MICROGATE

WITTY•TAB

User Manual

Version 1.0.0

Contents

1 HARDWARE

Figure 1 – Witty·TAB

Weight	2.9 kg, batteries included
Dimensions	13 x 41.5 x 6 cm (H x W x D)
Operating temperature	0° C/+45°C
Unit of time measurement	1/100 s Selectable speed m/s – km/h – mph
Measurement resolution	4 x 10^{-5} s (1/25000 s)
LED matrix	Numerical: 6 digits x 7 segments (10 x 5 LEDs) with 4 punctuation marks (full stop or colon) with manual/automatic brightness adjustment.
Radio module	433-434MHz multi-frequency transceiver
Radio transmission	Digital FSK transmission; redundant code with information correctness verification and auto-correction
Radio frequencies	433.1125 MHz to 434.7375 MHz
Radio transmission power	10 mW
Radio transmission range	Approx. 150 meters
Processing unit	16-bit microcontroller
Time base	12. quartz 8 MHz, stability ±10ppm between 0°C and +45°C
Power supply	Two internal Pb batteries

Battery charging	Intelligent external Pb battery charger device
Battery life	> 10 hours
Buttons	• START/STOP button • LAP/RESET button
Connections	• Type B MICRO USB connector to connect to a PC • Jack connector for external input/output • SMA connector for connection to an external aerial

1.1 CONTROL PANEL

Figure 2 – Control panel

ANT: radio aerial connector

STATUS: status signal LED.

START STOP: Green START STOP button used for manual START and STOP signals and for modifying values in program settings[1]

LAP RESET: Yellow LAP RESET button used for manual LAP signals and for confirming program settings[2]

USB: USB cable connector for firmware updating

I/O: 3.5 mm jack for external sensors, such as starting pads, start gun sensor, button, etc.

POWER: On/Off switch

SUPPLY: Connector for external power supply and battery charging

[1] This button will hereafter be referred to as START-STOP

[2] This button will hereafter be referred to as LAP-RESET

1.2 POWER SUPPLY AND BATTERY CHARGING

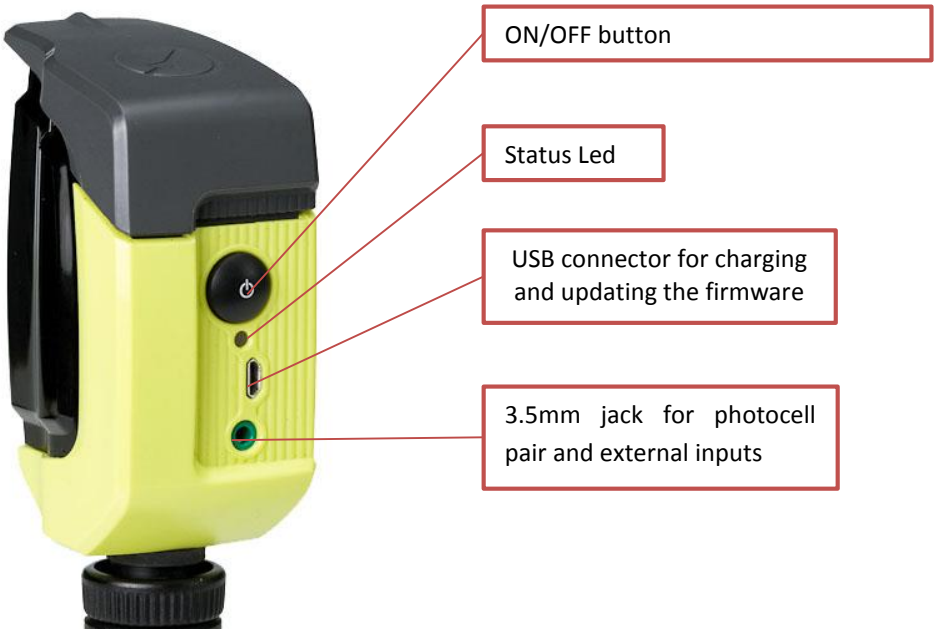
Witty TAB comes with two internal lead batteries ensuring an average 10-hour life. The status LED on the side panel indicates the state of the battery (see table below).
To recharge the display board (or for mains-operated use) connect the power adapter to the Supply socket and to the outlet. A LED on the power adapter (see below) allows monitoring the charging process, which is approximately 5 hours.

STATUS	***STATUS LED on WITTY·TAB***
NORMAL Mode • Battery charged • Low battery • Battery completely empty (LED matrix turned off)	 Green - steady light Red - pause Red - steady light
BOOTLOADER Mode • Witty•TAB has been turned on with the ON/OFF switch by keeping the two buttons (“START STOP” and “LAP RESET”) pressed	 Red - Green

The LED on the power adapter indicates the following statuses:

STATUS	***STATUS LED on the POWER ADAPTER***
• Charging • Charged/maintenance	Yellow Green

1.3 PHOTOCELLS



To **switch on** the photocell press the ON button for one second; the status LED blinks with a green light (if the battery status is sufficient) or with an orange light (if the battery status is low). A continuous beeping sound is produced until the **correct alignment** with the reflector (or a similar reflecting surface) is found.

To **switch off** the photocell press the button until the LED turns red, then release it.

1.3.1 Mounting Photocells and Reflectors on Tripods

To mount the photocells and the reflectors on the tripods supplied with the kit, proceed as follows:

Take the little platform off the tripod's top and screw it onto the photocells and below the reflectors (the platform is square-shaped and therefore allows 4 mounting directions with respect to the tripod). Mount the devices onto the top of the tripod inserting the front of the platform, and then the rear until the tab clicks into place.

Extend the tripod legs to the required height (usually the photocell must be interrupted by the chest of an athlete), and position the photocells and the reflectors at a distance of 1-7 meters.

1.3.2 STATUSES AND COLORS OF THE PHOTOCELL LED

PHOTOCELL OFF	
STATUS	***STATUS LED***
• Battery charged/empty	Off
• External supply • Battery charging	Orange blinking light
• External supply • Battery charging completed	Green steady light

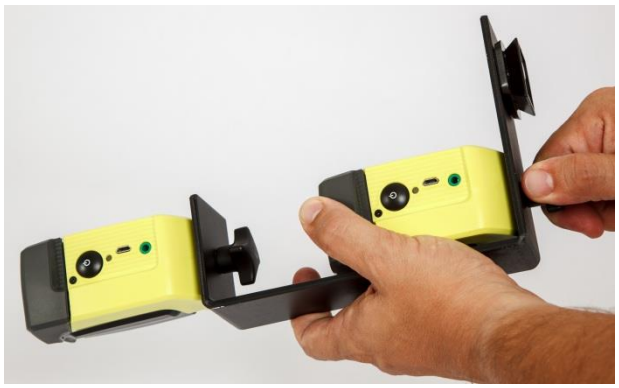
PHOTOCELL ON	
STATUS	***STATUS LED***
NORMAL Mode • Battery charged • Battery empty	Green - Pause Red - Pause
BOOTLOADER Mode • The photocell has not been switched on pressing the ON/OFF button but connecting the USB cable to a PC. This activates the BootLoader HID and the firmware can be updated.	Red - Green
CONFIGURATION Mode • When switching on, the ON/OFF button is pressed for at least 5 seconds and the configuration mode is activated.	Red blinking light
TWO PHOTOCELLS Mode: Master photocell (higher serial number) • Battery charged • Battery empty Slave photocell (lower serial number) • Battery charged • Battery empty	Green - Pause Red - pause Green fast blinking light Red fast blinking light

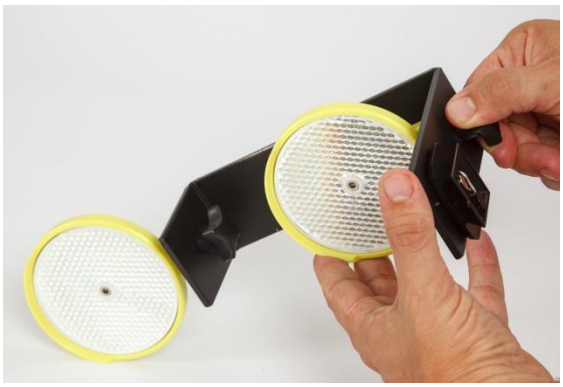
1.3.3 PAIRED PHOTOCELLS

To prevent the photocell being interrupted by an athlete's arm swinging forward, in official competitions or in any case when measurement must be as precise as possible, the use of paired photocells is necessary.

