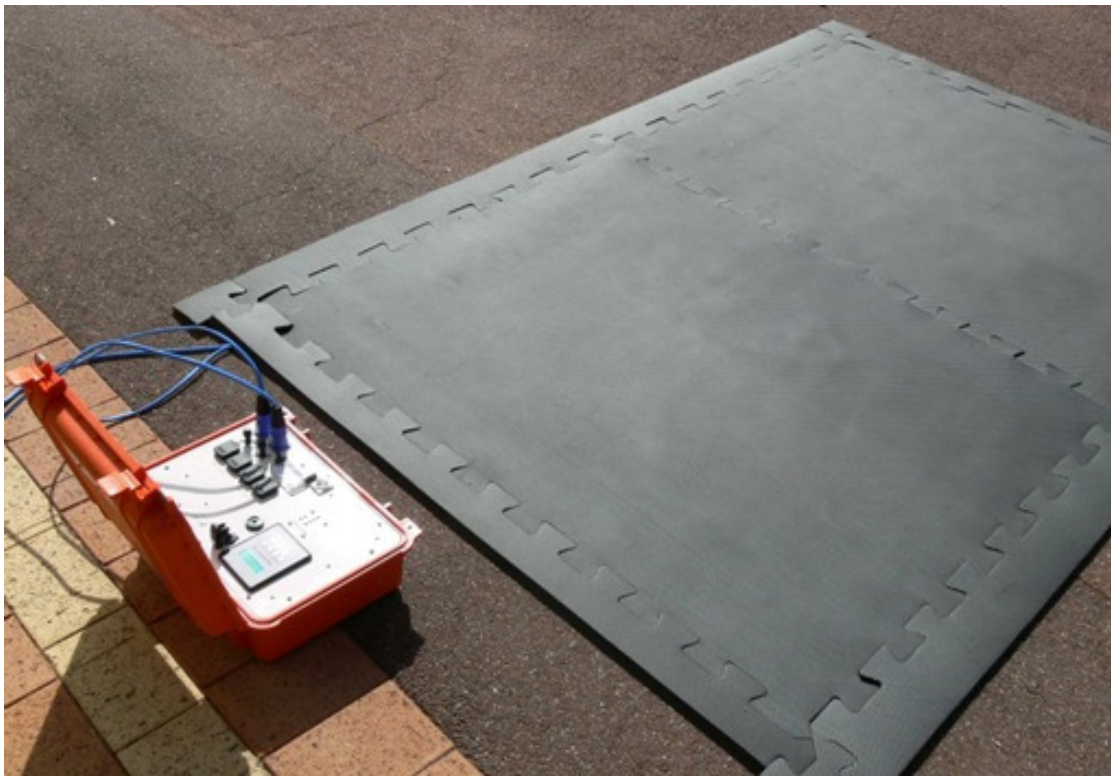


Operational Manual



MKIII Dual Antenna System

RFID Race Timing Systems
September 2008



Introduction

Congratulations on buying the RFID Race Timing System. The acronym RFID stands for Radio Frequency Identification and is widely used in the electronics industry to describe the reading of tags or transponders using a radio frequency based communication protocol. This product should give many years of service if well maintained and transponders have an infinite lifespan since they contain no moving parts or batteries. The RFID Race Timing System comes with a 1 year warranty from the date of delivery.

How it Works

The RFID Race Timing System uses low frequency (134.2khz) radio signals to communicate between small coded transponders and an intelligent control module via a fixed antenna. This communication cycle is performed in 50 milliseconds so that there can be up to 18 read cycles per second. In a read cycle, the antennas are firstly charged with an electric current which produces a strong electromagnetic flux both above and to the side of the antenna mat. This electromagnetic energy is partially captured by a small antenna coil in the transponder. This powers a chip which sends its unique 16 digit code back to the antenna. The antenna then listens for 20 milliseconds so that it can receive the analogue signal from the transponder and decode it within the TIRIS control modules. Transponder codes and the time of day to the nearest 1/10 second are saved in memory and can be sent to a PC via an Ethernet network in real-time, or downloaded afterwards.

