely suitable for this purpose are to be used to connect the device.

The **SiCon** has twenty banana jacks on the back (see Figure Figure 5), which are divided into the sections „Supply,“ „PWM- & Measuring Out,“ „Analog In“ and „Analog Out.“

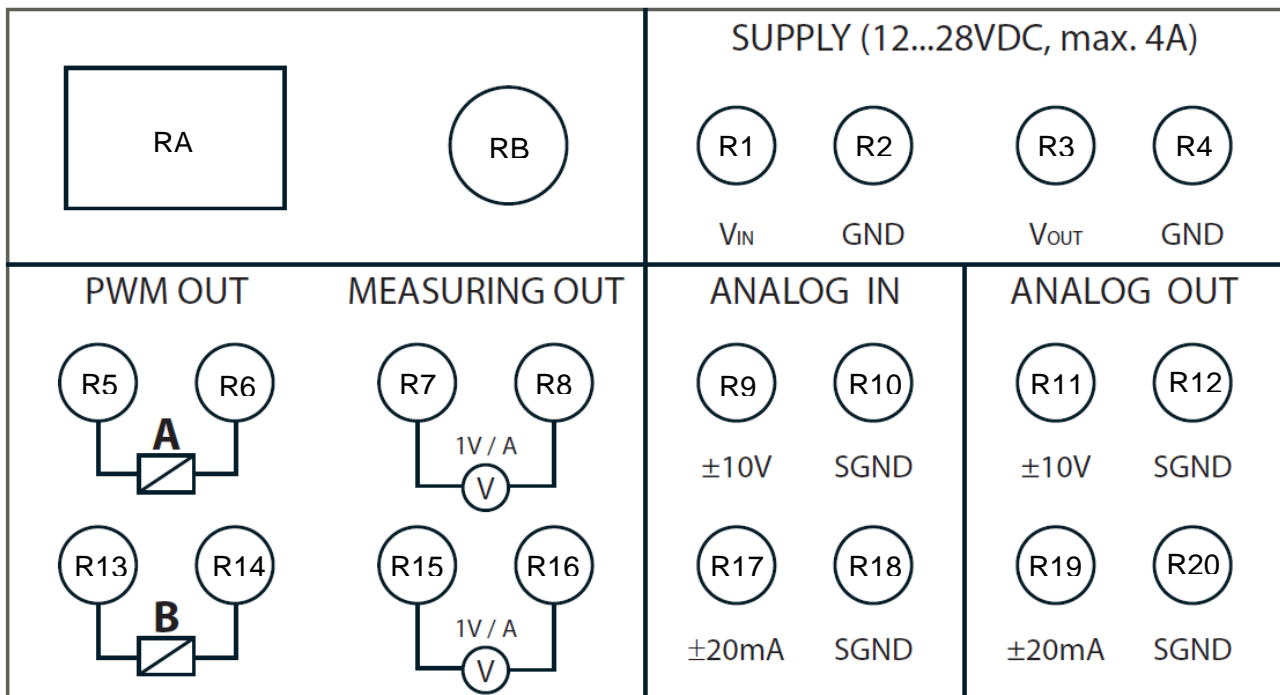


Figure 5: Connector pin-assignment, top view of the back of the device

5. Electric Connection



The banana jacks have the following assignments:

Supply:

Jack R1 („V_{IN}“) and jack R2 („GND“) are the jacks for the power supply of the device. Jacks R3 („V_{OUT}“) and R4 („GND,“) output the levels of jacks R1 and R2 for external use.

PWM- & Measuring Out:

Jack pairs R5 and R6 („A“) and R13 and R14 („B“) serve as connections for up to two coils. There is an analog voltage value at the test ports (jacks R7 and R8, R15 and R16, respectively) that is directly linked to the coil current. 1A coil current corresponds to a measurand of 1V.

Only connect a voltmeter to the coil current test ports. Incorrect connection may result in malfunction and/or damage.



Analog In:

Jack R9 is the analog voltage input. Permissible voltage range is -10...+10V relating to signal ground (jack R10). Jack R17 is the analog power input. Permissible signal range is -20...+20mA relating to the signal ground (jack R18).

Analog Out:

Jack R11 is the analog voltage output which can output target values in a range of -10...+10V relating to the signal ground (jack R12). Jack R19 is the analog power output which can output target values in a range of -20...+20mA relating to the signal ground (jack R20).

The signal ground of the analog current output must not be connected to the other ground (earth) of the device.



5. Electric Connection



5.2. Power Supply of the Device

The device is supplied with DC voltage (9 to 28V) via jacks R1 and R2 („V_{IN}“ and „GND“). Connect jack R1 to the positive terminal, jack R2 to the negative terminal of the power supply unit.

Make sure that the On/Off switch is in the “0” position when connecting the power supply unit.



After having connected the power supply unit, switch on the **SiCon** with the *On/Off* switch. The device starts automatically, displays the ARGO-HYTOS logo for a few seconds and then changes to the basic view.

Please do not press any key(s) while the device is booting.



5.3. Connecting a Valve

In the following, the connection of a valve to PWM-outputs („A“ and „B“), as well as the connection of a voltmeter to the coil current test ports (jacks R7 and R8 or R15 and R16) is shown.

The two PWM-outputs („A“ and „B“) serve to connect a valve with up to two coils. Both outputs generate a PWM-voltage signal, with 0V as L-level and U_B as H-level. The maximum output current of a PWM-channel is 4A. The PWM-frequency can be freely selected across a range of 30Hz to 10kHz.

Note:

It is not possible to operate both PWM-outputs simultaneously. However, it is possible to switch outputs during signal output (e.g. sine with one half-wave on each output).

To connect a coil, fit the banana jacks connected to the valve to the pair of jacks „A.“ During operation current always flows from the red to the black jack via the coil. A second coil can be connected to the pair of jacks „B“ in the same way.

Note:

When operating the device with one coil, only connector “A” is active.

5. Electric Connection



Do not remove or connect any plugs during operation.



Each PWM-channel additionally has a coil current test port (R7, R15). This port transmits as an analog, unfiltered voltage signal of the respective coil current with an amplification of 1V/A. To measure the coil current connect the positive terminal of an appropriate measuring tool to the red jack and the negative terminal to the black jack of the test port.

