USER'S REFERENCE.

race result System 4000 series.

race | result

Precision. Passion. German Engineering.

www.raceresult.com

TABLE OF CONTENTS

1. SAFETY AND REGULATIONS

1.1. General Safety Responsibilities

This unit has been designed and tested in accordance with the CE Certificate of Conformity and has left the manufacturer's plant in condition, fully complying with safety standards.

To maintain this condition and to ensure safe operation, the user must observe all instructions and warnings given in this operating manual.

Applicable local and national safety regulations and rules for the prevention of accidents must be observed in all work performed.

1.2. FCC/IC Statement

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules and with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

1.3. Warnings and Cautions

The following alerts are used in this manual:

- WARNINGS alert users of potentially dangerous situations.
- CAUTIONS alert users of potential equipment damage.

Warnings and cautions are indicated by:

- the text WARNING or CAUTION,
- a description explaining the hazard and how to avoid it,
- an icon: 

1.4. Where to Operate the System

UHF operates globally on different frequencies (e.g. Europe 865 - 868 MHz, USA 902-968 MHz) with different detailed regulatory requirements. That is why race result provides different versions of the system for different regulatory areas. When operating the passive part of the system in another country, make sure it complies with local regulation.

The active part of the system, on the contrary, runs on universal frequencies that can be used globally.

2. DECODER BOX EXPLAINED

2.1. What Does the Decoder Box Do?

The race result decoder receives the signals from the transponders through the antennas, and calculates and saves the final detection time, based on a very precise clock and the transponders' signal strength when crossing the timing line.

It provides these passings (bib number, time, and additional information) to the scoring software such as *race result 11* or uploads the data directly to an Internet server.

The decoder does not perform further calculations such as calculating the net time, lap times, etc. All this will be done by the scoring software.

It also guarantees uninterrupted operation as it runs independently from a computer and external power supply. All passings information is automatically stored on the device.

2.2. Accessing Timing Data

The timing data ("detections" or "passings") can be retrieved three different ways:

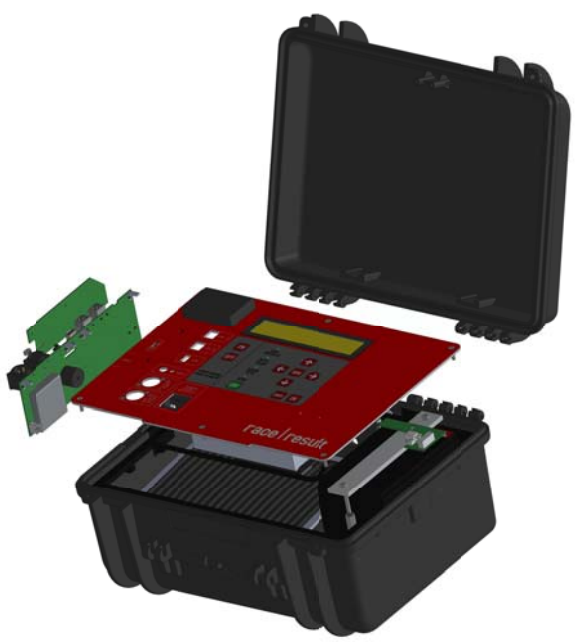
- via the Ethernet interface (see chapter 8)
- via the USB port (see chapter 9)
- When uploading the data through the internal GSM modem, the data can be downloaded from the Internet (see chapter 10).

2.3. Case

The electronics of the race result decoder are integrated into a solid hard case. Because of the connectors on the front panel, the front panel is not water-proof. Therefore please note:

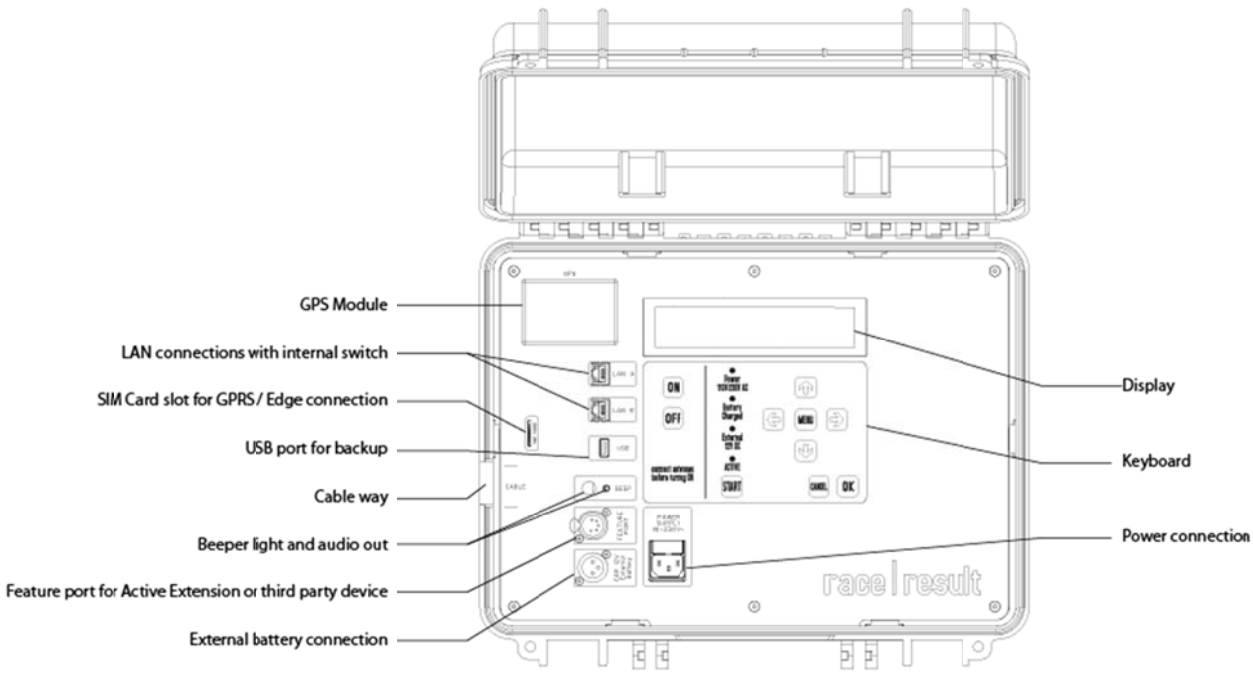
*During **rain**, the lid of the decoder must be closed and locked. Therefore, all cables have to be led through the slot between front panel and lid on the side.*

*When operating the system during hot temperatures (>25°C / 80°F) and located in **direct sun light**, the lid should not be closed. Otherwise, the system may perform a temperature triggered emergency shutdown.*



2.4. Connectors

The decoder box has the following connectors on the front panel:



Power: Power supply, 110-240V, 50/60Hz.