Important Rules

1. Be very careful when removing the control box panel. The internal components are sensitive to static electricity if touched and can be irreparably damaged. The panel should only be removed to replace the lead acid battery.
2. Never connect or remove any leads or plugs with the control box power already turned on. This may lead to permanent damage of the internal components. The correct procedure is to plug in all cables prior to switching the control box on.
3. Never operate the control box with the panel removed. There are high voltages within the components and these can cause injury.
4. Never allow water or large amounts of dust to fall on the panel. The control box can be operated in the rain as long as a good plastic cover is put over the unit. The control box is fully waterproof when closed. Mats are fully waterproof.
5. Replace all damaged cables. High voltages pass through the antenna mat cables. Damaged communication cables (Data and Synchronisation cables) will result in poor system performance.
6. If the ambient temperature surrounding the control box exceeds 30 °C, keep the control box in a shaded position. The internal components get quite hot after prolonged operation and can be damaged if operated in very hot environmental conditions. The internal control modules will shutdown if the temperature inside the control box exceeds 70 °C

7. Try to keep sync and data cables away from other cables such as power, PA and television camera cables.
8. Always test the equipment well before the race to ensure that there is no metal or airborne interference.
9. Never operate the timing system with lightning in the area

Basic Set-up Instructions for Timing Gear:

1. Plug in antenna mats (never plug in or unplug mats while unit is turned on);
2. Turn on main power switch;
3. Set proper preferences on the in-built computer including the correct time;
4. Plug in data / sync cable between systems if more than one unit is being used (remember to use the daisy chain sequence between systems);
5. Connect an ethernet patch cable between your scoring laptop and the master unit via one of the Data Only ports;
6. Make a TCP/IP connection between your scoring laptop and the control box(es) using RFID SERVER and either press Start Reading on the LCD keypad or remotely start the timing process;
7. Tune each antenna mat. Tune ANT 1 first to maximum current of about 0.8mA and then tune ANT 2. Fine tune the tuning on each antenna by making sure maximum current is showing on the tuning meter. Note that changing the tuning on antenna 1 will affect the tuning on antenna 2. Scan a test chip in the correct orientation taking note of the read height which should be just over 1 meter above the middle of the mat.
8. Never operate the timing system with lightning in the area

Troubleshooting

Problem	Checks
Red On lights do not flash when pressing "Start Reading"	Is unit set as master? If set as slave the unit will not read without being synced to another master unit via data/sync ports
Red On lights flash but cannot read chips	Is yellow CPS light flashing. If not there may be a damaged sync cable being used. Does the needle on the meter go above 0.6mA when the mats are separated by 1 meter? If not you may have a break in the antenna lead or antenna plug terminal.
Two units synced but sporadic reads and tuning meters rising and falling	Do you have two masters (both units with lit blue Sync LED's)? Only 1 master per set of synced units
Cannot get tuning meter above 0.6mA and/or tuning knob is turned all the way	Mats are possibly placed over surface with metal underneath. Reposition mats

in or out.	to non metallic area
Cannot connect to box with RFID Server	Can you ping the boxes IP address? If not, are you using a Ethernet cable exceeding 90m? Is the computer on the same subnet? Sometimes having wireless and wired LAN's at the same time (wireless on router) can cause problems.

Parts List

- Control box (orange plastic case)
- Two (2) lightweight antenna mats with beveled edge pieces - (1.1m x 1.4 m each)
- Cat 5 ethernet cable(s) if more than one system is purchased (double shielded only)

Antenna Mats

Each MKIII Dual Antenna System comes with 2 lightweight antenna mats with a special jigsaw cut out design that allows for the mats to be connected together like puzzle pieces. Beveled edge pieces are provided and should be put along the outside edges of the mats (see picture below).



Great care should be taken to push down the connecting pieces so that a nice flat surface for the athletes to run over is created (See picture below).



Each antenna mat has a 7 foot long blue cable attached with a locking connector plug on the end. **These locking connector plugs should be plugged into the control box before the main power switch is turned ON and should be unplugged after the main power switch is turned OFF. Never plug in the antenna mats or unplug them while the control box is turned ON. Warning: Failure to follow this procedure will damage the control box and void the warranty.** You should be aware that high voltage goes through the antenna mats and cables. Due care and maintenance should always be taken when using them. Before each use, visual inspection of the mats and cables should always be made to insure they are not damaged or broken. Repairs to damaged mats, cables and connector plugs should always be done by RFID Race Timing Systems. During events, the blue antenna cables should always be placed under the mats so that they do not become a tripping hazard for the athletes crossing over the mats. In events where spikes are being worn by the athletes, a thick carpet should be laid over the mats so that the spikes do not penetrate the surface of the mats. Laying a carpet over the mats will not effect read rate performance of the transponder chips.

