



RR400/410/411/412/420

Regularity timer

User's manual



Tips and tricks

Firmware version 251215

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Important:

The **forum** is now the way to keep up to date with the latest programme updates and documentation, get advice on the main rallies, find a trainer, driver or co-driver... register to benefit from all these advantages and then follow the advice in the **General Advice** section:

<https://forum.crisartech.com>

Videos explaining the operation of the device can be viewed on **CRISARTECH YouTube channel**:

<https://www.youtube.com/user/CRISARTECH>

The latest program and documentation updates can be found on this page:

https://www.crisartech.fr/download/rr400_en.html



Table of Contents

| | | |
|----------|---|-----------|
| 1 | HISTORY AND DESCRIPTION OF THE MATERIAL | 5 |
| 2 | CONNECTIONS | 6 |
| 2.1 | RR420 (WITH INTEGRATED INTERFACE, BEHIND DISPLAY) | 6 |
| 2.2 | RR410/412 (WITH INTEGRATED INTERFACE IN THE DISPLAY), "CLASSIC" VERSION | 6 |
| 2.3 | HARNESSES FOR « CLASSIC » RR410/412/420 | 7 |
| 2.4 | HARNESSES FOR RR410/411 « RAID » | 8 |
| 2.5 | PILOT DISPLAY | 8 |
| 2.6 | 220V POWER SUPPLY | 8 |
| 2.7 | 12V EMERGENCY BATTERY | 8 |
| 3 | BASIC PRINCIPLES | 9 |
| 4 | CHANGING DISTANCES | 11 |
| 4.1 | FREEZE/CHANGE DISTANCE - PARTIAL DISTANCES | 11 |
| 4.1.1 | Case of Trip1 | 11 |
| 4.1.2 | Case of Trip2 and Trip3 | 12 |
| 4.2 | NEW DISTANCE | 13 |
| 4.2.1 | Case of Trip1 | 13 |
| 4.2.2 | Case of Trip2 and Trip3 | 14 |
| 4.3 | ON-THE-FLY CORRECTION | 14 |
| 4.4 | CANCELLING A CORRECTION | 15 |
| 4.4.1 | Case of Trip1 | 15 |
| 4.4.2 | Case of Trip2 and Trip3 | 15 |

| | | |
|------------|---|----|
| 4.5 | CHECKING TRIP1 CORRECTIONS | 15 |
| 5 | FORWARD / REVERSE, STOP | 16 |
| 6 | MAIN MENU | 17 |
| 7 | OPERATING MODES | 17 |
| 7.1 | « PILOT » DISPLAY, DISPLAY ONLY | 18 |
| 7.2 | BEGINNER | 18 |
| 7.3 | CONFIRMED | 18 |
| 7.4 | EXPERT | 18 |
| 7.5 | ORGANIZER | 18 |
| 8 | GUIDANCE OPTIONS | 19 |
| 9 | HARDWARE CONFIGURATION, VEHICLE TYPE, TESTS, CALIBRATION | 22 |
| 9.1 | MEASUREMENT TYPE CONFIGURATION | 22 |
| 9.1.1 | <i>Type of connection choice</i> | 22 |
| 9.1.2 | <i>Left or Right wheel choice</i> | 23 |
| 9.2 | SENSORS TEST | 24 |
| 9.3 | CALIBRATION | 26 |
| 9.4 | MANUAL MODIFICATION OF THE CALIBRATION | 27 |
| 9.5 | SIMULTANEOUS CALIBRATION OF THE GPS | 27 |
| 9.6 | AUTOMATIC CALCULATION OF CALIBRATION PERCENTAGE DIFFERENCE | 27 |
| 9.7 | CALIBRATION FINE ADJUSTMENT | 29 |
| 9.8 | COMPENSATION OF CENTRIFUGAL FORCE APPLIED TO TIRES | 29 |
| 9.9 | CALIBRATION COMPENSATION IN MOUNTAIN AREAS | 30 |
| 9.10 | IMPROVING MEASUREMENT ACCURACY IN OBD11 AND OBD29 BIT MODE | 30 |
| 9.11 | NAMING A CALIBRATION | 31 |
| 9.12 | WHEEL SENSOR MONITORING | 32 |
| 9.13 | GPS RECEIVER CONFIGURATION | 33 |
| 9.14 | BATTERY VOLTAGE MONITORING | 34 |
| 9.15 | CORRECTING THE BATTERY VOLTAGE | 34 |
| 10 | ENTERING AVERAGE SPEEDS | 35 |
| 10.1 | MANUAL ENTERING | 35 |
| 10.2 | SPEED FAST CHANGE (« RAIN » MODE FOR EXAMPLE) | 36 |
| 10.3 | USING MULTIPLE SETS OF AVERAGES | 37 |
| 10.3.1 | <i>Creating the zr_desc file</i> | 37 |
| 10.3.2 | <i>Importing average files via USB drive</i> | 38 |
| 10.4 | INPUT ON A COMPUTER | 39 |
| 10.5 | USE OF A REDUNDANT PILOT DISPLAY | 39 |
| 10.6 | DUPLICATION OF AVERAGES | 39 |
| 11 | STOPWATCH | 40 |
| 11.1 | STARTING AN INLINE STAGE IN MANUAL MODE | 40 |
| 11.2 | STARTING AN INLINE STAGE IN AUTOMATIC MODE | 40 |
| 11.3 | STARTING AN INLINE STAGE, BUT LATE! | 40 |
| 11.4 | STARTING ON A CIRCUIT WITHOUT REFERENCE LAP | 41 |
| 11.5 | STARTING ON A CIRCUIT WITH REFERENCE LAP, IN GPS MODE | 41 |
| 11.6 | STARTING ON A CIRCUIT WITH A REFERENCE LAP WITHOUT GPS | 42 |
| 11.7 | STOP | 42 |
| 12 | TIMER | 43 |
| 12.1 | OPERATING PRINCIPLE | 43 |
| 12.2 | CLOCK SHIFT | 44 |
| 13 | LINK PAGE AND TIME CONTROL MANAGEMENT | 45 |
| 14 | DISPLAY CONFIGURATIONS | 47 |
| 15 | USB DRIVE USAGE | 48 |
| 15.1 | COPY OF RALLY PREPARATION FILES AND RECORDS | 48 |
| 15.2 | MANAGING ARCHIVED FILES | 49 |

| | | |
|-----------|---|-----------|
| 15.3 | USB DRIVE FORMATTING..... | 50 |
| 16 | INFRARED REMOTE CONTROL..... | 50 |
| 16.1 | MANAGING RTs WITH THE REMOTE CONTROL..... | 51 |
| 16.2 | USEFUL REMOTE CONTROL SHORTCUTS..... | 52 |
| 17 | ENTERING AN AVERAGE ON-THE-FLY SPEED CHANGE DISTANCE..... | 53 |
| 18 | SHIFTED START..... | 54 |
| 18.1 | FUNCTION ACTIVATION..... | 55 |
| 18.2 | AVERAGE SPEEDS CHANGES SINCE THE BEGINNING OF THE ROAD BOOK..... | 55 |
| 18.3 | AVERAGE SPEEDS CHANGES SINCE THE BEGINNING OF THE RT..... | 56 |
| 19 | MULTISPEED MODE..... | 57 |
| 20 | REDOING A RT AT THE SAME PACE..... | 58 |
| 20.1 | WITHOUT GPS ASSISTANCE..... | 58 |
| 20.2 | WITH GPS ASSISTANCE..... | 59 |
| 21 | RECORDINGS..... | 60 |
| 21.1 | REGULARITY TESTS RECORDING..... | 60 |
| 21.2 | GPS TRACE DURING SCOUTING..... | 61 |
| 21.2.1 | <i>Distance-based traces.....</i> | 62 |
| 21.2.1.1 | <i>Traces in CSV format.....</i> | 62 |
| 21.2.1.2 | <i>Traces in GPX format.....</i> | 62 |
| 21.2.2 | <i>Traces NMEA (based on fixed time: 0.1 second).....</i> | 62 |
| 21.3 | CONVERTING FILES TO GPX OR KML..... | 63 |
| 21.4 | CORRECTING WAYPOINTS DURING SCOUTING..... | 63 |
| 22 | “GRAVEL CREW” NOTES FUNCTION AND SEMI-AUTOMATIC MANUAL CORRECTIONS 63 | |
| 22.1 | CONFIGURATION..... | 64 |
| 22.2 | SEMI-AUTOMATIC CORRECTIONS OR ASSISTED MANUAL CORRECTIONS..... | 64 |
| 22.3 | IMPORTING FROM THE AVERAGE SPEED FILE..... | 65 |
| 22.4 | GRAVEL CREW NOTES..... | 65 |
| 22.5 | IN CASE OF A PROBLEM..... | 66 |
| 23 | FIRMWARE UPDATES..... | 67 |
| 24 | OPTIONAL FUNCTIONS PURCHASE / ACTIVATION / DEACTIVATION..... | 68 |
| 25 | PILOT ASSISTANT..... | 70 |
| 26 | Welcome picture update..... | 70 |

1 History and description of the material

In 2014: birth of the **RR100**, a monochrome timer, with infrared remote control, two wheel sensor inputs, GPS for measurement, distance correction and time synchronisation.

In 2016, a **4 LED "head-up"** module for the pilot was added, followed by a **4"3 colour display**. This display also has the ability to store a large amount of data to provide the GPS files to the timer and to record the progress of the rally.

In 2017, the RR100 was replaced by the **RR400**, a **4"3 colour touchscreen timer** with infrared remote control. This is the model that made the CRISARTECH reputation. The interface for the sensors is in the "glove box" and the "head-up" module has been upgraded to **10 leds**.

For 2019, the RR400 is evolving into the **RR420**, with a sensor interface behind the display and a shell enclosing it all. All automotive-style connectors are underneath the unit and the harnesses are protected by a robust cable clamp. The head-up display is upgraded to **6 multi-colour leds** (equivalent to 18 leds).

In 2022, the RR420 evolves into the **RR410**, which is more compact, lighter, more industrialised (easier to manufacture) and more economical. It is available in two versions:

- "raid": with simplified, waterproof and reinforced connections, without on/off switch,
- "classic": with identical connectors to the RR420.

The sensor interface is now in the display, the "button box" input and the "intercom" output have been removed. The **internal GPS** (option to be ordered at manufacture) is switchable with the remote control or the touch screen but is less sensitive than the previous version. The more modern electronics allow a new **wheel sensor diagnostic** function ("classic" version) and open up the possibility of **"wireless" connectivity**...

In 2023, the RR410 can be configured as a 'redundant' driver display, i.e. by installing two identical devices in the car, the one on the left can be configured as the 'driver', but if the one on the right (the 'co-driver') fails, the driver display can be quickly reconfigured as a pacemaker. This is particularly useful for rallies like the '*Dakar Classic*'.

In 2024, the Led6 module was upgraded with LEDs on the printed circuit board (SMD) and light guides, and the adjustable bracket was no longer needed. It can be connected in place of the pilot display and the specific 'old model Led6' connector disappears from the RR410. It is also possible to use 2 LED modules simultaneously. In this way, one module displays the advance and the other displays the delay.

In 2025, the RR410 is replaced by the RR412, which offers a wired remote control input to increase the reliability of important button presses (for rallies with navigation). An optional internal GPS can be added after the device has been manufactured.

The RR410 'raid' is replaced by the RR411 'raid', which also gains a connector for a wired remote control (waterproof) but loses the receiver for the infrared remote control.

The second Led6 module can now be used as a 'pilot assistant': the pacer can activate coloured flashes to indicate specific landmarks to the pilot, such as a slippery area or its end, or a section where it is necessary to increase or decrease speed.

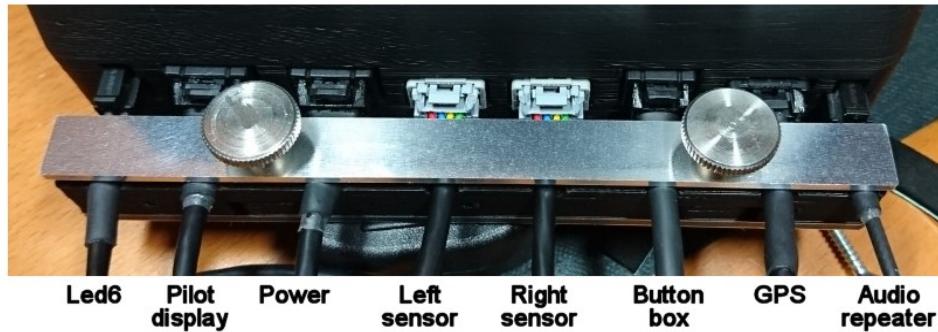
The display (and therefore its program) is identical for the RR400/410/412/420 models.

2 Connections

2.1 RR420 (with integrated interface, behind display)



Connections:



2.2 RR410/412 (with integrated interface in the display), "classic" version



The connector for USB is now on the right side.

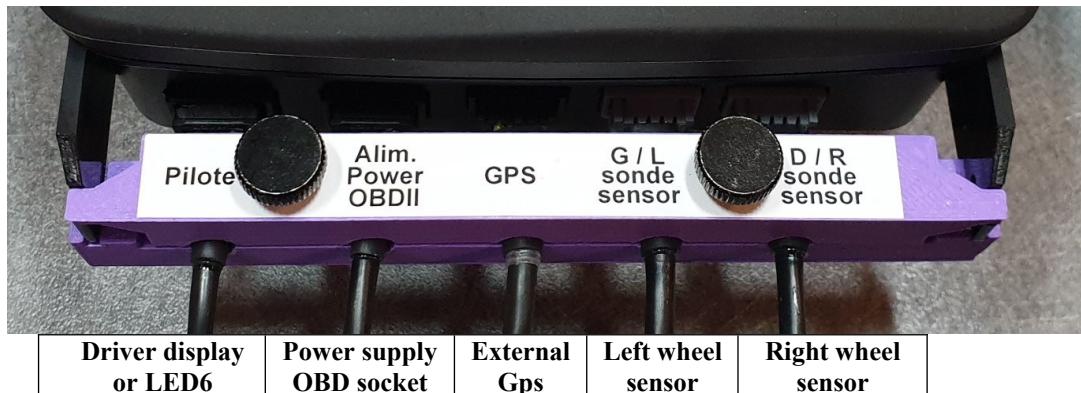
On the left, you will find the on/off switch as well as the connector for the wired remote control (RR412 only).

There are two options for the LED6 module:

- old model (with swivel bracket): connection on the left-hand side of RR410s produced until December 2023,
- new model (flatter): connect in place of the pilot display. To connect both accessories at the same time, you need to use a multi-socket available separately.

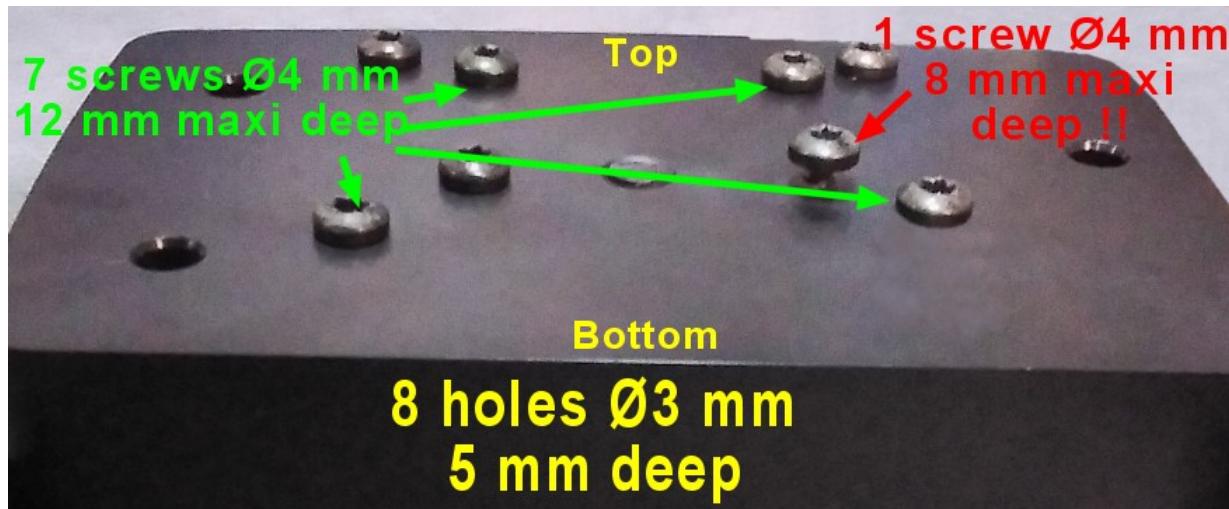
The buzzer is internal.

The connectors on the bottom side:



Mounting, with RAM ball or on dashboard:

Attention: holes are pre-drilled for 4x12 mm plastic screws. You have to finish drilling them with a 3 mm drill bit, with a depth of 5 mm. **But for one of the holes, you don't need a screw longer than 8 mm, otherwise you will damage the electronics!**



2.3 Harnesses for « classic » RR410/412/420

"Universal" 4-wire harness connected to 2-wires sensor (gray connector, 4-pin):

| | | | | | |
|----------------|---|--------|--------|--------|---------------------------|
| +12V | 1 | Red | Red | Red | Usually sensor brown wire |
| Ground | 2 | Blue | Black | Black | Not connected |
| Signal | 3 | Green | Orange | Orange | Not connected |
| Ground -Signal | 4 | Yellow | Yellow | Brown | Usually sensor blue wire |

"Universal" 4-wire harness connected to 3-wires sensor (gray connector, 4-pin):

| | | | | | |
|----------------|---|--------|--------|--------|---------------------------|
| +12V | 1 | Red | Red | Red | Usually sensor brown wire |
| Ground | 2 | Blue | Black | Black | Usually sensor blue wire |
| Signal | 3 | Green | Orange | Orange | Usually sensor black wire |
| Ground -Signal | 4 | Yellow | Yellow | Brown | Not connected |

Power harness (black / blue connector, 4 points):

| | | | | |
|--------|---|-------|-------|------|
| +12V | 1 | Red | Brown | Red |
| Ground | 2 | Black | Black | Blue |

Notes:

- the main switch (red button) is intentionally withdrawn from the housing. This is a safety measure to avoid an unwanted stop during the race. Therefore, you have to fully press the button until you hear a small "click". It is often easier to press with a pencil, pen or fingernail,
- the RR410/412/420 provides a power supply for sensors that is protected by an automatically resettable fuse. There is nothing to do in case of a short circuit.

2.4 Harnesses for RR410/411 « raid »

Power harness (waterproof grey connector, 2 points):

| | | |
|--------|---|-------|
| +12V | 1 | Brown |
| Ground | 2 | Blue |

2.5 Pilot display

It is plugged into the connector of the RR410/412/420. It can be an RP380 pilot display (non-touch). It can also be a RR410/412 specifically configured as a "pilot display", see §7.1 « *Pilot* » *display*.

In both cases, this device must be instructed to send data to the pilot display by ticking the **Pilot Display** box in the **Config. equipment**:



Note: with the latest versions of the copilot and pilot programmes, this tick is made automatically: the cadence unit detects the presence of the pilot display.

2.6 220V power supply

Useful for simulation and in-salon training, or working in a hotel (outputting recorded data, entering average speeds), **it can only power one device**. This means that **if the pilot display is connected, the power is too high and it goes into safety**. The displays flash but do not come on.

2.7 12V Emergency battery

It connects between the car's power cord (or the cigarette lighter socket) and the RR410/412/420.

It has a switch:

- **OFF**, it is transparent: the current passes through it and the indicator lights up green, but **it does not charge and does not take over in the event of a power cut**,
- **ON**, the indicator lights up in green, or orange when it is charging and takes over in the event of a power cut.

