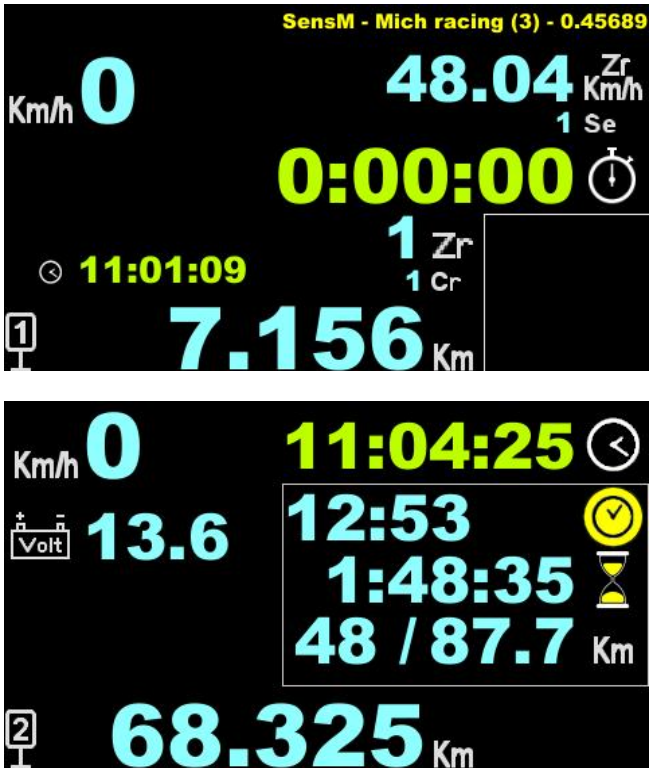
RR400/410/420 Regularity timer
User's manual



Tips and tricks

Firmware version **231219** 19/12/2023

CRISARTECH
+33 (0)5.63.93.25.24
www.crisartech.com

C. MARQUES
christophe.marques@crisartech.com

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

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**...

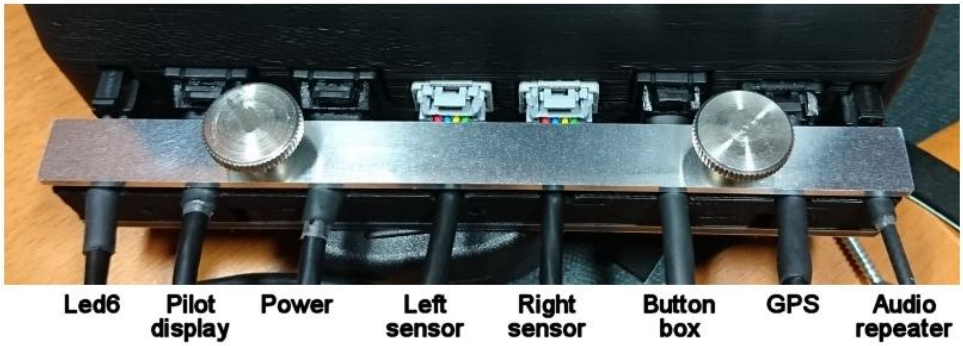
In 2023, the RR410 can be configured as a 'redundant' driver display, i.e. by installing two identical devices in the car, the one on the left can be configured as the 'driver', but if the one on the right (the 'co-driver') fails, the driver display can be quickly reconfigured as a pacemaker. This is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

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

2 Connections

2.1 RR420 (with integrated interface, behind display)

Connections:



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

The connector for USB is now on the right side.
The on/off switch is on the left.
There are two options for the LED6 module:

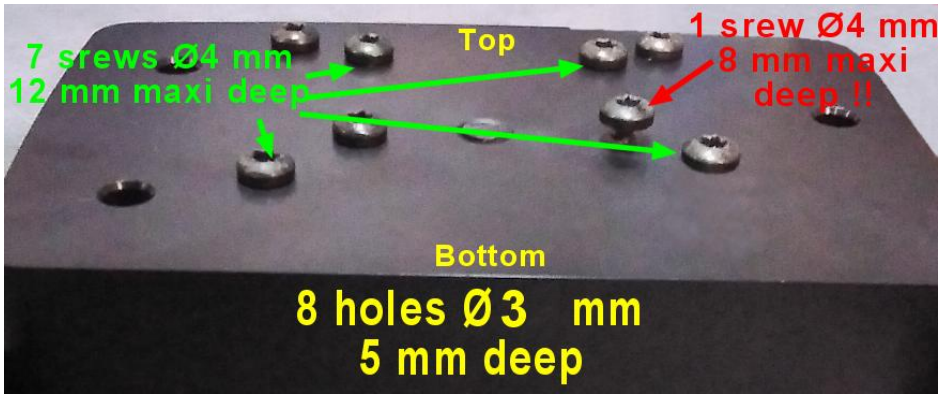
- old model (with swivel bracket): connection on the left-hand side of RR410s produced until December 2023,
- new models (flatter): connect in place of the pilot display. If you want to connect both accessories at the same time, you need to use a multi-socket available separately. The buzzer is internal.

The connectors on the bottom side :

Driver display or LED6	Power supply OBD socket	External Gps	Left wheel sensor	Right wheel sensor

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 » RR410/420

"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 RR410/420 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 « 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 RR410/420. It can be an RP380 pilot display (non-touch) or an RR410 configured as a "pilot display", see section 7 for its configuration.

In both cases, this device must be instructed to send data to the pilot display by ticking the "pilot display" box in the "**Guidance options**", left-hand tab:

Note: with the latest version 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 RR400/410/420.
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.

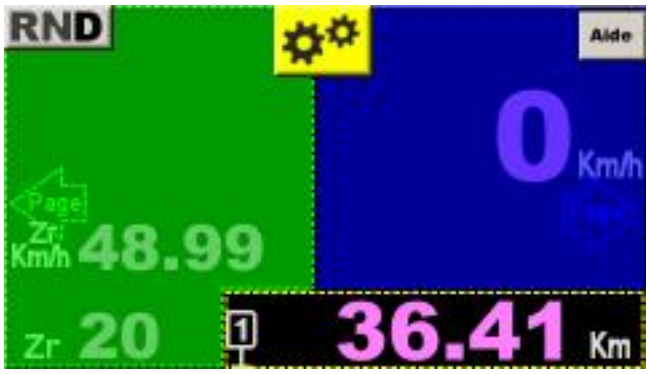
Warning: **it is not compatible with reading information via OBD port**. These sockets are reliable and connected in "permanent 12V" and do not require the use of this accessory.