This setup ensures that time is measured exactly when the athlete's chest crosses the line, as the impulse (start/stop/lap, depending on the position) is given only when both photocells are interrupted.

To mount the photocells, screw the C bracket onto the tripod platform, the photocells, and the reflectors, as shown in the figure (the photocells are mounted at 90° with respect to the C bracket).





Then mount the bracket onto the tripod and connect it with the photocells using the jack-jack cable. The **MASTER** photocell is the one with the *higher serial number* and *blinks more slowly* than the **SLAVE**. As the Master photocell transmits the signal to the timer, to ensure a wider aerial range, the latter should always be mounted *on top*.

Master:
Higher S/N,
blinking at regular speed.
Always on TOP!

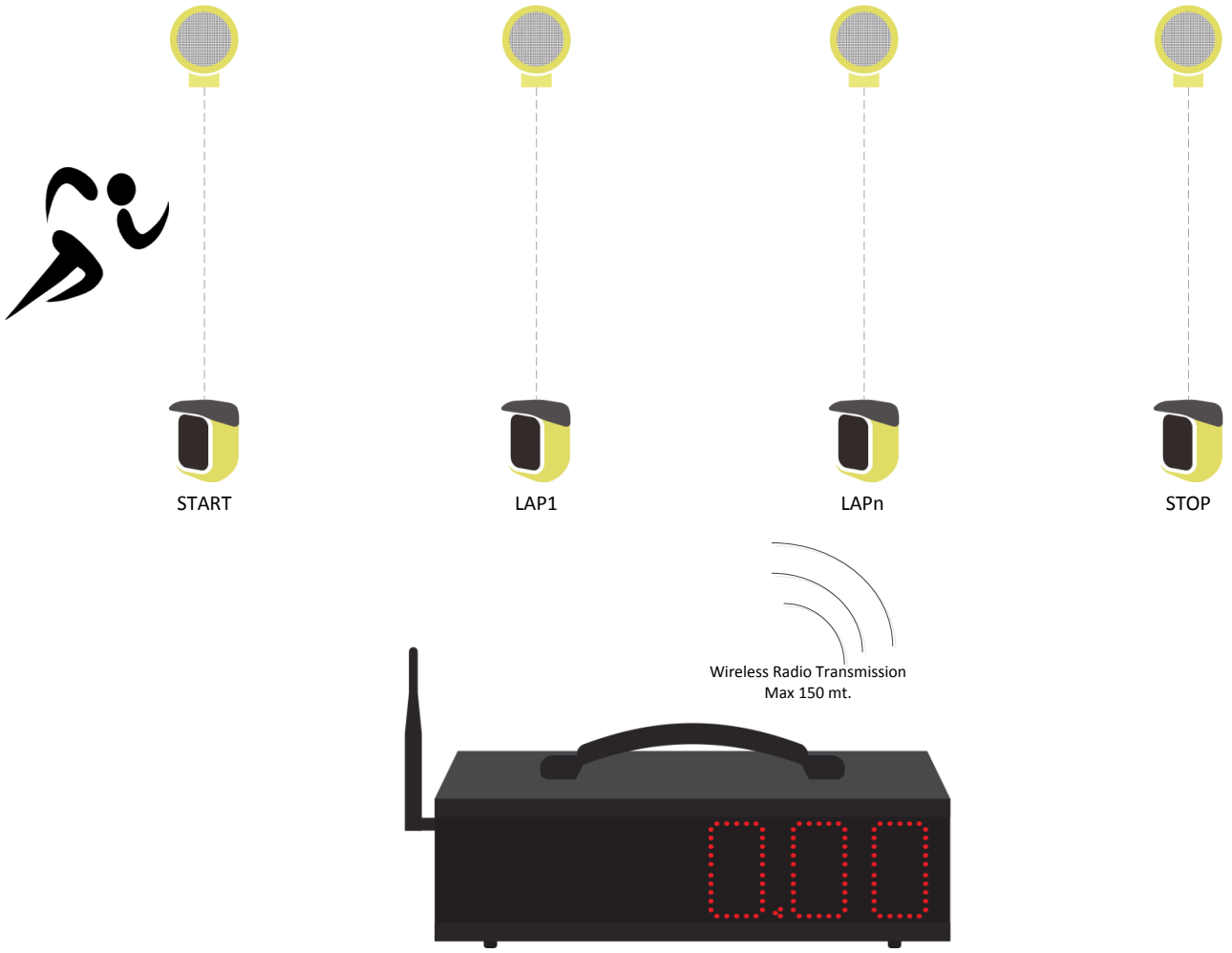
Slave:
Lower S/N,
blinking fast.

1.4 RADIO SYSTEM

The Witty·TAB display board communicates with the Witty photocells via 433Mhz radio transmission with a **maximum range of 150 meters** in standard conditions. To prevent frequency collisions with other Witty·TAB Kits on the field, it is possible to change the transmission channel (of both the timer and photocells, which must have the same channel). Please refer to chapter 2.15 for information about changing the channel number.

In **case of rainy weather** radio transmission can be disturbed by the water drops and therefore the maximum distance must be reduced.

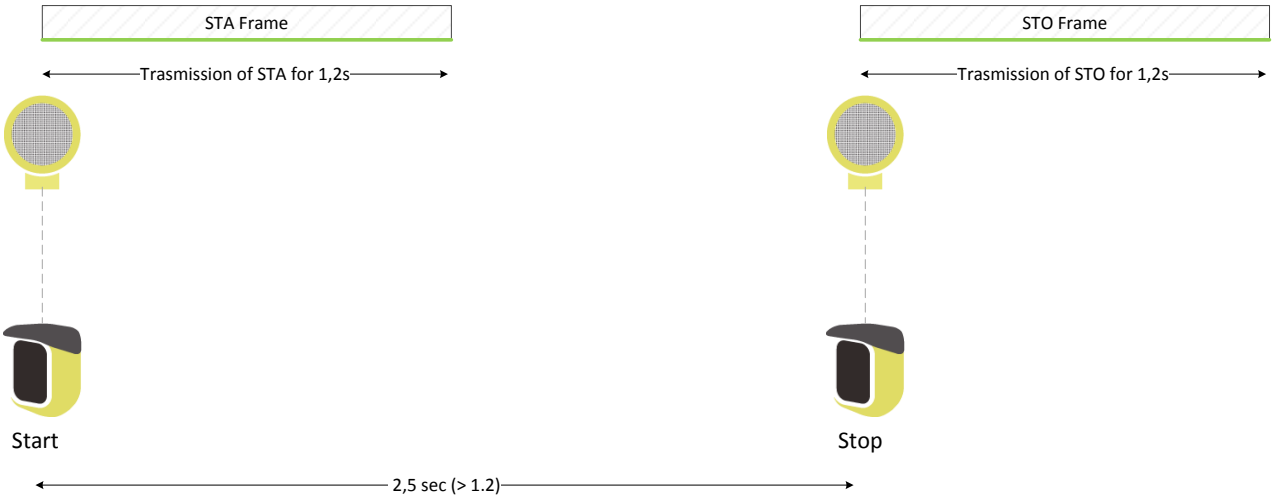
For excellent reception, position the Witty·TAB display board at **a height of at least 50 cm** (without it touching the ground) and **do not place it on top of metal objects**.



