



Tg
Timegrapher

User Manual

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Introduction

Tg is a free and open source timegraphing program for the timing of mechanical watches. Tg uses an external microphone combined with software filtering to listen for the ticking made by the escapement of a mechanical watch. The advanced filtering used, allows the use of non-specialized microphones to pickup the noises from the watch. This provides a very cost effective way for users without watch timing equipment to time their watches.

Tg automatically detects the rate of the watch and displays the deviation in seconds per day, the beat error in ms, and the amplitude in degrees. Along with the timing data, the software also displays a rate chart and scope graphs of the watch timing. This user manual explains how to operate Tg and is written for users that already have a basic understanding of the concept of watch timing.

Tg is a cross-platform open source project, below are links to the download page and the GitHub project.

Download page <https://tg.ciovil.li/>

GitHub Project <https://github.com/vacaboja/tg>

Requirements

Computer

1GB Ram

50mb Free Space

External microphone

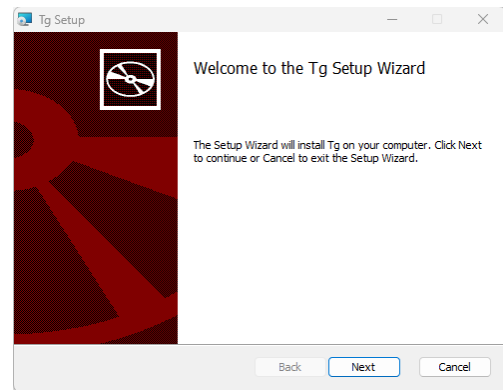
TIP

Tg is designed to isolate the noise of the watch and does not require specialized microphones or vibration pickups. Small microphones that can touch or be very close to the watch work best. A quite space is recommended as fans and other continuous noise sources can cause interference with the timing of the watch.

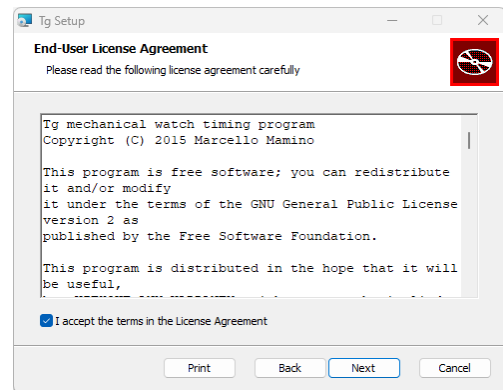
Installation

Windows 7 and above

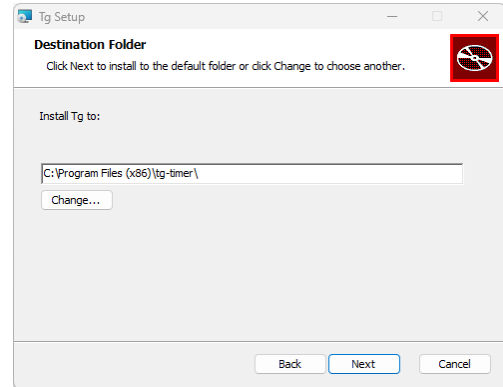
- 1) Download **tg-timer_0.5.0.msi** from the download page <https://tg.ciovil.li/>
- 2) Once download is complete, open **tg-timer_0.5.0.msi**
- 3) The installation starts with the *Welcome to the Tg Setup Wizard* page
 - 1) Click **Next**



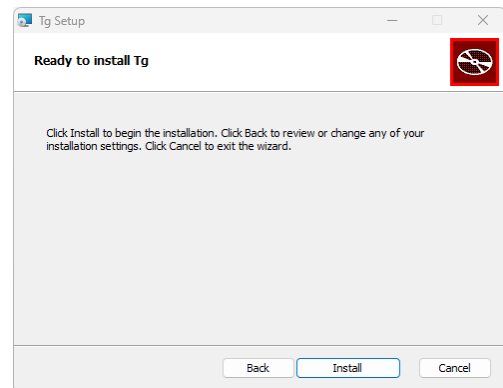
- 4) The *End-User License Agreement* page explains the software license
 - 1) Read the agreement
 - 2) Check the box **I accept the terms in the License Agreement**
 - 3) Then click **Next**