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 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, refueling, or any other purpose.

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.

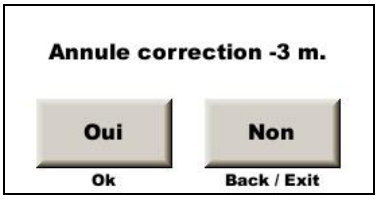
Data fields with a blue-white-blue gradient background are input fields with the touch keyboard:

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:



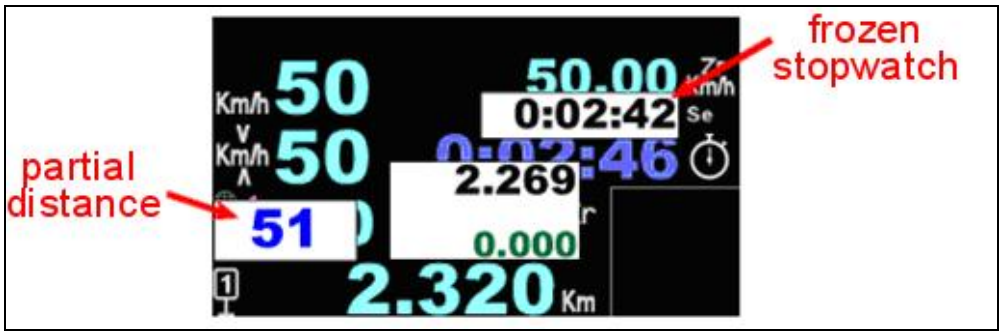
Popup with buttons. Below the buttons
you find the Help for the remote control :
OK button for **Yes**
Back or **Exit** button for **No**

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

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

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 sign14.226 km,
- on the road book is written for this sign. We type this value14.235 km,
- valid further to km 14,600, the trip goes to applying the difference14.609 km,
- The difference is displayed in the history at the bottom right of the screen9 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 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 value14.235 km,
- If the distance was, then the difference appears in the history at the bottom right of the screen14.226 km9 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:

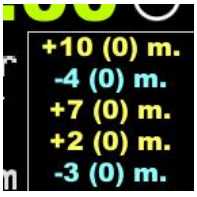
This correction is then applied when this popup closes (1.5 seconds without changing the value). By handling quickly, a correction that requires several key presses can be applied at once.:
- press 3 times on +1 to get a correction of +3 m.
- press 1 time on +10 m. then 3 times on - 1 m. to get a correction of +7 m…

4.4 Cancelling a correction

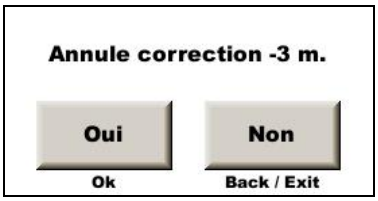
4.4.1 Case of Trip1

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*.

All trip1 corrections are displayed in the "historical" section at the bottom right of the page:



It is possible to cancel this 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.

5 Forward / Reverse, Stop

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

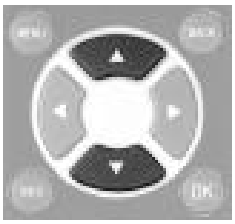
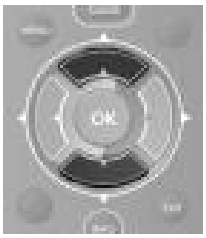
- press the screen (top-middle of preference) then on the button 

that appears in the top left,
- press the 

key on remote control Philips or 

key on the “one for all”

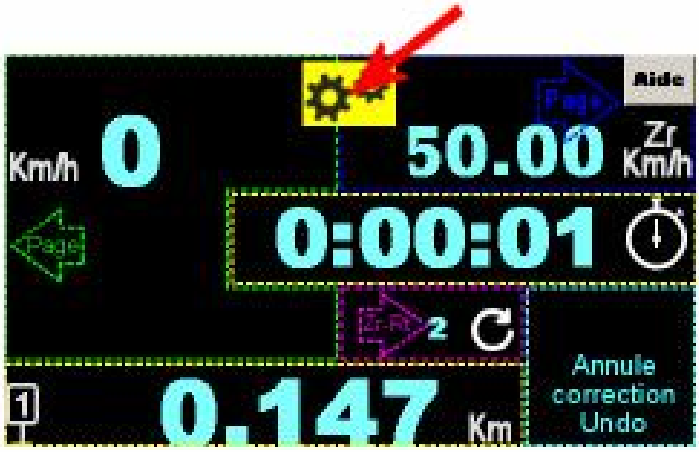
- **R** for "Reverse"
- **N** for "Neutral" or stop counting,
- **D** for "Drive" or Forward.

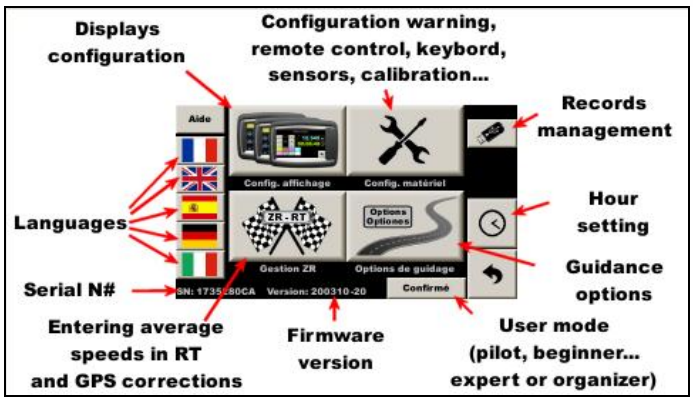
Then press the desired operating mode or use remote control:  or 

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:

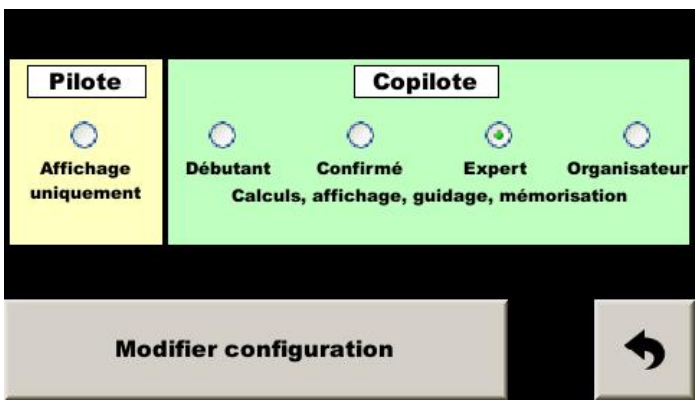




7 Operating modes

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

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** (i.e. the copilot!) that it must send the data to the pilot display by ticking the "Pilot display" box in the "**Guidance options**", left-hand tab:

Note: with the latest version 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.

