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AMB i.t.   Manual:AMBrc/Rev.3.3

The AMBrc System is designed for the timing and scoring of RC model car races. The (magnetic) signal of each car carrying an AMBrc transponder is picked up by the detection loop installed in the track surface. This loop is connected to the AMBrc decoder. The decoder timestamps the received transponder signals and sends this data a connected computer. Two types of transponders are available: a rechargeable battery powered transponder and a Direct (externally) Powered transponder. Each transponder has a unique number, which enables you to identify and time/score each RC car on the track.
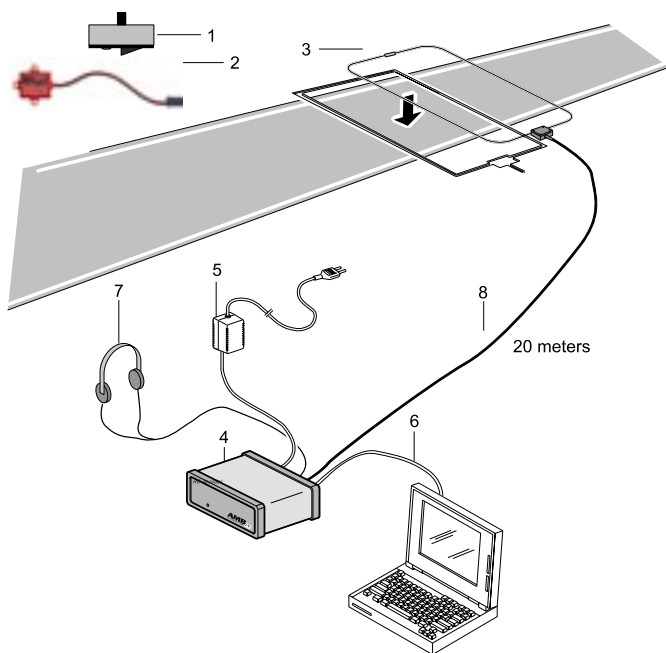

Figure 1.1 System overview

System components:

1.	AMBrc rechargeable transponder
2.	AMBrc Direct Powered transponder
3.	Detection loop
4.	AMBrc decoder
5.	12 VDC adapter for AMB decoder
6.	Connection cable RS232
7.	Headphones for decoder
8.	Coax cable and connection box

Not in picture: charger rack

2.Installation of the system

To install the AMBrc system, one needs to install a detection loop, connect the decoder and mount the AMBrc transponders to the cars. For optimal results, please follow the instructions in the following paragraphs carefully.

2.1 Installation of the detection loop
All wiring of the detection loop must be installed according to the drawing below in order to avoid a serious degradation in the performance of the system.

Positioning the detection loop
a)   The detection loop must be positioned in such a way that the transponder is above the center of the detection loop when the front of the car is above the finish line. Make sure vehicles cannot pass outside the detection loop. Extend the detection loop outside the track if necessary.
b)   The detection loop can be used for a track width of a maximum 10 m (33 ft).
c)   Cut the slots in the track a maximum of 2 cm (3/4 inch) deep and 30 cm (1 ft) apart.

Installation of the detection loop wires and cabling
a)   Make sure the slots are clean and dry. This will ensure a perfect seal when the silicone is applied after installation of the wiring. Put the wires of the detection loop in the slots and cut the excess length of the detection loop wires.
b)   When all wires are installed, put the heat shrinkage sleeve over a detection loop wire end. Then solder the loop wire end to the short wire end of the connection box. When soldering the wires together, the solder should flow through the entire connection and not only around it. Now put the shrinkage

sleeve over soldered connection and hold it over a heat source to shrink the sleeve (also see the drawing on the next page). Repeat this procedure for the second wire end of the detection loop.

c) Fill the slot with silicone. Make sure not to overfill the slots and that the silicone is fully under the surface of the track, otherwise tires may pull out the silicone. If any silicone spills out of the slot, remove the excess silicone by scraping the top with a small piece of cardboard. This also ensures that the silicone is pressed into the slot and into the sides of the slot to ensure a perfect seal.
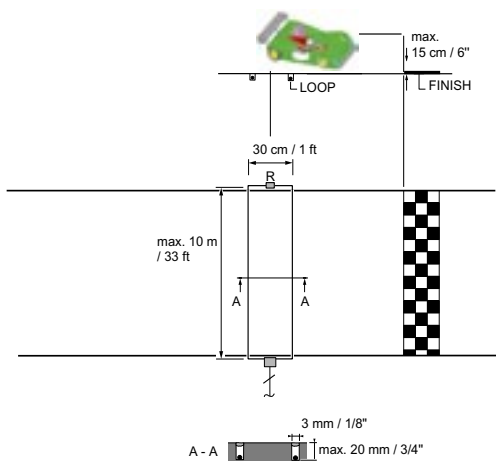
Figure 2.1 Detection loop installation overview

d) In the case of an OFF-ROAD track, cover the loop with carpet or something similar. The carpet can then be covered with sand.
Please be aware of the max. distance of 15 cm/6"
between the transponder and the detection loop.