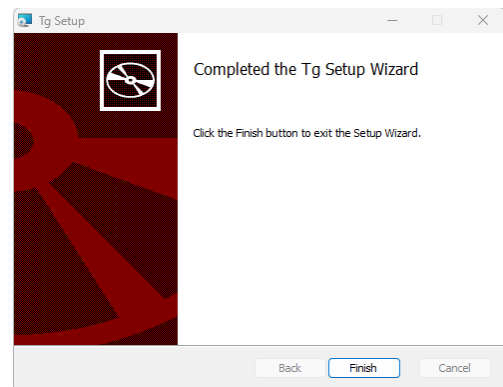
- 5) The *Destination Folder* page allows the user to set the install location
 - 1) Leave the location as the default or click **Change...** to bring up a dialog for selecting a new location
 - 2) Then click **Next**



- 6) The *Ready to install Tg* page informs the user the install will start
 - 1) When ready click **Install**



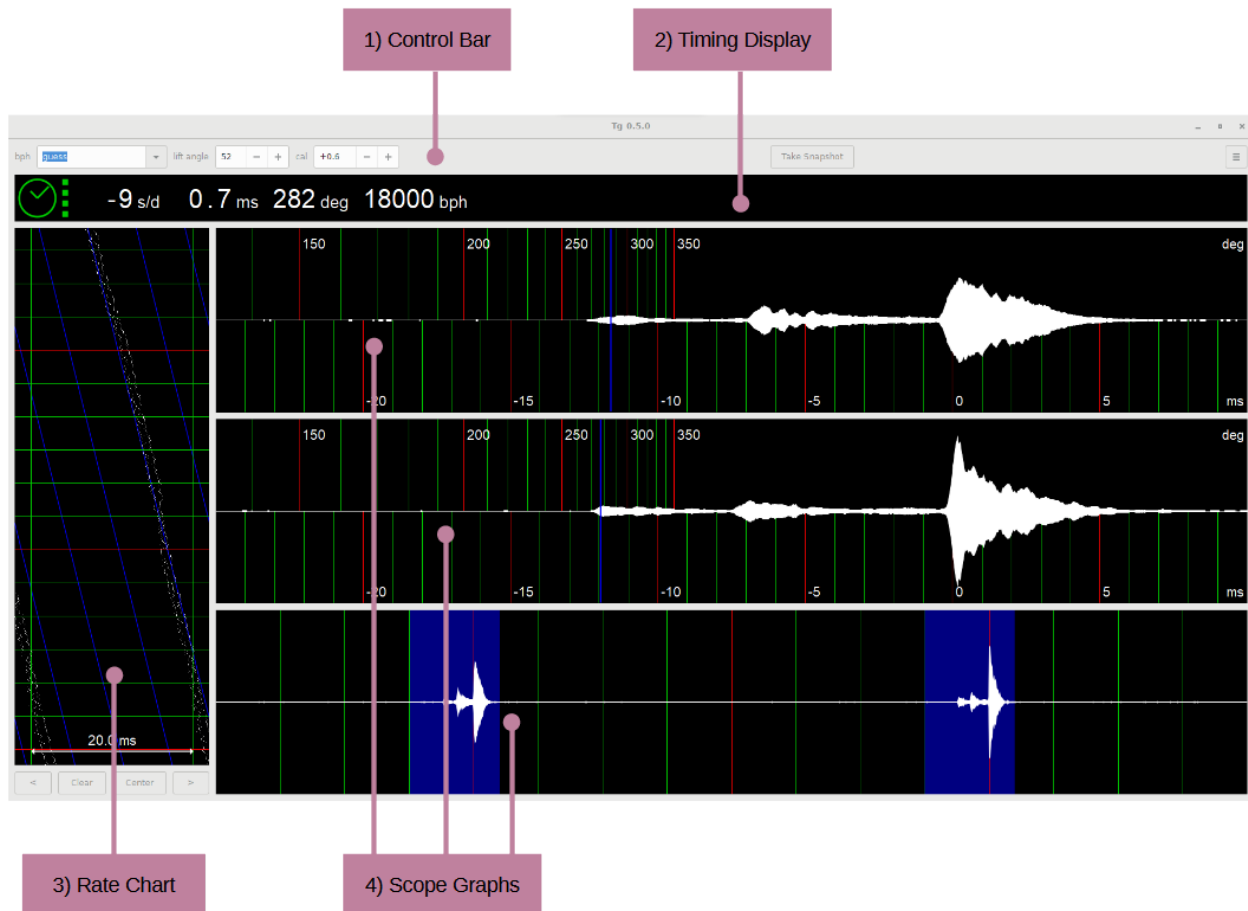
- 7) Wait for the installation progress to complete
- 8) The *Completed the Tg Setup Wizard* page informs the user the install is done
 - 1) Click **Finish**