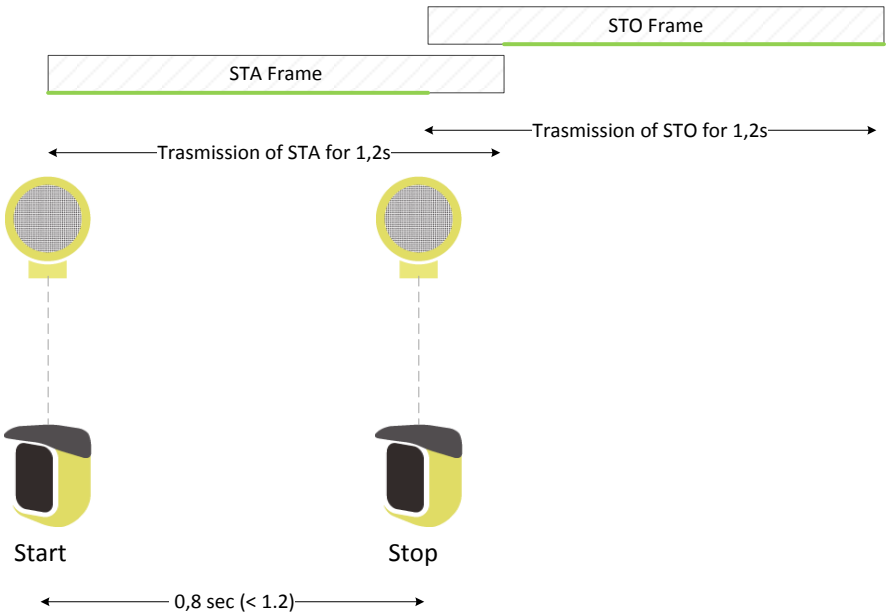
1.4.1 Duration of the Transmission Impulse (Radio Power)

To increase radio transmission reliability, photocell impulse data packages are transmitted repeatedly over a set time of 1.2 seconds. This ensures that, in case of data loss, redundant information can be used to rebuild the event with absolute precision.

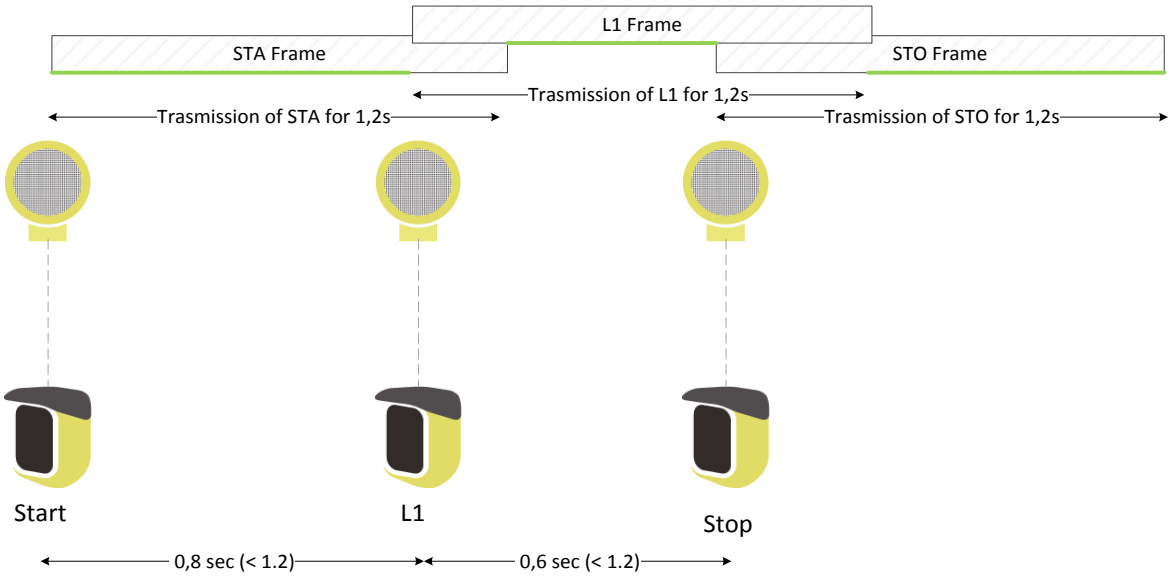
If more than 1.2 seconds pass between two impulses (e.g. start and stop photocell) there will be no problems, of course.



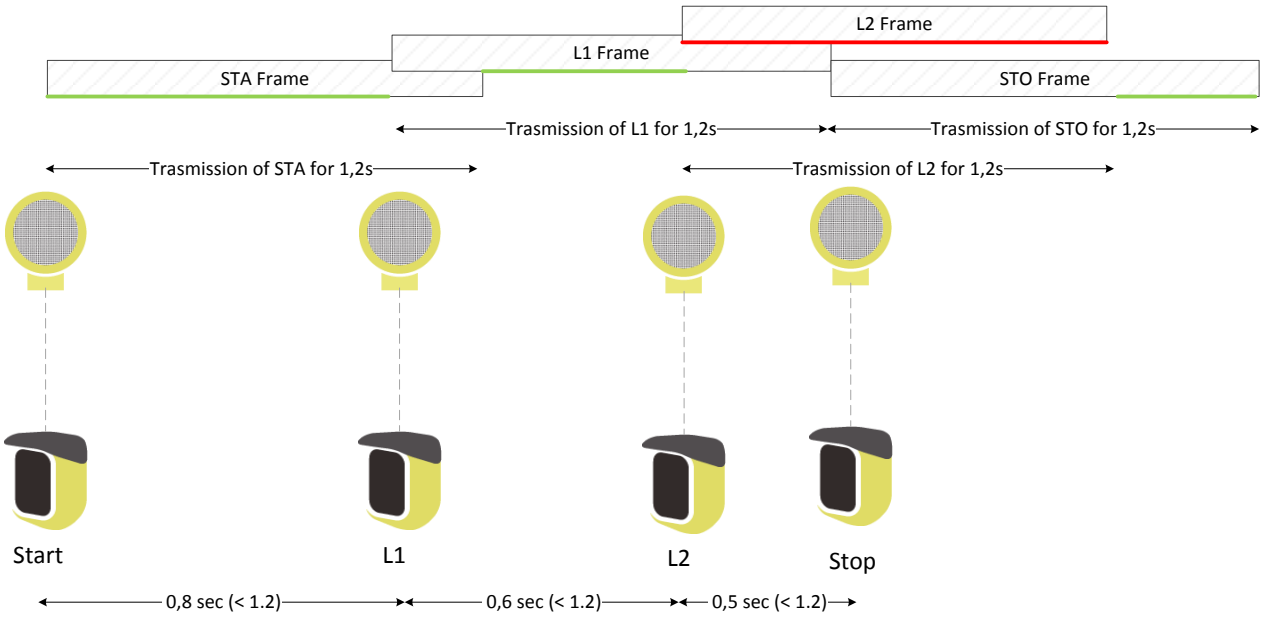
Even if the distance is shorter, the second impulse will be detected anyway, as its "tail" will be longer than that of the previous one.