External Battery: Using the enclosed cable, the decoder can be connected to an external battery or a cigarette lighter of a car (see chapter 13).

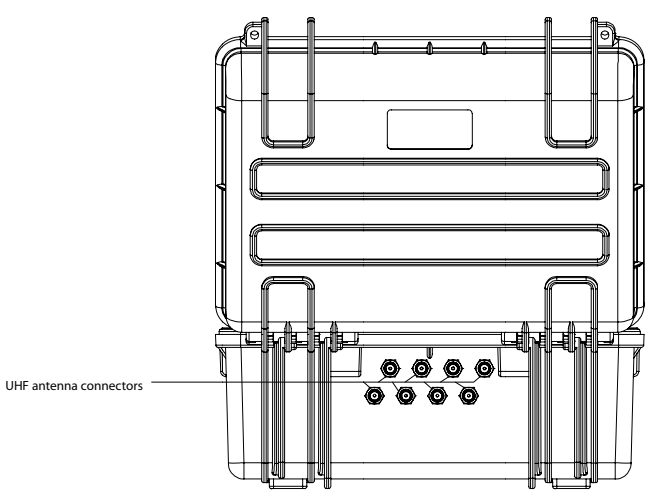
Ethernet: The detections can be read through a network connection (see chapter 8).

USB: Using the USB port, the detections can be saved on a USB stick (see chapter 9).

Audio: The decoder contains an internal beeper, which will give an acoustic signal on each detection. Alternatively, you can connect an external speaker or headphones. The internal beeper will then be turned off.

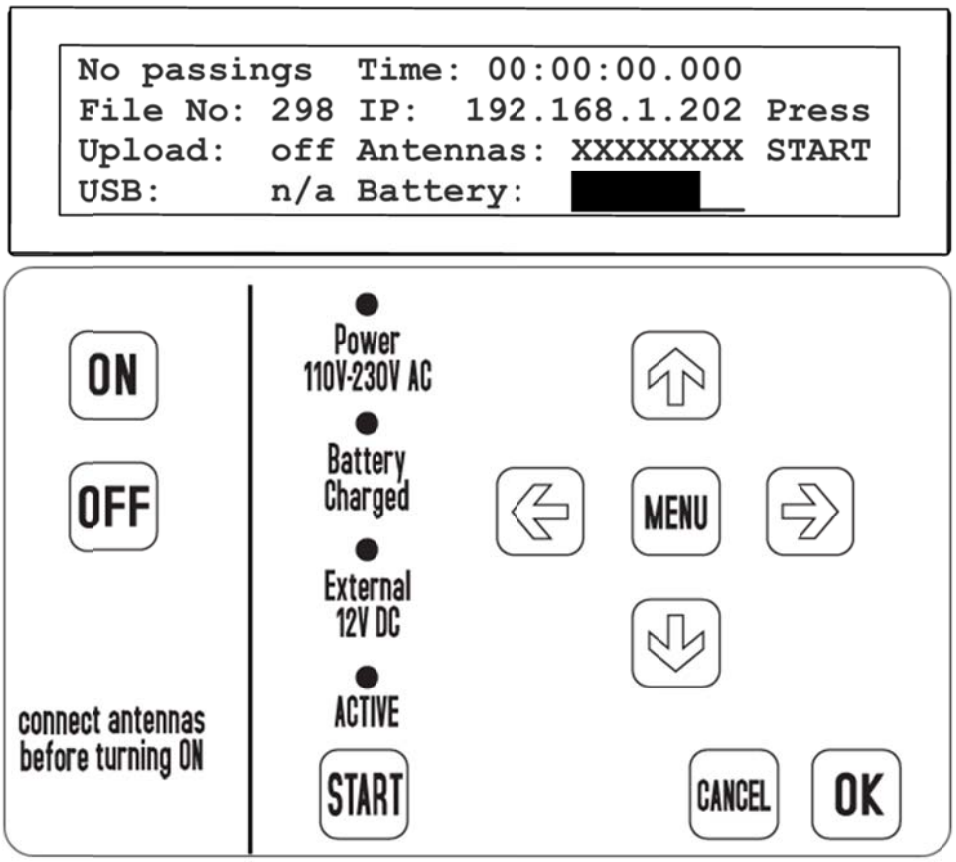
Feature Port: The Feature Port serves to connect additional accessories, including the Active Loop (see chapter 12).

Additionally, the decoder box has 8 antenna connectors for the passive UHF antenna on the back (see chapter 3).



2.5. Display, Main Screen and Keypad

The display has an integrated backlight and is easy to read in both darkness and sunlight.



The display shows the following status information:

Left Column

Count: shows the number of detections since the last start, or *No Passings.*

File No: shows the number of the current passings file, see chapter 5

Upload: shows the status of the server upload, see chapter 10.1

USB: shows the status of the USB stick, see chapter 9

Middle Column

Time: shows the running time (can be time of day or race time, see chapter 6)

IP: shows the IP address of the system, see chapter 8

Antennas: shows the status of the eight passive antennas or the status of the active loop.

Battery: shows the state of the internal battery, see chapter 2.6

Right Column

Shows the ID of the last 4 transponders detected (or *Press START* when still in Test Mode, see chapter 5)

2.6. Battery

The decoder has an internal lead acid battery of 15Ah capacity which will last approximately 8 hours with the passive antenna or 24 hours with the active loop.

It can be charged while running, so it is recommended to connect the decoder to external power during the race when available.

Charging an empty battery takes approx. 4 hours when the decoder is turned off, and 8 hours when running. The LED *Battery Charged* on the keypad indicates the battery has been charged by at least 75%.

The battery fulfills IATA Special Provisions A48 and A67. The system can hence be handled as common cargo for both air shipment and boat shipment.

3. PASSIVE UHF ANTENNA SETUP

The passive UHF antenna cables connect to the antenna ports on the back of the decoder and are used to detect the race result passive chips. Compared to the active transponders, the passive chips are far less expensive but have less precision and need to be attached (to the race bib, or to an athlete's ankle, shoe or bicycle) in a certain way for reliable detection.

race result offers two types of antennas for use with passive chips: the ground antenna, used for almost any type of race (running, triathlon, mountain bike, etc.); or the side antennas, which can be used for a flat finish line (avoiding the slightly raised profile of the ground antenna) or for special applications such as canoe races, skateboard races, etc. Note that the side antennas have two major disadvantages:

1. When several athletes pass the timing line they may block the signal from the antenna as the signal does not go through the human body. In other words, the side antenna should only be used for low-density split timing points.
2. Since the antenna field is horizontal and does not have a defined end, chips close to the timing line can be detected easily. That is why the side antennas are not recommended for finish line scenarios when athletes can stand close to the system.

In consequence, use the side antennas only when necessary. Note: side antennas may not be available for sale in all regions.

