

WITSCHI GPS RECEIVER



User Manual

Document Nr. 19.91D35e

Rel. 2.2

April 2011

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1 OVERVIEW

All *new* Witschi test equipment for mechanical and quartz watches perform a software compensation of the offset of their internal time base. In order to measure the device time base offset a highly accurate external reference signal is used. The reference signal is a pulse-per-second (pps) signal that could be offered by Witschi GPS receiver.

This solution takes benefits of the timing capabilities of the Global Positioning System (GPS). The GPS consists of a constellation of 24 satellites providing worldwide, 24 hour, and three-dimensional coverage. Each GPS satellite contains a highly stable Cesium clock, which is continuously monitored and corrected by the GPS control segment. GPS receivers use the signal from the GPS satellites to correct its internal clock and to output a highly accurate timing pulse synchronized to UTC (Universal Time, Coordinated).

2 GETTING STARTED

The receiver is ready for fast, easy installation. Just follow the setup steps showed below, and you have an instant GPS message and after few minutes an accurate PPS signal.

The PPS signal is available only when valid position fixes are being reported (minimum 4 tracked satellites) and is indicated by "Signal LED" blinking.

The numbers in the illustration match the corresponding setup steps.



- 1** Connect antenna cable to its connector on back of device.
Antenna connection is made by pushing the antenna cable connector onto SMB connector on the unit. To remove antenna cable, simply pull the antenna connector off of the SMB connector.
See later "Antenna Placement" paragraph for a GPS antenna install overview.
- 2** Carefully align to avoid bending connector pins and gently insert communication cable to its connector on front of device. Then tighten thumbscrews.
To use the receiver for the Witschi's devices calibration purposes, as Chronoscope M1 or Analyzer Q2, see their specific operation guides. Use the delivered RS232 cable to connect the receiver port with the device's serial port. The 1PPS signal is an open-collector interface on pin 9 of this port.
- 3** Connect the power adaptor jack to its connector on back of device.
Make sure voltage shows on power adaptor corresponds to your main supply voltage.
Plug power adapter into wall outlet.
- 4** LED Power - switched on when the device is supplied.
- 5** LED Signal - blinks one time per second only when valid position fixes is being reported.

2.1

ANTENNA PLACEMENT

Because the GPS signals are spread spectrum signals in the 1575 MHz range and do not penetrate conductive or opaque surfaces, the GPS antenna must be located outdoors with a clear view of the sky. The antenna can receive satellite signals through glass, canvas, and thin fiberglass, but dense wood, concrete and metal structures shield the antenna from satellite signals.

- ***View of the sky***

Select an area where the GPS antenna will have an unobstructed view of the sky. An ideal position has no obstructions above a point 10 degrees above the horizon. The total blockage of the sky (due to buildings, mountains, etc.) should be less than 50%.

- ***Lightning considerations***

Locate the antenna at least 15 meters away from lightning rods, towers, or structures that attract lightning. The GPS antenna damage is usually not the result of a direct lightning strike, but the effects of a lightning strike on a nearby structure. Locate the GPS antenna lower than any structures that will attract a strike.

- ***Maintenance considerations***

If the GPS rooftop antenna fails or must be checked, having the antenna positioned in an easily accessible location will facilitate maintenance.

When magnetic-mount GPS antenna is installed on a metal surface for prolonged periods, care must be taken to insulate the antenna in order to prevent galvanic corrosion.

- ***Interference considerations***

The antenna is an active-head antenna. For optimal performance, place as far as possible from transmitting antennas, including radars, satellite communication installation and cellular transmitters.

2.2

Verification / Adjustment of the equipment's quartz time base

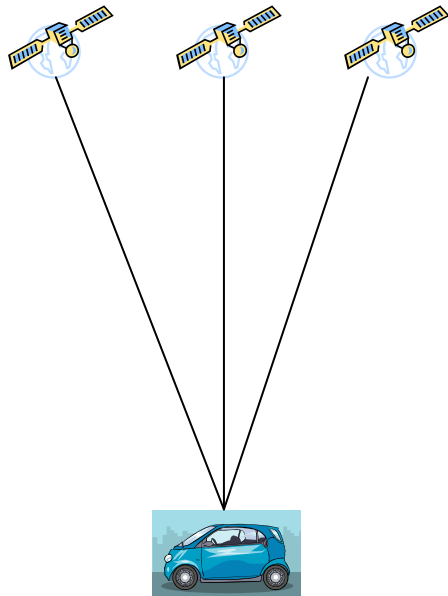
The procedure is described in the respective operating manual (please consult the equipments manual).

3 GENERAL KNOWLEDGE ABOUT GPS

3.1 THE DIFFERENCE BETWEEN GPS RECEIVER SYSTEMS

Navigation

minimum 3 satellites (atomic clocks) are requested



Mode of calculation:

The time difference of the input signal of 3 satellites allows determining the geographical position of any receiver on earth.

The achieved geographical accuracy: ~ **2 x 2 meters**.

The available short time accuracy of the 3 satellites on ground:

(Due to atmospheric disturbances) is

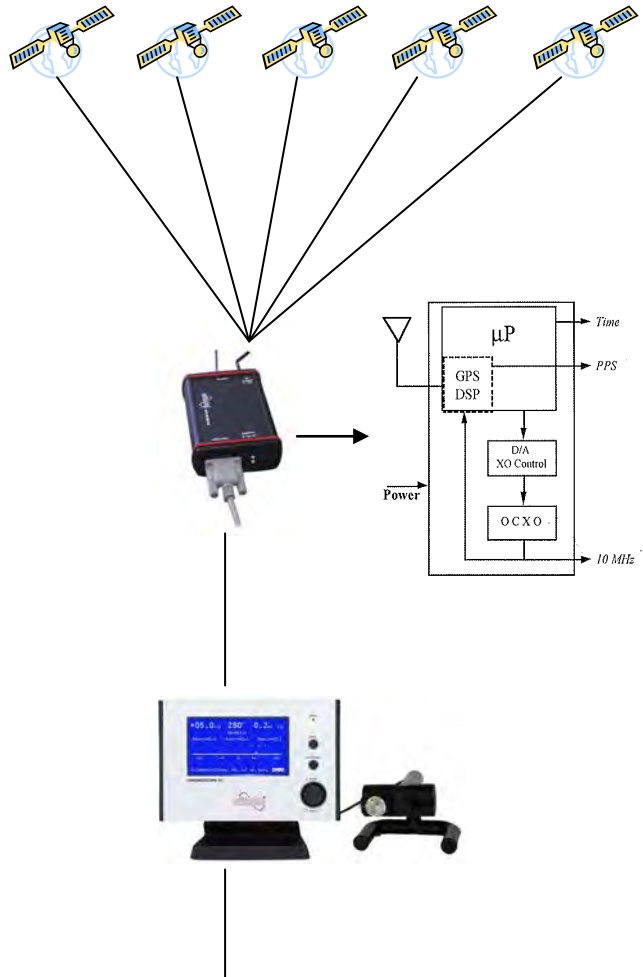
~ **0.01-0.001 seconds**.

