

## 5 DISPLAY MODES

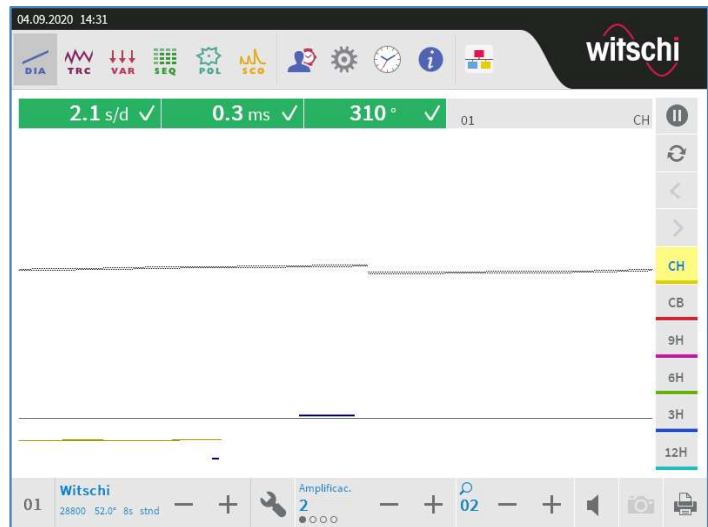
### 5.1 Display Mode Diagram



Measured values for rate deviation and beat error are continuously displayed during the measurement process. The slope of the diagram can be changed (1, 2, 4, 8 and 16 times) by pressing the *plus* and *minus* buttons (zoom).

Measured values for rate deviation, amplitude and beat error are displayed numerically. The last measured result remains displayed when measurements are paused.

The last eight pages of the measurement are shown as small strips under the current diagram if measurements have been performed for a long time. If measurements are paused, one of the last pages can be selected with the *left* and *right* buttons. The desired page can also be displayed in a large format by directly touching it.



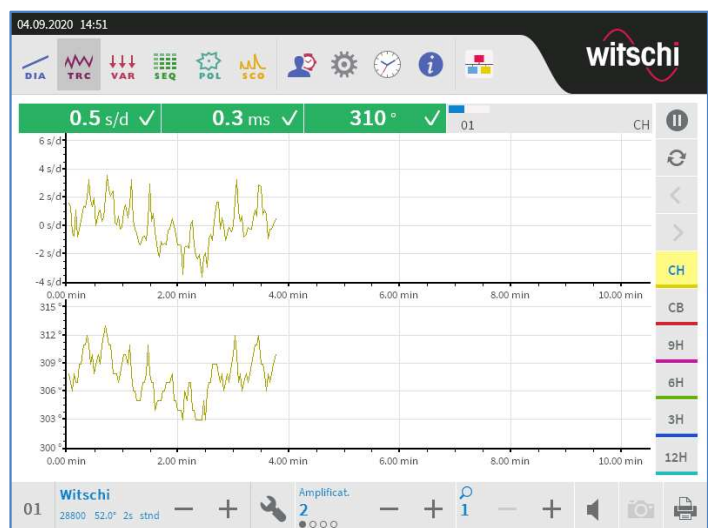
### 5.2 Trace Display Mode



This display mode is combined with the Vario display mode. It is possible to switch between the two modes during measurement or during a pause.

The rate deviation and the amplitude are contiguously recorded. The *plus* and *minus* buttons allow zooming in and out (1 to 8 times).

Measured values for rate deviation, amplitude and beat error are displayed numerically. The last measured result remains displayed when measurements are paused. The means are numerically displayed at the end of the measurement time.



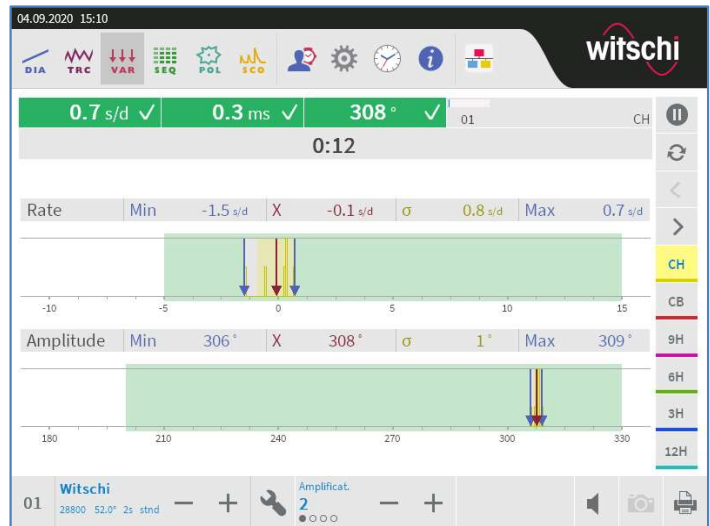
### 5.3 Vario Display Mode



The Vario display mode measures the rate and amplitude over a longer time range.