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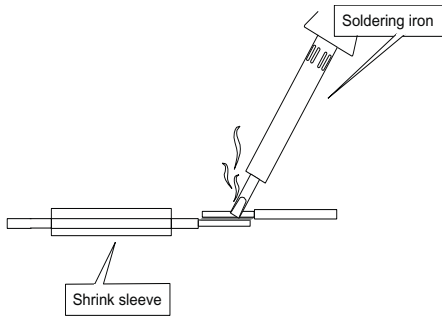
Figure 2.2 Solder the loop wire end

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If you wish, you may pad the slots with a backing rod or nylon cord before sealing the slot with silicone. This helps to prevent the excessive use of silicone and is also useful when pulling out the silicone if the detection loop has to be replaced.

Silicone

There are a wide variety of silicone types available in hardware stores; it is important that the right type is used. Silicone that can withstand different temperatures as well as both wet and dry conditions since weather situations can vary should be used. If you are unsure, check the specifications of the silicone.

The following types of silicone have been shown to yield lasting results and are recommended by AMB:

• Dow Corning 890SL is a self-leveling silicone kit. It is applied as a liquid and fills the slot completely.

• Purflex is a polyurethane-based silicone that retains its elasticity under a wide range of temperatures.

f) The detection loop is sensitive to interference, sometimes emitted by nearby cables. When possible, keep other cables 5 m (15 ft) away. Also make sure cars on other parts of the track will not get closer than 5 m (15 ft) to the detection loop, to avoid false inputs.

Testing the detection loop installation

Once the loop has been installed, it should be tested to ensure that it is functioning correctly. We also recommend repeating the same procedure at the start of each race event. You can determine if your loop is functioning correctly by doing the following tests:

a) Connect the detection loop to the decoder and computer running AMB i.t. timing software (also see paragraph 2.2 Installation of the AMBrc decoder). Check the background noise, which is updated every five seconds in the Track Timing software. The background noise level should be between 0 and 40 points. A higher value may indicate a bad loop installation or interference by other electrical equipment in the area. Try switching off any suspected equipment or removing nearby objects and check for improvements. Short-wave radio transmitters may cause an increased background

noise, especially at night.

b) Check the signal strengths of the transponders as they are picked up by the system during a test (also see paragraph 2.3 Installation of the Transponder). A good loop will yield consistent transponder signal strengths of at least 100 points with a hit rate of at least 20 points. The hit rate may vary depending on the speed of the transponder passings (slower passings yield higher hit counts), but the signal strength should be consistent for the same car.

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Loop installation for temporary tracks

If slots for the loop can not be made in the track, the loop can be fitted overhead on a bridge.

Do not make this bridge of any type of metal or carbon fiber, this will weaken the signal severely.
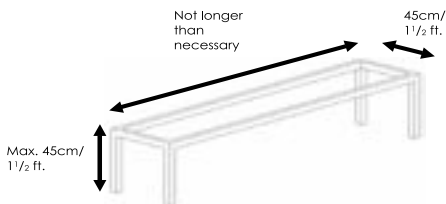
Figure 2.3 Bridge for temporary tracks

a)   Construct a bridge (wood, PVC) with max clearance 45 cm/ 1½ ft. (lower is better). Do not make the bridge longer than necessary. Make sure no cars can pass outside the bridge.

b)   Wires of the loop must be 45 cm/ 1½ ft apart and fixed underneath the bridge. Put the connection box on top of the bridge. Solder all connections and insulate well.

Please keep in mind that since a bridge has a larger distance between detection loop and passing transponder, this results in a weaker signal for the decoder. At dawn and at night, the interference from short-wave radio signals intensifies strongly and may occasionally cause the transponder signals to get overwhelmed by the interference. To avoid this, keep the loop on the bridge as short (less than 3 m / 10 ft) and low as possible (less than 45 cm / 1.5 ft).