Problems may arise when intermediate times (Laps) are used and these are very close to each other or between start and stop. Again it is not necessary that the delta (difference) between the impulses be more that 1.2 s; it is enough that the impulse has a "period of time" (green line) during which it does not overlap with others.



If there are many close intermediate times, one of them might be "completely" obscured by the previous or following impulses (as in the case of L2 in the figure below) and therefore won't be detected.



1.5 USE OF THE DISPLAY BOARD IN MANUAL MODE

The display board can be used in manual mode using the two buttons on the side panel:

GREEN START-STOP button: Simulates a START or STOP impulse

YELLOW LAP-RESET button: during a “running time” it simulates a LAP impulse; when the timer is stopped the display board is reset to the starting time

1.6 BRIGHTNESS SENSOR

Display board LED brightness can be set manually (from the menu) or assessed automatically depending on the ambient light detected by the brightness sensor in the lower part of the first digit. There is another sensor on the fourth digit, but only the one in the upper left corner is used for active control.

The manual minimum/maximum brightness values range from 0 to 100% at 5% steps (see program 99)

2 INTERNAL PROGRAMS

The Witty·TAB display board also has a series of internal programs for various needs in athletic performance evaluation.

The programs available at the time of printing this guide are:

#	Name	Description
P0	**Start, Stop**	Basic timing with auto reset after 5 seconds
P1	**Start, Lap1, Stop**	Basic timing with 1 intermediate time
P2	**Start, Lap1, Lap2, Stop**	Basic timing with 2 intermediate times
P3	**Speed**	Speed measurement based upon any length between two photocells
P4	**Lap Speed**	Lap speed measurement with one photocell
P5	**Start, LapN, Stop**	Basic timing with n intermediate times and configurable display time
P6	**Continuous Timing**	Continuous timing, configurable "dead time"
P7	**Starting System**	Start and Stop with reaction time at start
P8	**Event Counter**	Counter increasing automatically with each impulse
P9	**Parallel Event Counter**	Two counters (left and right) for two photocells
P10	**Date and Time**	Displays date and time
P11	**Time**	Time display
P97	**LED Segments Test**	Checks that the LEDs work correctly
P98	**Photocell Radio Signal Test**	Checks the correct radio transmission functioning
P99	**Parameter Configuration**	Configuration of the brightness, radio channel and date & time parameters

To change program follow these steps:

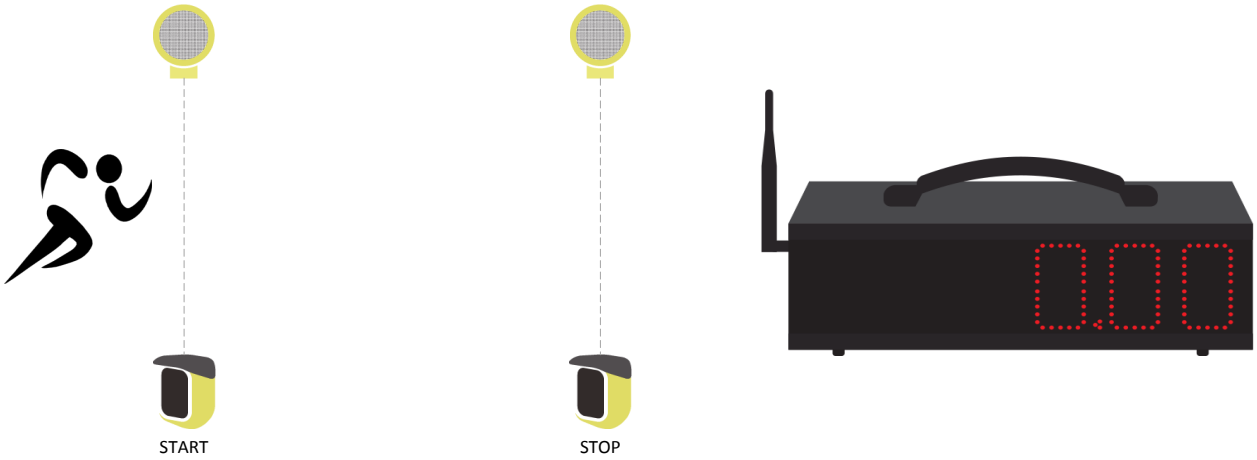
- Keep the YELLOW LAP-RESET button pressed for at least 3 seconds.
- The currently selected program is displayed.
- Press the GREEN START-STOP button to scroll down the above-listed programs.
- Once the desired program has been reached, press the LAP-RESET button to confirm.
- Depending on the chosen program, further settings may be required or the program is executed immediately.

To change the parameters of a particular setting use the GREEN START-STOP button to increase digits one by one every time you press it, **keep pressed to scroll ahead**. When inputting 3-digit parameters (0-999), counter scrolling speed increases after 99.

2.1 P0 – START AND STOP

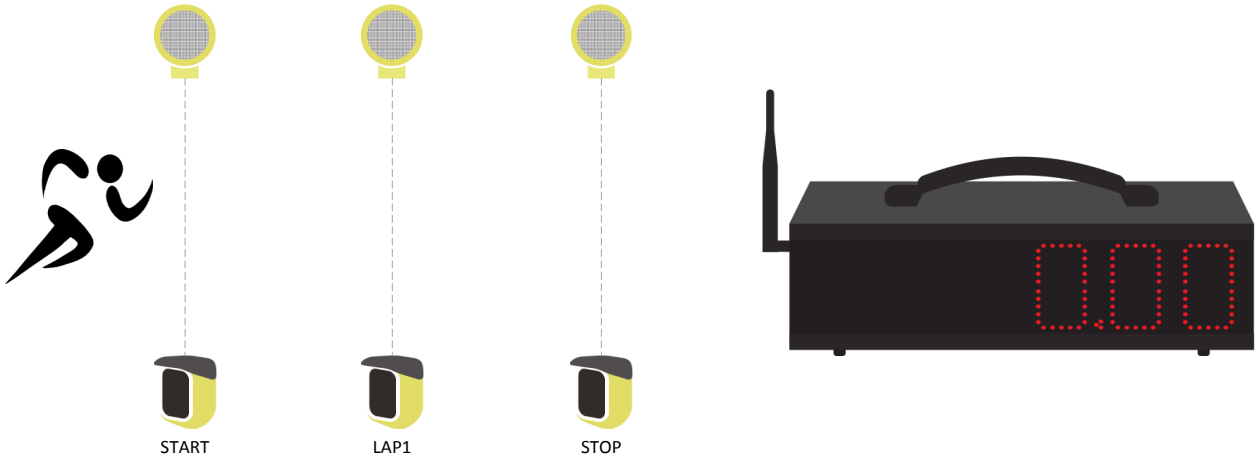
Basic timing program. The impulse of the first photocell starts the running time; the second impulse stops the timer, and the final time is displayed for 5 seconds, finally time is reset. To reset the display board without waiting 5 seconds, press the yellow LAP-RESET button.

No particular photocell configuration is needed (the first impulse is the start impulse, the second is the stop impulse).