This achieved accuracy is absolutely sufficient to appropriate the geographical position of a driving car.

For the high accurate time base adjustment, the accuracy **of 0.01 to 0.001 seconds is however not sufficient.**

Timing (Timebase adjustments)

Minimum 4 to 5 satellites (atomic clocks) are requested



Mode of calculation:

The GPS receivers for the high accurate time base adjustment work normally with 5 satellites.

The incoming GPS signals are stored for 5 to 12 seconds to get a very accurate and stable average value of the GPS signals. (1.4 - 1.6 GHz)

The receiver provides now an ultra stable reference signal of 1 Hz or PPS (pulse per second).

Achieved tolerance of 1 PPS= +/- 15 - 75 ns (nano seconds), related to the atomic clock of the GPS system.

= 0.015 – 0.075 milliseconds

(Certified and controlled by the NIST = National Institute of Standards and Technology)

4 GPS Equipment

4.1 SYSTEM DESCRIPTION

The Witschi GPS Receiver Kit is composed of the following items:

Set I – Art. 19.91PK1

1. Receiver
2. 2 pcs. AC/AC mains Adapter / 230 Volt + 110 Volt
3. GPS Antenna
4. RS 232 9 pin link cable - for Chronoscope M1 / S1 / Watch Expert II + III / NT Handy II / Analyzer Q1 and Analyzer Twin

1



2



3



4



Set II – Art. 19.91PK11 (including point 1 to 4)

5. Magnetic signal transmitter - for QT 6000 , (NT Handy- Rate check only)
6. DIN 5 pin plug with cable - for WE / Wicometre Prof

6



5



5 Technical data per type of device

Important remarks:

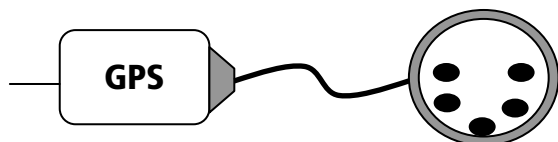
The instrument has to be always **on-state** during **10 minutes before** you start the adjustment procedure.
Witschi Electronic takes over no responsibility for the result of the adjustment.

Type of device	Time base adjustment system	Cable connection and plug (GPS receiver to device)	Accepted standard tolerance In s/day (for adjusted device)	Special remarks
Chronoscope X1 with Micromat C	Software	RS 232 9 Pin	+/- 0.005	Connect cable on Micromat C interface.
Chronoscope M1	Software	RS 232 9 Pin	+/- 0.005	Connect cable on interface "calibration"
Chronoscope S1	Software	RS 232 9 Pin	+/- 0.005	Connect cable on interface "PC / calibration"
Watch Expert II / III	Software	RS 232 9 Pin	+/- 0.02	Connect cable on RS interface
Analyzer Q1 / Analyzer Twin	Software	RS 232 9 Pin	+/- 0.005	Connect cable on interface "Calibration"
New Tech Handy (light grey case). From Software version 1.40 and >	Software	Magnetic signal transmitter	+/- 0.005	Magnetic signal transmitter on sensor <i>motor / LCD / 32kHz</i>
New Tech Handy 2	Software	RS 232 9 Pin	+/- 0.005	Connect cable on R interface S
Watch Expert (Red case)	Trimmer	DIN 5 Pin	+/- 0.02	The time base adjustment by GPS is only possible for instruments with a serial number of > 3000
Wicometre Professional	Trimmer	DIN 5 Pin	+/- 0.02	The automatic microphones Micromat P and S are not adjustable (No time base inside)
QT 6000	Trimmer	Magnetic signal transmitter	+/-0.01	On QT 6000, select pos. "stepp. motor"
New Tech Handy (Red case) Not adjustable by GPS	Software (8Hz)	Magnetic signal transmitter	+/-0.02	Not adjustable by GPS (Output signal 8 Hz capacitive) Rate can be examined by magnetic signal transmitter
Wicometre High Tech	Trimmer	-----	-----	Not adjustable by GPS

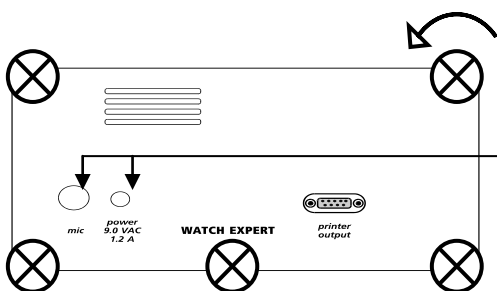
6 Watch Expert (Red case / Trimmer)

Important remarks:

- The instrument has to be **on-state** during **10 minutes before** you start the adjustment procedure.
- **Witschi Electronic** takes over no responsibility for the result of the adjustment.



Connect the **5 pin DIN plug** on the signal output of the GPS receiver.
Check the presence of the GPS signal.
(Blinking LED of the GPS receiver)



Remove the five locking screws of the case back.

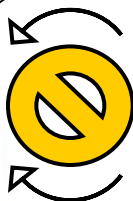
Connect now the adaptor plug on the **power supply** socket-, and the **5 pin DIN plug of the GPS** on the mother board and switch on the Watch Expert. The instrument has now to be **on-state** during **10 minutes before** you start the adjustment procedure. (Stabilizing of the time base)

Caution: The time base adjustment by GPS on the Watch Expert's (red cases) is only possible for instruments **with a serial number ≥ 3000** . Starting from this serial number, the instruments are equipped with the additional measuring mode **quartz**. This automatically selected standard mode to adjust the time base by GPS.

Settings on the WE: *Graph. Resol.* (Resolution): Level 5 / *Meas. Time:* 2 sec. / *Speaker:* on



Select a screwdriver with blade size 2-3mm and place it carefully into the trimmer screw head / slit.
(On the motherboard, there are two possible positions of the trimmer)



Observe now the actual displayed rate on the LC display **rate** and adjust it on zero (0.00) by turning the screw driver on the left- or right direction.

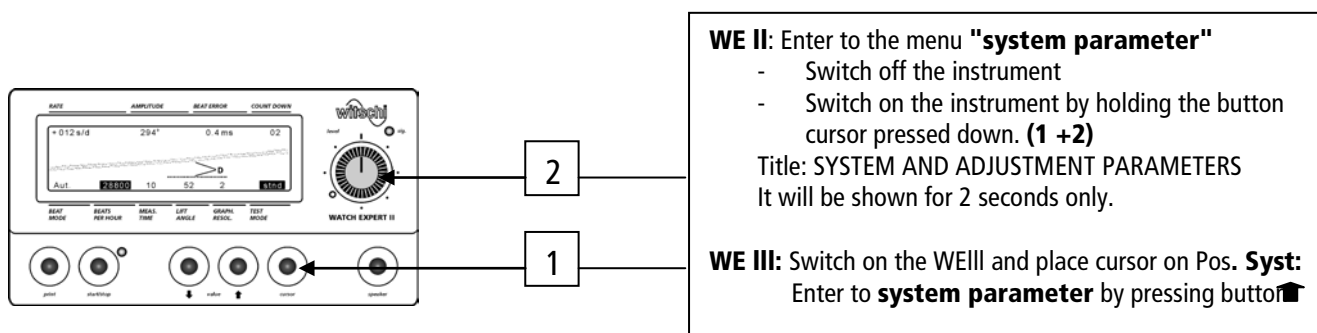
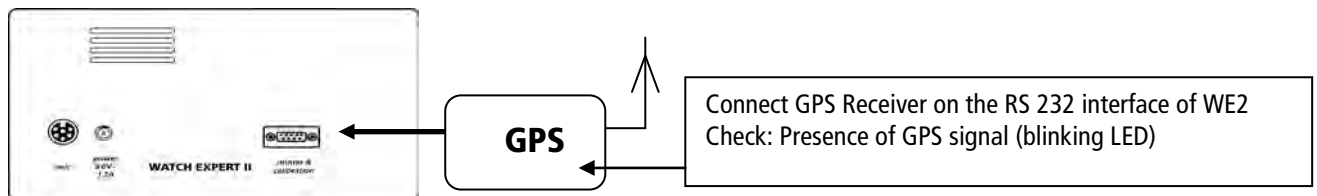
Accepted standard tolerance: ± 0.02 s /day.