5.4. Using the Analog Outputs

In addition to the possibility to actuate a coil with a PWM-signal, the **SiCon** allows you to actuate a valve with integrated electronics via an analog set point signal. Both a $\pm 10\text{V}$ voltage output (R9) and a $\pm 20\text{mA}$ current output (R17) are available for this.

Only a device suited for connection to analog outputs may be connected. Connecting a coil to an analog output may damage the device.



Switch off the **SiCon** and disconnect it from the power supply prior to connecting a valve to one of the analog reference signal outputs. To control a valve with an analog reference signal, hook up the analog input of your valve to the respective analog output of the **SiCon**. The signal ground of the valve must be connected to the respective signal ground of the **SiCon**.

When using the analog current outputs, make sure that the ground of the SiCon is connected to the ground of the valve only in the form of the signal ground of the analog power output. All other grounds of the SiCon must not be connected to the valve's ground in this case.



Note:

PWM-outputs and analog outputs cannot be used simultaneously.

Note:

The limitations $\pm 10\text{V}$ / $\pm 20\text{mA}$ given in the specifications denote the physical limits of the outputs. By parameterizing the function parameters, signals such as 0 – 10V, 0 – 5V or 4 – 20mA may be displayed, as well.

5. Electric Connection



5.5. Using the Analog Inputs

The **SiCon** has both a $\pm 10\text{V}$ -voltage- (R3) and a $\pm 20\text{mA}$ -current input. These can be used to assign target values. Both inputs have a 12Bit resolution over the given measuring range. Sample rate is 10kHz.

Switch off the **SiCon** and disconnect it from the power supply prior to connecting an external signal to one of the analog inputs.

To actuate a valve with an external analog reference signal, connect the analog output of your set point device to the analog input of the **SiCon**. The signal ground of the set point device must be connected to the respective signal ground of the **SiCon**.

6. Operation and Task Menu



6. Operation and Task Menu

After you have switched on the **SiCon**, the screen automatically displays the main menu. Starting from here you can adjust all settings, as well as start and stop the signal output.

6.1. General Operation

6.1.1. Navigation with Keyboard

SiCon is operated via six menu keys. The menu item chosen is marked by a „>“ (subsequently called „Cursor“) preceding the item. The cursor is moved with the direction keys [▲] [▼] [◀] [▶]. If the chosen direction is not available, your entry remains ineffective. To access the chosen submenu hit the „Enter“ key [✓]. To return to the previous menu hit the „Cancel“ key [X].

6.1.2. Setting Numerical Values

To change a numerical value move the cursor in front of the respective value and press [✓]. Only the chosen value is shown on screen now.

Black arrows above and below the numerical value mark the decimal to be altered (see Figure 6).

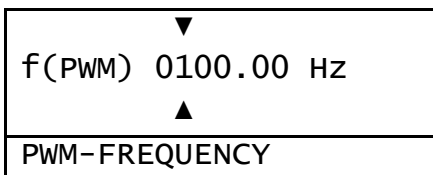


Figure 6: Entering numerical values

Press the direction keys „Up“ [▲] or “Down“ [▼] to increase or reduce the value shown at the chosen decimal. Use the direction keys „Left“ [◀] or „Right“ [▶] to move between the decimals.

To end your entry hit „Enter“ [✓] again. The adjusted value is saved.

If you do not want to apply the new value, end your entry by pressing the “Cancel” key [X]. The value that was originally set is reset.

Note:

Each numerical value can be changed within the range specified in the data sheet. Should your entry lie outside the permissible range, the device automatically sets the maximum / minimum value.

6. Operation and Task Menu



Example:

You set a PWM-frequency of 9500Hz and want to change it. If you increase the thousands digit now, the numeric value automatically jumps to the max; hence, the new PWM-frequency is 10.000Hz.

6.1.3. Selecting Options

In the selection menu there is a box on the left side of the options which can either be empty or marked with a cross. When the box is marked with a cross, the function designated on the right side of the box is active.

To select an option move the cursor to the respective position and hit „Enter“ [✓]. The box that has previously been empty is now marked with a cross (see Figure 7).

> <input checked="" type="checkbox"/> Open loop
<input type="checkbox"/> Closed loop
SELECT CONTROL

Figure 7: Selecting options

To apply the change move the cursor downward until it reaches the menu item „Next“ or „OK.“ Your selection is applied.

Should you not want to apply your selection move the cursor downward until it reaches the menu item „Back,“ then hit „Enter“[✓] to return to the previous menu or hit „Cancel“[✗] to return to the main menu without saving.

Note:

The device immediately returns to the start screen of the main menu every time you press „Cancel“ [✗].

6.2. Structure of Task Menu

Figure 8 shows the entire structure of the **SiCon**'s task menu and is supposed to give you a general idea of the **SiCon**'s functionality. The individual menu items are described in more detail in the following pages.