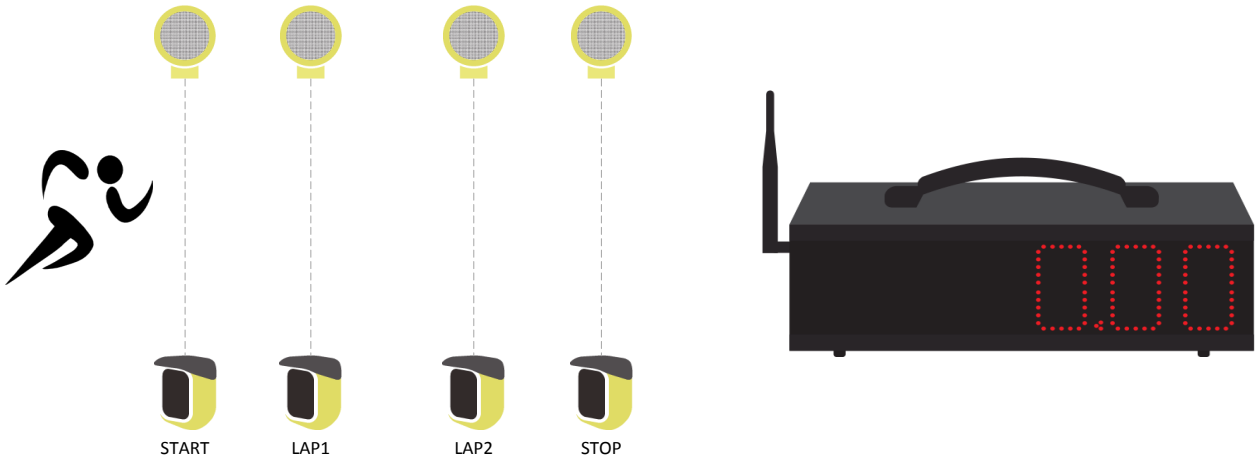
2.2 P1 – START, LAP1, STOP

Similar to the previous but with the addition of an intermediate time. When the second impulse (Lap1) is received, the display board displays the intermediate time for 5 seconds, then the running time is shown again. The third impulse (stop event) has the final time displayed for 5 seconds and then automatically resets to zero.



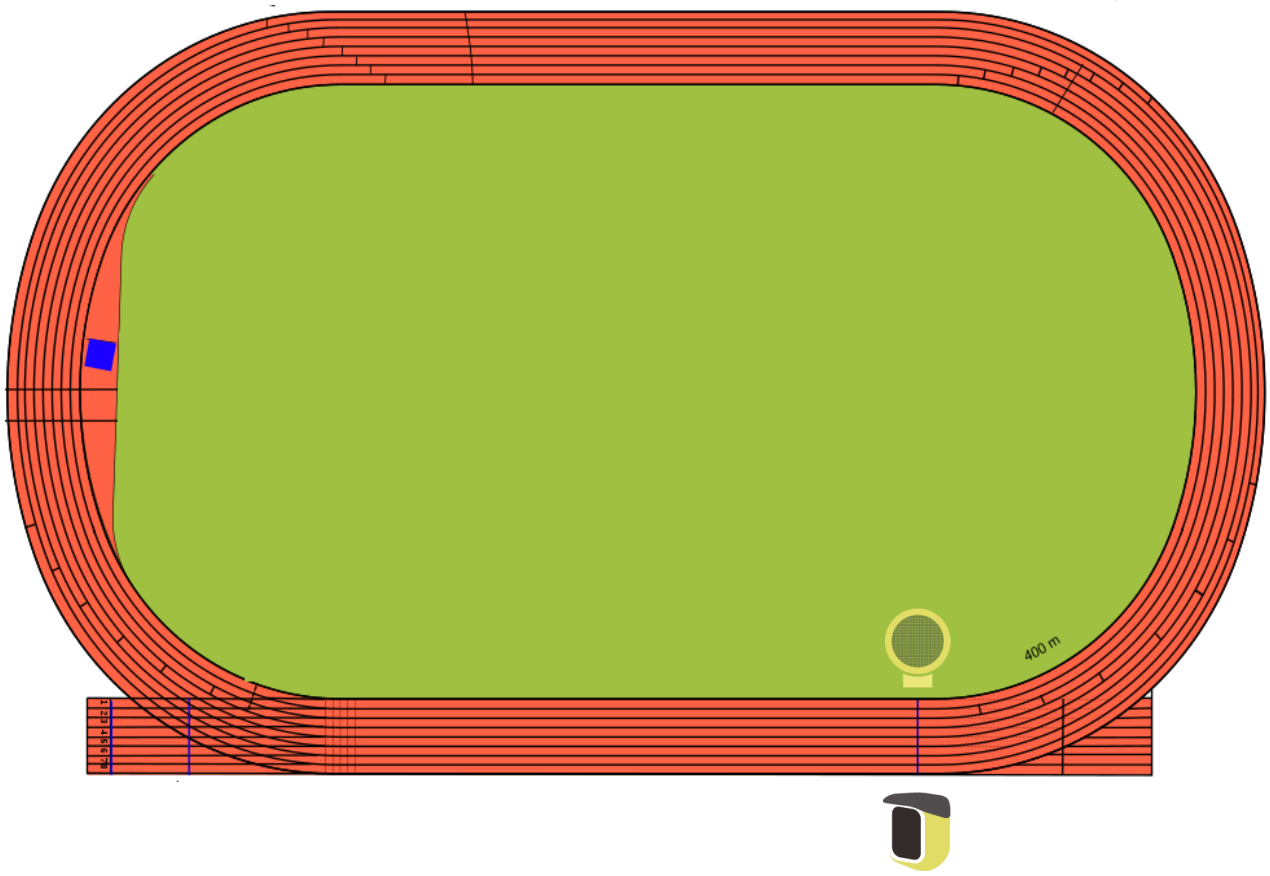
2.3 P2 – START, LAP1, LAP2, STOP

Similar to the previous but with the addition of two intermediate times. Both intermediate times and the final time are displayed for 5 seconds.



In the above-mentioned cases it is not necessary that the number of photocells be the same as that amount of intermediate times, one photocell used as start/stop/lap is enough.