3.1. Ground Antenna

When setting up the ground antenna, please carefully follow the instructions in the separate antenna manual. In particular take care of the barrier around the antenna in order to detect only those participants crossing the timing line and not those standing close by the antenna.

Also, follow the instructions showing how to unfold and fold the antenna. The method described is most efficient and makes sure that the antenna will not be twisted.

3.2. Side Antenna

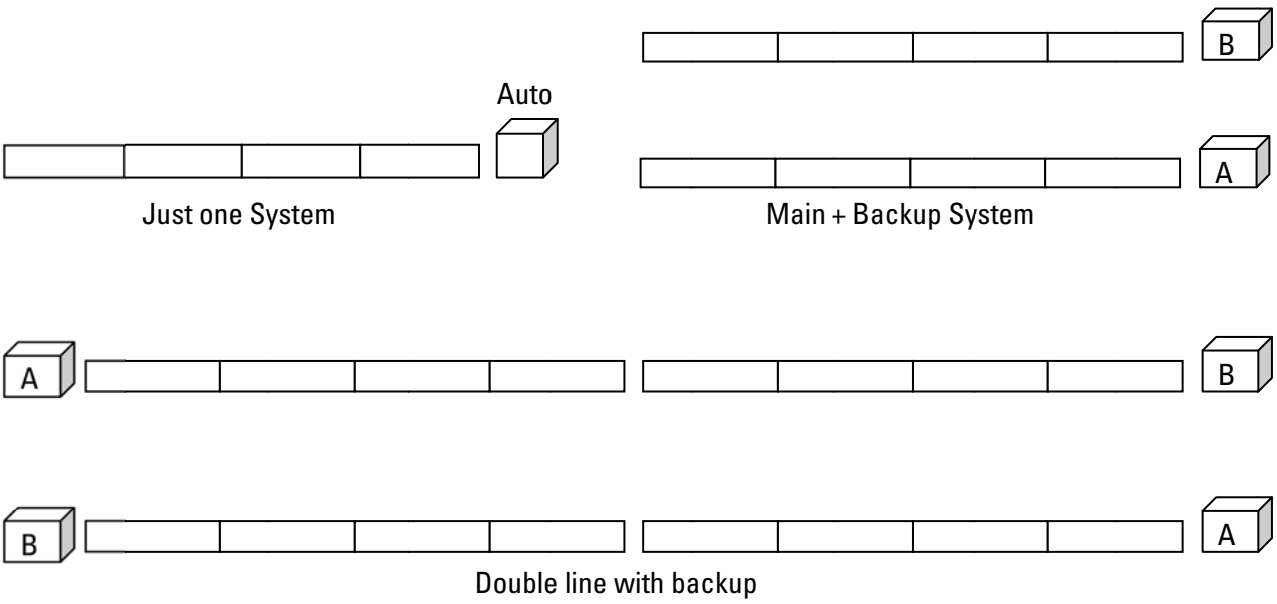
When setting up the side antennas, please carefully follow the instructions in the separate side antenna manual.

3.3. Connecting the Antennas to the Decoder

For maximum performance the antennas need to be connected before turning on the decoder since it performs a fine tuning while booting. When connecting the antennas after turning on the decoder, the system still works but the performance may be slightly reduced.

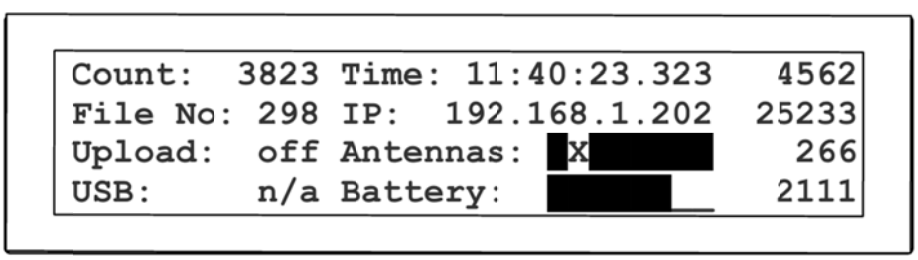
3.4. Frequency Setup (EU Systems Only)

In Europe, UHF has a very small bandwidth, which means two or more systems at one timing point can interfere with each other. When using several European race result Systems at the same timing point, different frequencies should be set in order to reduce interferences. In the *Frequency* menu you can chose between an Auto mode, frequency A and frequency B. Please see recommended frequency settings in the graphics below.



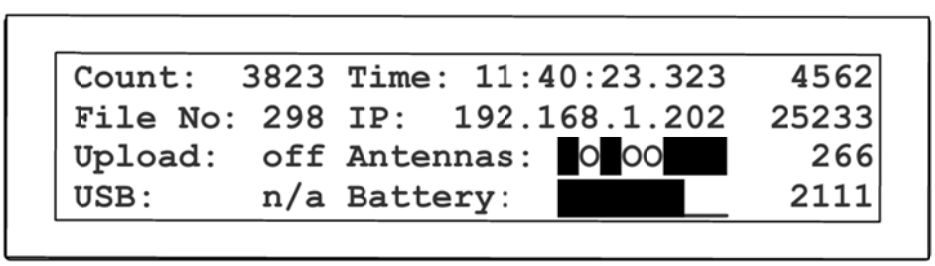
3.5. Antenna Indicator on the Display

The display will show a block (▮ - or A/B if one of these frequencies has been selected, see above) for an antenna port if an antenna is connected, or an X if no antenna is connected or if the antenna is broken:



The left-to-right order of the antenna indicators mirrors the left-to-right order of the ports on the back (or right-to-left when looking from the rear).

When an antenna detects a chip, the symbol will switch to a O for the duration of one second.



4. ACTIVE LOOP SETUP

The active transponder is a very different technology compared to the passive chips. Active means that the transponder has a battery and is thus more powerful, has more features and higher precision.

Most of the time the transponder is sleeping, but when in close proximity to a race result loop, the 125kHz signal from the loop will wake up the transponder. It starts analyzing the 125kHz signal and if it stems from a race result loop, it will turn on its microcontroller which analyzes the signal strength from the loop, calculates the time when it crossed the center of the loop, and transmits this information on a 2.4GHz channel to the decoder. When the decoder acknowledges that the data has been received, the transponder goes back to sleep.