6. Operation and Task Menu

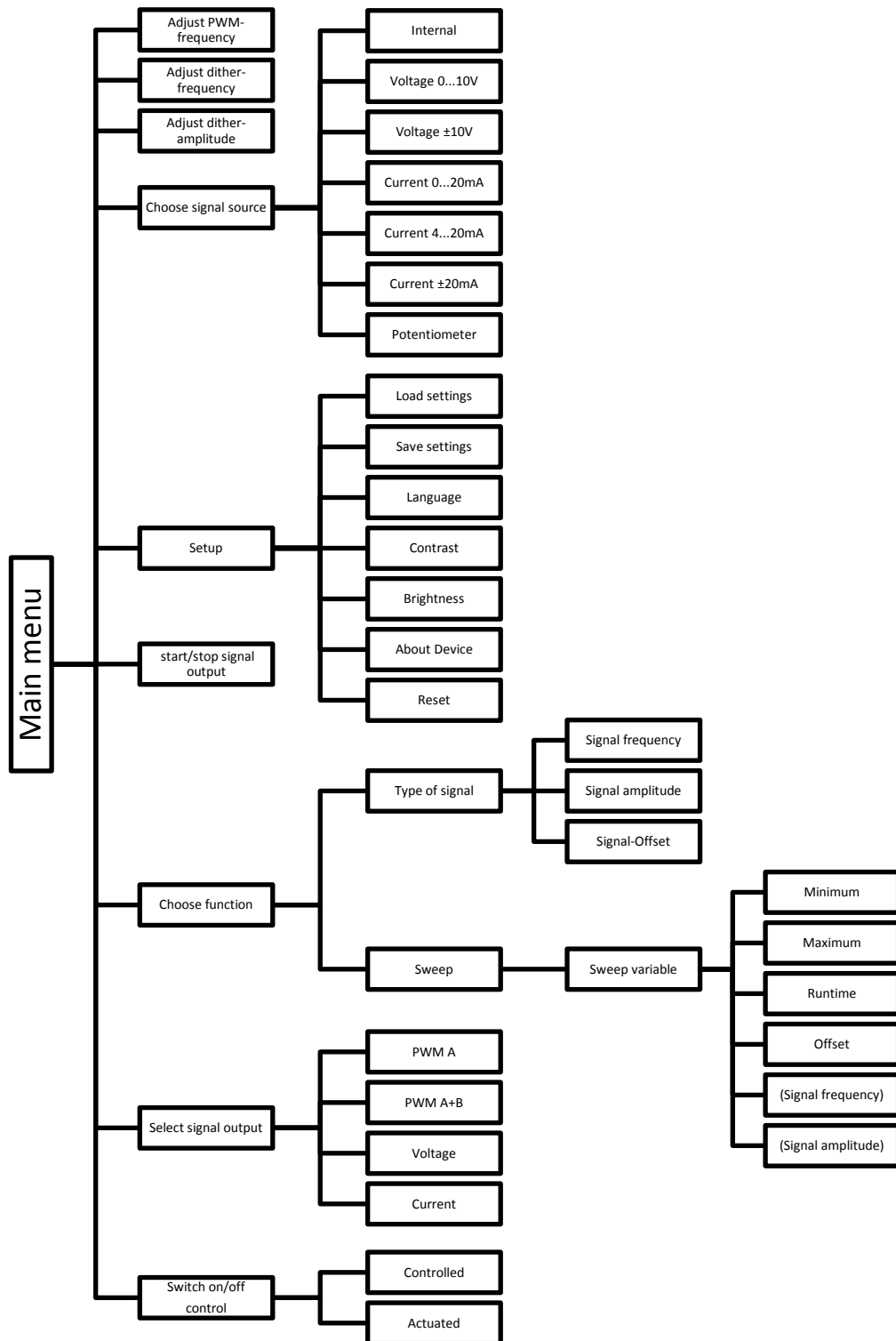


Figure 8: Menu structure

6.3. Main Menu

The main menu is divided into two columns. In the left column there are PWM frequency, dither frequency and amplitude, as well as the signal source and the setup menu* (in plaintext). In the

6. Operation and Task Menu

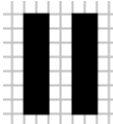
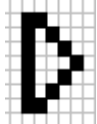
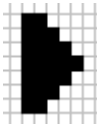
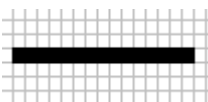
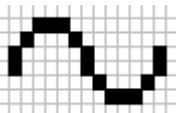
right column you can find the system status, function, output, as well as the operating mode depicted as symbols (see Figure 9).

(* = Not illustrated)



Figure 9: Main menu

Table 2 shows all of the symbols, including their meaning, which can be found in the main menu. You will get a detailed description of their respective functions in the following chapters.

SYMBOL	MEANING
<u>System Status</u>	
	Pause
	Semi-active
	Active
<u>Function</u>	
	Constant
	Sine

6. Operation and Task Menu

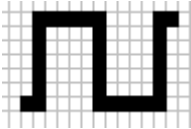
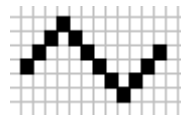
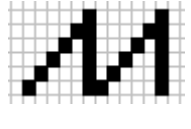
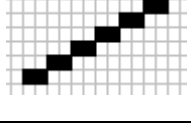
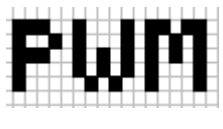
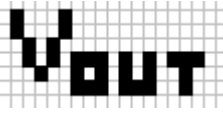
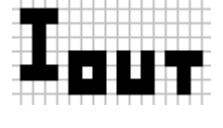
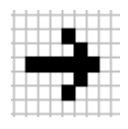
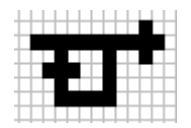
	Rectangle
	Triangle
	Ramp
	Sweep
<u>Output</u>	
	Output-PWM
	Voltage set point
	Current set point
<u>Operating Mode</u>	
	Open loop
	Closed loop (current controlled)

Table 2: Menu symbols and their meaning

6. Operation and Task Menu

6.4. Starting and Stopping Signal Output

There are three system states of the **SiCon** - „Pause“, „Semi-active“ and „Active“ (see Figure 10). When the device is on „Pause“ all outputs are inactive. When the device is „Semi-active“, output value equals preset offset value; however, a function you might have chosen is not proceeding. The function won't start until you set the state to „Active“ by hitting „Enter“ [✓] one more time.