Main Power Switch

The main power switch for the control box is located at the top of the main panel just to the right of the LCD Screen and 7 button keypad. The main power switch turns on the control box. Make sure the antenna mats are plugged into the control box before turning on the main power switch. Furthermore, do not unplug the antenna mats until the main power switch is turned OFF.

In-Built Computer with LCD Screen and Interface Keypad

When the main power switch is turned ON, the inbuilt computer on the control box is automatically booted up displaying the logger software on the water resistant LCD screen. A 7 button keypad provides a simple human interface with the logger software which makes changing menu settings a breeze. The 7 buttons on the keypad are right, left, up, down, plus, minus and a return key.

Logger Software on the MKIII Control Box

All functions on the control box are controlled by the Logger software.

Main menu:

1. Start Reading

This will start the read cycle and if synchronization is set correctly, the 2 red LED's will flash rapidly. The system is now ready to read transponders

2. Synchronization

Options are Master or Slave. Only one Master can be set when using multiple synchronized systems. The blue sync LED will illuminate when a unit is set as a Master.

3. Set Date and Time

Use the keypad keys to set the date and time. The + and – keys increment by 10.

4. Display Date and Time

Displays the current set date and time

5. Preferences

5.1 Split Name

This can set the name given to the split being recorded. There are a number of split name options and is saved in a field in each record saved when a transponder is read.

5.2 Network

When turned on, the control box is given a static IP address and the inbuilt computer will act as a server allowing a socket connection to another device using TCP/IP. A basic understanding of IP addresses is needed to setup a LAN with control boxes and laptop computers running the race scoring software.

5.3 Gating

Determines how and when transponder codes are saved and time stamped. The default setting is a 3 second gate which allows the same transponder to be read once every 3 seconds. This setting is best when there is low to moderate traffic over the mats. The second option is "OFF" which will turn off the gating and allow a transponder to be read repeatedly if it stays on the antenna mat. This option is

best used when the mats have very high traffic, or where the unit is being tested.

LED's on the Control Box:



There are five sets of LED's on your control box (see picture above). The first set of red, orange and green LED's which are located on the top of the picture show the condition of the internal battery. Green means the power level is good; orange means the power level is moderate; and red means the battery condition is critically low. Never let the battery condition get into the red zone. The second set of LED's in the middle of the picture are red and will flash rapidly when the control box is in the read mode. When a transponder is read on antenna mat 1 or 2, the third set of green LED's in the middle right portion of the picture will flash for each respective reader. The fourth LED is a blue sync LED which will illuminate when the unit is set as the master and is described in further detail under the **Synchronization** section. Lastly, the yellow LED is the CPS LED which should be flashing when multiple systems are properly synced together and reading chips. If the yellow CPS light is not flashing, your units are not properly synced together which will result in poor system performance and possibly no chip reads. Causes for this could be a damaged sync cable or one unit has not been set properly as a master.

Sync and Data Ports

There are 4 ethernet style sockets where data cables can be plugged between control boxes, and between computers. Two ports are just ethernet (data) only and will route data to another control box, ethernet switch, router or PC computer. A cross-over cable is not required but can be used as can the usual straight through Ethernet cable. These two ports are connected to an internal ethernet switch. The other two ports (Sync/Data) combine synchronization signals with ethernet communication. These are the two ports that are used to 'daisy chain' multiple control boxes together so that the group of timing points are all synchronized together. The Sync port is crucial to the systems performance where more than one

box is used in a system. The Sync port carries several signals that tell each box when to charge-up transponders.

Synchronization

Without correct synchronization, there will be poor transponder reads (or no transponders read) because one control box will be charging transponders whilst another will be trying to read transponders. When this occurs, the systems are said to be out of synchronization. The powerful charge up signal from one set of mats will swamp the small signal transmitted from a transponder at another set of mats. The receivers within the control box are extremely sensitive and any interference in the vicinity of 134 kHz will have a drastic effect on the reading performance of the system. If all control boxes within the vicinity are synchronized together, the charge and receive modes of each mat will occur simultaneously. It takes experience and on-site testing to determine how far systems need to be separated before synchronization is not required. It is often good practice to synchronise all units since in many applications it is desirable to create a local area network (LAN) so that data can reach a central laptop from all timing points. Be aware that interference from the charge up of one mat can travel down a sync cable and reduce the performance of an un-synced control box if the sync cable is attached between control boxes. The sync pulses will travel up to 400m (and often further) but be aware that Ethernet should not exceed 90 meters between systems, or between ethernet switches. In a synchronized system, one control box is set as a master and the other units as slaves. The master unit will be responsible for sending the synchronization pulse and oscillation signal to all other units. The most important LED's on the control box is the blue sync LED which indicates whether the unit is set as a master and the orange CPS LED which confirms whether the sync pulse is being correctly received between the master unit and the slave units.