Other Operating Systems

Tg is cross-platform compatible and there are installers for: older versions of Windows, Mac OS X, Linux Debian 64bit and 32bit. Tg can also be compiled from the source code, see the download page for installers and source code. <https://tg.ciovil.li/>

Main Window



- 1) **Control Bar** – Allows the parameters for timing to be set: rate of the movement in **bph** (Beats Per Hour), **lift angle** of movement in degrees, **cal** (calibration offset). The control bar also allows the user to **Take Snapshot** of the current timing. On the far right is the **Menu** with other options.
- 2) **Timing Display** – This shows the current timing data of the watch. From left to right: **Signal Quality**, **Rate Deviation** in s/d, **Beat Error** in ms, **Amplitude** in degrees, and **Rate** in bph.
- 3) **Rate Chart** – This chart displays the rate deviation and beat error over time. There are controls at the bottom to adjust the horizontal position and clear the chart.
- 4) **Scope Graphs** – These graphs display a complete cycle of the balance wheel containing two ticks. The top two graphs show each tick of the escapement and have a scale for the amplitude calculation. The bottom graph shows both ticks together.

Menu

Open – Opens dialog to open a saved snapshot.

Save current display – Opens dialog to save the currently displayed snapshot.

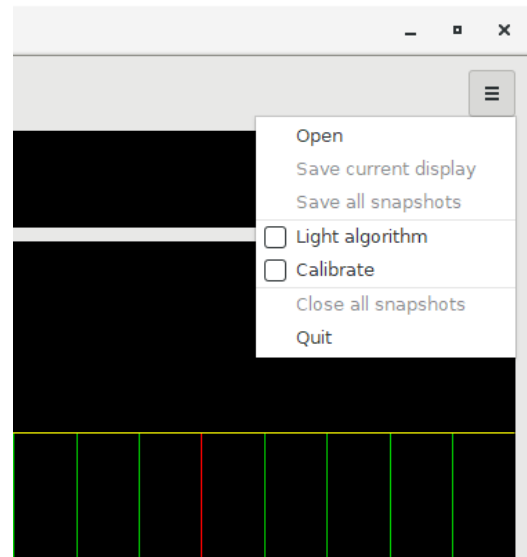
Save all snapshots – Opens dialog too save all open snapshots.

Light algorithm – When toggled, Tg will run a less processing intensive algorithm for filtering out noise. Useful if Tg is being run on a slower computer.

Calibrate – Enables calibration mode. See the calibration selection for more details.

Close all snapshots – Closes all open snapshots.

Quit – Closes Tg.



