User Manual

Lap timers

Release 1.00

Lap timers

1 – Lap timers

Who frequently drives on a race track one fine day wants to know his lap times. Therefore he can give his mechanic the stopwatch and a pen in the hand: at some point this will not be satisfying anymore, because after 10 laps the driver cannot remember why he was so fast in the fifth lap. Therefore a Lap timer is needed, because it shows him at the end of each lap the lap time, and he can directly assess what the “other” line has brought. In the mode "Running lap time" you can focus on certain points of the track in order to evaluate whether he has become faster.

Like any other product the Lap timer has physical limits which decide on whether the lap times are displayed accurately or not. For example, the first AIM lap timer was a **MyChron1** with inductive tachometer. That Lap timer still had an IR transmitter in a black ABS housing with 16-way – coding options, so that each **MyChron1** user was able to set his own "signal set" without disturbing others or being disturbed by them. Yet soon we had to recognize that 16 settings are not enough, we would have needed hundreds or even thousands of them. So a standard AIM signal without adjustability was introduced.

The customer buys a lap timer and immediately asks himself: “What should I do?” The right answer is: "Take a look at the manual. Everything is explained in there.” Unfortunately the customer generally answers: "Just try it out and somehow it will work." At this point, our manual has lost. Although everything that one needs to know about the Lap timer is written down in the manual, it is ignored.

We will tell you what you should not do in order to not influence the correct working of the logger and why some things are different than people think.

2 – Working way

The Lap timer needs a fixed point on the track where he can trigger accurately and reliably lap by lap. There are currently four popular methods.

Manual Timing. The driver presses a push button when passing a certain point of the track, e.g. at the finish line. This is not very accurate and is often forgotten in the heat of the moment.

Lap timing using an infrared beacon. This is the most common method because it is inexpensive, accurate, reliable and widely applicable. At the edge of the track is **ONE only** IR transmitter which sends a coded infrared light signal. “Coded” means that the light-on and light-off phases, pulse times and intervals are precisely defined. In order not to be disturbed by transmitters from other manufacturers or to disturb transmitters from other manufacturers every manufacturer has its own frequencies.

IR Transmitter


IR Receiver

The error of measurement in IR lies, when it is correctly installed and used, at the third decimal place, i.e. in the range of milliseconds (1ms = 1 / 1000 s). But it is somewhat inconvenient to handle the transmitter, because if you forget it on the pit wall it's gone as everybody can use it. It also requires electricity – i.e. maintenance.

Lap timing via magnetic strip.
There is one (or more for split times) permanent magnetic strips across the track as trigger and a magnetic field sensor passes over. Almost all go-kart tracks in Europe are equipped with magnetic loops, but nearly all automotive and motorcycle racing tracks (except of Hockenheim and some tracks in France and Spain) are not equipped with it.

Lap timing by a magnetic strip is extremely accurate, reliable, convenient and cheap, but for motorcycles it is not very practical (as opposed to racing cars and karts) because of the large ground clearance and related mounting deficits.

Lap timing via GPS.
They are very convenient because do not require a transmitter. You go with the lap timer to the finish line and "set" the measure point. The problem of the cheap GPS lap timer is the low sampling rate: there are devices that only detect the position of the device on earth once a second. And because each measurement has a tolerance of less than + / - one measurement cycle these lap timers are only good for hikers with orientation problems.

The slightly better ones with a sampling rate of 4 Hz still have ± 1 / 4 second measurement uncertainty. With lap times at 8 minutes on Nordschleife it is ok but if you go to the kart track, you may have a serious problem. Here are 10 Hz or more announced. 50 Hz or 100 Hz would be a bit exaggerated, because prices rise exponentially to the sampling rate and because of a few hundredths tolerance only factory teams in Moto GP spend € 5,000 more than others do. The use of these devices only makes sense if a visible reference point on the route of each station is available.

Each of these methods has advantages and disadvantages and requires certain procedures to ensure the reliable operation of the system. The magnetic field sensor is completely foolproof, but you can forget to press the manual trigger. Yet the most things can be done wrong when using infrared measurement.

The signal of the IR transmitter is a clocked infrared light, for example – OFF – ON – OFF – ON – OFF – pause – ON – OFF – ON – OFF – ON – OFF – pause, etc. The times of these cycles are definitely set by each manufacturer.

Abb.1

It is from the emitter diode in the form of a light cone with 18° spread continuously sent, and once it is seen IR receiver of the display will show the lap time.

That is, the further the transmitter is removed, the greater is the area where the signal can be detected. This also means that the further one passes the transmitter, the less important is the height of the receiver. Furthermore the further one goes by the transmitter, the sooner you go into the light cone. To get more earlier in the light cone one can turn the transmitter on the pit wall by 9 ° in the direction of the turn and then one travels always at the same point in the light cone, regardless of the distance to the transmitter.

The closer one goes by the transmitter, the shorter the time that the receiver has to detect the signal. At 10 m distance and height are the best 3.17 m. At 252 km / h shall be back 70 feet per second, at 252 km / h takes you through the 3.17 m wide cone in 0.022 s. Therefore, the receiver must have a clear view to the transmitter.

Of course, the more transmitters are set up, the stronger the signal, and the more reliable the system works. Such as in singing, where a choir is louder than a soloist. Far from it, because the lap timer responds only to the coded light. Therefore there is this warning on the transmitter:

If two transmitters send signals, perhaps even from the same manufacturer, it could look like this:

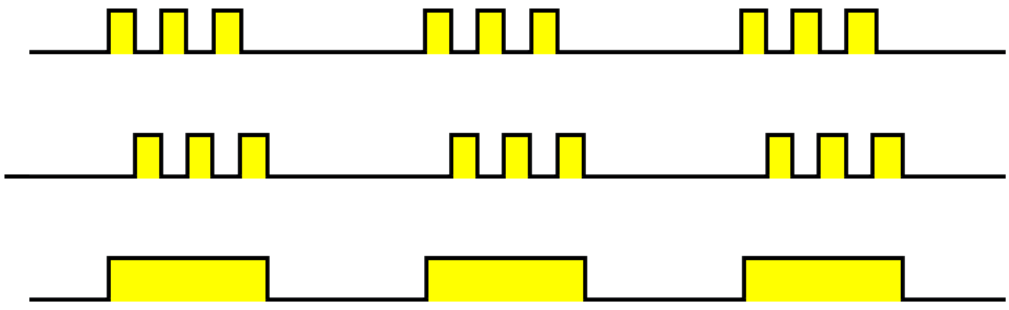

Abb.3

The receiver now ignores what he sees there, because that's not his signal. This effect is independent from which manufacturers the transmitters are coming from, because each manufacturer has a different signal code. And also not with transmitters of one manufacturer, because they are not synchronized.

The cone has at 20 m distance (width of the start / finish straight on many tracks such as Hockenheim, Nurburgring and Monza) a diameter of 6.23 m, which means that In this case, the distance from one to the other transmitters must be at least 6.23 m to ensure the reliability of operation. For "security" reasons 10m should be adhered as there are transmitters with larger viewing angle.

An occasionally occurring phenomenon is the picket fence effect: when the sun is low and you drive past a fence or trees and the solar radiation interrupts the corresponding

frequency in the IR receiver a lap time might be triggered. Quite stupid was the idea of a mechanic who acquired the driver's lap times via a lap timer a few years ago. For this he had the transmitter mounted on the motorcycle and he was standing with his MyChron in the hand at the pit wall. So many supposedly broken Lap timer it had not given so far.

The powering of the transmitter can be done via 8 AA batteries at 1.5 V in normal mode (range with fresh batteries approx 15m). We recommend at distances of more than 10 m to change to high power mode (range 30 m). In this state an external 12V battery is needed. Lap timers are powered by a 3V button cell CR 2430 battery. To prevent that batteries "stand out" because of vibrations and crushes and the lap timer therefore turns off you should (when having this problem) put foam rubber in the cavity.

GPS devices: there are two or three things that need to be considered when installing the antenna. Furthermore one need to consider the cold start procedure during which the device searches 1-2 minutes for satellite signal while the car is standing still. The GPS module stores the distance data (measuring points for laps and split times), and recognizes on the basis of the coordinates stored in the Lap timer on which track you are. However, ordinary AIM customer uses the GPS not as a Lap timer, but for data analysis (over ground speed, gyro, inclination angle, curve radium, trajectory, etc.).