Reinstall the case back on the rear side of the Watch Expert case and screw on the five locking screws. Connect now the adaptor plug on the power supply socket and the 5 pin DIN plug of the GPS on the Watch Expert and check now again the rate value of the adjusted instrument.

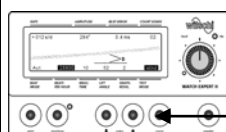
7 Watch Expert II and III

Important remarks:

- The instrument has to be **on-state** during **10 minutes before** you start the adjustment procedure.
- **Witschi Electronic** takes over no responsibility for the result of the adjustment.



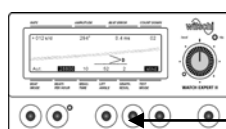
```
No signal: clear  Default param
Graph speed:1/1  Time base
Unit resol: 1 s/d  IDN:00241
1:Witschi Electron. AG
2:CH - Bueren a. A.
Quit
```



Menu:
SYSTEM AND ADJUSTMENT PARAMETERS

Go to POS. **Time base** by pressing the button CURSOR

```
Time base? Verify
```



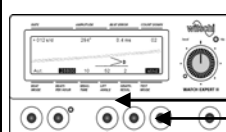
Menu:
SYSTEM AND ADJUSTMENT PARAMETERS

Select by pressing the button or the desired function. (Loop)
You can choose between
Verify/ Adjust /Cancel

```
Time base? Adjust
```

Select: **Adjust**

```
Start adjustment? yes
```



Go to the menu:
Start adjustment by pressing the button CURSOR
Select by pressing or Pos. **Yes**

Start by pressing CURSOR the **adjustment**
and **re-check it by verify**
Accepted standard tolerance: +/- 0,02 s/day

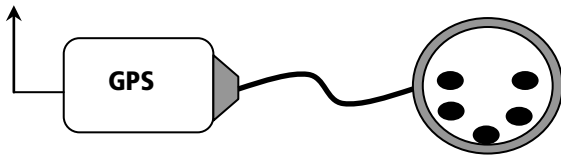
If the selected function is **successful executed**,

- remove the GPS plug from the calibration socket
- switch off the instrument (reset)
- and switch on again the instrument (restart)

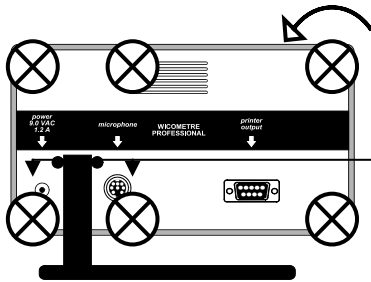
8 Wicometre Professional (Trimmer)

Important remarks:

- The instrument has to be **on-state** during **10 minutes before** you start the adjustment procedure.
- **Witschi Electronic** takes over no responsibility for the result of the adjustment.



Connect the **5 pin DIN plug** on the signal output of the GPS receiver.
Check the presence of the GPS signal.
(Blinking LED of the GPS receiver)



Remove the six locking screws of the case back.

Connect now the adaptor plug on the **power supply** socket-, and the **5 pin DIN plug of the GPS** on the mother board and switch on the Watch Expert. The instrument has now to be **on-state** during **10 minutes before** you start the adjustment procedure. (Stabilizing of the time base)

Caution: If the 5 pin DIN plug of the GPS and the power supply is connected on the motherboard, the WM Professional switch's automatically to the measuring mode **quartz**. This is the standard mode to adjust the time base by GPS.

Settings on the WM Prof.: *Graph. Resol.* (Resolution) : Level 5 / *Meas. Time*: 2 sec. / *Speaker*: on



Select a screwdriver with blade size 2-3mm and place it carefully into the trimmer screw head / slit.
(On the motherboard, there are two possible positions of the trimmer)

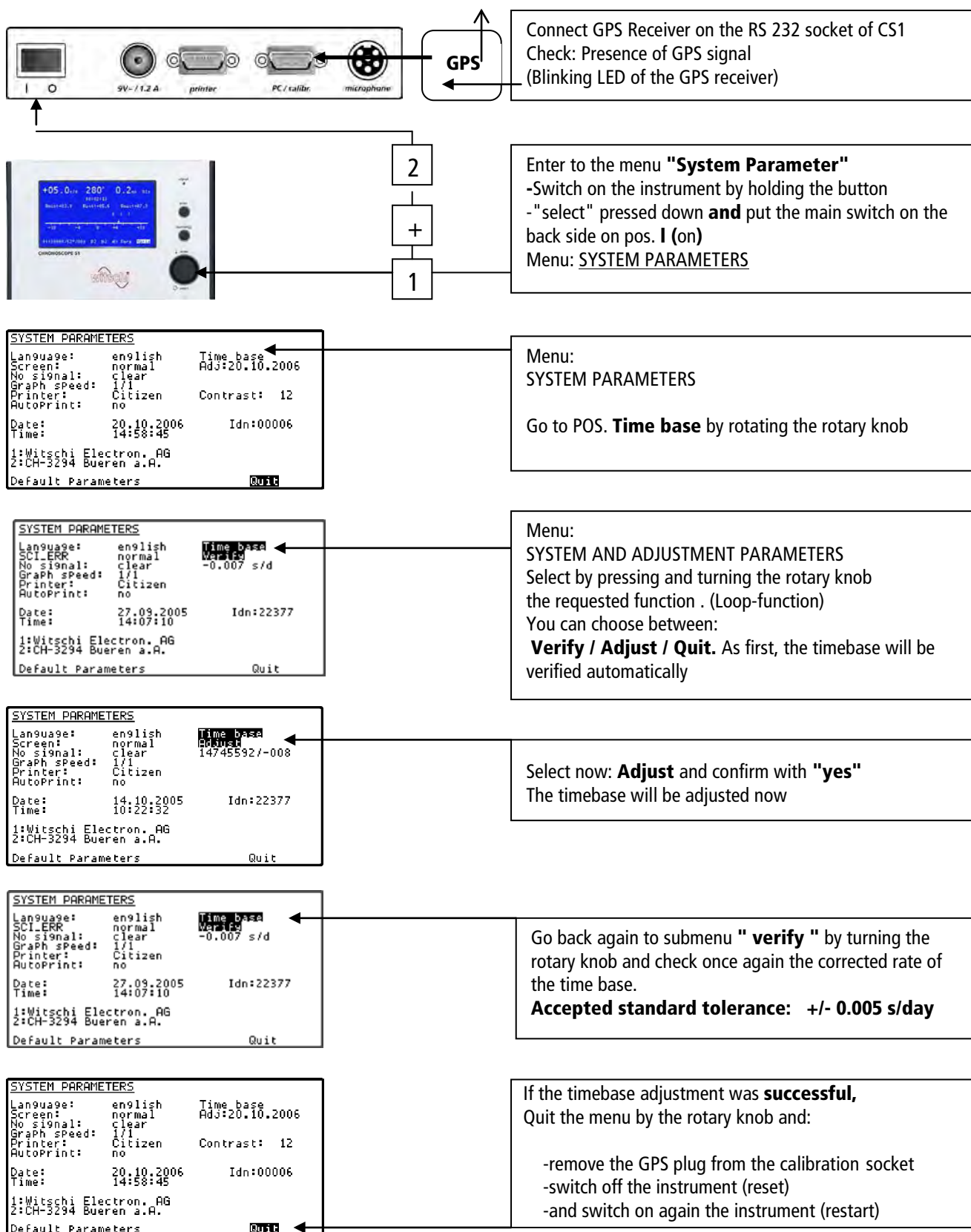
Observe now the actual displayed rate on the LC display **rate** and adjust it on zero (0.00) by turning the screw driver on the left- or right direction.
Accepted standard tolerance: +/- 0.02 s /day.