Warning: **it is not compatible with reading information via OBD port**. These sockets are reliable and connected in "permanent 12V" and do not require the use of this accessory.

Note: It has not been sold since March 2025. A new smarter model is under development.

3 Basic principles

This timer uses a touch screen for the configuration, calibration, speed input...

To modify an item, press the item zone. In "beginner" mode, the user is guided by a grid that indicates the different sensitive zones:

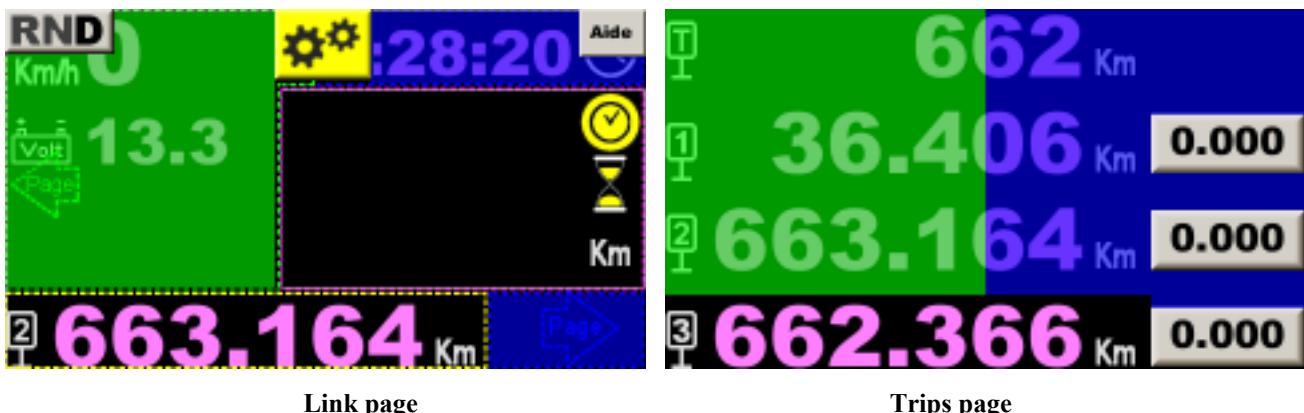
- "chrono"
- "trip"
- 'RT'
- "correction cancellation"...

The page change is made by pressing outside these areas, next page on the right and previous on the left, in blue and green respectively on the following images:



Pilot page

Co-pilot page (main page)



Link page

Trips page

At the bottom of the first two pages, we find **Trip1** which is dedicated to regularity tests. This trip is compared to the stopwatch and the speed table by the timer.

At the bottom of the link page, we find the **Trip1** or **Trip2** which is used to calculate the average to be maintained during the link.

On the last page, we have 4 counters:

- **T**: totalizer which can be used for the total distance for the day, the rally, or other (car maintenance if the timer is always used with the same car) ... It is now possible to reset it to 0,
- **T1**: reminder of **Trip1**,
- **T2**: reminder of **Trip2**,
- **T3**: **Trip3** which can be handled like the other trips (remote control and / or touch screen by pressing the value displayed at the bottom of the page). It can be used for total distance for the day, refuelling, or any other purpose.



In front of each counter is a sign indicating which trip it refers to, as shown here Trip1:

Note: Trip2 is only used in the RMCH type configuration. This is one of the few rallies to require a road trip independent of the regularity tests.



buttons allow you to go back, exit the configuration pages...

Warning: if a parameter has been modified, the modification is saved!
Unless a **Modify configuration** button is present on the page.

Data fields with a blue-white-blue gradient background are input fields with the touch keyboard:



Do not forget to use the **help buttons** when in doubt (except **EXPERT** mode), or “**Guide**” key on the remote control:

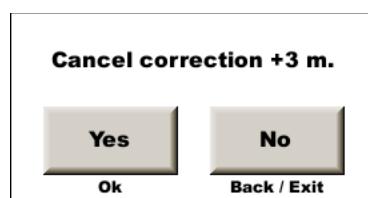


Fugitive or temporary data is displayed using so-called "popup" windows that appear above the current display:



Example of partial distance display

They can have buttons (Yes, No...) and pressing on one of the buttons closes this window:



Popup with buttons. Below the buttons
you find the Help for the remote control :

OK button for **Yes**
Back or **Exit** button for **No**

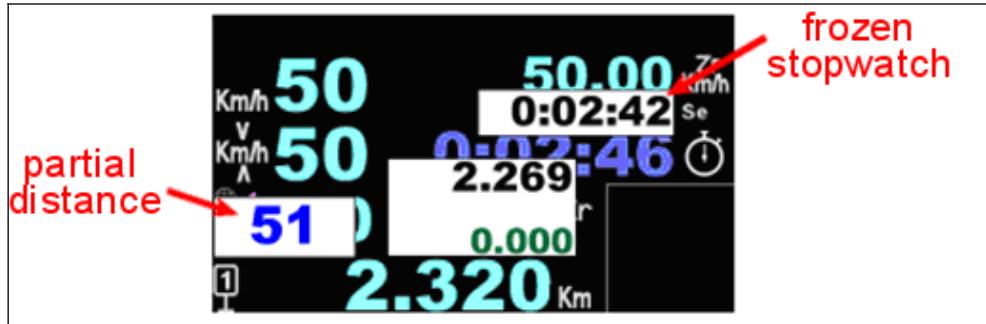
Larger popup displays may appear with information text (grey background), error (red background) or special data (yellow background):



Important: To close these popup windows, just press the window (touch screen) or press any button on the remote control except the **Chrono**, **OK** and **color buttons**.

4 Changing distances

4.1 Freeze/change distance - partial distances



To freeze the distance

- press the distance (at the bottom), left part. By pressing the right part of the distance, the virtual keyboard is directly opened, see below,
- use the **OK** button of the remote control.

4.1.1 Case of Trip1

The Trip1 is considered the main trip for the follow-up of a road-book with subtleties and *its operation is therefore a little finer*.

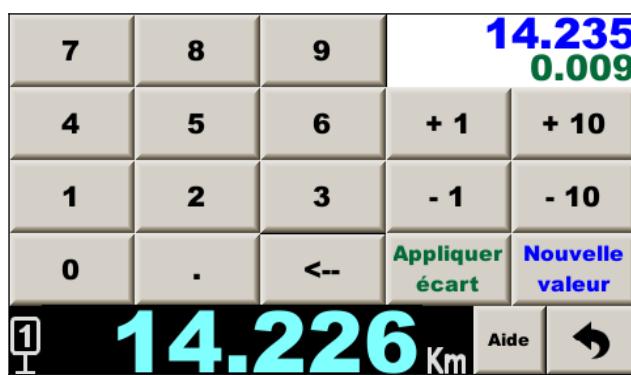
If the timer runs, a popup with the **frozen value of the timer** is displayed above the time. This allows checking a possible timing on the road-book.

The **partial distance** from the frozen point is shown on the left. This distance is **reset to 0 with each new push on the distance or on that same button**.

To clear these popups, you must press the **BACK** or **EXIT** button on the remote control or press one of the "Partial Distance" or "Frozen Time" popups on the touch screen.

To change the frozen value:

- with the touch screen: press the popup with the frozen value that appeared above the distance to make the virtual keyboard appear :



If the correction to be applied is small, it is easier to press the +/- 1 or +/- 10 buttons on the right.

If the correction to be applied is more important, it is faster to retype the correct distance with the number keys. Then you have to validate with the "apply gap" button. See the example below.

Note: pressing the right part of the distance opens directly this keyboard.

- with the remote control: number keys or with the +/- 1 or +/- 10 m.

The new value appears in blue and the difference in green. When validating with the "apply gap" button or the **OK** button of the remote control, this is the difference that is applied, i.e. the trip takes into account the distance that scrolls during the time of handling:



Example:

- frozen distance to . in front of a sign 14.226 km,
- on the road book is written for this sign. We type this value 14.235 km,
- valid further to km 14,600, the trip goes to applying the difference 14.609 km,
- The difference is displayed in the history at the bottom right of the screen 9 m.

Remarks:

- The difference display (in green) can be hidden in the configuration of the co-pilot page,
- The frozen timer display can be hidden in the configuration of the co-pilot page,
- The partial distance can be hidden in the configuration of the co-pilot page,
- The frozen value is displayed in metres as part of the command history, at the bottom right, and during the race, it is recorded in the trace file (preceded by the letter F).

In the "offbeat start" and **Expert** mode, an extra distance is added in the popup: the distance from the shifted start of the time (in brown):



4.1.2 Case of Trip2 and Trip3

For these kilometer counters, the handling in touch mode is simplified: pressing the distance, at the bottom, directly opens the virtual keyboard. It's a little faster but it hides the whole screen, even if you just want to freeze the distance to compare to the road-book.

For the remote control, the handling is the same.

4.2 New distance

4.2.1 Case of Trip1

The Trip1 is considered the main trip for the follow-up of a road-book with subtleties and *its operation is therefore a little finer*.

To force a new distance:

- with the touch screen: start by pressing the right-hand side of the distance (as before) :



Type the new distance with the number keys.

You can then validate with the "New Value" button by passing in front of the marker corresponding to this new distance. See the example below,

But you can also close the popup (with the arrow at the bottom right) and keep this value ready to be validated later and end up in the same case as below with remote control. To validate the distance in front du marker, **you have to**

tap on the distance popup  in our example.

- with the remote control: use the digital number keys and then validate with the **OK** button by passing in front of the marker corresponding to this new distance.

If the distance entered is greater than the current distance (the classic case of distance shifting) a "countdown" indication is displayed on the left: negative distance. This degressive indication makes it possible to better situate the visual marker to make the correction (do not go wrong with the telephone pole for example) or the crossroads of change of direction. The first officer can announce the degressive distance without having to calculate and without making a mistake:



Example:

- on the road book is written for a sign. You type this value 14.235 km **before** you get to the sign,
- valid in front of the panel, the trip goes to by applying the new value 14.235 km,
- If the distance was, then the difference appears in the history at the bottom right of the screen 14.226 km 9 m.

If the distance typed is greater than the current distance or if one "misses" the marker or crossroads the indication becomes positive and grows as one moves away:



Remarks:

- this distance popup is displayed from 1 km before 1 Km to after the taped distance, and disappears when the distance is validated to correct the Trip1,
- the degressive distance can be hidden in the configuration of the co-pilot page,
- the degressive distance is also on the pilot display (hideable), **which allows the pilot to participate in the navigation.** For example, when changing direction, he can take a look at his degressive just before steering. If the heading is not within +/- 15m, there may be a problem, and **it is best to stop and take stock rather than take a wrong turn.**

It is this manual correction technique that is strongly recommended to use.

It has the following advantages:

- **we prepare the distance if we have the time** without feeling constrained by the difference found with the previous technique. Indeed, if one freezes in the village entrance for example, one may miss a change of direction in the village by what one is overwhelmed by the correction,
- if you haven't had time to prepare the distance, you can fall back on the previous technique,
- If you have made a typing error, you can detect it before you validate it, and if you don't detect it, the resulting correction (shown in the history at the bottom right of the screen) will be important and could be cancelled.

To clear these popups, if you missed the visual cue for example, you have to press the **BACK** or **EXIT** button of the remote control or press the "partial distance" popup of the touch screen.

4.2.2 Case of Trip2 and Trip3

For these kilometer counters, the handling in touch mode is simplified: pressing the distance, at the bottom, directly opens the virtual keyboard. The rest of the manipulations are the same.

4.3 On-the-fly correction

If the pilot cuts a turn and the co-pilot feels that he is missing 8 m on the distance, it can correct the Trip:

- touch screen: see previously "Freeze / edit,"
- with the remote control: with the +/- 1 ou +/- 10 m keys **but without freezing.**

With remote control, a small popup opens with the desired correction:



This correction is then applied when this popup closes (1.5 seconds without changing the value). By handling quickly, a correction that requires several key presses can be applied at once:

- press 3 times on +1 to get a correction of +3 m.
- press 1 time on +10 m. then 3 times on - 1 m. to get a correction of +7 m...

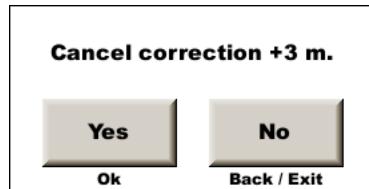
Remark: The value added or subtracted each time the + or - button is pressed on the remote control can be configured in **Config. Hardware** then **config. keyboards** (except in beginner mode).

4.4 Cancelling a correction

4.4.1 Case of Trip1

The Trip1 is considered the main trip for the follow-up of a road-book with subtleties and *its operation is therefore a little finer*.

It is possible to **cancel the last correction** by pressing this history (touch screen) or with **BACK** or **EXIT** button of the remote control. The device then asks for confirmation:



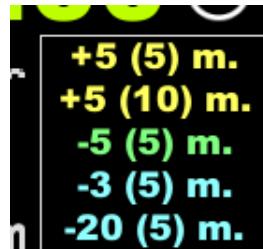
4.4.2 Case of Trip2 and Trip3

For these kilometre meters, there is no cancellation possible.

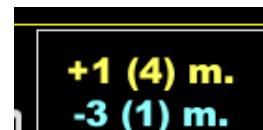
4.5 Checking Trip1 corrections

Trip1 is considered the main trip for following a road book with subtleties, *and its operation is therefore a little more refined*.

The last five corrections made to Trip1 are displayed in the 'history' section at the bottom right of the regularity page:



At the bottom right of the link page, only the last two corrections are displayed:



The colour code is as follows:

- blue corresponds to a negative correction (the distance was too long),
- yellow is a positive correction (the distance was too short).

Automatic GPS corrections have an additional nuance: if the distance is short, considered 'normal', the colour is light. If it is excessive, the colour is darker.

If it is green, it is a cancellation.

If it is red, it is an error such as a failed automatic GPS correction.

The cumulative corrections are shown in brackets. Only corrections applied in relation to the distances in the road book are cumulative. Corrections made 'on the fly' are not taken into account (except in expert mode if '+/- X m. for % calibration' is checked in the **Guidance options**, middle tab). This cumulative total is important for monitoring the accuracy of the calibration, see §9.6 *Automatic calculation of calibration percentage difference*.

Each time you correct the distance, it is important to check the value of this correction. If the correction is in the order of a few metres, it is consistent and the correct reference point has been validated. However, if it is in the order of tens of metres (and you have not performed any acrobatics or passed through a tunnel while measuring GPS), then you have made a mistake.

There are **three** ways to correct an error:

- Compensate for the error using the **+- 1** or **10 m** keys: this is **not recommended** if you have only made one error, as it takes more time and requires more concentration from the co-pilot,
- **BACK** or **EXIT** key. Please note that if you use semi-automatic corrections with distance notes, this only works if the next note is not yet displayed: **not recommended** because the next note may appear just as you decide to press the button, and it will be the next note that is deleted and the correction error will not be corrected.
- Long press on the **BACK** or **EXIT** button: **recommended method**. A confirmation pop-up will appear, as with any correction cancellation, but when using distance notes, the next note will not be affected and can therefore be validated.

To correct **several** errors, however, it is best to use the **third** method to correct the last error and then the **first** method for the previous ones.

5 Forward / Reverse, Stop

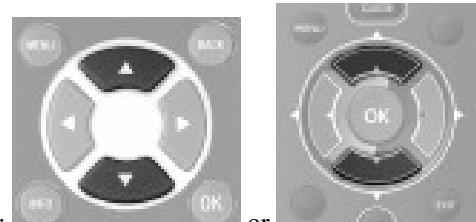
To access the RND panel (analogy to the automatic gearboxes):

- press the screen (top-middle of preference) then on the button   that appears in the top left,

- press the  key on remote control Philips or  key on the "one for all"



- **R** for "Reverse"
- **N** for "Neutral" or stop counting,
- **D** for "Drive" or Forward.

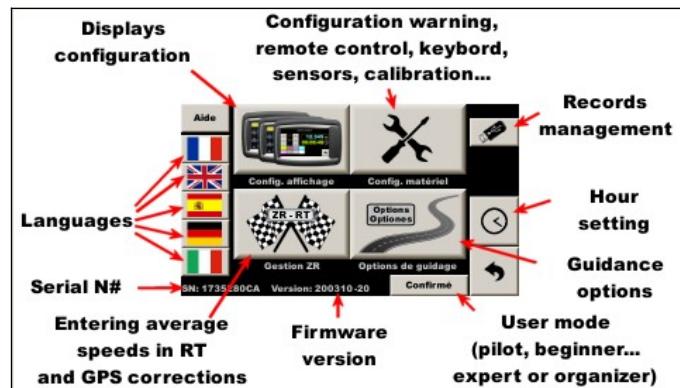


Then press the desired operating mode or use remote control:

This panel will only be displayed when the position is different from "Drive".

6 Main menu

To access the main menu, press the screen (top, middle preferably) and then the yellow button that appears:

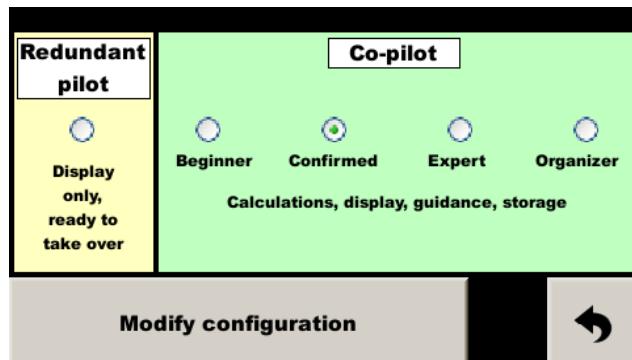


7 Operating modes

This system has 2 main functions:

- "pilot" display, repeater of the information calculated by the "co-pilot" main device,
- timer with 4 operating modes, depending on the experience of the co-pilot.

The choice is made using the button at the bottom of the main menu page, opening the following configuration page:



7.1 « Pilot » display, display only

The same device can be used as a display repeater for the pilot. Configured in this way, it becomes a slave to the co-pilot's timer.

You must tell the **timer unit** (on the co-driver's side) that it must send the data to the pilot display by ticking the **Pilot display** in the **Config. Equipment**:



Note: with **the latest versions** of the co-pilot and pilot software, this check is made automatically: the timer unit detects the presence of the pilot display.

In this configuration, the two devices receive the remote control signals and send each other the key codes. As a result, each press is doubled. To avoid this, the firmware on the acquisition card must be version **45** or higher (at least for the unit used on the driver's side). This is the number shown after the display program version, e.g. **230929-45** indicates version **230929** for the display and **45** for its acquisition card.

Warning: when a display is configured in pilot mode, it must be connected alone: **it must therefore be connected in place of the co-pilot's display** during this configuration.

Important: **in order for the pilot display to take over in the event of a failure of the co-pilot's timer, it must have the same operating parameters stored in its memory:**

- if the data (averages, opener notes/manual corrections, GPS corrections, navigation) are entered via a USB key, the key must also be inserted into the pilot display in order to download the files,
- if the data is 'produced' by the display, it must be copied to a key and then downloaded to the pilot display,
- in both cases, the calibration file must be transferred via a USB key from the timekeeper to the pilot display.

It is now possible to choose which files to transfer to or from the USB key, see *§15.1 Copy of rally preparation files and records*.

7.2 Beginner

This mode displays a help grid to know the different sensitive areas.

It hides certain complicated parameters:

- clock shift,
- setting the number of km / h by buzzer beep,
- conditions of lighting of the bar graph...

7.3 Confirmed

Mode to be used as soon as the user feels comfortable with the machine to take full advantage of it.

7.4 Expert

This mode removes the help buttons and certain safeguards, and adds a few more advanced settings to use.