The following measured values related to rate and amplitude is continuously updated during the measurement process: smallest and largest measured values, mean, standard deviation, elapsed measurement time and current measured value.

Measured values for rate deviation, amplitude and beat error are displayed numerically. The last measured result remains displayed when measurements are paused. The means are numerically displayed at the end of the measurement time.



#### Checking the rate quality:

The evaluation of the quality takes place via the interpretation of the 2 analysed rate values.

- The difference between the minimum and the maximum rate value, presented with the vertical arrows, is a quality indicator of the watches condition. The smaller the difference the better is the rate stability.
- The average value **X** is an indicator for the adjustment quality of the watch movement.
- $\sigma$  (Sigma) shows the standard deviation ( 68.2%) of all instantaneous rate and amplitude measurements. (1 Sigma = +/- 34.1% = 68.2%)

### 5.4 Sequence Display Mode



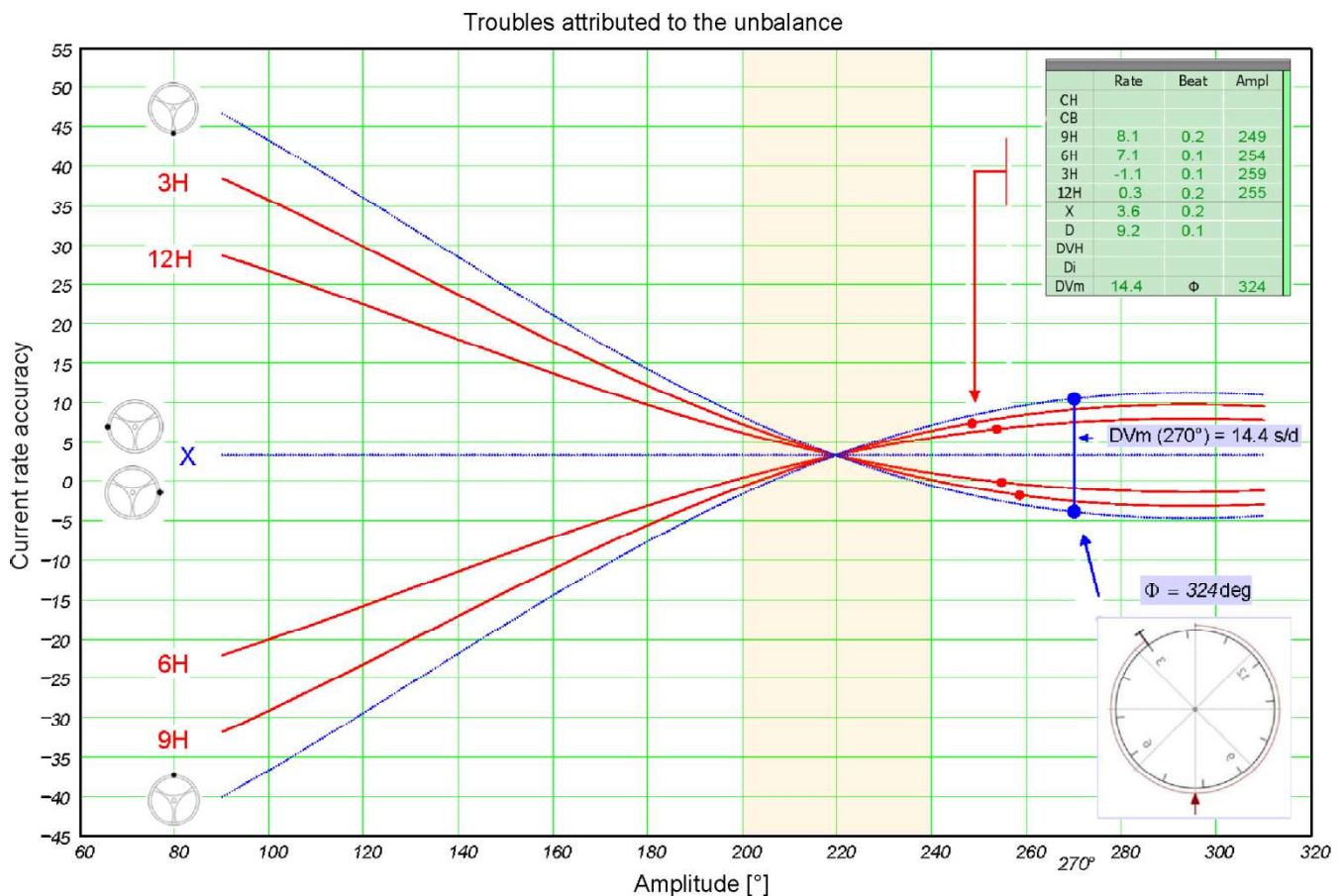
A measurement cycle including up to 10 test positions can be defined in this mode. The measurement cycle can also be started from Micromat C.