Be aware that the master unit **MUST** be reading (the red LED's of both readers flashing) before the slave units will be able to read transponders. The Master must also be reading if the synchronized Slave units are being tuned. Only when the master is in the read mode will the oscillation signal be sent down the synchronization line. The oscillation signal determines the frequency of the charge up phase (134kHz) whereas the synchronization signal indicated by the status LED is a pulse turning the charge up phase on and off.

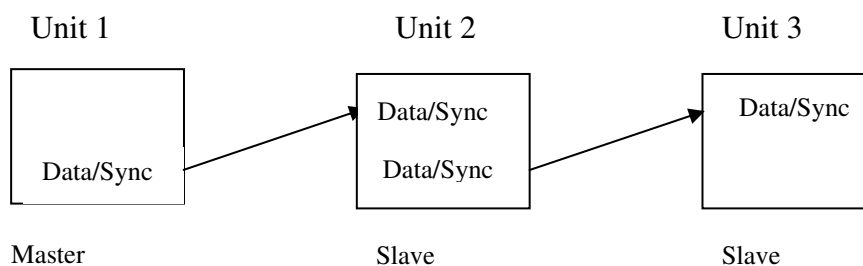


Diagram showing a 'daisy chain' of 3 synchronised Control Boxes

Specification of Ethernet cable

Systems of two or more control boxes are supplied with the necessary sync/data cables. However the lengths supplied are less than 10 metres in length. When systems are setup for a triathlon or events where timing points are separated by more than 10 metres, more data/sync cables are needed. We recommend that only the best Cat5 double shielded Ethernet cable is used for this purpose. We recommend Eurocable which has multiple shields and is made of stranded twisted pairs. The RJ45 jacks must be of the shielded type and the cable shield must be soldered to the RJ45 jack for a reliable ground connection. This cable is designed for outdoor use and should be kept on high quality cable reels (we suggest Schill cable reels). We suggest either ordering this cable from RFID Race Timing Systems or sourcing the cable locally and preparing the cables using a qualified network technician. The Ethernet jacks are protected by Neutrik Ethernet jack protectors.

The type and condition of Sync/Data cables is very important for the correct functioning of the system. Problems with the timing system are usually due to faulty sync cables.

Tuning procedure



Very important: Never plug in or unplug the antenna mats when the control box power is turned on as this will damage the timing system. Plug in the antenna mats before the main power switch is turned on and unplug the antenna mats after the main power switch is turned off.

In order to tune the antenna mats, the system needs to be set as a master or running as a slave with an actively synchronized master prior to tuning. Antenna tuning can commence after the readers are started (see Logger software pages 4 and 5). Tune ANTENNA 1 first by flipping the toggle switch up and then turning the tuning knob until the peak current on the tuning meter is in the range of 0.6mA to 0.8mA. Repeat the procedure for ANTENNA 2. Fine tune the tuning on each antenna mat by making sure the maximum current is showing on the tuning meter. Note that

changing the tuning on ANTENNA 1 will affect the tuning on ANTENNA 2. Scan a test chip in the correct orientation taking note of the read height which should be just over 1 meter above the middle of the mat. The presence of metal under the antennas (i.e. Steel reinforced concrete) will result in a lower peak current being drawn from the antenna mats. This also results in a reduction in the read range of transponder timing bands. On some surfaces with high metal content the read range can be substantially reduced resulting in poor read rates of transponders. It is advisable to check the tuning on these surfaces and possibly reposition the mats to a better location. The higher the current, the higher the read range off the mats.

Networking

Many mistakes are made with setting up an outdoor local area network (LAN). The true power of the RFID Race Timing System is realized when real-time data is sent to a central computer for results processing. RFID Race Timing Systems has created interface software for your central computer which is called RFID Server and comes with the sale of each RFID Race Timing System. A separate manual is provided on how to use RFIDServer so that realtime data can be transmitted from each control box to a central computer using a Local Area Network (LAN).

The best way to capture the data is to add the control box to the LAN and give each unit a unique static IP address. The control box does not currently support DHCP so routers and PC computers should not be given conflicting static IP addresses. The recommended IP addresses are in the range 10.10.0.1 to 10.10.2.254 or 192.168.0.1 to 192.168.2.254.