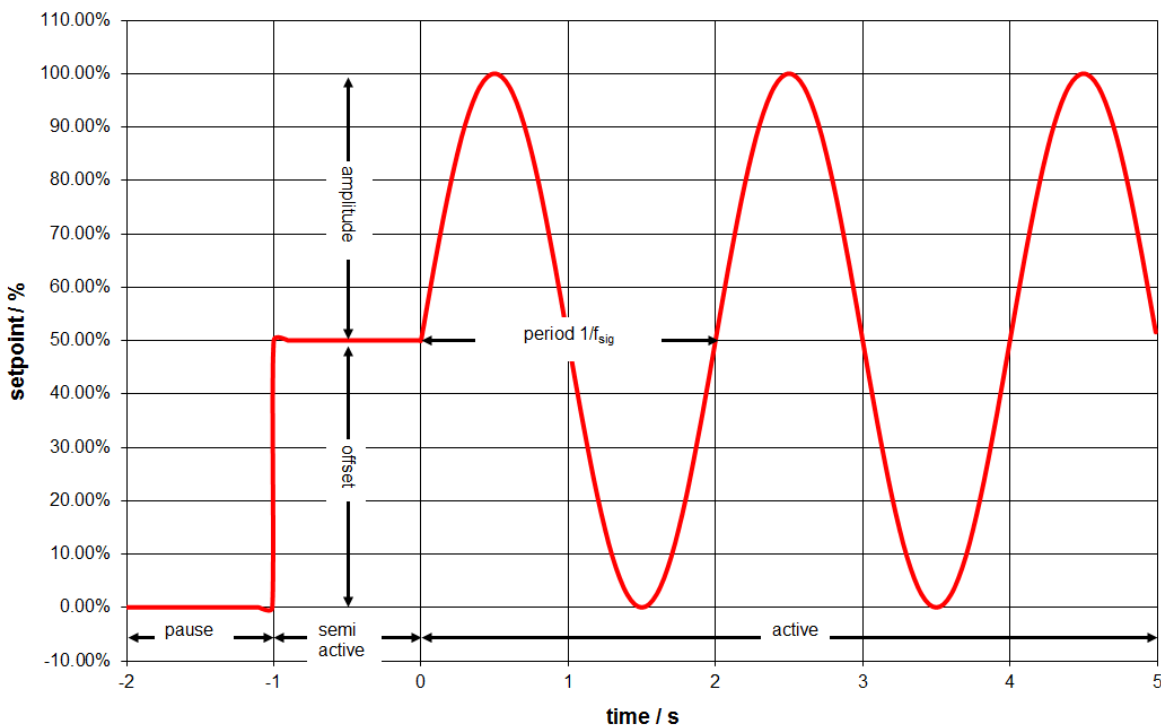


Figure 10: Signal output states

Note:

The „Active“ state may only be achieved via the „Semi-active“ state. It is not possible to jump directly from „Pause“ to „Active.“

To change the state move the cursor, using the direction keys, in front of the symbol „System status“ and press „Enter“ [✓]. The device switches from „Pause“ to „Semi-active“, from „Semi-active“ to „Active“, or from „Active“ back to „Pause“.

Note:

As long as you are in the main menu you can interrupt the signal output any time by pressing „Cancel“ [✖].

6. Operation and Task Menu



Note:

For safety reasons, an ongoing signal output is automatically interrupted whenever you open a configuration menu.

6.5. Setting the PWM-Frequency

To set the PWM-frequency move the cursor to the front of the menu item „f(PWM)“ and press „Enter“ [✓]. Change the numerical value of the PWM-frequency, as described in chapter 6.1.2, and confirm your entry by hitting “Enter” [✓] again. Press „Cancel“ [✖] if you do not want to apply your setting.

6.6. Setting the Dither-Frequency and –Amplitude

To set the dither-frequency or dither-amplitude move the cursor to the front of the menu item „f(Dit)“ or „A(Dit)“ and press „Enter“ [✓]. Adjust the numerical value, as described in chapter 6.1.2, and confirm your entry by pressing “Enter” [✓] once more. Press “Cancel” [✖] if you do not want to apply your setting.

The dither-frequency can be set within a range of 0 to 500Hz. When the frequency set is 0Hz or the amplitude set is 0%, the dither is deactivated.

A symmetrical rectangular function with a pulse/pause ratio (duty cycle) of 50,0% is used as dither function (see Figure 11). The dither-amplitude is always given in % as part of the respective basic signal.

Example:

You have set a constant signal with an offset of 50,0%. A dither-amplitude of 20% corresponds to an actual amplitude of $50\% \cdot 20\% = 10\%$.

One dither cycle period is made up of one pulse of the positive amplitude followed by a pulse of the negative amplitude. Therefore, a dither cycle period at least needs two PWM-pulses. Hence, the dither-frequency can never be higher than half the PWM-frequency.

6. Operation and Task Menu

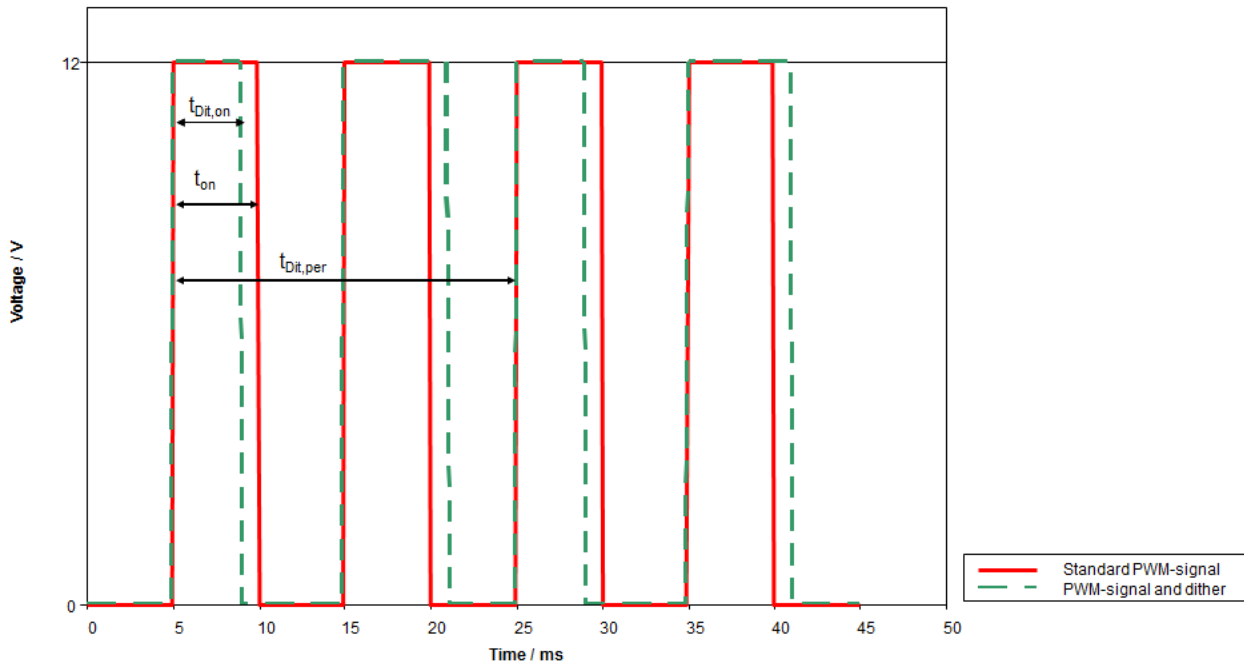


Figure 11: Example Dither

Note:

The output signal can only be updated with each new cycle period of the PWM-signal. The dither's 50% pulse/pause ratio (duty cycle) can only be maintained for dither-frequencies which are in even, integral proportion to the PWM-frequency.