4.1. General Setup

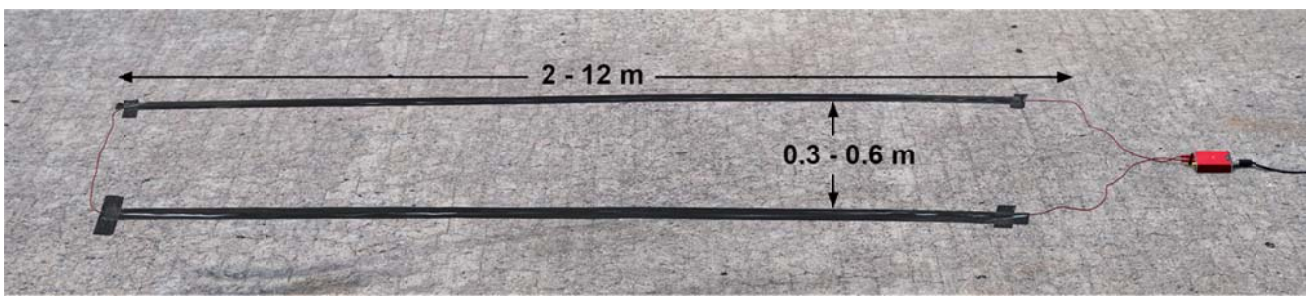
The active system is set up by 1) connecting the Active Extension to the Feature Port of the main decoder, and 2) connecting the cable loop to the Active Extension.

Note: the system will automatically detect the Active Extension; no further configuration required.

4.2. Setting up the Cable Loop

In most cases the cable loop will be laid on the ground and either taped down with duct tape or covered by a mat. Make sure that the loop forms a rectangle with 30 – 60 cm width. If you require higher precision, the loop should be narrower, and greater care must be taken to set up the loop precisely. Note that 0.01 second means only 5cm distance at 70km/h. So when fixing the loop a few centimeters askew, this will have a negative effect on precision.

A wider loop, on the other hand, will result in higher read height but less precision.



4.3. Loop Power

In the *Active Extension* menu (only visible when an Active Extension is connected) the loop power can be set, i.e., how much power the decoder sends through the loop. Higher loop power results in higher read height above the loop, but less precision.

Depending on the type of sport, choose the appropriate value. For example for cycling (high precision needed, transponder fixed on the bike and thus close to the loop) choose a low value like 25%. However, if participants wear the transponder on the wrist and can finish with their arms raised, choose a high loop power like 75% or 100%.

Depending on what materials happen to be underground at the timing point, the maximal read height with 100% loop power is 2-2.5 meters. Metal in the ground will reduce the read height.

Note that the read height is independent from the loop length. The system automatically determines the length of the loop and adapts the real power on the loop accordingly, so that the same percentage value should always result in roughly the same read height.

4.4. Channel ID setup

The back channel from the transponder to the decoder operates on 2.4GHz which is a worldwide public band also used for many purposes, such as WiFi. Within this band, the active system can use 8 different frequency channels. When the loop activates the transponder, it also encodes the channel ID on the loop signal so that the transponder knows on which channel the decoder is listening for the reply from the transponder.

By default, the Channel ID is set to *auto*. In this case, the system performs a channel survey when turned on and selects the channel used the least in order to avoid interferences between the active system and other devices. Note that

- even if a channel is heavily used by WiFi there would still be sufficient gaps to operate the active system on the same channel.
- Auto mode will usually select channel 1 because this channel is not used by WiFi and is often completely free.

If necessary, a different channel can be selected on the main decoder. The system will first perform a channel survey and then show the channels and their qualities.

4.5. Loop ID Setup

When activating a transponder, the loop also transmits a loop ID. When transmitting the detection back to the decoder, the transponder will also transmit this loop ID. This way, several active systems can run on the same channel: decoders within an area will 'hear' the detections from all loops but only process those from transponders that have been activated by their own loop.

Similar to the channel ID, the loop ID can be set in the menu of the main decoder but normally runs in an *auto* mode: every Active Extension sends out a status beacon every second on 2.4GHz. When turning on a decoder with auto loop mode, it will listen a few seconds for the signals from the other decoders and then select an unused loop ID.

The auto loop mode is easy to use and fool-proof, but it may make sense to assign fixed loop IDs so that you immediately know which loop ID belongs to which decoder. Make sure not to assign a loop ID twice – otherwise you will receive the detections on both decoders (when running on the same channel).

4.6. Possible Loop Issues

The Active Extension monitors the status of the loop constantly and can report the following loop issues which will be shown in the display of the decoder:

Loop Error: The loop is not connected anymore or has been cut. This error will be signaled by the decoder with a long beep sound.

Loop Limit: The system cannot provide enough power for the selected loop power. Either the cable is too long or too thin.

Overflow: Transponders are being detected faster than they can be transmitted from the Active Extension to the main decoder (~50 per second).
The Active Extension has an internal buffer for 1000 detections. Should this buffer be full detections will get lost and the decoder will show the *Overflow* error.

5. TEST MODE AND TIMING MODE

5.1. Test Mode

After booting, the system is in test mode, i.e. it does not store any detections. Instead, it steadily beeps/blinks when seeing a transponder. This way:

- the set up of the system can be checked easily to make sure it detects as expected
- you do not need to filter any detections in the scoring software from athletes' warm-up before the race.

5.2. Timing Mode

The timing mode will be started when pressing the *START* button on the key pad. If not running on day time/GPS time, the time will start from 0:00:00 and the decoder will immediately start processing and recording every chip passing the antenna.

5.3. Stopping Timing Mode

The timing mode can be stopped by pressing the *Cancel* button or by selecting the entry *Stop Timing* in the menu. The system will then be back in Test Mode.

Next time the Timing Mode is started, the system creates a new file for the detections, indicated by a new file number on the main screen. Note that:

- Through the Ethernet interface, only detections from the current file can be read.
- All (old) files can be accessed any time through the browser (chapter 14) or USB stick (chapter 9).

5.4. Marker

When pressing the *START* button again in Timing Mode, an additional marker will be created. A marker is a fake detection with a certain bib number which can be used in the scoring software, e.g. to indicate the start of a second start wave.

In the *Feature Port* menu the bib number of the fake detection can be defined. There also is an option to increase this number every time a marker has been created.

Markers can also be set using feature port accessories (e.g. push button, light barrier, see chapter 12).

5.5. Startup Options

In the *System* menu the *Startup* option can be set to *"GPS time & activate"* to switch to Timing Mode using GPS time immediately after booting.

6. TIME SETUP

6.1. How to Set Decoder Time

While in Test Mode (see chapter 5) the time of the decoder can be set via the *Time* menu. The following options are available:

Set Running Time: The time entered will be set and start running even while being in Test Mode. This option is usually used to set the clock time / time of day.

Set Start Time: The time entered will be set, but will not start running before starting the Timing Mode. This option is usually used to set the time to 0:00:00.

Set GPS Time: When using this option the system will try to receive the precise time from a GPS satellite. It may be that the GPS signal cannot be received inside buildings and under trees. In this case the system will show an error message after 15 seconds.

6.2. Startup Options

In the *System* menu you can enable the S*et GPS Time* Start-up option. In that case the decoder will set the GPS time after finishing booting (if reception is sufficient).