Reinstall the case back on the rear side of the Watch Expert case and screw on the five locking screws. Connect now the adaptor plug on the power supply socket-and the 5 pin DIN plug of the GPS on the Watch Expert and check now again the rate value of the adjusted instrument.

9 Chronoscope S1

Important remarks:

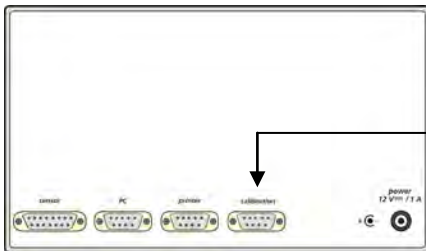
- The instrument has to be **on-state** during **10 minutes before** you start the adjustment procedure.
- **Witschi Electronic** takes over no responsibility for the result of the adjustment.



10 Chronoscope M1

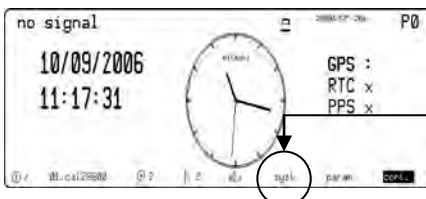
Important remarks:

- The instrument has to be **on-state** during **10 minutes before** you start the adjustment procedure.
- **Witschi Electronic** takes over no responsibility for the result of the adjustment.

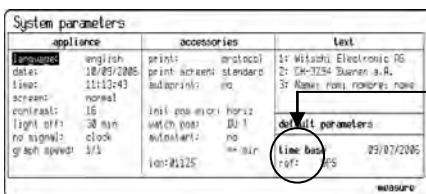


GPS

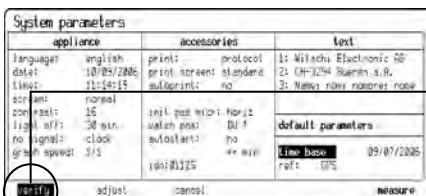
Connect the GPS Receiver on the RS 232 socket
"calibration" of the M1.
Check the presence of the GPS signal.
(Blinking LED of the GPS Receiver)



Switch on the Chronoscope M1.
If the GPS signal is present: the symbol PPS is active =✓
Enter to the menu "**syst**" system parameter by turning and pushing the rotating knob.



Place the cursor on position "**time base**"
By turning the rotating knob.

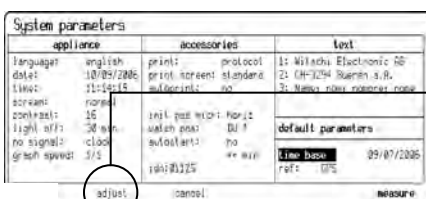


Activate the menu **time base adjustment** by pushing the rotating knob.

Select now between the possible functions:

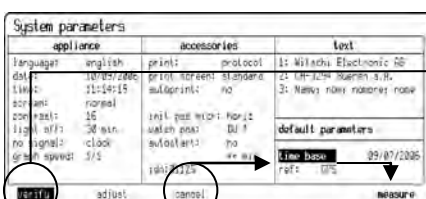
verify or **adjust** or **cancel**

Start with **verify**. The verification of the time base takes about 5 seconds and shows the actual deviation of the rate between M1 and the GPS signal in 0.0xx sec./ day



Select now **adjust** and confirm "**Start adjustment?**" with **yes**.

The procedure takes about 5 second and shows you the real frequency of the M1 and the correction values indicated in "Hz".



Go **back again** to the mode **verify** by pushing the rotating knob. Execute the procedure verify once again to check the new corrected rate of the M1.

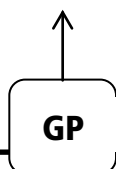
Standard tolerance: = + /- 0.005 s/day

If the time base adjustment was successful, move to position **cancel** by turning the rotating knob. Push on it to leave the adjustment menu. Leave now the menu **system parameter** by turning and pushing the rotating knob.

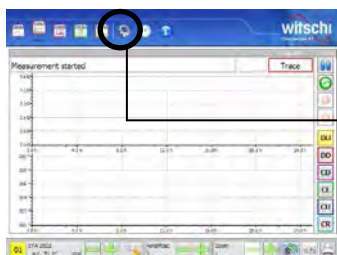
11 Chronoscope X1

Important remarks:

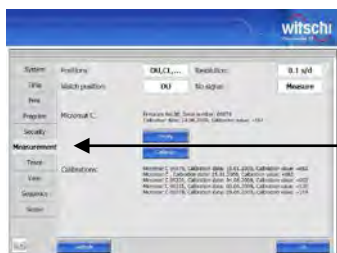
- The instrument has to be **on-state** during **10 minutes before** you start the adjustment procedure.
- **Witschi Electronic** takes over no responsibility for the result of the adjustment.



Switch on the Chronoscope X1 and the Micromat C.
Connect the GPS Receiver on the RS 232 socket
on the ground plate of the Micromat C.
Check: Presence of GPS signal.
(Blinking LED of the GPS receiver)

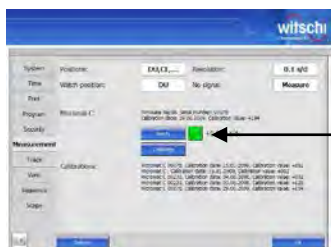


Enter to the menu **"System Parameter"**



Select menu:

Go to POS. **Measurement**



Verification:

Start the verification of the time base system by pushing on the Icon Verify:

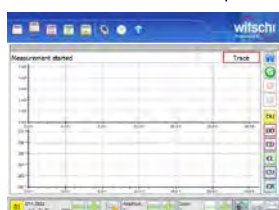
Result O.K.? Leave the menu by pushing on the Icon Ok. on the bottom line of the screen back to a standard menu



Adjustment:

If the verification shows the result **Not O.K.**
Proceed to **"Calibrate"** and start the Time base adjustment procedure.