If you cannot connect to the control box using your PC race timing software... check:

1. The IP address of the control box
2. The IP address of the PC computer
3. The subnet mask of the PC computer (see TCP/IP in network settings)
4. The Logger program has been initialized from power on (press enter to get to the main menu)
5. The data or data/sync cable is not damaged or exceeds 90 metres length between control boxes, Ethernet switches or PC computers.

Charging and External Power

There are two common sockets for use in charging the internal lead acid battery, or supplying external 12V DC power. Never use a switched mode power supply (SMPS) to supply power to the unit as this can induce interference at the 100kHz band. A linear power supply or SMPS with an operating frequency of greater than 200kHz should be used. The CTEK battery chargers supplied with the system can be used to power the system from AC power. Never put a direct AC power source into these sockets. The supplied CTEK battery charger puts out a maximum of 3.3A making the total charge time about 5 hours for a fully discharged sealed lead acid Battery. It is

good practice to not fully discharge the internal lead acid battery as this will reduce the lifespan of the battery. An external battery can be attached to the system through the power ports making sure that the correct polarity is used. **ALWAYS ENSURE THE CORRECT POLARITY OF ANY EXTERNAL POWER SOURCE.** Incorrect polarity will damage the internal components and short the fuse in the fuse holder on the positive (red) battery lead. The correct pinout for a Neutrik Powercon connector (grey) is N = positive and L = ground. The GND pin is not used. We suggest that only qualified RFID Race Timing Technicians prepare these connectors. Damage due to incorrect wiring of these connectors will not be covered in the 1 year warranty of the system.

Buzzer

The buzzer signifies a read of a transponder. The buzzer has two volumes and can be turned off (see **LCD Keypad** section).

LCD Display

The LCD display is used to changed settings of the RF008-1 and also show read transponder codes. When the RF008-1 is powered up, it shows an initial start up screen and then goes automatically into reading mode. The R1, R2 and CPS lights should all start strobing. The LCD screen will show the number of transponders read, the static IP address of the unit and transponder code and time when a transponder is read.

LCD Display LED's

There are 7 LED's below the LCD screen and above the keypad. They signify some diagnostic information. LED 2 (green) indicates that the unit is in read mode, LED 3 (green) signifies a transponder code has been read and saved to the units memory. LED 6 (yellow) indicates that the unit has networking turned on and LED 7 (yellow) indicates that a unit has a socket connection open with RFIDServer.

Message: *Change Time or Purge Data?* : This message will come up on the LCD screen if the users tries to read transponders with the time set to an earlier time than the last transponder read. For example, if the time is set to the 12pm on the 1 January 2007 and the last transponder read 2 weeks ago was at 12pm on the 1 January 2008, then the unit will not be allowed to read transponders. This is to protect the fast search function of the file system which needs read transponder codes to be saved in correctly sorted time series. If this message comes up, either set the correct time of the control box or purge the data. Purging the data will remove all saved data on the control box.

RFIDServer

Transponder codes and times are stored on the control box microcomputer for later downloading to a race scoring program. Many timers choose to relay this data in realtime to a scoring program using RFIDServer. The RFIDServer executable program comes bundled with every system and is the conduit between control box and PC computer. There are several ways of importing data into a race scoring package. For Racetec, RFIDServer will store data from the control box into a Microsoft SQL Server table. This table is accessed by the main Racetec program. Many other scoring programs (ie RaceDirector, RaceTrak and Runscore) import a text file generated by RFIDServer either in realtime or as a rewind of the data saved on the control box.

RFIDServer is also used to monitor the control box during operation and is being continually updated and improved to give diagnostics on the system. Features include starting and stopping boxes from reading, checking and setting box time and rewinding saved data, even when the control box is still reading live data.

The manual and latest version of RFIDServer can be downloaded from the following internet address;

<http://www.racetec timing.com/downloads.htm>

Firmware Upgrades

The Dual Antenna MK3 control box has an inbuilt microcomputer which runs special firmware for operation. From time to time this firmware will be updated and made available on the RFID Race Timing Systems website. The link for this website is;

<http://www.rfid timing.com/Software/Software.htm>

Firmware upgrades are now easy using the Ethernet Loader. This program takes a firmware binary file and uploads it to the control box via a standard Ethernet connection. The entire process should take less than 20 seconds and multiple boxes can be upgraded at the same time. The Ethernet Loader and help file can be downloaded at the web address shown above.