7. DETECTION SETUP

7.1. Dead Time

The *Dead Time* in the *Detection* menu defines the minimum time between two reads of the same chip. After a chip read, more reads of the same chip will be ignored for the duration of the dead time. The default value is 5000ms. It can be set to value between 0 and 9999ms.

In addition to the dead time in the system, a higher double detection time out (e.g. 30 seconds) may be set in the scoring software.

7.2. Reaction Time

As a chip approaches the ground antenna, the race result System monitors the chip's signal strength. After it passes over the antenna, the system records the time of the highest signal strength, which is expected to be directly above the antenna. The *Reaction Time* in the *Detection* menu defines for how much longer a (passive) chip will be monitored after the last signal strength peak before providing the final time.

When increasing the reaction time, the calculated finish times will be more precise but it takes longer until the system can provide this time. When using a small reaction time, the system can return the detection very quickly, but the precision will be reduced.

The default value is 500ms. If necessary, this value can be decreased for fast races (e.g. mountain bike) and increased for slow races (e.g. children).

7.3. Beep / Blink

The *On Detection* setting in the *Detection* menu defines if the decoder shall blink and/or beep upon a detection.

Note that there is a beep / blink queue of length 5. If more than 5 athletes are being detected at the same time, the system will beep/blink only five times. If 5 or less athletes are being detected at the same time, the system will beep / blink several times with a short delay so that you can verify the number of detections easily.

8. ETHERNET CONNECTION & SETUP

8.1. Basics

The Ethernet connection is the recommended connection type to read out live data from the system during the race. The system can be connected directly to a computer using a standard patch cable or cross-over cable, or be integrated in a local network using a switch or router.

The race result System offers two Ethernet ports and both ports can be used to connect to a computer/switch. The additional port can be used for example to connect to another race result System (loop through). Both Ethernet ports and the race result System itself are connected via an internal switch.

Please consider the following basics:

- Each device in an Ethernet network has an address, called the "IP address".
- Each device in a network needs to have a unique address. Do not use the same IP address twice.
- An IP address consists of 4 number blocks (each having a value between 0 and 255) separated by a period, e.g. 192.168.1.100
- In local networks, IP addresses usually start with 192.168. (this is a reserved address space not used in the Internet).
- When two devices in a local network (e.g. computer and timing system) want to communicate with each other, they need to be in the same subnet, i.e. they need to have the same first three blocks of the IP address (but different fourth block!), e.g.
  Timing System: 192.168.1.201
  Computer 1: 192.168.1.101
  Computer 2: 192.168.1.102
- When connecting a device to your local network at home, your Internet router will automatically assign IP addresses using a technique called DHCP. However, when operating the system without a router (e.g. direct connection between computer and system, or local network using a switch), static IP addresses need to be assigned to both the timing system and computer. If you don't know how to set a static IP address on your computer, please search Google "how to set up ip address on windows [version]" which will show you manuals and YouTube tutorials.

8.2. Defining Ethernet Parameters

The parameters of the Ethernet connection can be defined in the *Network* menu. By default, it is set to DHCP so that the system retrieves a dynamic IP address from a router/DHCP server in your network. For race timing it may be better to assign fixed IP addresses to each system. For that, simply turn off DHCP and enter the IP address manually (you can also set the subnet mask, standard gateway and DNS server which will be necessary when the decoder needs to access the Internet, e.g. for a firmware update).

8.3. Using the Ethernet Connection

When using the race result 11 software, the data can be read out easily using the *Transponder Module*. When using other software, please refer to the Communication Protocol at:

http://www.raceresult.com/en/solutions/RRS_Communication_Protocol.pdf

9. USB CONNECTION

The USB port serves to save the detection files on a USB stick. This can be done either after the race or live during the race. When plugging in a USB stick, the decoder will show a message that a stick has been detected and will copy all existing passing files to the stick. A separate folder named by the decoder ID will be created on it.

If a USB stick is plugged in during the race, the system will save the new detections every few seconds on the stick. This can serve as an additional backup: theoretically, even if the decoder would burn down, the passing data is still stored on the USB stick which can be pulled out.

Please do not remove the stick while the system is in Timing Mode. This may destroy the file system on the stick.

For the data format of the passing files, please refer to Appendix 1.

10. GSM MODULE

The integrated GSM module can be used to upload the detection data to a race result data base in the Internet. The data can then be downloaded from any place with an Internet connection. In other words, this is an easy way to connect remote timing points.

10.1. Upload

To upload the detections using the GSM module proceed as follows:

1. Insert your SIM card in the SIM card slot.
2. Go to the menu *Upload*.
3. Enter your customer number, the PIN of your SIM card, and select connection *GPRS*.
4. Set the option *Enabled* to *yes*.

Alternatively, you can also upload the data via an Ethernet connection with Internet connectivity. Therefore, choose *Ethernet* for the *Connection* option. Make sure that standard gateway and DNS server are set correctly or turn on DHCP (see chapter 8).

From now on, the main screen will show the status of the upload.

10.2. Download

When using the race result software, you can download the passing data in the Transponder Module using the connection type *race result System Online*. Otherwise, the passing data can be accessed using this link:

`http://data.raceresult.com/interface/passings/getpassings.php?user=`*`user`*`&pw=`*`password`*`&device=`*`device`*`&file=`*`file_number`*

The *italic* parts must be replaced as follows:

`user:`	your customer number as specified in the upload settings
`password:`	password of your customer account
`device:`	serial number of your race result decoder, e.g. D-4001
`file_number:`	the current file number as shown on the display of the race result decoder.

In order to download only a part of the file, add the parameter *minid*. The ID is the first column of the data returned. Thus, it is recommend using the last value plus one for the minid parameter.

`http://data.raceresult.com/interface/passings/getpassings.php?user=`*`user`*`&pw=`*`password`*`&device=`*`device`*`&file=`*`file_number`*`&minid=`*`minid`*

The data format is described in Appendix 1.

11. ACTIVE LOOPBOX

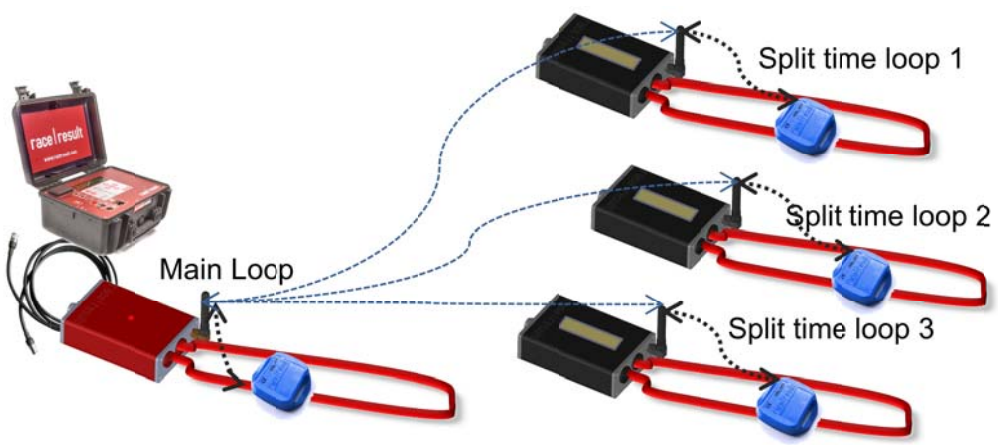
The *LoopBox* is an additional stand-alone device which activates the active transponder, but does not process the data of the transponders.