Speed measurement and split time

Speed or split time is measured with help of a second detection loop. The AMBrc decoder can not distinguish between transponder signals coming from the finish, speed or split time loop, **permanent manual supervision** is necessary in this case. For instance, when a car stops in between the two loops used for the speed trap for longer than the minimum lap time set in the software, the software will add a lap when the car passes the second speed loop. **Software designed to support speedtrap and/or splittimes is necessary.**
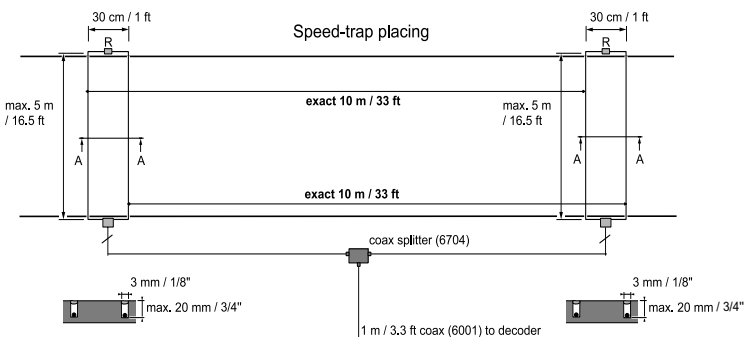
Figure 2.4 Loop installation for speed trap

For speed measurements two loops have to be installed at an exact distance of 10 m / 33ft of each other at the fastest part of the track. For split time, the second loop can be installed at any desired position on the track.

When two loops are used, the maximum width allowed is 5 m / 16.5 ft per loop. Via an AMB coax splitter and extra coax cable (part numbers 6704 and 6001/6002/6003) the two loops are connected to the AMBrc decoder.

For speed measurements the AMBrc decoder has to be set into speed-trap mode with the help of suitable software. The speed-trap mode is indicated on the AMBrc decoder by rapid flashing of the green LED. In speed trap mode the decoder can detect the same transponder again after 0.2 seconds instead of 2 seconds.

Please note that a second decoder is needed for true speed-traps and split-timing.
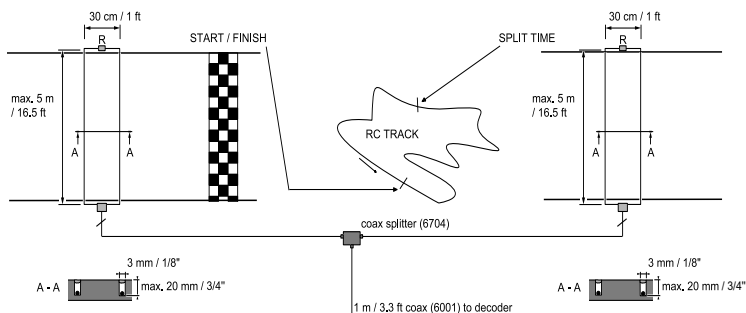
Figure 2.5. Loop installation for split time

2.2 Installation of the AMBrc decoder

The decoder is a precision instrument. Although it is designed to withstand shocks, please handle it with care and keep the decoder out of direct sunlight and avoid high humidity. Take special precautions in case of thunderstorms by disconnecting all cables (coax and mains) from the decoder. Nearby lightning strikes may damage the decoder.
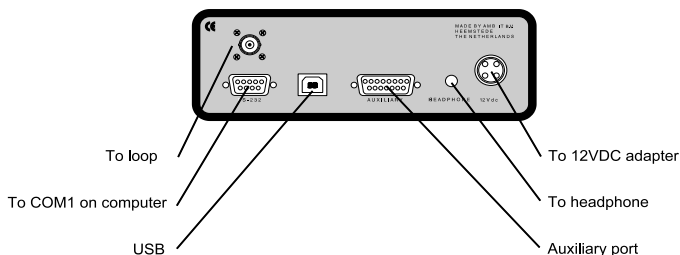
Figure 2.6 Connecting the AMBrc decoder

a)   Connect the detection loop by connecting the 75 Ohm double shielded coax cable to the AMBrc decoder. Keep the coax cable at least 30 cm (1 ft) away from other cables to avoid interference.

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A metal timekeeping building can cause the system to pick up more interference via the coax cabling, which can result in an increased background noise.

b)   Connect the RS232 serial cable between the AMBrc decoder and the COM port of the computer (a straight pin-to-pin male/female RS232 connection cable, AMB part number 6201). Secure both connections with the fixing screws on the connectors to prevent losing a connection with the decoder.

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c) Connect the headphone. A beep will sound for every passing transponder providing an easy check on proper operation of decoder and transponders out on the track.

d) Connect the 12 VDC adapter to the decoder and a power outlet. Since a power interruption will result in a failure of the timing and scoring system, connecting the 12 VDC adapter to mains through a UPS (Uninterruptible Power Supply) is recommended. The power plug to the decoder is a 4-pin CB radio plug (pins 1, 2 negative (-), pins 3,4 positive (+)).

2.3 Installation of the transponder

The AMBrc transponder is available in a battery-powered and a Direct Powered (DP) version. The battery-powered transponder can be charged in the AMBrc charger rack.

Installation of the Direct Powered transponder

The AMBrc Direct Powered transponder is powered by the RC car's receiver and does not need to be charged.

1) The transponder must be mounted horizontally (flat). The position of the transponder must be identical in all RC model cars competing in the race for best finish accuracy.

2) Transponders must be positioned no higher than 15 cm / 6" (lower is better), with no metal or carbon fiber between the transponder and detection loop.

3) Fix the transponder to the car with the help of double-sided adhesive tape or nuts and bolt. Make sure the transponder can not get detached during a race.

4) Connect the power plug to a free servo channel or use a Y-splitter.

5) Check for an orange LED on the transponder when radio receiver is on.

O.K.

Not O.K.
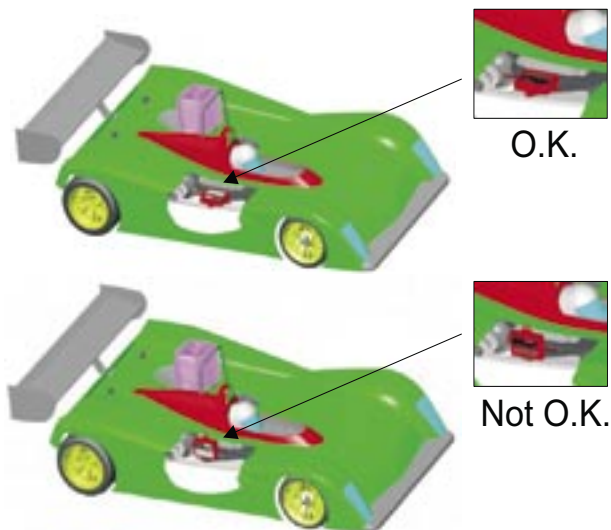
Figure 2.7 Mounting the AMBrc Direct Powered transponder

Carbon fiber or metal chassis

If the AMBrc transponder is fitted directly onto a carbon fibre or metal chassis, the signal from the transponder is weakened severely, which shows as low hits and strength readings from the AMBrc decoder (in AMBrc mode only). Try to find a position for the transponder free from the chassis, for instance on the front bumper and check for better readings from the decoder. Hits should be no less than 20 (at speed) and strength not lower than 100 points, see also: Operating the system / Trouble shooting.

If no good horizontal position can be found, as a last resort the transponder may be placed vertically, with the wiring facing the left- or right side of the car. In that case the signal from the transponder exits over the front and back of the car.

Power and polarity

When no free channel is available use a Y-splitter servo wire, obtainable via your local hobby store.

If the polarity of the servo plug does not match the polarity of your radio receiver, it must be reversed (red wire is +). Carefully lift the plastic lugs of the plug and pull the connectors out. Re-insert the connectors into the plug according to the polarity of the radio receiver. The connectors may not be rotated before re-insertion, otherwise the lugs will not keep the connectors in place. Make sure the connectors are fully seated into the plug and then push the plastic lugs very carefully back into the servo plug.

Lift lip to remove connector

Figure 2.8 Installation of the AMBrc Direct Powered transponder

When a power voltage of more than 8 VDC is to be used, a resistor of 100 ohms per volt over 8 VDC must be connected in series with the red wire. So 10 VDC means 200 ohms in series with the red wire. Power of the resistor should be/ is 0.1 watt per volt, so 0.2 watt or more in case of 10 VDC.

Interference

RC model cars can suffer from self generated interference, resulting in poor range of the radio. This is usually caused by incorrect lay-out of the wiring.The AMBrc DP transponder does not use frequencies used by the RC model cars. However adding some wiring (power to the AMBrc DP transponder) does not help in case of the problem mentioned above.

To check if the signal from the transponder is causing trouble, disconnect the transponder power plug from the receiver and check the performance of the car.

To check if the wiring causes problems, disconnect one lead from the power connector (keep the other lead connected) and check the performance of the car. With one lead disconnected, the transponder is, of course, not working.

Installation of the rechargeable transponder

Body-clip

Washer

Max
15cm
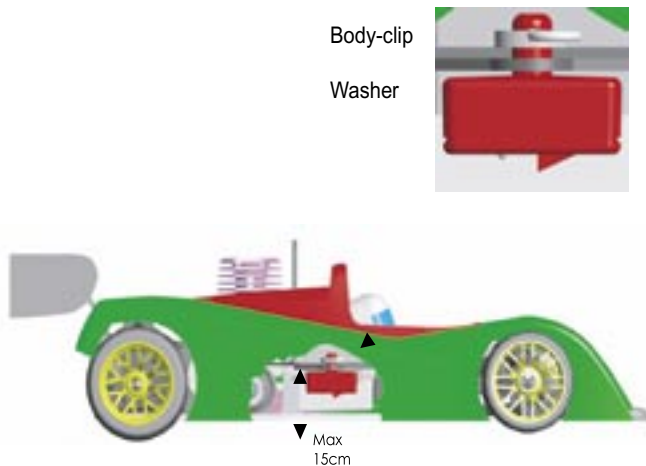
Figure 2.10 Installation of the rechargeable transponder

a) The transponder must be mounted **horizontally** (see drawing), preferably inside the car against the side, withthe fixing pin pointing upwards or downwards. The position of the transponder must be identical on all RC model cars competing in the race for best finish accuracy.