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 deletes the help buttons and adds a history of distance modifications, manual or automatic (GPS).

7.5 Organizer

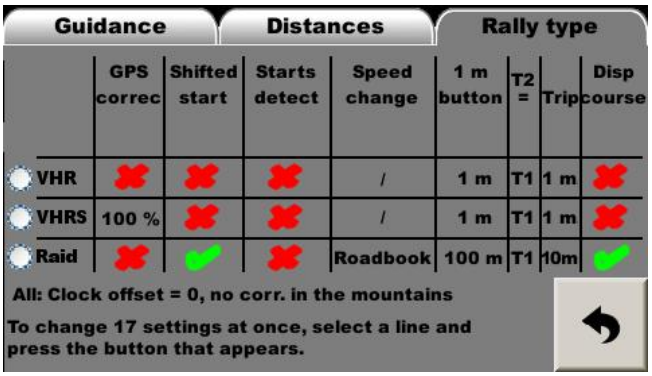
This mode replaces the waypoints entered in automatic GPS corrections by the points useful to edit a road book as well as timing. A separate manual explains these functions.

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

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, 14 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:



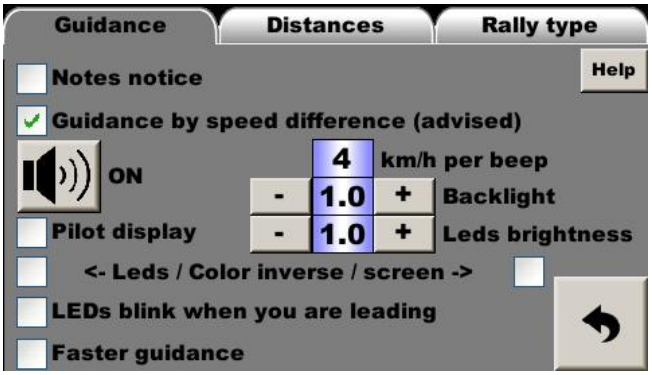
In the order of the 17 individual modified options:

- 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:



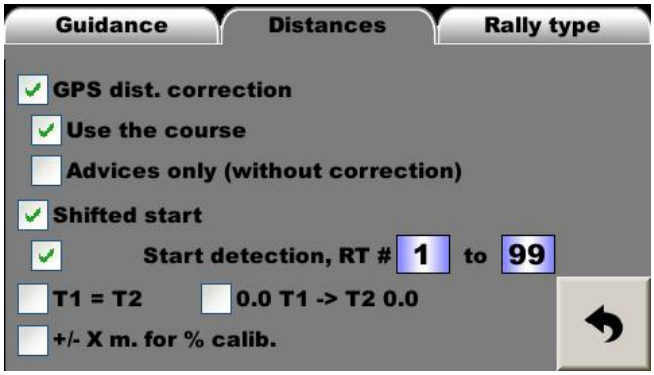
- activation of the **« gravel crew » notes** announcement function, or **semi-automatic corrections** with distances that may have been entered in advance (see below),
- “speed difference” guidance mode which uses the difference between the actual speed of the vehicle and the speed at which the cadencer 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 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 (2 km/h per beep), the buzzer will be silent if the speed difference is 0 or 1 km/h. It will sound a beep every half second 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 sound a beep every half second if the difference is 3, 4 or 5 km/h. It will sound two beeps every half a second 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,
- the following two check boxes **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 the section on activating the functions below,
- this function can use the vehicle's course to simplify the entry of points during recognition (no more green points at the exit of hairpins). It is strongly recommended,
- 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.** 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,
- shifted start: see § below,
- departure detection: this function is associated with shifted starts with distance correction by GPS. In this configuration, the distances correspond to a reset to zero at a point different from the actual start of the regularity zone. The actual stopwatch departure being secret, the reconnaissance is started before the stopwatch departure. **During the race, the co-pilot will have to trigg the stopwatch while passing over the starting point of the reconnaissance so that the system starts to readjust the distances. This function will help him by automatically triggering the stopwatch when approaching this point**, at about 100 m. In the event that the correction files are duplicated, to have the choice between different styles of measurements (distances measured with 2 wheels or with 4 for example), the system could arbitrarily activate one RT or another. The co-pilot will therefore indicate a range of file numbers to be taken into account when looking for departures. By default from 1 to 99, so all files are taken into account. But if the co-pilot has two series of files in his device (1 to 17 and 21 to 37 for example), he will ask the system to take into account only the first series if he configures 1 to 17 or the second 21 to 37,

Warning:

- when this function is activated, **the system must find the file corresponding to the first RT requested** (RT1 in our example) on its internal disk, otherwise an error message is displayed and the start detection function does not work,
- **this function should not be used in VHRS** when the same RT is made several times, as the system could start a RT that you don't want because several RTs have the same starting point.

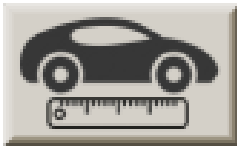
- by checking “T1 = T2”, only Trip1 is used (for RT and link), Trip2 is no longer managed, which is more common in most rallies which do not distinguish between distances between regularity and liaison zones (except RMCH),
- in **expert** mode, Trip1 and Trip2 can be kept independent but reset to 0 at 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 Vehicle type configuration, tests, calibration…

In the main menu, press the button with tools:

9.1 Vehicle 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** (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.

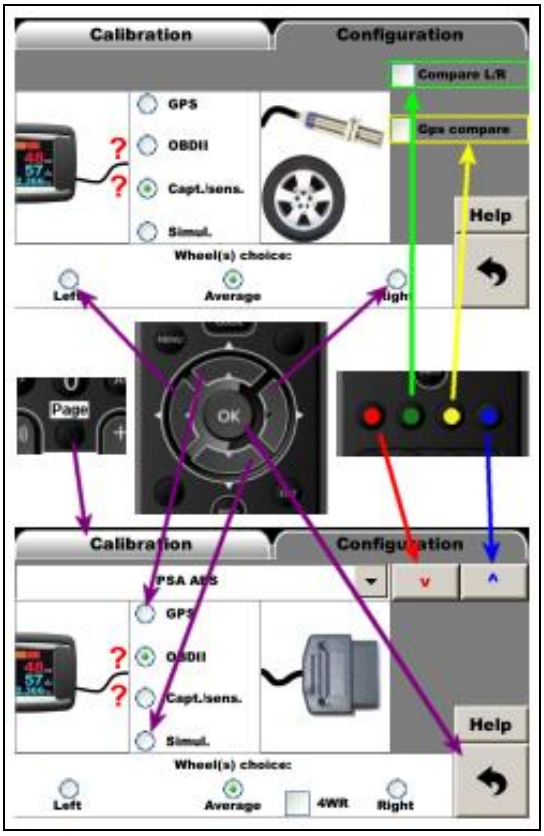
These choices can be "swept" using the **left** and **right** arrow keys on the remote control.