There are two use cases:

11.1. Repeater Mode

In this mode, the LoopBox activates the transponder, receives its data and sends (repeats) it to an Active Extension.

This is an easy way to realize several timing points within an area, e.g. a triathlon finish, transition in and transition out. The maximum distance between LoopBox and Active Extension can be up to 300m depending on conditions.



Note that the LoopBox has an internal buffer for 1000 detections. Even if the connection between LoopBox and Active Extension is interrupted, the detections will not be lost: once the connection recovered, the LoopBox will transmit the buffered detections. Thanks to the precise internal clock of the LoopBox, the detection time will still be correct and precise.

For the communication between LoopBox and Active Extension please note:

- LoopBox and Active Extension need to run on the same channel (see chapter 4.4 and chapter 11.3). It is recommended that you select a fixed channel on the main decoder instead of using the *auto* mode.
- The Active Extension that shall receive the detections from the LoopBox(es) must have loop ID 1. This way the LoopBoxes know where to send the data even if several Active Extensions are present.

11.2. Store Mode

This mode only works with the ActivePro transponder!

In this mode, the ActivePro transponder will be activated by the LoopBox, but instead of transmitting the detection data, it will start its internal clock and thus know the time since it had been activated. This internal clock runs for a maximum of 24 hours (activations will be deleted afterwards) and a maximum of 64 detections can be saved.

When being activated by a real active system, the transponder will transmit not only the new detection but also all stored detections. For example for a MTB downhill race, a LoopBox at the start could activate the transponder, and at the finish two detections will be received: start time and finish time.

The LoopBox is a very easy way to make sure athletes have passed several check points: Simply put a LoopBox at every check point and at the finish the transponder will transmit the detections from all the check points.

Note that the internal clock of the ActivePro transponder is only as precise as the clock on your wrist. It can have deviations of up to 5 seconds per day. High deviations between different chips may occur when they are being used with very different environmental temperatures.

At the same time note that a deviation of 5 seconds per day, equals a deviation of only 0.03 seconds in 10 minutes.

11.3. Configuring the LoopBox

The LoopBox can be configured by pressing the button for 2 seconds. The first of the four settings (loop ID, channel ID, loop power, store/repeat mode) will start blinking and can be changed by pressing the button again. By pressing the button again for 2 seconds, the setting will be confirmed and the next setting can be changed.

To use the repeater mode, proceed as follows:

1. Set the loop ID of the main active system to 1 (see chapter 4) and select a channel ID (see chapter 4.4).
2. Set the loop ID of the LoopBox to a value not used yet.
3. Set the channel ID to the same channel as used by the main active system.
4. Make sure the LoopBox mode is set to *Repeat* (instead of *Store).*

To use the store mode, proceed as follows:

1. Set the loop ID of the LoopBox to a value not used yet (in order to identify detections from this LoopBox).
2. Make sure the LoopBox mode is set to *Store* (instead of *Repeat*).

11.4. How to Receive LoopBox Data using race result 11

When using one or more LoopBoxes, the detections from several timing points will be received through the one and only main race result System with Active Extension and thus come into the Transponder Module through one connection.

Probably, detections from a certain loop shall be assigned to a certain timing point (*location*) in the software. Therefore, several connections to the race result System can be created, each using a different loop ID / channel ID filter. Then, for each connection, different settings can be set.

11.5. LoopBox Time

Note that the LoopBox and the ActivePro transponder do have an internal clock, but do not need to have the precise time. They simply tell the Active Extension how much time has elapsed since the detection occurred. The Active Extension will then calculate the detection time by subtracting this offset from its current time.

11.6. Power connection

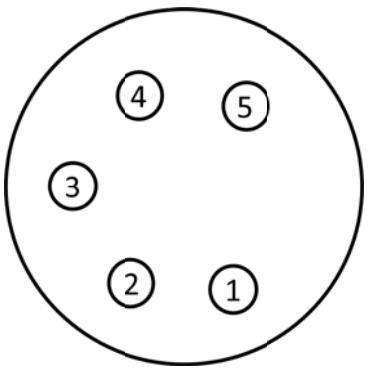
The LoopBox will be shipped with a 12V AC/DC power adapter and an additional DC plug. If you do not have a reliable power supply for the LoopBox, you can easily use the additional DC plug to connect a battery.

As the LoopBox needs a maximum of 100mA, a small 2Ah battery will last for a day.

12. FEATURE PORT

The feature port serves to connect any type of accessories to the race result System. It provides ground, +12V, +5V, RX and TX. Besides the Active Extension (see chapter 4) there are several accessories (see below).

The pins on the feature port are used as follows:



1: +4,8V output (5V - shottky diode)

2: +11V-15V (unfused! two way!)

3: TXD 3,3V TTL

4: RXD 3,3V TTL internal Pull Up 10k

5: IO Digital Trigger - max 3,3V

SHIELD = GND

Connect non-race result equipment at your own risk! Short circuits will damage the system.

Only use original Neutrik connectors, cheap connectors do not connect GND reliably.

12.1. Start/Marker Push Button

The *Start/Marker Push Button* is an extended *START* button. Instead of the button on the keypad, the button at the end of the cable can be pressed to start the timing mode or to set markers.

For events with many starts or single start it may be easier to push the button instead of pressing the keypad button on the decoder on the ground.

The Start/Marker Push Button is available as accessory in the raceresult.com shop.

12.2. Light Barrier

Using the extension cable (available in the raceresult.com shop) an ALGE or Tag Heuer light barrier can be connected to the race result System.

If only one athlete can cross the timing line at a time, the light barrier will be used to keep the time and the transponder will be used for the identification.

The light barrier can be positioned either before or after the detection line. The mode can be defined in the *Feature Port* menu.

When using one of these modes, the large LED of the system will light while the first but not the second information has been received.

12.3. WiFi Bridge Set

The WiFi Bridge Set can be used to connect the race result System to a WiFi network. The bridge will be connected to the Ethernet port and powered through the feature port. Note: powering the WiFi Bridge Set via the feature port reduces the battery run time by approximately 1 hour.