The left and right buttons allow selecting one of the Diagram, Trace, Vario and Sequence formats during or after the measurement cycle.



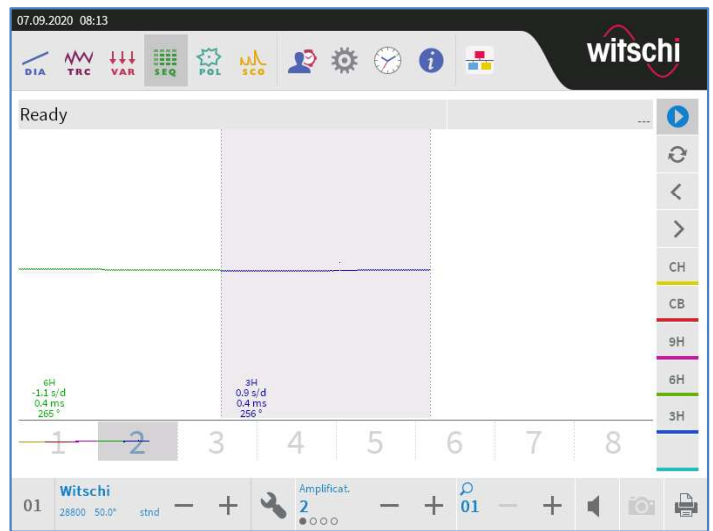
The following measurement results are calculated for rate, amplitude and beat error:

- Mean for each test position
- **X**: Mean of all test positions
- **D**: Difference between the largest and the smallest measured value.
- **DVH**: Only for rate and amplitude. Difference between the mean of all vertical test positions and the mean of all horizontal test positions.
- **Di**: Only for rate. Difference between the 6H and CH test positions.
- **DVm**: Standardized rate difference proportionally to the size of the unbalance. I.e. theoretical maximum rate difference caused by the unbalance of the balance wheel, at an amplitude of  $270^\circ$ , in the two vertical positions where the unbalance is down or above on the vertical.
- **$\Phi$** : Watch is in vertical position. Shows the place of the unbalanced point on the balance wheel (flash)  
I.e. The rotation angle of the stem refers to the 3H position.



During a measurement cycle, the test position and measured rate accuracy will be displayed.

After an elapsed measurement cycle appears in “Diagram” display mode the test positions with its numerical measuring values of rate accuracy, beat error and amplitude.



## 5.5 Polar Display Mode



POLAR display mode indicates the rate stability in a polar diagram. One revolution (rotation time) of the Tourbillon watch corresponds to one revolution on the diagram. The average values of rate, beat error and amplitude for specific angles are calculated and displayed. The watchmaker can now determine the centre of gravity of the balance wheel.

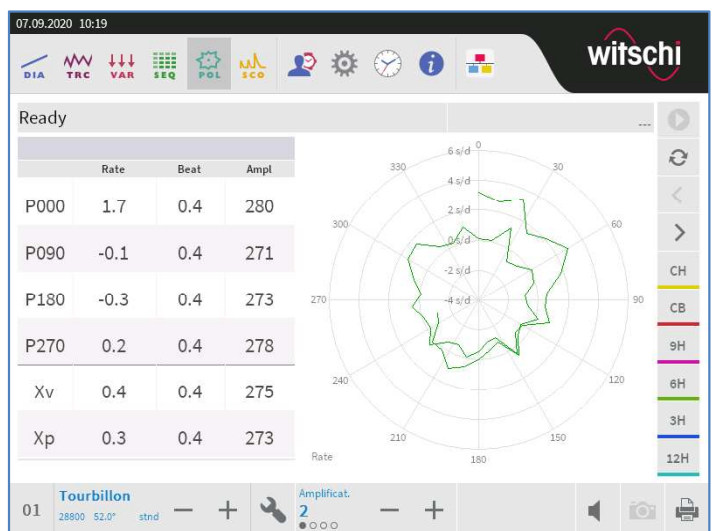
First, the desired start position (9H, 6H, 3H or 12H) must be selected. By pressing the **▼start** button on the MMC, the start position 6H is automatically approached.

Upon reaching the start position, the stabilisation time must be awaited before starting the measuring cycle (i.e. 30 seconds stabilisation at a rotation time of 60 seconds = half turn of the Tourbillon cage). Then start the cycle with:

- **▼start** button on the MMC or



- button on the X1



### Important!

The measurement time should be at least the tourbillon rotation time. Recommended is a measurement time that corresponds to five full tourbillon rotations (see chapter 6.5, page 26).

