

Telemetry Box



Figure 1: Telemetry Box

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Warranty: two years. We retain the right to reject under warranty repairs of *Telemetry box* showing signs of tampering and/or not accompanied by the repair application (downloadable at www.slot.it) totally filled in. This product is in accordance with RoHS guidelines. Do not dip it into water and do not put it in the microwave oven.

The product has not been tested on animals, also because they would not understand the meaning of "Lap time" .

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We thank you for choosing the *Telemetry Box* system. Before operating, please read this manual attentively.

Warning: improper use, at high volume and for a long time, can damage the auditory apparatus.

1 Contents of the selling pack

In the package are the following objects:

1. A *Telemetry Box*;
2. A *connection cable* for the signals coming from the *Track Interface*, to be (optionally) linked up with the cartridge of the controller SCP-01;
3. A *quick start* user manual.

2 General description

Telemetry Box is an innovative timing system that allows to:

- reproduce via audio the lap times recorded by the pilot, in a language to be chosen among many;
- store in the device's internal memory the times heard on earphones, sector times and in case the telemetry data of the SCP button of Slot.it to which it is connected;
- listen to your favourite music while driving, by connecting the *Telemetry Box* to a MP3 player through a normal audio cable not included in the package;
- download the stored data that can be looked up by the user from a PC by means of a special program downloadable for free (we're generous, aren't we?) at www.slot.it (*Telemetry Box PC Interface*);
- update the software of the system, with the opportunity to add new specifications to the *Telemetry Box* in the future without any additional charge;
- delete stored data (good idea);
- remember the status of data storage button and *mute* button so that it is not necessary to repeat the setup carried out before the supply was cut off.

Moreover, *Telemetry Box* is a versatile system, since its functioning requires only the presence of the *Track Interface* and is totally independent of the kind of controller employed.

The presence of the *Track Interface* is necessary since the latter has the job of interfacing the *Telemetry Box* with the track by collecting the signals coming from the sensors on the circuit (DS bridge, dead strip, Winchro, ...) and sending them after suitable elaboration to the *Telemetry Box* itself. For further information concerning the *Track Interface* system, see the relative manual.

3 Quickstart audio playback for the impatient

Connect the *Track Interface* to your track's sensors according to the relative manual.

Connect the *Telemetry Box* to the *Track Interface* through the “*Track to Telemetry*” cable. Connect the power supply to the *Track Interface*.

IMPORTANT: Before using the telemetry box for the first time, an “Erase stored data” operation must be performed (please refer to § 5.3.1), else the box will behave as if its memory was already full. This does not apply if you change language from the default English as the language change erases all stored data.

Make sure that the LED near the “*Red = Audio off*” label is off. Adjust the volume.

Check, by passing a car over the lap or sector sensor(s), that the *Track Interface* and the *Telemetry Box* receive their signals (LED flashing on both boxes: yellow or green on the *Track Interface*, green on the *Telemetry Box*).

At this point, you're playing with the cars, your lap times are transmitted in your earphones, your driving has improved, and you've promised yourself to read the manual afterwards. It always happens, but nobody ever *really* reads the instructions. What a pity. There are many other features that we engineers love to put in products, and, weirdly, we are paid for doing it. The *Telemetry Box* is no exception and without a thorough reading of the manual it is very difficult to make the best use of all its features. It stands to reason that if nobody reads the manual many features of the product do not come to light and turn out to be useless. Then, why develop them? Does not this render the engineers' role useless? So please, save the engineers and read the manual.

4 Telemetry Box's components description

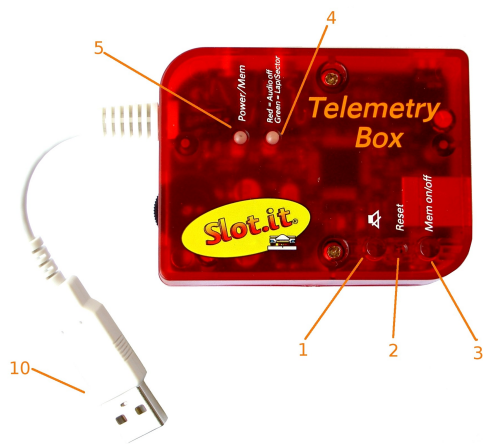


Figure 2: Telemetry Box: seen of above



Figure 3: Telemetry Box: seen from the rear

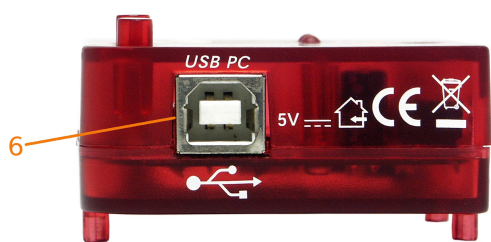


Figure 4: Telemetry Box: seen from the right side

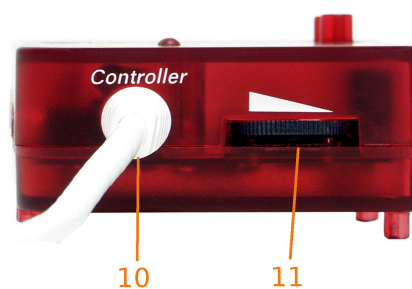




Figure 5: Telemetry Box: seen from the left side



Figure 6: Connection cable

With reference to the previous pictures of the *Telemetry Box*, the following components can be distinguished:

1. mute switch: it enables/disables Lap Time Playback;
2. “*Mem on/off*” button: it has two functions:
 - simple pressure: it enables/disables telemetry data storage and/or lap time storage in the *Telemetry Box*'s internal memory;
 - pressed down for at least 4 seconds: it enables the deletion of stored data. This operation can be carried out only when the *Telemetry Box* is not connected to the PC. Otherwise, this function is carried out by the *Telemetry Box PC Interface* application;.
3. bicolour LED “*Red = Audio off Green = Lap/Sector*”:
 - green light:  one flashing signals the car's passing on a sector sensor (DS bridge or dead stripe), while two flashings signal the car's passing on a lap sensor (DS bridge or dead stripe);
 - steady red light:  it signals that lap time playback has been disabled by pressing the mute switch(1);
 - red light flashing for five times in succession: supply diagnostics function: signals that the last system reset was caused by a problem with the supply;
4. “*Power/Mem*” red LED: it has several functions:
 - steady light: the system is powered and ready for use;
 - flashing light: it signals that data storage is enabled;
 - flashing light with frequency higher than in the previous case: it signals that the data stored in the internal memory are being erased;
 - flashing light with frequency higher than in the latter case: it signals that the memory is full and therefore it is impossible to store further data;
5. USB port (type B): it allows to connect the system to the PC by means of a USB cable (type AB);
6. double switch: it allows to select which data are to be stored on the internal memory of the *Telemetry Box*: times only or all data (times + telemetry);
7. audio output: jack female where the earphones can be connected to listen to the times and/or your favourite music;
8. MP3 player input;
9. USB white cable: it allows to connect the *Telemetry Box* to the SCP controller or to the “*Track to Telemetry*” cable of the *Track Interface*;
10. Audio Volume control: it allows the lap time playback's volume control. The MP3 volume control is to be carried out on the MP3 player itself;
11. *connection cable*: necessary cable in order to connect the SCP-01 controller to the “*Track to Telemetry cable*” of the *Track Interface*, in order to bring the output signals from this latter to the *Telemetry Box* through the controller. In order to connect the “*connection cable*” to the SCP-01 controller's cartridge it is necessary to follow the instructions in paragraph 4.3. Moreover, in order to avoid accidental tear of the two welded wires, the tearing proof device has to be inserted in the apposite slot in the cartridge's shell;
12. *reset*: restart of the microcontroller in case of malfunctioning;



Never connect the USB cable (10) of the *Telemetry Box* to the USB ports of the PC. There's no break hazard but the male USB of the *Telemetry Box* is not a USB cable for PC.

5 Operation description

5.1 Telemetry Box supply

The *Telemetry Box* can be powered in several ways, but only as follows:

1. by means the USB white cable (10);
2. by means of a USB cable (type AB) coming from the PC and connected to the USB port (6) of the *Telemetry Box*;
3. combining the two previous instructions.

All the methods described above supply the *Telemetry Box* with a voltage of 5V DC.

The supply option 2 does not require any comment since it is totally independent of the kind of controller used.

With regard to the supply option (1) a clarification is necessary. Especially for those who have a Slot.it SCP-01 controller, there are two possibilities of supplying the *Telemetry Box* by means of the USB (10) cable. These are:

- insert the USB cable's male plug(10) into the SCP-01 controller's USB port (figure 8);
- insert the USB cable's male plug (10) into the USB female plug of the "*Track to Telemetry cable*" of the *Track Interface* (figure 7).

Instead, for users who make use of other types of controller and need to power the system according to option (1), it is necessary to insert the USB cable's male plug(10) into the USB female plug of the "*Track to telemetry cable*" of the *Track Interface* (figure.7).

Once the *Telemetry Box* is powered, the LED (5) gives out a steady red light in order to show the user that the system is ready for use.

N.B.: by directly inserting the USB cable's male plug (10) into the USB female plug of the "*Track to telemetry cable*" of the *Track Interface*, the user is not allowed to select, by means of the double switch(7), what kind of data are to be stored, since no telemetry data come from the *Track Interface*. The *Telemetry Box* recognizes this operating mode and automatically prepares itself to store timing lap, and also possible timing sector, regardless of the double switch's status. If the saved dictionary in the *Telemetry Box* is "*multilingual*", in this configuration the switch (7) can be used to select the language in which the lap times are heard. This function will be available from the software version 1.0.3.

N.B. When turning the *Telemetry Box* on, it can happen that the "*Power/Mem*" LED (5) lights up with a slight delay. This is due to the initialization the *Telemetry Box* carries out every time it is turned on. During this short time span (max 4") the system cannot be used.

5.2 Lap time playback

In order to make use of this function it is necessary to connect the earphones to the female jack (8) of the *Telemetry Box* and then power everything according to the option (1) described in paragraph 5.1. At this point a clarification is necessary relative to the supply option chosen by the user. In particular, if the user has powered the *Telemetry Box* by inserting the USB cable's male plug (10) into the USB female plug of the "Track to Interface cable" of the *Track Interface* (figure7), no further operation is needed: Lap Time Playback is already possible.

But, if the user has chosen to supply the *Telemetry Box* according to the other option (by means of the SCP-01 controller), it is necessary to insert the male plug of the *connection cable* (12), into the USB female plug of the "Track to telemetry cable" of the *Track Interface* (figure.8).

For information as to the connection of the *connection cable* to the SCP-01 controller's cartridge, see paragraph 5.3.

Now Lap Time Playback is possible.

In particular, when a car passes on the sensor positioned on the finish line, the bicolour LED flashes twice with green light, whereas it flashes only once with green light when the car passes on possible sector sensors.

The *Telemetry Box* reproduces the times only when the car passes on the finish line and moreover it begins to time the lap only when the car passes on the finish line for the first time. The volume of Lap Time Playback can be adjusted according to one's needs by means of the volume control (11) on the left side of the *Telemetry Box*.

While driving, the user can listen to the music by connecting the audio output of any MP3 player to the female jack (9) (MP3 player input) using an audio cable (not included in the package). The audio cable must have at both ends a 3,5 mm male jack.

When the *Telemetry Box* reproduces the driver lap time, the volume of the music gradually decreases, then it gradually returns to its former volume once the time audio reproduction is completed. Note that the music volume has to be adjusted on the MP3 player and not through the volume control (11) of the *Telemetry Box*.

In case that one wants to listen to music only and no longer have Lap Time Playback, one only needs to press the *mute* button (1). The bicolour LED (4) signals that this function has been disabled: it gives out a steady red light. Pressing again the *mute* button (1) is enough to re-enable the function. Practically: audio ON, red light off, audio OFF, red light on.

As already mentioned previously, the *Telemetry Box* remembers the status in which the *mute button* is at the moment immediately before the supply is disconnected. Therefore, when the system is powered again, the *mute* function can be enabled or not, according as it was enabled or not before the supply was disconnected.

It is also possible to hear lap time playback while the *Telemetry Box* is connected to the PC, at the stage of "live Telemetry". For the necessary connections, see paragraph 5.6.

As already mentioned in paragraph 5.1., in case that the *Telemetry Box* is directly connected to the *Track Interface* through the "Track to telemetry cable", and in case that the language in the *Telemetry Box* is "multilingual", it is possible to use the switch (7) to select the Lap Time Playback language. This function is available for versions of the firmware starting from 1.0.3 and is conceived in particular for events with participants from several nations.

5.3 Data storage on the Telemetry Box's internal memory

The function of lap and possible sector times storage is available whatever controller is being used. In case that the *Telemetry Box* is used together with a SCP-01 controller, it is also possible to see and store the data complete with telemetry.

Case a: lap/sector time playback and storage / PC chronometer.

Valid for any controller with a clarification in case that the user is using the *Telemetry Box* connected to the USB connector of the SCP-01. In this case it is necessary to position both switches (7) on *OFF*.

N.B: in case of a controller which is not SCP-01, the function PC chronometer will be available from the firmware version of *Telemetry Box* 1.0.3.

Case b: lap/sector time playback and storage. PC chronometer. SCP-01 telemetry.

Valid only for SCP-01 with “*connection cable*”(12) connected to the SCP-1 controller's cartridge according to instructions.

Below, the connections the user has to make according to the case:

1. **Connections to make in case a:**

- in case that one wants to connect the *Telemetry Box* to the *Track Interface* through the SCP-01 controller, see point (2);
- insert the USB white cable's male plug (10) of the *Telemetry Box* into the USB female plug of the “*Track to telemetry cable*” coming from the *Track Interface*. The final result is shown in figure 7.

2. **Connections to make in case b:**

- connections:
 - insert the USB white cable's male plug of the *Telemetry Box* (10) in the USB female plug of the SCP-01 controller;
 - insert the USB male plug of the “*connection cable*” (12) welded to the SCP-01 controller's cartridge (for instructions, see the following point) into the USB female plug of the “*Track to telemetry cable*” coming from the *Track Interface*. In case one wants to avoid the use of the “*connection cable*” (12) of the *Telemetry Box*, the user can follow what described in point (1);
- welding “*connection cable*” (12) to SCP-1 controller's cartridge: with reference to figure 9 and 10, the black wire must be welded in point 2, the red one in point 1. Figure 9 can be referred to in case of use of positive or negative analogue cartridge, figure 10 in case of high-current cartridge. IMPORTANT: The welding must be done keeping the cartridge not connected to the power supply; play the welding safe acting only on the indicated circuit points;

N.B. Data Storage cannot be enabled in case of *multilingual* dictionary on the internal memory of the *Telemetry Box*.



Figure 7: case a connections



Figure 8: case b connections

In order to enable the Data Storage function, press button (3) of the *Telemetry Box*. The start of data storage is signalled by the *Telemetry Box* through the flashing of LED(5) which keeps flashing for the entire duration of the storage. Pressing again the button (3) the storage is disabled and LED (5) stops flashing. If, during data storage, LED (5) starts flashing very quickly, this means that the memory is full and therefore the *Telemetry Box* cannot store further data. At this point the user has to delete stored data after downloading them if it is thought appropriate. Once stored data have been deleted, LED(5) stops flashing and Data Storage function can be re-enabled.

The amount of data that can be stored depends on the situation the user is in. In particular, in **case a** it is possible to store about 200.000 among laps and sectors. In **case b** it is possible to store data for about 23 minutes.

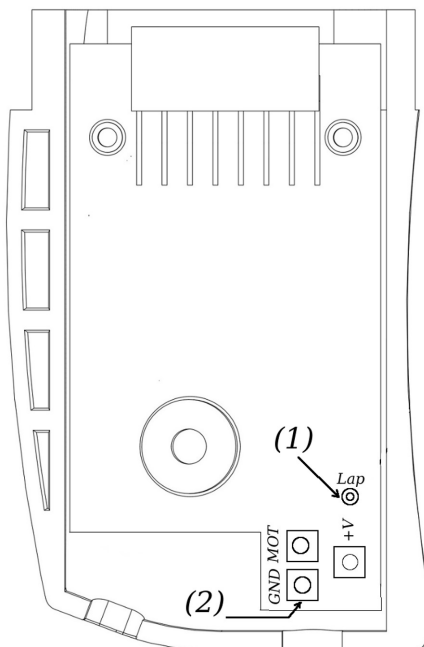


Figure 9: negative/positive analog cartridge

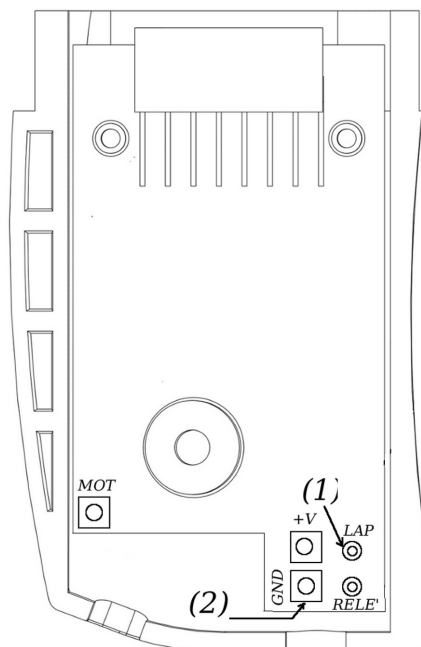


Figure 10: high-current cartridge

The user can enable and disable Data Storage several times without having to delete the data stored in previous sessions.

Once the content of the *Telemetry Box*'s memory has been downloaded, the data will be differentiated according to the storage session they belong to. In particular, they will be shown in the following format:

```
#stint.#lap    lap time          sector time#1.....  sector time#n
```

where:

- #stint: indicates the number of the data storage session;
- #lap: indicates the number of the lap performed during the #stint session. #lap is reset at the beginning of every new data storage session;
- lap time: driver lap time on the lap number: #lap;
- sector time #1: driver sector time on the sector number 1;
- sector time #n: driver sector time on the sector number n.

To change from a storage modality "times only" to a "complete telemetry" one and vice versa, it is necessary to delete the memory and position, in the first case, at least one of the switches on "ON"; in the second case, both switches on "OFF".

As for the *mute* button, also for the *Mem on/off* one the *Telemetry Box* remembers the status the button is in before the supply is disconnected. This ensures that once the *Telemetry Box* is powered

again the Data Storage function restarts from the status it was in before the supply was disconnected.

To download the data from the *Telemetry Box*'s internal memory, the system must be connected to the PC only, through a USB cable (type AB) inserted into the USB port (6) of the *Telemetry Box* itself. Run the application "*Telemetry Box PC Interface*" and select from the menu "*selected function*" the option "*Download telemetry data*". Now the software asks to indicate the name of the file where to save the data which are to be stored. Once the choice has been made, the download starts. Its completion is signalled by the software through an apposite notice. The result of this operation is the creation of two files having the same name indicated by the user, but differentiated by the adding of "_t" and "_d" at the end of the name itself. The first contains the times, the second the telemetry data. Now you only have to disconnect the *Telemetry Box* from the PC. For further details as to the use of the *Telemetry Box PC Interface* application, see the apposite manual.

5.3.1 Erase stored data

To erase the stored data from the *Telemetry Box*'s internal memory you only need to follow one of the following operations according to the way the *Telemetry Box* has been powered. In particular:

1. ***Telemetry Box powered only through the USB white cable (10)***: hold the "Mem on/off" button down (3) until the LED (5) starts flashing. Then release the button and wait, without carrying out any operation, for the LED to stop flashing and begin to throw a steady red light again. Now the *Telemetry Box* has completed the deletion of the data stored on the internal memory. During this phase the *Telemetry Box* is unable to perform any other function;
2. ***Telemetry Box powered by PC***: in this case the user can delete the data stored on the *Telemetry Box* only through the *Telemetry Box PC Interface* software. In particular, once the *Telemetry Box* has been connected to the PC through a normal USB cable (type AB) inserted in the "USB PC" port of the *Telemetry Box* itself, it is necessary to run the application and choose from the menu "*Selected function*" the option "*Erase stored data*". Now the deletion process starts and for its entire duration the LED(5) flashes with red light. Then it will return to steady red light.

5.4 Audio language updating

The *Telemetry Box* is sold with a default language for time playback: English. Nevertheless, the user can decide to set the *Telemetry Box* on one of the following languages, which can be downloaded for free from the website www.slot.it:

1. Italian;
2. English;
3. Spanish;
4. Portuguese;
5. French;
6. German;
7. Japanese;
8. multilingual (four languages).

In order to set the *Telemetry Box* on the chosen language, the system must be connected to the PC through a normal USB cable (type AB) (generic cable for printer). Moreover, nothing else can be

connected to the *Telemetry Box*.

Run the application "*Telemetry Box PC Interface*" and choose from the menu "*Selected function*" the option "*Download language*". The software now asks to indicate the name of the file to be downloaded on the *Telemetry Box*'s memory. Once the choice has been made, the application starts the process of language setting, whose completion is signalled by the software with an apposite notice. Notice that the language updating entails the deletion of all the data stored until that moment.

The operation fulfilled, you only have to disconnect the *Telemetry Box* from the PC.

5.5 *Telemetry Box* firmware updating

As already mentioned previously, it is possible to update the firmware of the *Telemetry Box*. This operation allows the user to add new functions for free. For further information as to the procedure to follow, see the manual "*Telemetry Box* firmware updating".

5.6 Use of the PC chronometer function

Very interesting is the PC chronometer function which can be used at present with the SCP controller only, but with any controller beginning from software version 1.0.3. With regard to the connections to be made, see figure 7 if a controller different from SCP-01 is used, otherwise see figure 8. In both cases the *Telemetry Box* must be connected to the PC as previously explained.

At this point you only have to run the *Telemetry Box PC Interface* application and from the "*Selected function*" menu choose the option "*Telemetry*". This causes the opening of two pages: the second one is dedicated to the timing function. In this page the following data are displayed:

- lap time and lap number;
- best time and lap number;
- time of the last 10 laps.

For further information, see the *Telemetry Box PC Interface* application's manual.

5.7 Use of the *Telemetry live* function

Before moving on to the description of this function, it must be underlined that the telemetry can be carried out exclusively with SCP-01 controllers, as they are the only ones preset for this function.

This operation can be carried out with the *Telemetry Box PC Interface* application, which can be downloaded for free from the website www.slot.it. It allows the user to:

1. see in real time on the monitor of the PC the settings adjusted on the SCP-01 controller, thus becoming a good support for setting the controller and learning how to use it;
2. store various parameters while driving (lap time, possible sector time, braking, acceleration, minimum and maximum speed);
3. save, load and make comparisons between different drivers or between different sessions.

In order to be able to make use of telemetry, the following connections are necessary:

1. connect the *Telemetry Box* to the PC with a generic USB cable (type AB) inserted into the USB port (6);
2. connect the SCP-01 controller to the *Telemetry Box* by inserting the USB male plug of the latter (10) into the controller's USB connector;

3. Weld the "connection cable" to the cartridge of SCP controller (see paragraph 5.3, case b) and insert the USB male plug into the USB female plug of the "Track to telemetry cable". The final result is shown in figure 8.

Once the described connections have been made, it is possible to run the *Telemetry Box PC Interface* application. For further information as to use this software application, see the manual.

6 Telemetry Box assembly on SCP-01 controller

Those owning the Slot.it SCP-01 controller can assembly their *Telemetry Box* on the controller itself, thus creating a single and very convenient structure.

In order to do this, the following procedure has to be followed:

1. open the SCP-01 controller's plastic shell and remove the electronic circuit from it, unscrewing the three anchor screws;
2. remove the frame on the back side of the shell, unscrewing the four screws;
3. insert the feet of the *Telemetry Box* into the free holes on the back side of the shell;
4. lock the *Telemetry Box* with the same screws removed in step 2;
5. reassemble the PCB removed in step 1;
6. close the shell again: now the controller is fully assembled. The final result is shown in figure 20;
7. insert the USB white cable's male plug (10) of the *Telemetry Box* into the USB connector of the SCP-01 controller;
8. power the SCP controller.

Once the listed steps have been followed, the LED (5) of the *Telemetry Box* throws a steady red light and the lot is ready for use.



Figura 11: Telemetry Box assembled on SCP controller.

7 System diagnostics

The *Telemetry Box* is provided with some diagnostics functions which allow the system to detect possible problems regarding:

1. system power supply;
2. memory containing the language of time playback and lap/sector time and telemetry data.

The result of the diagnostics is reported to the user by means of the bicolour LED(4). In particular:

1. red light flashing five times: a problem with the supply has occurred, which has caused the last system reset. This is due to the fact that the power supply value has fallen below the minimum threshold required for the proper functioning of the *Telemetry Box*. A possible cause for this could be the presence of a short-circuit;
2. red and green light flashing alternately: there's a problem on the internal memory of the *Telemetry Box*. If this happens, the electronic component has to be replaced;
3. red light flashing three times: the language in the memory of the *Telemetry Box* is not recognized. It is therefore necessary to update the language of time playback. Refer to the paragraph 5.4.

Notes

CE mark



This device is compliant with the requirements of the CE mark for uses in residential districts, shopping precincts, vehicular and light industrial zones.

RAEE / WEEE directive



This symbol on the product or on the package indicates that this product must be separated from household-type waste. In conformity with 2002/96/EC European directive on waste electrical and electronic equipment (RAEE /WEEE), this electrical product cannot be disposed of together with undifferentiated waste. This product must be disposed of by means of restitution to the dealer or to the local waste collection area for recycling.