Calibration

Before first using Tg, a calibration needs to be performed. The calibration takes about 15 minutes and uses a quartz watch to calibrate the sound card of the computer. The sound card very precisely measures frequency but each card will have an offset that needs to be corrected to get accurate timing from a watch. Any time the sound card is changed, for example switching to an external sound card, a new calibration needs to be performed. Basic quartz watches work best as they have no compensation circuits that can affect the calibration process.

To use automatic calibration:

1. Place microphone on quartz watch.
2. Click the **Calibrate** option in the menu.
3. Wait for the beat of the watch to be detected and the calibration to start.
4. Wait for the calibration to complete. This step will take about 15 minutes and has a progress indicator.
5. Once complete the new calibration value will be updated in the **cal** field.
6. Uncheck the **Calibrate** option in the menu.

To use manual calibration:

1. Press the + or – in the **cal** field until the desired calibration value is reached.

Watch Timing

TIP

Before starting the software, connect microphone to computer and make sure that any noise canceling or filtering is turned off on the computer.

Starting

A mechanical watch can be timed by placing the microphone on or near the watch.

1. Start by selecting the **bph** of the watch movement from the drop down menu. If you select **guess**, Tg will attempt to figure out what bph to use for the watch.
2. Set the **Lift Angle** for the watch. If the lift angle is unknown, use 52°; this is the most common angle for wrist watches.
3. Wait for the **Signal Quality** to turn green and stay green.
4. Depending on the quality of the signal, it can take some time before the timing stabilizes and an accurate result is shown.

Signal Quality

The **Signal Quality** displays the current status of the detected watch beat. When there is no beat detected the icon is red. Once the beat is detected the icon will turn green. On the right side of the icon a column of squares will appear to indicate the quality of the detection. No squares is the lowest quality and four squares is the highest. Lower quality signals can cause the timing information to be inaccurate or not displayed.



Beat Not
Detected



Beat
Detected



High Quality
Beat
Detected

How to read the results

The timing values are shown in the **Timing Display**. This display has the rate deviation in s/d, the beat error in ms, the balance amplitude in degrees, and the rate in beats per hour.

The **Rate Chart** shows the rate deviation and beat error in a chart over time. The chart is updated every beat and runs from top to bottom. Each beat will have two dots on the chart. The horizontal distance between the dots indicates the beat error, the larger the error the farther apart the dots. If there is a beat error of 0.0ms then the beat will appear as only one dot. The rate deviation is

displayed as sloping line of dots with a vertical line representing no deviation. The rate chart is useful for diagnosing issues with the watch that happen over time.