b) Transponders must be fitted no higher than 15 cm / 6" (lower is better), with no metal or carbon fiber between the transponder and detection loop.

c)   Put a washer around the fixing pin and fix the
       transponder with a fixing clip.
d)   Make sure the transponder can not get detached
       during a race.
e)   Check before each race to see if the green LED on the
       transponder blinks.

For OFF-ROAD RC model cars, the transponder may be fixed
underneath the rear wing.
If the pin breaks, the transponder cover can be replaced (part
number 00551102)

Charging the transponder
Charging must be done in the AMB charger rack, which is
powered by a standard AMB 12VDC adapter. Input voltage for
the rack is 10 - 15 VDC (4 pin power plug type). The charger
rack converts the input voltage to a regulated voltage of 3.3
V. as is needed by the AMBrc transponders.
Charging is done at room temperature. When charging, the
red LED in each transponder indicates it is charging. One
hour charge gives a minimum of 1 hour use, so the relation
between charge/use time is one to one or better. Charge time
for an empty transponder is 16 hours to reach full charge.
After 16 hours the red charge led will change over to a steady
green led, indicating trickle charge. Transponders may be
trickle charged for weeks, but please let the transponders fully
discharge once every two months.
When transponders have not been used for a couple of
months, the first re-charge will not be fully effective. To
ensure maximum capacity, give the transponders a full charge
and discharge cycle before use. Use the full charge/discharge
cycle to check if transponders have sufficient operating time.
When not in use give the transponders a full charge/discharge
cycle once every 2 months.

Operating time

Operating time is 18 hours minimum after a full charge.When the transponder is removed from the charger rack the LED will blink green (when sufficiently charged) indicating the transponder is working. A low battery voltage is indicated by a blinking red LED.

The amount of time the transponder blinks red (when nearly empty) depends of the amount of charge the battery has received previously. When charged until full, the red LED may blink for half an hour or longer.

3.Operating the decoder

To enable compatibility with AMB20 compatible software from various sources, the AMBrc decoder starts-up in AMB20 data format mode. This mode uses only the transponder numbers 1 to 10, so only the **last digit of** the 7-digit transponder number is sent. For example: AMBrc transponder number 1234567 shows as transponder number 7, but transponder number 6543217 shows up as transponder number 7 as well (not as 17). In order to have the full benefit of the 7-digit individual and unique transponder number suitable AMBrc software must be used, which automatically switches the AMBrc decoder over from AMB20 data format mode to the AMBrc mode. When switched-on the decoder shows a red LED and is in the initial AMB20 stop mode. The decoder must be started using suitable (AMB20) software. When started, the LED shows green. Each time the decoder sends data, the LED flashes red.

3.1 Noise level
In AMBrc mode the AMBrc decoder sends the average background noise every five seconds to the computer. The noise (and signal strength) has a range of 0 up to 255. **Noise level**, as shown by the Track Timing software, **should not exceed 40**. If the noise level is higher, the received transponder signal strength should be 60 points above noise level to ensure perfect functioning of the system.

3.2 Signal strength
Signal strength, as shown by the AMB i.t. Timing software, should preferably be **below 100** and should at least be 60 points higher than the indicated background noise. Higher figures, for instance due to transponders closer to the track, give a higher immunity against interference.

3.3 Number of hits

The number of hits, as shown by the AMB i.t. Timing software, is an indication of the number of repeated contacts during a passing. Hit-rate varies with the speed of a passing transponder. Slower passings yield higher hit counts.

Appendice A : Frequently asked questions

What if my background noise is higher than 40 points?

An increased background noise is an indication of a higher interference level picked up by the system. In AMBrc mode, every five seconds an average background noise measurement is performed by the decoder and sent to the computer. This figure is only updated if no transponders are received within this five second interval.

If the noise level is higher than 40 points, the received transponder signal-strength should be 60 points above noise level to ensure perfect functioning of the system. Peaks in background noise level can be caused by any electrical switch in the area or, usually at night, by short-wave radio stations. Electronic equipment may also cause an increased background noise level. Switch off the suspected equipment to determine if this is the cause. Ignitions of engines may also be a source of interference which only shows when the vehicle without a transponder passes.

If the noise level is increased and fluctuates strongly, your detection loop may be cut or broken, or have an electrical connection to ground. The loop may still detect transponders, but there will be some degradation of the system's performance.

The system is especially sensitive to interference with bad connections in the detection loop or coax cable. Typically, when connections in the detection loop are not soldered and mounted with heat shrinkage sleeves or when BNC connectors are not properly fitted, interference is picked up more easily. The fluctuation in noise level will be more noticeable in wet conditions since water acts as a conductor and will give a better connection to ground.

What if the received signal strength is below 100 points?

A received signal strength lower than 100 points can be caused by several things. Usually, one can determine the cause by evaluating the received signal strength in combination with the background noise and number of hits.

- If the signal strength is fluctuating heavily in combination with high noise levels, the loop wires may be cut.

- If the signal strength of the same car is fluctuating heavily with a normal noise level, this usually indicates that the coax cable or BNC connector short-circuits occasionally.

- If the coax cable is permanently short-circuited (core and shielding touching each other), the signal strength and hit count will always be low with a normal noise level. Measure the coax cable (must be 100 kOhm) and try replacing the BNC connector first. If the problem persists, try a new coax cable.

How can I prevent unwanted signal reception?

The shielding of the coax cable prevents unwanted signals from being received by the decoder. The AMB coax is double shielded with two copper wire braids. Often, double shielded coax is supplied with a foil shielding and a braided shielding. The use of this coax is not recommended because over time the foil can get torn and not provide a sufficient shielding anymore.

Although shielded, a transponder signal is strong enough to penetrate the shielding and is detected on the coax cable itself. Especially when coax cable needs to be routed through the pit lane, this can cause phantom transponder inputs. Therefore, the coax cables are best routed through a metal cable duct.

The metal surrounding the cable duct will act as a shielding itself and will therefore prevent transponders from being detected on the coax cable.

How can I connect photocells via the auxiliary port?
To use a photocell, connect it using the AMB photocell cable (article no. 5503 and 5504) or make an appropriate cable using the scheme and table below. The sync input, enables you to synchronise multiple decoders running. Both photocell and sync input need a 5-12 VDC (5-15 mA) power source. Pins 8,15 may be used for this purpose, but for reasons of possible interference an external power source is preferred (9V battery).

	Pin	Signal
Power Supply	8+15	12V/300 mA
Photo Cell 1	5	ground
	6	photo cell 1 - input
	7	photo cell 1 + input
Photo Cell 2	5	ground
	12	photo cell 2 - input
	13	photo cell 2 + input
Sync Pulses	1+9	ground
	10	sync - input
	11	sync + input

<u>**Appendice B: Troubleshooting**</u>

Start-up

To enable compatibility with AMB20 compatible software from various sources, the AMBrc decoder starts-up in AMB20 data format mode. This mode uses only the transponder numbers 1 to 10, so only the **last digit of** the 7-digit transponder number is sent. For example: AMBrc transponder number 1234567 shows as transponder number 7, but transponder number 6543217 shows up as transponder number 7 as well (not as 17).

In order to have the full benefit of the 7-digit individual and unique transponder number suitable AMBrc software must be used, which automatically switches the AMBrc decoder over from AMB20 data format mode to the AMBrc mode.

LED indications

When switched-on the decoder shows a red LED and is in the initial AMB20 stop mode. The decoder must be started using suitable (AMB20) software. When started, the LED shows green. Each time the decoder sends data, the LED flashes red.

Problems

Most problems are due to bad connections or improper installation, usually the cabling, lay-out or position of the pick-up loop. To check the coax cable: use Ohmmeter to measure Ohms between center pin and outer metal the of BNC connector. It should read 95 kOhm to 105 kOhm. Also the yellow wires into the connection box can be measured: it should read 95 kOhm to 105 kOhm (470 Ohm resistor disconnected).Mobile phones and other forms of personal radio communications do not affect AMB i.t. systems.

If you still have questions, remarks or problems, please contact AMB i.t. by fax or e-mail supplying the following data:

1. Description of the problem and the purpose the system was used for.
2. Decoder type and serial number and transponder type(s).
3. Highest noise level and minimum indicated transponder signal strength (AMBrc suitable software only)
4. Data files showing problems.
5. Use of in-track or bridge detection loop.

You can find our contact details on page 3 of this manual.

Appendice C: Optional Equipment

The AMBrc system, as delivered to you, is a complete system for timing and scoring. The optional equipment mentioned in the following paragraphs may prove to be valuable aids.

Back-up system

Since electronic timing and scoring has become an integral part of most racetracks all over the world, a second AMBrc system may serve as a back-up system (e.g. in case of an important event). The signal coming from the detection loop(s) can be connected to both the decoders by using an AMB splitter (article no. 6704) and two short coax cables (2x article no. 6001). Another solution is to place a back-up system detection loop 5 m (15 ft) or more before the main detection loop and connect it separately to the second decoder. Naturally, connecting one or both decoders through a UPS may prevent a failure in the timing and scoring system in case of a power interruption.