7.5 Organizer

This mode replaces the waypoints entered in automatic GPS corrections by the points useful to edit a road book as well as timing. A separate manual explains these functions.

To use this function, the "GPS distance correction" option must be activated, see end of manual.

Please note: this function is for organisers who write road books, not for competitors who carry out reconnaissance and record their GPS correction files.

8 Guidance options

Three tabs provide access to the main options of the device.

The one on the right allows a pre-configuration according to the type of rally. With one click, 17 individual configurations can be configured. This is ideal for beginners who are not yet familiar with the various options. It also saves time to reset the device before a rally:

| | Guidance | | Distances | | Rally type | | | |
|------|------------|---------------|---------------|--------------|------------|------|------|------------|
| | GPS correc | Shifted start | Starts detect | Speed change | 1 m button | T2 = | Disp | Tripcourse |
| VHR | ✗ | ✗ | ✗ | / | 1 m | T1 | 1 m | ✗ |
| VHRS | 100 % | ✗ | ✗ | / | 1 m | T1 | 1 m | ✗ |
| Raid | ✗ | ✓ | ✗ | Roadbook | 100 m | T1 | 10m | ✓ |

All: Clock offset = 0, no corr. in the mountains

To change 17 settings at once, select a line and press the button that appears.

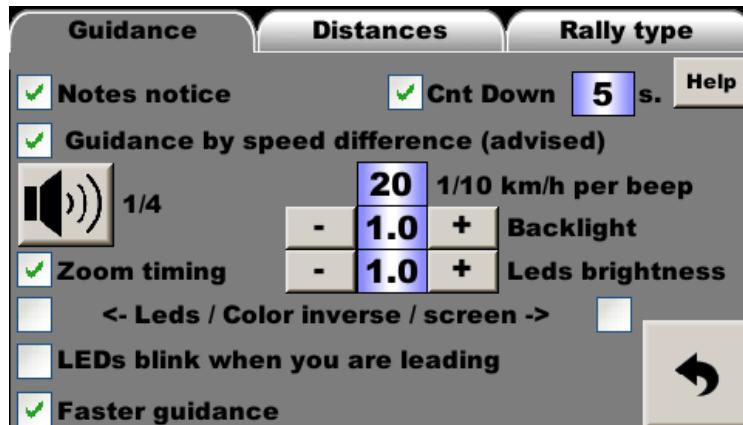


In the order of the 17 individual modified options:

- automatic adjustment of distances by GPS: this option is configured to reset the distances to 100% for VHRS rallies (the bends are cut frankly), or less when GPS reception is disturbed. For example, with a 60% configuration, if the device calculates that it needs to correct by 10 m, it will only correct by 6 m,
- shifted start: does not automatically reset the distance to 0 at the start of the stopwatch, if the starts are secret (formerly RMCH) or when the regularity zones are integrated into the links (in rally raid, with trip reset only at the beginning of the stage),
- automatic departure detection: the GPS detects the start of reconnaissance to arm the stopwatch at this point (now not recommended),
- average speed change when starts are shifted: at a distance measured from the start (secret) for the former RMCH (and if change of average speed) or at a distance indicated in the road-book (since the reset to 0 in the morning for example, like the *Dakar Classic*),
- "1 m" button on the remote control: in rally raid, it turns into a "100 m" button for more substantial adjustments,
- Trip2: used independently of Trip1 during RMCH. Trip1 for regularity zones and Trip2 for links. For other rallies, the same trip is used in both phases of the rally. In rally raid, the trip is not reset to 0 at the start of the regularity zones. In other rallies, the trip is generally set to 0 at the start of the regularity zones and then continues during the following link, until the next regularity zone,
- resolution of trips: for the rally-raid, the meters are hidden for a "trips precision of 10 m",
- display of the followed course (direction): only in rally-raid,
- the clock offset is reset to 0 to prevent a clock offset, necessary for a preceding rally, forgotten during the next rally,
- the "guidance" is a little less strict in rally-raid: the lighting of the leds or the cobbles indicating leading / delay starts at 5 km / h (or 5 tenths of a second) instead of 2 in the other configurations. **Faster guidance** mode is not activated.

Note: When the page is opened, the system tests the 17 configurations concerned. If they correspond to one of the pre-configurations, then it is checked. So once a pre-configuration is validated, if you go back to the page, it is ticked... as long as none of the 17 individual configurations is modified.

The left tab contains the main guidance options:

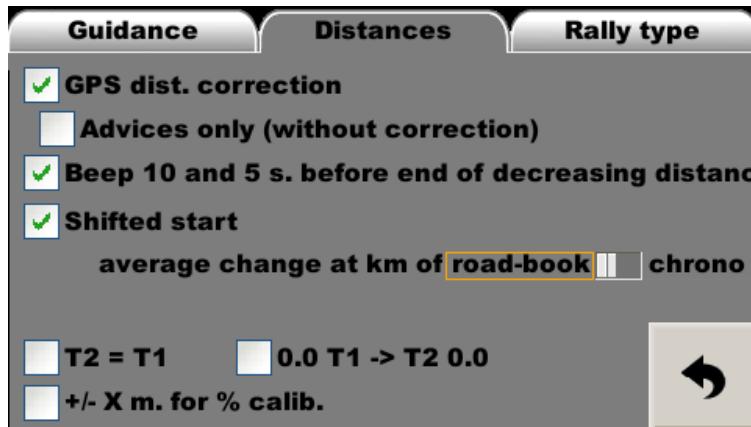


- activation of the « **gravel crew** » **notes** announcement function, or **semi-automatic corrections** with distances that may have been entered in advance (see below),
- “countdown” mode, so that the pilot can use beeps to set the finish time. This is mainly used for rallies with Italian-style tubes. This is the subject of an option still under development and of a separate manual,
- “speed difference” guidance mode which uses the difference between the actual speed of the vehicle and the speed at which the cadencer advises driving. The leds and beep then indicate “faster / slower” instead of “late / lead”, which avoids doing the yoyo. In the event of a big delay, the cadencer slows the pilot down **before** he catches up. The pilot therefore no longer needs to constantly analyze his delay in order to know when to ease up or brake when he needs to catch up. **He can therefore be more focused on his piloting**,
- buzzer configuration: by pressing the button, you can decrease (a little) the volume of the buzzer or stop it completely. In “expert” mode, you can also configure the sensitivity of the buzzer: the number on the right corresponds to the speed difference **in tenths of km/h** (in speed difference mode) or the number of tenths of a second of advance / delay from which the buzzer starts ringing.

Examples:

- with the default configuration (20, or 2 km/h per beep), the buzzer will be silent if the speed difference is 0 or 1 km/h. It will beep **at each calculation of the cadencer** if the difference is 2 or 3 km/h. It will sound two beeps every half second if the difference is 4 or 5 km/h...
- with a “softer” configuration, 3 km/h per beep for example, the buzzer will be silent if the speed difference is 0 or 1 or 2 km/h. It will beep **at each calculation of the cadencer** if the difference is 3, 4, or 5 km/h. It will beep twice if the difference is 6, 7, or 8 km/h.
- the two digits below allow you to adjust the brightness of the screen and of the remote LED module. The screen is equipped with a light sensor that automatically adjusts the brightness of the display and the LEDs. It is possible to refine this brightness with these two parameters,
- **Zoom timing** allows you to display the advance or delay in hundredths of a second when the error is less than +/- 0.25 seconds. If an RP380 driver display is used, its program must be 250904 or later (displayed at the end of the startup screen).
- the following two checkboxes **invert the lead or late display colours**. By default, warm colours (yellow to red) correspond to a delay and cold colours (blue to green) correspond to leading. By checking the left box, the colours of the LEDs are reversed. By checking the box on the right, the colours of the displays on the screen are reversed (co-pilot and pilot),
- the next checkbox makes the LEDs blink when you are leading. This is especially useful for drivers who are **colour blind**,
- the **last checkbox** activates the “Faster guidance” mode: the advance/delay calculation is performed **5 times per second instead of 2 times per second**. This provides a little more precision in the braking phase after catching up. On the other hand, the buzzer has less range of action: as soon as you are a little too far ahead or behind, it sounds continuously,

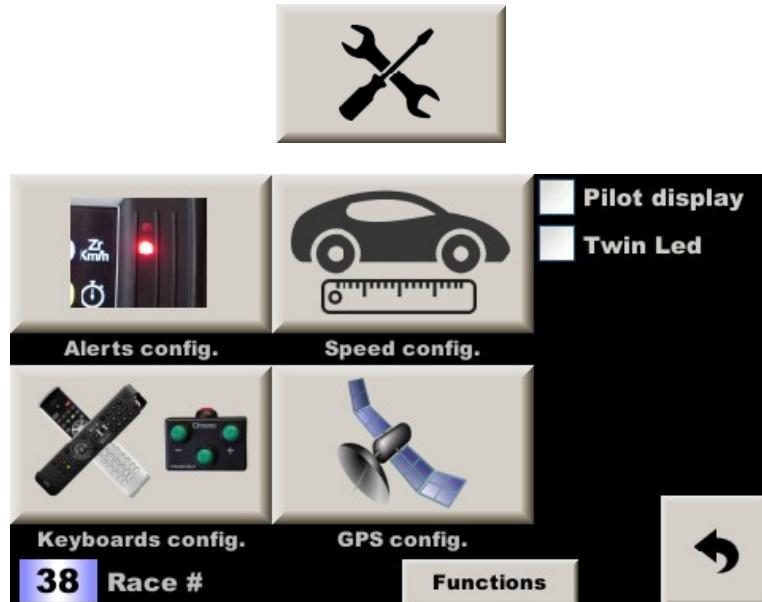
And finally the middle tab contains options relating to distances:



- automatic correction of distances by GPS from the distances measured during reconnaissance. This function is optional. To be active, it requires an activation code, see §2424 *Optional functions purchase / activation / deactivation*,
- in expert mode, it is possible to replace the corrections by advice: once the device has calculated the necessary correction, it does not apply it, it only displays it. It is then up to the co-pilot to decide whether to apply this correction, in full or in part. In the main (regularity) page, pressing the **blue** button activates / deactivates this function and switches between **Without** and **With** GPS correction, as shown to the right of this option. Upon activation, the last correction is also cancelled. In fact, we consider that the co-pilot has decided to switch to "advice only" because he has just detected an excessive correction and thinks he has entered an area of poor GPS reception,
- a beep can be activated 10 and then 5 seconds before the end of a destination distance (with the decreasing distance displayed). On longer journeys, this allows the co-driver and first officer to focus on something other than monitoring the decreasing distance. On the motorway, it is advisable to program a shorter distance than the exit distance to allow for some margin, as the road book distance can be inaccurate, or to point to the end of the deceleration zone. These beeps are not active when the timer is running.
- shifted start: see §18 below,
- by checking "T1 = T2", only Trip1 is used (for RT and link), Trip2 is no longer managed, which is more common in most rallies which do not distinguish between distances between regularity and liaison zones (except RMCH),
- in **expert** mode, Trip1 and Trip2 can be kept independent but reset to 0 at the same time (resetting Trip1 to 0 at the start of RT automatically resets Trip2 to 0), which makes it possible to see at the end of RT the difference between the Trip2 which has not been corrected and Trip1 which has been corrected. This allows to have another vision of a possible calibration deviation,
- always in **expert** mode, the last box corresponds to the inclusion of the +/- 1 or 10 m correction keys. in the total of corrections for fine modification of the calibration, see below.

9 Hardware configuration, vehicle type, tests, calibration...

In the main menu, press the button with tools:



The large buttons open configuration pages for display, measurements, remote control, and GPS.

On the right, checkboxes configure the accessories connected to the timing system:

- **Pilot display:** Check this box to tell this device to send data to the pilot display. With the latest software versions for both the co-pilot and pilot, this checkbox is set automatically: the timing system detects the presence of the pilot display.
- **Dual LED:** This only appears if an **LED6 Auxiliary** is connected. This check mark activates the use of a second module that the clock generator can control independently of the first (main) module to separate "forward or slow down" on one module and "retard or speed up" on the other.

The **race number**, which can be entered in the bottom left corner, is used to name the files recorded during the race. This number, followed by the RT number, then the date and time, form the file name. At the end of a rally day, if a USB drive is used to collect files from several cars for analysis, it's easy to identify which file came from which car.

The button at the bottom, near the middle, configures the optional functions; see § 24 Purchasing/Activating/Deactivating Optional Functions.

9.1 Measurement Type Configuration

In the following menu, press the button with auto and ruler:



9.1.1 Type of connection choice

Start by choosing the type of connection:

- **GPS** (not very accurate),
- **OBDII** (diagnostic socket), then the vehicle type. Those marked "ABS" have a very precise measurement of the distance (from 1 to 10 cm). "**OBD 11 bits**" and "**OBD 29 bits**" are *universal* but not very accurate (1 to 3 m error per km, even more with some vehicles). This precision is sufficient in the race because it is negligible in relation to the trajectories cut but insufficient for the measurements carried out for creating road-books or scouting,
- **wheel speed sensor(s).**

- **speed simulation** for salon learning (speed is set with two buttons).

These points can be "swept" using the **up** and **down** arrow keys on the remote control. In **OBDII** configuration, the **red** and **blue** function keys are used to select the type of vehicle.

Reminder: by choosing the "**Obd 11 bits**" and "**Obd 29 bits**" modes, there is no accuracy guarantee and these modes are strongly discouraged for carrying out reconnaissance and road-book measurements, even if the accuracy can be improved, see below.

9.1.2 Left or Right wheel choice

When possible, a panel at the bottom of the screen can then choose whether the distance should be **measured on the right / left / average** of the two wheels.

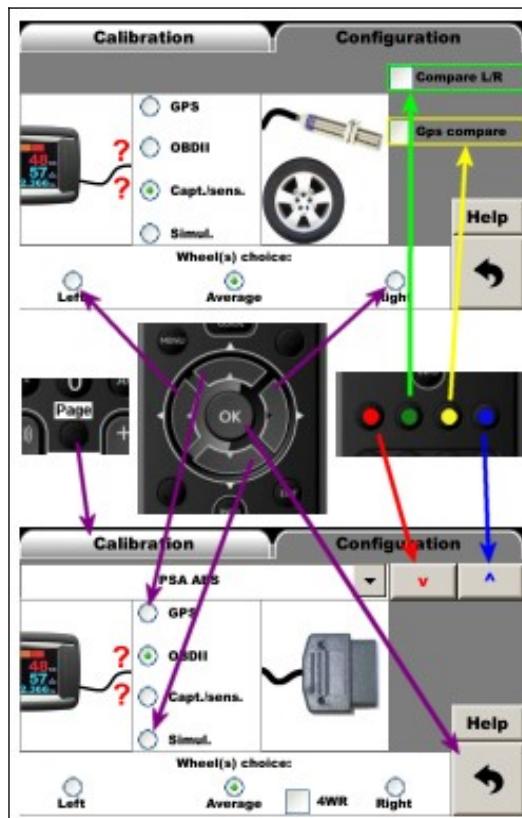
These choices can be "swept" using the **left** and **right** arrow keys on the remote control.

Note:

- with the configuration on **OBDII** in **PSA ABS** or **Megane 4 ABS** mode, it is possible to choose the measurement on front or rear wheel(s). A check box **4WR** allows to measure on the average of the 4 wheels,
- with the configuration on **OBDII** in **PSA ABS** mode the detection of reverse is automatic (with auto or manual gearbox). But that can pose problems with certain vehicles, thus it is possible to deactivate this function in **Expert** mode, by unchecking the box **AutoDetectRev**,
- in **Expert** mode, with the **Capteur/sensor** configuration, when the measurement choice is on **Average**, it is possible to set the preponderance of the right wheel, as a percentage, by default 50%. This is of no interest when the right and left sensors are on the same axle, but becomes interesting if you place one sensor on a driven wheel and the other on a non-driven wheel. In this way, you can try to approximate the measurement of a 4x4 vehicle that would have been used to measure a road-book,
- with the **Capteur/sensor** configuration, two checkbox add the sensor monitoring function based on the GPS (**Compare GPS**), or on left/right wheel sensor comparison (**Compare L/R**), see below.

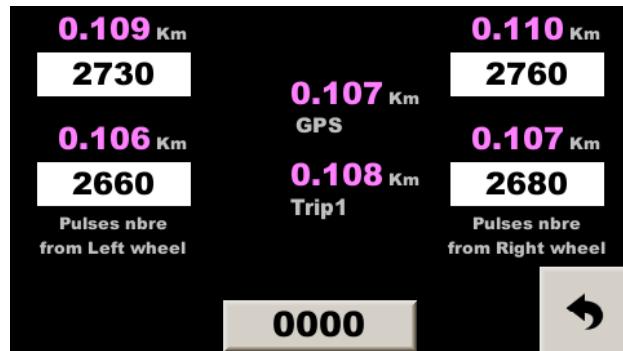
Then go to the "**Calibration**" tab (**Page** key on remote control).

Remote control usage:



9.2 Sensors test

If the system allows it (wheel speed sensor or OBDII in ABS mode), the **Detailed distances** button displays the pulses sent by the sensors via the page (the number of counters can be different according to the configuration):



This page help to compare all the wheel "sensors", the distance calculated for each wheel, the GPS distance calculated and Trip1, based on the configuration and the above distances

In case the timer is connected to wheel speed sensor(s), it is recommended to gradually move the sensor closer until it becomes active, measure the distance to the target, and divide that distance by two.

Then begin by verifying that each pulse increments the counter of the rotating wheel.

At the end of the installation, before calibration, carry out a test by accelerating progressively up to the maximum speed of the vehicle. The displayed speed must be stable (even if it is false because not yet calibrated).

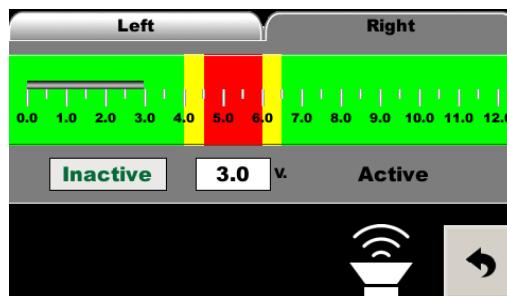
If this is not the case, the speed sensor(s) are incorrectly adjusted:

- if the speed tends to fall to 0 beyond a certain speed, the sensor misses tops at high speed, it must be too far from the "target" or "target" is not of good "ferromagnetic quality",
- if the speed tends to double at certain times, the sensor records "rebounds". This can happen with ILS sensors when they are too close to a very powerful magnet. Or problems of false contacts.

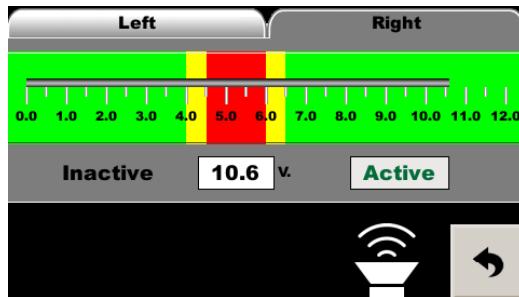
With the **RR410/412**, it is possible to further test the wheel speed sensors, by displaying the voltage value read on the sensors. This is especially useful for checking the compatibility of 2-wire sensors that are not supplied by CRISARTECH. An additional **Test** button is at the bottom of the previous page:



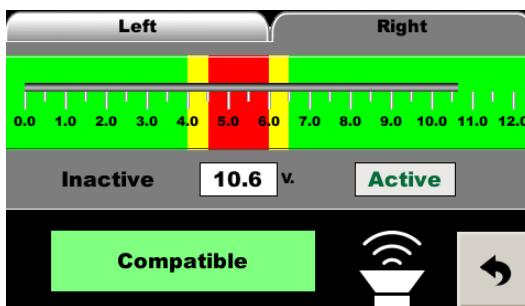
When the sensor is **not active** (not in front of a pad in general), its voltage must be **lower than 4 V**:



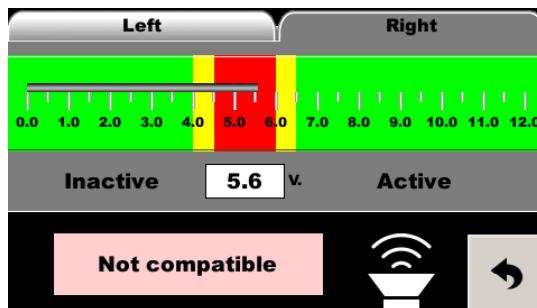
When the sensor is **active** (in front of a stud in general), its voltage must be **higher than 6.5 V**:



By gently turning the wheel, you should see these two distinct states.
If this is the case, a "Compatible" message is displayed:



If the sensor voltage falls between 4 and 6.5V an "incompatible" message is displayed:



By pressing the buzzer at the bottom of the page:



The buzzer sounds when the sensor is active. This is an aid to setting up sensors that do not have a light. If the workshop is quiet, even under the car, the buzzer should sound when the sensor is approached from the magnet or its pad.

Caution: **the output voltage of 2-wire sensors usually fluctuates with the battery voltage.** It is therefore necessary to carry out tests in the most unfavourable cases:

- engine at high speed with all electrical consumers off (especially if the "inactive" voltage is high, close to 4V),
- engine at low speed with all electrical consumers on (especially if the "active" voltage is low, close to 6.5V): headlights, windscreen wipers, defrosting/demisting, etc.

9.3 Calibration

Once measurement configuration has been chosen (GPS, OBDII, or sensor), it is necessary to calibrate for your device measures the distances precisely, but especially in the same way as that of the organizer. The RR400 uses a very precise calibration coefficient. Or rather several coefficients:

- calibration coefficient when the measurement is made by GPS (the value is about 1),
- calibration coefficient when the measurement is made by the OBDII socket (the value is about 1),
- 3 calibration coefficients when the measurement is made by the wheel speed sensor (the value corresponds to the distance of a sensor top, ie the perimeter of the wheel divided by the number of tops per revolution), one coefficient for each tyre type (A, B or C),
- calibration coefficient when the speed is simulated (the value is about 1).

But this coefficient is then used to measure ALL distances (Trip1 to Trip3, and Totalizer)

On the calibration page, select the calibration mode:

- **Trip1** uses the first counter to perform the calibration. This is the default mode, the simplest,
- **Trip2** uses the second counter to perform the calibration. Used to calibrate (or refine calibration) during the first RT. In this case the Trip1 was used and adjusted during the RT, so not usable to calibrate. Trip2, on the other hand, has not been modified and can be used to calibrate at the end of RT, using the theoretical distance written on the road-book. The advantage is to have a distance generally longer than the calibration zone and taking into account the cut curves (driving style),
- **Free calculation:** here only the function of "special calculator with rule of proportionality" is used: calculation of the calibration from a distance that has been measured before and the corresponding theoretical distance,
- **GPS:** to perform a **rapid calibration** of the speed sensors, we use the GPS speed. This method does not have the precision required to perform a rally but allows a quick calibration after the sensor test. This allows you to have a correct speed displayed in the main page without needing to go on a calibration zone, but **does not replace in any case a real calibration at the beginning of the rally**.

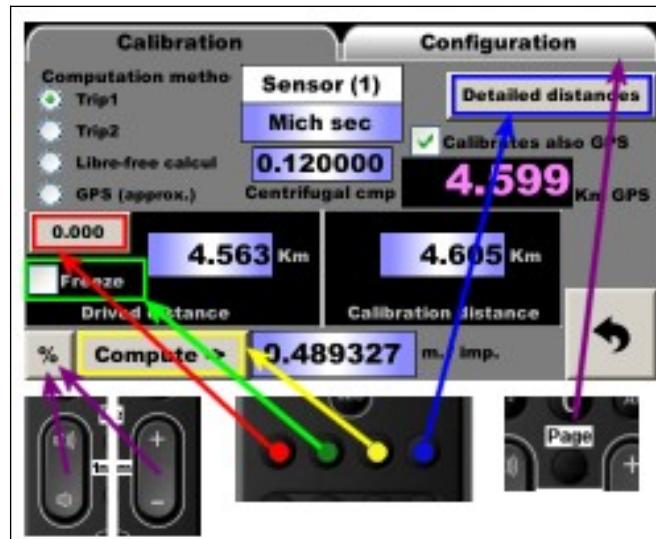
Typical case of Trip1:

- drive to the beginning of the calibration zone,
- press button "0.000"
- drive to the end of calibration zone, the distance is displayed in the "driven distance" left field,
- enter the zone theoretical distance in the "Calibration distance" right field,
- then press the "**Compute**" button: the new value is displayed next to it.

Congratulations, it's over!

Note: tests are carried out on the calculated calibration coefficients consistency. If they are less than 0.05 or greater than 3, the system displays an error message instead of recording them, unless you are in **Expert** mode. At start-up, these tests are also carried out regardless of the operating mode.

Infrared remote control use:



Tip: use the rally calibration zone on the first day as a base calibration, then refine this calibration during the first RT (or in the first part of the RT if it is long enough) using the method described in the following paragraphs § 9.6

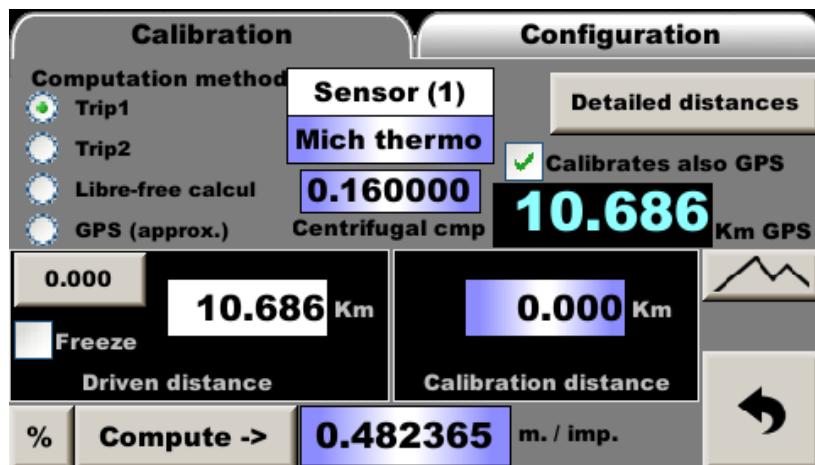
Automatic calculation of calibration percentage difference and §9.7 Calibration fine adjustment. Then, if it is not perfect, adapt it during the next RT, but avoid returning to the calibration zone.

The calibration measured from the calibration zone is often slightly different because the organiser (or yourself) has driven with tyres at a different temperature to the rest of the rally, the calibration zone is often short, in a straight line (whereas RT are full of curves), at a lower speed...

It's worth noting that when you measure with GPS, half of these parameters are not affected.

9.4 Manual modification of the calibration

In all cases, it is possible to modify a calibration manually. Simply press the calibration value at the bottom of the page to bring up the keyboard and modify it:



This is particularly useful when a GPS calibration value is recommended during a well-prepared rally such as the Tour de Corse Historique.

9.5 Simultaneous calibration of the GPS

When one or more speed sensors are used to measure the distance, the GPS can be used as a backup measurement means in case of failure of the sensor (s). For this purpose, the GPS must be calibrated in the same way as the speed

sensors. On the calibration area, just check the box: **Calibrates also GPS**

By calculating the calibration coefficient of the speed sensors, the RR400 calculates the calibration coefficient of the GPS and displays it in an information panel. It must be close to 1.

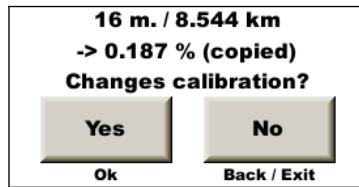
Warning: in the event of a **tunnel** in the calibration area, do not calibrate the GPS there, but rather at the start of the link. To do this, configure to GPS measurement, perform the calibration and then return to the original configuration.

9.6 Automatic calculation of calibration percentage difference

If the co-pilot realizes that his calibration is not optimal, he can have the system calculate the percentage difference. As the corrections are made while driving, they are displayed at the bottom right of the main as well as the total number of corrections, in parenthesis:

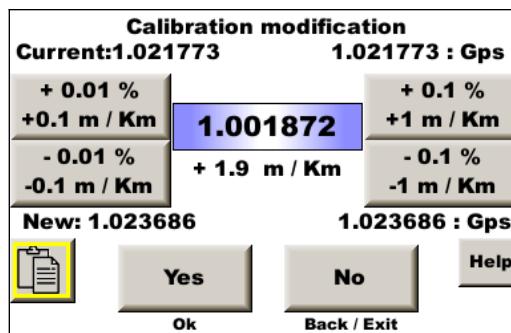
+3 (11) m.
-4 (7) m.
+5 (12) m.
-2 (10) m.
+6 (16) m.

If these corrections are made in comparison to the road-book, they reflect a slight difference with the race organizer's calibration (not to be confused with the corrections for cut turns). When the co-pilot considers that the distance over which he has applied his corrections is sufficient (half of the first RT for example), he can press the **Info** button on the remote control to display the following popup:



He therefore has a clear idea of the necessary calibration adjustment, in meters / km and in percentage. **The percentage is memorized by the device for use in the fine-tuning calibration page** (see below). The distance reference is the starting point for the cumulative correction, usually reset to 0 at the start of a RT. The percentage calculation is made from this point, up to the distance where the co-pilot pressed the **Info** button on the remote control. The co-pilot then has two options:

- press the **No** button (or **Back** or **Exit** on the remote control) and continue his adjustments in relation to the road-book. The total is not reset and the distance reference remains the same (the start of the RT in our example),
- press the **Yes** button (or **Ok** on the remote control). In this case, the correction total is reset to zero and the distance reference for the next corrections becomes the distance when pressing the **Info** key. Continuing with our example, this will allow to refine even more the calibration on the second part of the RT with the new calibration modified by fine adjustment. The "fine tune" calibration page opens:



It is possible to modulate the correction before applying it by pressing the Yes (or Ok button on the remote control).

If you are not using the IR remote control, the small popup window showing the correction and the reference distance opens automatically when you access the fine-tuning calibration page.

The cases of resetting the accumulation to 0 and modifying the distance reference are:

- Trip1 reset to 0,
- percentage calculation by the above popup and validation,
- Trip1 modification by more than 200 m. We consider that the Trip1 has been modified following an error, an itinerary change... but not a correction due to a difference in calibration. In this case, the distance reference is the new value of Trip1.

Note: If the percentage difference is greater than 10%, it is considered to be an error and the value is not saved for fine tuning of the calibration.

Warning: by default, the corrections made by adding or subtracting 1/2/10 m. using the dedicated keys are considered corrections of "anormal trajectory" (cut turn for example). They are not counted in the cumulation. In Expert mode, you can ask the system to take these corrections into account by checking the "+/- X m. for %calib." at the end of the guidance options, middle tab.

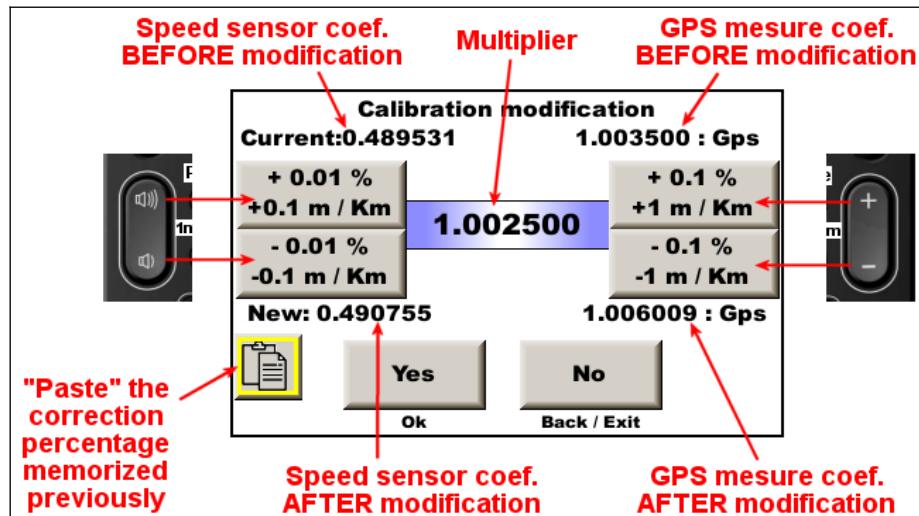
Advice: at the end of the RT, set the distance of the last road-book box to make a final correction. If the distance is correct, add 1 m anyway. Then subtract it off immediately with "freezing distance" method. The sole purpose of this manipulation is to make the distance reference match with the end of the RT. Therefore, the calculated percentage corresponds well to the totality of the corrections applied to the correct distance.

9.7 Calibration fine adjustment

To adjust the calibration **in percentage** (except **beginner** mode), go to the calibration screen, and push the button



or use the IR remote control +/- 1 or 10 m keys to open the calibration fine adjustment window:



For memory, each button displays the % and the number of meter per Km of the adjustment, and the coefficient that will be applied to the calibrations is "translated" into meters per Km unit.

The "paste" button (or **yellow** button on the infrared remote control) allows you to paste the percentage of correction calculated in one of the following cases:

- automatic calculation of calibration percentage difference (see above),
- normalization of a GPS correction file (see appendix manual).

9.8 Compensation of centrifugal force applied to tires

With the speed of the wheels, the centrifugal force applied to the tires can interfere with distance measurements. This is true for any type of measurement based on wheel speed or counting wheel revolutions, so all measurement modes except GPS mode.

This centrifugal force causes the tire to "inflate", increasing its diameter and therefore reducing the distances measured. It is particularly evident in tires with high, supple sidewalls, such as "winter" tires. In most cases, it is negligible, but in **Expert** mode, there is a coefficient in the calibration page which compensates this phenomenon by slightly lengthening the distances when speed is greater than 55 km / h:

0.120000
Cmp centrifuge

By default, the coefficient is 0.12 to correct ordinary modern car tires.

When participating in a rally, it is usually assumed that the organizer has measured the distances by driving slowly, on the right side of the road or not. During the race, we will drive much faster and our tires can be subject to this phenomenon, unless they are "racing" tires. We can do a few tests before the rally to try to calibrate this coefficient: increase it if we measure too short at high speed and vice versa.

9.9 Calibration compensation in mountain areas

It is common to feel that you need a different calibration between ascents and descents. This is caused by a difference in measurement between the organiser and ourselves. The organiser measured on the front wheel(s) and we measured on the rear wheel(s) or vice versa.

This is accessed via the button on the calibration page, but this function is still being tested and improved.

If you activate the function, you have to configure how the organiser measured and how you measure by checking the checkboxes. If the configuration of the two measurements is identical, the system exits in error.

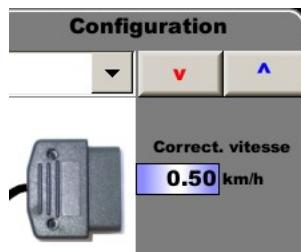
The default coefficients are those found after many tests with a compact sedan equipped with standard tyres. They will have to be adjusted according to the differences found during the race. For this, the user is guided according to the configuration to increase or decrease them by help texts displayed...

9.10 Improving measurement accuracy in OBD11 and OBD29 bit mode

Depending on the vehicle, measurement in **OBD11** or **OBD29** bit mode suffers from variable calibration depending on the speed.

Example: if calibrating at an average speed of 45 km / h, then when driving at 70 km / h, the calibration takes longer. When driving at less than 45 km / h, the calibration is shorter, which is particularly the case during the start and stop phases. We can also observe an inverse effect of speed.

In **Expert** mode, there is a coefficient in the configuration page which corrects this phenomenon:



By default, the coefficient is 0.5. We can make it vary it between 0 and 1 to try to correct these errors. For this it is advisable to practice tests between two benchmarks on a straight road and compare the distances measured at different speeds. Pay attention to the centrifugal force compensation (see above) which also disturbs these measurements. For it to be negligible:

- choose “racing” tires, if possible,
- largely over inflate the tires during the test,
- do not exceed 80 km / h.

9.11 Naming a calibration

In the calibration page: press the name of the calibration (here **Sans nom1**):



... to open the calibration name file management page:

| Name | Date-Hour | Meth. | Calibration | Centrifug. | Sens |
|-------------|----------------|-------|-------------|------------|------|
| Mich thermo | 25/11/13-06:04 | MAN | 0.482365 | 0.16 | |
| Mich sec | 25/11/13-06:10 | MAN | 0.471423 | 0.0 | |
| Yoco pluie | 25/11/13-06:09 | MAN | 0.474521 | 0.12 | |
| Sisteron | 25/11/13-06:09 | MAN | 0.512896 | 0.2 | |
| Burzet | 25/11/13-06:08 | MAN | 0.53925 | 0.25 | |
| Nameless6 | | | 1.0 | 0.0 | |
| Nameless7 | | | 1.0 | 0.0 | |
| Nameless8 | | | 1.0 | 0.0 | |
| Nameless9 | | | 1.0 | 0.0 | |
| Nameless10 | | | 1.0 | 0.0 | |

There is a different file for each entry (GPS, sensor, OBD, simulation).

The **Method** column reminds us what was used to change the calibration:

- **MAN**: The calibration value was entered directly with the keyboard,
- **TRIP1** or **TRIP2**: The value was calculated on a calibration area,
- **FREE** : The value was freely calculated based on distance travelled and a reference distance,
- **GPS** : The value was calculated approximately using the GPS speed,
- **%**: The value was adjusted by percentage.

You have to press on a line to select it. It becomes framed in green.

The button clears the selected line.

The button changes the name.

It is not necessary to save the changes to the name and/or the selected line, this is done automatically when leaving the page.

9.12 Wheel sensor monitoring

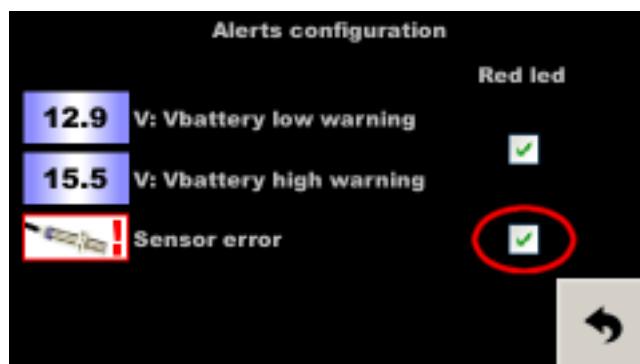
Specifically for the **Captor/sensor** configuration it is possible to activate the sensor signal monitoring function by ticking the **Compare GPS** or **Compare L/R** box in the configuration tab of the input used for speed measurement:



The distances measured by the sensors left and right and/or the GPS are compared and if a significant difference appears, an alert popup is displayed in the main running screens:



The red LED flashes if the corresponding box is checked in the alert configuration screen:



Menu - Config. equipment - Alerts config.

By removing this popup, we can display the percentages of error, which allows to better understand the problem:

- if a slight difference appears between right and left, following a succession of turns in the same direction, we can consider that it is a false alarm, but it is necessary to monitor the / the sensors,
- **if a slight difference appears after changing tires, you must change the calibration,**
- if a difference with GPS appears after having crossed a tunnel, an avalanche barrier, or a very dense forest, it is normal the GPS lost some meters,
- **if a significant difference suddenly appears, a sensor may be faulty, especially not perform “on-the-fly” correction (+/- 1 or 10 m key) before confirming or reversing this assumption.** To do this, go to the detailed distances page to monitor the distances of each sensor. If the failure of one sensor is confirmed, use the other or the GPS. The most correct distance will be restored automatically when the faulty sensor is ignored, because the distances (L wheel, R wheel and GPS) are measured separately, then selected or averaged to serve Trip1. But during a correction, the three are synchronized, that's why we must not correct “on the fly” when we have a doubt.

| | action on the touch screen: | action on the remote control: | the test resumes after: |
|---|-----------------------------|-------------------------------|-------------------------|
| hide popup and display the percentages of error | maintained push (2 seconds) | INFO key | 30 seconds |
| simply hide popup | simple push | other key | 2 minutes |

There are three parameters to fill in:

- measurement distance before comparison (in km), common for both tests,
- maximum error for left / right wheel comparison (in%),
- maximum error for GPS and wheel comparison (in%).

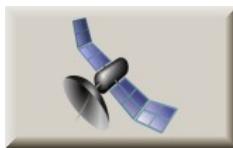
This function can be used in two ways:

- monitoring "health" sensors: put a distance short enough to quickly detect a failure (0.15 km for example) and a maximum error large enough to avoid false alarms (5% for example),
- calibration error detection (forget calibration change after changing wheels for example): put a distance long enough to avoid false alarms (0.8 km for example) and a maximum error strict enough to detect small errors (1 % for example).

The given values are indicative and are to be refined before the rally according to the configuration (number of pulses per revolution for example).

9.13 GPS receiver configuration

In expert mode, there is an additional button in the tools menu:



In the page that opens, you can configure the constellations used by the receiver to calculate its position.

Indeed, it is not always desirable to have the best position for regularity rallies. It should not be more precise than the measuring / timing system that refers.

For GPS timed rallies, when using automatic GPS corrections and when the receiver can be placed on the roof, it is advisable to set up on the first point (**GPS + Glonass**) in order to measure in conditions close to the measurement system.

In other cases, it is advisable to configure on the fourth point (**GPS + Galileo + BeiDou**) in order to measure in the best conditions.

The other points are only useful for testing.

Once the point has been chosen, press the bottom configuration button. An hourglass animates during setup.

On the right are displayed:

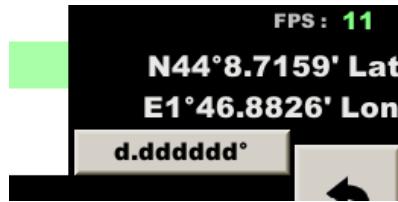
- reception quality, from 0 when reception is null or very poor, to around 75 under the best conditions. This is the number that is displayed on many pages,
- the number of satellites used. When the number 12 is reached, it means 12 or more, the receiver being able to manage more than 30 satellites,
- FPS correspond to the number of positions received per second. It should be 10, but occasionally it may fleetingly display 9 or 11,
- when the figures are yellow, the system has not yet found the satellite that will reduce its position error (SBAS). They then turn green.

When the numbers are yellow, the system has not yet found the satellite to reduce its position error (SBAS). They then turn green.

Important:

- **the configuration is not saved in the cadencer. It is transmitted to the receiver when the configuration button is pressed. When you exit the page and come back, no configuration is displayed and this is not a fault,**
- **if you have several receivers (including internal receiver), you have to connect and repeat the operation for each receiver.**

There's also the current **GPS position** (handy if you need to call for help, for example) and a button to change the format:

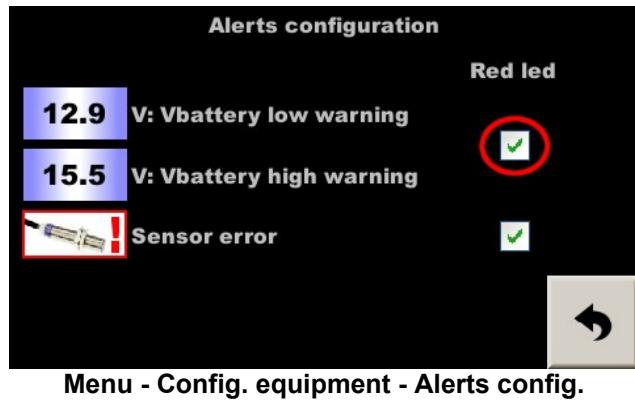


In the example above, the format is degrees-decimal minutes and pressing the button switches to decimal degrees. Pressing it again will switch to degrees-minutes-decimal seconds.

9.14 Battery voltage monitoring

The battery voltage is displayed in the link screen.

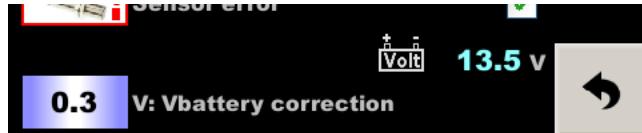
In case of low or high battery level, a warning popup is displayed in the main running screens. The ignition thresholds can be changed in the alerts configuration page and the red led can follow the display of the popup:



Menu - Config. equipment - Alerts config.

9.15 Correcting the battery voltage

In **Expert mode**, it is possible to adjust the battery voltage for display as well as for monitoring. At the bottom of the alerts configuration page:



In some cars, there may be a few tenths of a volt difference between the displayed voltage and the actual voltage. This parameter allows them to be compensated. The value read and corrected is displayed on the right (here 14.0 V) and should be compared with a voltmeter connected to the battery.

Note: the use of a back-up battery CRISARTECH requires systematically adding 0.6 Volt.

10 Entering average speeds

10.1 Manual entering

The average speed entry form is accessible:

- from the main menu: big button with flags,
- from the co-pilot page (main page): press the area of the screen where the RT number is displayed:



- from the co-pilot page (main page): press the yellow button on the remote control.



For each speed segment (**Se**, left column), enter the end distance and the average speed. The corresponding timing is displayed progressively in the right column, which allows to control the accuracy with some road-books that give these indicative values.

Do not tick the Timing checkbox when entering distance/speed couples. This function is made to enter distance/timing couples.

The "Follow T1" checkbox highlights the line that follows segment changes during speed zones.

This checkbox should be selected when you want to modify the distance or average speed on the fly (the data is found on roadside signs and not in the road book). See §17 Entering an average on-the-fly speed change distance. This checkbox should not be selected if you are entering road book data during the speed zone, as in Multi-Average mode. See §19 Multispeed mode.

The segment start distance does not have to be entered, it corresponds to 0 for the first segment, and at the end of the previous segment for the others.

At the end of the entry, the data must be saved in a file by pressing the floppy disk button.

If the data is modified during the RT, they are taken into account immediately but it is necessary to save before leaving. In case of forgetfulness a popup asks if one wishes to save.

To change the RT, you can press on the top left the + and - buttons or the RT number.

The small button under the **Start** column with a red number corresponds to the set of averages used, see 10.3 Using multiple sets of averages.

Note: to quickly enter a large number of distances / speed it is easier:

- to put the timer on the knees, like a tablet, and use pencil with eraser or a plastic pen (not ball side!) as a stylus. Styluses for tablets or smartphones are generally too soft. Ladies with long nails can also use a nail,
- or use the infrared remote control, see §16 Infrared remote control for the use of this accessory.



Before starting a new rally, it is strongly recommended to clear the device's data using the **button**, but be aware that this erases ALL files for ALL RT. This includes GPS corrections, gravel crew notes/manual corrections, and navigation data. It also resets the index of the next RT to 1, so when you start the rally, you won't get the error message indicating that you are not completing the RT in the correct order.

10.2 Speed fast change (« rain » mode for example)

Use the button at the top of the page to open a popup window that lets you add a value to ALL the speeds in the RT you are editing (and only that RT).

This is useful if you are entering speeds for several vehicle categories. You manually enter the 'low' averages, then add 5 km/h for the 'intermediate' averages and 10 km/h for the 'high' averages.

This is especially useful to subtract 3 or 5 km/h at the last minute, when the organisers announce rainy weather. In this case, you add a negative value. On the keyboard, type **3** or **5** then **+/-**.

Note: for negative values, press **3 or **5** on the keypad, then press **+/-**.**

10.3 Using multiple sets of averages

It is possible to manage multiple sets of average speeds for situations where averages vary depending on weather conditions, or to group averages from several categories in the same file.

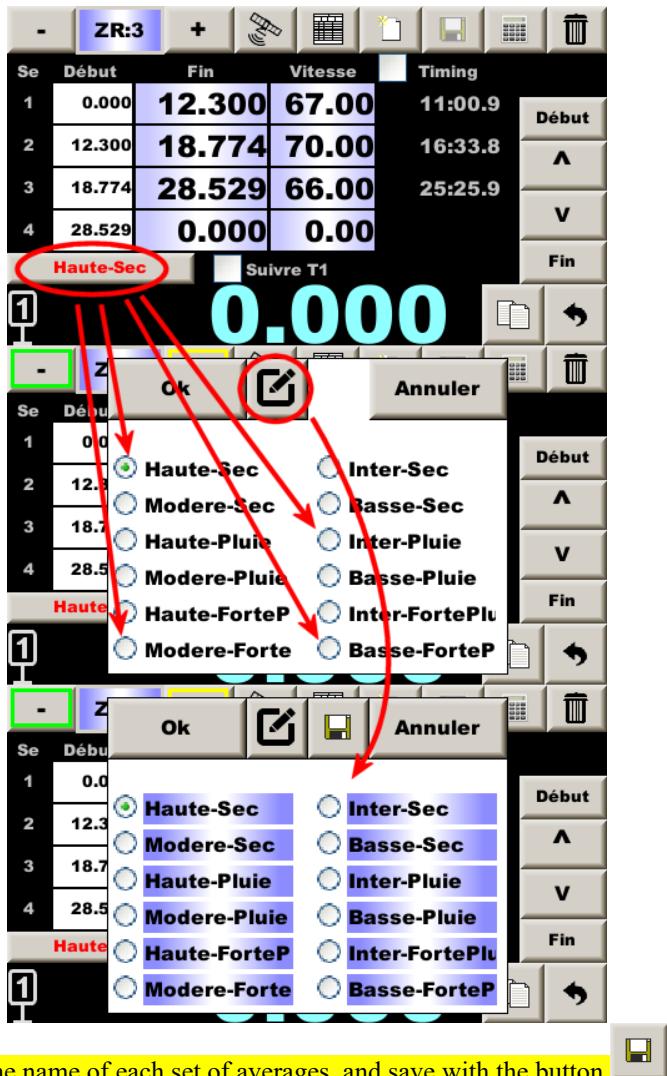
In this case, the system uses the **zr_desc.csv** file to determine the number of average sets and assign a name to each set.

Example:

High-Dry; Inter-Dry; Moderate-Dry; Low-Dry; High-Rain; Inter-Rain; Moderate-Rain;

Low-Rain; High-HeavyRain; Inter-HeavyRain; Moderate-HeavyRain; Low-HeavyRain

In this case, we have both 4 types of averages (High, Intermediate, Moderate, Low) and 3 weather conditions (Dry, Rain, Heavy rain).



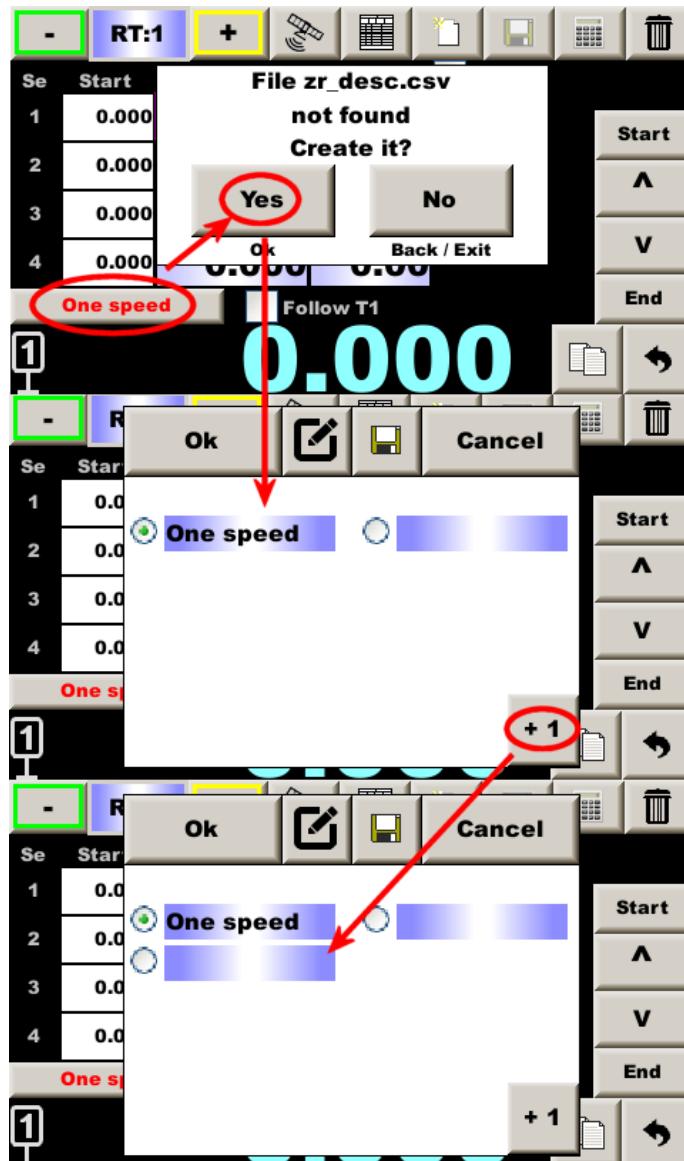
allows you to change the name of each set of averages, and save with the button

10.3.1 Creating the zr_desc file

When the device is blank (after erasing everything using the button), this file doesn't exist, and the system assumes that only one set of averages is present in each file. The small button below the **Start** column indicates **One speed**.

To create this file, simply press this button. A confirmation will be requested, and the average set management popup will open with two lines corresponding to two sets of averages. If this is not enough, simply press the **+1** button in the bottom right corner to add as many lines as needed. The maximum number is 12 sets (H, I, M, L multiplied by Dry, Rain, Heavy Rain).

Then, fill in the Blue-White-Blue lines with the names of each set of averages and save using the button.



Warning: Once the **zr_desc.csv** file is created, it is not possible to undo changes or remove average speeds. You must then delete **EVERYTHING** using the button. This is a good reason to use it for each new rally.

Tip: when manually entering average speeds, you'll generally have 2 or 3 driving conditions. It's recommended to proceed as follows:

- enter the "normal" distances and average speeds for the first RT, then save,
- switch to « rain » averages, for example, without changing the RT. The device retains the distances and, by default, offers the same averages as "normal." Generally, averages for adverse conditions are calculated from "normal" averages, minus 3 km/h, for example. Therefore, simply use the calculation function with the button to adjust all the "rain" averages in our example at once. **However, you must verify that all averages are calculated with the same margin by the organiser.**
- switch to "heavy rain" averages, for example, without changing the RT and perform the same procedure...

10.3.2 Importing average files via USB drive

Don't forget to put the **zr_desc.csv** file on the USB key before importing it into the device.

10.4 Input on a computer

It is possible to enter or paste data that has been copied from a file provided by the organizer.

A separate file is required for each RT named simply "zr" followed by the RT number. The file format is semicolon-delimited text with a ".csv" extension. On each successive line, the following information must be entered:

- the distance of the speed change, in km, with a period or comma as the decimal separator,
- a semicolon ";" ,
- the speed, in km/h, with a period or comma as the decimal separator,
- if there are multiple sets of averages, add a semicolon ";" and the speed for each type of average, respecting the order of the **zr_desc.csv** file.

Example:

zr_desc.csv :

Dry;Rain;Heavy Rain

zr8.csv :

1.234;45;43;40

3.456;49,9;46,9;44,9

This corresponds to the following table:

ZR08

| From | To | V. Dry | V. Rain | V. Heavy Rain |
|-------|-----------|--------|---------|---------------|
| 0 | 1,23 4 | 45 | 43 | 40 |
| 1,234 | 3,45 6 | 49,9 | 46,9 | 44,9 |

This can be done with a spreadsheet like Excel or LibreOffice Calc or simply a text editor like Notepad, especially when pasting data from a .pdf file.

10.5 Use of a redundant pilot display:

This is an RR400 type touchscreen display used as a pilot display. Once the average speeds are entered on the co-driver's timing unit, they must be copied to the driver display via a USB drive.

During the rally, the timing unit sends the RT number being run, as well as any changes in average speed, to the driver display.

Important: After calibration, remember to transfer the calibration file from the timing unit to the driver display.

10.6 Duplication of averages:



On many rallies, the RT are run several times. The button duplicates the average speed file from one RT to another.

11 Stopwatch

The stopwatch is started in several steps, but you must always start with the arming: press the Chrono button on the remote control or the stopwatch displayed on the screen (right, in the middle). This brings up the timer launch panel:



Note: when the background of the panel is **yellow**, the timer is in “shifted start” mode, see below.

11.1 Starting an inline stage in manual mode

“Inline stage” meaning stage other than on a circuit.

This operating mode is the default mode.

To start the stopwatch, just one operation:

- press the large red button on the left of the touch screen, or
- press the **Chrono** or **OK** button on the remote control.

Note: This is the simplest operation, but the least precise and the least secure.

11.2 Starting an inline stage in automatic mode

You can choose the automatic start “on time” by pressing the **Auto Start** button, or one of the adjustment buttons in 30-second increments (with the infrared remote control, buttons +/- 10 or +/- 1 m.). The large button on the left then shows a clock on a yellow background. The countdown starts in green instead of the stopwatch. Once the time has been chosen, it must then be validated:

- press the big left button of the touch screen, or
- press the **Chrono** or **OK** button on the remote control.

Note: if the chosen time is passed, the displayed time is red, as well as the stopwatch.

When the countdown reaches 0, **if the departure time has been validated**, the stopwatch starts!

This is the safest operation (no risk of staying too long on the button, of pressing by mistake too early), the most precise (when the clock is synchronized via the GPS, we have an accuracy of 2 hundredths of a second).

Tip:

- choose the departure time in the departure queue according to the cars before you. Wait for the commissioner to confirm your departure time to validate.
- if we use the time control (CH) management of the link page, and the departure from Rt is also a time control, then we choose the departure time in the management page and press the chrono button to return to this page with the departure time automatically synchronized, [§13 Link page and time control management](#).

11.3 Starting an inline stage, but late!

If you missed the start of the stopwatch at the start of the RT, it could happen to anyone, **don't panic!**

You can program the departure “at the time of your real departure” as above by pressing the **Auto Start** button, or one of the adjustment buttons in 30 s steps...

The scheduled time has passed, the displayed time is red, as is the stopwatch, this is normal.

Once the time has been programmed, it must be validated:

- press the large **yellow** button on the left of the touch screen, or
- press the **Chrono** or **OK** button on the remote control.

The stopwatch starts by catching up!

You can also use this technique if you have to stop / restart the stopwatch **for some reason**.

11.4 Starting on a circuit without reference lap

- This isn't the most common or interesting type of lap time trial: competitors are asked to complete laps at a predetermined average speed. First, you need to select **Circuit** mode: arm the timer, then check the bottom box and uncheck the box that appears **With ref. time**:



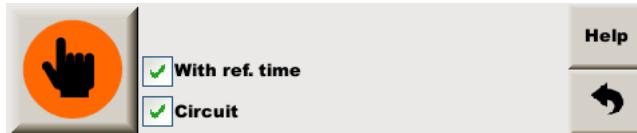
You must then enter the imposed average speed in the field above.

Important: As timing is based on the average speed and distance covered, the trajectory is therefore very important. You should therefore try to follow a "natural" trajectory of the track. In some cases, intermediate distances may be given; use these to correct the distance (enter the distance with the remote control and then confirm by passing in front of the marker).

11.5 Starting on a circuit with reference lap, in GPS mode

The circuit with a reference lap is the most common: a reference lap then 1, 2, 3 laps that must be completed as close as possible to the first lap. **If you have the option "GPS distance correction", it is better to activate it. It is no longer necessary to uncheck "Guidance options" in the left-hand tab.** The guidance is not done in relation to an average speed but in relation to the times of passage on points recorded during the reference lap but the system automatically takes into account the fact that one is in circuit mode and not "on line".

You must first choose the **Circuit** mode: check the bottom box then the box that appears **With ref. time**:



In practice, generally:

- we leave the pits after the starting line, we do a "scouting" lap,



- we cross the starting line: we press stopwatch (large left button on the touch screen or **Chrono** or **OK** button on the remote control). We are on our reference lap. The timer "learns" our lap. It memorizes a reference point every second, which will set the tempo in subsequent laps. It also displays the average speed at the top right.

Please note: in some regulations a minimum average speed is imposed.

- we go back to the starting line: the device detects it, automatically ends the reference lap and starts the first "chrono" lap. It indicates lead or delay every second, which gives an excellent tempo, even in the event of a different trajectory,
- we cross the starting line again: the device automatically goes to the next "chrono" lap...
- we end our series of laps with a deceleration lap, then we exit through the pits. The stopwatch must be stopped manually, see below.

Remarks:

- a small popup above the stopwatch displays the lap time achieved on each lap,
- the lap counter below the stopwatch helps us to situate ourselves in our series of laps. The reference lap is noted 0.

11.6 Starting on a circuit with a reference lap without GPS

The circuit with a reference lap is the most common: a reference lap then 1, 2, 3 laps that must be completed as close as possible to the first lap.

You must first choose the **Circuit** mode: check the bottom box then the box that appears **With ref. time**:



In practice, generally:

- we leave the pits after the starting line, we do a “scouting” lap,
- we cross the starting line: we press stopwatch (large left button on the touch screen or **Chrono** or **OK** button on the remote control). We are on our reference lap. The displays the average speed at the top right.

Please note: in some regulations a minimum average speed is imposed.



A "lap change" button appears to the left of the stopwatch:

- we go back to the starting line: we press the **Chrono** button on the remote control or the button above, which ends the reference lap and starts the first “chrono” lap. The timer only indicates whether our average speed is lower or higher than that of the reference lap average. This indication should only be watched in the last few meters. If you slow down in fast passages, it will not be possible to accelerate in slow passages. In addition, it is advisable to take a distance reference point in the last turn of the reference lap to correct the distance manually at the end of each “chrono” lap, in the event that the trajectory is different from that of the reference lap,
- we pass again on the starting line: we press the **Chrono** button on the remote control or button above, to go to the next “chrono” lap.
- we end our series of laps with a deceleration lap, then we exit through the pits. The stopwatch must be stopped manually, see below.

Remarks:

- just press the **Chrono** button on the remote control each time you cross the start line!
- a small popup above the stopwatch displays the lap time achieved on each lap,
- the lap counter below the stopwatch helps us to situate ourselves in our series of laps. The reference lap is noted 0.

11.7 Stop

You have to press twice with a waiting time of 2 to 4 seconds to stop the stopwatch.

Remote control: two presses on the chrono button.



Touch screen: pressing the displayed stopwatch then pressing the “stop” button that appears:

12 Timer

12.1 Operating principle

It makes the link between the distance, the stopwatch and the average speed imposed by the organizer. It works at the same time as the stopwatch to indicate the advance or the delay in seconds and tenths, and this **five times** per second. **When the difference is less than 0.25 seconds, the display then switches to hundredths of a second.**

Note: it is not possible to configure the advance/delay in meters because the rally results are **always** noted in time and because this result is independent of the imposed average speed (if the average speed changes, the advance / delay distance changes).

The timer then animates the buzzer and bargraph (on the top of screen or deported "head up"). Two configurations are possible:

- "classic" configuration: the timer indicates advance/delay, but if the pilot does not want to "play yoyo", he must constantly adapt his speed so as not to get ahead after catching up. He needs to slow down when he feels he will soon catch up. This need for concentration decreases the piloting concentration because he must constantly know how much he is in advance/delay (reading a precise figure or bargraph) **to anticipate**.
- "speed difference" configuration (a CRISARTECH exclusivity): in this mode, the timer calculates how fast you should drive to catch up with the delay, then animates the buzzer and bargraph according to the difference between this recommended speed and the actual speed. The instructions are no longer advance/delay but become faster / slower. The pilot no longer needs to know his exact advance/delay. **The device anticipates for him and it changes everything in terms of concentration.**

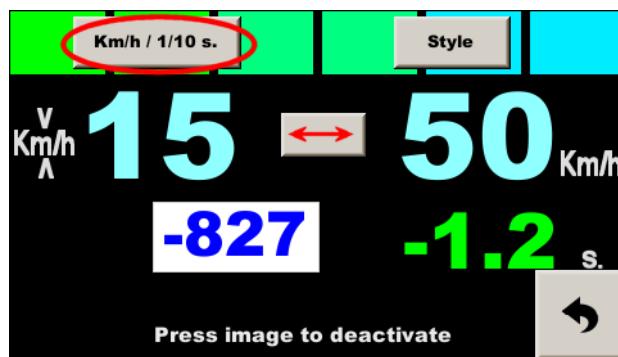
This second mode is therefore recommended, by checking the box at the top of the **Guidance options** page, left tab.

The buzzer emits a series of beeps for each timing calculation **(so 2 or 5 times per second, depending on the configuration)**. If the beeps are high-pitched, they indicate late or "faster". If they are low-pitched, they indicate lead or "slower".

Depending on the number of beeps per series, the pilot knows if it is a little or seriously "faster" for example. By default, a beep is equivalent to **20 tenths of a km/h speed difference** (or **20 hundredths** in the "classic" configuration). This value can be modified in the **Guidance options** page (except in beginner mode).

Of course when the buzzer goes silent it's ok. This is the award to be savoured, because it usually doesn't last long!

The bargraph indicates these same data visually, with colors. By default yellow/orange/red for the delay and blue/green for the advance. This trend can be reversed in the **Guidance options** page (except in beginner mode). But to individually configure the light-on threshold of each pad/LED, look for the button at the top left of the configuration page of the **Pilot** page in **Display config.** (except in beginner mode):



These configurations now have a resolution of tenths of a km/h of speed difference, or hundredths of a second in the "classic" configuration. This doesn't mean it's realistic to start up the first LED for a tenth of a km/h or a hundredth of a second, but the most skilled drivers will be able to start it up at 8 or 5 tenths of a km/h or a hundredth of a second.

12.2 Clock shift

It often happens that when you read the results of a rally, you notice a tendency to be rather early or late, **whereas we regulate correctly at 0**. This may be due to a number of factors:

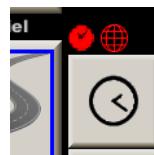
- in rallies without GPS correction, a calibration that is too short can result in an early ranking, while one that is too long can result in a late ranking. In this case, the time lag is irregular, and is easily detected because when you correct the distances, you see this tendency to be regularly too short or too long. You need to start by correcting this, see §9.6 *Automatic calculation of calibration percentage difference*,
- the pilot is unable to maintain the average. Here too, the time lag is irregular,
- the pilot goes ahead to anticipate difficulties and the timekeeper has placed checkpoints before the difficulties. Here again, the time lag is irregular. For these last two cases, if you have a bit of time, it's a good idea to analyse the recorded files and try to compare the lead/lag recorded with the timing results to deduce a slightly different race strategy, i.e. taking more or less of a lead before the difficulties,
- depending on how the organiser measures, depending on the time delay of the equipment when the organiser measures, our measurements during reconnaissance (if possible using GPS corrections), measurements during the rally and the timing system, depending on the way the driver rides, we have 5 inaccuracies which pile up and which can compensate for each other or accumulate (add up). The time lag is then more or less constant (if the parameters mentioned before this point are controlled). If the timing is in tenths of a second, it's easy to make an average. If it's in seconds, you need to count the number of seconds and divide by the number of measurement points. For example, if you're 5 times a second late on 10 test points, you're about half a second late.

In the latter case, it is a good idea to shift the clock to compensate for this tendency. In the general menu, press the 'Clock' button, and then the + or - button in hundredths of a second (not in **Beginner** mode). A help text appears to help you avoid shifting the clock backwards. If you are running late, you should apply the 'Compensate for delay' option:



We're often tenths behind on rallies. Up to 5 or even 7 at some rallies like Monte-Carlo Historic. At the start of a rally that you don't know, it may be a good idea to put 1 tenth or 10 hundredth in 'Compensate for delay'. On a rally that you ran the previous year, if it was necessary to shift the clock, so it may be a good idea to shift it as you did the previous year. In all cases, you need to keep a close eye on the results to adapt the time shift accordingly.

In the main menu, two icons indicate that the clock setting is no longer at its default value:



The one on the left indicates that the clock is out of sync with the official time. It is no longer perfectly synchronised with the GPS clock. It follows the GPS clock with a constant and extremely precise offset.

The one on the right indicates that the clock has been instructed to no longer synchronise with the GPS clock. The time changes without control and can lose several seconds of accuracy per day. **This setting should be avoided at all costs.**

13 Link page and time control management

To scroll through the pages and find the **Link** page, you can use the **Page** button on the remote control or press twice in the top right corner of the Copilot page.

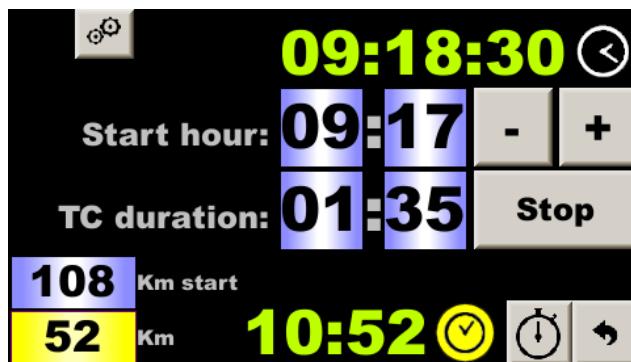
Note: In the display settings, you can either remove this page from the display or set it as the default page. See §14 *Display configurations*.



The current speed and time are displayed at the top of the page, and the **Trip1** or **Trip2** distance, depending on the configuration, is shown at the bottom. This is the most important information for communication.

It is complemented by the battery voltage and GPS signal strength on the left.

The yellow box on the right contains the Time Control (TC) data. To enter TC data, press the button in the box or the yellow button on the remote control:



The principle is to enter the departure time and the duration so that the device can calculate the arrival time. If you enter the distance between the two TC, it can also calculate the average speed to maintain until arrival and the advance and the delay.

By default, when you access this page, the system suggests the current time as the departure time.

You can quickly adjust this using the + or - buttons on the right.

You can also enter the hour and minute directly and separately by pressing the blue-white-blue input field.

You can also enter the data using the remote control: the active input field turns yellow, and you confirm/move to the next field with the **OK** button or by entering two digits each time. To go back, use the < button.

Similarly, you enter the number of hours and minutes of the duration separately.

If we are working with a shifted start, you need to enter the km from the TC start (108 in the example), in addition to the length (52 km in the example).

Upon exiting (using the button with the arrow or the **EXIT** button on the remote control), the device calculates the data related to the TC:



In the example above, we see that we still have 38 minutes and 15 seconds to cover 21.6 km. To arrive on time, we will need to drive at an average speed of 34 km/h.

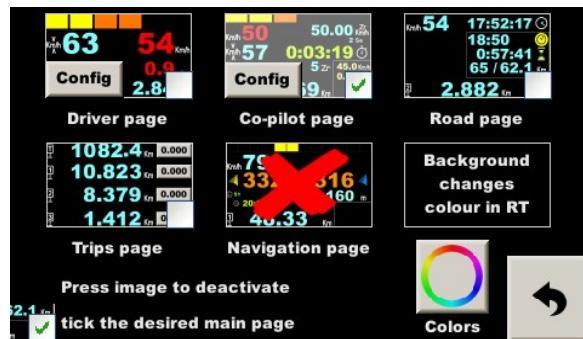
Based on the overall average speed for this section, it informs us that we are one minute late (in red). Over 21 km and at an average speed of 34 km/h, this seems easy to make up, but it indicates that we have no margin to stop, especially since the device doesn't know the remaining distance. If it's a main road, no problem, but if we have to enter a city with traffic lights and congestion, it could become problematic.

When the device indicates time to spare, the figure is negative, shown in green.

If the TC also corresponds to a RT departure, instead of exiting the page to return to the liaison page, you can press

the stopwatch button at the bottom of the page  or the **Chrono** button on the remote control. This switches directly to the **Copilot** page with the stopwatch set to the same departure time as the TC. If there are any last-minute changes (delays, for example), the TC departure time will be adjusted accordingly.

14 Display configurations



In the display configuration page, there are thumbnails that correspond to each of the "main" pages. By tapping on these thumbnails:

- in the middle: the corresponding page is hidden (a red cross appears). It is not possible to hide the **Codriver** page, which explains why this thumbnail is "greyed out",
- bottom right (check box available if the page is not hidden): defines the default page. This is the page that will appear when starting the device and exiting the configuration menus,
- **Config** button to configure the displays of the **Pilot** and **Codriver** pages.

By default, the background of the **Pilot** and **Codriver** pages changes color to follow the bar graph's last block color. By pressing on the text **Background changes color in RT**, this function is deactivated and the background remains black.

The button with the chromatic circle gives access to the page for modifying the color of the main texts, "time / stopwatch", and course. When opening this page, you have to press on the text to modify (framed in orange), then on a colored pad at the bottom left. It is then possible to refine by adding / removing a little primary color (red / green / blue):



Note: dark colors cannot be obtained.

For the display configurations of the **Pilot** and **Codriver** pages, the same principle is applied: press the elements to be hidden and red crosses indicate this choice.

15 USB drive usage

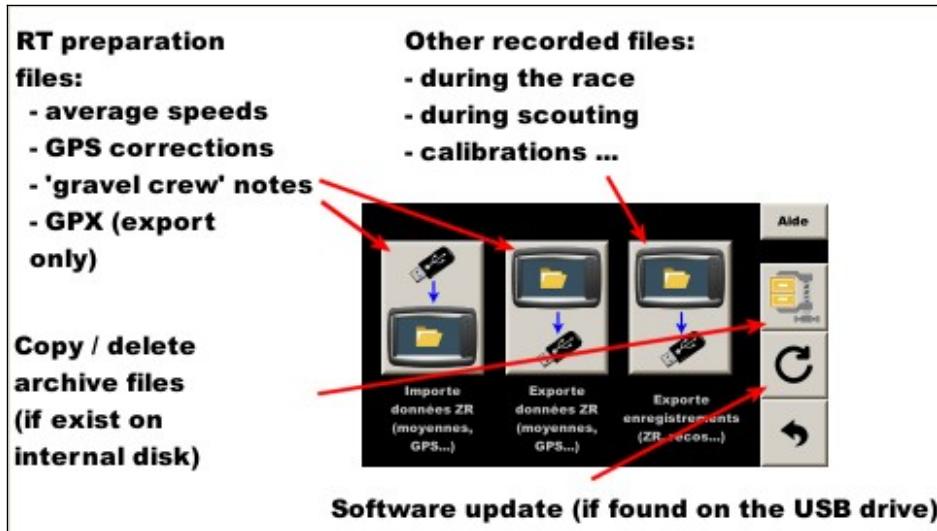
Important:

- the file system read by the device is **FAT32**. This is the most common and most commercial USB drives use this file system,
- **USB3** keys (blue connector inside) are generally not usable.

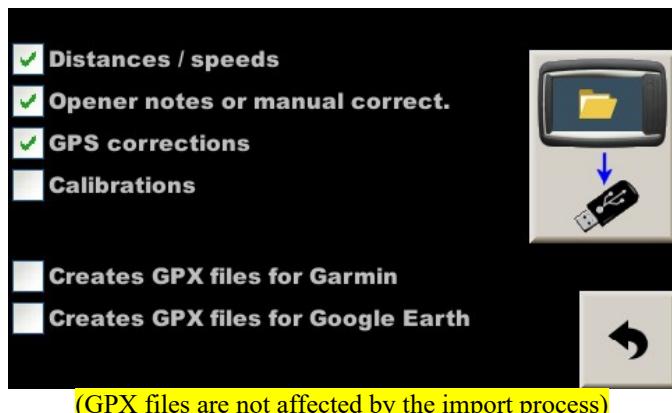
If in doubt about the file system of your USB drive, it is possible to format it on the device before using it, see below.

15.1 Copy of rally preparation files and records

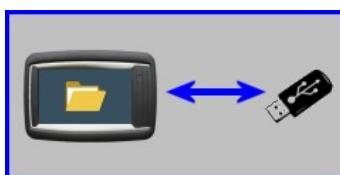
Once a USB key is inserted into the USB socket, a specific page opens:



For RT data, a specific page allows you to choose which types of files you want to copy:



A popup panel is displayed during the copy:



After closing this panel, please wait to remove it until the "operation" led of the USB key is off or about 5 seconds if the USB key has no led.

After importing data from RT, the device quickly counts the number of files of each type and displays a popup showing these numbers. Then, it performs a verification operation on these files (opening each one to check its consistency) and then offers to display the details of what it has verified:

**Verified file
on internal disk. Details?**

Yes **No**

| Ind | Seg | Note | WP | Length | Distance | Nbr : 15 |
|-----|-----|------|-----|--------|----------|----------|
| 1 | 0 | 0 | 592 | 17.972 | ~466 km | ▲ |
| 2 | 0 | 0 | 726 | 22.303 | ~462 km | = |
| 3 | 0 | 0 | 619 | 18.806 | ~473 km | = |
| 4 | 0 | 0 | 117 | 14.005 | ~479 km | = |
| 5 | 0 | 0 | 560 | 16.978 | ~465 km | = |
| 6 | 0 | 0 | 676 | 20.517 | ~446 km | = |
| 7 | 0 | 0 | 487 | 14.686 | ~426 km | = |
| 8 | 0 | 0 | 499 | 15.076 | ~405 km | = |
| 9 | 0 | 0 | 558 | 16.87 | ~424 km | = |
| 10 | 0 | 0 | 353 | 10.591 | ~437 km | = |
| 11 | 0 | 0 | 758 | 22.949 | ~427 km | = |

C ↶ ↶

For each RT, and for example RT 1, the following information is provided:

- the number of average speed segments found in the zr-1.csv file, here 12,
- the number of course opener notes/manual corrections found in the frun_zr1.csv file, here 12,
- the number of GPS correction points found in the gps_zr1.csv file, here 377,
- the length of RT1 found in the same file, here 11.534 km,
- the straight-line distance from the start of RT1, here approximately 669 km.

After the recorded files copy (right button), **the files are compressed, archived to internal drive** in case of problem with USB drive. The format of archive file is .tar.gz (linux format, can be unpacked with IZArc, 7-Zip, WinZip...).

Then the original files are erased from internal disk.

15.2 Managing archived files

In case of loss of the race files, it is possible to recover the archived files. In the main configuration page, press the button with the USB key:



Insert a USB drive in the socket then push on the left button to access a page to:

- copy the archive files if needed (if files on USB drive have been lost),
- delete the archive files.

After each race, the archive space should be cleared to free internal flash disk!



Note: it is now also possible to access this page via the button found on the page which opens automatically when a USB drive is inserted in the reader (if at least one archived file is found on the internal disk).

15.3 USB drive formatting

This function will erase **ALL** data and then formats and conforms it for use with this device.

To access this function, in the main configuration page, press the button with the USB drive:



Attention:

- this operation **erases ALL** the data present on the key, even if they were written with a computer or a tablet,
- it is advisable to wait ten seconds after the end of the operation, when the display asks to remove the key.

16 Infrared remote control

The decimal point is obtained with the key at the bottom right for Philips (formerly "reset to 0" or "---") or left for newer remotes:



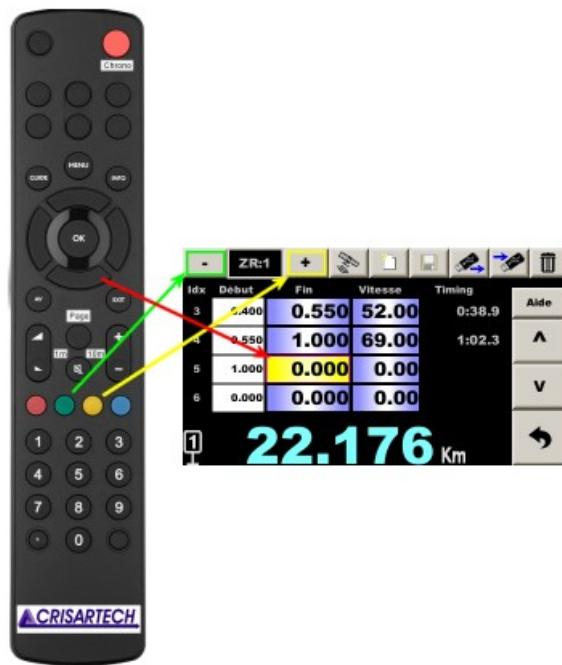
As soon as the remote control is used, frames in red, green, yellow, blue appear in certain areas or buttons. These zones are activated by pressing the corresponding function keys on the remote control:



16.1 Managing RTs with the remote control

To change the RT, use the green and yellow keys.

To program the distances / speeds in RT, use the arrow pad to move the active box, then simply type the distance or speed and validate with "OK" key:



Save with the red key.

16.2 Useful remote control shortcuts

| Page | Key | Function |
|--|---------------|--|
| Co-pilot (main) | Yellow | Go to RT management page |
| Co-pilot | Green | Go to speed configuration page (sensor/OBD...) |
| Co-pilot | Page | If stopwatch is active, go to 'pilot' page if not authorized following page |
| Co-pilot | BACK or EXIT | Last correction cancelation |
| Co-pilot | Info | Calibration difference computation |
| RT management | Green | Previous RT |
| RT management | Yellow | Following RT |
| RT management | +10 m | First line |
| RT management | -10 m | Last line (practical for checks) |
| RT management | Red | Record |
| RT management | Short Page | Go to GPS auto correction page |
| RT management | Long Page | Go to gravel crew notes page |
| Gravel crew notes/ Manual corrections | +10 m | First line |
| Gravel crew notes/ Manual corrections | -10 m | Last line (practical for checks) |
| GPS auto correction | Page | Go to typing comments page |
| Speed configuration | Page | Go to calibration page |
| Speed configuration | OK | Record and direct back to copilot page (main) |
| Calibration | Page | Go to speed configuration page (sensor/OBD...) |
| Calibration | OK | Record and direct back to copilot page (main) |
| Calibration | +/- 1 or 10 m | Go to fine tune calibration popup |

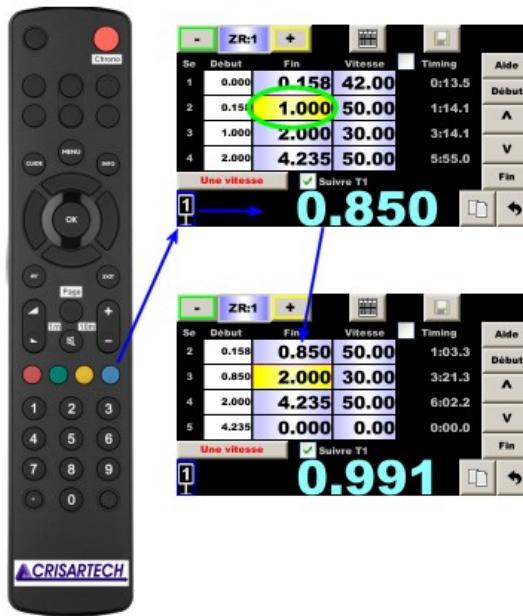
Examples to do quickly while driving:

- a wheel sensor breaks -> go from average measurement to left wheel measurement only:
green, right arrow, OK
- the last wheel sensor breaks -> go from wheel sensor measurement to GPS measurement:
green, up arrow, up arrow, OK
- the calibration is too short, add 3 m / Km:
Green, page, +10 m, +10 m, +10 m, +10 m, OK, OK
(It is necessary 4 push on +10 m because the first one opens the correction by% function)
- the calibration is not perfect, and we corrected the distance several times **in the same sense**. Calculate the adjustment and apply it:
Info, Ok, OK, OK

17 Entering an average on-the-fly speed change distance

In the case that a shift distance is not given before departure, but "at the sign", proceed as follows:

- by preparing the RT, put a longer distance than plausible for each unknown distance. For example, if the road book distance is 1.2XX, enter a distance of 1.300. Check **Follow T1**,
- start the RT normally,
- before arriving at the sign, open the page with the distances / speeds table,
- with the IR remote control:
 - yellow button on the remote control is the shortcut to open this page. The device automatically positions itself on the square corresponding to the end of the segment. A blue border has appeared on the Trip 1 icon in the bottom left corner to indicate that the blue button has a function related to Trip 1.
 - press the blue button as you pass in front of the panel:



- with the touch screen:

- press the RT number on the main page to open that page. The device will automatically position itself on the square corresponding to the end of the segment,
- tap on the box corresponding to the end of the segment, the virtual keyboard opens with a special key with the pictogram of Trip1, then press this key passing in front of the panel.



- the cadencer copies the distance at the moment the box is pressed, updates the advance/delay, and moves to the next line,
- maybe change the speed if it was written on the panel, **but be careful, the new speed is on the next line, which is already selected!**
- **if the next distance needs to be copied, the corresponding box is already selected.** This is the common case when measuring the distance at the village entrance and exit signs,
- **save the modification (red key on the remote control or floppy disk button):** the timer recalculates the timing and updates the advance/delay. Then return to the main screen.

18 Shifted start

In some rallies, the Regularity Tests are "included" in the links, ie the distance is not reset to 0 from the RT start, in rally-raid for example.

You can also use this function when you are doing reconnaissance (with automatic GPS or manual corrections) and you do not know the exact starting point of the RTs. We will then start the reconnaissance before the earliest estimated starting point to be sure, the race day, to start the correction notes BEFORE the start of the RT. This is often the case for Monte-Carlo rallies.

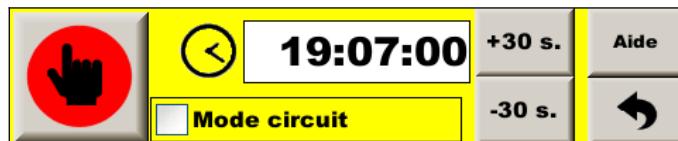
Example: a RT is organized between village A and village B, but we don't know where exactly:

- we start our **reconnaissance** by resetting Trip1 at village A exit sign or better, on a road book note. **It is the 0 point of reconnaissance**,
- we take our road to village B by taking our correction points (by GPS preferably),
- arrived at village B, preferably on a road book note, we stop the correction points,
- **the race day, we reset our Trip1 to 0 at the 0 point of reconnaissance**. If we **use GPS correction**, we arm the chrono (press only once on the chrono or the chrono button to popup the chrono panel), **but we do not start the chrono**,
- in case of automatic GPS correction, corrections begin while we drive towards the secret departure of the RT,
- **at the start of RT, do not reset Trip1 to 0**,
- we begin the RT by starting the stopwatch as usual (preferably in automatic "on time" mode) except that Trip1 is not reset at 0,
- the timer does its job taking into account the distance which was at Trip1 at the start of the RT...

In this case the changes of average speeds are made according to the beginning of the RT, see §18.3 Average speeds changes since the beginning of the RT.

Notes:

- the chrono management panel is yellow instead of white when the "shifted start" mode is configured:



- in **Expert** mode, the distance from the shifted start of the stopwatch is added to the frozen distance popup (in brown):



- while the stopwatch is running, in the RT management page, a new button is available to display and possibly modify the distance of the shifted start:



It is possible to change this distance by pressing the value, typing a new value and then pressing **Yes**. If you do not want to change it (just close the popup), just press **No**.

- the arming of the stopwatch at **the 0 point of the reconnaissance** can be automatic, see **Guidance options**, middle tab.

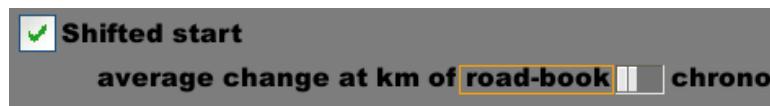
18.1 Function activation

To do this, in **Guidance options**, then in the **Distances** tab, tick the **Shifted start** box. By doing this, the Trip1 is not set to 0 automatically when the timer starts and the timer takes into account the distance to the counter at the start for his calculation for advance/delay.

18.2 Average speeds changes since the beginning of the road book

Generally, the distances of the average changes are given starting from beginning TC of the section of the road-book.

Under the **Shifted start** box, place the "average change at km of" cursor on the **road-book chrono** position:



This is what is done when using the **Raid** preconfiguration, in **Guidance options**, right tab.

On the first line, we **enter the Km road-book of our RT start, with an average speed of 0**. The timer will thus take this distance into account but not the associated timing. Moreover, the distance of this first line will be used to:

- **automatically correct the distance of Trip1 at the start of the chrono**: whatever the distance of Trip1, when the chrono starts, Trip1 will take the value of the distance of this first line,
- **detect a RT selection error**: if the difference between the distance of Trip1 and the distance of this first line when the stopwatch starts is greater than 300 m, the device displays a "Distant start" error message.

The following boxes must be completed as in a normal case.

Example:

- departure from the RT to 28.5 km at 49.00 km / h
- change of average to 30.0 km (after 1.5 km) at 50 km / h
- change of average to 32.0 km (i.e. after 2 km) at 45 km / h
- end at 35.0 (after 3 km) km



Notes: if the timings are given by the organizer, they must be compared with those indicated by the device to detect a possible typing error. On the above example 8:14.2 is to compare with the value of the organizer.

Tip: if the timings are given by the organiser, enter the distances of the average speed changes **as well as the distances without change** in order to be able to use these "verified" (because we compared the timings) distances for the semi-automatic corrections, see dedicated §22 "Gravel crew" notes function and semi-automatic manual corrections.

18.3 Average speeds changes since the beginning of the RT

In some rallies, even if the Trip1 is not reset to 0, the average changes distances can be given from the beginning of the RT, when the timer is started. This is the case if the starting point is secret (not indicated in the road book).

Under the **Shifted start** box, place the "average change at km of" cursor on the **chrono** position:



Example: distances / speeds idem previously:



Note: if the timings are given by the organizer, they must be compared with those indicated by the device to detect a possible typing error. On the above example 8:14.2 is to compare with the value of the organizer.

19 Multispeed mode

In this case the co-driver must enter distances and times of passage (instead of average speeds). The table can be given by the organizer in advance or just before the start of the regularity test.
In the classic mode, end of segment timings are given as an indication. In the multispeed mode, you can enter them, with the touch keyboard or remote control.

Check the **Timing** box in the top right corner and uncheck the **Follow T1** box at the bottom:



At the bottom of the page, press the button **ss.0** if your timesheet doesn't have a tenth of a second or the button **ss.d** if it has one.

After entering the distance, the cursor automatically switches to the time entry box. You have to enter:

mm:ss.t

- mm: minutes beginning with 0 if less than 10 mn
- ss: seconds
- t: tenth of a second that can be omitted if 0

A timing is proposed, based on the timing of the previous line. To accept it, just confirm with **OK**. It is possible to adjust this timing with the **+/- 10 m** key (one second) and **+/- 1 m** key (0.1 second).

Once the timing is entered, the timer takes into account the segment, it calculates the average speed and refreshes the lead / delay, it is not necessary to record with the red key.

The following distance is proposed, **by systematically adding the distance of the first line**. It is therefore important to choose the first distance wisely (to be entered before the start), because it will give "the tempo" for the whole RT. It is possible to change this proposed distance:

- by entering a new distance,
- by adding / subtracting 100 m using the **+/- 10 m** or **+/- 1 m** keys.

Once modified or if the proposed distance is correct, it simply remains to validate it with **OK**.

It is possible to enter the average speed as the conventional mode if the table mixes speeds and times of passage.

Warning:

- it is necessary to start the timer with at least one speed line, otherwise the timer does not know how to start,
- when leaving this page, it is necessary to save in the file with the red key, otherwise the timer will resume the file data before these changes.

20 Redoing a RT at the same pace

20.1 Without GPS assistance

To do the same RT a second time at the same pace at the first time, the easiest way is to note the distance and time it took you to complete the first pass (so you need to start the timer at any average speed). In the display configuration, you can enable the timer to freeze when you freeze the distance (which is inactive by default, indicated by a red cross):



This allows you to freeze the distance and time at your finish line.

Next, for the second pass, on the RT management page, where you usually enter average distances/speeds, you will enter the total distance and then the target time.

To do this, you must check the **Timing** box.

Simply start the timer as usual. The device automatically calculates the average speed to maintain and indicates "faster / slower".

Note: this guideline should only be used in the last few hundred meters. If you slow down too much in the fast sections, you risk not being able to keep up in the slow sections.

Tips:

- if the RT is long, it will be difficult to maintain a consistent driving style throughout. Since the indication is based on distance, if you cut corners more or less, you may have a difference of a few meters at the finish. It is therefore advisable to choose a reference point a few hundred meters before the finish line on the first pass (and freeze there as well), noting the distance. On the second pass, you must enter this distance before arriving and then confirm the distance to correct any discrepancy.
- sometimes, you are asked not to achieve the same time, but a time a few seconds more or less. Simply transfer this difference to the time you want to enter in the RT management.

20.2 With GPS assistance

In this mode, which requires the GPS distance correction option, we will use the GPS to take reference points on the first pass, then, by passing over each point, the device will guide us with an indication "delay/advance".

First, check the **GPS dist.correction** in **Guidance options** and in the **Distances** tab.
To activate the function, you need to go to the timer control panel and check the "Replay" box:



For the "reference" passage, start the stopwatch as usual (preferably in automatic start on time). The device takes a reference point every second. At each point, it records the timing (timer value). After the finish, stop the timer as usual.

On subsequent passes, the timer is started as usual; the device guides us precisely at each point, even if our trajectory is slightly different, because it bases its calculations on the time from the first pass. In this case, we don't have to worry about the differences between fast and slow zones.

If you want to redo the reference run, and delete the file containing the checkpoints, you can press the  button on the stopwatch control panel.

Tip: sometimes you're asked not to achieve the same finishing time, but a time a few seconds faster or slower. You then have to watch for any advance or delay out of the corner of your eye to keep it at the required value in the last few meters.

21 Recordings

This equipment records files during the race.

It can also record several files during scouting:

- GPS trace in two formats,
- correction waypoints for GPS auto-correction.

21.1 Regularity Tests recording

As soon as the stopwatch is triggered, a file is recorded into the internal flash disk. Its name is the starting number, the RT number, date and hour.

Example: 012_ZR01_210209-133140.csv

- car n° 12 (number entered in the "Hardware configuration" page),
- RT n° 1,
- departure on February 9, 2021 at 13:31 and 40 seconds.

The format is the following:

| Type | UTC time | Dist/Param | Delay/GPS qual. | Lat | Lon | Ver 210209 | SN 2031186FA |
|------|----------|------------|-----------------|-----|------------|------------|--------------|
| S | | 10 | | 60 | 44.7522823 | 4.2335585 | |
| V | | 4500 | | 60 | 44.7522823 | 4.2335585 | |
| P | 14:26.0 | 0 | | 0 | 44.7522833 | 4.2335588 | |
| ... | | | | | | | |
| P | 14:39.7 | 17962 | | 128 | 44.7515079 | 4.23257836 | |
| G | 1 | 2 | | 62 | 44.7514067 | 4.23258083 | |
| ... | | | | | | | |
| M | | 42587 | | 58 | 44.7514067 | 4.23258083 | |
| G | 2 | -1 | | 62 | 44.7514067 | 4.23258083 | |
| D | 3 | 5 | | 58 | 44.7514067 | 4.23258083 | |
| A | | -10 | | 72 | 44.7514067 | 4.23258083 | |
| C | | 10 | | 71 | 44.7514067 | 4.23258083 | |
| F | | 42697 | | 70 | 44.7514269 | 4.23257554 | |
| W | 4 | 0 | | 68 | 44.7514067 | 4.23258083 | |

The first line is the header allowing you to know the meaning of the following data, as well as the firmware version and the serial number of the device.

The first column is a label indicating the **type** of data:

- S: automatic start of RT, with the index of RT. Here RT10,
- s (lowercase): start of RT in manual start, with the RT index. Here RT10,
- V: speed imposed in 1/100 km / h. Each imposed speed change is recorded. Here 45.00 km / h,
- P or p: GPS position and then:
 - timestamp: Minute: Second. tenth, here 14 minutes and 39.7 seconds,
 - distance in meters, 0 at the start, then 17.962 km,
 - delay calculated by the timer in 1/100 second, 0 at the start then 1.28 s. delay.
- G: index of the GPS correction point (here 1 then 2), then correction, in meters. Here the GPS added 2 meters to the Trip1 during the first readjustment, then removed 1,
- M: manual adjustment, in meters. Here the co-pilot put Trip1 at 42.587 km,
- D: index of the GPS advice point (here 3), then GPS advice, in meters. Here the GPS advises to add 5 meters to the Trip1 (but has not added),
- A: manual (relative) adjustment. Here the co-pilot subtracts 10 meters from Trip1,
- C: cancel operation in meters. Here, the co-pilot cancels the '-10 m' so he added 10 meters,
- F: the co-pilot froze the distance from column 3, in meters,
- W: GPS automatic correction waypoint missed, then the waypoint index,
- X: GPS automatic correction waypoint passed because correction too large, then the waypoint index,
- Y: GPS automatic correction waypoint passed because speed too low, then the waypoint index,
- I: launch of the procedure to search for the nearest GPS correction point, following a distance travelled that was too long without having had a GPS correction (**GPS magic** procedure).

Column 4 corresponds to the quality of GPS reception (except for P data).
 Columns 5 and 6 correspond to the GPS coordinates (latitude then longitude).

Remark: latitude longitude can be copied/pasted in Google Map (after removing « ; » if the file is opened with a text editor).

The "P" lines are recorded by default at **2 times per second** (2 Hz). If you want a "finer" recording, it is possible to push the recording of these lines to **10 times per second** (10 Hz) as it was the case in older programs, but this slows down the global functioning of the program and is therefore not recommended, except in very special cases. To do this, you must be in **Expert** mode and go to the bottom of the recording management page (in the main menu, press the button with the USB key) and modify the recording period. It is set to 5 tenths of second. To reach maximum speed (not recommended in a race), you can set it to 1 tenth of second. And if you want fewer position/distance/delay points, you can set it to 10 tenths of second or more.

The files can be copied in a USB drive when inserted, then archived (see above).

21.2 GPS trace during scouting

Three GPS traces can be recorded (**outside of race**) when enabling the recording function.
 To access this function, in the main menu, push the USB drive button:



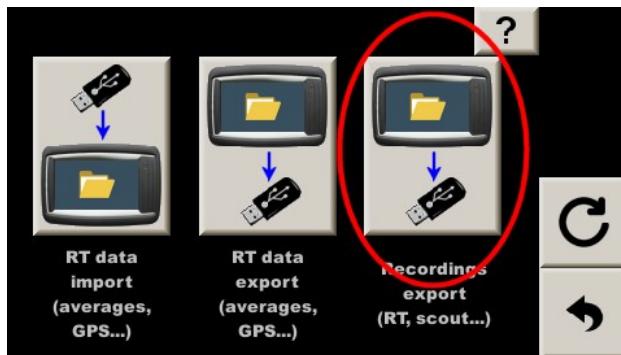
The NMEA checkbox only appears in **Expert developer** mode (contact us to activate it).

The recording starts and **the files are created when Trip1 is reset to 0**. A red point pictogram appears on the screen.



The recording stops when stopwatch is armed (no need to trigger, just arm).

The files are copied to a USB stick by pressing the right button in the screen that appears when a USB stick is inserted:



The files are then archived (see §15.2 *Managing archived files*). They can be visualized and/or converted in different formats, for example with:

GPS Visualizer see <http://www.gpsvisualizer.com/>

21.2.1 Distance-based traces

It is a trace that records a point after driving a configurable average distance (closer points in the turns and more spaced-out points in the straights). This distance gives the precision but also the weight of the generated file. 10 m is a good compromise between accuracy and size.

In this **Recordings** page, press the button in the top left corner and enter the desired average distance between two points recorded for this trace. The device records 2 files in parallel, in CSV format and in GPX format.

21.2.1.1 Traces in CSV format

It is interesting to record this trace during GPS auto-correction waypoint recording. It associates waypoints with distance on every wheel. If necessary, it then allows correction points to be added to the GPS correction point file, after the end of scouting, once back at the office (to fill in any "gaps" due to handling errors during the recording of correction points).

File name is: **Scout_date_hour.csv**

Format is the following:

| GMT Hour | Left | Right | AuxLeft | AuxRight | Lat | Lon | Course | Elev |
|----------|------|-------|---------|----------|------------|------------|--------|-------|
| 134304 | 0 | 0 | 0 | 0 | 45.0149405 | 5.63988717 | 128 | 494.6 |
| 134347 | 0.01 | 0.01 | 0.01 | 0.01 | 45.0148463 | 5.63988683 | 156 | 495 |
| 134349 | 0.02 | 0.02 | 0.02 | 0.02 | 45.0147582 | 5.63988 | 178 | 495.5 |

- **GMT Hour** is the time-stamp from the GPS. In France, add one hour in winter and 2 hours in summer.
- **Left** and **Right** distances are the main sensor input distances (non driving wheel),
- **AuxLeft** and **AuxRight** distances are the auxiliary sensor input distances (often driving wheel).

Note: for auxiliary distances, the **4WR** checkbox must be checked in the choice of wheels for speed calculation. In this firmware version, only the **Peugeot / Citroën ABS** and **Megane4 ABS** OBDII configurations are compatible with this function.

- latitude and longitude in degrees. Can be copy/pasted in GoogleMap (after removing « ; » if using a text editor),
- course taken,
- elevation.

21.2.1.2 Traces in GPX format

This trace can be viewed directly in mapping software on a computer or tablet for co-pilots who are content to read the track to their co-pilot or if there was not enough time to take proper turn notes.

File name is: **Scout_date_hour.gpx**

It is transferred to the USB drive along with the other saved files (large button on the right of the file transfer page). It remains on the device and is transferred with each new transfer. It will be deleted along with the archive files, see [§15.2 Managing archived files](#).

21.2.2 Traces NMEA (based on fixed time: 0.1 second)

An **NMEA trace** (historical GPS protocol) can be recorded by checking the corresponding box. Raw data from the GPS are directly recorded, so 20 lines every seconds! This trace is not concern by Trip1 distance and can be used to simulate the GPS on desk or can be converted in GPX or KML file.

It is not recommended to record this trace during scouting if you stop often to hand write landmarks because the files become huge.

File name is: **GP_date_hour.csv**

Note: this function is only available in **Expert developer** mode, and slows down the device very strongly.

21.3 Converting files to GPX or KML

CSV files can be converted for use with mapping software such as Google Earth or Garmin BaseCamp on computers, or other programs on tablets. One way of doing this is to use the online GPS Visualizer tool:

Open the site: <https://www.gpsvisualizer.com/>

In the middle, select your file in "browse", then select "GPX file" or "Google Earth" for a KMZ file, then press "Convert it":



Be careful, there may be some catchy adverts around!

On the next page, click on "Download" and rename the file, as it has taken on the name of the date and time of conversion:

GPS Visualizer output

Your data has been converted to GPX. If something doesn't look like you expected it to, please send an email to bugs-10+20210702093440-12165@gpsvisualizer.com.

Right-click on the following link to download the file to your hard drive; you may want to give it a more sensible name.

[Download 20210702093440-12165-data.gpx](#)

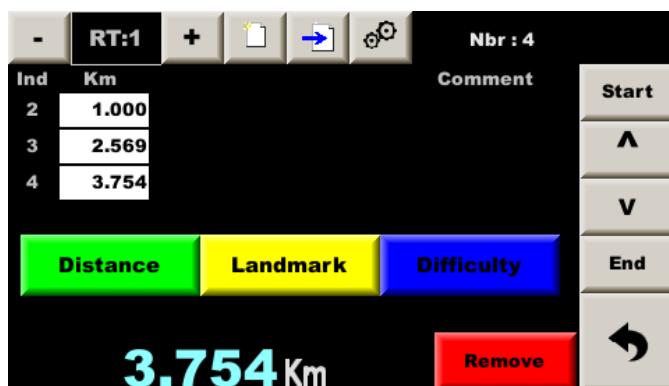
21.4 Correcting waypoints during scouting

Please see annex document for this function. GPS auto-correction option is needed.

22 “Gravel crew” notes function and semi-automatic manual corrections

The function must be enabled in the **Guidance options** page, left tab (top).

The function is accessed by the button located in the RT management screen:  or long press the page key on the remote control:



Notes are taken by pressing buttons (or a remote control with a corresponding colour or number button):

- enter the distance directly on the remote control or by pressing the value displayed at the bottom,
- **green** button for **semi-automatic correction without reference mark** or
- **yellow** button for **semi-automatic correction with reference mark** or
- **blue** button for a “gravel crew” note, then button or remote control with corresponding number key to select the note to be announced,
- **red** button to **delete the last note**.

Note: If the distance entered is less than the last distance in the list, the system requests confirmation before inserting a line into the file.

22.1 Configuration

The  button opens the function's configuration page:



The configuration parameters are as follows:

- distance at which the note is announced before the distance is reached (here 0.2 km or 200 m),
- distance during which the note is still available after reaching the distance, this is the holding distance before the note automatically disappears (here 0.1 km or 100 m),
- distance added when importing distances from the average speed file (here 0 km), see below. In expert mode only,
- checkbox to display markers and comments that can be added in addition to distances,
- the last two checkboxes are for a feature currently being tested; do not use them.

22.2 Semi-automatic corrections or assisted manual corrections

This function enables you to make **semi-automatic corrections based on distances entered in advance** (when preparing the road-book: enter the distances of the boxes that seem suitable for correction). The new distance popup is displayed before the correction point, exactly as if the distance had been typed in, with the **degressive distance**, if it has not been deactivated, making it easier to find the reference point. A comment popup can also be displayed: the reference mark or the “gravel crew” note **if the first box is checked**. All that remains is to confirm (**OK** key) or cancel to move on to the next marker (**BACK** or **EXIT** key).

Once the distance correction has been made, **it is important to check the correction**, see [§4.5 Checking Trip corrections](#).

How do I adjust the display and retention distances of the note?

If you are using an **organiser's road-book**, the reference points are generally changes of direction, village entrances/exits... so on average every 500 m to 2 km. In this case, it is preferable to set the parameter to **1 km or more**. The sooner the next distance is displayed, the less stressed the driver will be ("when's the next note? Huh? Tell me??"). If the co-driver neither confirms nor cancels this distance, it may remain displayed for up to a distance of 0.5 to 1 km after passing the road-book point.

Navigation is not considered to be obvious and if the crew misses a change of direction and reverses (or turns back further), the co-pilot validates by passing over the point indicated in the road-book to correct the distance error caused by reversing (or turning back). This is why it is useful for the proposed distance to remain displayed for some time after passing the point.

If you are using a **road-book designed for regularity corrections**, the markers are less spaced, and it may be possible to confuse the markers. In this case, it is preferable to set a **shorter distance, 150 or 200 m**, which means that the distance will be displayed shortly before the marker and will limit the risk of error.

Navigation is considered to be easier (without any traps), but if the crew misses a turn anyway, it is possible that the distance has been erased during the turn, but it is then likely that the next correction marker will be found before the delay has been made up. It is a good idea, however, to remove (several keystrokes -10 m) approximately the distance made too far during the U-turn to avoid being too far off course and the distance for the next correction also disappearing. Or, which is much more precise, but not easy to do because of the stress induced by the navigation error: **manually type the distance from the box in the road book where you resume the correct road.**

It is possible to prepare files containing the distances. The name should be `frun_zrl.csv` for the first RT, for example. It is a simple text file with the distances in km, with as decimal separator the point or the comma, one per line.

You can then add comments, which will be displayed in a small yellow popup above the distance (only on the regularity page). These comments must be added on the same line as the distance, separated by a semicolon.

Example :

```
0.469;4:Pst >
0.811;6:HP <
1.191;8:Ms >
1.433;11:BM <
```

Here, we have a little code for a Post on the right, a Hair Pin on the left, a Milestone on the right, a Blue Marker on the left...

22.3 Importing from the average speed file

It is possible to retrieve the distances entered for average speed changes and import them into this function by pressing the button . This is particularly useful when the road-books include timings for passage at box distances. By checking the timings, you can be sure that no errors have been made in entering distances, so that the imported distances will also be accurate. In this case, it is advisable to enter all distances/speeds, even if the speed does not change.

If you are using a road book where distances are truncated to 10 m, it may be wise to systematically add 5 m (half the accuracy range to statistically position yourself in the middle). To do this, set the **Distance added during import** parameter to **0.005 km**.

Note: when the note announcement function is checked, each time the distances/speeds file is saved, the system will offer to import the distances as notes.

22.4 Gravel crew notes

This function can also be used to announce "gravel crew" notes using the "difficulty" notes associated with the **blue** button. The number keys 1 to 8 on the remote control activate buttons 1 to 8.

You can customise the buttons to quickly programme messages:

- create a file with the texts you want to use, one text per line. You can use a spreadsheet or a simple text editor such as Notepad.
- name the file `diff.csv`. If you use a spreadsheet, you must save it in CSV format (semicolon separator).
- copy the file to a USB key.
- insert the key into the device to import the file.

Example:



Notes:

- it is possible to enter codes to activate the auxiliary LED6 module; see §25 Pilot assistant
- button 7 is not currently usable.

22.5 In case of a problem

Important: during the race, the system may become desynchronized, for example in the event of untimely presses on **BACK** or **EXIT**. The correction distances are no longer displayed when required. It is then possible to resynchronize the distance file by pressing the **Yellow** button (to enter the distance/speed entry page) and then **BACK** or **EXIT**. On exiting this page, the system looks for the next correction distance, displays it and then continues in this way.

23 Firmware updates

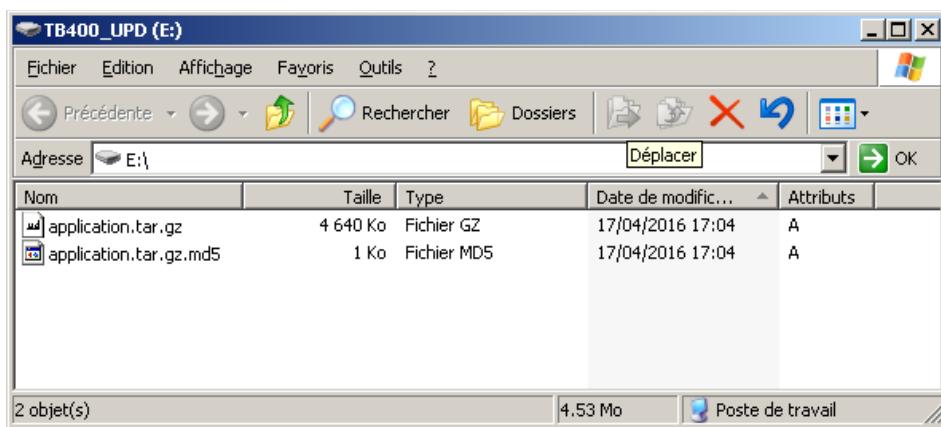
The program update includes the files **application.tar.gz** and **application.tar.gz.md5**.

**do not decompress or "de-zid" them, especially
APPLEhardware.**

In case of problems, **check on the USB key that the names of the files are strictly "application.tar.gz" and "application.tar.gz.md5"**. If the download is done several times, the computer adds "(1)" and then "(2)"... in the name of the files.

If this is the case, they should be removed (be careful not to leave a "space" character)

You have to copy these two files on a USB drive, so that you have them at the "root" of the drive:



Insert the USB drive into the connector, the dash read it. In the screen automatically opened, a button appears **if both files are found at the "root" of the drive**:



Press the button corresponding to the desired update:



The timer displays a popup asking **not to turn off the power or remove the USB key**. The USB key can be removed once the program restarts.

Note: If one or more updates have been missed, it is not necessary to do the intermediate updates: just do the last one.

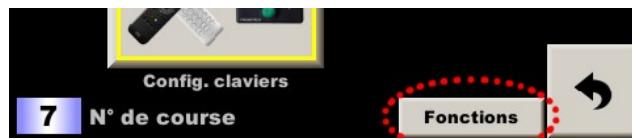
24 Optional functions purchase / activation / deactivation

This device program has several optional functions:

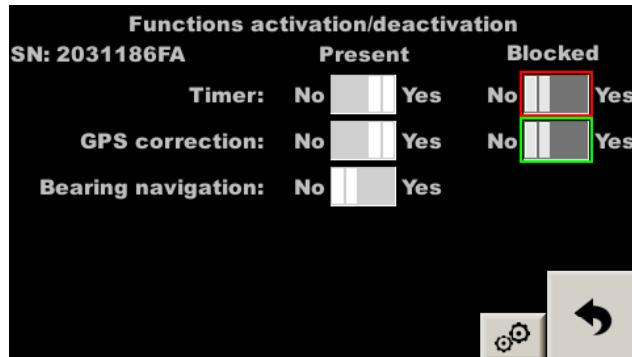
- timer. Without this option, the device becomes an odometer (tripmaster) / stopwatch,
- automatic correction by GPS. This option includes the preceding, so no need to activate the timer option,
- help in normalization of the GPS correction files. This option includes the two preceding,
- heading navigation. This option includes the timer,
- countdown (Italian tubes). This option includes the timer.

A specific code, calculated from the serial number, allows each function to be activated. When the device is purchased, the functions that have been bought are active, but it is possible to buy options later. A code must be entered to activate this function. Once the code(s) have been stored in the device, it is possible to temporarily deactivate certain functions in order to participate in rallies where these functions are not allowed, **without having to purchase another device.**

A specific page is dedicated to these functions management. It is accessed via a **long press** (or **double press**) on the **Menu** button of the remote control or other the button at the bottom of the hardware configurations page:



The page that opens shows the functions and their status:



In the middle, the presence of the function (present if it has been purchased). The buttons are greyed out, they cannot be manipulated. See below how to add functions.

On the right, the status of the functions. By default, they are not blocked (button on **No**). To temporarily block them, switch the button to **Yes**:



The date displayed is the current date.

You must then enter the number of days during which the function must be deactivated (maximum 9 days).

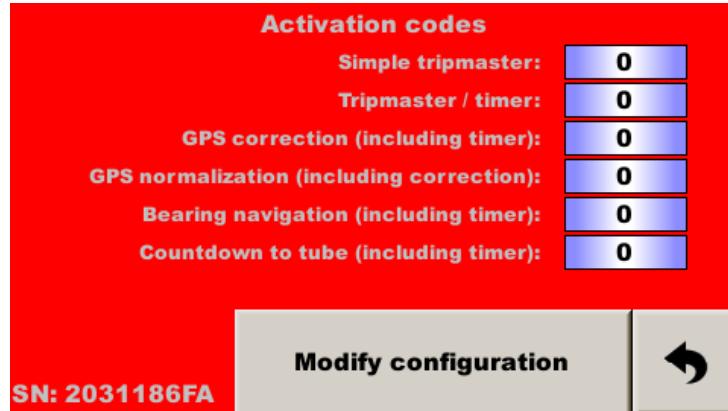
Underneath, we check that the end of the block is after the end of the rally. Sunday evening in our example.

Once the number of days has been set, simply exit this page by confirming the wish to block the function(s).

Important: as the device uses the date and time to automatically reactivate the functions, **you will not have access to the time setting for the duration of the blocking, unless adjusted by 5/100 of a second**. It is therefore very important to **set the time of the device before blocking a function and to synchronise the time with the GPS time** to ensure that there is no time drift.

Once back in the main page, you will notice that the **background of the screen is blue or green** when a function has been blocked, so that the **stewards can check from a distance that the device has not been replaced by an unblocked device!**

To add a function, press the configuration button at the bottom of this activation/deactivation page:  Then enter the code provided on the line corresponding to the function:



Warning: an **incorrect code can deactivate an already active function!** The device can thus be in trip / stopwatch demonstration mode.

25 Pilot assistant

A specific **Led6** module can be used to indicate particular landmarks to the pilot, such as a slippery area or the end of one, a passage where it is necessary to take more or less of a lead, etc.

To do this, use the ‘pacer note’ function, see §22 “*Gravel crew*” notes function and semi-automatic manual corrections. In addition to displaying text, such as ‘Ice’, the pacer will flash the LEDs on the auxiliary Led6 module. Add the following code before the text to be displayed:

- **#**
- number of LEDs to light up: 2, 4, or 6. If 2 or 4, these will be the middle LEDs. 1, 3 or 5 are not allowed
- **R** or **G** or **B** to light up Red, Green or Blue LEDs
- number of flashes, maximum 9
- **F**
- flash duration in seconds, maximum 9
- **S**

The number and duration are optional. If they are not specified, there will be 1 flash lasting 1 second.

The LEDs light up when the pop-up displays the text, i.e. a few metres before the programmed distance, depending on the configuration.

Example: **#4V3F2S** will light up 4 green LEDs in 3 flashes of 2 seconds.

There are two ways to record these codes:

- directly in a free comment in an opener note, using the virtual keyboard (yellow button then press the text entry area at the top right). To find the **#** key, press the **SHIFT** button at the bottom left. This is easy for a test but quickly becomes tedious if you have to repeat the operation during the rally,
- program the difficulty keys (blue button) with the codes you want to use. See §22.4 *Gravel crew notes*

Example:

```
#2V2F2S 0.5 s av
#2V4F2S 1 s av
#4V3F2S 1.5 s av
#4V4F2S 2 s av
#4R2F2S Slide
#4B2F1S Black
```

```
#6R4F2S DANGER
```

26 Welcome picture update

Prepare a file with 480 * 272 pixels size and .**PNG** format. The name must **imperatively** be "**logo.png**".

Place this file on a USB drive formatted in FAT32 (in the root).

Introduce the USB key into the connector, the display reads it and proposes to update the home image (first and long part only), if the **name and file format are respected** (pixel size near).

Note: on **RR410/412/420**, picture has to be drawn upside down.