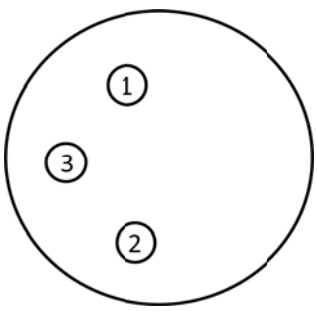
The WiFi Bridge Set is available as an accessory in the raceresult.com online shop.

13. EXTERNAL BATTERY PORT

The internal battery of the race result System lasts for approximately 8 hours (passive ground antenna), or 24 hours (active loop). The external battery port can be used to connect a larger battery or a car (via the cigarette lighter) for longer uptimes without another power supply.

When determining the necessary size of a battery, calculate with a power consumption of 2A using the passive antenna and 500mA using the active loop.

The system is sold with a special cable with XLR connector for the decoder on one end and a car connector on the other end. The pins are used as follows:



1: GND

2: +12V Input (10A Fuse)

3: NC

SHIELD = GND

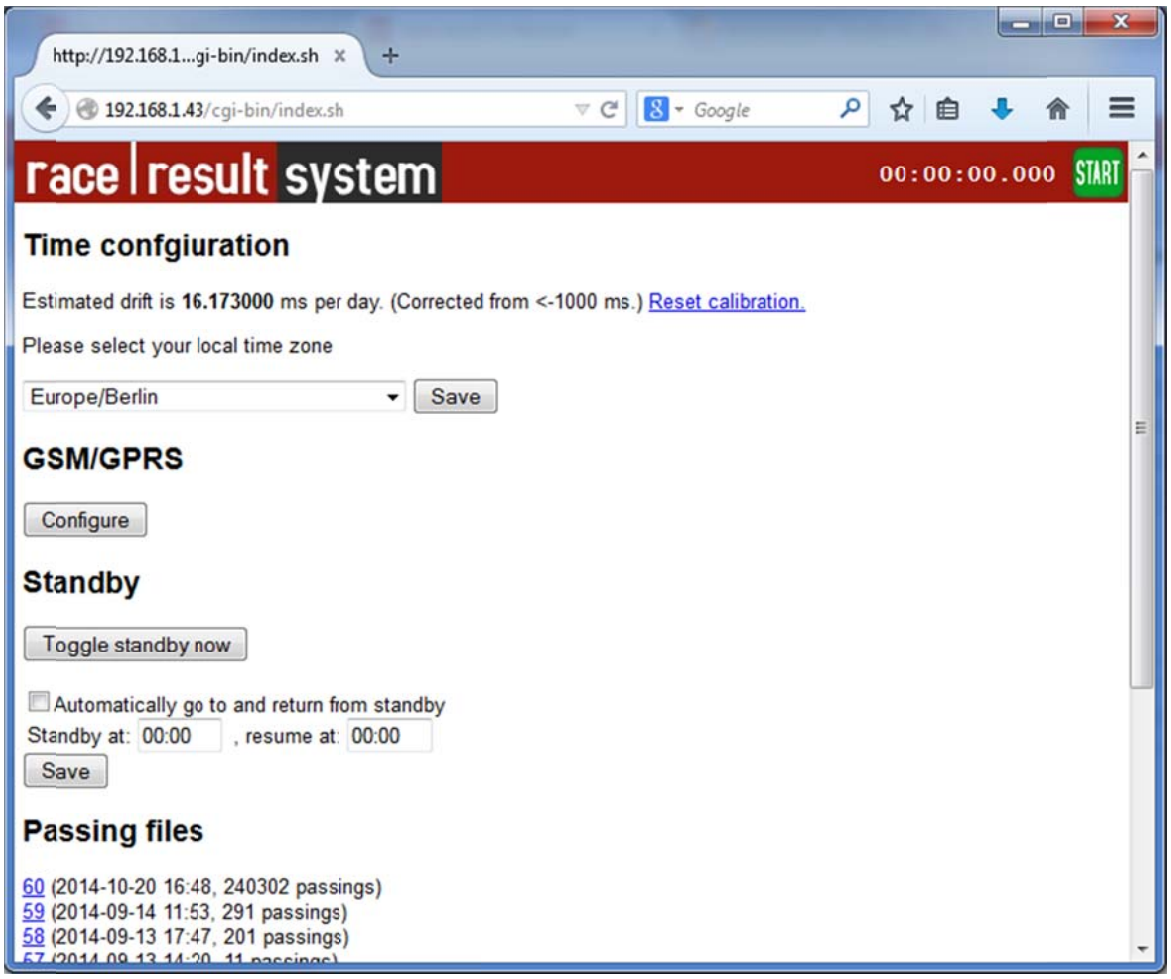
Note that the external battery does not charge the internal battery, but instead power will be taken from both batteries, internal and external, at the same time.

14. BROWSER ACCESS

You can easily access the decoder by entering the IP address in your browser, e.g. http://192.168.1.43

In the browser you can:

- Access all (old) passing files. Note that you cannot delete passing files. When the internal memory of 85 MB is full (it can save over 1 million detections), the oldest files will be deleted automatically.
- Set the time zone
- Set special GSM/GPRS settings
- Check the status of connected LoopBoxes



15. ONLINE FIRMWARE UPDATE

There are frequent decoder firmware updates, e.g. for new features or new accessories. It is recommended to update the firmware frequently. The race result website provides an overview of the firmware versions and implemented changes.

For the firmware update, proceed as follows:

1. Make sure, the system is connected to external power, so that it does not run out of battery during the update process.
2. Connect an Ethernet cable with Internet connectivity.
3. Make sure DHCP is used or make sure the standard gateway and DNS server are set correctly (see chapter 8).
4. Go to the main menu, select the entry *System*, select *Check online for new firmware* and press the OK button. The system will now do the update process and then restart.

APPENDIX 1: DATA FILE FORMAT

The passings in the passing files are stored in the following format:

```
<PassingNo>;<Bib/TranspCode>;<Date>;<Time>;<EventID>;<Hits>;<MaxRSSI>;<InternalData>;
<IsActive>[;<Channel>;<LoopID>;<LoopOnly>;<WakeupCounter>;<Battery>;<Temperature>;
<InternalActiveData>]<CrLf>
```

`<PassingNo>`	Passings are numerated from 1 to n
`<Bib/TranspCode>`	Bib number of the transponder (or transponder code in case of multi use tags or Active[Pro] transponders.)
`<Date>`	Format: yyyy-mm-dd If GPS is used, date of the detection, otherwise 0000-00-00 or 0000-00-01 after 24 hours and so on.
`<Time>`	Time of the detection, format: hh:mm:ss.kkk
`<EventID>`	ID of the bib set / order ID. The combination of <Bib> and <EventID> is unique. In case of multi use tags <EventID> is 0.
`<Hits>`	Number of times the tag was detected.
`<MaxRSSI>`	Maximum RSSI value found while determining <Time>.
`<InternalData>`	This field is only used for internal race result purposes.
`<IsActive>`	1 if this passing is from an Active or ActivePro Transponder
`<Channel>`	Channel ID (1..8)
`<LoopID>`	Loop ID (1..8)
`<LoopOnly>`	1, if this detection was generated in Store Mode.
`<WakeupCounter>`	Overall wakeup counter of the transponder (starts at 10000).
`<Battery>`	Battery level in volts.
`<Temperature>`	Temperature in degrees Celsius.
`<InternalActiveData>`	Used for internal purposes only.