Appendice D: Useful tool/parts/ equipment

Useful Tools
- Resistance meter (Range at least: 1 Ohm - 1 Mega Ohm)
- Wire cutter / stripper
- BNC Crimper
- (Butane) Soldering gun
- Blade knife
- Coax stripper
- Screw driver (normal and Phillips)

Useful Spare Parts
- BNC couplers (3 pieces)
- Thick BNC connectors 5 mm 75 Ohm
- Thin BNC connectors 3 mm 75 Ohm
- Shrink sleeves
- Spare loop (for tracks up to 20 m (65 ft) wide)
- Electrical tape

Additional Tool for new loop installations
- Chalk line to get a straight line on the track surface
- Caulk gun to apply silicone.

Please contact AMB i.t. if you would like to receive detailed specifications on any of the above items.
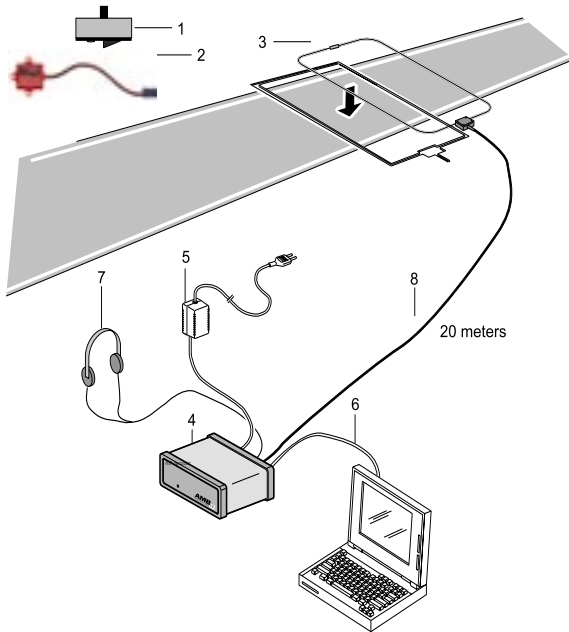
Appendice E: System Overview

Figure E-1 Complete system overview

1.   AMBrc rechargeable transponder
2.   AMBrc Direct Powered transponder
3.   Detection loop
4.   AMBrc decoder
5.   12 VDC adapter for AMBrc decoder
6.   Connection cable RS232
7.   Headphones for decoder
8.   Coax cable

Appendice F: Technical Specifications

AMBrc Decoder

Dimensions	: 120x170x55mm / 4.7"x6.7"x2.2"
Weight	: 0.8 kg / 1.9lb
Clock stability	: 25 PPM
Timebase Resolution	: 0.001s
Timing Resolution	: better than timebase of used AMB transponder type
Memory	: 5000 passings
Temperature range	: 0 - 50C / 32 - 122F
Humidity range	: 10% to 90% relative
Operating voltage range	: 10 to 16VDC (12VDC input)
Power consumption	: 0.1A via 12VDC input, 0.3A via USB
Output	: RS232, 9600 baud, 8 bit, 1 stop-bit, no parity
Number of loops	: 1 (or 2 with help of T splitter)
Max. track width	: max. 10m (33'), when 2 loops are used: 5 m / 16.5"
Aux. Inputs	: 3x opto coupled 4-12 VDC / 5-15 mA
Aux. Outputs	: 2x opto coupled, max 10mA
Compatible with	: rechargeable and Direct Powered transponders

AMBrc Rechargeable Transponder

Dimensions	: 35 x 31 x 12 mm approx. 1.4"x1.2"x 0.5"
Weight	: 22 g
Humidity	: max. 90% relative
Max. speed	: 120 km/h / 75 mph
Temperature range	: 0-50 C / 32-122 F
Operating time	: min. 18 hrs
Charge time	: 16 hrs for full charge
Charge indicator	: LED indicator green / red
Signal transfer	: magnetic induction
Resolution timebase	: 3 ms

| Transponder position | : max. height 15 cm / 6″ |
| Charging voltage | : 3.3 VDC |

AMBrc Transponder Charger

Transponder Charger	: 380 x 117 x 65 mm approx. 15″x5″x3″
Capacity	: 20 transponders
Power supply	: 10 to 16VDC / 0.4 A via 115/230 VAC adapter

AMBrc Direct Powered Transponder

Dimensions	: 22x28x7 mm approx. 0.9″x1.1″x 0.3″
Weight	: 8 g. complete
Humidity	: max. 90% relative
Max. speed	: 120 km/h / 75 mph.
Temperature range	: 0-50 C / 32-122 F
Operating time	: Unlimited
Signal transfer	: magnetic induction
Resolution timebase	: 3 ms
Transponder position	: max. height 15 cm / 6″
Power	: Power feed from a free receiver channel (ch3 or batt)
Connection Plug	: Connect using a standard servo plug
Power consumption	: 15mA @ 5VDC
Operating voltage	: 4 –8 VDC

Detection Loop

| Track width | : max. 10 m / 33 ft (or 2x 5 m / 16.5 ft) |
| Coax to decoder | : 75 Ohms, double shield, max.length 200 m / 660 ft |

Specifications are subject to change without notice.