The formula that applies is $f_{DIT} = \frac{f_{PWM}}{2 \cdot n}$, with $n = \text{integral}$.

Example:

You have set a PWM-frequency of 1000Hz. Hence, the dither can maintain the pulse/pause ratio of 50% for the frequencies 500Hz, 250Hz, etc.

6. Operation and Task Menu



6.7. Selecting the Signal Source

The following signal sources can be used to preselect target values:

- Internal computation based on predetermined values
- External 0 – 10V voltage signal
- External ± 10 V voltage signal
- External 0 – 20mA current signal
- External 4 – 20mA current signal
- External ± 20 mA current signal
- Integrated potentiometer

To select the desired signal source move the cursor to the front of the menu item „Source“ and hit „Enter“ [✓]. A list showing the options named above is displayed on screen. The source that is currently selected is marked with a cross. To change the signal source, proceed as described in chapter 6.1.3. Your new selection is shown under “Source” in the main menu.

6.8. Selecting the Signal Output

The **SiCon** can generate the following output signals:

- PWM A
- PWM A+B
- Voltage ± 10 V
- Current ± 20 mA

To select the desired signal output move the cursor to the front of the symbol „Output“ and hit „Enter“ [✓]. A list with all options named above is displayed on screen. The output that is currently selected is marked with a cross. To change the signal output, proceed as described in chapter 6.1.3. Your new selection is indicated with a symbol in the main menu.

Note:

When you change the signal output, the units of the parameterization of internal functions change, as well. Hence, all function parameters are reset to 0 whenever the signal output is changed.

6. Operation and Task Menu



6.9. Switching On and Off Current Control

The PWM-outputs of the **SiCon** can be actuated as well as current-controlled. To switch current control on or off, move the cursor to the front of the symbol "Operating Mode" and press "Enter" [✓]. To change the operating mode, proceed as described in chapter 6.1.3. Your new selection will be indicated with an icon in the main menu.

Note:

The current-controlled mode works only if you have chosen „PWM“ as signal output and the signal source is set to „Internal.“

Note:

When you switch from actuated to current-controlled mode, the units of the parameterization of internal functions change, as well. Hence, all function parameters are reset to 0 whenever the signal output is changed.

6.10. Parameterization of Internal Functions

When „Internal“ is selected as signal source, the chosen output needs to be parameterized (menu item „Function“). To do so, move the cursor to the front of the „Function“ icon and hit „Enter“ [✓]. A list of all selectable function types, as well as the option „Sweep,“ are displayed on screen. Select the desired function, as described in chapter 6.1.3, move the cursor to menu item „Next“ and hit „Enter“ [✓].

6.10.1. Parameterization of Continuous Functions

Once you have selected a function, all adjustable parameters are displayed. Adjust the parameters as described in chapter 6.1.2. To apply your selection and adjustments, move the cursor to „Save“ and press „Enter“ [✓].

Note:

When the PWM-output is used, positive target values always control the coil of PWM-output A. The value of negative target values always controls the coil of PWM-output B.

The following diagrams show examples for a parameterization of the functions. Signal output becomes "semi active" at -1s and "active" at 0s.