APPENDIX 2: SPECIFICATIONS

Safety & Conditions Decoder	
Protection Class with closed Cover	IP54
Safety Norm	EN60950
Regulatory Conformity	CE, RoHS, FCC
Relative Humidity	Max. 90%, non-condensing

Power & Battery Decoder	
AC Power Supply	110V-230V, 50-60Hz (2A fuse)
DC Power Supply	12V-14V, 2A (when battery full)
Battery flight safety	15Ah (Pb) (~ 8 hours), IATA - A48/A67
Charging Time	4h (switched off), 8h (running)
Power Consumption	30W (battery full), 60W (charging)

Weight & Pack-Size		
	Weight	**Pack-Size**
Decoder	12.5 kg	36x26x45cm
4m Antenna	21.5 kg	22x31x120cm
8m Antenna	42.0 kg	2x 22x31x120cm

Antenna & Transponder (passive)	
Transponder Frequency	866MHz (EU), 903-927MHz (US), 920-925MHz (AUS)
TX Power	33dBm max
Track Widths: **with 4m antenna** **with 8m antenna**	 2x2m, 1x4m 2x4m, 1x8m
Read Range[1)]	4m
Detection Rate **Read Rate**	> 99.8%[2)] > 3000 chips/min
Maximum Transponder Speed[3)]	40 km/h, 25 mph
Timing Accuracy[4)]	200 ms

1) Transponders are detected multiple times while crossing the antenna.
   The detection with the highest signal strength – right above the antenna - is used for timing.
2) With transponders attached correctly.
3) Higher speeds are possible, detection rate may be lower.
4) Use GPS time to get most accurate results.

Ports & Features	
Internal GPS	uBlox 50 Channel Receiver, 30 seconds cold start
Internal GSM	Quadband - GPRS, EDGE (850/900/1800/1900 MHz) Standard SIM-Card
2x LAN	Dual 100MBit/10MBit Lan Port. Auto Crossover Detection. Switched internally for loop thru to next device.
USB	USB data stick for backup
Antenna Ports	8x BNC
Feature Port	Supplies 5V & 12V, Start Gun, Photo Sensor
Audio Beep	3,5mm Headphone Plug (mono)

Safety & Conditions Active Extension & Loop Box	
Protection Class **with cable/antenna screwed on**	IP67 -waterproof-
Safety Norm	EN60950
Regulatory Conformity	CE, RoHS, FCC
Temperature	-30°C to 70°C
Dimensions **Weight**	27x65x97mm 170g

Power & Battery	
AC Power Supply **Loop Box**	110V-230V, 50-60Hz (2A fuse)
Loop Box	10V-15V, 100mA (at 100% loop power)
Battery Life Decoder with Active Extension	approx. 24 hours

2.4GHz RF & Loop Specification	
Transponder 2.4GHz **Channel Frequencies** **(Worldwide Compliance)**	1: 2480 MHz 5: 2415 MHz 2: 2405 MHz 6: 2460 MHz 3: 2425 MHz 7: 2435 MHz 4: 2475 MHz 8: 2450 MHz
2.4GHz TX Power	3dBm
Loop Frequency & Data	125kHz Data-Packet = Loop ID + channel Packet rate: 150Hz OOK-modulation, manchester encoded 16bit anti-false-wakeup pattern
Loop Power	100% = 200mA RMS regulated peak current

Loop Cable & Length	5m-25m, >0,5mm², standard 4mm banana plugs
Data Cables	5m (standard), 15m, 20m
Read Range **25% Loop Power** **100% Loop Power**	 60cm (2ft) 2m (6ft)
Detection Rate **Read Rate**	100% 250 chips/second burst for 4 seconds 50 chips/second continuously
Internal Data Buffer	1000 passings
Clock Stability	24/1000th second per day 0.28ppm TCXO calibrated to Rubidium Frequency Standard traceable to NIST
Prewarn Data Delay	100ms (from entering the loop field)
Max Passing Data Delay	250ms (after loop center)
Repetitive Passing rate over Loop	1 per Second

Active Transponders	Active	ActivePro
Loop Detection Antenna	1D	3D
Maximum Speed	75 km/h (45mph)	150 km/h (90mph)
Timing Accuracy	2/10th second	1/100th second
Passings Storage	-	64 passings up to 24 hours +/- 7/100th per hour (+/- 20ppm)
Expected Battery Life	7 years	6 years
Guaranteed Battery Life	4 years & 100.000 passings	
Battery Indicator	temperature compensated battery status data in passing	
Dimensions **Weight**	36x40x9mm 16.8g	
Housing	IP69 TPE molded case, sealed with PU compound 100% salt water proof	
Temperature	-40°C to +70°C	
Shock Resistance	>1000G	

Tray	
Dimensions	522x297x12mm
Weight	approx. 1kg (including 50 transponders)
Material	4mm rugged PE (UV-Stabilized)
Features	Stackable, with numbering 1-50 / 51-100

APPENDIX 3: CE DECLARATION

CE DECLARATION OF CONFORMITY

We,

race result AG
Haid-und-Neu-Str. 7
76131 Karlsruhe
Germany

declare that the sports timing system components

race result System, 4000 series
race result Active Extension
race result Active LoopBox
race result Active Transponder

in accordance with the following directives:

2006/95/EC	**The Low Voltage Directive**
2014/53/EU	**Radio & Telecommunications Terminal Equipment Directive**
2004/108/EC	**The Electromagnetic Compatibility Directive**

have been designed and manufactured to the following specifications:

Safety:	**EN 60950-1**
Radio:	**EN 301-489-1/3** **EN 302-208** **EN 50364** **EN 300 328** **EN 300 330**
Power Line EMC:	**EN 55022** **EN 55024** **EN 61000** **EN 61547**

I hereby declare that the products named above are designed to comply with the relevant sections of the above referenced specifications, and all essential requirements of the directives.

The equipment will carry the CE and a Class 2 equipment identifier as depicted:

CE

Name of authorized person: Nikias Klohr
Function of authorized person: Head of R&D
Place and Date: Karlsruhe, 28 October 2014

Signature of authorized person: