

ChronoCube®

OPERATING INSTRUCTIONS



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1 Security advise



Please read carefully all the information contained in this document and strictly follow the operating instructions, which will help you to use and safely operate our product. Keep these instructions in a safe place near the instrument and give it to any other user.

The facility must be used only for the aims and purposes described in these very operating instructions and must be set up and operated as described and under the conditions herein specified.

The Manufacturer, Witschi Electronic AG in CH - 3294 Büren a.A. Switzerland takes no responsibility and offers no warranty for damages that may follow from the non-observance of these directives or from inappropriate handling, such as damages to the checking device, to watches and/or people!

1.1 Recycling

This electronic instrument should not be disposed of as household refuse. If it is not accepted by public collecting points, kindly bring it back to the sales outlet. It will provide suitable disposal according to legal directives. Your equipment suppliers in the EU will take back free of charge all instruments manufactured after the 13.8.2005, as well as an older instrument provided an equivalent new instrument is purchased.

Congratulations

You have made an excellent choice.

By purchasing a **ChronoCube** you have selected a revolutionary and easy-to-operate testing device for mechanical watches.

The system consists of a **ChronoCube** measuring unit and PC software with an extraordinary user interface that requires almost no parameterisation.

Never before was a device so easy to operate – this is a first.

2 Scope of supply

- ChronoCube test device with USB cable.
- Installation CD with PC software and PDF files containing the Operating instructions in German, French, English, Spanish and Italian.
- Brief instructions.

3 Minimum requirements of PC or laptop

- Suitable processor for operating system Windows XP, Windows 7, Windows 8
- RAM: min. 2 GB
- Graphics card: with MPEG-4 support
- CD/DVD drive
- USB port: 2.0 (high power 5V/500mA)
- Operating system: Windows XP SP3 (32 bit), Windows 7 (32 / 64 bit) or Windows 8 (32 / 64 bit)



The ChronoCube software can be started only once and supports only one ChronoCube.

4 Installation

- Remove ChronoCube, CD and documents from the packaging (please do not throw the packaging away).



Firstly install the software!

- Insert the CD into the drive and close. Installation starts automatically.
If the installation does not start, double click on the file '**chronocube_setup.exe**'.
Then follow the instructions.
The ChronoCube icon is placed on your desktop.
- Connect the ChronoCube to the USB port of your computer.
The new hardware will be recognised and installation of the ChronoCube driver takes place automatically. If not, install the driver manually.

5 Operation

5.1 Switching the ChronoCube on and off

The ChronoCube does not have an ON/OFF switch of its own.

The device is switched on and off at the same time as the computer via the USB port.

5.2 Using the device

1) Start-up software program



2) Settings

A click on **Options** opens the adjoining windows.
The default lift angle is 50°. Is the lift angle of the watch known, it can be set (from 10° to 90°) by using the <+> and <-> button. Reset to 50° with the <S> button.

Language Select preferred language

Select **Printer** and **Format**

Before the first printout the attached printer must be selected by a click on **Printer**, as well as the paper size; A4, A5 or Letter.

Show Tooltips can be turned on and off



3) Design

With a click on **Design** one of the three display modes can be selected:

Classic



Sport



Sport Light



5.3 Test watch



The sensor can only be moved in and out in the horizontal measuring position (HH).

Touch the Witschi logo → The sensor travels out → Put watch or watch movement in place
The crown must be pointing **inwards**!



Touch the Witschi logo → Watch is fixed → The watch signal is detected and the symbol flashes in time with the beat rate and the measurement procedure starts with stabilisation.



The beat number and remaining stabilisation time are displayed. Beat number is not displayed when display mode Sport Light is selected.

Measurement starts automatically once the stabilisation time has elapsed.

Measurement time is from 2 seconds to max. 60 minutes. On reaching the maximum measurement time, measuring is stopped. The rate, beat error, amplitude, average rate value, beat error and the measurement time elapsed are displayed.



The measurement procedure is restarted by clicking on **Restart** or by putting the ChronoCube into another measuring position.

5.4 Print-out of the measurement results

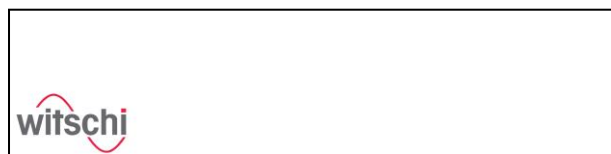
Clicking on **Print** will print the measurement results of rate, amplitude and beat error as well as additional informations, such as beat number, lift angle, device data, Date / Time, Witschi logo or customer logo.

Print with customer logo

The Witschi logo file "**logo.jpg**" is placed in the directory **c:\Witschi\ChronoCube\Cc**
This logo can be replaced with your own logo.

The size of the graphic area of the logo is 16 x 4 cm.

Thus the customer logo appears in the header on the left, it is placed to the left in the graphic area. The logo can also be placed in the center or right.



IMPORTANT!

The file name "**logo.jpg**" of the personalized graphic file must be maintained. The file must be saved to the same directory, i.e. the existing file is overwritten.

The file must be removed from the directory, if no logo on the printout is desired

5.5 Recommendations for typical measuring values

- Rate accuracy for recent watches: in the range of about - 5 to + 20s/d.
- Amplitude for recent and wound watches: in the range of about 280° to 330°
- Beat error for recent watches: should not exceed 1ms.

If present, consult the information provided by the watch manufacturer.

5.6 Error messages

- << *The ChronoCube cannot be open in this position.* >>
Place the ChronoCube in the horizontal position (HH).
- << *Beat number not recognized. The measure is stopped* >>
Causes:
Unstable signal → Outside of the measuring range → Beat number not measurable → Watch not wound enough → Very bad beat noises due to dirty movement, gummy oil etc.
- << *No watch signal detected.* >>
Cause:
Watch is not running, watch is may be not wound up.

Measuring positions

You can put the ChronoCube into different measuring positions manually. The new measuring positions are detected automatically and the measurement procedure starts again.

Possible measuring positions

Dial up (HH)



Dial down (HB)



Crown down (9H)



Crown right (12H)



Crown left (6H)



If you close the ChronoCube software, the sensor is automatically retracted. Make sure there is not a watch on the sensor!

6 Informations

Click on the icon



Various items of information can be called up: software licence, software version, data of the attached ChronoCube, user manual as a PDF file and direct link to the Witschi Support Website.



7 Maintenance

The ChronoCube requires no special maintenance.

Only ever use a soft cloth to clean any dirt off the device. Never use aggressive cleaning agents or solvents. If you require technical support, please contact our Customer Service department at our company headquarters or your local representative.

8 Technical data

- Measurement options: Rate variation, amplitude and beat error of mechanical watches.
- Rate: ± 99 s/d or ± 999 s/d
- Amplitude: Maximum 359° , or xxx if amplitude $> 359^\circ$
- Lift angle: Adjustable from 10° to 90°
- Beat error: Numerical display in milliseconds, 0.0 to 9.9 ms
- Test positions: Automatic detection
- Beat number: 12,000, 14,400, 18,000, 19,800, 21,600, 25,200, 28,800, 32,400, 36,000, 43,200, 50,400, 57,600, 64,800 and 72,000.
Beat numbers are determined automatically.
- Stabilisation time: 20 secs., pre-specified (cannot be modified)
- Measurement time: 2 secs. to 60 mins.
- Interface: USB 2.0
- Current consumption: 5 V, max. 500 mA via USB 2.0 or USB 3.0 interface.
- Colour: Aluminium, Steel or Ruby.
- Dimensions: 110 x 110 x 110 mm.
- Weight: 1.2 kg.

9 EC Declaration of Conformity

The instrument is in conformity with the following EC-Directives:

Guidelines:

2004/108/EG	electromagnetic compatibility
2006/42/EG	EC machinery directive

Standards:

EN 61326-1:2006	Electrical equipment for measurement, control and laboratory use. EMC requirements, General requirements.
EN ISO 12100-x	Safety of machinery
EN 55022:2006	Information technology equipment. Radio disturbance characteristics. Limits and methods of measurement.
IEC 1000-4-x	Electromagnetic compatibility (EMC), HF, Burst, Surge, Cond. Immunity, 50Hz Magn. Puls, Dips

10 Definition of the quality display rate accuracy

For better understanding the display of the rate accuracy, it is also visualized with a quality indicator in the form of 5 stars.

Quality class	Rate Tolerance min. s/d	Rate Tolerance max. s/d
★ ★ ★ ★ ★	-4	+6
★ ★ ★ ★ ☆	-5	+8
★ ★ ★ ☆ ☆	-6	+10
★ ★ ☆ ☆ ☆	-10	+15
★ ☆ ☆ ☆ ☆	-20	+30

The quality display rate starts immediately after the stabilization period, based on the measured value "average rate" and is reinterpreted every 2 seconds. The measured value "average rate" is the average over the whole measurement period.

The quality class is a statement about the **rate adjustment quality** of the watch. The influence of the winding state of the watch (oscillation amplitude) is not considered. Greater rate deviations can have various causes, such as the watch has been subjected to shocks or strong magnetic fields.

Due to this classification no statement can be derived about the overall quality respectively the high grade of the watch.

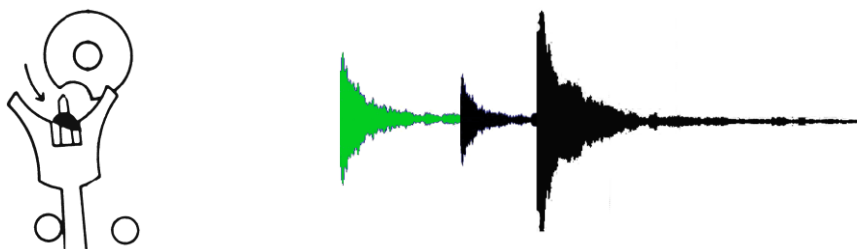
11 Test and measurement technology for mechanical watches

11.1 Functioning of the regulating organ

11.1.1 The beat noise of the Swiss lever escapement

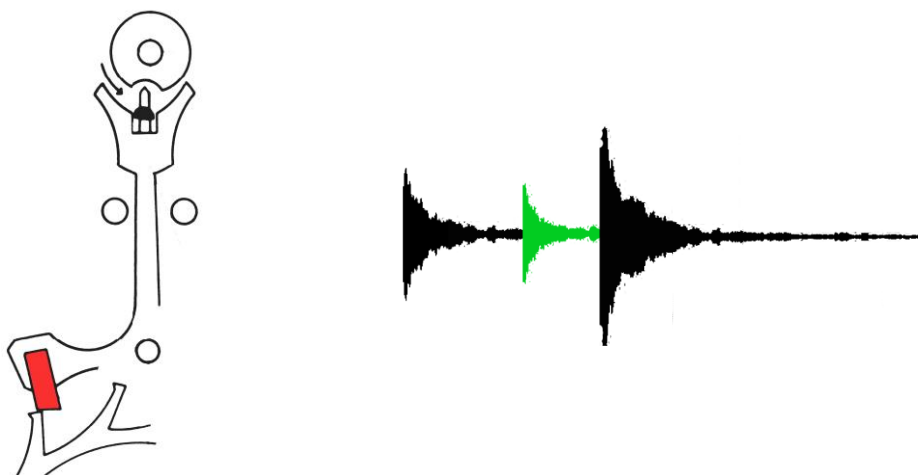
Normally, the beat noise of the Swiss lever escapement consists from three different pulses.

The first noise occurs when the impulse-pin of the roll strikes the fork of the pallets. This noise is temporally very precise and is therefore used for the graph recording and for calculation of the rate deviation and the beat error (repère).

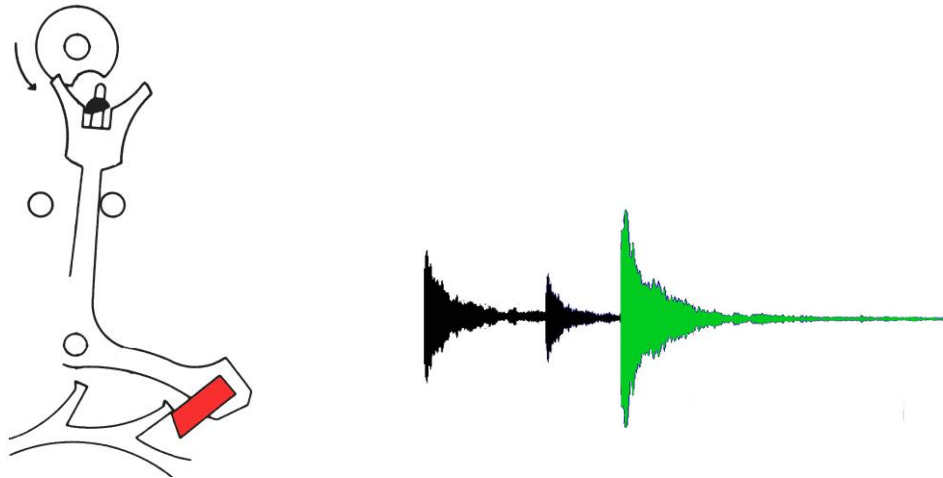


A second noise is created when a tooth of the escape-wheel meets the pulse area of a pallet stone and the pallet fork touches the impulse-pin.

This very irregular noise cannot be used for an evaluation.



The third and most powerful noise is created when a tooth of the escape-wheel meets the locking plane of the pallet-stone and the lever hits the banking-pin. This noise is evaluated for the calculation of the amplitude.



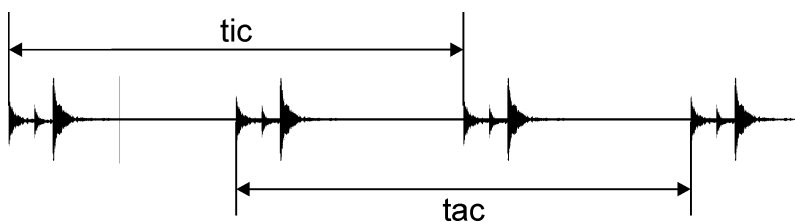
Further noises, which can be of different strengths, are also generated by friction or by secondary causes.

11.2 Evaluation of the beat noise

For the evaluation of the beat noise a measuring instrument with a very accurate time base is needed. It is also important that the beginning of the first sound package is reliably detected. If there is a very weak in this **first** noise of a watch, or if the watch generates strong background noises, the gain must be adjusted accordingly.

11.2.1 Rate Deviation

To calculate the rate deviation the differences between the measured period and the nominal value are each averaged over the set measuring time, converted in s/24h and displayed on the screen.

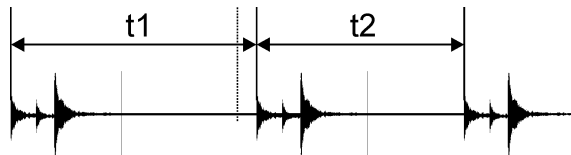


$$\text{Rate} = \frac{\text{rate tic} + \text{rate tac}}{2}$$

11.2.2 Beat Error (Repère)

Asymmetrical oscillation of the balance wheel. The vibration of a balance wheel can be described by the rotating angle. If the watch has stopped, the zero position is defined by the position of the balance wheel. Under a (still existing) "beat error" refers to the fact, that the vibration is not running in all test positions quite symmetrical around the zero position, i.e. the balance wheel is swinging in a direction further than the opposite. This asymmetry may be visible on a test device. The beat error is measured in milliseconds (ms). High quality watches have a special device for setting the beat symmetry.

The graphic below shows a typical beat error. For a nonexistent beat error, **t1** and **t2** must have identical values.

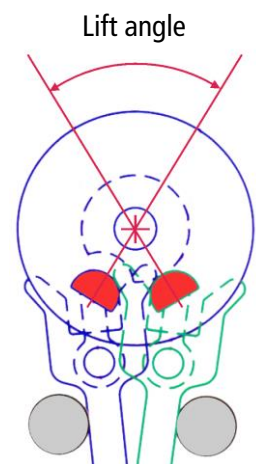


$$\text{Beat error} = \frac{t1 - t2}{2}$$

11.2.3 Functional principle Amplitude-Lift Angle

The angular velocity of the oscillating system (balance wheel with hair spring) passes through the zero point is dependent on its amplitude. The speed is determined by the elapsed time between the trigger signal and the event of the escapement. This period is called lift time of the balance wheel and the means of the balance wheel during this period traversed angle, **Lift Angle**.

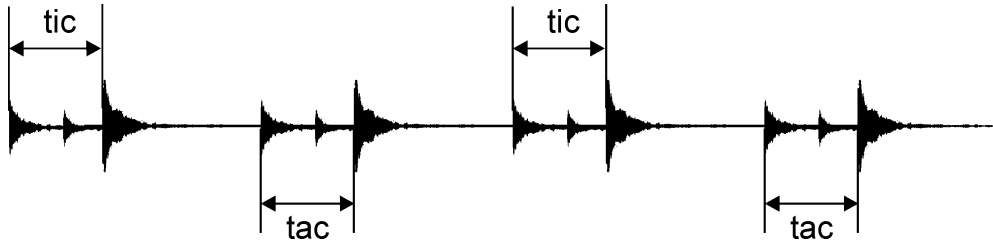
While passing through this angle, the impulse-pin (ellipse) remains in contact with the pallet fork. For the most of the standard watch movements the lift angle is about 51°.



11.2.4 Amplitude

The amplitude is the angle from the equilibrium (idle position of the balance wheel) up to the maximum distance (turning point). The amplitude values of today's popular wristwatches are located at about 260° - 310° . With increasing aging of the oils, this value decreases gradually.

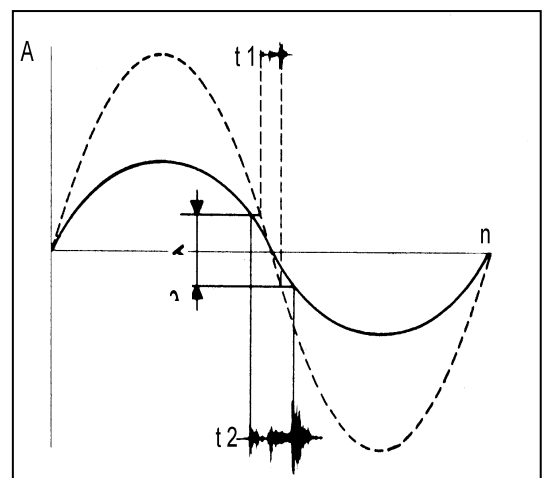
To calculate the amplitude, the time between the first pulse and the third pulse of the beat noise is measured.



Between these two pulses, the balance wheel rotates a certain angle. This so-called lift angle is determined by the construction of the movement and is entered as a parameter. The larger the amplitude of the balance wheel, the greater is the speed with which it goes through these lift angle and the shorter is the time it needs to traverse this angle.

The amplitude can therefore be calculated from the time between the first and the third pulses in the beat noise, taking into account the beat number and the lift angle.

The distance travelled during a period range of the oscillating balance wheel is a sine function. The full line corresponds to weak amplitude and the dotted line to large amplitude. The horizontal lines of the constant lift angle λ cut the two sine waves at various points. This results in weak amplitude for a long lift (t_2) and large amplitude for a short lift (t_1).



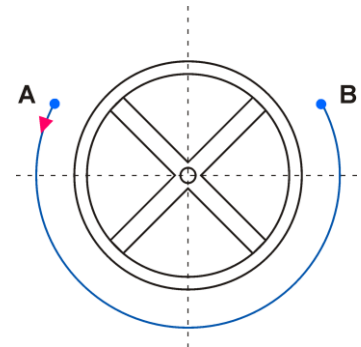
11.3 Oscillation and Frequency of the Watch

11.3.1 Oscillation

The **oscillation** of the balance wheel is the way from a turning point to another, and back (**A – B – A**).

11.3.2 Vibration

Half an oscillation of the balance wheel is called the **vibration** (**A – B**).



11.3.3 Frequency of the balance wheel

The frequency of the balance wheel (number of oscillations per second) is calculated by the formula:

$$F = \frac{A/h}{2 \cdot 3600}$$

F Frequency (Hz)

A/h Number of variations per hour

Some examples:

18'000 A/h = 2.5 Hz

21'600 A/h = 3 Hz

28'800 A/h = 4 Hz

36'000 A/h = 5 Hz

12 Witschi Measuring and Testing Technology

Witschi Electronic Ltd is a global leader in the field of measuring and testing technology for watches and other micro-technical products.

Our offer consists of devices for measuring and testing purposes for the production and repair services of mechanical and quartz watches.

In all our activities we pursue the vision, to be and to remain the world leader in the field of test technology for watches.

We want to provide innovative, quality products with customer value.

More information is to be found on our Website www.witschi.com