The first result is automatically assigned to the value P000. Thus, the user must define a starting point based on the visible balance wheel position and the trigger the measurement always in the correct condition (Fig.).

With the two arrow buttons you can toggle between the displays of rate accuracy and amplitude.

Results:

	Rate	Beat	Ampl
P000	1.7	0.4	280
P090	-0.1	0.4	271
P180	-0.3	0.4	273
P270	0.2	0.4	278
Xv	0.4	0.4	275
Xp	0.3	0.4	273

- **P000:** Average value of the results at the star of the measurement
- **P090:** Average value of the results after a 90° rotation of the tourbillon cage
- **P180:** Average value of the results after a 180° rotation of the tourbillon cage
- **P270:** Average value of the results after a 270° rotation of the tourbillon cage
- **Xv:** Average value of the four results P000, P090, P180 and P270
- **Xp:** Average value of all results of the total measurement time

## 5.6 Scope Display Mode

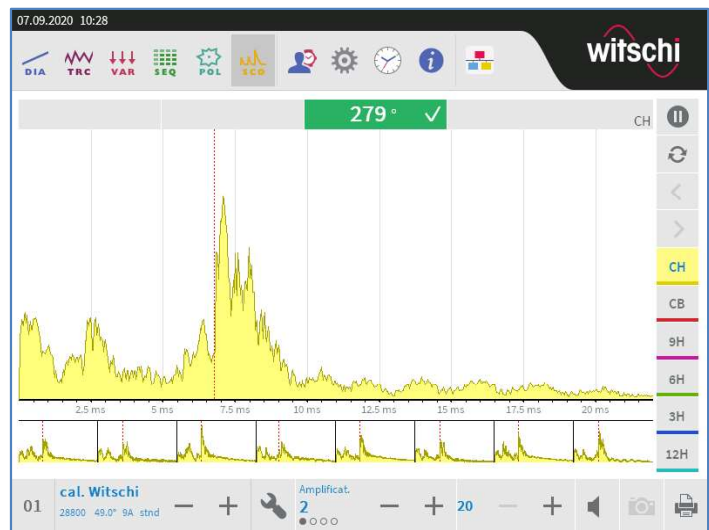
### Mode: Scope 1



The acoustic beat noise of the watch is graphically shown in this mode. The Tic and the Tac are shown alternatively.

A time range of 20 ms, 200 ms or 400 ms can be selected with the left and right buttons.

The last eight scopes are shown as small strips under the current beat noise if measurements have been performed for a long time. The desired beat noise can also be displayed in a large format by directly touching it.

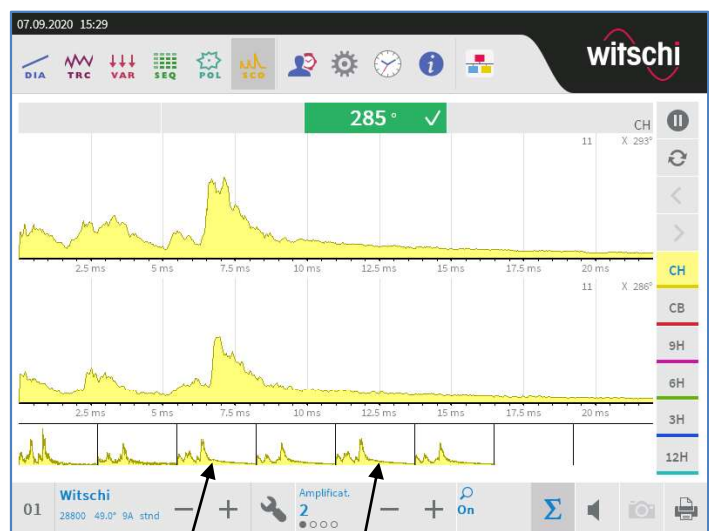


### Mode: Scope 2

In this mode the averaging can be switched on and off with the  $\Sigma$  button. The time range is fixed at 20 ms. Presentation of the beat noises (tic and tac) on two horizontal axes.

When the averaging mode is turned off, the beat noises are continuously recorded.

When the averaging mode is turned on, the graphical presentation of a certain amount of beat noises is averaged.



Picture 3

Picture 5

The duration of the measurement cycle is determined by the beat number and the selected interval. It is finished after 50 Tic and 50 Tac intervals and the average value of the amplitude is displayed on each horizontal axis. The assignment of the Tic and the Tac to the two diagrams cannot be determined.

When you click on Picture 3 the average value after 10 intervals is displayed, and for Picture 5 after 20 intervals.

The **Averaging** of the signal is a process, by which the noise can be reduced in repetitive signals. By additive superposition the signal is thereby increased, while the superposition of random noise leads to a lower gain. Overall, the signal-to-noise ratio is improved.