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**,
- 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), first check that each pulse increments the counter of the rotating wheel.

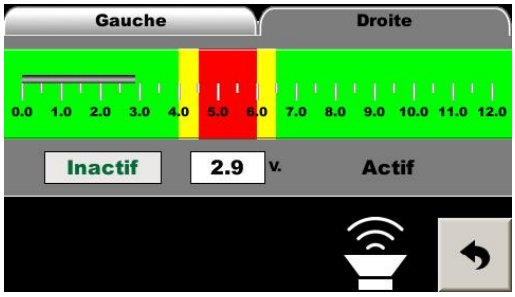
At the end of the installation, before calibration, carry out **a test by accelerating progressively up to the maximum speed** of the vehicle. The displayed speed must be stable (even if it is false because not yet calibrated).

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

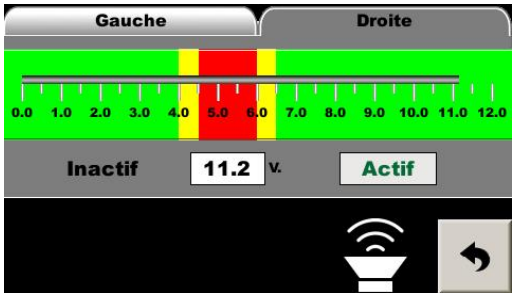
- if the speed tends to fall to 0 beyond a certain speed, the sensor misses tops at high speed, it must be too far from the "target" or "target" is not of good "ferromagnetic quality",
- if the speed tends to double at certain times, the sensor records "rebounds". This can happen with ILS sensors when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

With the **RR410**, 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:

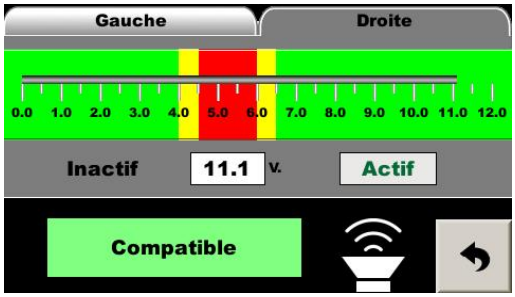
When the sensor is **not active** (not in front of a pad in general), its voltage must be **lower than 4 V**.:



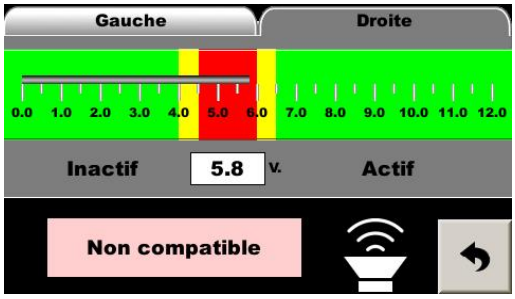
When the sensor is **active** (in front of a stud in general), its voltage must be **higher than 6.5 V**.:



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)

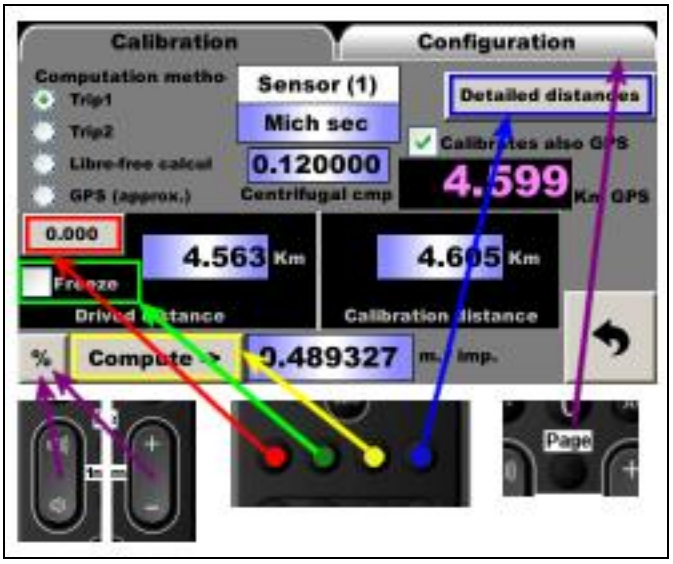
On the calibration page, select the calibration **mode**:
- **Trip1** uses the first counter to perform the calibration. This is the default mode, the simplest,
- **Trip2** uses the second counter to perform the calibration. Used to calibrate (or refine calibration) during the first RT. In this case 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 “drived 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.

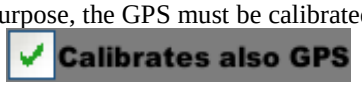
Congratulations, it's over!

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:



9.4 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: 

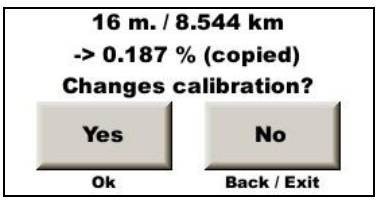
By calculating the calibration coefficient of the speed sensors, the RR400 calculates the calibration coefficient of the GPS and displays it in an information panel. It must be close to 1.

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.

9.5 Automatic calculation of calibration percentage difference

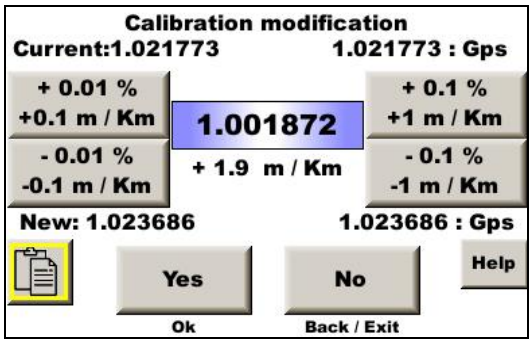
If the co-pilot realizes that his calibration is not optimal, he can have the system calculate the percentage difference. As the corrections are made while driving, they are displayed at the bottom right of the main as well as the total number of corrections, in parenthesis:

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:

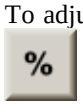
- Trip1reset to 0,
- percentage calculation by the above popup and validation,
- Trip1 modification by more than 200 m. We consider that the Trip1 has been modified following an error, an itinerary change... but not a correction due to a difference in calibration. In this case, the distance reference 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.

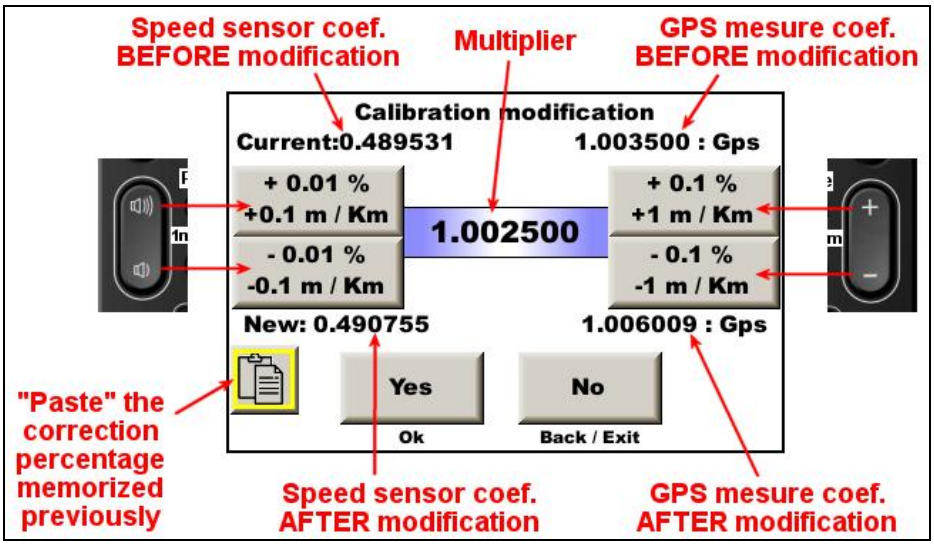
Warning: by default, the corrections made by adding or subtracting 1/2/10 m.using the dedicated keys are considered corrections of "anormal trajectory" (cut turn for example). They are not counted in the cumulation. In Expert mode, you can ask the system to take these corrections into account by checking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

9.6 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).

9.7 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:

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.

9.8 Calibration compensation in mountain areas

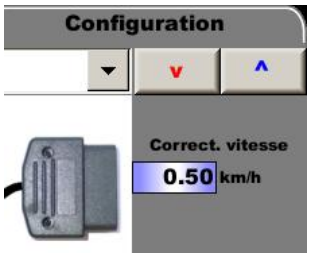
It is common to feel that you need a different calibration between ascents and descents. This is caused by a difference in measurement between the organiser and ourselves. The organiser measured on the front wheel(s) and we measured on the rear wheel(s) or vice versa.
This is accessed via the button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

9.9 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:



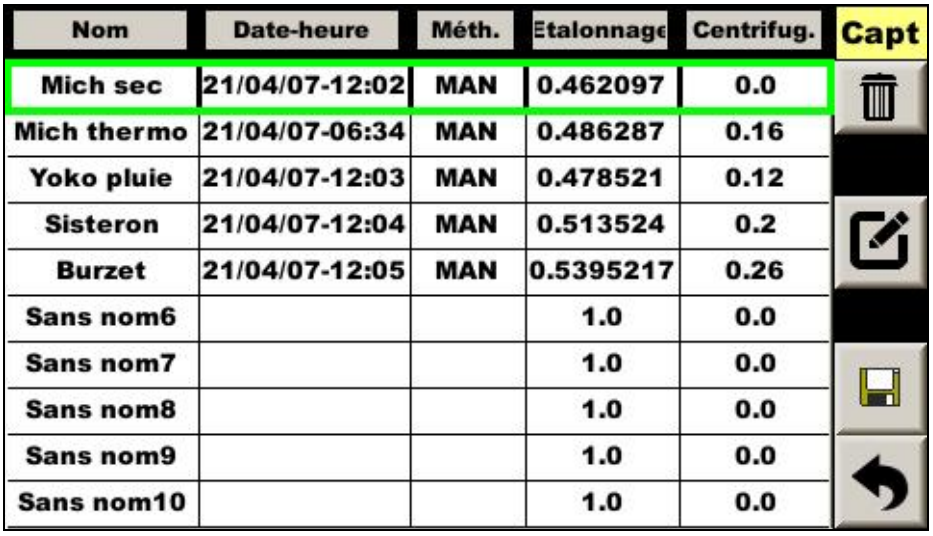
By default, the coefficient is 0.5. We can make it vary it between 0 and 1 to try to correct these errors. For this it is advisable to practice tests between two benchmarks on a straight road and compare the distances measured at different speeds. Pay attention to the centrifugal force compensation (see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

9.10 Naming a calibration

In the calibration page: press the name of the calibration (here **Unnamed1)**:

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



Nom	Date-heure	Méth.	Etalonnage	Centrifug.	Capt
Mich sec	21/04/07-12:02	MAN	0.462097	0.0	
Mich thermo	21/04/07-06:34	MAN	0.486287	0.16	
Yoko pluie	21/04/07-12:03	MAN	0.478521	0.12	
Sisteron	21/04/07-12:04	MAN	0.513524	0.2	
Burzet	21/04/07-12:05	MAN	0.5395217	0.26	
Sans nom6			1.0	0.0	
Sans nom7			1.0	0.0	
Sans nom8			1.0	0.0	
Sans nom9			1.0	0.0	
Sans nom10			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.

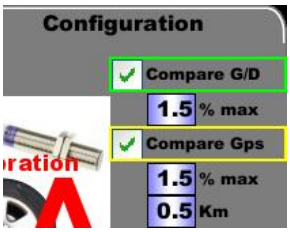
The button  clears the selected line.

The button  changes the name.

Warning : you have to save the changes with the buttons  , after changing the name and/or line selected.

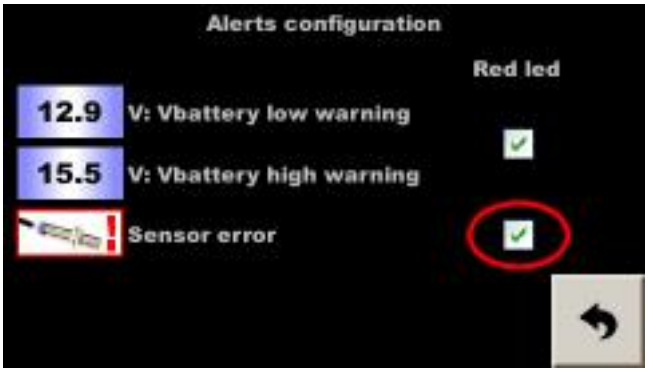
9.11 Wheel sensor monitoring

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:

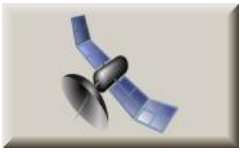
- measurement distance before comparison (in km), common for both tests,
- maximum error for left / right wheel comparison (in%),
- maximum error for GPS and wheel comparison (in%).

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).

9.12 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.

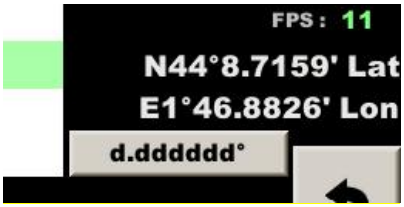
Once the point has been chosen, press the bottom configuration button. An hourglass animates during setup.

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

Important:
- **the configuration is not saved. It is transmitted to the receiver when the 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 connecte 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.

9.13 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.

9.14 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 requires systematically adding 0.6 Volt

10 Entering average speeds

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.

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.

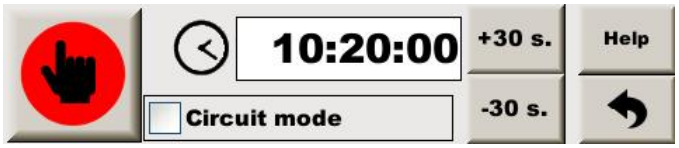
Note: to quickly enter a large number of distances / speed it is easier:
- to put the timer on the knees, like a tablet, and use pencil with eraser or a plastic pen (not ball side!) as a stylus. Styluses for tablets or smartphones are generally too soft. Ladies with long nails can also use a nail,
- or use the infrared remote control, see later § the use of this accessory.

Use of a redundant pilot display:
This is an RR400 type touchscreen display used as a pilot display. It is then necessary to check that each recorded RT (floppy button or red button on the remote control) is transmitted to the pilot display. This results in the display of a popup on the pilot side: gray if things go well, red if things go wrong.
If the RTs are copied via a USB key, you should see all the RTs transmitted on the pilot side.
In the event of a transmission problem, to restart the copy, the summary table of RTs must be displayed:
- button  ,
- then in the transfer page, the button  .

The case of shifted starts raises the question of the origin of the average speed distances, see §17 Shifted starts, further.

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 “offset 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 big left button 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 clock, the displayed time or one of the adjustment buttons in 30 s steps. (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, 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.

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 clock, the displayed time 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:

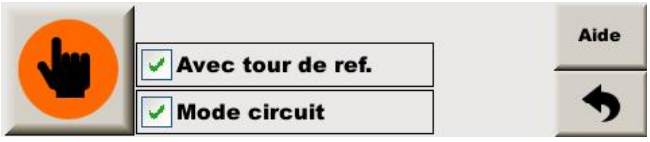
- press the big left button of the touch screen, or
- press the **Chrono** or **OK** button on the remote control.

The stopwatch starts by catching up!
You can also use this technique if you have to stop / restart the stopwatch (start on bad RT ...).

11.4 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 "Speed difference guidance" 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.

11.5 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. If you have the option "GPS distance correction", it is better to activate it.

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.

11.6 10.6 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

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 lead or the delay in seconds and tenths, and this twice per second.

Note: it is not possible to configure the lead / 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 lead / 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 lead / 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 lead / late (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 lead / late but become faster / slower. The pilot no longer needs to know his exact lead / 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 (therefore every half of a second). 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 a difference of 2 km/h (or 2 tenths 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 lead. 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 (except in beginner mode).

13 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.

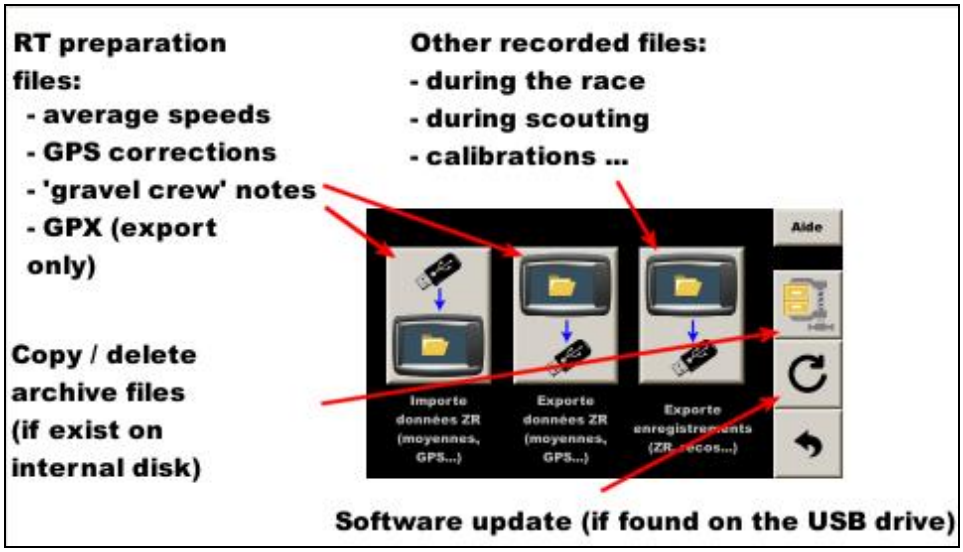
14 USB drive usage

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.

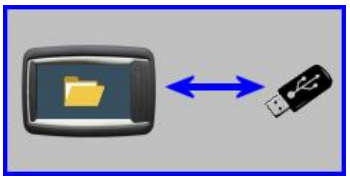
If in doubt about the file system of your USB drive, it is possible to format it on the device before using it.

14.1 8.1 Copy of rally preparation files and records

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



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 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.

14.2 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).

14.3 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.

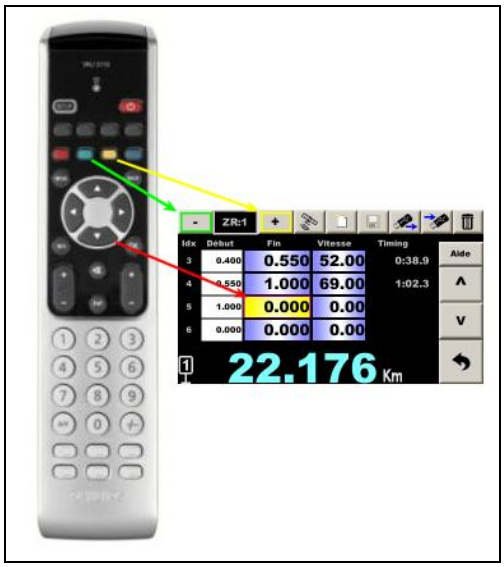
15 Infrared remote control

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

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:

15.1 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.

15.2 Useful the 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	Red	Record
RT management	Short Page	Go to GPS auto correction page
RT management	Long Page	Go to gravel crew notes page
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. Compute adjustment and apply it:
  Info, Ok, OK, OK

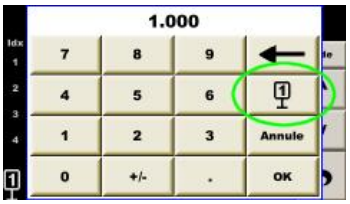
16 Entering a speed change distance on the fly

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,
- start the RT normally,
- before arriving at the sign, open the page with the distances / speeds table,
- with the IR remote control: place on the corresponding box at the end of the segment (a blue frame appears on the pictogram of Trip1 in the bottom left), then press the blue key passing in front of the sign:

The timer saves the new distance and updates the lead / delay.
Maybe change the speed if it was written on the panel, **but be careful, the new speed is on the next line!**
Save this speed change (red key on the remote control): the timer recalculates the timing and updates lead / delay with new speed, then return to the main screen.

Tip: you can access this page directly from the main page by the yellow key on the remote control.

- with the touch screen: 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:



If necessary, modify the speed if it was written on the panel, **but be careful, the new speed is on the next line!**
Save the modification (floppy button): the timer recalculates the timing and updates the lead / delay. Then return to the main screen.

17 Shifted start

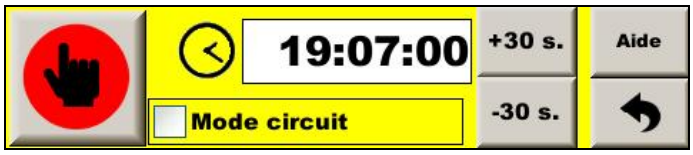
In some rallies, the Regularity Tests are "included" in the links, ie the distance is not reset to 0 from the RT start, in rally-raid for example.

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 §17.3

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 offset 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.

17.1 Function activation

To do this, check the box "**Shifted start**" in **Guidance options**, middle tab. 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 lead / delay.

17.2 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, and not from the beginning of the RT as usual.
It is then necessary to slide the cursor "**Km from start**" located under the table of distances / averages to "**road-book**".

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

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.

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" distances for the semi-automatic corrections, see dedicated § below.

17.3 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).
You must then slide the cursor **"Km since start"** located under the distance / average table to **"chrono"**.

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

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.

18 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, **but only on the remote control** in this version.

Check the box at the top right:

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.**

19 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.

19.1 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: start of RT, with the index of RT. Here RT10,
- V: speed imposed in 1/100 km / h. Each imposed speed change is recorded. Here 45.00 km / h,
- 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,

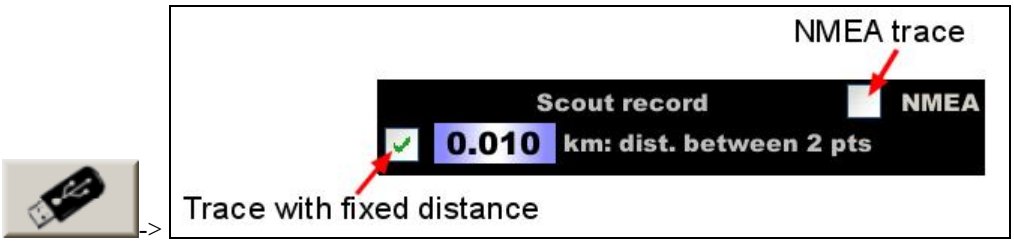
Column 4 corresponds to the quality of GPS reception (except for P data).
Columns 5 and 6 correspond to the GPS coordinates (latitude then longitude).

Remark: latitude longitude can be copy/pasted in GoogleMap (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).

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

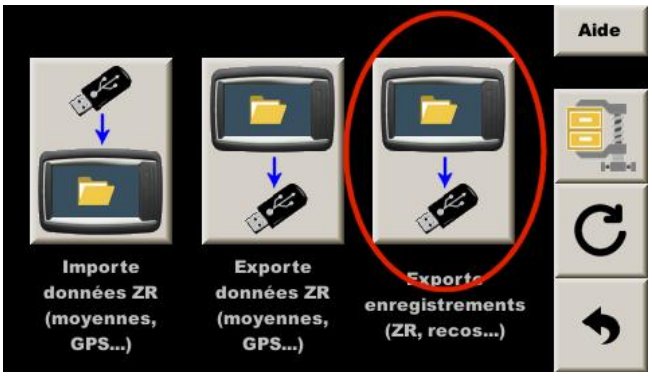
19.2 GPS trace during scouting

Two 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 recording **starts and the files are created when Trip1 is reset to 0**. A red point pictogram appears on the screen.
To stop recording, press the red dot.
The recording stops when stopwatch is armed (no need to trigger, just arm). *A more friendly stop function is to be added to firmware.*

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 later §). They can be visualized and/or converted in different formats, for example with:
GPS Visualizer see http://www.gpsvisualizer.com/

19.2.1 Traces with fixed distance

It is a trace that records a point after driving a configurable distance. This distance gives the precision but also the weight of the generated file. 10 m is a good compromise between accuracy and size.
In the **Recording** page, push the button on the left and enter the desired distance between 2 points recorded for the "fixed distance" trace. It is interesting to record this trace during GPS auto-correction waypoint recording. It associates waypoints with distance on every wheel. Then it allows to add correction points in the GPS waypoints file, after the end of scouting, once back in office.
File name is: **`Scout_date_hour.csv`**

The 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.

19.2.2 Traces with fixed time (0.1 second)

An **NMEA trace** (historical GPS protocol) can be recorded checking the check box on the upper right corner. 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`**

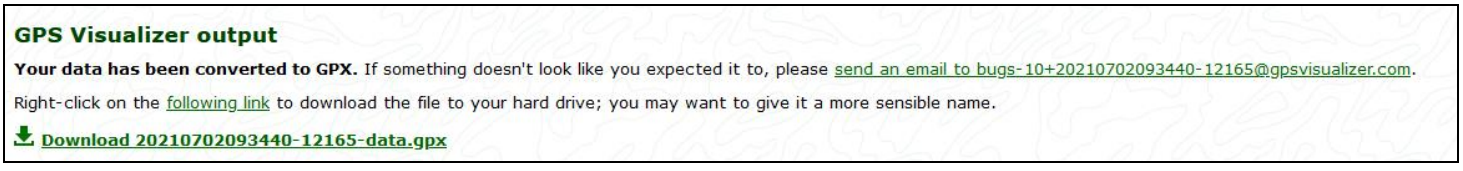
Note: this function is only available in **Expert** mode, and **slows down the device very strongly**.

19.3 Converting files to GPX or KML

These files can be converted for use with mapping software such as Google Earth or Garmin BaseCamp. 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:



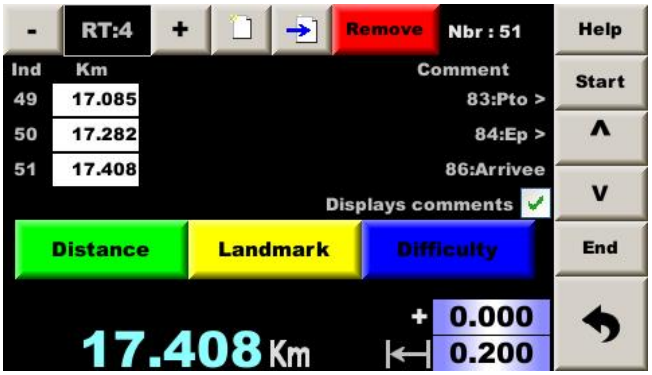
19.4 Correcting waypoints during scouting

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

20 “Gravel crew” notes announcement and semi-automatic 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,
- 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.

Bottom right:
- distance added when importing distances from the averages file (here 0 km),
- distance at which the note is announced before the distance is reached (here 0.2 km or 200 m).

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 box in the middle is ticked. 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 in the correction history** at the bottom right of the screen. If the correction is of the order of a few metres, it is consistent and the correct reference point has been validated. If, on the other hand, the correction is a few dozen metres (and you haven't done any acrobatics, haven't gone through a tunnel using GPS measurements, etc.), then you've made a mistake.

There are three ways of correcting **one** 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 longer time and requires greater concentration for the co-pilot,
- **BACK** or **EXIT** key 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 key and it is the next note that will be erased and the correction error will not be corrected,
- long press on **BACK** or **EXIT**: **recommended**. A confirmation popup will appear, as for any correction cancellation, but the next note will not be disturbed and the next note can therefore be validated.

To correct **several** errors, on the other hand, it is best to apply the **third** method to correct the last error and then the **first** method for the previous ones.

How do I set the distance for announcing the note (parameter at bottom right)?
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 validates nor cancels this distance, it will remain displayed until the same distance after passing over the point in the road-book.
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, 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 (-10 m key) 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.

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 reliable.

This function can also be used to announce “gravel crew” notes using the "difficulty" notes associated with the **blue** button.

Note: it is not possible to insert distances between distances already entered. In the above case, therefore, it is advisable to enter all the distances/speeds, even if the speed does not change.

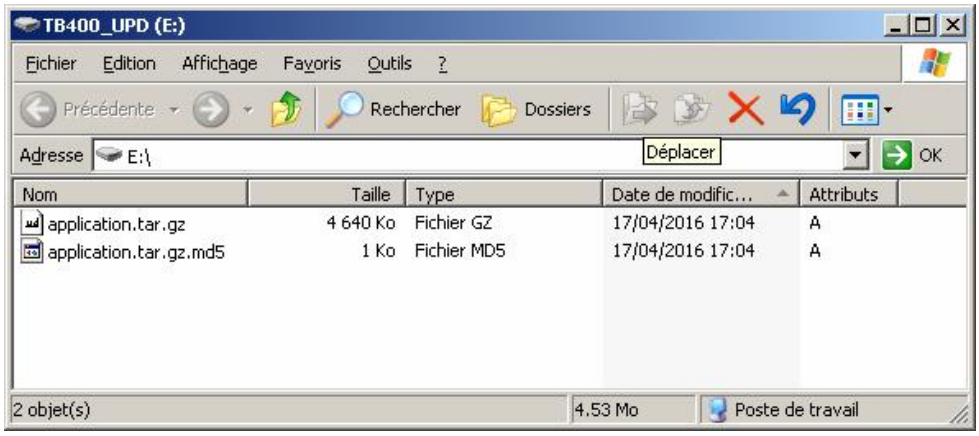
Important: it is possible for the system to go out of sync, if **BACK** or **EXIT** is pressed accidentally, for example. The correction distances are no longer displayed when required. It is then possible to resynchronise the distance file by pressing the **Yellow** button (to enter the distance/speed 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.

21 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**:

Note: on versions before **201229**, this button appears in the main menu.

Press this button to go to the system update screen and 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.

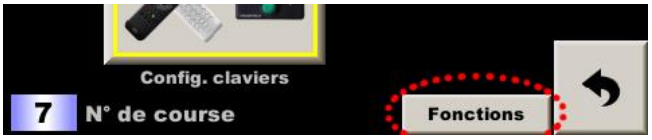
Note: If one or more updates have been missed, it is not necessary to do the intermediate updates: just do the last one.

22 Optional functions purchase / activation / deactivation

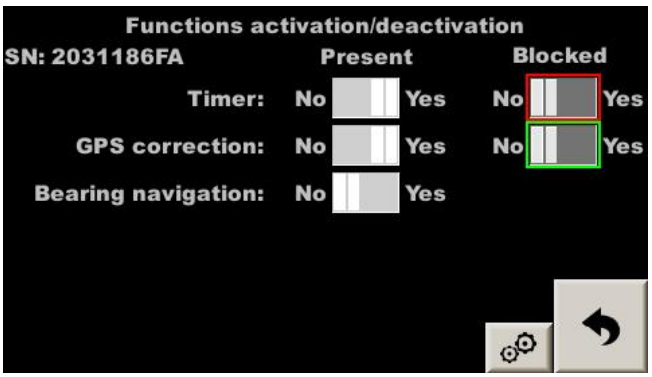
This device program has several optional functions:
- timer. Without this option, the device becomes an odometer (tripmaster) / stopwatch.,
- automatic correction by GPS,
- heading navigation.

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 these 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.

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

Note: **the GPS corrections and heading navigation functions are exclusive**: activating one function deactivates the other. It is advisable to keep the activation codes so that you can switch from one to the other depending on the rally.

23 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 **RR410/420, picture has to be drawn upside down**.