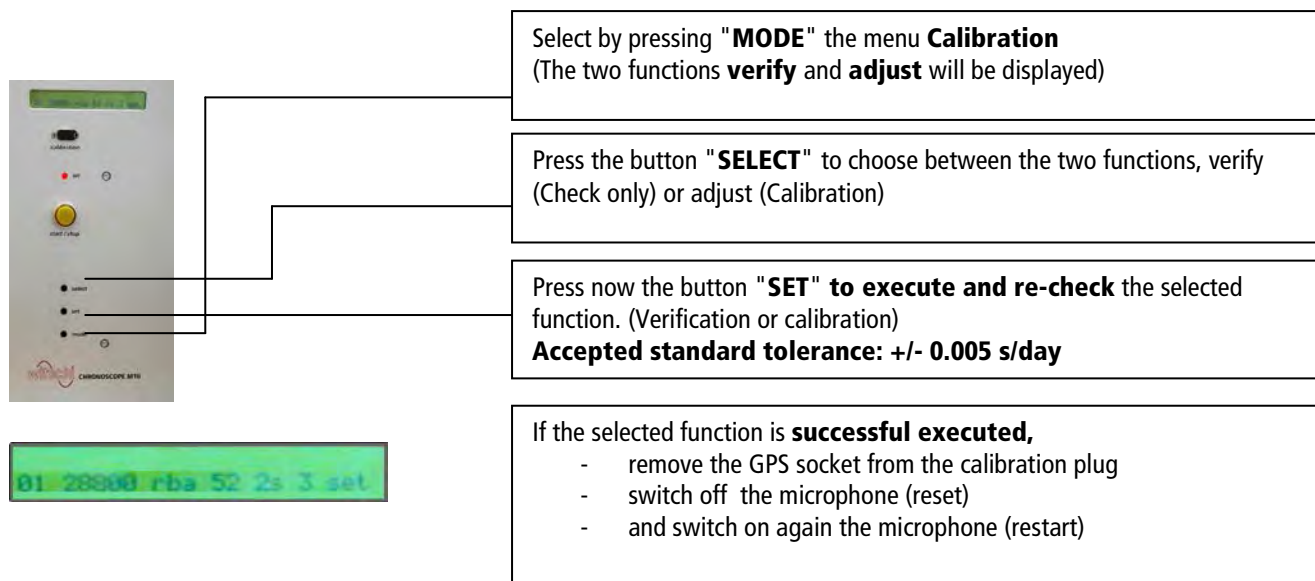
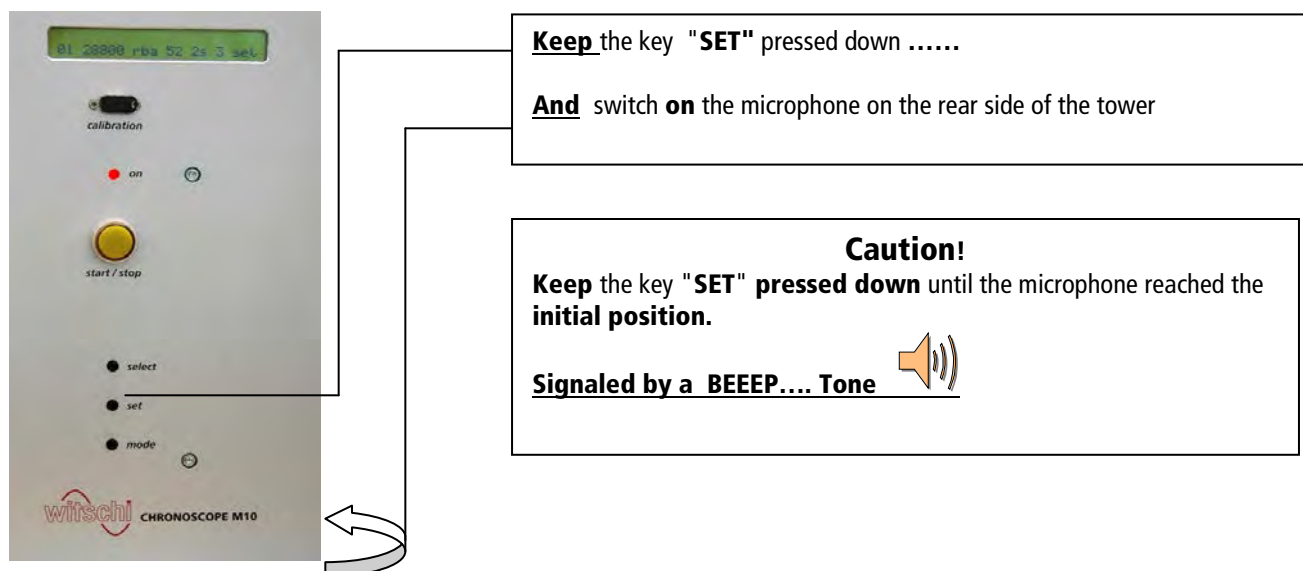
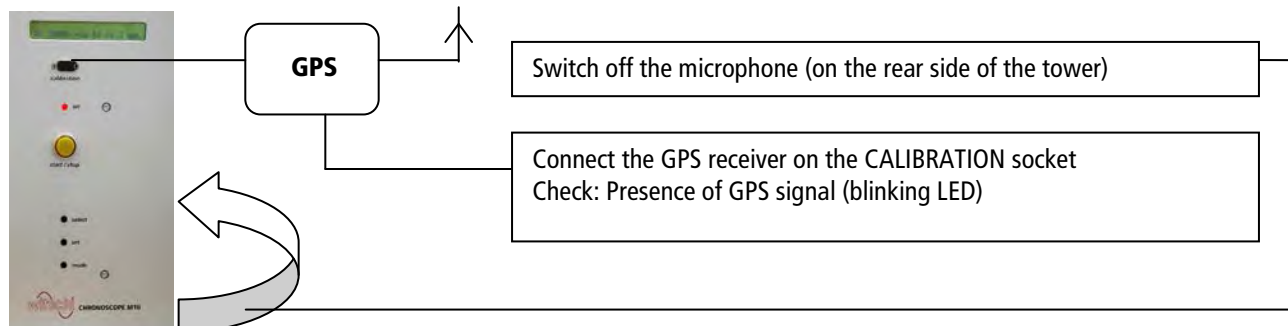
If the system confirms you; result **O.K.**
Leave the measurement mode by pushing the Icon Ok on the bottom line of the screen back to a standard menu



12 Chronoscope M10

Important remarks:

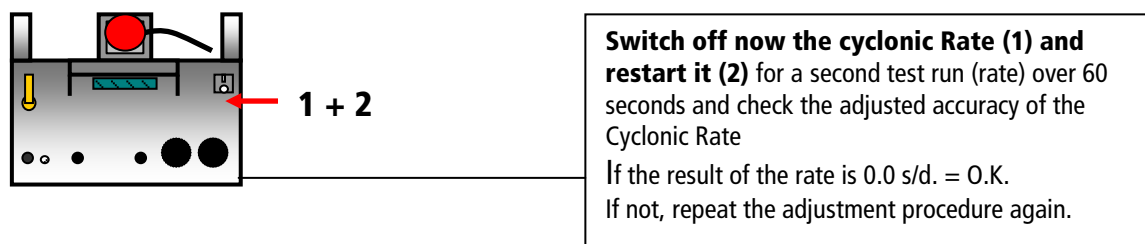
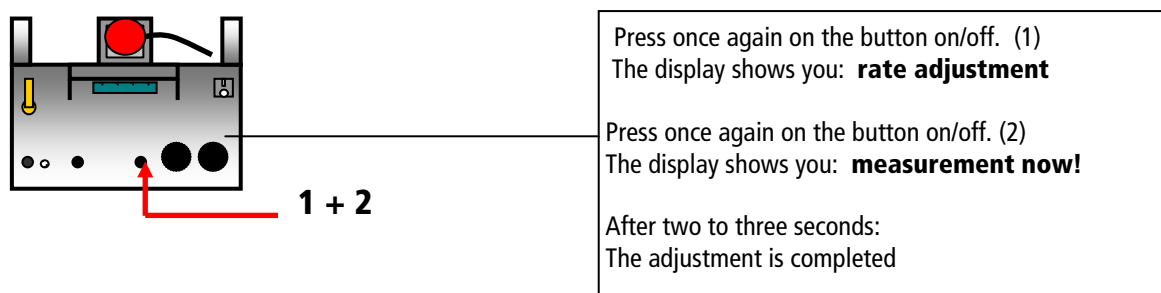
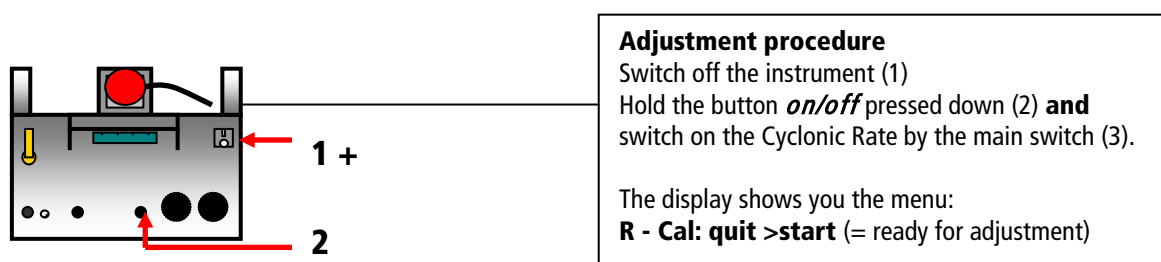
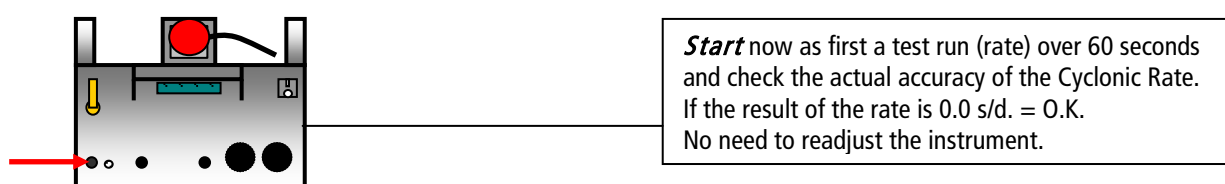
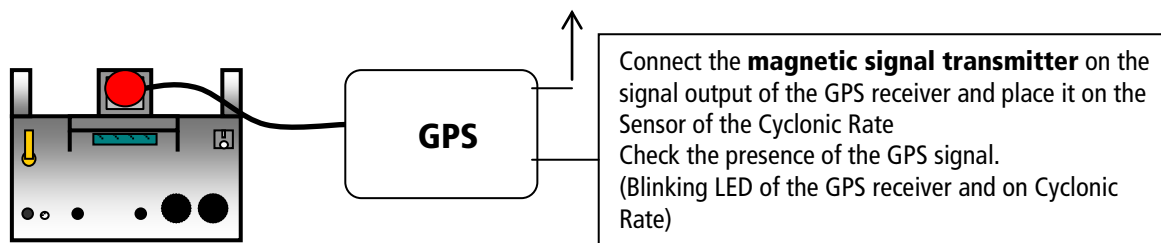
- The instrument has to **be on-state** during **10 minutes before** you start the adjustment procedure.
- **Witschi Electronic** takes over no responsibility for the result of the adjustment.



13 Cyclonic Rate

Important remarks:

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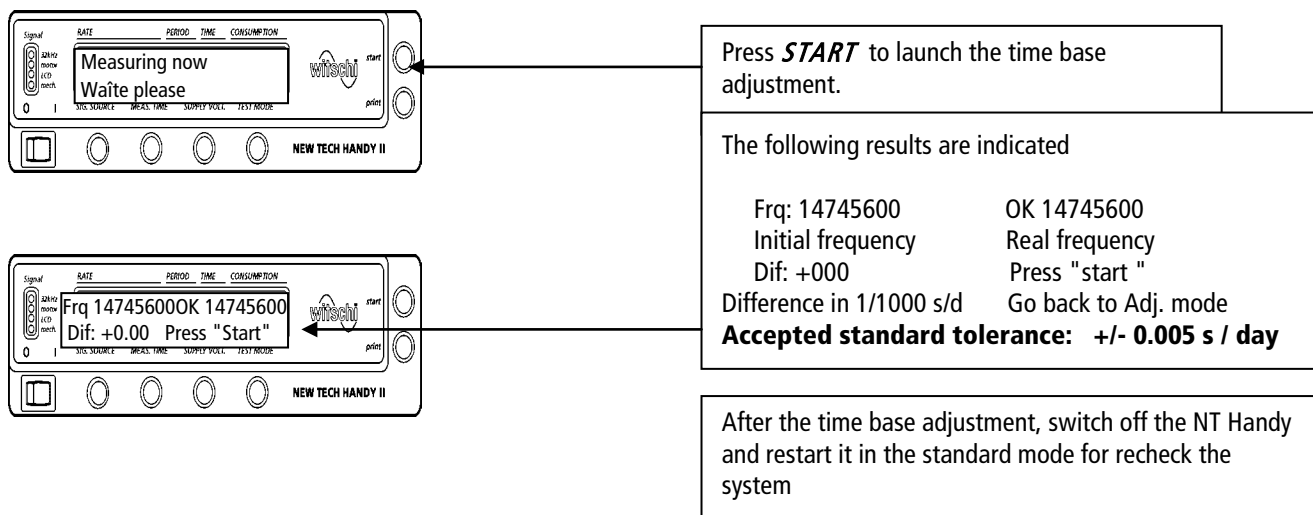
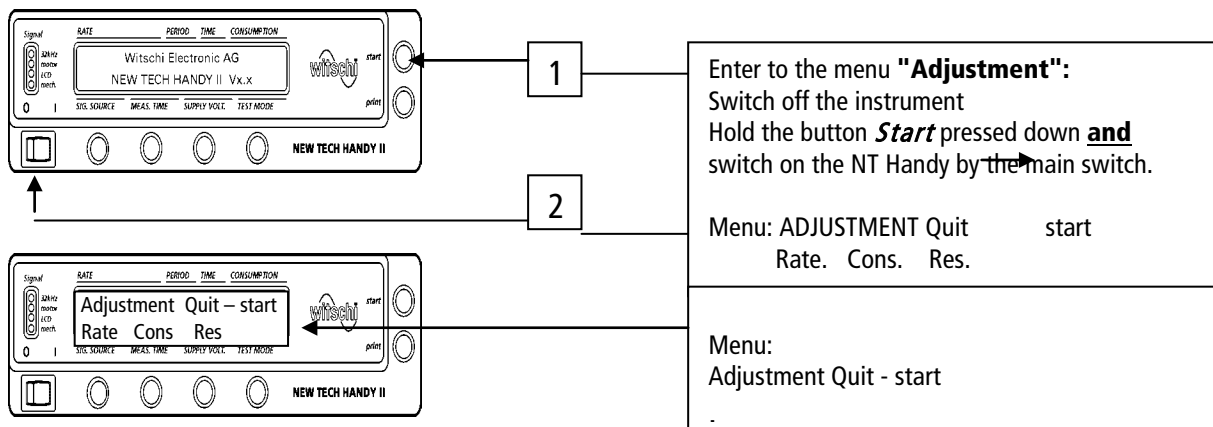
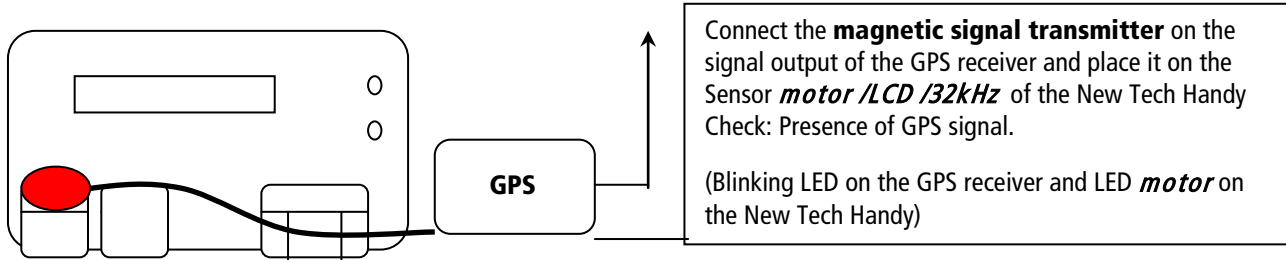


14 New Tech Handy

Important remarks:

- The instrument has to **be on-state** during **10 minutes before** you start the adjustment procedure.
- **Witschi Electronic** takes over no responsibility for the result of the adjustment.

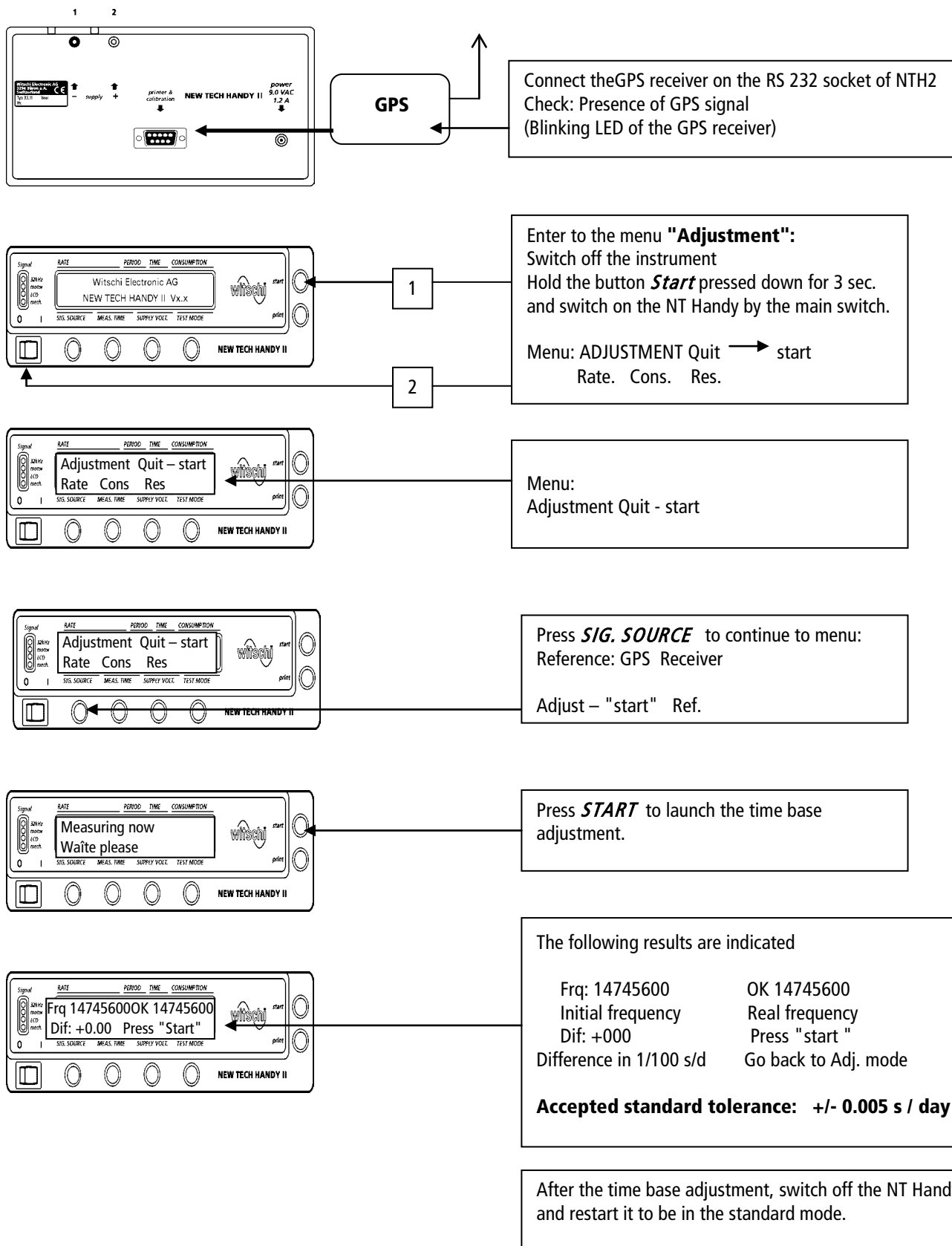
New Tech Handy from Software version 1.40 and > (light grey case)