6. Operation and Task Menu

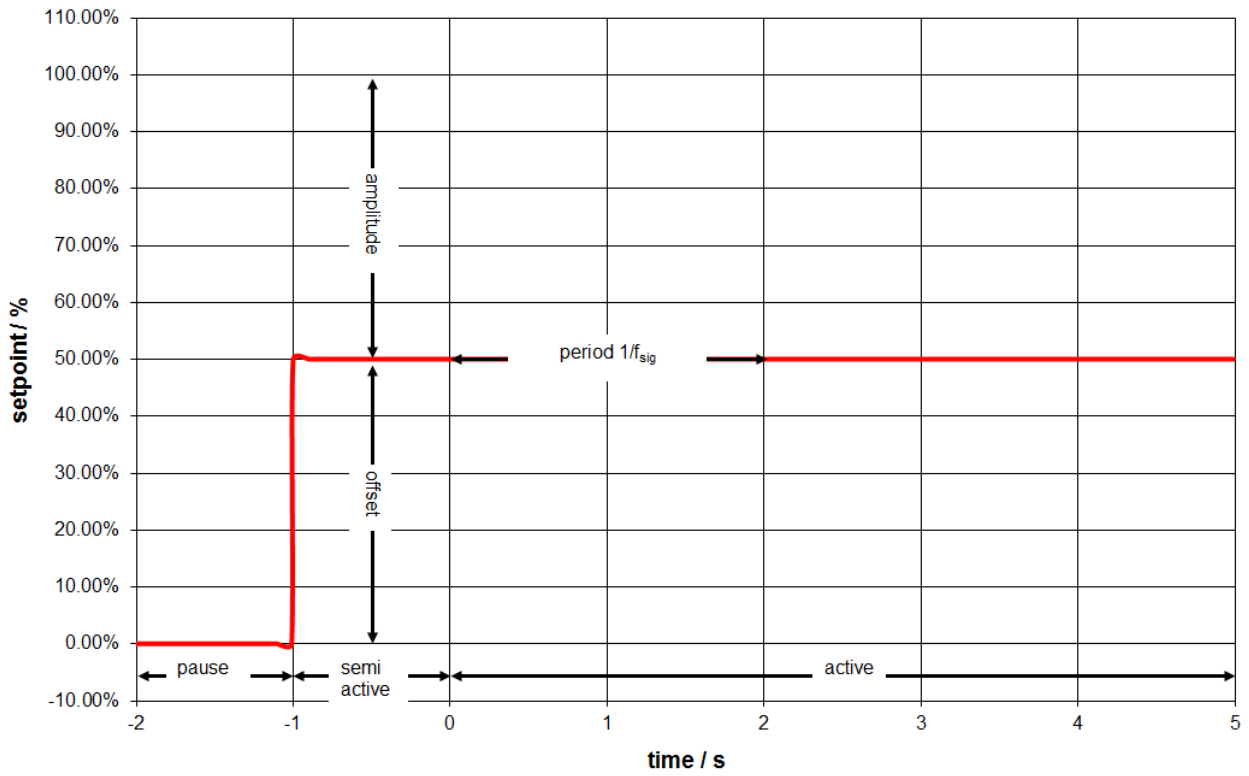


Figure 12: Signal characteristics of the function „Constant“ with offset 50%

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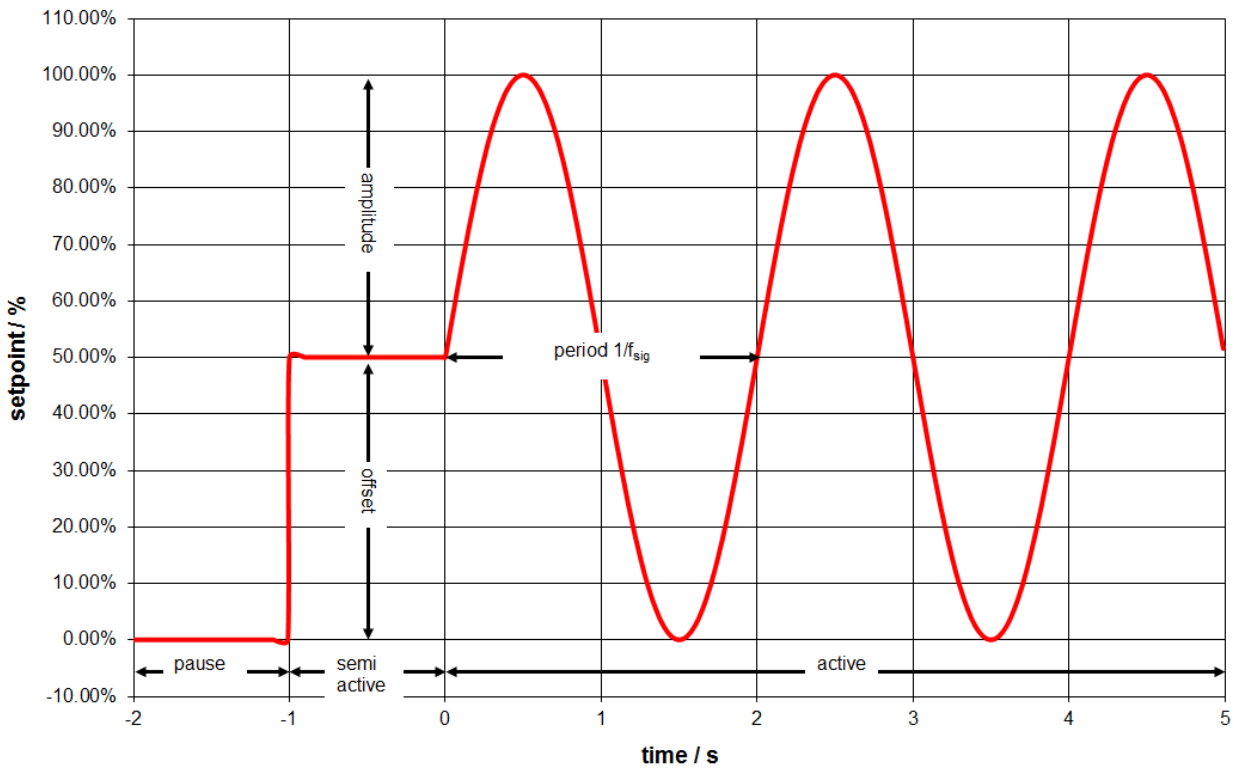


Figure 13: Signal characteristics of the function "Sinus" with offset: 50%, signal frequency: 0,50Hz and signal amplitude: 50%