e.g. Lap time on an athletics track



2.4 P3 – SPEED

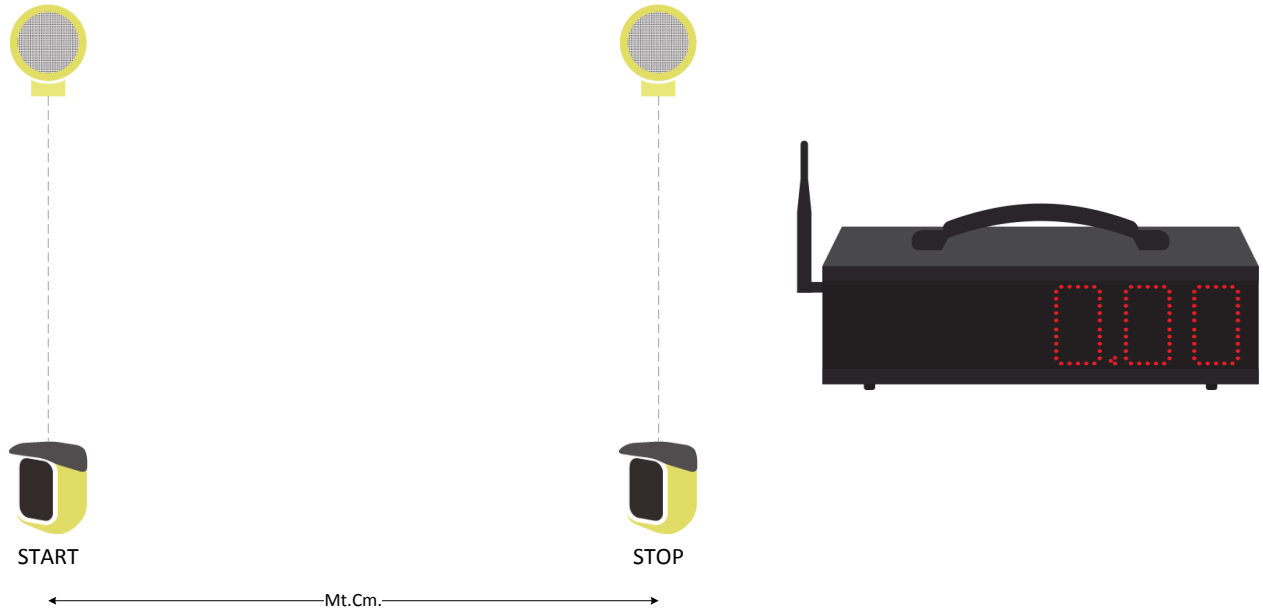
Measures the speed (in m/s, km/h or mph) between two photocells set up at a certain distance.

When the P3 program is accessed, the following parameters are required to set the length of the speed base and the measurement unit:

L ____	Insert the number of METERS of the speed base length (0-999)
C ___	Insert the amount of CENTIMETERS of the speed base length (0-99)
S _	Insert the measurement unit: 0 = m/s 1 = km/h 2 = mph

e.g. Speed base 36.58 meters (40 yards), measurement unit mph

When the display board receives the first impulse, it displays -- -- -- -- , after the second impulse it shows the calculated speed until the next impulse is detected or the yellow Lap-Reset button is pressed.



Please note: the P3 program expects the impulses to be coming from two different photocells, so for timing the lap speed use program P4.

2.5 P4 – LAP SPEED

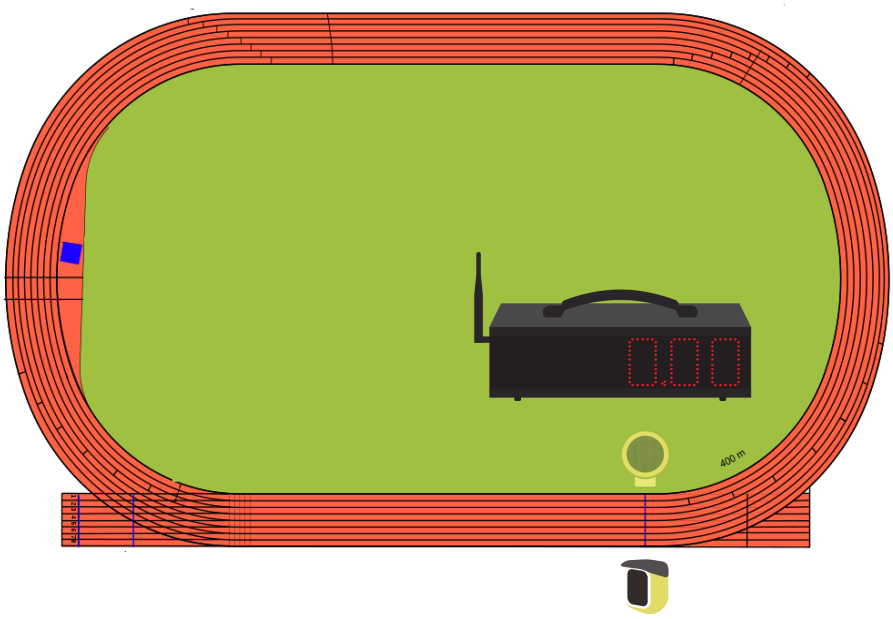
Measures the speed (in m/s, km/h or mph) between two impulses from the same photocell. Usually the speed base length refers to the lap (e.g. 400 m athletics track)

When the P4 program is accessed, the following parameters are required to set the length of the speed base and the measurement unit:

L ____	Insert the number of METERS of the speed base length (0-999)
C ___	Insert the amount of CENTIMETERS of the speed base length (0-99)
S _	Insert the measurement unit: 0 = m/s 1 = km/h 2 = mph

e.g. Speed base 400 meters measurement unit km/h

When the display board receives the first impulse, it keeps displaying 0.00; after the second impulse it shows the calculated speed, displaying it until the next impulse is detected (second, third, nth lap) or the yellow Lap-Reset button is pressed.

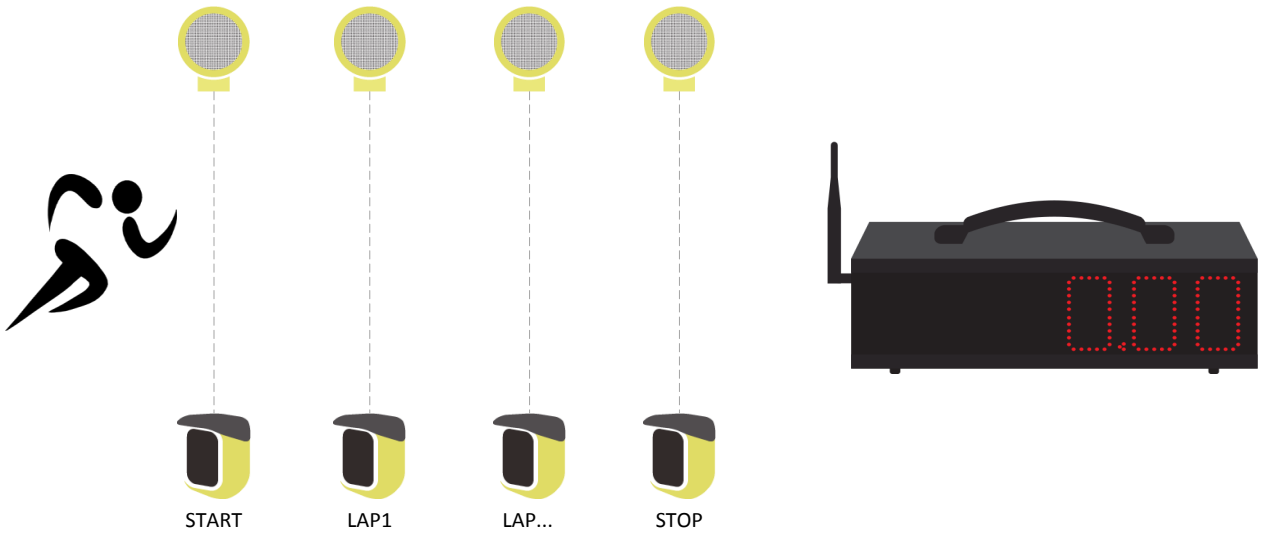


2.6 P5 – START, LAPN, STOP

Basic timing program with the possibility of defining any amount of intermediate times, as well as the display time (in seconds) of the final time.

