

Timekeeper³ ACCURACY



The purpose of this document is to describe how the timekeeper3 is able to obtain a high time measurement accuracy and, doing this, it globally describes the common competitors approach and their disadvantages.

Timekeeper³ ACCURACY

THE SENSOR REQUIREMENTS

- A good system for time measurement in sport competitions needs a good sensor for this scope. The photocells are commonly used for this scope because they constitute the most appropriate and accurate method. The accuracy of this kind of sensor is given by the really low and constant reaction times and by the ability to generate a really narrow light beam, and then it is able to reveal with extremely high accuracy the passage of athletes between photocell and reflector.



Timekeeper³ ACCURACY

THE SENSOR – IDENTIFIED SOLUTION

- The selected photocell, unlike other medium and low-end products, is an industrial photocell developed with many precautions to avoid interferences and to guarantee high performances.



Note: Other competitors systems use proximity sensors and they do not guarantee accurate revealing of the moment when the athlete pass in front of the sensor because they generate a electromagnetic wide «beam» with variable intercept point and they usually have high reaction times, not always constant. Our photocell sensor instead, is globally identified as the best solution for this scope.

Timekeeper³ ACCURACY

ELECTRONIC REQUIREMENTS

- The time measurement requires a real time processing for sensor's signals data. **It is fundamental that each sensor is physically connected to the device that measures the time.** This because the transmission via electromagnetic waveforms (wireless, in example bluetooth, WIFI, RF, etc.) is affected by transmission delays, electric conversion delays and electromagnetic interferences that may delay and avoid the proper working of the device.
- **It is fundamental that the signals are measured via a real time processing because, operative systems like Windows, Linux, Mac,IOS,Android etc.** dedicates only part of the time to the operations requested by the user, and they averagely «sleep» each 0,01 seconds in order to manage other system process. These times where the operative system «sleeps» are not constant and they are not always known. So, to delegate the time measurement to these operative systems does not guarantee an accurate measurement, unless you use other real time hardware devices, delegating to the operative system just the graphic processing or the management of not real time tasks.

Timekeeper³ ACCURACY

ELECTRONIC – IDENTIFIED SOLUTION

- For the previously detailed reasons, the Timekeeper3 measures the times through the audio input of a smartphone. The audio input has an audio real time digitizer able to store data coming from the sensors, «freezing» the times reading and saving them on a memory «buffer». The processor on the Android operative system will then periodically take data from the «buffer» and report times to the user, doing not real time processing part of the work.

Note: Other competitors systems send, via wireless, the data coming from the sensors and/or they measure the times by means of operative systems like Linux, but unfortunately measures taken with those systems are necessarily affected by variable and unpredictable errors, as previously described.



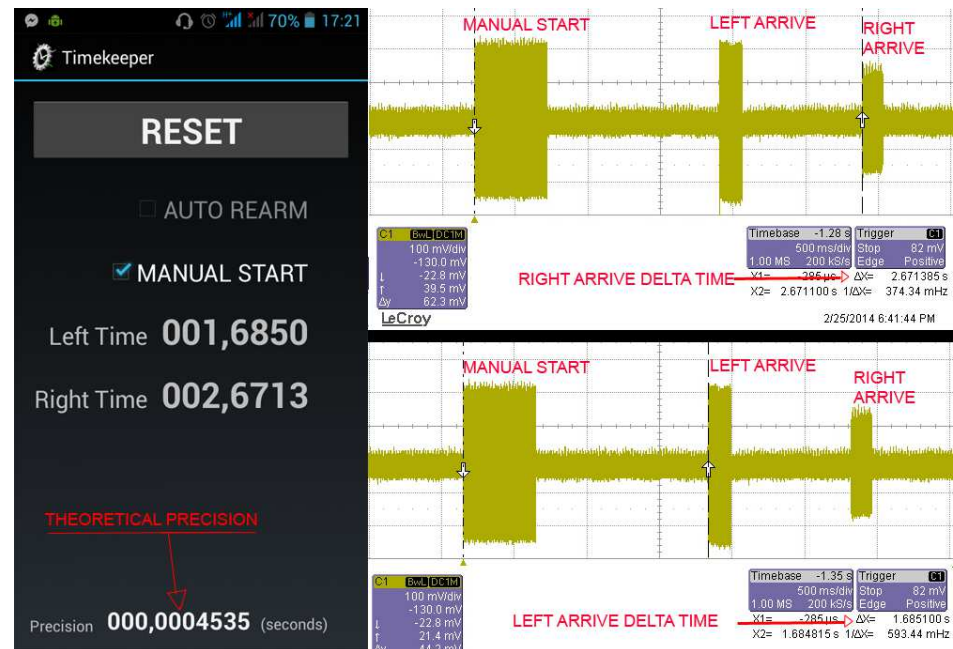
Timekeeper3 ACCURACY

CONCLUSIONS

- The theoretical assessments made for the Timekeeper3 system accuracy, considers all the real variables and allowed us to define a system accuracy equal to 0.0004535 seconds. Subsequently, an extensive measurement campaign, carried out by means of professional equipment (mainly oscilloscope) was able to confirm the theoretical accuracy of the product.

Note1: Sending times to a remote location via wifi, will not introduce additional errors because the measurement is made by the Timekeeper3, before to send the times.

Note2: Other competitors systems do not declare the accuracy because they are not able to guarantee it, apart some old and obsolete certified devices supplied to the national sports authorities.



Timekeeper

RESET

AUTO REARM

MANUAL START

Left Time 001,6850

Right Time 002,6713

THEORETICAL PRECISION

Precision 000,0004535 (seconds)