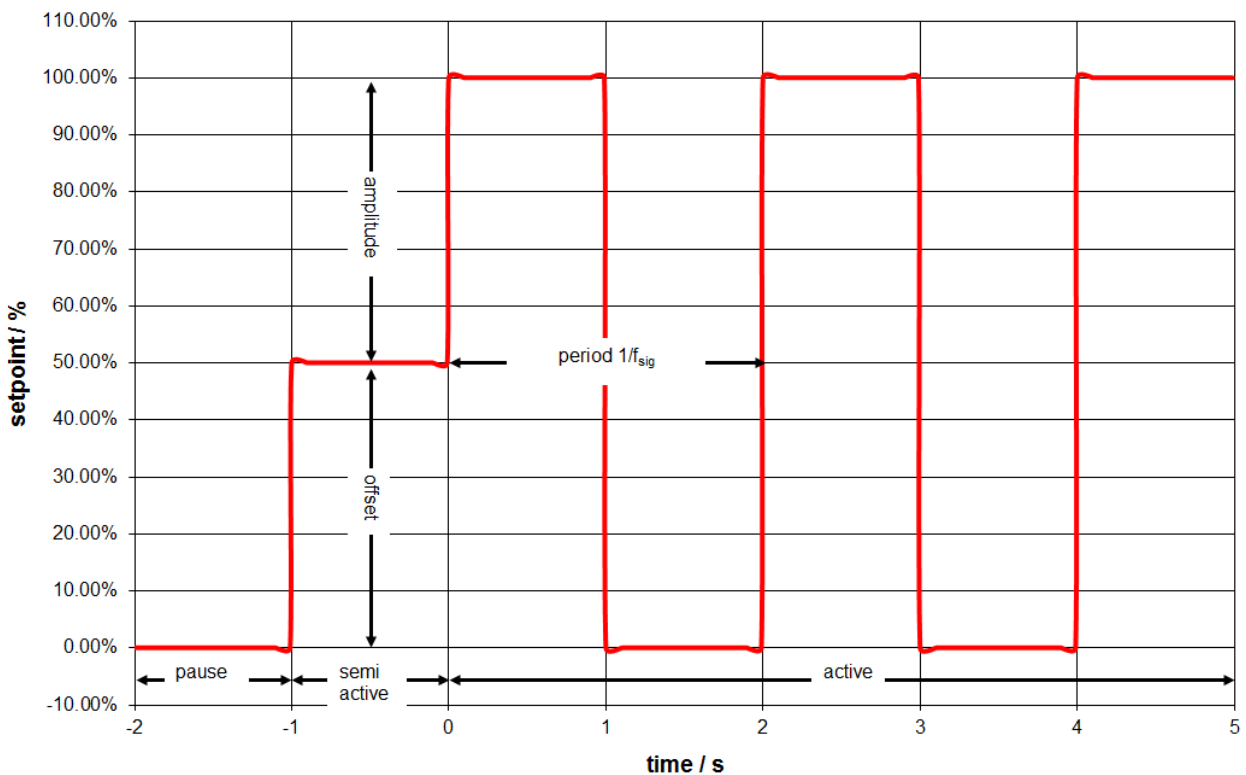


Figure 14: Signal characteristics of the function "Rectangle" with offset: 50%, signal frequency: 0,50Hz and signal amplitude: 50%

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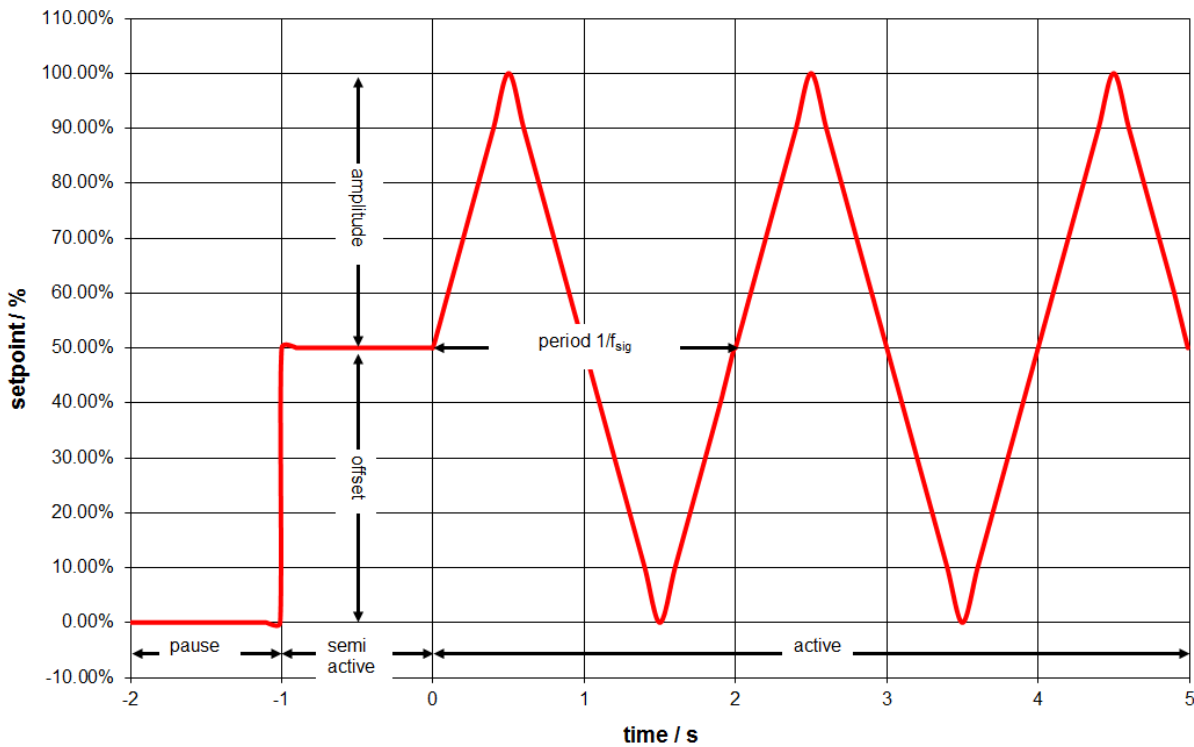


Figure 15: Signal characteristics of the function "Triangle" with offset: 50%, signal frequency: 0,50Hz and signal amplitude: 50%