L __	Insert the number of LAPS (0-20); for inline timing it equals the number of photocells - 2 (exclude the start and stop photocells)
t __	Insert the amount of SECONDS the final time is displayed (5-60)

e.g. Three intermediate and waiting times of 10 seconds after arrival before resetting the timer



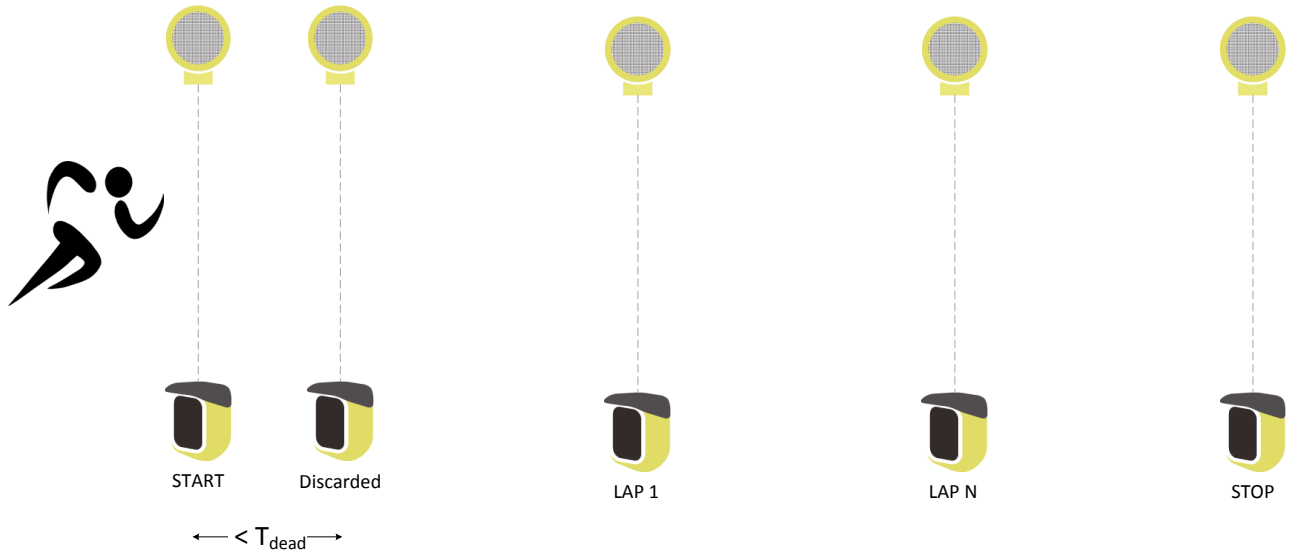
2.7 P6 – CONTINUOUS TIMING

Continuous Timing Program with the possibility of setting a number of seconds - the so-called "dead time" -, during which incoming impulses are not considered.

Time keeps running until the yellow LAP-RESET button is pressed and every incoming impulse is considered as a Lap.

t __	Insert the amount of SECONDS of the dead time, during which no impulse is accepted (0-60)

e.g. Three-seconds dead-time

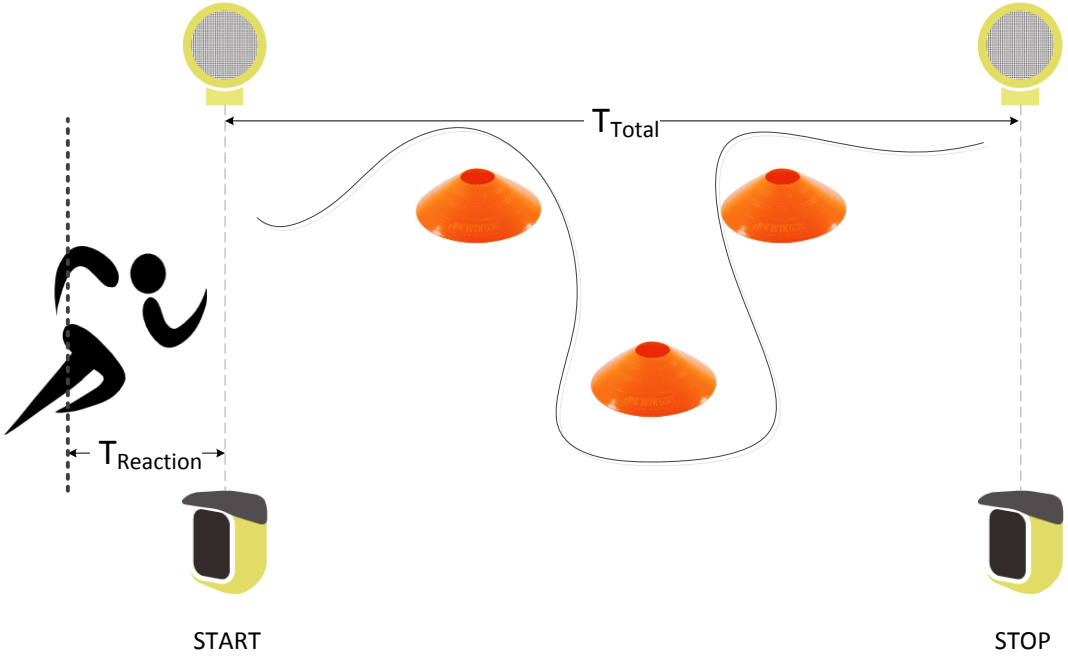


2.8 P7 – STARTING SYSTEM

Program for testing the start reaction time, a circuit or a sprint lap.

The program includes the following steps:

- the trainer (or athlete) **starts the test** interrupting the photocell or pressing the green START-STOP button
- The display board shows a **5-second countdown**
- After 5 seconds the display board resets and after a **random time of 0-5 seconds** the writing "GO" appears
- If the athlete starts BEFORE the writing GO appears, the display board detects a **false start** and shows a blinking FFFFFF
- If the athlete starts after the GO sign, the **reaction time** (e.g 0.31) is shown on the display board for 5 seconds
- The athlete runs his stretch and when he interrupts the photocell (the same as the start photocell on a ring circuit, or otherwise a second photocell) the total test time is displayed for 5 seconds.
- The display board goes back into waiting mode for the next athlete, displaying ------

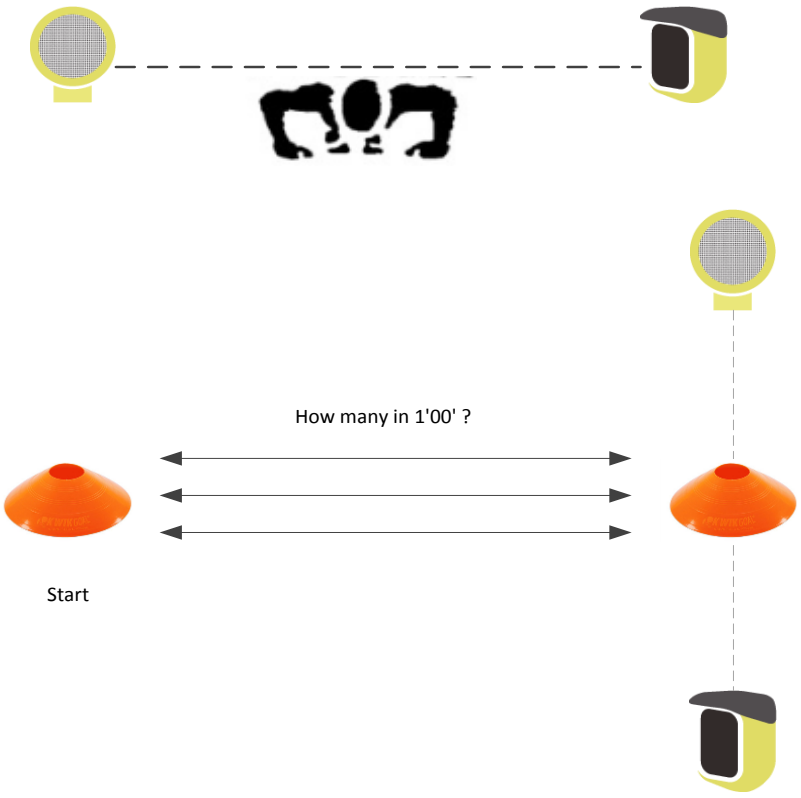


In order to have homogeneous data for various athletes, it is advisable that they all start at the same distance from the first photocell, for instance applying an adhesive strip a few cm before it.