15 New Tech Handy II

Important remarks:

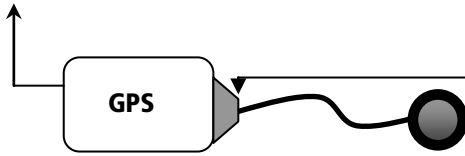
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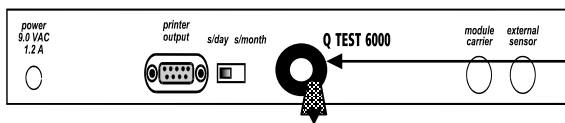
16 Q Test 6000 (Trimmer)

Important remarks:

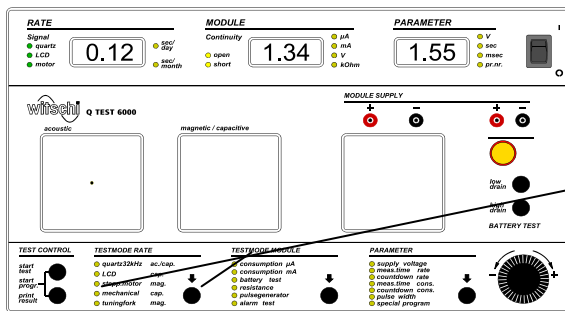
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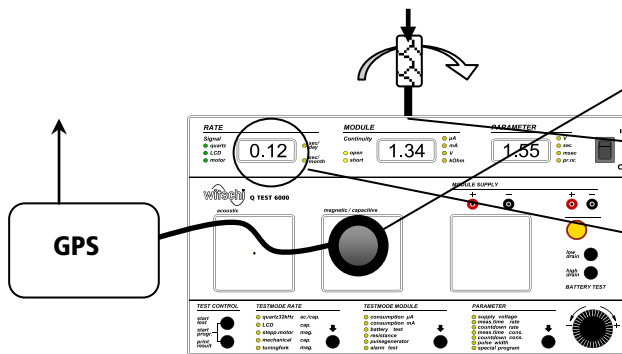
Connect the **magnetic signal transmitter** on the signal output of the GPS receiver.
Check the presence of the GPS signal.
(Blinking LED of the GPS receiver)



Remove the cylindrical plastic protection cover of the trimmer on the rear side of the QT 6000.



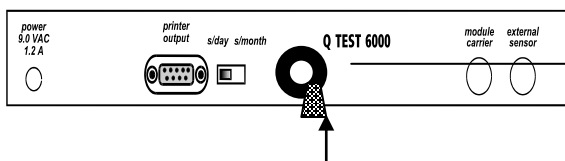
Select measuring mode "**stepp.motor**"



Place now the magnetic signal transmitter on the magnetic sensor of the QT 6000 and check the presence of the magnetic 1Hz pulses.
(Blinking LED "**motor**")

Select a screwdriver with blade size 2-3mm and place it carefully into the trimmer screw head / slit.

Observe now the actual displayed rate on the left LCD display rate and adjust it on zero (0.00) by turning the screw driver on the left- or right direction.
Accepted standard tolerance: +/- 0.01 s/day.

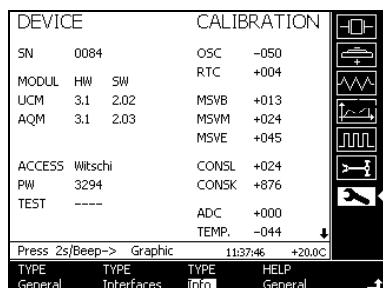
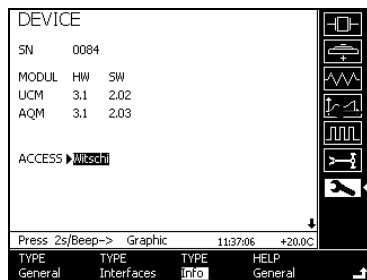
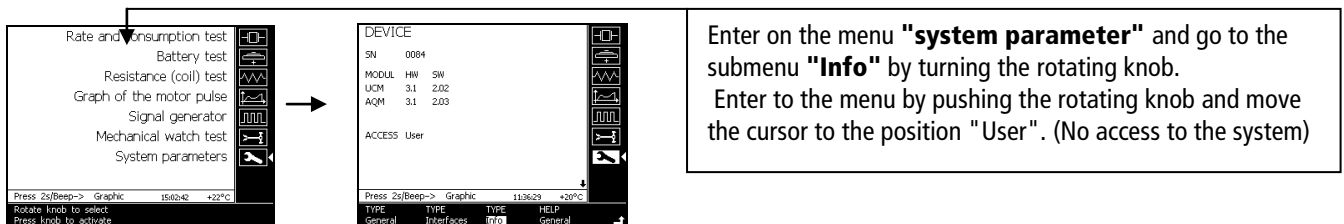
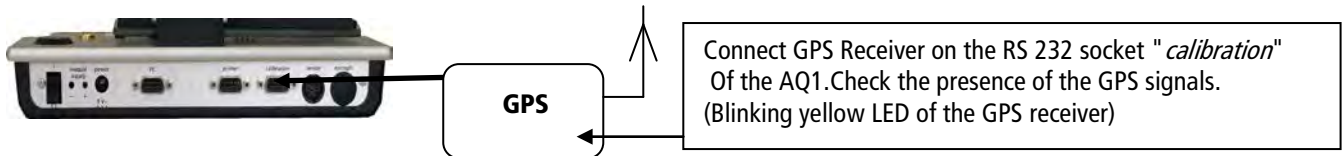


If the time base adjustment is successful terminated, close the trimmer opening by the plastic protection cover.

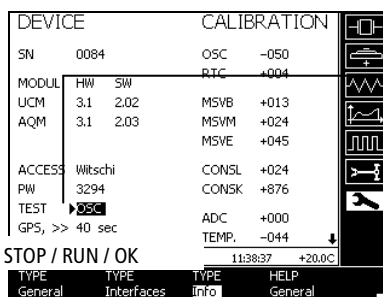
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Important remarks:

- The instrument has to be **on-state** during **10 minutes before** you start the adjustment procedure.
- **Witschi Electronic** takes over no responsibility for the result of the adjustment.



Now you have free access to the system as administrator for the time base adjustment



The AQ1 **is now ready** for the time base adjustment (Stand by mode). Indicated on the task bar by: "**STOP**".

Start now the time base adjustment by pushing the rotating knob. Indicated on the task bar by: "**RUN**"
The whole procedure lasts 40 seconds.

After 40 seconds, the successful adjustment of the time base will be indicated on the task bar by: "**OK**"

Now you can leave the administrator status and the program **by pushing the rotating knob for 2 sec.** (Back to the main menu)

Additional remark:

The time base adjustment will be executed by the firmware of the AQ1. **Accepted standard tolerance: +/- 0.005 s/day.** All indicated values on the right side of the display, e.g. OSC - 50 / RTC - 004 etc. have no influence and no relation to the real adjusted rate of the Analyzer Q1. If the AQ1 can not detect the correct GPS signal, it will be indicated on the display by the message "**error**".

Notes