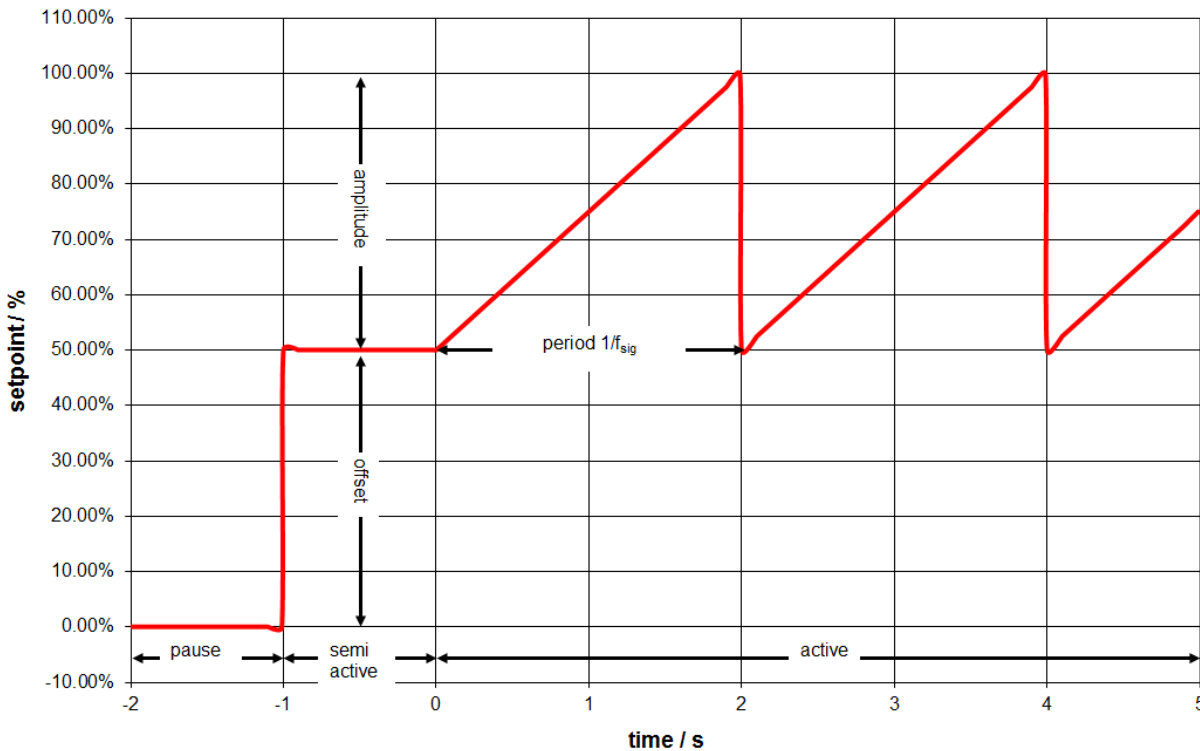


Figure 16: Signal characteristics of the function "Ramp" with offset: 50%, signal frequency: 0,50Hz and signal amplitude: 50%

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6.10.2. Parameterization of a Sweep

When you choose the option „Sweep,“ a list with the variables applicable for a Sweep is shown on screen. Choose the desired variable, as described in chapter 6.1.3, move the cursor to menu item „Next“, and hit „Enter“ [✓].

Now the Sweep parameters „Offset,“ „Min,“ „Max“ and „Time“ are displayed. Change the parameters as described in chapter 6.1.2, move the cursor to menu item “Next” or “Save” and hit „Enter“ [✓].

Note:

Even if the „Offset“ value is not changed through the Sweep you have to set a value. The value corresponds to the constant component during the Sweep.

Example:

You choose the dither amplitude as Sweep variable and set the offset to 0,00. Since the dither amplitude is always computed as a part of the basic signal, the output signal stays on 0,00 during the entire signal output. It is not before you set an offset value that you get correct values for the dither amplitude during signal output.

If you chose „Sine Frequency“ or „Sine Amplitude“ as Sweep variable, the menu shows the constant values for parameterization. Set the value as described in chapter 6.1.2, move the cursor to „Save“ and hit „Enter“ [✓] to save your adjustments.

6.11. Configuration

This menu allows you to change and adjust language, brightness and contrast of the display screen, and to reset the device to factory default. In addition, settings can be saved under a given name and loaded again at a later date.

6.11.1. Save Settings

To save settings go to „Setup“ menu, move the cursor to „Save Setting“ and hit „Enter“ [✓]. A list of the designations of all settings saved so far is displayed. In delivery status and after the device was reset to factory default (see chapter **Fehler! Verweisquelle konnte nicht gefunden werden.**), all settings are equal to the standard settings and are called „default01“ to „default10“.

To save your current settings use the cursor to choose the desired location and hit „Enter“ [✓]. The current designation of the location is shown on screen. You can edit it using the arrow keys, just as

6. Operation and Task Menu



you would change numerical values. To confirm your entry and to save the setting hit „Enter“ [✓] again. If you want to end the entry without saving, press „Cancel“ [×].

6.11.2. Load Settings

To load settings, go to „Setup“ menu, move the cursor to „Load settings“ and press „Enter“ [✓]. A list with the designations of all the settings that were saved is displayed on screen. Move the cursor to the desired location and hit „Enter“ [✓]. The settings saved under the designation displayed are loaded.

Note:

Saved settings always include all setup options; hence, they also include language, contrast and brightness.

6.11.3. Changing Language

To change the language go to the „Setup“ menu, move the cursor to „Language“ and hit „Enter“ [✓]. You will now see a list of all available languages on screen. Choose the desired language, as described in chapter 6.1.3.

To save your setting move the cursor to menu item „Save,“ using the direction keys, then hit „Enter“ [✓]. The device saves your setting and displays the setup menu again.

Should you want to discard your setting, move the cursor to menu item „Cancel“ to return to the previous menu or press the „Cancel“ [×] key to return to the main menu without saving.

6.11.4. Adjusting Brightness

To adjust brightness go to „Setup“ menu, move the cursor to „Brightness“ and press the „Enter“ key [✓]. You will now see a bargraph showing the current brightness setting on screen. When the bar is completely “empty,” brightness is set at 0%; when the bar is completely “filled,” brightness is at 100% (see Figure 17).

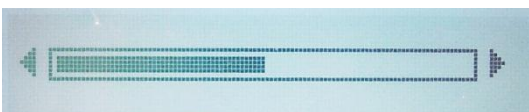


Figure 17: Bargraph for brightness adjustment

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To increase brightness press direction key „Right“ [▶], to reduce brightness press direction key „Left“ [◀]. The new setting is applied immediately as a preview.

To save your setting press „Enter“ [✓]. The device saves the newly adjusted brightness and returns to the setup menu.

To discard your setting press „Cancel“ [x]. The device resets the previous setting and returns to the setup menu.

6.11.5. Adjusting Contrast

To adjust the contrast go to „Setup“ menu, move the cursor „>“ to „Contrast“ and press the „Enter“ key [✓]. You will now see a bargraph showing the current contrast setting on screen. When the bar is “empty,” contrast is set at 0%; when the bar is completely “filled,” contrast is at 100%.

To increase contrast press direction key „Right“ [▶], to reduce contrast press direction key „Left“ [◀].

The current setting is applied immediately in order to make it easier for you to choose the setting you want.

To save your setting press „Enter“ [✓]. The device saves the new setting and returns to the setup menu.

To discard your setting press the „Cancel“ [✕]. The device returns to the previous setting before returning to the setup menu.

6.11.6. About Device

The name of the device, as well as the soft- and hardware versions and the current operating voltage, are displayed in the „About Device“ menu.

6.11.7. Resetting the Device

To reset the device to factory default go to setup menu, move the cursor to „Reset“ and press the „Enter“ key [✓].

The device restarts within five seconds and loads the standard settings. Any data and settings you might have saved will be lost.

7. Contact



7. Contact

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8. EC Declaration of Conformity



8. EC Declaration of Conformity

9. Change Log



9. Change Log

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