2.9 P8 – EVENT COUNTER

This program works as a counter that is increased with each impulse (or when the green START-STOP button is pressed). To reset the counter press the yellow LAP-RESET button.

Examples of use: counting push-ups or "Go & Back" in a certain amount of time.



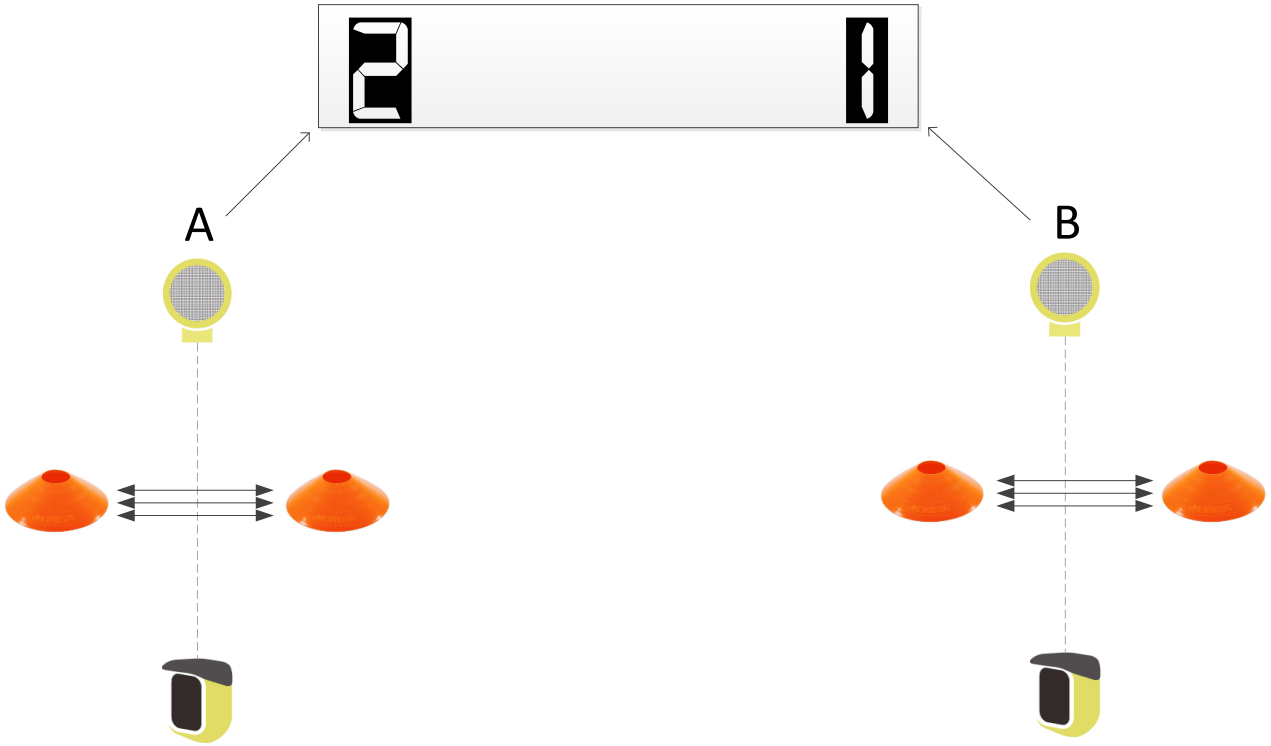
2.10 P9 - PARALLEL EVENT COUNTER

Similar to the previous program, but for parallel tests (of the same athlete or two different athletes) two photocells are used.

The first impulse of two photocells is used to define which photocell is displayed on the left side and which on the right side.

In the example below first interrupt photocell A so that it is shown on the left (the display board changes from "-" to "0") and then photocell "B"; when both sides show "0" the test can begin.

To reset both counters press the yellow LAP-RESET button.



2.11 P10 – DATE AND TIME

This program allows you to display the date and time of the internal Witty·TAB clock. The number of seconds after which date and time alternate can be defined by the user. To set the exact time and format (EUUS) see par. 2.15

t __	Insert the number of SECONDS after which date and time alternate (5-60)

2.12 P11 – TIME

This program allows you to display the time of the internal Witty·TAB clock. To set the exact time and format (EUUS) see par. 2.15

The two possible date and time formats are as follows:

- **EU** = DD.MM.YY HH:MM:SS (24h)
- **US** = MM.DD.YY HH:MM:SS AM/PM

2.13 P97 - LED SEGMENTS TEST

The Test Segment Program is used to check the correct functioning of LEDs: the display board turns all 7 segments of the 6 digits and all punctuation marks on and off. If a segment or a LED does not turn on, please contact our technical support.

Pressing the green START-STOP button, the test of each segment is alternated when all segments are turned on simultaneously (full display test). To begin a new test press the yellow LAP-RESET button.

2.14 P98 - PHOTOCELL RADIO SIGNAL TEST

The Radio Signal Test Program allows checking the correct functioning of radio transmission between photocells and the display board, as well as the signal power (0-100%).

Enter the P98 program and generate an impulse interrupting the photocell/reflector beam. If nothing appears on the display board, check (and change) the transmission channel as per program P99 (see chap. 2.15).

If the impulse is received, on the left side a counter is shown which increases with each impulse and on the right side the percentage indicating the signal power.

To begin a new test press the yellow LAP-RESET button, in order to reset the counter and percentage.

2.15 P99 – PARAMETER CONFIGURATION

The program P99 allows setting three different parameter types, i.e. the radio channel, the brightness, and internal time/date.

Changing the Radio Channel (display board and photocells are set on CH.1 by default) may be necessary to prevent frequency collisions with other Kit Witty·TAB on the field.

Put the n photocells that must be set into "*configuration mode*": turn off the photocells and then press and hold the on/off button for 5 seconds (see chap. 1.3.2). When all photocells have a red blinking light, continue with the channel configuration on the Witty·TAB. Confirming the channel number with the yellow LAP-RESET button, it is transmitted to all listening photocells emitting a dual tone beep, restarting them and turning them on in normal mode. Use the P98 program (chap. 2.14) to ensure that the channel has been set correctly.

CH _	Insert the radio channel number (1-8) assigned to the display board and to all photocells which are in "*configuration mode*" in that moment
L _	It is possible to choose between Automatic ("A") brightness or set to a fixed value of 0-100 (with steps of 5), where 100 is the maximum brightness and 0 the minimum. (see also chap. 1.6)
d:t:__	Choose the date/time format, either "EU" (= DD.MM.YY; HH:MM:SS 24h) or "US" (MM.DD.YY HH:MM:SS AM/PM)
Date	Insert Day, Month, Year (or Month, Day, Year for the US format)
Time	(Only for the US format) choose if AM/PM have to be added to the time displayed Insert Hours, Minutes and Seconds of the current time (for the EU use the 24h format)

When confirming the last settings (the seconds of the current time) using the yellow LAP-RESET button, the previously selected program appears.

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