Appendice G: EC and FCC Regulations

Most electronic equipment produces some undesired interference at a close distance. To make sure the increasing numbers of electronic equipment will not cause harmful interference, the CE (Europe) and FCC (US) regulations state very low levels of interference that should not be exceeded. The AMB equipment does not exceed these levels.

The CE regulations also state the equipment must be able to tolerate levels of interference generated by other sources without malfunctioning. These levels are considerably higher than the interference levels produced by the electronic equipment itself. Cellular telephones may generate interference levels, which may cause other electronic equipment to malfunction. AMB made sure its equipment is insensitive to the interference generated by cellular telephones or other modern forms of personal radio communications.

The FCC regulations for Information Technology, equipment which must be printed in the manuals, state that you must tolerate interference produced by others and you must switch off when interference produced by your equipment is experienced by others. The level of interference is strongly reduced when you increase the distance between two pieces of electronic equipment. For example: your portable radio will most likely experience interference when placed on top of your monitor, but will work very well a few feet away. Since the AMB transponders operate on magnetic induction, they have no antenna but a built-in coil instead. The transponders do not produce an electromagnetic (radio) wave but only a magnetic wave. The difference between an electromagnetic (radio) wave and a magnetic wave is that the electromagnetic wave travels by itself over great distances and the magnetic wave does not. As the distance increases, the strength of the magnetic wave is greatly reduced. This is why AMB transponders are not transmitters.

This equipment complies with part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This equipment may not cause harmful interference, and (2) this equipment must accept any interference received, including interference that may cause undesired operation.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

Reorient or relocate the receiving antenna.

Increase the separation between the equipment and receiver.

Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

EC Declaration of Conformity

The EC Declaration of Conformity is the method by which AMB i.t. declares that the AMBrc system complies with the EMC directive (89/336/EEC) and low voltage directive (73/23/EEC).

The **AMBrc System** consists of:
- AMBrc decoder
- Mains adapter 230 V AC/12 V DC
- Detection loop
- AMBrc Transponder

Applicable harmonized EMC standards

EN 55022	Class B, Information Technology Equipment
EN 50082-1	IEC 801-2 Electrostatic Discharge
IEC 801-3	Immunity to Radiated Electromagnetic Fields
IEC 801-4	Electrical Fast Transient, Burst
EN 60335	Low voltage directive

Authorized signature

H.Q. van Dooren
General Manager

Guarantiees & Warranties

AMB i.t. guarantees that, for a period of twelve months from the date of dispatch, any items manufactured or sold by AMB i.t. with defects caused by faulty materials and/or workmanship and/or design, will be repaired. If repair is not possible or economical for AMB i.t., AMB i.t. has the choice to refund the purchase price of these goods or to deliver new goods. AMB i.t.'s liability shall be strictly limited to replacing, repairing or issuing credits at its option for any goods returned within 12 months from the date of dispatch. AMB i.t. shall not be liable for incidental or consequential damages including, but not limited to costs of removal and reinstallation of goods, loss of goodwill, loss of profits or use. If the requirements set forth above and described below are not complied with, the AMB i.t. warranty/guarantee shall not apply and AMB i.t. shall be discharged from all liability arising from the supply of defective goods.

EXCEPT AS EXPRESSLY PROVIDED IN THIS SECTION, AMB i.t. MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND, NATURE OR DESCRIPTION, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION, ANY WARRANTY OR MERCHANTABILITY, FITNESS OF THE GOODS FOR ANY PARTICULAR PURPOSE, OR NONINFRINGEMENT, AND AMB i.t. HEREBY DISCLAIMS THE SAME.

Remedies and damages

AMB i.t. shall not incur any liability under the above warranty unless:

a)   AMB i.t. is promptly notified in writing upon discovery by the customer that such goods do not conform to the warranty and the appropriate invoice number and date of purchase information is supplied;

b)   The alleged defective goods are returned to AMB i.t. carriage pre-paid; and

c)   Examination by AMB i.t. of goods shall confirm tha the alleged defect exists and has not been caused by misuse, neglect, method of storage, faulty installation, handling, or by alteration or accident.