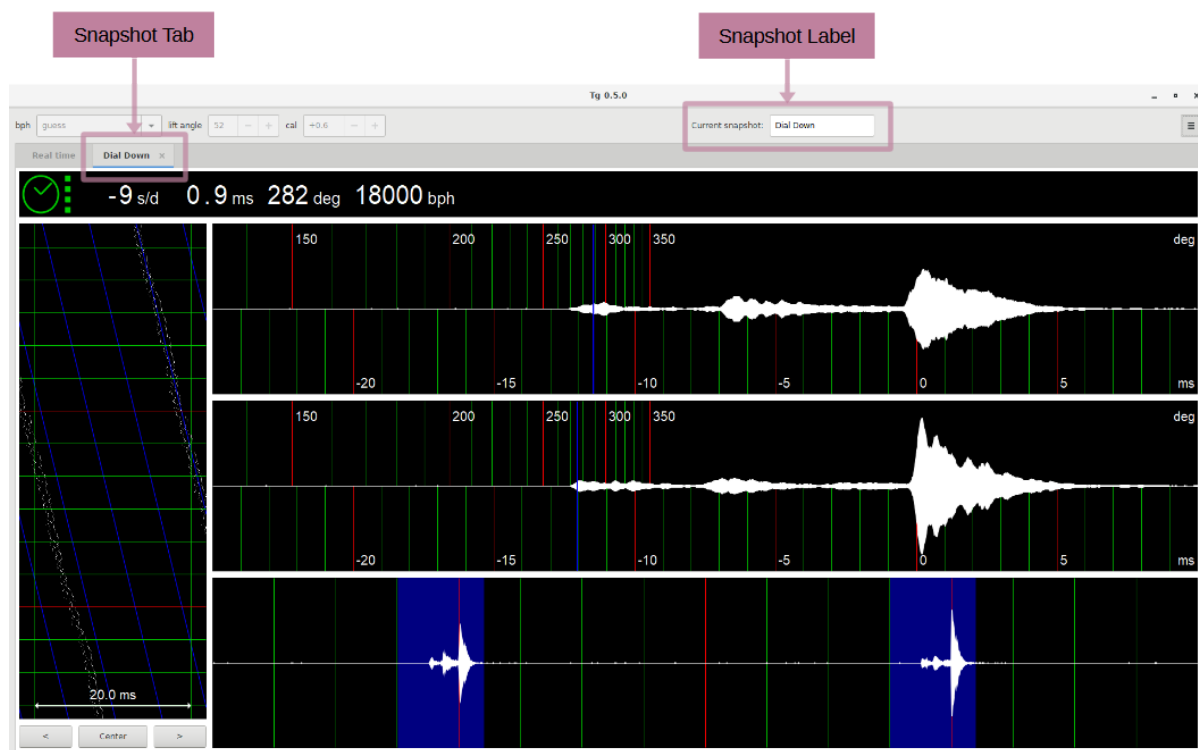
The **Scope Graph** shows the noise of each beat in real time. This graph is made up of three windows: the top two show the individual ticks and the bottom shows both ticks together. The individual displays have a scale showing the amplitude calculation in both degrees and milliseconds. Seeing the noise as the impulse jewel passes through the pallet fork gives valuable information when diagnosing issues in the escapement.

INFO

The beat noise of the Swiss lever escapement consists of three different impulses. The first noise is from the impulse-pin striking the fork of the pallet. The second noise is created by a tooth of the escape-wheel meeting the pallet stone and pallet fork touching the impulse-pin. The third noise is the loudest and is caused by a tooth of the escape-wheel hitting the locking-plane of the pallet stone and the pallet fork hitting the banking-pin.

Snapshots

The snapshot feature allows the user to capture the timing data at the moment the **Take Snapshot** button is pressed. The new snapshot is displayed in a new tab that can be labeled. Multiple snapshots can be captured and viewed. This allows the user to quickly compare the watch timing in different positions for example. Snapshots can be saved for later viewing in Tg.



Troubleshooting

Signal Quality not staying green or is poor quality

If **Signal Quality** display is switching between green and red or the quality indication is staying at two or less squares, this indicates that there is an issue with either too much noise in the environment or too weak of a beat noise from the watch. First check the **Scope Graph** to make sure that you can see some sort of beat being displayed.

If the watch beat can be seen, follow the instructions for **Too much noise on Scope Graph**. Otherwise if no watch beat can be seen, follow the instructions for **No signal detected**.

Too much noise on Scope Graph

If the graph looks noisy the software may not be detecting the watch beat correctly. Try turning off any sources of noise or moving to a new location. The computer fans can be a source of noise and moving the computer away from the microphone can help. Also check the placement of the microphone to make sure that it is as close as possible to the watch, sometimes switching placement sides can help.

No signal detected

If no watch beat can be seen on the graph but other noises are present, this indicates that there is an issue with the microphone picking up the watch beat.

Check to make sure that the correct microphone is selected in on the computer's operating system (Tg uses the microphone the operating system marks as active).

Next check the placement of the microphone to make sure that it is as close as possible to the watch, sometimes switching placement sides can help.

Next check if the sound card or operating system has any noise canceling turned on. Noise canceling will remove the watch beat noise along with the background noise being picked up by the microphone.

Calibration failed

If the calibration failed it is likely caused by issues with the watch signal from the microphone.

If the watch beat can be seen, follow the instructions for **Too much noise on Scope Graph**. Otherwise if no watch beat can be seen, follow the instructions for **No signal detected**.